Minto Mine Phase IV Reclamation and Closure Plan
Revision 4.0

Prepared For:

capstone
MINTO MINE

Minto Explorations Ltd.
September 2013

ACCESS

MINTO MINE PHASE IV RECLAMATION AND CLOSURE PLAN

REVISION 4.0

September 2013

Prepared for:

MINTO EXPLORATIONS LTD.

ACCESS CONSULTING GROUP SIGNATURES

Report prepared by:

Ken Boldt, B.Sc.
Environmental Engineer (EIT)

Report prepared by:

Jim Theriault, P.Eng. (ON & YT)
Senior Geological Engineer

Report reviewed by:

T. Scott Keesey, B. Sc., EPt
Sr. Environmental Manager

CONTEXT OF THIS DOCUMENT

This fourth revision of the Minto Mine Reclamation and Closure Plan (RCP) is presented for review and will be revised to incorporate reviewer comments. This version is an update to the Minto Mine Decommissioning and Reclamation Plan, Revision 3.2 (DRP), submitted to Yukon Government, Energy Mines and Resources in June 2011. This RCP contains additional detail to further refine Phase IV concepts, now that this phase is almost complete. Minto also recently submitted a Preliminary Reclamation and Closure Plan (PRCP) to YESAB presenting proposed closure methods for the mine features and layout anticipated from the proposed Phase V/VI expansion at the preliminary or conceptual level, with the intention of providing a level of detail to support the intended purpose of the Project Proposal submission to YESAB for the Phase V/VI Expansion. Closure planning is a process continuum, and RCP documents accordingly advance in detail as the Project proceeds through its mine life. These two RCP documents—although representing different mine life plans—share key closure concepts and methods, and both plans will be advanced in detail during licencing.

This RCP is now considered to be Revision 4.0. Significant advancements in the RCP over the 2011 DRP include:

- A much improved understanding and analysis of site closure hydrology, which has informed revisions to site runoff conveyance alignments, sizing and design;
- Updated water balance and geochemistry source term evaluation, combined for a revised site water quality prediction (prepared for Phase V/VI, and considered conservative as a planning tool for the Phase IV mine plan);
- Supporting rationale for the selection of isolating soil covers as the primary reclamation measure, based on a further characterization of available construction materials;
- Advanced supporting rationale for the application of semi-passive treatment technologies as contingency water treatment measures for closure, including the framework for a research program aimed at providing proof of concept for these technologies in the Minto site context; and
- An updated closure cost estimate for financial assurance purposes, including all proposed revisions to the closure methodologies and adjustments to the costing based on emergent closure costing guidance from YG EMR.

PROJECT CONTACTS

MINTO EXPLORATIONS LTD. c/o Capstone Mining Corp. Suite 900, 999 W Hastings St Vancouver B.C. Telephone: (604) 684-8894 Fax: (604) 688-2180 Website: www.capstonemining.com	**Jennie Gjertsen** Environmental Manager Email: jennieg@mintomine.com **Ron Light** General Manager Email: rlight@capstonemining.com
ACCESS CONSULTING GROUP #3 Calcite Business Centre 151 Industrial Road Whitehorse, Yukon Y1A 2V3 Telephone: (867) 668-6463 Fax: (867) 633-4882 Website: www.accessconsulting.ca	**Jim Theriault, P.Eng. (ON, YT)** Email: jtheriault@alexcoresource.com **T. Scott Keesey, B.Sc., EPt** Email: skeesey@accessconsulting.ca

EXECUTIVE SUMMARY

This RCP addresses the long-term physical and chemical stability of the site, including reclamation of surface disturbances. A program is presented for site management and monitoring both during implementation of closure and after decommissioning and reclamation measures are completed. Decommissioning and reclamation cost estimates are provided and financial security requirements reviewed.

The RCP has been specifically scoped to fulfill the requirements of closure plan submissions in both of the projects primary regulatory instruments – Quartz Mining Licence QML-0001, and Water Use Licence QZ96-006, and to adhere to guidance documentation on closure plan development from both the Yukon Government and the Yukon Water Board.

A systematic approach to decommissioning and closure reclamation has been developed for the Minto project. Progressive reclamation measures have been implemented where possible during mine construction and operations. This approach has provided valuable reclamation success feedback for use in advanced/final closure, and these progressive efforts will also help reduce slope erosion through physical slope stabilization of revegetation efforts, enhancing ultimate reclamation success.

The closure phase of the Minto mine will commence with the cessation of economic mining of the open pit and the milling of ores and stockpiles from the ore zone. Once all mineable ore reserves have been processed, the mill, concentrator and other facilities will be decommissioned, and waste facilities and disturbed areas will be covered and revegetated. During the active closure phase, which is expected to last approximately 3 years, the number of personnel required will vary depending on site activities; however, it is expected that as major decommissioning and reclamation tasks are completed the number of site personnel required will decline.

Cost estimation for implementation of the proposed closure measures is the basis for establishing the financial security that will be required on the project. The Phase IV closure cost estimate has been prepared based on the final extent of disturbance for each of the infrastructure units described in this report. A closure cost of approximately $35,900,000 is estimated for final closure.

TABLE OF CONTENTS

1 INTRODUCTION 1
1.1 CLOSURE PHILOSOPHY 1
1.2 SCOPE OF PLAN 2
1.3 STATUTORY AND REGULATORY RESPONSIBILITIES 5
1.4 REGULATORY APPROVALS 5
1.5 ACKNOWLEDGEMENTS 6

2 PROJECT DESCRIPTION 8
2.1 PROJECT LOCATION AND BACKGROUND 8
2.2 PHASE IV ACTIVITIES 11
2.3 PROPOSED PHASE V/VI EXPANSION 14
2.4 EXISTING SITE INFRASTRUCTURE 15
2.4.1 Access to Mine Site 15
2.4.2 Site Power Supply 15
2.4.3 Fuel Storage 16
2.4.4 Camp and Camp Services 16
2.4.4.1 Minto Camp Upgrade and Expansion 16
2.4.5 Solid Waste Management 17
2.4.6 Warehouse and Mechanical Shops 17
2.4.7 Explosives Storage 18
2.5 MINING AND WASTE MANAGEMENT ACTIVITIES 18
2.6 ORE PROCESSING 19
2.6.1 Crushing Circuit 19
2.6.2 Processing Plant 20
2.6.3 Concentrate Building 20
2.6.4 Tailings Filtration Building 20
2.7 WATER MANAGEMENT 20
2.7.1 Water Management Strategy 21
2.7.2 Water Balance 21
2.7.2.1 Water Balance Model 22
2.7.2.2 Precipitation and Runoff 22

2.7.3 Water Management Plan 22

2.7.3.1 Water Storage 23

2.7.3.2 Conveyance Network 24

2.7.3.3 Water Treatment Plant 27

2.7.3.4 Source Control 28

2.7.3.5 Monitoring Program and Mine Water Discharge 28

3 ENVIRONMENTAL SETTING 29
3.1 CLIMATE, HYDROLOGY AND DESIGN EVENTS 29
3.2 CLOSURE WATER QUALITY PREDICTIONS 30

4 RECLAMATION STRATEGY 34
4.1 RECLAMATION AND CLOSURE OBJECTIVES 38

4.1.1 Closure Water Quality Objectives 39

4.2 KEY RECLAMATION AND CLOSURE METHODS 40

4.2.1 Source Control 40

4.2.1.1 Operational Materials Characterization and Materials Handling Plans 40

4.2.1.2 Sub-aqueous Disposal 42

4.2.1.3 Waste Cover Systems 43

4.2.2 Contingency Water Treatment Methods 44

4.2.2.1 Pit Lake Pre-Treatment 44

4.2.2.2 Passive and Semi-Passive Treatment Systems 45

4.2.2.3 Candidate Contingency Passive Treatment Locations 52

4.2.2.4 Active Water Treatment 60

4.3 RECLAMATION TO DATE 61
4.4 NATURAL REVEGETATION 61
4.5 RECLAMATION RESEARCH 61

4.5.1 Soil Covers 62

4.5.2 Growth Media and Revegetation 62

4.5.3 Main Waste Dump Trials 65

4.5.4 Passive/Semi-passive Water Treatment 68

4.5.4.1 Pit Lake Pre-Treatment 68

4.5.4.2 Constructed Wetland Treatment Systems 69

4.5.4.3 Biological Reactors 73

4.6 RECLAMATION KNOWLEDGE TO DATE 76

5 IMPLEMENTATION SCHEDULE 78

6 CLOSURE MEASURES FOR SITE RECLAMATION UNITS 80

6.1 WASTE ROCK AND OVERBURDEN DUMPS 81

6.1.1 Main Waste Dump 82

6.1.2 Southwest Waste Dump 85

6.1.3 Ice-Rich Overburden Dump 86

6.1.4 Reclamation Overburden Dump 86

6.2 ORE STOCKPILES AND PADS 87

6.3 OPEN PITS 87

6.3.1 Main Pit 87

6.3.2 Area 2 Pit 88

6.3.3 Area 118 Pit 89

6.4 UNDERGROUND WORKINGS 89

6.5 HAUL ROADS 90

6.6 DRY STACK TAILINGS STORAGE AREA AND DIVERSION STRUCTURES 90

6.6.1 DSTSF Diversion Structures 91

6.7 MILL VALLEY FILL EXTENSION 92

6.7.1 Seepage at Toe of MVFE 92

6.8 WATER MANAGEMENT STRUCTURES AND SYSTEMS 93

6.8.1 Site layout 93

6.8.2 Hydrological Study 96

6.8.3 Design criteria for ditch sizing 99

6.8.4 Channel sizing 100

6.8.4.1 Primary ditches 100

6.8.4.2 Secondary ditches 103

6.8.4.3 Proposed ditch cross-sections and profiles 103

6.8.5 Water Storage Pond and Dam 104

6.9 MILL AND ANCILLARY FACILITIES 105

6.9.1 Mill Building 107

6.9.2 Generator Buildings 107

6.9.3 Concentrate Shed 107

6.9.4 Tailings Filter Building 108

6.9.5 Mill Water Pond 108

6.9.6 Mill Reagents and Chemicals 108

6.9.7 Contractor's Shop and Work Area 109

6.10 MAIN ACCESS ROAD 110

6.11 MISCELLANEOUS SITES AND FACILITIES 113

6.11.1 Mine Camp and Related Infrastructure 114

6.11.2 Airstrip 114

6.11.3 Exploration Sites and Trails 114

6.11.4 Land Treatment Facility 114

6.11.5 Solid Waste Facility 115

6.11.6 Explosives Plant Site 116

6.12 MINE ROADS 116

6.13 ADAPTIVE MANAGEMENT PLANNING 116

7 POST-CLOSURE SITE MANAGEMENT 118

7.1 ORGANIZATION, SITE ACCESS & SECURITY 118

7.2 SUPERVISION AND DOCUMENTATION OF WORK 119

7.3 MINE RECORDS 120

7.4 COMPLIANCE MONITORING AND REPORTING 120

7.5 LONG TERM MAINTENANCE 123

7.6 TEMPORARY CLOSURE 123

7.6.1 Physical Stability and Geochemical Stability 125

7.6.2 Security and Monitoring 126

7.6.3 Reporting 129

8 CLOSURE COSTS 130

8.1 FINANCIAL SECURITY UPDATES 131

9 LIMITATIONS OF REPORT 146

10 REFERENCES 147

LIST OF TABLES

Table 2-1 Project Area Overview and Environmental Setting 11

Table 2-2: Summary of the Fuel Tanks Inventory at the Minto Mine Site 16

Table 2-3 Minto Mine Site Precipitation and Runoff Estimates 22

Table 3-1: Expected Case Predictions for Effluent Quality (WSP) for key parameters during open water season 31

Table 3-2: Reasonable Worst Case Predictions for Effluent Quality (WSP) for key parameters during open water season 31

Table 3-3: Expected Case Predictions for Lower Minto Creek (W1) for key parameters during open water season . 32

Table 3-4: Reasonable Worst Case Predictions for Lower Minto Creek (W1) for key parameters during open water season 32

Table 4-1 Waste Rock Classifications and Handling Plans 42

Table 4-2: W15 CWTS Parameters. 58

Table 4-3: W37 CWTS parameters. 60

Table 4-4 Naming convention, areas, volumes and depths of each overburden plot 67

Table 4-5 Dry Area Seed Mix 76

Table 4-6 Wet Area Seed Mix 77

Table 7-1 Post-Closure Monitoring Program 122

Table 7-2 Summary of Care and Maintenance Activities and Surveillance Program during Temporary Cessation of Mining Operations 124

Table 8-1 Summary Table of Estimated Closure Costs 132

Table 8-2 Minto Mine Closure Unit Rates for 2013 133

Table 8-3 Waste Rock and Overburden Dumps, Estimated Closure Costs 134

Table 8-4 Open Pit and Haul Roads, Estimated Closure Costs 135

Table 8-5 Primary Water Conveyance Structures, Estimated Closure Costs 136

Table 8-6 DSTSF and MVFE, Estimated Closure Costs 137

Table 8-7 Water Storage Pond Dam, Estimated Closure Costs 138

Table 8-8 Mill & Ancillary Facilities, Estimated Closure Costs 139

Table 8-9 Mill Water Pond, Estimated Closure Costs 140

Table 8-10 Main Access Road, Estimated Closure Costs 141

Table 8-11 Miscellaneous Sites and Facilities, Estimated Closure Costs 142

Table 8-12 Reclamation Research and Revegetation, Estimated Closure Costs 143

Table 8-13 Site Management and Monitoring, Estimated Closure Costs 144

Table 8-14 Supporting Studies, Estimated Closure Costs 145

LIST OF FIGURES

Figure 2-1 Project Location 9

Figure 2-2 Area Overview 10

Figure 2-3 End of Phase IV Site Layout 13

Figure 2-4 Operational Water Management 25

Figure 4-1 Summary of Proposed Reclamation Measures 37

Figure 4-2 Conceptual Isolation Cover (SRK, 2013a) 44

Figure 4-3: Potential Passive Treatment Train Option for W15. 53

Figure 4-4: Profile of a Typical Surface Flow CWTS (Castle and Rogers 2008). 55

Figure 4-5: Schematic Flow Diagram of a Typical CWTS (Murray-Gulde et al. 2008). 56

Figure 4-6: Potential Treatment Cell Configuration Downstream of the DSTSF and MVFE. 59

Figure 4-7 Main Waste Dump near the end of construction season 2011 (September) 65

Figure 4-8 Main Waste Dump as it appeared in July 2012 with final placement of overburden into distinct plots ... 66

Figure 4-9 Final plot placement in August 2012. Note seedling emergence in upper right plots 66

Figure 4-10 Origin of overburden material from ROD placed in distinct plots on the MWD re-contoured rock surface 67

Figure 4-11 Example Layout of Greenhouse Setup for Pilot-scale CWTS. 71

Figure 4-12 Example Pilot-scale CWTS in Greenhouse 71

Figure 4-13 Example of On-site Pilot-scale CWTS 72

Figure 6-1 Typical Slope Reclamation Measures 84

Figure 6-2 Closure Water Management Layout 95

Figure 6-3 Upper Primary Ditch Catchments 97

Figure 6-4 Lower Primary Ditch Catchments 98

Figure 6-5 Mill and Ancillary Facilities Reclamation Measures 106

Figure 6-6 Haul Road and Site Road Typical Reclamation Cross -Section 112

Figure 7-1 Water Quality Monitoring Station Locations 128

LIST OF APPENDICES

Appendix A Minto Mine: Phase V/VI Expansion Water Balance and Water Quality Prediction

Appendix B Minto Mine Closure Hydrology Report

Appendix C Minto Closure Preliminary Failure Modes and Effects Assessment - Risk Register

Appendix D Minto Mine Closure Adaptive Management Plan

Appendix E Scoping Level Cover Assessment For Minto Closure Covers

Appendix F Design Drawings

1 INTRODUCTION

Minto Explorations Ltd. (Minto), a wholly owned subsidiary of Capstone Mining Corporation (Capstone), owns and operates the Minto Project located 240 km (150 miles) northwest of Whitehorse, Yukon. For the purposes of this reclamation and closure plan, the "Minto Project" means the mining of the Minto deposit by both open-pit and underground mining methods and related ancillary facilities.

This reclamation and closure plan (the RCP) addresses the long-term physical and chemical stability of the site, including reclamation of surface disturbances from existing development. A program is presented for site management and monitoring both during implementation of closure and after decommissioning and reclamation measures are completed. Decommissioning and reclamation cost estimates are provided.

The RCP is based on the best information available at the present time. A proposed continuation and expansion of the reclamation research program will provide more site-specific information to optimize closure methods. At the time of this writing, the Yukon Environmental and Socioeconomic Assessment Board's (YESAB's) Mayo Designated Office has received from Minto Explorations Ltd. a proposal for the Phase V/VI expansion of the mining and milling operations. If permitted, this expansion would see a significant extension (approximately 8 years) to the mining activities at the site. As part of that submission, Minto submitted a Preliminary Reclamation and Closure Plan (PRCP) that provided conceptual closure methods and supporting rationale for the Phase V/VI mine plan. These methods and the PRCP were optimizations of the previous 2011 DRP, and benefitted from an updated water quality prediction, an evaluation of the characteristics of soil materials available for closure cover construction at the site and candidate closure cover options, and a more detailed evaluation of the potential for passive water treatment implementation and a corresponding research program. Each of these evaluations – although prepared and presented in the context of Phase V/VI closure planning – is relevant and material to the Phase IV closure condition, and have been relied upon and utilized in this RCP.

The mine site and access road lie within the traditional territory of the SFN and comprises part of land claim settlement parcels R-6A, R-44A (Type A settlement lands) and R-40B. Minto has worked extensively with SFN and their technical advisors towards the development of a mutually agreeable plan for closure of the Minto site for a number of years. This collaborative effort has resulted in numerous improvements to this RCP, but Minto also recognizes that there are still areas of disagreement with respect to the plan for reclamation and closure at the site. Specifically, the parties have not yet come to an agreement on the definition of suitable quality of discharge water from the site in the closure period, and accordingly the required key closure measures to achieve this quality. The parties do have an agreement to continue to work together to develop a mutually agreeable definition and associated closure water quality objectives. In the interim, this RCP has been updated utilizing what Minto sees as responsible and appropriate objectives for closure water quality, founded in the protection of the most sensitive species and life stage of aquatic resources in the receiving environment.

1.1 CLOSURE PHILOSOPHY

In keeping with its high standards for environmental and social responsibility, Minto intends to implement an environmentally sound and technically feasible decommissioning and reclamation plan for the Minto mine. Closure planning and the implementation of this phase at a mine site must be undertaken with appropriate environmental care while respecting local laws, Selkirk First Nation (SFN) agreements, and the

public interest and ensuring that Minto's high environmental standards are achieved. Necessary environmental protection measures have been adopted in the development of this Plan to ensure that a healthy environment exists after mine closure. This approach is consistent with Minto's corporate policies.

A principle tenet of the philosophy followed during the development of this Plan was to work towards an eventual passive closure scenario, with minimal management required to achieve long-term chemical and physical stability of reclaimed mine components. This involved an assessment of the key mine components that require mitigation based on the current understanding of materials contained within these components. Mitigation measures have been incorporated into elements of the RCP to address public safety issues and environmental concerns with post-closure monitoring and inspections planned to ensure that this objective is met. Once the effectiveness of each mitigation measure is assured, then management of the site can be safely reduced to a level that is consistent with closure objectives. It is anticipated that final determination of the effectiveness of closure measures for passive and eventual walk-away status will be the subject of review and concurrence with regulatory agencies, SFN and the public. Under the Quartz Mining Act (QMA), Minto would then apply for a certificate of closure from Yukon Government (YG).

Minto has entered into a Cooperation Agreement (the Agreement) with the SFN. All activities at the site including closure measures are guided by this Agreement. Therefore, a strong working relationship with the SFN forms a foundation for this document. To that end, meetings with SFN related to closure issues have been ongoing since the first version of the RCP, and their comments on closure and other issues raised during ongoing dialogue were considered in the ongoing development of this Plan. This dialogue continues, and although there are still outstanding differences of technical opinion on closure objectives and required measures, parties continue to work towards their resolution in the ongoing closure planning discussions.

To ensure that the overall closure philosophy can be achieved, the following objectives were emphasized during the development of this plan:

- Protection of public health and safety;
- Implementation of environmental protection measures that prevent adverse environmental impact;
- Ensuring land use commensurate with surrounding lands;
- Ensuring full consultation with the SFN, so that closure measures are appropriate and supported by the local peoples who are most affected;
- Incorporate long term closure measures;
- Progressive reclamation measures implemented during mine operations;
- Post-closure monitoring of the site to assess effectiveness of closure measures for the long term; and
- Post-closure monitoring and management of the site until performance objectives are consistently met with minimal ongoing management.

1.2 SCOPE OF PLAN

The RCP has been specifically scoped to fulfill the requirements of closure plan submissions in both of the project's primary regulatory instruments – Quartz Mining Licence QML-0001, and Water Use Licence QZ96-006, and to adhere to guidance documentation on closure plan development from both the Yukon Government and the Yukon Water Board.

Specifically, the licenced requirements for closure plan submission under each licence are:

- QML-0001: *Section 9.0 Reclamation and Closure Plan*

  9.1 The Licensee must undertake reclamation at the site in accordance with the approved closure plan.
  9.2 The Licensee must:

  (a) submit to the Chief for approval a reclamation and closure plan within 30 days of the effective date and then on June 1, 2013 [Amended to September 16, 2013] and June 1, 2015; and

  (b) implement the reclamation and closure plan and any conditions of the approval as of the date each plan becomes an approved plan.

  9.3 The Licensee acknowledges that on the date an updated reclamation and closure plan, as described in paragraph 9.2(a) and including any amendments to it and any additional terms and conditions required by the Chief, becomes an approved plan, the previous reclamation and closure plan shall cease to be an approved plan.

- WUL QZ96-006: *Clause 103 Permanent Closure*

  The Licensee shall submit an updated detailed DRP to the Board by September 16, 2013 as an application for amendment of this licence. The detailed DRP shall:

  a) include the results of a Failure Modes and Effects Assessment of the proposed closure measures in the DRP that will examine risks associated with the proposed closure measures and will identify specific contingency plans necessary to manage risks identified in the assessment;

  b) be adequate for an independent assessment of the physical and geochemical stability of the mine wastes and mine workings remaining after application of the proposed closure measures and of the costs of the proposed closure measures and post closure monitoring and maintenance;

  c) the DRP shall include, but not necessarily be limited to, the following components:

     i) preliminary designs for the closure of all major mine facilities , including dams, spillways, diversion ditches, pits, dumps and mill/camp facilities;

     ii) plans to ensure long term stabilization of the DSTSF, including revegetation;

     iii) calculations of the Maximum Credible Earthquake;

     iv) calculations of the inflow design flood proposed for closure and the rationale for the severity or return period of the flood event;

     v) designs for the closure water management structures and conveyance channels to withstand the inflow design flood event;

     vi) an updated Reclamation Research Plan and proposed schedule for implementing the plan;

vii) a detailed Post-Closure Monitoring Program to verify that performance objectives for all facilities are being achieved;

viii) an updated Water Balance and Water Quality Model for the mine site and Minto Creek; and

ix) an updated detailed cost estimate, including clearly defined assumptions and calculations for decommissioning and on-going post closure monitoring and maintenance.

In addition, the EMR guidance document *Reclamation and Closure Planning for Quartz Mining Projects: Plan Requirements and closure costing guidance* released February 2013, has been very helpful in providing guidance for the appropriate content and costing of the RCP.

The RCP is intended to address closure of currently permitted infrastructure components. These activities and components are addressed in Section 2.2.

- Development, mining and milling of materials from the Area 2 open pit which contains 3,192 Kt of ore plus 25,980 Kt of waste;
- Development, mining and milling of materials from the Area 118 open pit which contains 88 Kt of ore plus 639 Kt of waste;
- Development, mining and milling of materials from the Area 2 and Area 118 underground areas which contain approximately 1,541 Kt of ore and 341 kt of waste;
- Expansion of the Southwest Waste and Reclamation Overburden Dumps;
- In-Pit deposition of tailings from Phase IV ore feeds (Area 2 and Area 118);
- Construction of the South Wall buttress in Main Pit;
- Construction of the Mill Valley Fill Expansion buttress;
- Extension of the camp pad;
- Operational water management; and
- Progressive reclamation of infrastructure components, as and whenever possible to reduce site liability.

The approach taken in the presentation of this Closure Plan is to provide a brief description of each mine component and the closure issues and measures related to that component. Previous work or reports on the project have been referenced without repeating details so that this document is focused on decommissioning and reclamation measures.

1.3 STATUTORY AND REGULATORY RESPONSIBILITIES

Versions 1, 2 and 3 of this Plan were developed to meet the regulatory requirements as stipulated in Minto's Water Use Licence and Quartz Mining Licences. Closure methods and details associated with the Phase IV Expansion were approved most recently by in the DRP version 3.2 Yukon Government, Energy Mines and Resources (YG EMR) in September 2011, and a required re-submission of the closure costing for a security update was provided to YG EMR September 30, 2012. This RCP incorporates site developments undertaken as part of Phase IV, and closure concepts advanced since the approval of the last Plan. It is intended to meet the regulatory requirements from the primary project authorizations as presented above in Section 1.2.

Prior to implementing the closure measures described in this Plan, meetings will be held with the SFN and the local community to ensure that First Nations and community interests and concerns are addressed and included in the closure planning of the Minto mine. Section 1 above describes the current state of closure plan discussions with SFN. Also prior to implementation of the RCP, the YG Water Resources and Mining Land Use Divisions will be informed of Minto's intentions. Meetings will also be held with Environment Canada, Environmental Protection, Department of Fisheries and Oceans, Environmental Health, and Government of Yukon Departments of Environment and Occupational Health and Safety to apprise regulators of planned site activities. These meetings will ensure that regulatory agencies' concerns with closure implementation are met.

1.4 REGULATORY APPROVALS

Several government agencies and SFN are involved in reviewing, assessing, authorizing and monitoring the Minto Mine. The relevant legal, regulatory and guideline-based instruments include:

- Selkirk First Nation Cooperation Agreement;
- Metal Mining Effluent Regulations (MMER) of the federal Fisheries Act; including guidance for:
    - Effluent Characterization; and
    - Environmental Effects Monitoring;
- Type A Water Use Licence QZ96-006 ("WUL QZ96-006"), issued in April 1998 and including subsequent amendments, and valid until June 30, 2016;
- Type B Water Use Licence MS04-227 ("WUL-B") issued in August 1996 and valid until June 30, 2016;
- Quartz Mining Licence QML-0001 ("QML-0001") issued in October 1999 and subsequent amendments and valid until June 30, 2016;
- Mining Land Use Permit;
- Fish Collection Permits;
- Waste Management Facility Permits:
- Multi-Use Land Treatment Facility Permit;
- Special Waste Permit;
- Commercial Dump Permit; and
- Air Emissions Permit.

In accordance with these instruments, Minto has submitted operational and monitoring plans including but not limited to:

- General Site Plan;
- Mine Development & Operations Plan;
- Underground Mine Development & Operating Plan;
- Main Waste Rock Dump Design Plan;
- Southwest Waste Dump Design Plan;
- Reclamation Overburden Dump and Ice-Rich Overburden Dump Design Plans;
- Dry Stack Tailings Storage Facility Design and Management Plans;
- Engineering Plans and a Construction Quality Assurance Manual for the Water Storage Pond dam;
- Mill Water Pond Design;
- Waste Management Plans;
- Waste Rock & Overburden Management Plans;
- Tailings Management Plan;
- Spill Contingency Plan;
- Heritage Resource Protection Plan;
- Sediment & Erosion Protection Plan;
- Explosives Management Plan;
- Wildlife Protection Plan;
- Emergency Response Plan; and
- Decommissioning and Reclamation Plan.

1.5 ACKNOWLEDGEMENTS

This Plan benefited from input by the following companies, many of which have contributed to previous versions of the Minto Mine closure plans:

Access Consulting Group (ACG) – Developed Revision 1 of the site Decommissioning and Reclamation Plan (DRP), provided support to Revision 2, and co-authored Revision 3 with EBA Engineering Consultants Ltd. (EBA).

Contango Strategies Ltd. – Provided specialist expertise related to the evaluation, design, and implementation of constructed wetland treatment systems in cold climates.

EBA Engineering Consultants Ltd. (EBA) – Assisted with development of Revision 2 of this Plan, developed Phase IV conceptual closure plan, and co-authored Revision 3, including the preliminary engineering design.

Selkirk First Nation (SFN) – Longstanding participation in many components of the closure planning process based on current and potential future use of the project area, including the development of closure objectives, reclamation measures and closure cost estimations.

SRK Consulting Ltd. – Provided geochemical characterization and predictive water chemistry modeling, as well as lead support on waste cover evaluation and recommendations.

2 PROJECT DESCRIPTION

2.1 PROJECT LOCATION AND BACKGROUND

The Minto Project is a copper-gold-silver project located on the west side of the Yukon River approximately 75 km (47 miles) north-northwest of Carmacks, Yukon Territory. The mine site and access road lie within the traditional territory of the SFN and comprises part of land claim settlement parcels R-6A, R-44A (Type A settlement lands) and R-40B. Minto concluded a comprehensive Cooperation Agreement with the SFN on September 16, 1997. This agreement is still in effect, however an amended agreement is being negotiated.

The Minto Property is centered at approximately 62°37'N latitude and 137°15'W longitude (NAD 83, UTM Zone 8 coordinates 6945000N, 384000E). The Minto Project consists of 284 claims. There are 120 pending quartz claims, 99 quartz claims and 65 quartz claims under lease. Minto is the 100% registered owner of the claims and leases. The property is accessible by crossing the Yukon River at Minto Landing. Barge landings have been constructed for ice-free crossing and an ice bridge is used upon freeze-up of the Yukon River.

Copper deposits were first discovered in 1970 and claims were staked in 1971. Extensive exploration yielded the first significant drill intersection in July of 1973. The claims and leases cover an area of approximately 10 square miles. Figure 2-1 and Figure 2-2 present visual depictions of the general project location within the Yukon and the project area overview.

Preliminary site development was initiated at the property in 1996 and continued during the following decade with Minto commencing operations in October 2007. From 2007 through April 2011, mining at Minto took place in what is known as the Main Pit. Exploration during those years identified several other high-grade areas of the ore deposit that are amenable to both surface and underground mining. These areas were upgraded from resources to reserves by a series of prefeasibility studies completed in 2010, 2011, and 2012.

The first of these reserves were submitted to YESAB for assessment in November of 2010 as application 2010-0198 (the Phase IV Project Proposal). That application presented two new pits and an underground mine, extending mining operations to early 2014 and milling operations to 2016. The Minto Mine has been conducting operations under the Phase IV Mine Plan since February 2011.

Pre-stripping of the Area 2 Pit commenced in April 2011, with ore processing following in May 2012. Processing of stockpiled ore from the Main Pit continued during the pre-stripping period; some low-grade and partially oxidized ore from the Main Pit still remains to be processed.

Development of the underground mining assessed in Phase IV commenced in August 2012 with stripping of overburden around the portal access; ore production is expected in Q3 2013.

The ore deposits are mined using conventional open pit truck and loader operations and processed in a mill plant on site. A 200 person camp is presently near capacity with the mine construction management, contractors and support staff. All existing facilities and development described in Section 2.4 have been assessed by YESAB (Minto Mine Phase IV Expansion, Project Assessment 2012-0198) and licensed under amendments to the QML-0001 and WUL QZ96-006.

MINTO MINE

PHASE IV

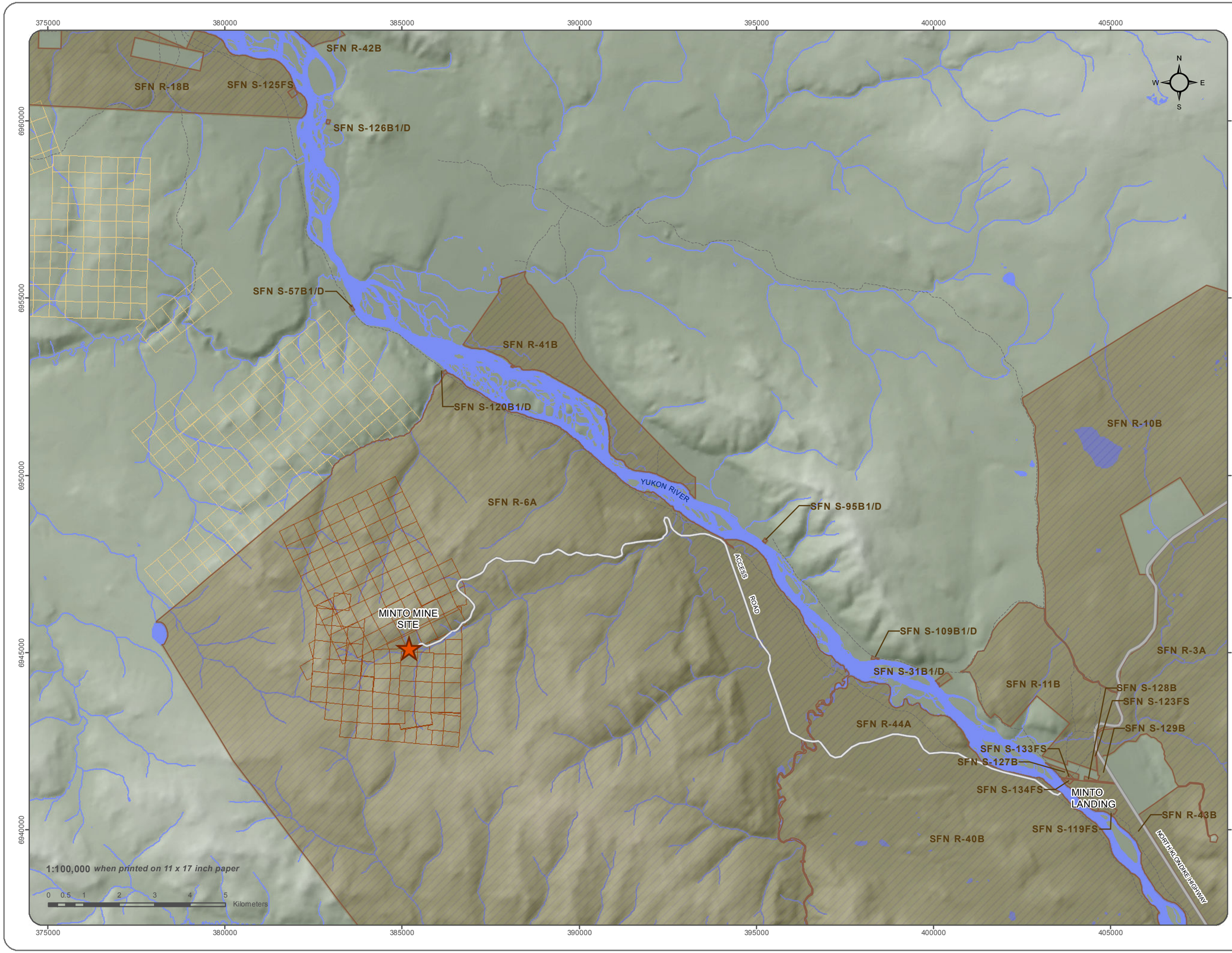
capstone
MINTO MINE

RECLAMATION AND CLOSURE PLAN - REVISION 4.0

FIGURE 2-1

PROJECT LOCATION

ACCESS



capstone
MINTO MINE

MINTO MINE PHASE IV

RECLAMATION AND CLOSURE PLAN REVISION 4.0

FIGURE 2-2
AREA OVERVIEW

SEPTEMBER 2013

Minto Mine Site

Mine Access Road

Road

Trail

Selkirk First Nation Settlement Lands

Minto Creek Catchment

Quartz Claims

Minto Explorations Ltd. Claims

Other Claims

ACCESS

First Nation Settlement land obtained from Natural Resource Canada. Quartz claim boundaires and ownership are current as of Feb 18th 2013. Data obtained from Mineral Resources Branch, Energy Mines and Resources Department, Government of Yukon.Site hydrology data provided by Minto Explorations Ltd, May 2009.

Datum: NAD 83 Projection: UTM Zone 8N

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_2-2_Area_Overview_20130911.mxd
(Last edited by: mducharme;12/09/2013/10:23 AM)

Table 2-1 provides an overview of the project area and environmental setting information for the study area. This table provides physical project location information, geographic reference, access route, watershed drainage, special designations, and key environmental features within the study area. The information has been extracted from a number of documents, including previous Canadian Environmental Assessment Act (CEAA) and Yukon Environmental and Socio-Economic Assessment Act (YESAA) screenings.

Table 2-1 Project Area Overview and Environmental Setting

Project Area Attribute	Description
Region:	Yukon
Topographic Map Sheet:	NTS 115 I/10, 115 I/11
Geographic Location Name Code:	Minto Project
Latitude:	62° 36' N
Longitude:	137° 15' W
Drainage Region:	Yukon River
Watersheds:	Yukon River, Big Creek, Wolverine Creek, Dark Creek, and Minto Creek.
Nearest Community:	Pelly Crossing, Yukon, approx. 33 km north on Klondike Highway.
Access:	Klondike Highway, Barge crossing on Yukon River at Minto Landing, Minto mine access road. Airstrip on site.
Traditional Territory:	Northern Tutchone, Selkirk First Nation peoples. Traditional use for hunting, trapping and fishing.
Surrounding Land Status:	Selkirk First Nation Settlement Lands and Federal Crown Land.
Special Designations:	Lhutsaw Wetland Habitat Protection Area located approx. 17 km NE of Minto Landing (outside the project area).
Ecoregion:	Yukon Plateau (Central) - Pelly River Ecoregion.
Study Area Elevation:	Rolling hills above mine site at 1131 metres to 600 metres at the Yukon River Valley bottom.
Site Climate:	Temperature ranges from –43.2°C (November 2006) to 30.3°C (July 2009). Mean annual temperature of –1.8°C. Mean annual rainfall is 174 mm.
Vegetation Communities:	Riparian, black spruce, white spruce, paper birch, lodgepole pine, buck brush/willow and ericaceous shrubs, feathermoss, sedge, sagewort grassland, mixed, aspen, balsam, and sub-alpine. Discontinuous permafrost is present on site. Site has been subject to recent forest fires.
Wildlife Species:	Moose, caribou, Dall sheep, mule deer, grizzly and black bear, varying hare, beaver, lynx, marten, ermine, deer mouse, fox, mink, wolverine, least weasel, wolf, squirrel, porcupine coyote, muskrat, otter and wood frog. Bird species include: spruce, blue, ruffed, and sharptail grouse, waterfowl, raptors, and a variety of smaller birds.
Fish Species:	In the Yukon River, chinook, coho, and chum salmon, rainbow trout, lake trout, least cisco, bering cisco, round whitefish, lake whitefish, inconnu, arctic grayling, northern pike, burbot, longnose sucker and slimy sculpin; In Big Creek, Chinook and chum salmon, arctic grayling and whitefish species; In Wolverine Creek, chinook salmon, arctic grayling, and slimy sculpins; In Minto Creek and project area watershed (lower reaches only), slimy sculpin, round whitefish, arctic grayling and Chinook salmon.
Known Heritage Resources:	East side of Yukon River in the vicinity of Minto Landing four historic sites designated KdVc-2 (Minto landing), KdVc-3 (Minto Resort), KdVc-4 (Old Tom's Cabin), and KdVD-1 (Minto Creek).

2.2 PHASE IV ACTIVITIES

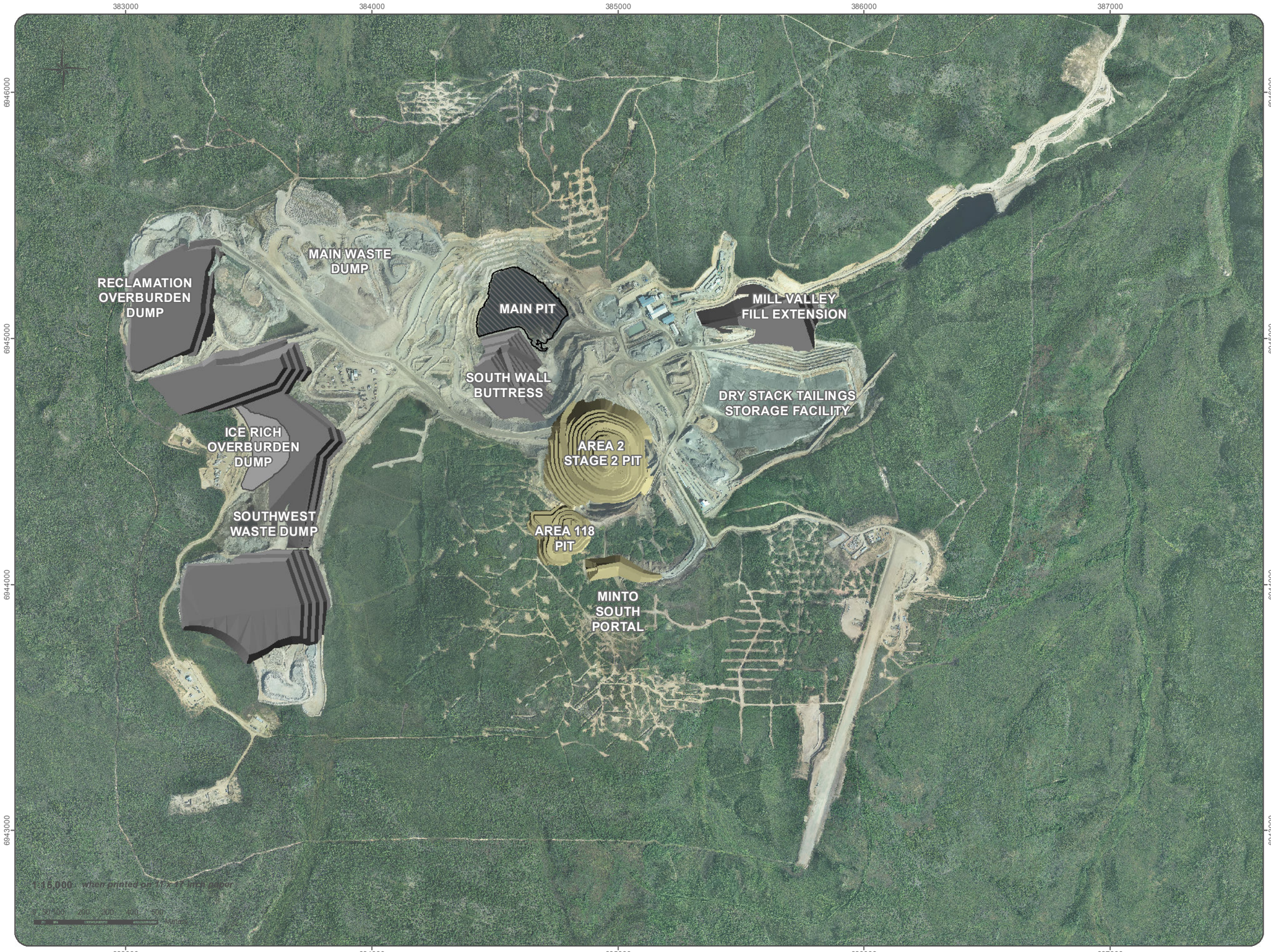
The following activities are in progress as part of Phase IV:

- Development, mining and milling of materials from the Area 2 open pit which contains 3,192 Kt of ore plus 25,980 Kt of waste;
- Development, mining and milling of materials from the Area 118 open pit which contains 88 Kt of ore plus 639 Kt of waste;
- Development, mining and milling of materials from the Area 2 and Area 118 underground areas which contain approximately 1,541 Kt of ore and 341 kt of waste;
- Expansion of the Southwest Waste Dump and Reclamation Overburden Dump;

- In-Pit deposition of tailings from Phase IV deposits;
- Construction of the South Wall buttress in Main Pit;
- Construction of the Mill Valley Fill Expansion buttress;
- Extension of the camp pad;
- Operational water management; and
- Progressive reclamation of infrastructure components, as and whenever possible to reduce site liability.

The open pit mining is being conducted using standard blast and haul open pit mining practices. Milling is conducted using a conventional crushing, grinding and flotation process plant utilizing standard unit processes and equipment). The plant currently processes a maximum of 4,200 tpd (metric tonnes per day).

Figure 2-3 shows the Phase IV development at End of Mine life (2014). Additional details and information on the project are contained in the Minto Mine Expansion - Phase IV Project Application submitted to YESAA in August 2010.



capstone
MINTO MINE

MINTO MINE PHASE IV

RECLAMATION AND CLOSURE PLAN REVISION 4.0

FIGURE 2-3
END OF PHASE IV SITE LAYOUT

SEPTEMBER 2013

Phase IV Tailings
Phase IV Dumps
Phase IV Pits

ACCESS

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14th 2012.

Datum: NAD 83 Projection: UTM Zone 8N

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_2-3_Phase4_EOL_20130906.mxd
(Last edited by: mducharme;12/09/2013/10:29 AM)

2.3 PROPOSED PHASE V/VI EXPANSION

The Phase V/VI expansion of the Minto Mine is currently under in assessment under YESAA. While this RCP does not address Phase V/VI, the progressive reclamation, reclamation research and site-wide water management have been designed to concur with closure goals and objectives for Phase V/VI.

The principal activities associated with Phase V/VI are:

- Mining of Phase V/VI pits (Area 2 Stage 3, Minto North, Ridgetop North, and Ridgetop South) using conventional surface mining methods, including an expanded network of haul roads (2.3 km of new roads) to accommodate the mining activities;
- Open pit mining at a rate of 12,800 BCM/day, followed by a decrease to 7,200 BCM/day after the completion of Area 2 Stage 3;
- Expanded mining of the Minto South Underground using conventional underground mining methods;
- Mining of a new Wildfire Underground, which will be accessed through its own separate decline and possess its own surface infrastructure separate from that developed for the Minto South Underground;
- An increase in open pit mine life to Q2-2017, underground mine life to Q4-2019, and milling of stockpiled ore to Q2-2022;
- New management practices for waste rock and overburden mined from the Phase V/VI pits; specifically, cessation of waste rock segregation on the basis of copper grade and adoption of material dispatching based on on-site assessments of acid-generating potential;
- Creation of a new waste rock dump (Main Pit Dump) within the footprint of the mined-out Main Pit;
- Continued placement of waste rock on the existing Main Waste Dump, including an expansion beyond its currently permitted design footprint and capacity;
- Backfilling of the completed Area 118 and Ridgetop South pits with overburden, and the further stacking of overburden on the footprints of these pits;
- Creation of a new waste rock dump (Ridgetop Dump) to the west of the Ridgetop North and South pits;
- The potential expansion of the current Mill Valley Fill to further stabilize dry stack tailings storage facility;
- The expanded use of the Main Pit and Area 2 Pit – and the new use of the Ridgetop Pit – as storage locations for slurry tailings from milling; and
- Construction of a small dam (Main Dam) to retain tailings within the footprint of the Main Pit.

Additional details and information on the project are contained in the Minto Mine Phase V/VI Expansion Project Proposal.

2.4 EXISTING SITE INFRASTRUCTURE

2.4.1 Access to Mine Site

The Minto Mine is accessible from Whitehorse, Yukon, by means of the Klondike Highway (YG Highway No. 2) to Minto Crossing (240 km). Passage across the Yukon River can be made by barge in the summer or by ice-bridge in the winter. The highway, river crossing, and gravel access road are suitable for heavy transport traffic. The barge has a 75,000 kg (165,000 lb.) net capacity capable of hauling loaded B-train transport trailers across the river. The Yukon River crossing experiences an impassable freeze-up and thaw period of approximately November through December and April through May, respectively. Normally, operations personnel and freight are transported to and from site by bus. During the river freeze and thaw periods, personnel and freight are transported by aircraft.

A 28 km-long, 10 m-wide gravel access road provides access from the west side of the Yukon River to the Minto Mine and is a well maintained class A all-weather gravel road, complete with drainage ditches, road signage and runaway lanes on steeper downhill sections. Roadbed material is fluvial sand or gravel along its lower reaches along the Yukon River and coarse sand along its upper reaches. The road crosses one major tributary of the Yukon River, Big Creek, by way of a single lane bridge made with reinforced concrete abutments and deck. The approaches to the bridge have been stabilized with berms and modifications to the spillway were constructed to divert any floodwaters exceeding the bridge capacity. In May of 2012, five new 48" culverts were installed at the 18.5 km mark to accommodate spring runoff and prevent washouts, and new chevrons were installed at the Big Creek Bridge. The road is maintained by mine personnel.

2.4.2 Site Power Supply

Power is being supplied to Minto Mine from a 32 km, 34 kV power line from Minto Landing. The power supplier is Yukon Energy Corporation (YEC). The current YEC's power purchase agreement with Minto Mine allows for a total capacity of 4,400 kVA with a total annual consumption limitation of 32.5 GWh. Minto Mine currently uses approximately 3,800 kVA of its allotted capacity.

The Mine's power is distributed from a YEC-owned substation at 5 kV. The system configuration uses a main switch room in the mill with two smaller switch rooms in the tailings building. Previously, Minto Mine was powered by diesel generators and continues to use these generators during electrical service disruptions.

As approved under Minto Mine Phase IV, to accommodate the loads required for the underground mining operation, a 600A-rated power line at 4,160 V has been installed and is fed from a 300A-rated switch in the tailings building's power distribution switch room. The power line follows the existing site haul road from the tailings building to the Minto South Portal laydown area. From there the pole line transitions from an overhead line to a 350A-rated surface Teck cable to the underground portal for approximately 320 meters. Three 100 KVA pole-mount transformers have been installed, providing power to the underground mobile equipment shop. Cutout switches for isolation have been installed, both at the start and end of the power line, as well as at the underground mobile equipment shop transformers. The power line is designed with adequate clearance to ensure a haul truck with its box in the upright position can pass under without incident.

2.4.3 Fuel Storage

Diesel fuel is stored in a diesel storage facility located just north of the process plant. Six large diesel tanks have a combined storage capacity of approximately 3.2 million litres (L); sufficient for supplying open pit and underground mine equipment for two months as is required during the Yukon River freeze and thaw periods, during which vehicle access to the site is not possible. A fuel tank inventory, including the types of products and volumes is presented in **Error! Reference source not found.**2.

Table 2-2: Summary of the Fuel Tanks Inventory at the Minto Mine Site.

Summary - Totals		
Quantity of Storage Tanks (#)	**Product Type**	**Volume (L)**
6	Diesel	3,267,668
1	Gasoline	8,000
6	Propane	911,000

2.4.4 Camp and Camp Services

The existing workforce camp at the Minto Mine consists of eight single-story modular housing units capable of housing a total of 208 people. Each housing unit consists of individual sleeping rooms with common showers, washrooms, and recreation areas. The main building houses the kitchen and dining hall and recreation facilities; a separate building has been provided to serve as a gym. Units are connected by interior corridors except for some of the outlying buildings.

Domestic water and firewater are provided from a well and storage tank system located in the camp area. Sanitary sewage is directed to a sewage treatment plant. Power for the camp is provided from the main sub-station via a transformer located in the camp area.

The existing camp buildings and septic fields are using the majority of available space on the upper bench, east of the mill and north of the Mill Valley Fill Extension.

2.4.4.1 Minto Camp Upgrade and Expansion

A camp upgrade, as already approved under Minto Mine Phase IV, is currently underway and will see the number of camp spaces increased to 248 through the use of three-storey modular housing units that will be installed in phases as the old buildings are decommissioned. The majority of the three-storey housing units will have 10 bedrooms per floor for a total of 30 people per unit. A washroom will be provided for each bedroom and a common lounge area and laundry room will be provided on each floor; plans have been sent to EMR, with completion expected in the fall of 2013. The new modular units will be constructed on pressure treated foundations.

The new camp buildings will be connected with an interior corridor that will also contain the building electrical, communication and water distribution services. A common mudroom will be provided at the south end of the camp.

A modular sewage treatment plant, approved under Phase IV, is in the process of being installed and will be commissioned to replace the septic fields. It will be installed so that the septic field at the north end of the camp can be decommissioned to provide space for the first of the new housing units. New temporary and permanent sanitary piping, manholes and a grinder lift station will be required to direct sanitary sewage to the new sewage plant.

Propane lines and electrical distribution equipment will be relocated and upgraded to service the new camp buildings. IT cabling will be re-routed to connect to the new camp buildings and to maintain service as the existing buildings are removed.

2.4.5 Solid Waste Management

Minto manages solid waste under permit #81-005 issued by Yukon Environment; this permit was last updated March 11, 2013.

The waste management area (WMA) is designed for staging, burning, incineration and burial of materials generated from site. The WMA is open 2 hours daily with an attendant directing traffic and monitoring waste disposal during this time and is locked outside of these hours. A 100-foot pole barn structure is used to stage all special waste and some recyclables before they are shipped off site for final disposal. The burn pit is designated to burn untreated wood and cardboard. An incinerator is used to dispose of all food waste and the majority of other camp and office waste. The landfill is used for burial of non-recyclable construction materials and other non-hazardous materials. No material is placed in the landfill that could potentially attract animals.

Supporting infrastructure includes an exclusion (bear) fence set up around the burn pit and incinerator. A bear-proof container is used to store all camp waste prior to being incinerated. Any recyclables that could be an animal-attractant are staged in a sea container before being shipped off-site. A fluorescent bulb breaker, oil filter crusher and drum crusher are in place to reduce environmental risk. Garbage disposal in camp and around the site has been segregated into five major categories to allow for better handling of materials, they include metal, incinerator, inert waste, aerosols, wood & cardboard. Kitchen waste is removed from camp twice a day during the spring and summer months when there is a greatest risk of attracting wildlife.

2.4.6 Warehouse and Mechanical Shops

There are several facilities on the site used for warehousing and mechanical work. The Minto warehouse and light-duty mechanics' shop is located beside the process plant. Pelly Construction Ltd. (mining contractor) utilises an 80 x 135-foot stretched fabric and aluminum structure as a heavy-duty mechanics' shop, and has several other ancillary facilities at the Pelly laydown. The underground operation is supported by the underground shop, which allows the space for equipment maintenance, repair, and some office support.

Under Phase IV operations, site warehousing will erect an 80′x 100-foot all- steel industrial warehouse with a cement floor and pallet storage as well as industrial shelving. The facility will be located on the existing Mill Valley Fill Extension (MVFE) and will house the warehousing needs for the mine operation. The location will facilitate better offloading of trucks and centralize services to the entire site. It will also ensure better control of regulated products.

2.4.7 Explosives Storage

The explosives storage facility is run by the explosives contractor, Dyno Nobel. The explosive magazine is located at the southwest region of the mine site and is isolated from any main infrastructure. The mine is currently authorized, through Natural Resources Canada license F72384, to store 180,200 kg of emulsion explosive and 1,500,000 kg of ammonium nitrate (unmixed with fuel oil). Minto also has two explosives magazines on site, allowing for the storage of 10,000 detonators and 60,000 kg of explosives under Yukon Workers' Compensation Health and Safety Board (YWCHSB), permit numbers YT534 and YT533, respectively.

2.5 MINING AND WASTE MANAGEMENT ACTIVITIES

Under existing Phase IV approvals, open pit mining is currently proceeding in the Area 2 Pit. Preliminary stripping took place at the Area 118 Pit in November and December 2012; that pit will be mined when Area 2 is mined to the limits of its approved Phase IV design. Waste rock from mining operations is being deposited in several locations including the southwest waste dump, the Main Pit south wall buttress, and the Mill Valley Fill extension. Overburden is being deposited in the reclamation overburden dump or in the ice-rich overburden dump, depending on the ice content of the material. Additional overburden material is being placed as a preliminary cover on the dry stack tailings storage facility.

Mining and waste placement in the following locations are currently authorized and in development as part of the Minto Mine Phase IV activities:

- **Main Pit**
  The Main Pit is centered in the Minto Creek valley west of the mill area. It hosted the Minto deposit, which was the first deposit mined at the Minto Mine. Mining in the Main Pit ended in April 2011 with the completion of the Stage 5 pushback. The tailings management plan for Phase IV entails the placement of slurry tailings in the Main Pit which began on November 1, 2012. The Main Pit is further discussed in Section 6.3.1.
- **Area 2 Pit**
  The Area 2 Pit is located south of the mill area and southeast of the Main Pit. As part of the Phase IV mine plan, the pit was mined in two stages, the first of which was started in April of 2011. The second stage, and the final one approved as part of Phase IV, is currently underway, and involves pushing back the walls and deepening the pit; it is expected to be completed by Q4 2013. Once open pit mining of Area 2 Stage 2 is complete, it is scheduled to receive slurry tailings under the final stages of the Phase IV mine plan. The Area 2 Pit is further discussed in Section 6.3.2.
- **Area 118 Pit**
  Area 118 is a small pit that is scheduled to be the final open pit mining under the Phase IV mine plan. It will be located uphill and southwest of the Area 2 Stage 2 Pit, and is scheduled to be backfilled with overburden as part of the Phase IV reclamation activities. The Area 118 Pit is further discussed in Section 6.3.3.
- **Minto South Underground**
  Development of the surface excavation and surrounding infrastructure for the Minto South Underground commenced in August 2012 as per the Phase IV mine plan. Decline development is ongoing, with initial ore production expected in Q3 2013. Seven stopes located under the Area 2 and Area 118 pits, totaling 1,591,000 tonnes of ore, were assessed under the scope of Phase IV. Minto South Underground is further discussed in Section 6.4.

- **Main Waste Dump (MWD)**
  The MWD is located west of the Main Pit, and was the first waste rock storage facility constructed at Minto. The MWD contains waste rock from the initial phases of mining in the Main Pit, and is at its original design capacity under Phase IV. The MWD is further discussed in Section 6.1.1.
- **Southwest Waste Dump (SWD)**
  Construction of the SWD began in March 2009; it has received waste rock continuously since that time, initially from the final stages of mining of the Main Pit, and later from mining of Area 2 Pit (Stage 1 and Stage 2). Expansions of the dump's height and footprint were permitted as part of Phase IV. The SWD is further discussed in Section 6.1.2.
- **Dry Stack Tailings Storage Facility (DSTSF)**
  The DSTSF received the mine's tailings output until the licensing of Phase IV authorized Minto to begin using the completed Main Pit for tailings storage. Tailings placement in the DSTSF ended on November 1, 2012. The DSTSF contains all tailings from milling of Main Pit ore as well as tailings from approximately seven months of milling of Area 2 ore (approximately 5.1 million dry metric tonnes). The DSTSF is accepting cover material from Area 2 Pit and Area 118 Pit excavations. The DSTSF is further discussed in Section 6.6.
- **Mill Valley Fill Extension (MVFE)**
  This facility is located at the toe of the DSTSF in the Minto Creek valley, immediately east of the original Mill Valley Fill that was constructed early in the mine life to provide space for milling and related activities. Construction of the MVFE was part of the Phase IV mine plan to be used as a buttress to mitigate the down-slope movement of the DSTSF. The MVFE is further discussed in Section 6.7.
- **South Wall Buttress (SWB)**
  The SWB is a rock fill structure that is designed to buttress the south wall of the Main Pit and preserve the remaining volume in the Main Pit for tailings and water storage purposes. Construction of the SWB began in May of 2011; it has received rock from the Area 2 Pit since that time. It is scheduled for completion to the design capacity before Phase IV open pit mining is completed.
- **Reclamation Overburden Dump (ROD)**
  The ROD is located west of the Main Waste Dump, and contains overburden materials released from both the Area 2 Pit and the Main Pit. The ROD is further discussed in Section 6.1.4.

2.6 ORE PROCESSING

Minto is currently authorized to mill ore at a rate of up to 4,200 tpd. The following sections describe the major components of the ore processing and storage facilities at Minto.

2.6.1 Crushing Circuit

Run-of-mine ore is first passed through a two-stage crushing circuit located outdoors on a pad west of the main process plant. Ore is first loaded into a hopper using a Caterpillar 980 front-end loader. A screen over the hopper rejects boulders larger than the crusher opening; these are moved aside and broken using an excavator-mounted hydraulic rock-breaking tool.

The primary crusher was originally intended to operate six hours per day, 365 days per year at 75% availability but, due to increased throughput, now operates 24 hours per day, 365 days per year at an availability of 75%.

2.6.2 Processing Plant

The processing plant consists of the following main unit operations:

- Two-stage grinding circuit comprised of a single SAG (semi-autogenous grinding) mill and two ball mills;
- Bulk flotation in rougher and scavenger stages, followed by cleaner flotation;
- Centrifugal gravity concentration of coarse gold;
- Concentrate thickening and pumping;
- Concentrate filtration;
- Concentrate storage (on-site);
- Tailings thickening and pumping to an in-pit deposition location; and,
- Water reclamation.

The mill circuit operates 24 hours per day, 365 days per year at an availability of approximately 93%. Availability is defined as the operating hours in a 24-hour day.

2.6.3 Concentrate Building

The concentrate storage shed on site is capable of holding 18,000 tonnes of concentrate. Shipping from site stops in the fourth quarter, while the Yukon River freezes up and the ice bridge is built, and in the second quarter, for spring thaw.

2.6.4 Tailings Filtration Building

The tailings filtration building currently holds all of the equipment formerly used to produce filtered cake, including a 13.5 m tailings thickener and five Lasta pressure filters. Dry stack tailings operations ceased in November 2012. The tailings thickener is still operational and thickened tailings are directed to the Main Pit using a combination of sub-aerial and sub-aqueous deposition over the life of deposition into the Main Pit.

2.7 WATER MANAGEMENT

Management of water at the Minto Mine plays an important part in the mine planning; strategies and systems for managing water are already in place with the current mining operations. The existing site water management plan has been refined through extensive planning and authorization amendment processes since the inception of the original water management plan prepared and presented with the original project water licence application in 1996. Most recently, these optimizations have been presented in applications for

Water Use Licence QZ96-006 amendments 7 and 8. Amendment 7 was specific to the water management plan, and involved amendments to the effluent quality limits, whereas Amendment 8 involved relatively minor changes specific to the Phase IV mine expansion.

The purpose of water management at the mine is to ensure that the mine operations do not result in unacceptable impacts on surface and groundwater systems, including downstream water quality.

This section describes the following aspects of water management at the Minto Mine:

- The overall site water management strategy;
- The site water balance;
- The Water Management Plan (WMP)

2.7.1 Water Management Strategy

Runoff from developed mine areas (mine water) can mobilize metals and mine-sourced contaminants, such as nitrate, that could have potential adverse effects to the water quality in the receiving environment. The water management strategy in place is intended to limit and manage the inventory of mine water stored on site by segregating clean runoff from mine water that has been impacted by mining activities.

Clean runoff is to be diverted to Minto Creek while mine water is to be used for milling of ore and sub-aqueous deposition of tailings and waste rock.

The strategy for managing the mine water inventory can be summarized as follows:

- Discharge-compliant (clean) runoff will be collected and diverted to the Water Storage Pond (WSP), and from there to Minto Creek. The release of clean runoff is expected to effectively control the inventory of mine water on site.
- Runoff from developed mine areas (mine water) will be collected and stored in the Main Pit Tailings Management Facility and the Area 2 Pit Tailings Management Facility. Mine water will be used for ore processing and deposition of tailings and waste rock.
- Water diversion and conveyance infrastructure will be upgraded to ensure efficient segregation of runoff from undisturbed and developed catchments.
- Water inventory targets will be defined based on forecasts of water demand and runoff volumes. Regular tracking of mine water inventory will allow operators to determine if the inventory is on target; or, if water must be withheld or released from site.

2.7.2 Water Balance

Understanding the site water balance is integral for the development of the water management strategy. The water balance is influenced by a number of factors including the geography of the site, precipitation, evaporation and evapotranspiration, surface runoff, site water inventory, and water use.

2.7.2.1 Water Balance Model

The water balance model for Phase IV was prepared for the Phase IV Yukon Environmental and Socioeconomic Assessment Board (YESAB) application (SRK Consulting, 2010) and for the Water License Amendment 8 application (SRK Consulting, 2012a). The water balance model has also been updated, most recently for the Phase V/VI Expansion Proposal, which is part of the information provided in Appendix A in SRK's report *Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report*. The water balance includes the development of a stochastic water balance model that incorporates historical water balance data and produced predictions of the range of future precipitation and surface runoff events for the proposed development through to post-closure. These predictions contribute to the refinement of options for managing both discharge to the environment and water inventory at the mine site.

The water balance model divides the site and surrounding areas into catchments and sub-catchments within the Upper Minto Creek (Minto Mine site) catchment. The area of the sub-catchments are calculated and classified as undisturbed, developed, or partially developed. Undisturbed catchments typically produce clean runoff that is of similar quality as background water quality in lower Minto Creek; developed catchments produce mine water runoff.

2.7.2.2 Precipitation and Runoff

Assessments of the annual water balance for the site have concluded that the portion of precipitation that ultimately is collected as runoff is approximately 30% of the total annual precipitation. Thus, an estimated 70% of the annual precipitation is lost through evapotranspiration, sublimation, and groundwater recharge. Table 2-3 shows the estimated range of annual precipitation and site-wide runoff,

Table 2-3 Minto Mine Site Precipitation and Runoff Estimates

		1:100 Dry Year	Average Annual Precipitation	1:200 Wet Year
Precipitation	mm	205	329	498
Estimated Site-Wide Runoff	m^3/year	450,000	850,000	1,400,000

2.7.3 Water Management Plan

Minto's comprehensive Water Management Plan (WMP) consists of segregation, diversion, conveyance, treatment and discharge of water to effectively manage water at the Minto Mine and meet licensed effluent discharge standards. The main components and features of the operational water management plan are described below. More detail can be found in the WMP.

2.7.3.1 Water Storage

Runoff is the primary source of the water required for mine operation. Water is currently collected during the spring, summer and fall and then used as required during the remainder of the year. Between approximately 170,000 m^3 (in a 10 year return period dry year) and 1,300,000 m^3 (in a 10 year wet year) of excess water is estimated to report annually to the upper Minto Creek watershed (Clearwater Consultants Ltd., 2011). Water balance updates (2011) suggest that the upper end of this range remains appropriate, but that the low end of the range may be underestimated.

Minto Mine currently has three main water storage areas:

- The Water Storage Pond with a water storage capacity of approximately 325,000 m^3;
- The Mill Pond with a water storage capacity of approximately 5,000 m^3;
- The Main pit with a water storage capacity of approximately 3,900,000 m3, decreasing as the life of the mine progresses due to the placement of waste in the Main Pit (waste rock and tailings); and
- The Area 2 pit, which could also be used for short term storage of excess runoff that cannot be immediately treated and/or discharged.

The WSP is formed behind the WSP dam. Storm water and runoff water from the catchment area above the WSP dam currently report to the WSP during spring, summer and fall. The maximum depth of water in the WSP dam is approximately 15 m. The area covered by water at maximum depth is approximately 5 ha and the length of the WSP is approximately 500 m. Minto uses the reclaim water system from the WSP when water from the Mill Pond is insufficient for operations, and in addition to using reclaim water from the main pit tailing supernatant. All runoff collected from the site can be directed to the WSP if warranted, i.e. during base summer flows to recharge the process water supply for the winter. The WSP also receives direct runoff from the slope to the south.

Impacted water is stored in the Mill Pond (approximately 3 m depth) southwest of the mill. Currently the Mill Pond receives discharge from Pit dewatering and excess process water from the plant and is isolated from most surface water flow. Upper catchment flows are piped around the Mill Pond to avoid mixing with impacted water.

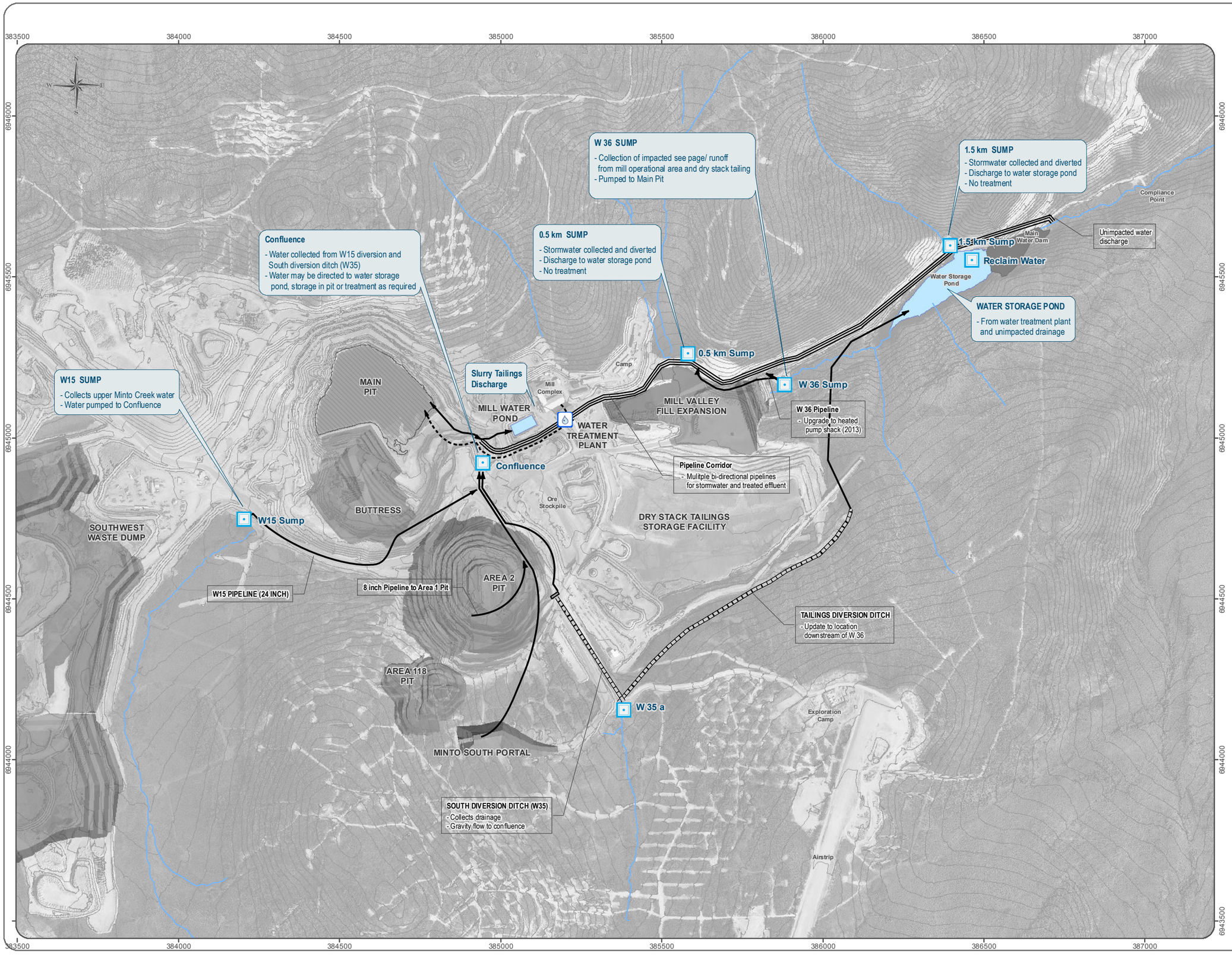
Runoff reporting to the W35 sump (including runoff pumped from the W15 sump and runoff from the South Diversion Ditch) can all be directed if appropriate into the Main Pit for temporary storage if required due to water quality constraints. Storage of water in the Pit is anticipated for short periods during freshet and significant precipitation events.

Stored impacted water will either be used as process water or treated prior to discharge. Undiverted storm water, and possibly some treated water, will report to the WSP, which may provide additional process water. As a contingency, the WSP may serve as a containment area in case of local failure of the impacted water circuit collection systems. If impacted water reports to the WSP, this water can be subsequently treated either directly in the WSP or pumped via the Conveyance Network for treatment in the Water Treatment Plant.

2.7.3.2 Conveyance Network

The Minto site has in place a network of collection points, ditches, berms, culverts, pipes and pumps (the "Conveyance Network" comprised of storm water and impacted water circuits) to divert storm water off site and, depending on observed water quality and operational requirements, discharge impacted water or move it to the WSP, Mill Pond or, if necessary, the Pit. The current locations and alignments of these collection and conveyance features are shown on Figure 2-4.

Pump stations are in place where gravity flow is not possible. Each collection sump is intended to briefly detain water during periods of peak flow until the associated pumping system is able to expel the excess water. Each sump includes a fail-safe consisting of a culvert, French drain or spillway which can release excess water from the collection sump in the event of pump failure or if the pumping capacity is exceeded. The collection sumps are designed to allow the pumps to operate at peak capacity, however Minto does not anticipate the collection sumps will capture all waters. Collection sumps and pump stations are not designed for 100% capture and conveyance of waters during freshet. The design of the Conveyance Network components anticipates that downstream structures (including the WSP) will accommodate overflow.



capstone
MINTO MINE

MINTO MINE PHASE IV

RECLAMATION AND CLOSURE PLAN REVISION 4.0

FIGURE 2-4
OPERATIONAL WATER MANAGEMENT

SEPTEMBER 2013

- Collection Point
- Water Treatment Plant
- Pipe Alignment
- Piping Corridor
- Tailings Slury Discharge
- Diversion Ditch

0 100 200 300 400 500 Meters

ACCESS

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14 th 2012.
Site contours derived from 2012 aerial imagery obtained from Challenger Geomatics.

Hydrology data provided by Minto Explorations Ltd, May 2009.

Datum: NAD 83 Projection: UTM Zone 8N

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_2-4_Operational Water Management_20130703.mxd
(*Last edited by: mducharme;16/09/2013/15:43 PM*)

2.7.3.2.1 W15 Sump

Runoff reports to the W15 Sump from the upper Minto Creek catchments where the Southwest Dump and Reclamation Overburden Dump are located. Minto has characterized waters from these catchments as impacted water, because they drain an operational area of the mine. However, this runoff is currently less impacted and can be handled separately from the more impacted waters associated with the Pit, the mill/stockpiling area and the Dry-Stack Tailings area. A collection sump and pump station (W15 Sump) pumps water through a nominal 24-inch pipe into the South Diversion Ditch and ultimately to the W35 sump at the confluence area and, depending on measured water quality, subsequently discharged to the receiving environment, diverted and stored in the Water Storage Pond or directed to storage in anticipation of treatment.

2.7.3.2.2 South Diversion Ditch and W35 Sump (Confluence)

The South Diversion Ditch (SDD) intercepts channelized surface water from the south area of the upper watershed, which drains the area west of the airstrip. Since the Phase IV expansion, the SDD has been directing flow to a headwall that directs diverted water into a pipe following the road alignment and ties into the existing diversion pipe network in the confluence area near the mill. The headwall has a spill way that allows excess water to spill into the Area 2 pit if the flow rate exceeds the pipe capacity.

The collected runoff is directed via the South Diversion Ditch to the Confluence area and W35 sump and handled based on the same decision process as described above for the water pumped from the W15 sump.

2.7.3.2.3 Tailings Diversion Ditch

The design for the Dry Stack Tailings Storage Facility includes diversion structures to the south/east of the facility to redirect upslope run-on water away from the tailings and into the Minto Creek valley (ultimately to the WSP). A berm/ditch structure was constructed in 2009 but does not function as required. This structure is being re-constructed and extended to the east of the tailings area.

2.7.3.2.4 Km 0.5 and 1.5 Sumps

Storm water reporting to the Km 0.5 and 1.5 sumps along the site access road is diverted around the Minto Mine infrastructure using a system of collection sumps, pumps and pipes.

2.7.3.2.5 W37 Sump and Pipeline (impacted water)

The W37 Sump in the Minto Creek Valley down-gradient of the Dry Stack Tailings Facility and the mill complex area is a key component of the current and ongoing water management plan. Water quality results to date from the monitoring of the seepage from the tailings facility, as well as runoff from the stockpile and operational areas around the milling complex show high metal loads that require treatment prior to discharge from the site. The sump currently collects impacted water and pumps directly to the open pit and then to the WTP for treatment prior to release, through a dedicated pipeline that follows the pipeline corridor along the access road.

As a result of the Mill Valley Fill Expansion material being placed downgradient of the mill and DSTSF area, the W37 pipeline required realignment to keep it on the surface in this area. The sump and water retention

berm were reconstructed to ensure adequate water capture, while the pumping system was upgraded to better handle large seasonal variations in flow rate.

2.7.3.3 Water Treatment Plant

In order to treat water to the required effluent quality standards, a clarifier system to treat impacted water using coagulants, flocculants and sulphide precipitation is used. In addition to the clarifier system, Minto also uses its Water Treatment Plant, constructed with similar technology and commissioned in May 2010. The 3,600 cubic metres per day (m^3/d) capacity WTP is located within a 60-foot by 150-foot building (18-feet in height) adjacent to the tailings filter building. This building enables year-round operation including in winter temperatures if necessary, however Minto's intent under normal conditions is to operate the WTP primarily during freshet and the summer months.

The WTP design incorporates the use of an inorganic aluminum-based coagulant as the best option to facilitate settling of TSS and metal sulphides. Sulphide chemistry is then used to achieve sufficient removal of copper, by first converting dissolved metals to metal sulphides, and then using a flocculent to achieve settling of the coagulated TSS and metal sulphides. A majority of the metal loading at Minto Mine is associated with TSS loading, therefore efficient TSS removal is an essential first step in the WTP design. To achieve this, the WTP is designed to accommodate a highly variable TSS concentration in impacted water and will incorporate several treatment steps, including coagulation of suspended solids using Nalco Aluminex 5 and use of organic sulphide TMT to convert dissolved copper to a sulphide that will be precipitated in a ballasted sand clarifier. The next step is addition of a flocculent in another clarifier to aid in the continued precipitation of TSS and sulphides. Treated water decants from the clarifier and undergoes filtration as a polishing step, and final discharge water may also be amended with sodium bicarbonate to maintain an adequate pH and alkalinity.

In 2011, Minto completed an assessment of options for adding a module to the existing WTP for removing these parameters to concentrations below the discharge standards. Treating water for selenium to concentrations less than 3 µg/L is possible but is exceedingly challenging without generating by-products that are far more environmentally hazardous and problematic from a disposal point of view. It was concluded that installation of a reverse osmosis (RO) unit offered the best chance of success of achieving the objective of releasing water from site in 2012. It was recognized, however, that the addition of a RO unit alone would not satisfy long-term water treatment requirements. An assessment of long-term water treatment or water management options is underway.

In 2012, two reverse osmosis (RO) trains capable of handling 2,500 m3/day per train were added to the treatment process downstream of the existing clarification and filtration units, for the purpose of treating nitrate and selenium, based on water quality limits received in the Water Use Licence Amendment 7. Treated effluent from the RO units may also be amended, when necessary, with sodium bicarbonate to adjust the pH and add salinity and alkalinity.

The RO process removes 95–99% of all constituents in the feed water. The feed water for the RO unit is the effluent from clarification and filtration unit, which is operated as a pre-treatment step. The RO unit produces a clean effluent stream that consists of approximately 75% of the feed water (the RO permeate). The by-product of the process is a brine stream, which consists of about 25% of the feed water and 95–99% of constituent loadings. The brine stream is pumped to the Main Pit. Because of this brine by-product, RO cannot

be considered a true water treatment process but is rather a process that concentrates mine water into a smaller volume with higher constituent concentrations.

2.7.3.4 Source Control

Since total suspended solids (TSS) can be a significant factor affecting water quality, an important part of the Water Management Plan is source control consisting of erosion prevention and dust suppression. Dust control efforts currently consist of watering roads, the addition of water and a dust-suppression reagent at the crusher, and use of a curtain at the top of the stacker conveyor. Minto continues to monitor dust levels and address any issues.

The primary erosion control initiative at the site is the establishment of the water diversion and conveyance network which significantly decreases water movement over disturbed areas at Minto Mine. On areas where diversion and collection as part of this network is not afforded, or areas upgradient of diversion and collection, protection against the mobilization of significant amounts of sediment is based on runoff, erosion and sediment control best management practices. Successful runoff control will reduce the need for more expensive and difficult erosion and sediment control measures. Ongoing BMPs at the Minto Mine include:

- Swales and tail ditches to limit sediment mobilization on exploration roads;
- Recovering and re-seeding of disturbed areas in order to establish a vegetative mat to address erosion; and
- Recontouring of disturbed surfaces to minimize the distance and control the direction of water flow across them.

2.7.3.5 Monitoring Program and Mine Water Discharge

A key component of the current and proposed water management plans is the water quality surveillance program. The water quality (and quantity) monitoring program results provide valuable information that is used on a variety of timescales from instantly to annually to make water management decisions at the site. The water quality surveillance program is reported monthly, quarterly and annually as required by the water use licence.

3 ENVIRONMENTAL SETTING

Table 2-1 provides a summary of the key environmental features near the project area. Baseline environmental reports have been prepared to document and describe the existing environmental setting of the site. These baseline reports are attached as Appendices in the Minto Mine Phase V/VI Expansion Project Proposal. Readers of this document are referred to those reports should additional information be required.

Forest fires have affected large parts of the Minto Creek basin and surrounding areas during the past twenty years, and as recently as the summer of 2010. An earthquake January 30, 2008 resulted in a review of the engineering design of all major infrastructure units, which are have design peak ground accelerations of 0.055 to 0.150 g.

3.1 CLIMATE, HYDROLOGY AND DESIGN EVENTS

The climate in the Minto region is subarctic continental characterized by long, cold winters and short, cool summers. The area experiences moderate precipitation in the form of rain and snow and a large range of temperatures on a yearly basis with a mean annual temperature below 0°C.

Meteorological data are available for the Minto Mine site from two meteorological stations that have been operational since 2005 and 2010, respectively. They provide a continuous but short record of air temperature, wind velocity and direction, pressure, and precipitation. Long-term meteorological data and climate normals are available from the Pelly Ranch (Fort Selkirk – Climate ID#2100880) Meteorological Service of Canada station, 25 km northeast of the Minto Mine, with a continuous record of daily air temperatures and precipitation in the form of rainfall and snowfall from 1956 to present (57 years). Snow surveys have been conducted at Minto Mine in 1994, 1995, 1998, and annually from 2006 to date, at three locations in the Minto Creek catchment area. Hydrometric data have been collected intermittently on Minto Creek since 1993 at two stations: W1, Minto Creek near the mouth, with a catchment area of 42 km^2 and W3, Minto Creek downstream of water storage pond dam, with a catchment of 10.4 km^2.

The mean annual rainfall measured at Minto is 174 mm (EBA 2010; omitting precipitation occurring when air temperatures were below zero due to improper tipping bucket readings). Environment Canada's Canadian Climate Normals (1971-2000) for Pelly Ranch indicate that on average, annual precipitation occurs 64% as rainfall and 36% as snow. With the assumption that regional precipitation is homogeneous and ignoring any significance of elevation, orographic effects or valley orientation, the Minto property can be estimated to receive an additional 100 mm of water-equivalent precipitation in the form of snow annually for a total annual precipitation of approximately 274 mm (EBA 2010).

August is the rainiest month at the Minto site with an average rainfall of 51.0 mm. The largest monthly rainfall total was 101.8 mm (July 2011). The largest one-day rainfall was 28.2 mm (August 25, 2008). The extreme daily rainfall recorded for Pelly Ranch was 34.8 mm on July 20, 1960, while the extreme daily snowfall recorded for Pelly Ranch was 20.8 cm on November 27, 1958, with 20 cm also recorded on March 23, 1993. Based on the ten years of snow surveys, the average water-equivalent snow depth remaining on the first day of March and April is 95.0 mm and 96.8 mm, respectively. May results indicate that the snowpack was either entirely melted or substantially reduced; thus highlighting that the majority of runoff due to snowmelt occurs in April.

Additional the climate baseline information and precipitation analysis are available in the Minto Climate Baseline Report (ACG, 2013a) and the Precipitation Analysis for the Minto Mine Memorandum (SRK Consulting, 2012b) respectively.

Design flood flows used for the design of water conveyance structures were calculated using the rational method. Given that extreme rainfall events tend to yield the largest instantaneous flows for small watersheds like the Minto Mine site, the rational method provides a methodology to calculate extreme flows from design rainfall events. For ditches located downstream of the pits, flow routing through the pits was also considered given the significant surface area of the pits compared to the calculated flows.

Sub-catchments for the different water conveyance structures was performed in ArcGIS using the end-of-Phase-IV contour data. Rainfall intensities were derived from the Pelly Ranch Intensity-Duration-Frequency. Runoff coefficients were selected for forested areas (0.25) and disturbed lands (0.5) within each catchment. The length of the rainfall event was adjusted to the time of concentration of each sub-catchment. The time of concentration is defined as the theoretical time it would take for water to travel from the headwaters of the basin to the outlet, or the time it would take for the entire catchment to contribute to flow.

The 200-year flood (0.5 % probability of exceedence in any single year) was selected as a baseline value for evaluating preliminary sizing of water conveyance and diversion channels for closure. Detailed explanations of the derivation of design flows and the design of water conveyance ditches are provided in the Closure Hydrology Report (Appendix B).

3.2 CLOSURE WATER QUALITY PREDICTIONS

Minto retained SRK to develop a predictive water chemistry model in order to understand more thoroughly what the potential water quality discharging from the site would be at closure. The predictive water chemistry model is based on site monitoring data and the ongoing geochemical characterization program which includes humidity cells conducted on appropriate material types, and is an update of previous similar work conducted by SRK for both closure and operational periods. A copy of the results of the predictive water quality model for the site can be found in Appendix A.

Previous water quality prediction work in support of the closure planning for Minto (2011 DRP) incorporated the following key elements:

- Hydrology source terms from the site water balance model;
- Areas and locations of waste placement;
- Geochemical source terms based on information available at the time; and
- Mitigation measures required to achieve closure water quality objectives for Phase IV. These included:
    - Soil covers; and
    - Passive/semi-passive treatment of surface waters at key locations.

Most of these key elements have been revisited for the update of the predictive modeling for Phase V/VI, and also utilized for this Phase IV RCP. These predictions, although developed for an expanded mine plan, are appropriate and conservative as planning tools for Phase IV closure planning. The reader is directed to SRK's report entitled *Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report* which is appended to this report as Appendix A.

This predictive modeling work was initially conducted as a screening exercise using isolating soil covers on waste facilities as the sole closure mitigation, and did not incorporate expected load reductions from planned passive treatment systems. This was conducted to inform the closure planning team of the initial mitigative value of isolating soil covers in mitigating expected water quality from site runoff and seepage at closure. A series of scenarios was evaluated in the modeling (typical/upper limit concentrations, expected case/reasonable worst-case) and summary tables for key parameters during the 'open months' (April through October) are provided below in Table 3-1 through Table 3-4 below for Site Effluent (Water Storage Pond) and Lower Minto Creek (W1) locations during the post-closure period.

Table 3-1: Expected Case Predictions for Effluent Quality (WSP) for key parameters during open water season

Parameter	Ag	Al	Ammonia	As	Cd	Cr	Cu	Fe	Fluoride	Hg	Mo	Ni	Nitrate	Nitrite	Pb	Se	Sulphate	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Post-Closure Period - Typical Concentrations																		
Apr	0.00011	0.74	0.085	0.0013	0.000096	0.0018	0.028	1.2	0.51	0.000049	0.0074	0.0028	1.2	0.015	0.00055	0.0021	42	0.013
May	0.00011	0.74	0.083	0.0013	0.000095	0.0018	0.028	1.2	0.50	0.000046	0.0074	0.0028	1.1	0.014	0.00054	0.0021	43	0.013
Jun	0.00011	0.75	0.082	0.0012	0.000094	0.0018	0.027	1.2	0.49	0.000045	0.0073	0.0028	1.1	0.014	0.00054	0.0021	44	0.012
Jul	0.00010	0.75	0.081	0.0012	0.000094	0.0018	0.027	1.2	0.48	0.000047	0.0072	0.0028	1.1	0.014	0.00054	0.0021	43	0.012
Aug	0.00010	0.76	0.079	0.0012	0.000094	0.0018	0.027	1.2	0.49	0.000049	0.0072	0.0028	1.1	0.014	0.00055	0.0021	42	0.012
Sep	0.00011	0.76	0.078	0.0012	0.000093	0.0018	0.027	1.2	0.49	0.000049	0.0072	0.0028	1.1	0.013	0.00055	0.0021	41	0.012
Oct	0.00011	0.75	0.077	0.0013	0.000093	0.0018	0.027	1.2	0.49	0.000048	0.0072	0.0028	1.0	0.013	0.00054	0.0021	41	0.012
Post-Closure Period - Upper Limit Concentrations																		
Apr	0.00011	0.78	0.12	0.0015	0.00010	0.0020	0.031	1.3	0.71	0.000055	0.014	0.0030	1.7	0.02	0.00060	0.0035	58	0.014
May	0.00011	0.78	0.12	0.0015	0.00010	0.0020	0.031	1.3	0.70	0.000054	0.014	0.0030	1.6	0.02	0.00059	0.0034	59	0.014
Jun	0.00011	0.78	0.12	0.0014	0.00010	0.0020	0.030	1.3	0.67	0.000051	0.013	0.0030	1.6	0.02	0.00058	0.0033	59	0.013
Jul	0.00011	0.79	0.12	0.0014	0.00010	0.0020	0.029	1.3	0.65	0.000054	0.013	0.0030	1.6	0.02	0.00059	0.0033	58	0.013
Aug	0.00011	0.79	0.11	0.0014	0.00010	0.0020	0.029	1.3	0.65	0.000054	0.013	0.0030	1.6	0.02	0.00059	0.0032	56	0.013
Sep	0.00011	0.79	0.11	0.0014	0.00010	0.0020	0.029	1.3	0.65	0.000054	0.013	0.0030	1.5	0.02	0.00059	0.0032	55	0.013
Oct	0.00011	0.78	0.11	0.0014	0.00010	0.0019	0.029	1.3	0.66	0.000053	0.013	0.0030	1.5	0.02	0.00059	0.0032	55	0.013

Table 3-2: Reasonable Worst Case Predictions for Effluent Quality (WSP) for key parameters during open water season

Parameter	Ag	Al	Ammonia	As	Cd	Cr	Cu	Fe	Fluoride	Hg	Mo	Ni	Nitrate	Nitrite	Pb	Se	Sulphate	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Post-Closure Period - Typical Concentrations																		
Apr	0.00016	0.89	0.14	0.0024	0.00018	0.0030	0.050	1.5	0.71	0.00014	0.015	0.0039	3.0	0.084	0.0012	0.0042	68	0.019
May	0.00016	0.89	0.14	0.0023	0.00018	0.0029	0.048	1.5	0.69	0.00014	0.015	0.0038	3.0	0.083	0.0011	0.0041	68	0.018
Jun	0.00015	0.88	0.13	0.0022	0.00017	0.0028	0.047	1.4	0.67	0.00013	0.014	0.0038	2.9	0.082	0.0011	0.0040	68	0.018
Jul	0.00015	0.89	0.13	0.0022	0.00017	0.0028	0.047	1.5	0.67	0.00013	0.014	0.0038	2.9	0.080	0.0011	0.0040	66	0.018
Aug	0.00015	0.90	0.13	0.0022	0.00017	0.0028	0.047	1.5	0.67	0.00013	0.014	0.0038	2.8	0.079	0.0011	0.0040	65	0.018
Sep	0.00015	0.89	0.13	0.0022	0.00017	0.0028	0.047	1.5	0.68	0.00013	0.014	0.0038	2.8	0.078	0.0011	0.0040	65	0.018
Oct	0.00015	0.89	0.12	0.0022	0.00017	0.0028	0.047	1.5	0.68	0.00013	0.014	0.0038	2.7	0.076	0.0011	0.0040	65	0.018
Post-Closure Period - Upper Limit Concentrations																		
Apr	0.00018	0.96	0.20	0.0028	0.00021	0.0034	0.056	1.6	0.96	0.00016	0.023	0.0044	4.3	0.12	0.0014	0.0067	90	0.021
May	0.00018	0.95	0.19	0.0028	0.00021	0.0034	0.055	1.5	0.95	0.00016	0.023	0.0043	4.3	0.12	0.0014	0.0066	90	0.021
Jun	0.00017	0.94	0.19	0.0026	0.00020	0.0032	0.053	1.5	0.90	0.00015	0.022	0.0043	4.2	0.12	0.0013	0.0063	88	0.020
Jul	0.00017	0.96	0.19	0.0026	0.00019	0.0032	0.052	1.5	0.89	0.00015	0.022	0.0043	4.1	0.12	0.0013	0.0062	87	0.020
Aug	0.00017	0.96	0.19	0.0026	0.00019	0.0032	0.052	1.5	0.88	0.00015	0.021	0.0042	4.0	0.11	0.0013	0.0061	85	0.020
Sep	0.00017	0.95	0.18	0.0026	0.00019	0.0032	0.052	1.5	0.88	0.00015	0.021	0.0042	4.0	0.11	0.0013	0.0061	84	0.020
Oct	0.00017	0.95	0.18	0.0026	0.00019	0.0032	0.052	1.5	0.89	0.00015	0.021	0.0042	3.9	0.11	0.0013	0.0061	84	0.020

Table 3-3: Expected Case Predictions for Lower Minto Creek (W1) for key parameters during open water season

Parameter	Ag	Al	Ammonia	As	Cd	Cr	Cu	Fe	Fluoride	Hg	Mo	Ni	Nitrate	Nitrite	Pb	Se	Sulphate	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Post-Closure Period - Typical Concentrations																		
Apr	0.000039	0.34	0.027	0.00064	0.000055	0.0010	0.013	0.59	0.23	0.000020	0.0025	0.0014	0.25	0.011	0.00025	0.00071	17	0.0064
May	0.000074	5.2	0.042	0.0029	0.00014	0.011	0.023	8.9	0.25	0.000020	0.0027	0.011	0.26	0.0065	0.0027	0.00096	32	0.025
Jun	0.000035	0.86	0.034	0.00095	0.000051	0.002	0.010	1.6	0.26	0.000039	0.0024	0.0029	0.24	0.0062	0.00051	0.00085	23	0.0090
Jul	0.000054	3.0	0.039	0.0020	0.000089	0.0058	0.017	5.0	0.32	0.000043	0.0027	0.0065	0.25	0.0057	0.0015	0.00089	13	0.016
Aug	0.000056	2.8	0.038	0.0023	0.000085	0.0053	0.016	5.4	0.64	0.000022	0.0025	0.0070	0.24	0.0055	0.0016	0.00085	17	0.017
Sep	0.000042	0.53	0.029	0.00084	0.000036	0.0013	0.011	1.2	0.32	0.000022	0.0024	0.0025	0.24	0.0046	0.00044	0.00088	18	0.0065
Oct	0.000034	0.28	0.030	0.00070	0.000045	0.00082	0.011	0.69	0.30	0.000021	0.0026	0.0018	0.27	0.0054	0.00024	0.00090	16	0.0046
Post-Closure Period - Upper Limit Concentrations																		
Apr	0.000044	0.38	0.044	0.00072	0.000060	0.0011	0.015	0.64	0.49	0.000023	0.0044	0.0015	0.54	0.021	0.00028	0.0012	30	0.0070
May	0.000079	5.4	0.064	0.0031	0.00014	0.011	0.025	9.2	0.31	0.000023	0.0045	0.011	0.48	0.017	0.0028	0.0014	38	0.027
Jun	0.000078	5.4	0.063	0.0031	0.00014	0.011	0.025	9.2	0.31	0.000042	0.0044	0.011	0.48	0.0088	0.0028	0.0013	38	0.026
Jul	0.000058	3.1	0.058	0.0021	0.000094	0.0061	0.018	5.2	0.37	0.000044	0.0042	0.0068	0.44	0.0087	0.0016	0.0012	26	0.017
Aug	0.000058	3.1	0.056	0.0023	0.000093	0.0061	0.018	5.3	0.70	0.000044	0.0040	0.0070	0.43	0.0079	0.0016	0.0012	21	0.017
Sep	0.000058	2.7	0.055	0.0023	0.000086	0.0052	0.016	5.3	0.70	0.000024	0.0039	0.0070	0.43	0.0077	0.0016	0.0012	23	0.017
Oct	0.000044	0.32	0.045	0.00076	0.000050	0.00098	0.012	0.80	0.35	0.000024	0.0043	0.0021	0.48	0.0081	0.00033	0.0012	23	0.0059

Table 3-4: Reasonable Worst Case Predictions for Lower Minto Creek (W1) for key parameters during open water season

Parameter	Ag	Al	Ammonia	As	Cd	Cr	Cu	Fe	Fluoride	Hg	Mo	Ni	Nitrate	Nitrite	Pb	Se	Sulphate	Zn
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Post-Closure Period - Typical Concentrations																		
Apr	0.000054	0.39	0.038	0.00094	0.000078	0.0014	0.019	0.66	0.28	0.000045	0.0046	0.0017	0.62	0.031	0.00042	0.0013	24	0.0080
May	0.000088	5.2	0.055	0.0032	0.00016	0.011	0.029	9.0	0.30	0.000044	0.0046	0.011	0.64	0.021	0.0028	0.0015	39	0.027
Jun	0.000047	0.89	0.045	0.0012	0.000070	0.0023	0.015	1.6	0.31	0.000059	0.0040	0.0031	0.57	0.019	0.00065	0.0013	29	0.010
Jul	0.000066	3.0	0.052	0.0023	0.00011	0.0060	0.021	5.0	0.36	0.000063	0.0044	0.0067	0.59	0.019	0.0016	0.0014	19	0.017
Aug	0.000068	2.8	0.050	0.0025	0.00010	0.0056	0.020	5.5	0.69	0.000043	0.0042	0.0073	0.58	0.018	0.0018	0.0013	22	0.018
Sep	0.000055	0.56	0.039	0.0011	0.000057	0.0016	0.016	1.3	0.37	0.000044	0.0042	0.0027	0.58	0.017	0.00059	0.0014	25	0.0079
Oct	0.000048	0.32	0.041	0.00098	0.000067	0.0011	0.016	0.75	0.35	0.000044	0.0046	0.0021	0.63	0.019	0.00040	0.0014	22	0.0061
Post-Closure Period - Upper Limit Concentrations																		
Apr	0.000063	0.43	0.066	0.0011	0.000090	0.0015	0.022	0.73	0.57	0.000054	0.0072	0.0019	1.3	0.050	0.00050	0.0021	39	0.0091
May	0.000096	5.4	0.085	0.0034	0.00017	0.011	0.032	9.3	0.38	0.000053	0.0072	0.011	1.2	0.044	0.0030	0.0023	47	0.029
Jun	0.000094	5.4	0.084	0.0034	0.00017	0.011	0.031	9.3	0.37	0.000065	0.0069	0.011	1.2	0.035	0.0030	0.0022	46	0.028
Jul	0.000072	3.2	0.077	0.0024	0.00012	0.0064	0.024	5.2	0.42	0.000068	0.0064	0.0071	1.1	0.032	0.0017	0.0020	33	0.018
Aug	0.000073	3.2	0.074	0.0026	0.00012	0.0064	0.024	5.4	0.76	0.000068	0.0062	0.0073	1.1	0.032	0.0018	0.0019	28	0.019
Sep	0.000073	2.7	0.073	0.0026	0.00011	0.0055	0.022	5.4	0.76	0.000050	0.0062	0.0073	1.1	0.032	0.0018	0.0020	30	0.018
Oct	0.000060	0.37	0.064	0.0011	0.000077	0.0013	0.019	0.87	0.41	0.000050	0.0068	0.0024	1.2	0.034	0.00052	0.0021	30	0.0076

For the post-closure period, the expected case (typical concentrations) and reasonable worst-case (upper limit concentrations) scenarios were evaluated in an aquatic resource effects assessment, described in Section 8 of Minto's *Phase V/VI Expansion Mining and Milling, Minto Mine* Project Proposal to YESAB (July 2013). The outcomes of the modeling and effects assessment suggest that even in the most conservative of evaluated model scenarios (reasonable worst case, upper limit concentrations), mitigation of potential metal loading from waste facilities using operational source control and closure isolating soil covers constructed from available site materials alone are not expected to result in adverse effects to aquatic resources downstream of Minto mine.

As such, further loading reductions from additional mitigations – namely passive treatment systems – were not integrated further into SRK's modeling work. SRK did provide the closure planning team with estimations for water quality/quantity at key proposed passive treatment areas (W15 below SWD, surface of Main Pit with completed tailings deposition, and W37 area at the toe of the MVFE). These estimations were utilized with additional site information to develop effluent estimations from wetland at these locations. This

information is provided in Section 6 as contingency water treatment rationale, along with proposed key reclamation measures for these locations.

The outcomes of the water quality predictions, the effects assessment evaluating the potential effects on aquatic resources from the Minto mine in a reasonably conservative closure scenario, and the feedback from the effects assessment on the proposed closure mitigation measures has led to the refinement of the Minto Mine closure and reclamation strategy. Section 4 introduces this reclamation strategy, and the subsequent sections provide more detailed information on the reclamation and closure plan.

4 RECLAMATION STRATEGY

This section of the RCP provides reclamation objectives and the overall reclamation strategy for the Minto site. Also provided is information regarding planned reclamation, revegetation research programs and details and observations on reclamation and re-vegetation to date. The reclamation strategy proposed by Minto is based on the long-term protection of aquatic resources in the downstream environment of Minto Creek and the Yukon River.

A systematic approach to decommissioning and closure reclamation has been developed for the Minto project. Progressive reclamation measures have been implemented where possible during mine construction and operations. This approach has provided valuable reclamation success feedback for use in advanced/final closure, and these progressive efforts will also help reduce slope erosion through physical slope stabilization of revegetation efforts, enhancing ultimate reclamation success.

An important part of the reclamation planned for the Minto Mine is the safe conveyance of surface water through the site toward Minto Creek. The alignment of major ditches to convey water on the mine site has been established to prevent erosion and to protect site infrastructure. The site layout is presented in Section 6.8, while additional discussion of the design of ditches is presented in subsequent sections.

Minto has received substantial feedback on closure plan submissions – from regulatory bodies, and from Selkirk First Nation, including their respective technical reviewers. This feedback – combined with results from reclamation research and specific evaluations of site conditions – has enabled Minto to refine their reclamation strategy for the Minto Mine site. A key exercise guiding this evaluation and refinement of the Minto reclamation strategy was undertaken in January 2013 in the form of a preliminary Failure Modes and Effects Assessment (FMEA) session. A two day workshop (followed by partial day sessions to complete the exercise with a smaller group was held to identify the risks involved with components of a few different closure option scenarios being considered for the Minto mine. The workshop, facilitated by Dirk van Zyl of the University of British Columbia, was held in Whitehorse from January 15th – 19th, 2013. Technical representatives from the following stakeholders and government agencies participated:

- Capstone Mining Corp.;
- Selkirk First Nation;
- Access Consulting Group;
- SRK Consulting;
- Yukon Government, Energy, Mines, and Resources (Steve Jan Consultants); and
- Yukon Water Board (Gomm Environmental Engineering Company).

Lead up meetings on closure planning strategies with technical representatives from SFN and YG EMR in December 2012 had 'shortlisted' 6 candidate closure scenarios for the Minto Site, each of which had a different key closure measure focus. The FMEA group concurred after reviewing some preliminary water quality estimations for each scenario that there were 3 most likely scenarios that were appropriate to carry forward through the FMEA process. These are presented below with the key assumptions of each:

Scenario1: Source Control Focus

- Highest quality covers on waste rock and tailings
- No treatment

Scenario 2: Hybrid of Source Control and Treatment Focus

- High quality covers on waste rock and tailings
- Use of active and passive treatments on site

Scenario 3: Treatment Focus

- Routine quality covers on waste rock and tailings
- Use of active and passive treatments on site, managing water using reservoirs to optimize treatment plant function and collection systems

The outcomes of the preliminary FMEA process are captured in the tables presented in Appendix C. The group initially identified classes of failure, which were used to identify potential failure mechanisms with associated likelihood and consequence factors. The pre-developed spreadsheet tools then assigned each failure mechanism with a risk ranking, and the team collaborated on considerations and potential risk mitigation measures for failure modes. The session completed with an understanding that once the final closure strategy for the site were determined, that the FMEA exercise should be revisited specific to the proposed closure measures.

As a result of the review of the preliminary FMEA findings (specifically the potential failure mechanisms assigned the highest risk), and further informed by more recent site evaluations (updated water quality prediction and cover material evaluation), Minto has adopted limited source control of potential contaminants with contingency load reduction through passive and/or active treatment as the principle tenets of the reclamation strategy for the Minto site. This is effectively a variation of Scenario 3, which employs water treatment (either passive or active) as contingency measures, as opposed to 'key' reclamation measures. This shift is predicated on the recent water quality prediction modelling for the site, and the attendant effects assessment submitted for the Phase V/VI Expansion, as outlined above in Section 3.2. This strategy will be employed with a stronger emphasis on Adaptive Management of the closure conditions, a clear outcome of the preliminary FMEA process.

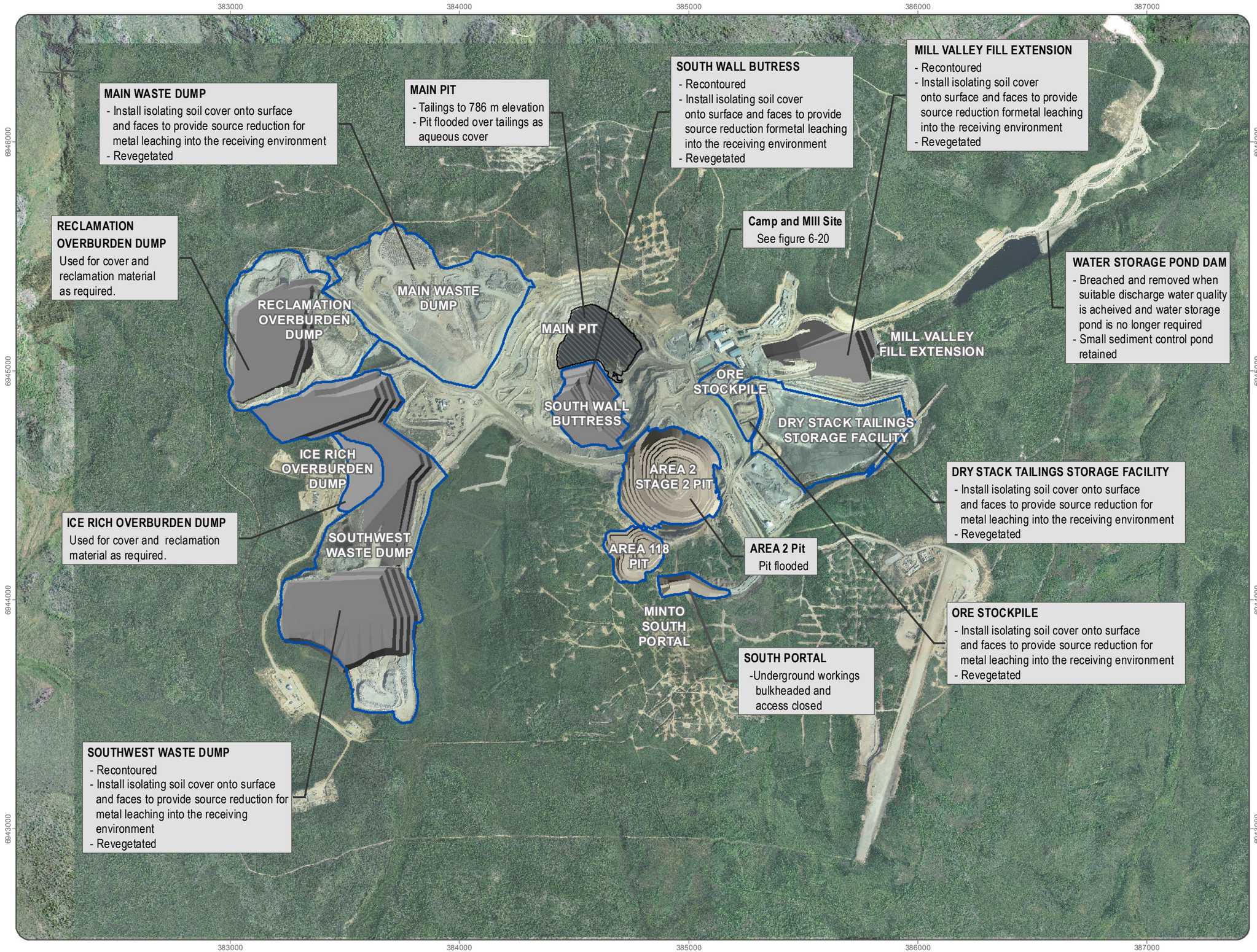
The revisiting of the FMEA in the context of this preferred strategy has not been completed to date, largely due to outstanding uncertainty regarding the required stabilization measures for DSTSF instability (for which internal and 3rd party evaluations are ongoing). Minto recognizes the sensitivity of the participating parties to the application of these preliminary results. Minto also recognizes that SFN may not concur with the adopted closure and reclamation strategy in this RCP, however Minto and SFN continue to work together on both leadership and technical levels to resolve key differences of opinion related to closure of the Minto site. Minto will continue these discussions in the ongoing collaborative closure planning efforts and ultimately attempt to achieve a set of closure objectives and mitigation measures that has the full support of SFN. In the interim, the preliminary FMEA results have been exceedingly useful in guiding the closure planning team towards the preferred closure strategy. Minto suggests that these findings adequately cover potential failure modes for the strategy presented in this RCP, and is confident that the reclamation and closure strategy put

forward is a responsible and achievable plan that will effectively achieve the stated closure objectives for the Minto site.

The application of the revised closure and reclamation strategy will be presented in Section 6 and detailed in key reclamation measures outlining the isolation of mining wastes from the environment. The use of passive water treatment technologies at the site has been contemplated as a key in previous site closure plans. Refinement of geochemical source term and water quality predictions suggests that the additional load reduction offered by passive treatment will not be required to meet suitable discharge water quality. Passive treatment systems are now included as contingency closure measures. Active treatment is discussed but is considered mitigation for the active decommissioning and transitional closure period, and beyond that, a worst-case final fallback mitigation to potential water quality impacts from the site if the mitigative measures described in Section 4.2 are not effective in reducing metal loadings to the receiving environment.

Overall reclamation measures are summarized by site feature in Figure 4-1.

There is inherent uncertainty in developing reclamation and closure plans, as mitigations and closure method performance are contingent upon the predictions of future conditions. Minto believes it is critical to acknowledge these areas of uncertainty and to provide for mechanisms in the planning stage that will address unexpected results or conditions in the closure period. Adaptive Management Planning is widely accepted as an appropriate tool for achieving this objective, and Minto has included an AMP framework with this RCP (Appendix D) and intends to advance its level of detail in future versions of this plan in collaboration with SFN and their technical advisors.



capstone
MINTO MINE

MINTO MINE PHASE IV

RECLAMATION AND CLOSURE PLAN REVISION 4.0

FIGURE 4-1
SUMMARY OF PROPOSED RECLAMATION MEASURES

SEPTEMBER 2013

Phase IV Tailings
Phase IV Dumps
Phase IV Pits

0 100 200 300 400 500 Meters

ACCESS

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14 th 2012.

Datum: NAD 83 Projection: UTM Zone 8N

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_4-1_Summa_Reclam_Measures_20130913.mxd
(*Last edited by: mducharme;13/09/2013/14:33 PM*)

4.1 RECLAMATION AND CLOSURE OBJECTIVES

The primary objectives of the closure and reclamation of Minto Mine are:

- To have a closure planning process that seeks input from SFN and incorporates the input into closure planning;
- To protect the health of people pursuing traditional activities including hunting, fishing, trapping, camping and collection of plants for food, medicinal or cultural purposes;
- To protect people from safety risks when they are pursuing traditional activities including hunting, fishing, trapping, camping and collection of plants for food, medicinal or cultural purposes;
- To protect the environment (including land, air, water, plants, animals fish and other environmental components and their interrelationships) from long term effects caused by the mine activities and facilities;
- To return the mine site and affected areas to a state similar to surrounding lands so that people can pursue traditional activities the same as they did before mining, including hunting, fishing, trapping, camping and the collection of plants for food, medicinal or cultural purposes;
- To protect the environment from long-term effects caused by post-closure access to the mine area;
- To protect the environment from effects of earthquakes, floods, climate change and other natural events on related mine structures;
- To have effective management and control structures in place during operation, closure and post-closure to provide:
    - Adequate financial resources to carry out all closure activities including plan implementation and long-term activities;
    - Adequate flexibility during closure and post-closure to allow adaptation of activities in order to address unexpected performance and events; and
    - Consideration of Minto's long-term desire to "walk away" from the site under conditions acceptable to SFN and with adequate resources provided to address long term requirements.
    - To minimize long term activities by ensuring long term chemical and physical stability of mining components and disturbed areas;
    - To confirm the effectiveness of closure measures by monitoring the site after closure, and to respond adaptively if measures are not performing as expected;
- To undertake mine planning incorporating progressive reclamation;
- To provide short and long term slope stabilization and erosion control on linear and non-linear disturbances;
- To ensure the long-term chemical stability of residual mining components and their effects on water quality draining the property;
- To ensuring the long-term physical stability of key structures such as the waste dumps and the diversion and drainage ditches; and
- To work towards a passive closure scenario for most or all mine components.

The overall goal of closure at the Minto site is to leave the area as a self-sustaining ecosystem, ensuring that land use after closure is compatible with the surrounding lands, and that the site vegetation returns to a state as near as possible to that in existence prior to mining activities. Further information on the key reclamation

and closure methods is introduced in Section 4.2, and information regarding the selected methods for specific mine components is presented in Section 6.

These closure objectives are reflective of the closure objectives laid out for the licensee to achieve in Schedule B of the Quartz Mining Licence QML-0001 "Terrestrial Reclamation Standards for the Minto Mine". These standards were derived from the YG's Reclamation and Closure Policy as well from a submission from the SFN Lands and Resources Department which represents the interests of SFN members.

4.1.1 Closure Water Quality Objectives

As identified above, one of Minto's key closure and reclamation objectives for the Minto site is:

> *To protect the environment (including land, air, water, plants, animals fish and other environmental components and their interrelationships) from long term effects caused by the mine activities and facilities;*

Minto considers this goal as the paramount guiding objective to follow in the identification of objectives for runoff and receiving environment water quality from the Minto site at closure. Minto used recent predictive modeling work and subsequent potential environmental effects evaluations related to the proposal for the Phase V/VI Expansion of the Minto Mine as the premise for the closure water quality objectives.

In that proposal (YESAB, Project #2013-0100) Minto evaluated the existing effluent and water quality standards in the Water Use Licence QZ96-006 in terms of their appropriateness, achievability, and effectiveness in ensuring protection of aquatic resources in the Minto Creek and Yukon River receiving environments. Since early 2011 natural variability in the Minto Creek system downstream of the area of the mine's control has resulted in substantial exceedances in water quality standards at station W2 in the absence of any discharge from the mine. Minto cannot, under any scenario, achieve water quality in lower Minto Creek meeting these values.

Minto is proposing a reclamation and closure strategy which defines water quality objectives as:

- the existing *licenced* effluent discharge *limits* as measured at the last point of control for the site in closure (proposed at station W50).

Minto's revised closure water quality prediction for Phase V/VI (considered a reasonable and conservative proxy for Phase IV) suggests that most of the existing licenced effluent limits would be achievable under the proposed Phase IV closure and reclamation strategy. Cadmium and selenium are the sole licenced parameters for which this may not be the case. Minto has however put forward in the Phase V/VI Expansion proposal to YESAB extensive rationale for – and evaluation of potential effects of – the revision of the cadmium and selenium effluent limits. The outcome of that effects assessment supports the revision of the cadmium and selenium limits and does not anticipate any significant adverse effects related to cadmium and selenium concentrations from effluent discharge under proposed closure conditions.

Minto recognizes that monitoring of potential effects to aquatic resources in the receiving environment is a responsibility of the company in both operational and closure conditions. Minto will use the Adaptive Management Plan framework committed to in this RCP to achieve the closure objective of *long-term protection of aquatic resources in lower Minto Creek and Yukon River*. Appropriate monitoring and effects

evaluation tools, e.g. the Biotic Ligand Model for aqueous copper, will be employed throughout the proposed closure monitoring period to ensure this objective is achieved.

Closure water quality objectives are the subject of ongoing discussion with SFN, and Minto is committed to continuing the dialogue and technical evaluation of alternative water quality objective definitions going forward. These discussions are currently aimed at finding a mutually agreeable definition of suitable water quality and mechanisms for ensuring its achievement.

4.2 KEY RECLAMATION AND CLOSURE METHODS

Through previous closure planning initiatives and ongoing reclamation research, Minto has identified several key reclamation and closure methods that are consistent with meeting the reclamation objectives identified in the previous section. To this end, Minto has considered closure and reclamation measures that are low maintenance, cost effective, and has adopted standard or widely accepted methods where appropriate. Where opportunities exist to reduce active management in closure through the application of more innovative techniques (i.e. application of passive/semi-passive technologies), Minto has explored their viability using a combination of the current state of industrial knowledge, plans for furthering 'proof of concept' through site-specific research, and adaptive management planning to mitigate remaining uncertainty.

Most of the methods proposed for employment at Minto are standard practice (e.g. recontouring, seed and fertilizer application, scarification of compacted surfaces) and do not require detailed explanation of their application. The remainder of this section describes the techniques and methods that are specific to addressing higher risk failure mechanisms and to achieving suitable site discharge water quality at closure. These include:

a) Source Control methods; and

b) Contingency Water Treatment.

4.2.1 Source Control

Source control is intended to be the primary control for the reduction of metal loadings to the receiving environment through limiting the access of water to materials known to have metal leaching issues. Source control includes such measures as operational characterization and materials handling programs, sub-aqueous disposal, engineered cover systems and encapsulation. Source control measures that are proposed for Minto Phase IV will primarily be a combination of operational characterization and materials handling programs, sub-aqueous disposal and soil covers.

4.2.1.1 Operational Materials Characterization and Materials Handling Plans

Materials characterization allows mining companies to understand the different ore and waste material types present at a site and develop special handling plans based on any identified environmental concerns associated with each material type. Minto tests all of its development rock in advance of the materials being

removed from the active mining face. For Phase IV, the waste rocks are characterized based on the acid rock drainage potential and the contained copper content.

The use of copper content for the development of the waste rock classification system is supported by the association of increased abundance of copper sulphide mineralization with increasing mineralization of the deposit. A review of the geologic database indicates that over 90% of the total contained metals within the geological materials at this site occur within materials with a copper content of greater than 0.1%. It should be noted that the lack of materials characterization and handling programs during the initial phases of mining at the site resulted in potential metal leaching material being placed into the waste rock dumps which have a larger surface area. Geochemical characterization work conducted by SRK in support of Phase IV identified the need for materials characterization and handling program to ensure that waste materials with the potential for metal leaching could be identified and stockpiled or disposed of in an appropriate manner.

Material handling plans are used to instruct the mining operation crews as to where the different rock classes may be placed. Minto has an established materials handling and classification system in order to identify ore and waste during operations. The current Minto waste materials handling procedure is summarized as follows:

- Drill cuttings from every blasthole are sampled, bagged, tagged, and sent for to the assay lab prior to blasting;
- A representative sample of the cuttings is assayed using atomic absorption (AA) to determine the metal content: The Minto assay lab, under supervision of the Chief Assayer, has the ability to conduct copper, oxide, and silver assays;
- The assay results are sent to the Geology Department for interpretation;
- The Geology Department plots the results spatially, then draws polygons enclosing holes with similar assay results to identify regions of similar average grade;
- After blasting, the aforementioned polygons are laid out in the field by the Mine Surveyor working with the Production Geologist in order to inform Mine Operations of where the materials within a polygon are to be taken;
- Field layout is done with using stakes and flags of various predefined colors for ore bearing materials;
- Ore and waste are loaded out and dispatched to the appropriate locations based on the aforementioned flags;
- These locations are communicated to foremen and operators by the Production Geologist and under the direction of the Mine Foreman.

The current Minto materials handling procedure has been expanded during Phase IV development to include the identified waste categories. Table 4-1 contains the waste rock material classifications and handling plans that were utilized during Phase IV.

Table 4-1 Waste Rock Classifications and Handling Plans

Material	Handling Plan and Closure Measure
Waste rock with no copper content	Material to be used for general construction fill at the site. No neutral metal leaching expected to occur.
Waste rock with contained copper content of less than 0.1%	Material to be placed into the waste rock dump or backfilled into the Area 118 pit. Minor neutral metal leaching may result from this material but is not expected to be significant due to the low metals content
Waste rock with a contained copper content from 0.1% to 0.3%	Medium Grade Waste originally to be stockpiled in the Grade Bin Disposal Area for subsequent disposal at closure. South Wall instability necessitated relocation of this stockpile to SWD, revision of geochemical source terms and water quality prediction suggest rudimentary cover in place is a sufficient closure measure.
Waste rock with a contained copper content from 0.3% to 0.64%	High Grade Waste which could be milled at the end of mining, to be stockpiled. Currently stockpiled at southern extent of SWD, will most likely remain in place at closure given current commodity prices, Minto suggesting high quality cover as precautionary closure measure, although revised geochemical source terms do not suggest this is necessary.
Waste rock classified as Potentially Acid Generating based on geochemical characterization program	Material to be simultaneously disposed with tailings into the Main Pit for subsequent sub-aqueous disposal at closure. This is being conducted currently.

Overburden segregation is required for mine sites where there is a need to ensure that waste materials generated by stripping and other development activities are preserved for future reclamation activities. The implementation of reclamation at the Minto Mine will require a large volume of overburden for isolating soil cover construction. Overburden has been stockpiled separate from waste rock since in the Ice-Rich Overburden Dump and the Reclamation Overburden dump for this purpose. SRK's characterization of available and expected overburden materials in the context of their potential for use in construction of waste covers is included in Appendix E.

4.2.1.2 Sub-aqueous Disposal

Sub-aqueous disposal involves the placement of materials underwater. In the case of potentially acid-generating materials, this method of disposal is done in order to limit exposure to oxygen. This method of source control can be very effective given that the dissolved oxygen content of water is approximately 10,000 times less than for materials that are located above water. In the case of tailings materials for Minto, which are not an acid generating concern, sub-aqueous disposal is conducted to contain the materials and to limit the neutral metal leaching, erosional and runoff concerns associated with surface disposal options. Minto currently employs this method with NP:AP<3 waste material from the Phase IV mining, and disposes of the slurry tailings from milling in this fashion (in the Main Pit currently).

Flooding of waste rock in a pit lake will result in some initial flushing of metals as the materials become wetted but this can be treated either with passive batch treatment or active treatment if required prior to

water being discharged from the pit. Once the waste rock and tailings within the pit has become flooded the movement of water through the flooded materials becomes controlled by diffusion which acts to limit metal leaching.

Over time, the development of a fine sediment layer on the surface of flooded materials helps to seal off the materials and further limits their ability to contribute to metal loadings. The period immediately following the placement of soil covers onto waste dumps will potentially contribute to the development of sediment layers until such a time as vegetation becomes well established.

4.2.1.3 Waste Cover Systems

A number of candidate waste cover systems have been identified for Minto's waste facilities. SRK Consulting has undertaken a scoping level evaluation of available materials at the Minto site (and commercially available products) to identify types of covers that could be considered for placement on site waste material at closure. Different cover options have very different performance, installation and maintenance considerations. SRK has presented a thorough scoping level assessment of waste cover options, and this evaluation is presented in Appendix E.

As identified in Section 3 previously, the water quality at closure is expected to be protective of the most sensitive receiver – even under reasonable worst case, upper limit concentration conditions – from the application of a rudimentary isolating soil cover on waste materials. Accordingly, the reclamation strategy now adopts the application of this cover type to all site waste facilities. This cover type can be constructed from available materials (stockpiled overburden) at the Minto site.

The isolating soil cover is the simplest and least expensive of evaluated cover options. It is expected to provide modest reductions to infiltration (from approximately 30% of mean annual precipitation on native ground to 20% MAP), but not without expected periods of significant breakthrough. The construction materials are expected to be erodible, and revegetation and runoff control will be key to establishing and maintaining their integrity. Figure 4-2 below presents a simple preliminary design of this preferred closure cover type.

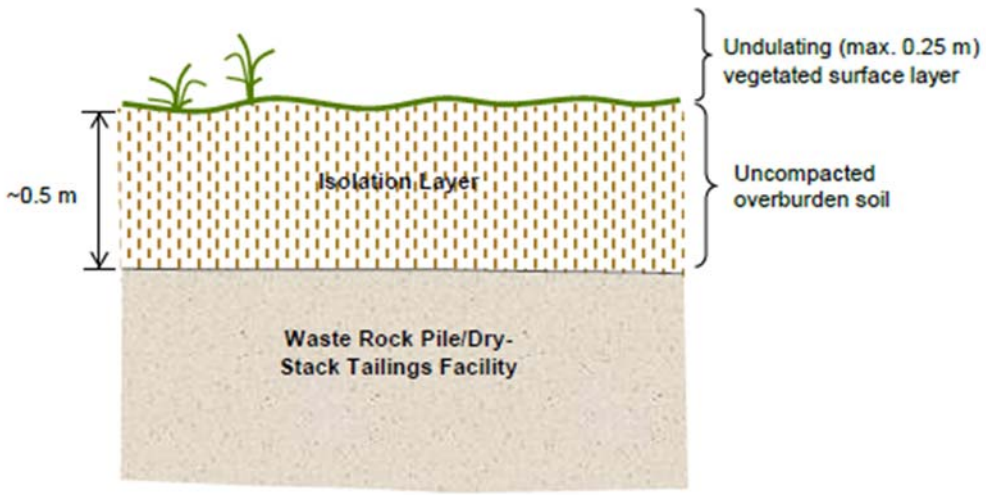


Figure 4-2 Conceptual Isolation Cover (SRK, 2013a)

The following sections detail contingency mitigation measures that are intended to provide additional load reduction capacity from site sources should the isolating soil covers not provide the anticipated mitigation.

4.2.2 Contingency Water Treatment Methods

4.2.2.1 Pit Lake Pre-Treatment

The Main Pit and Area 2 Pit will be flooded at closure and will create a large sedimentation pond in the post-closure period. Using the pit for the removal of suspended solids will act to reduce potential total metal loadings to the receiving environment. Flooding of the pit will also allow for some natural attenuation and removal of metals from the water column based on the results of investigations on in-pit lakes at other mine-sites. The potential in-pit treatment of site water has not been included in the current predictive modelling conducted for the closure of the site, but may be used as a pre-treatment technique, if conditions in closure are amenable, to improve water quality leaving the Main Pit and/or Area 2 Pit.

Completely passive mechanisms for water quality improvements in pit settings may include:

- Particle settling to remove suspended solids in runoff waters.
- Oxygenation of constituents in seepage by exposure of collected water to the atmosphere. Oxygenation of iron or manganese contained in waste rock or tailings seepage can lead to precipitation of iron or manganese oxides, which will provide a sorption-based removal mechanism for some trace metals including copper.

- Algal or other photosynthetic microbial sorptive removal of dissolved metals by sorption on organic biomass. Naturally, pit lakes will develop some photosynthetic biomass, which in a low-productivity catchment such as that absorbed at Minto Mine will be low in nutrients; consequently this mechanism will be limited unless enhanced by nutrients. The use of pits as pre-treatment sites for semi-passive treatment vessels could be done especially during the transition from active water treatment to passive closure. Two practical approaches that could be combined include:
    - Addition of organic reagents and/or alkaline reagents to the pits to create an anaerobic zone in the lake where metal removal in reductive forms, including metal sulphides or reduced metal oxides, is encouraged. Typically a combination of carbon sources is utilized to achieve both rapid formation of reductive conditions (carbon sources such as sugars and alcohols), and sustained maintenance of reductive conditions (carbon sources such as wood chips and other biomass forms).
    - Addition of nutrients including nitrogen and/or phosphate will enhance the development of a photosynthetic algal or microbial population in the lake, which will provide both a direct removal by sorption on biomass, as well as sustaining anaerobic conditions in the deeper part of the lake as the photosynthetic biomass decays, acting as a sustainable mechanism for anaerobic conditions in the lake bottom.

- Examples of the pre-treatment of pit lakes for metals removal include:
    - The Anchor Hill pit at the Gilt Edge Mine in South Dakota, which had ice-covered conditions for more than five months of the year, where alkaline reagents and multiple organic sources including wood chips, alcohols, and sugar syrups were added (Harrington et al., 2004). Greater than 90% removal of metals including copper were achieved and sustained for several years.
    - The pit lake at the Barite Hill Mine in South Carolina, alkaline reagents and multiple organic sources including wood chips, alcohols, and sugar syrups were added (Harrington et al. 2009). Greater than 99% removal of most metals including copper was achieved.

Investigations are currently underway to evaluate the feasibility and effectiveness of batch treating pit-lake water by adding additional carbon sources (e.g., sugars and alcohols) to create reducing conditions that would facilitate the precipitation of metals as sulphides. Initial limnocorral tests have provided promising results for sequestering metals. These evaluations will continue over the next several years to develop "proof of concept" for batch treatment of the pit-lake water. More details of the ongoing pit-lake treatment evaluation are presented in Section 4.5.4.1.

4.2.2.2 Passive and Semi-Passive Treatment Systems

Passive treatment systems were identified as critical to achieving required closure water quality in previous Minto closure planning efforts. Refinement of expected site geochemistry and drainage at closure by SRK suggests that the application of standard reclamation measures and covering of wastes with isolating soil covers will be sufficient to achieve suitable discharge water quality without the need for additional treatment. That said, the importance of additional load mitigation measures to account for unexpected site conditions is

acknowledged by the closure planning team, as is the importance of applying reasonable mitigation effort to minimize effects to the receiving environment. Passive and semi-passive treatment systems are therefore still proposed as key adaptive management measures for the achievement of acceptable water quality from the Minto site in the closure condition. The use of passive treatment will be guided by the Adaptive Management Plan (Appendix D).

Passive treatment as a remediation method for mine-impacted water can be a sustainable method used during post-closure of a mine, as they generally involve significantly less direct capital costs, as well as lower operations and maintenance costs, when compared to traditional active treatment options (Kilbourn Inc., 1999).

There are numerous definitions of passive treatment that have been used. Gusek (2002) defined passive treatment in terms of the use of each type of treatment that occurs within a system, such that

> *Passive treatment is a process of sequentially removing metals and/or acidity in a natural-looking, man-made bio-system that capitalizes on ecological and geochemical reactions. The process requires no power and no chemicals after construction and lasts for decades with minimal human help.*

While Pulles et al. (2004) defined passive treatment processes in terms of energy:

> *A water treatment system that utilizes naturally available energy sources such as topographical gradient, microbial metabolic energy, photosynthesis and chemical energy and requires regular, but infrequent maintenance to operate successfully over its design life.*

The Global Acid Rock Drainage (GARD) Guide's (INAP, 2010) definition builds from the previous two to describe passive treatment as

> *Processes that do not require regular human intervention, operations, or maintenance and should typically employ natural construction materials, (e.g., soils, clays, and broken rock), natural materials (e.g., plant residues such as straw, wood chips, manure, and compost) and promote the growth of natural vegetation. Passive treatment systems use gravity flow for water movement.*

The terms "passive" and "semi-passive" are often used almost interchangeably, with no clearly defined transition between the two terms. In general, the term passive suggests a system that is largely self-sustaining with minimal requirement for ongoing maintenance while semi-passive refers to systems engineered systems that require a higher degree of monitoring and active management to perform optimally.

All of the definitions involve a minimal amount of operations and maintenance, and the use of mimicking natural mechanisms in a controlled environment; however, it is Gusek's definition which includes the concept of sequential that becomes significant for the purposes of remediating mine-closure sites. No single cell or specific type passive treatment system can completely remediate a complicated mine drainage site on its own. The use of numerous systems or groups of systems are designed to target different aspects of the whole to work together to achieve adequate removal. Thus, passive treatment must be seen as a sequence of processes that achieve an end result together, since there is no single system that can be effective in every situation (Gusek, 2009).

With that in mind – and with the assumption that if required, passive treatment systems would be employed in a contingency, adaptive manner – it was recognized at the outset that reclamation research into passive

treatment at the Minto site would need to focus not only the individual technologies but also innovative ways in which the various complementary passive treatment technologies can be combined in an optimal manner to create robust, self-sustaining, integrated passive treatment systems which can handle a wide range of conditions, variable flow rates and large fluctuations in water quality.

The incorporation of passive treatment systems to treat mining impacted waters at the Minto mine site has been discussed previously at a fairly conceptual level. The current reclamation plans and reclamation research are now working towards developing specific, detailed, quantifiable designs to have available for implementation should the key source control closure measures not perform as anticipated. In order to confirm the feasibility of passive treatment systems to provide significant additional reduction of contaminant load generated by the mine it was necessary to confirm that 1) a significant portion of the contaminant load could be passively routed through areas which are amenable to constructing passive treatment systems, and 2) that passive treatment technologies would work at Minto given the anticipated contaminant loads and cold climate.

A detailed review of the site wide water balance confirmed that significant portion of the mining impacted seepage, surface flow and contaminant load could be passively intercepted at a few specific areas which have sufficient space and topography for the incorporation of a wide variety of passive treatment systems (e.g., constructed wetlands).

The various potential passive treatment technologies were evaluated and ranked in order to determine which passive treatment technologies held the greatest promise for incorporation in Minto water management and closure planning. A guidance document to help short list and then select an appropriate method for managing mine waste sites was created by The Interstate Technology and Regulatory Council (ITRC), a body of socio-economic and environmental regulators, industry, federal government, and stakeholders that work towards innovative environmental decision making (ITRC, 2010).

ITRC's "Mining Waste Treatment Technology Selection" guidance document (and associated literature reviews) is an interactive and iterative web-based decision tree which provides a systematic framework that can be used to identify a short list of appropriate technologies (ITRC, 2012). The ITRC decision tree framework was used for identifying the range of potential passive treatment technologies which may be applicable at the Minto Mine because it provides a straightforward and transparent method for selecting treatment technologies. It also provides legitimacy in the selection process by using an internationally recognized method that was created specifically for mining waste sites.

Following the identification of potential passive treatment technologies, a screening level evaluation and ranking of the potential passive treatment technologies was conducted. Some of the key considerations evaluating the various treatment technologies included:

- Work acceptably in cold weather;
- Sustainable in the long-term;
- Minimal/low intensity active maintenance scenario;
- Suitable for addressing Minto's specific CoCs (e.g., Cu, Cd, Se);
- Robust technology with adequate precedent of successful application;

- Amenable to collaboration with SFN and consistent with their aspirations for long-term employment and future land use;
- Cost effective; and
- Amenable to incorporation in an Adaptive Management Plan and modifying/expanding if initial design underperforms.

The technology evaluation and ranking (based on key considerations listed above) concluded that biological reactors (bioreactors) and constructed wetland treatment systems (CWTSs) are the two most promising technologies for further, site-specific consideration at Minto. Permeable reactive barriers (PRBs) also ranked high; however, it was recognized that foundation conditions (in particular discontinuous permafrost) combined with the site layout may limit potential applicability at the Minto site. Research is also ongoing into the potential for in-pit treatment to play a role in addressing site wide water quality issues.

4.2.2.2.1 Constructed Wetland Treatment Systems (CWTS)

Wetlands are areas of transition between uplands and open water, possessing unique biogeochemical cycles that function to transfer and transform materials within the ecosystem (Mitsch and Gosselink 1993). These biogeochemical cycles are influenced by a number of interrelated biological, chemical, and physical processes involving unique hydrologic, vegetation, hydrosoil, and microbial conditions (Mitsch and Gosselink 1993). Because of their inherent ability to transfer and transform materials that flow through them, wetlands have received considerable attention for water treatment (Hammer 1989, Dunbabin and Bowmer 1992, Moshiri 1993, Davies and Cottingham 1994, Kent 1994). Mitsch and Gosselink (1993) listed the following wetland attributes that can affect surface water character:

- A decrease in water velocity, causing sediments and chemical sorbed to sediments to drop out of the water column;
- A variety of anaerobic and aerobic processes in close proximity, promoting de-nitrification, chemical precipitation, and other chemical reactions that remove certain materials from the water column;
- High rates of productivity that can enhance mineral uptake by vegetation and subsequent burial in the sediments when plants senesce;
- A diversity of decomposers and decomposition processes in wetland sediments;
- Significant sediment-water exchange; and
- Accumulation of organic peat, resulting in burial of sediment-bound chemicals.

However, natural wetlands are often not available or appropriate for water treatment purposes. Therefore, wetlands can be constructed with specific design features (vegetation, hydroperiod and hydrosoil) that enhance transfers and transformations of targeted materials (Sinicrope et al. 1992, Hawkins et al. 1997, Gillespie et al. 1999, Gillespie et al. 2000, Huddleston et al. 2000).

Constructed wetlands differ from natural wetlands in that they are typically designed for a specific purpose or purposes, such as wastewater treatment, fish and wildlife habitat, migratory waterfowl usage, flood control, and aesthetic values (Bastian and Hammer, 1993). Wetlands have been designed and constructed for treatment of wastewaters from a variety of sources, including storm water and agricultural runoff (Ferlow 1993, Higgins et al. 1993, Rodgers and Dunn 1992, Moore 2000) municipalities (Bastian et al. 1989)

petroleum refineries (Litchfield and Schatz 1989, Hawkins et al. 1997, Gillespie et al. 2000, Huddleston et al. 2000), pulp and paper mills (Sherwood 1992, Boyd et al. 1993, Thut 1993, Moore et al. 1994), and acid mine drainage (Brodie 1993, Eger et al. 1993, Hedin et al. 1994). Wastewater constituents that have been successfully treated (decreased or removed) by constructed wetlands include biochemical oxygen demand, suspended solids, nitrogen and phosphorus compounds, organic chemicals, and metals (Hammer 1989, Moshiri 1993, Kent 1994).

There exists considerable literature (even entire books) that report successes and failures of passive treatment systems in cold climates (e.g. Mander and Jenssen 2002). This literature needs to be winnowed to focus on studies that are applicable to this particular situation and site. Of critical importance will be studies regarding the influence of cold temperatures on:

- removal pathways for constituents requiring a decrease in concentrations;
- the success of decreasing concentrations of specific constituents;
- the effects on reaction rates and removal efficiency;
- designs employing detention basins for equalizing flows and increasing residence times that might equalize concentrations; and
- Other important factors, such as nitrogen-limited CWTSs for sustained treatment.

One of the assessments that must be made when considering the potential for impacts of cold climate on the performance of a CWTS is the determination of whether water will be requiring treatment year-round, or only during warm, free flowing months. Much of the scientific literature on cold climate function of CWTS has focused on treatment of municipal wastewater, which is produced year round and requires treatment year round. In the situation of municipal wastewater, rarely is it possible to use a retention pond to store the volumes of water requiring treatment until the summer months. In contrast, at a northern mine site during post-closure, impacted water is only occurring during the months where water is free flowing and the amounts of water that might flow (typically seepage of ground water) during frozen months would be minimal and can be stored in retention ponds until spring thaw. This difference in periodicity of treatment needs alters the design considerations and applicability of both cold-climate concerns and technologies. In light of these aspects of CWTS design basis, it must be realized that the available literature can form an initial basis for a feasibility study, but information gleaned from the literature alone will need to be supported by and confirmed through more site-specific investigation.

Constructed wetlands are considered to be one of the most established passive treatment methods for remediating mine-impacted water and have been used by the mining industry since the mid-1980s (Eger and Wagner 2003, Gusek, 2000, ITRC 2003). Wetlands have numerous unique characteristics. Anaerobic CWTS can be designed to facilitate microbial metabolism involved in sulphate reduction, achieving treatment of the water through reduction of the valency of elements such as aluminum, antimony, arsenic, cadmium, chromium, copper, lead, mercury, manganese, molybdenum, nickel, silver, selenium, sulphur, thallium, uranium, and zinc. Some elements will be precipitated in their reduced form, for example, selenium will be reduced from Se IV or VI valency to Se 0 which becomes a precipitate. Treatment in an anaerobic CWTS is also achieved through precipitation of metal sulphides, including primary metal sulphides as well as precipitation of iron sulphides such as amorphous FeS and co-precipitation of metals within the FeS matrix. For example, manganese and aluminum are traditionally thought of as elements that are treated aerobically; however, they may be precipitated in mineral form through complexation with FeS matrixes.

There have been many wetland systems that have had long-term success but there have also been failures among improperly designed systems, and these failures have had a negative impact on the perception of wetland effectiveness. Many of the systems that failed or were not effective at remediating the contaminants of concern were either improperly sized or designed, all of which can be corrected through a systematically designed piloting program (INAP 2010).

It must be recognized that it is not the origin (e.g., mining, oil and gas, industrial) of the water requiring treatment that is important in the design and effectiveness of a CWTS, but rather, the characteristics of the water chemistry itself and the elements requiring treatment. There are two main types of constructed wetlands; those that are designed to maintain surface flow conditions, and those that have been designed to encourage sub-surface flow. Surface flow wetlands can be designed to encourage either aerobic or anaerobic conditions, depending on design, while sub-surface flow wetlands typically encourage permeable, anaerobic conditions. (Gammons and Frandsen 2001, Eger and Wagner 2003, ITRC 2003, Kilbourn Inc., 1999).

For long-term removal to continue within constructed wetlands, not only must the mechanisms at work keep pace with the contaminant loadings but must also account for seasonal loadings. To achieve effective water treatment, the CWTS must be designed with the proper characteristics and size. A series of sequential treatment cells, incorporating aerobic and anaerobic treatment can be used in combination with other aspects such as oxygenating waterfalls and sediment collecting riffles. Regular monitoring and maintenance will ensure that clogging or invasive plants have not inhibited the removal processes, also monitoring the flow rate and paths will ensure full use of the wetland (ITRC 2003, Kilbourn Inc. 1999).

One of the main constraints of using a constructed wetland for remediation of mine-impacted water is that it can requires a significant amount of land. The amount of land is proportional to the volume of flow being treated and the removal coefficient for the contaminants of concern. This does not mean that size alone means an effective remediation wetland, and a solid understanding and application of the mechanisms described previously should be considered. Treatment wetlands require a footprint that is dependent on the volume of flow to be treated and loading of constituents of concern. A widely used approach in municipal wastewater treatment is based on volumetric loading, with a treatment volume of 3.28 to 6.57 m^3/day per square meter of wetland (INAP 2010). However, depending upon the targeted constituents, other approaches to determine the footprint including rate coefficients and removal pathways may be more reliable to determine appropriate sizing of a CWTS, especially when metals treatment is of importance.

Areas that have been identified as potential locations for construction of passive treatment wetlands on the Minto Site include the:

- W15 Area – Upgradient of the runoff collection sump at the toe of the Southwest Dump; and
- W37 Area – vicinity of the existing Water Storage Pond and Dam location, below the toe of the MVFE.

More information on how CTWSs could be implemented at these candidate locations is presented below.

4.2.2.2.2 Biological Reactors

Bioreactors are proposed as the complimentary contingency passive treatment technology to CTWSs for Minto closure. In the broadest sense, a bioreactor can be defined as permeable treatment zone that uses biochemical processes. Biological reactors use the degradation of organic materials for the purposes of treatment and often involve installation of the treatment materials into lined trenches or pond systems. These systems have been used in mining applications to treat groundwater discharges from underground workings and also for shallow groundwater systems. Treatment media for biological reactors in the documented studies are often derived from local municipal and industrial waste sources; however, it would be necessary to determine whether these sources exist in the local area or can be sourced and transported to site in a cost effective manner. Wood chips or peat are local products that could be utilized. These systems could also be operated in a semi-passive mode where an alcohol tank can be set up to drip into the influent end of the biological reactor, and only require infrequent refilling.

Because of the northern climate for this location, a bioreactor installation at the Minto mine site is anticipated to be an in-place (buried) treatment cell. By its location and placement, it is designed to intercept and remediate contaminated (mining impacted) water, and would be employed if locations monitored in the surveillance program, and comparison with site objectives and thresholds in the AMP, determined that further load reduction from seepages were warranted to meet suitable site water quality discharge.

In general, the bioreactor treatment zones would be created indirectly using materials designed to stimulate secondary processes e.g., adding carbon substrate such as wood chips or soluble carbon sources such as sugars and alcohols to enhance microbial activity which will in turn generate biochemical reducing conditions that will enhance metals removal. The COCs in consideration at the Minto site can be reductively precipitated either as an elemental precipitate (such as Se0) or as a sulphide form (such as CuS). In the same reactor, other mine-related parameters, such as nitrate, will also be removed by the microbial processes. Bioreactors with excess reduced species (elevated sulphide, dissolve organic carbon, or reduced metals such as iron or manganese) will need to be paired with a subsequent oxidation cell, which could be an open water body such as a pit lake, a rock-filled cell, a buried or surface water cascade, or an aerobic wetland) to remove these constituents prior to discharge from site.

In this document the term bioreactor refers to shallow permeable treatment zones which are gravity fed and installed immediately down gradient of the source of contamination (e.g., intercepting shallow seeps along the toe of the waste rock dumps). The term “permeable reactive barrier” (PRB) is a specialized form of bioreactor in which the reactive media is trenched and placed deeper into the subsurface, forming a permeable reactive barrier through which a contaminant plume flows. When a PRB is working according to design, water passes through the PRB but the contaminant is retained and removed in the PRB by precipitation processes. Biochemical PRBs, where the permeable substrate contains a carbon source, operates on the same basic principles described for the bioreactor above. It is anticipated that there is limited potential for the application of PRBs at the Minto Site, with the possible exception of the area down gradient of W37 where the ground is presumed to be thawed by the presence of the reclaim pond.

For a PRB to work, it is essential that the in situ hydrogeology of the flow path is known, and that there is certainty that contaminant plume flow will go through the PRB, and that the flow is reasonably uniform across the plume thickness. Where PRBs fail is typically because of flow around the PRB, or concentrated flow through one section of the PRB exhausting the treatment capacity faster than other sections. PRBs are not currently being considered as contingency passive treatment technology for the Minto site.

As discussed previously, the contingency bioreactors proposed for Minto are not intended to be a stand-alone remedy, but rather an important piece of a passive "treatment train" which would include engineered wetlands and monitored natural attenuation. Research is also ongoing for additional in-pit treatment as mining-impacted waters fill the open pits and runoff is eventually routed through the open pits at the end of mine life.

It is generally recognized that the success or failure of a bioreactor depends on the ability of bioreactor to accomplish the following (adapted from ITRC-PRB Technology Update June 2011) (ITRC 2011):

- Promote hydraulic performance whereby target contaminants are routed through the reactive material with an appropriate residence time;
- Adequately collected and routed through the bioreactor (i.e., seepage is not allowed to flow around the bioreactor without being treated); and
- Promote contaminant treatment within the bioreactor zone whereby target contaminants are reduced to intended concentrations in the outflow through the targeted treatment processes.

The bioreactor treatment process itself is relatively straightforward to evaluate. A primary challenge with the design of bioreactors and PRB systems, which can lead to poor performance, is the inadequate characterization of the in situ flow conditions within the permeable reactive media which results in the bioreactor failing to achieve suitable hydraulic performance and residence time. The nature of potential failures includes improper sizing of the reactor for the flow conditions at the site, and problems with the substrate composition. Examples of flow-related failures are cases where the range flow is too great, causing—at certain times of the year—situations where not all of the flow can be routed through the bioreactor (because of limitations of the media), or where the concentration of seepage varies through the year, and the mass loading exceeds the potential mass removal. Examples of these substrate-related failures includes insufficient inclusion of porous media (typically gravel), layered substrates where one layer becomes a flow barrier, and changes in hydraulic properties of organic substrates as they degrade. Other design considerations that affect the potential for bioreactors to work are the physical configuration of the reactor, with some configurations more susceptible to dead zones where substrate is partially or entirely unused for treatment because flow does not pass through these zones.

4.2.2.3 Candidate Contingency Passive Treatment Locations

4.2.2.3.1 W15 Area (Below SWD)

The area adjacent to the SWD and leading into W15 is expected to offer the greatest potential for addressing the mining impacted surface water and shallow groundwater contaminant load close to the potential sources. This area is also near its final configuration with a minimum potential for future mining disturbance. These factors make the area up gradient of W15 ideal for both detailed characterization work and the construction of field scale pilot passive treatment cells.

It is anticipated that insights gained up gradient of W15 will also provide significant insights into other areas that appear to be amenable to passive treatment—including down gradient of the Main Dump, down gradient

of the DSTSF and associated with the outflows of both Area 1 and Area 2 pits, locations which are still active areas of mine operation.

Below is an example of a possible treatment train which may have application at multiple locations on the Minto site, including W15 (Figure 4-33).

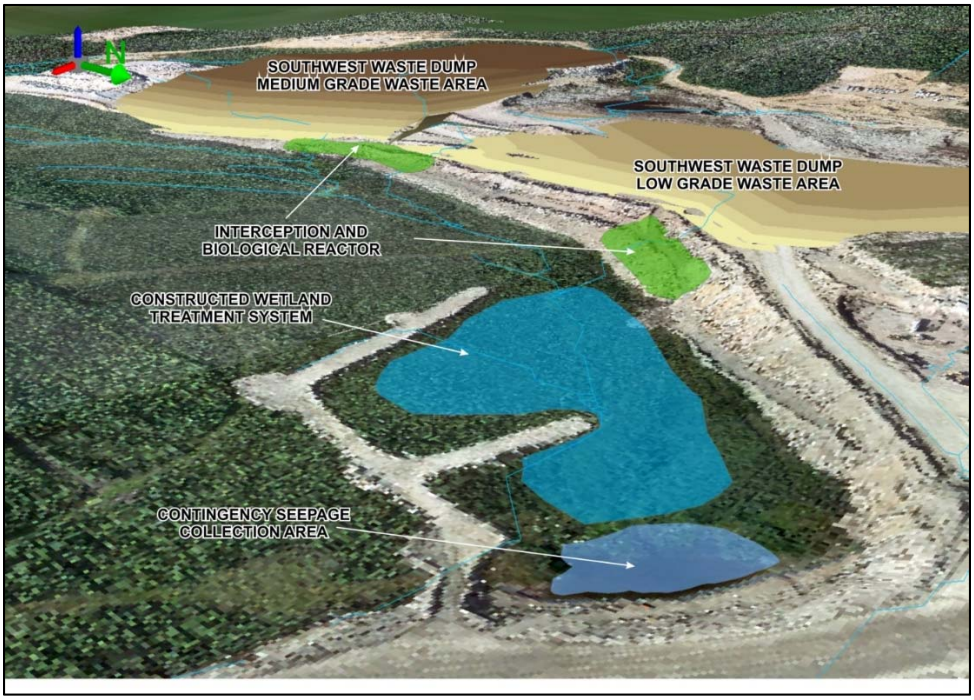


Figure 4-3: Potential Passive Treatment Train Option for W15.

The concept includes the installation of a seepage interception system (i.e., granular filled trenches) along the down gradient toe of the waste rock dumps which would route seepage into shallow bioreactor cells. The bioreactor cells could include both reactive permeable medium and injection ports to enable the introduction of amendments (i.e., additional liquid phase carbon sources to enhance desired biological processes). The bioreactor cell(s) could be designed to overflow into a constructed wetland cell which by its design supports anaerobic processes. This anaerobic wetland cell could, in turn, flow into a constructed aerobic wetland. The Minto site also has significant topographic relief which can be used advantageously to provide aeration and further enhance the removal of metals through precipitation/co-precipitation of metals in an oxidized form.

A treatment train such as the one described above (bioreactor/anaerobic wetland/aerobic wetland) may be suitable for application at multiple locations on the site, including down gradient (east) of the SW Dump, down gradient of the Main Waste Rock Dump, and down gradient of the DSTSF.

While the focus of the early stages of passive treatment characterization work is clearly on the area adjacent to W15 and the SW Dump, additional characterization work will also be completed in subsequent field seasons in the areas down gradient of the DSTSF, adjacent to W37, and within the footprint of the current Water Storage Pond.

Conceptual CWTS Design

As identified above in the treatment train discussion, the CWTS will be made up of multiple treatment steps in a series. Based on the predicted water chemistry, the steps will be a series of anaerobic cells separated by berms to maintain desired depths and reset water flows as needed. Between the three CWTS areas (W15, Main Pit, and W37) small riffles lined with rip-rap will promote reoxygenation of the water and treatment of elements such as aluminum and manganese through oxidative processes.

An anaerobic wetland cell refers to a wetland ecosystem where the microbes in the substrate of the wetland (where the water and soil meet) perform their metabolism without the need for diatomic oxygen. In this case, the wetland is specifically designed so that there is a decreased amount of oxygen in the substrate. This is accomplished by using a deeper water depth, adding organic matter into the soil when the wetland is built, and stimulating microbial activity by growing certain types of plants. Each winter the leaves that fall into the water provide organic material to feed the microbes for the next year.

The anaerobic wetland cells will treat the water for elements such as arsenic, cadmium, cobalt, lead, selenium, uranium, and zinc. Additionally, elements such as aluminum and manganese can be treated in anaerobic wetlands by co-precipitation and sorption. Some of these elements will be removed from the water by microbes that use them as terminal electron acceptors. Other elements will be removed from the water through dissimilatory sulphate reduction. Once the microbes have reduced the sulphur to sulphides, it can then bind to other elements and form minerals that precipitate to the sediment of the wetland.

As an example layout, each CWTS will be built with multiple small cells connected together in a treatment series. The series will be replicated at least in parallel. This design element serves several purposes as described below:

- Water in wetlands can channel over time, causing a faster waterflow through the system. By dividing a water flow into multiple cells separated by spillways, the water can only ever channel through only a single cell at once, thereby maintaining the overall hydraulic retention time and treatment effectiveness.
- Having replicates of the series allows for any alterations needed during demonstration and acclimation phases, as one series can be taken off line and adjusted while the others two will continue to treat water.

Two typical conceptual CWTS schematics have been included in Figure 4-4 and Figure 4-5. Assumptions specific to the conceptual design of the CWTSs include the following:

- Multiple series of flat bottom cells will operate in parallel.
- Cell base and side slopes will be lined.
- Anaerobic cells and have an operating water depth of approximately 0.30 m (using *Carex aquatilis* as the vegetation species, however this could be deeper if other species are used).
- Cells are divided by lined berms with rip-rap armouring along the slopes and at the inlets.
- Perimeter berms will be constructed with a crest width sufficient to accommodate maintenance vehicles or foot traffic, as appropriate.

- The soil to be placed at the bottom of the cells will be sourced on-site, analyzed and amended as needed to achieve the appropriate conditions to treat water and promote plant and microbial growth. The soil will be mixed with amendments such as biochar, slow release fertilizer, wood chips and crushed oyster shells in order to provide enhanced surface area, nutrients, organic carbon, and buffering capacity, respectively, to initiate natural biological cycles for water treatment within the CWTS.
- The CWTS will be densely planted (i.e., about 2-4 plants per cubic meter) by hand with emergent aquatic vegetation obtained from, at, or near the site. These plants are typically dug with a backhoe and then the rhizomes (thick roots that the plants use to spread) are cut into smaller pieces for planting.
- After planting, the cells can be brought on line. During this maturation period, good-quality water will initially be used (i.e., not seepage) so that the plants can have a chance to develop, multiply and mature. This water can be partially recycled through the wetland using a pump.

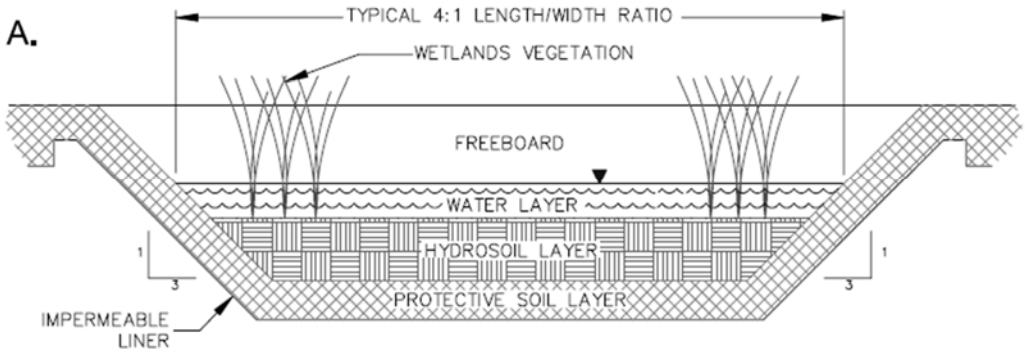


Figure 4-4: Profile of a Typical Surface Flow CWTS (Castle and Rogers 2008).

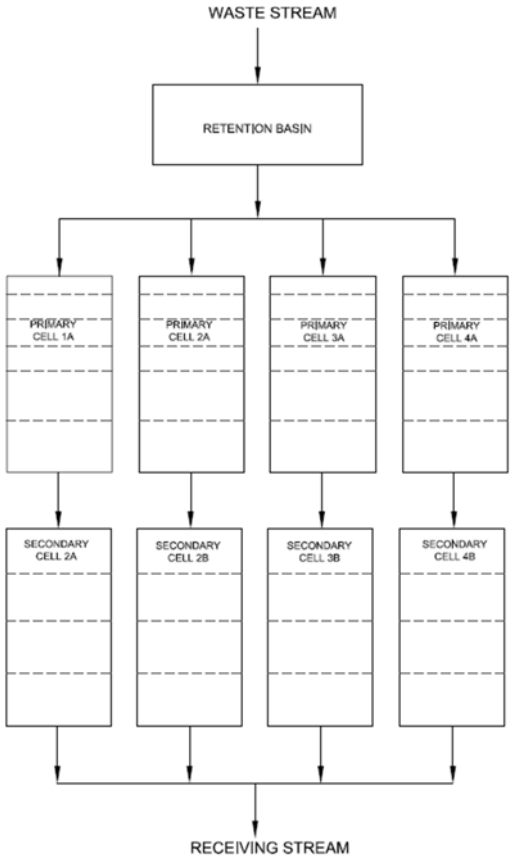


Figure 4-5: Schematic Flow Diagram of a Typical CWTS (Murray-Gulde et al. 2008).

Flows will be allowed to follow seasonal variation, with some equilibration of flows and concentrations of constituents provided by sedimentation ponds upstream of each CWTS.

Minimal ongoing maintenance will be required during operation of the CWTSs. This will include regular inspections to remove debris, examine berms and spillways, adjust rocks or sandbags at the spillways to even flow paths and remove burrowing animals. Monitoring of flow, pH, redox, dissolved oxygen, and alkalinity will be required. Routine water quality sampling begins during maturation to confirm that the explanatory parameters are within desired ranges and monitor their stability. If they are out of range, it is possible to adjust using additional amendments such as those that were originally added to the soil. Access to the CWTSs to allow for this limited maintenance and monitoring will be required

Because sediments and detritus mass has accreted within the CWTSs, it may be necessary to raise the operating water level within the cells during their operation (e.g., after 50+ years). Inter cell flow structures will be constructed to allow for the placement of stop logs (or rocks, sandbags) to raise the water levels and accommodate this build-up of mass.

In the winter, when the wetlands freeze, they may freeze through to the ground or they may have a small amount of liquid water between the ice and soil. Either scenario will allow the treatment to continue. If the wetlands freeze solid, the water will stop flowing and there will be nothing to treat until the spring thaw. If

there is a small amount of water flowing, it will be beside the soil where the microbes are and will be treated. There are microbes (called psycrophiles or cold-loving bacteria) that live best at temperatures between +10^{0}C and -15^{0}C. If the water is liquid, these bacteria will be living and actively treating the water. If there is still water between the ice and soil, the water will not flow from one cell to another because the water flows by spillway. Since the water is covered by ice, it cannot spill over.

The riffles will perform an additional function in winter. The riffles are covered in rip-rap to disperse water, decreasing velocities, and aid in freezing in the winter. By spreading out the water in a thin layer over the rip-rap, it is more likely to freeze and stop water flow.

In spring thaw, water that flows over the surface of the wetland will be diluted by snowmelt and ice melt. The ice in the wetland is cleaner than the water because as ice freezes it leaves salts and elements in the liquid water portion. So as the ice cover melts, it is actually cleaner than the water underneath it. When wetlands begin to melt, they melt from the edges in, and also melt starting from each plant stem outwards, forming liquid tubes in the ice surrounding the dead plant stem from the previous year(s). This allows water exchange to the sediment to begin very early in the thawing process, and the decaying plant stems themselves are a very active spot for microbial activity.

Further information regarding how this plan for a CWTS at the W15 location will be scaled up and optimized is presented in Section 4.5.4.2 discussing reclamation research.

Conceptual Design Assumptions

The following site specific information was utilized to assess the feasibility and expected performance of a CWTS in this vicinity:

- The maximum predicted post-closure influent flow rate;
- Estimated area available for CWTS construction, based on a GIS evaluation of available area constrained by mine facilities and slope;
- The aspect ratio of the polygons for available area for CWTS construction were evaluated with a goal of constructing CWTS cells of between 3:1 and 4:1 length:width. This determined the total number of cells in a series and the number of replicates of the series for the site. A conservative 6 meters for internal berms and 3 meters for each side of external berm was then applied; and
- For the CWTS at W15 an exceedance of the target range of aspect ratio is deemed acceptable in this situation for the following reasons:
    - Accomplishes goal of three series at W15, allowing for possibility of demonstration series to be incorporated into final closure designs; and
    - Velocity at peak flow remains low despite decreased width (0.23cm/sec).

For the W15 Area, the following assumptions were made:

- Removal coefficients used in calculations for predicted performance of the CWTS were calculated based on a combination of published (peer-reviewed) data and pilot data. Recognizing that none of

these removal coefficients were developed from the actual water from the Minto site, conservative estimates were used for all elements. The actual removal rates and thermodynamic minimums for the CWTS will be established experimentally through site-specific pilot and demonstration-scale testing during the operations of the mine.

- The depth of water in the CWTS was estimated to be 30 cm, based on assessment of characteristics of emergent wetland plant species that have been previously documented on site. Water Sedge (*Carex aquatilis*) have been described as a dominant-emergent wetland plant species on site. While ecovar specificities remain to be determined, literature reviews indicate that this species should able to survive and reproduce in water depths of approximately 30 cm. While *C. aquatilis* will grow in water of less depth (or moist soils), the water depth is maximized to promote anaerobic properties of the CWTS and increase the hydraulic retention time of the system.

- The wetlands were assumed to be planted with *Carex aquatilis* which are known to be present on site. This is a conservative assumption, as other plant species such as *Typha latifolia* (cattail) and *Schoenoplectus acutus* (hardstem bulrush) could potentially be growing in the area but off-site, and be viable candidates for planting of the CWTS. Should *T. latifolia* or *S. acutus* be potential candidates for vegetating the CWTS, the depth, and therefore the hydraulic retention time of the system could be increased as much as three- or four-fold.

- The reasonable worst-case post-closure scenario using maximum expected concentrations were used as the influent inputs.

- The maximum predicted post-closure influent flow rate was used.

The main parameters of the W15 CWTS design are summarized in Table 4-2.

Table 4-2: W15 CWTS Parameters.

Total area for CWTS construction	46,800 m^2
Working area for CWTS water treatment	38,976 m^2
Depth	0.3 m
Dimensions of each cell	174 m length : 37.3 m width
Number of series	3
Number of cells per series	2
Volume of water in CWTS	11,693 m^3
Hydraulic retention time (minimum time, at max flows)	41 hrs
Peak water velocity	0.23 cm/sec

4.2.2.3.2 W37 Area (Toe of MVFE)

Currently, seepage from the toe of the MVFE, which includes seepage from the DSTSF via the finger drain channels beneath the facility, is collected at the Minto Creek Detention Structure and pumped back to the Main Pit prior to treatment for discharge. Figure 4-6 below shows a possible configuration of the treatment cell and contingency seepage collection system in relation to the MVFE (under a conceptual expanded design), with a downstream CTWS in the vicinity of the current water storage pond.

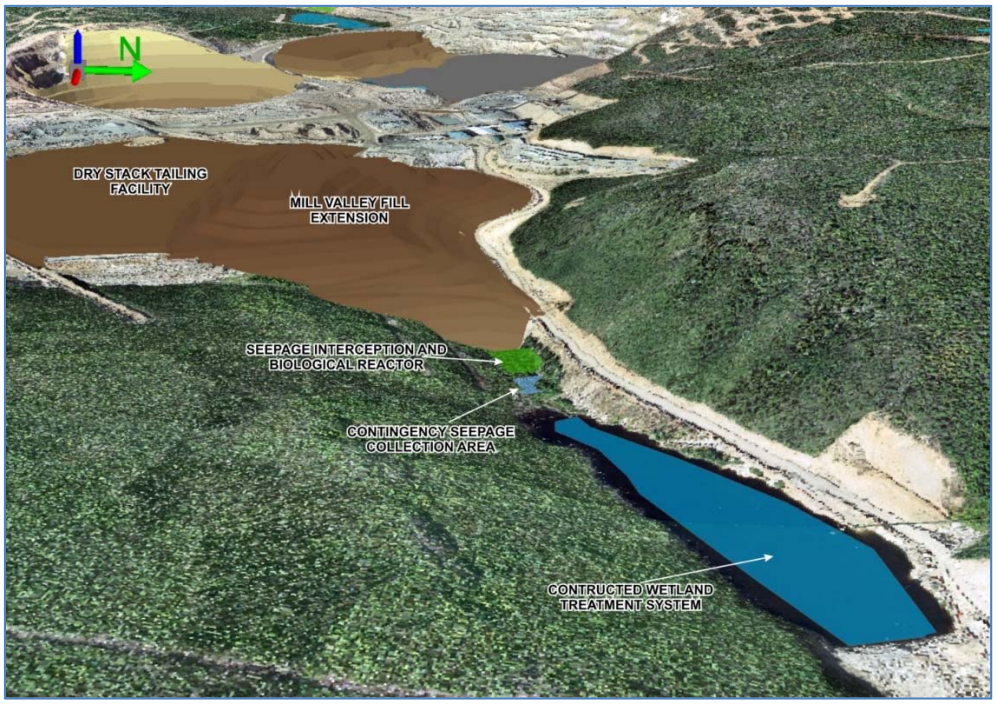


Figure 4-6: Potential Treatment Cell Configuration Downstream of the DSTSF and MVFE.

Expected Biological Treatment System Performance

Ultimate configuration and design of this passive treatment configuration between the toe of the MVFE (W37) and the WSPD (Water Storage Pond Dam) will be determined as the research in this area of the site advances. Although the above configuration contemplates a bioreactor to treat the DSTSF/MVFE seepage, then a CWTS for final polishing of all site drainage prior to discharge from site, final drainage channel configuration will likely determine the possible configurations of passive treatment systems in this area.

For the purposes of comparison with the performance estimations from CWTSs in the W15 area in previous sections, it is possible to use the same process and assumptions as were described in those sections to evaluate the potential performance of a CWTS at the toe of the MVFE (as opposed to the bioreactor proposed above.) A much smaller CWTS was evaluated for this purpose, leaving area along the stream channel for conveyance of higher flow volumes if required (to be determined in final engineering prior to closure).

The main parameters of a conceptual W37 CWTS design are summarized in Table 4-3.

Table 4-3: W37 CWTS parameters.

Total area for CWTS construction	4,375 m^2
Working area for CWTS water treatment	2,869 m^2
Depth	0.3 m
Dimensions of each cell	37.8 m length : 9.5 m width
Number of series	1
Number of cells per series	4
Volume of water in CWTS	860.7 m^3
Hydraulic retention time (minimum time, at max flows)	6.4 hours
Peak water velocity	0.64 cm/sec

A CWTS system at the W37 location could be employed if required and triggered in AMP monitoring to provide valuable additional contaminant load reduction from up gradient sources (SWD, MWD, pit walls, etc.) where that loading may have deviated from expectations. This could include instances where surface water diversion structures up gradient of the DSTSF did not perform as expected (increasing contact with tailings materials and ultimately seepage rates at W37). This treatment would be valuable in mitigating these potential conditions and in further ameliorating the expected seepage from the DSTSF facility, prior to its contribution to the rest of the conveyed flow from the site for discharge.

4.2.2.4 Active Water Treatment

As per the stated reclamation objectives, Minto is committed to trying to close out the Minto Mine in a manner that does not require the long-term use of active water treatment to achieve discharge criteria. The application of the source control mitigation measures described in the preceding sections should be successful in reducing metal loadings from the waste dumps on site; however, it is realized that there will be the need to actively treat water during the immediate post-closure period while revegetation of the cover systems and reclaimed areas becomes established, and while other source load reduction and tertiary water treatment systems stabilize. Minto currently operates a water treatment plant and supporting collection/conveyance system for impacted waters under a management plan which has been approved under Water Use Licence QZ96-006. This system has been shown to be successful in reducing metal loads to a level where it is possible to discharge the treated water directly into the receiving environment. Information on this WTP and supporting water collection/conveyance system is presented in Section 2.7 Water Management.

Minto will retain and keep operational the required elements of this active collection/conveyance and treatment system for as long as is required to ensure that appropriate site water quality performance objectives are met. Its use will be guided by the Adaptive Management Plan (Appendix D). Section 8 presents assumptions and costing related to the use of active treatment in the closure and post-closure period at Minto.

4.3 RECLAMATION TO DATE

To date there has been little opportunity to conduct final reclamation measures at the various infrastructure units on site because of the discovery of several new ore deposits that have given way to the Phase V/VI permit application and uncertainty around the final mine footprint. However, where possible, progressive reclamation has been conducted to address water management and aesthetic objectives.

For example, in 2009 Minto conducted reclamation activities on exploration roads and drill pads, particularly in erosion-sensitive areas that can potentially impact surface run-off water quality. Reclamation of disturbed areas along the access road and at Big Creek in the vicinity of the Big Creek Bridge was completed between May 6 and May 10, 2000.

In 2011/12, Minto recontoured, covered, and revegetated the face of the Main Waste Dump with the intention of scaling up the research findings from smaller revegetation plots. This work is outlined in greater detail in Section 4.5.3 as reclamation research, and along with the other reclamation research findings, this information will be used to assist with planned progressive reclamation measures, reclamation research, and measures for final closure.

As required in Water Use Licence QZ96-006, Minto is also placing a soil cover on the surface of the DSTSF, as placement of tailings in the facility has now ceased. This cover will serve as a temporary surface stabilization measure while the design of soil covers for site facilities is being refined. This activity is discussed further in Section 6.6.

4.4 NATURAL REVEGETATION

Overall reclamation is expected to be successful with seeding and natural revegetation complimenting each other.

The project area was first disturbed by the construction of trails and trenching which was done as part of exploration programs on the property from 1971 to 1976. Natural revegetation has been effective in largely covering these disturbed areas in the 35 years since the area was first disturbed. For example, prior to construction activities in 2006, the airstrip was almost completely revegetated and required extensive clearing in preparation for recommissioning. Other areas that have seen significant natural revegetation on the site (some of which are now re-disturbed by current construction activities) include areas adjacent to the WSPD centerline, old borrow sources, and the cleared right-of-way of the main access road.

The primary colonizing plant species now found around the mine site are willows and graminoids. The extent of recolonization at each location is dependent on local conditions, including soil conditions (type and moisture content) and aspect. Generally, revegetation is occurring more extensively next to undisturbed areas and on linear disturbances.

4.5 RECLAMATION RESEARCH

An important component of the reclamation planning process is ongoing reclamation research with the objective of developing the methods required to implement a successful reclamation program. Reclamation

research will focus in certain areas related to the key and contingency closure methods proposed for the site, as well as the proposed adaptive management measures:

- soil cover revegetation and erosion control; and
- semi-passive water treatment technologies.

The relative success of these techniques at the Minto site compared with expectations built on evidence from applications and use in other similar sites will be dependent on a number of site-specific conditions. A comprehensive Reclamation Research Program has been designed and initiated to provide proof of concept for these techniques in the Minto Mine setting. The elements of this program are presented in this section. Other aspects of mine site reclamation including recontouring and erosion stabilization techniques are well established and are less reliant upon site-specific research for success.

Documentation of natural revegetation successes is ongoing during current reclamation research activities as documented in the annual reclamation reports. Information developed on site will be supplemented with information obtained from other mine reclamation programs in the Yukon and other jurisdictions. Considerable research has been carried out into the reclamation and revegetation of disturbed lands in the Yukon, including operating and abandoned mines, and mineral exploration sites. Much of this information is in the public domain and is well presented in the guidance document Mine Reclamation in Northwest Territories and Yukon (INAC, 1992.)

The true benefits of reclamation research will be realized if the information obtained and knowledge gained is incorporated into larger scale reclamation projects as quickly as possible.

4.5.1 Soil Covers

SRK Consulting has produced a Scoping Level Cover Assessment study for the Minto Mine Site Closure, which is presented in Appendix E. Mine waste at Minto Mine includes both waste rock and tailings (dry stack and in-pit tailings). At the end of Phase IV, there will be a total of six distinct waste rock and overburden piles on site. Isolating soil cover systems constructed from locally available stockpiled or mined materials are proposed in order to reduce metal loadings to the receiving environment (Section 4.2.1). Geochemical characterization of the mine waste has confirmed that acid generation potential is low at the site, and performance estimates for these covers are based on considerable relevant experience on similar projects.

Refinement of site-specific performance expectations related to infiltration reduction is not considered to be valuable given the reduced reliance on infiltration reduction and the nature of the available cover construction materials at site. Further research related to cover performance will be conducted in the context of revegetation and erosion control, as discussed in the following sections.

4.5.2 Growth Media and Revegetation

Plants require, as a minimum, a medium that will allow roots to penetrate, that will retain adequate moisture and that contains suitable levels of nutrients for successful growth. The natural vegetation found on undisturbed sites around the mine generally provides information the underlying soil properties, including texture, drainage, and pH, and the level of available nutrients that presently occur at the site. A soil sampling

program was initially conducted in the project area during 1994 as described in the original environmental assessment report. The results of this program provide the basic information required for reclamation planning.

Research is being proposed for 2014-2016 to more adequately characterize moisture and nutrient regimes, and will be dovetailed with the soil cover research where possible. This will include three subprojects in partnership with Yukon College, which are identified at a preliminary level below.

The revegetation trials are designed to determine the best methods of restoring the Minto mine site footprint to a functioning and self-sustaining ecosystem. Four important components of a revegetation process that are being examined presently or proposed are briefly described below and other related considerations are further discussed:

1. Practical seed mixes - while it is known what seed types have been used at the site previously and what types of plants have been naturally revegetating the site, further reviews and investigations are necessary to confirm the appropriate seed mixes that should be used in conjunction with different soil covers. The ultimate seed mixtures will be developed using:

    - knowledge of the naturally occurring vegetation and soil conditions;
    - an inventory of naturally occurring seed sources on site;
    - results from revegetation activities to date;
    - existing literature on regional revegetation science; and
    - information gained from revegetation test plot trials on site.

2. Soil covers - different plant varieties and species, waste characteristics, cover designs and other environmental conditions are all factors influencing uptake of metals by plant tissues. Sampling of plant tissues from both background plots and expanded revegetation test plots (i.e. Main Waste Dump) will be conducted to assist in designing the revegetation program, and existing literature and research regarding plant metal uptake and animal foraging patterns will be incorporated into the seed mix design.

3. Transplanting and collection of seeds of local plants that have been noted, during monitoring, to have colonizing potential (especially trees, shrubs and nitrogen fixing legumes). The creation of vegetation islands can also enhance natural succession.

4. Utility of soil amendments - such as biochar, peat, wood fibre or mulches need to be investigated for usefulness in areas where soils are deficient or unstable.

The establishment of an initial ground cover of graminoids (all grasses and grass-like plants, including sedges and rushes) has historically been viewed as a desirable objective on most disturbed areas to stabilize slopes and control soil erosion. Initial test plots were typically small and optimum conditions may have applied. The information obtained from test plots was then applied to larger reclamation efforts in 2011/12 on the face of the Main Waste Dump (see Section 4.5.3 below). Moving forward, vegetation growth will be assessed using standardized methods each summer. The successes from the trial plot program will be transferred to more

progressive reclamation efforts that will provide a large-scale opportunity for refinement of reclamation and revegetation techniques and measures.

The revegetation component of the reclamation research program will be expanded in the following ways:

1. Revegetation trial plots will be established in concert with soil cover trials where appropriate. Methodology yet to be determined.

2. Revegetation research will be expanded beyond grasses to larger, later successional shrub/tree species. Establishment of these species in the revegetation program will enhance the natural succession. This will involve a combination of:

    - Local stock collection and transplanting trials;
    - Local seed collection and broadcasting and propagation trials; and
    - Live planting for erosion control
    - Preferred aspect and slope conditions for different plants

3. Identify nearby areas for native vegetation seed and stock collection. Areas slated for clearing need to be inspected so suitable plants can be salvaged. A general inventory of indigenous plant communities in the area was conducted in 2010 as a component to the Minto Mine Ecosystem Mapping program (Access Consulting Group) and the network will be re-surveyed in 2013. This information can be used to locate naturally occurring shrub or tree species that could be used in transplanting /seeding trials.

4. Vegetative erosion control methods will be field tested on site - they can provide a cost effective alternative to synthetic or other manufactured products. Grass seeding of slopes is an immediate step towards stabilizing soils on steep slopes, however live shrub/tree plantings are more effective at reducing soil/cover erosion on steeper slopes and gullies.

5. Nitrogen fixing flora will be included as a critical component of revegetation prescriptions, so soils are not depleted of plant available nitrogen. Native species that are nitrogen-fixing candidates for seed collection are:

    - Arctic lupine (Lupinus arcticus)
    - Yellow locoweed (Oxytropis campestris)
    - Hedysarum alpinum; and
    - Alder (Alnus sp.)
    - Agronomic species include alfalfa and clover.

4.5.3 Main Waste Dump Trials

Previous years' research has provided Minto Mine with information to pursue a large-scale project: the cover trial on the Main Waste Dump (MWD) re-contoured rock surface. Two variables were considered in the trial; the suitability of the major types of overburden found on-site as cover material and amendments such as fertilizer and organic material. These will be compared to simply seeding the overburden, allowing Minto Mine to gauge if these amendments improve seeding success. Re-vegetation success will be monitored and will provide Minto with information to customize site-specific reclamation methods. The cover trial will also stabilize inactive slopes, reduce the amount of reclamation taking place at end of mine life, and improve aesthetics on-site.

Ongoing data collection from the next few growing seasons will provide Minto Mine with additional information, including:

- Assessing success of seed mix on large scale plots;
- Determining if different types of overburden on-site can support vegetation; and
- Gauging benefit of using amendments to overburden (organic matter and/or fertilizers).

Figure 4-7 shows the reclamation work that Minto Mine completed on the Main Waste Dump in 2011. At the beginning of the 2012 summer Minto completed the re-contouring of the slopes (Figure 4-8) and placed 1m of overburden over the re-contoured slopes (Figure 4-8). As sections of the overburden were placed, they were hand seeded and fertilized (depending on plot amendment) (Figure 4-9).

Figure 4-7 Main Waste Dump near the end of construction season 2011 (September)

Figure 4-8 Main Waste Dump as it appeared in July 2012 with final placement of overburden into distinct plots

Figure 4-9 Final plot placement in August 2012. Note seedling emergence in upper right plots

To support SRK's further investigation into available cover construction materials at site, materials were recovered from the site's Reclamation Overburden Dump, characterized, and placed in distinct plots (Figure 4-10). The naming convention of the overburden plots reflects the position the overburden was placed on the Main Waste Dump. There are two benched areas, identified as "Upper and Lower". West facing slopes and east facing slopes are also pointed out in the convention. Table 4-4 below indicates the naming convention for the plots, along with their areas.

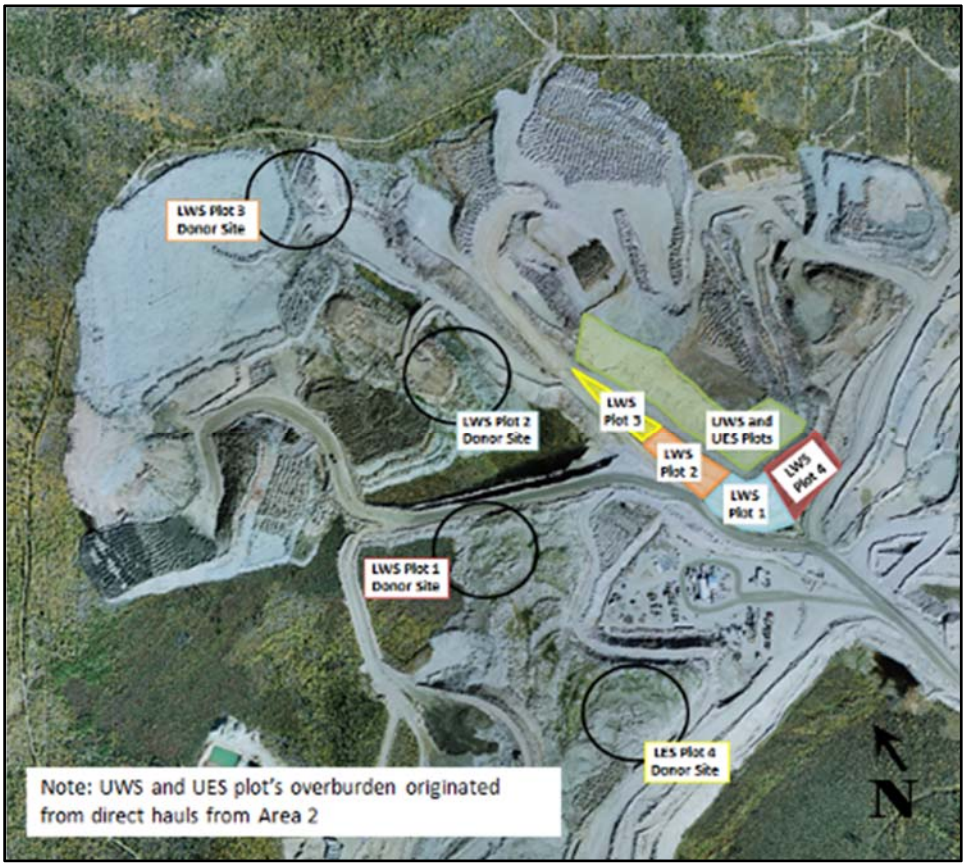


Figure 4-10 Origin of overburden material from ROD placed in distinct plots on the MWD re-contoured rock surface

Table 4-4 Naming convention, areas, volumes and depths of each overburden plot

			Area (m2)	Area (ha)	Depth of OVB cover (mm)	Total volume of material placed (m3)
Plot Name	Upper West Slope (UWS) and Upper East Slope (UES)	**UWS and UES Plots**	17229	1.72	1000	17229
	Lower West Slope (LWS)	**LWS Plot 1**	10309	1.03	1000	10309
		LWS Plot 2	6237	0.62	500	3118
		LWS Plot 3	6219	0.62	1000	6219
	Lower East Slope (LES)	**LES Plot 4**	3970	0.40	1000	3970

Plot size was chosen to balance the minimum area required to gather scientifically sound information, initiating enough diverse treatments to analyze different scenarios, and field fitting the plots for the most efficient use of space. Each overburden plot was chosen to represent materials available from the overburden stripping that occurred in Main and 2 pits. As mentioned in Figure 4-8, the upper slope plots were capped with material directly excavated and hauled from Area 2 pit development indiscreetly, without much segregation. A selection method occurred for the lower slope's plots within the ROD area. Sites were chosen to represent a wide range of materials on site (gravelly and sandy overburden, to loam-textured, to overburden containing high clay content pockets). Stockpiles and pads of materials were surveyed for

material types using field cues (hand texturing, colour comparison, visual estimation of coarse to fine material composition).

Minto is currently re-evaluating the reclamation research objectives and structure of these plots, and the ongoing observations and findings from these larger scale efforts will inform revegetation and erosion control measures elsewhere on the site.

4.5.4 Passive/Semi-passive Water Treatment

4.5.4.1 Pit Lake Pre-Treatment

Minto has initiated a preliminary investigation into the effectiveness and viability of pit lake pre-treatment methods. In 2012, four limnocorrals were placed into the Main Pit, filled with pit water, and amended with reagents to encourage microbial reductive treatment of selenium, copper, and nitrate. The treatment method for the removal of these constituents is biochemical reduction, where nitrate is reduced to nitrogen (gas), selenium (as selenite/selenite) is reduced to elemental selenium (solid precipitate). In the higher doses of organic carbon sources, sulphate reduction is also expected; in this case, some metals such as copper may be removed as sulphide precipitates. This limnocorral study is part of an ongoing program to evaluate the feasibility of passive treatment at the Minto Mine site, and the results of this study will be used to design possible larger scale trials in the lake and/or will inform other potential passive treatment studies, including constructed wetlands and bioreactors, at the site.

The limnocorrals were installed in the pit in the fall of 2012, filled with pit lake water, and three of the limnocorrals were used as test vessels, and the fourth was retained as a control without any reagent addition. The rest of the pit began to receive tailings at around the same time; the control limnocorral is used to show how the water chemistry evolves without the effect of tailings addition over time.

The variables being tested in the three test limnocorrals are the addition of both soluble organic carbon sources (alcohol and molasses) and solid phase carbon sources (wood chips) to the pit lake water column. Microbes that are free floating in the water column will react with the dissolved carbon sources, leading to the biochemical reduction and removal of the constituents from the water column. The wood chips provide both an additional carbon substrate for this biochemical reduction process, as well as an attachment site for microbes.

The tests were begun in the fall of 2012 and during initial tailings deposition access to the limnocorrals for sampling was restricted due to safety concerns. Sampling of the limnocorrals has been accomplished during the summer of 2013, and the results are currently being evaluated. An initial assessment of the results is encouraging from an aqueous contaminant reduction perspective, which includes all licence parameters. Biochemical indicators will also be tracked, which will provide information about the nature of the microbiological community in the test limnocorrals. When all of this analytical information is fully interpreted, the next steps in the evaluation of in-pit treatment of mine water will be formulated.

4.5.4.2 Constructed Wetland Treatment Systems

Proposed as contingency load reduction measures, CWTSs have good potential for success at the Minto site, should additional load reduction beyond the proposed source control measures be required. The ability to achieve water quality targets by any type of technology is reliant upon accurate knowledge of input parameters and clearly defined objectives. Many of these have been assessed for the Minto site, and a research program has been designed to obtain additional necessary information for the successful development and implementation of the CWTS. This preliminary site data will then be applied to pilot-scale CWTS on site and in testing in Contango Strategies Ltd.'s (CSL's) year-round greenhouse in order to develop the design basis for the eventual demonstration and full-scale CWTS on site. The phases required to design the constructed wetland systems are as follows:

Information Gathering

The purpose is to gather information about the Minto site in the context of passive water treatment and design of a site-specific CWTS that will achieve predictable treatment of water post-closure. This work will be initiated with meetings between Minto, contractor specialists and other parties of interest, including a site visit as early as possible during the project.

Initially there will be a focus on the W15 area of the site that is receiving seepage and runoff from the Southwest Waste Rock Dump (SWD) as this is anticipated to be the most significant single source of major element loadings on site. A stream and wetland have formed naturally in this area and will provide opportunity to evaluate the natural remediation processes occurring on site as well as the tendencies of local flora and microbial populations.

Water

Rates of removal of constituents of potential concern (CoPCs) and changes in water quality will be estimated as water passes through the natural system along the stream and pond preceding the W15 monitoring station. Characterization of waters for the SWD will be based on data collected from existing water monitoring sites W15, W32, W37, W38, W39, and W40. Additional monitoring sites located in the pond preceding the W15 pump area will be identified during the initial site visit. The pH, Eh, conductivity, temperature and flow rate at each point will monitored weekly, and it is recommended that the monthly monitoring currently being performed as per the Water Use Licence (WUL) be increased to once every two weeks (e.g., total metals by ICP-MS, nutrients). In situ redox probes and thermistors will be installed to monitor sediment Eh and temperature, respectively. Site staff will be trained in how to take measurements of these in situ devices.

Sediments

Sediment samples will be collected seasonally with a coring device near the locations of the thermistors and redox probes. Cores will be collected seasonally, once immediately after spring thaw, during the peak growth period of summer, and finally once before freezing. These sediment samples will be subjected to a panel of tests, including NPK, pH, BOD, COD, TOC, and ICP-MS (metals scan). Additionally, the microbial composition of these sediments will be determined by metagenomic analyses (DNA-based community compositions) for bacteria, eukaryotes and archaea to determine established vs. transient populations that may be important to the biogeochemical activities of the CWTS on site.

Plants

After spring thaw has occurred and plants are actively growing, local plant species will be identified for potential use in the CWTS. Although lists of plant species at or around the site exist, it is important to evaluate ecovars to determine aspects such as water depth preference and record association with redox and pH zones in the water and sediments.

Potential plant species will be identified for use in the CWTS. Plant species will be selected based on a combination of criteria, including observations of explanatory parameters associated with specific plant species (e.g., redox associated with root zones, apparent preference for specific water depths, on-site abundance), socio-cultural importance of the plants (e.g., traditional medicine or food), and consideration of impact on local animal species (e.g., key food source for local animals).

The main components of the information-gathering phase are:

1. Characterization of water for treatment;
2. Identification of targeted constituents and performance goals;
3. Identification of borrow sites for plants and hydrosoil substrate;
4. Evaluation of natural remediation processes occurring on site; and
5. Site assessment for feasibility of implementation of CWTS.

- This information gathering exercise has begun, with CSL's first investigative visit to site completed in August of 2013. Findings from that visit were encouraging, and a follow up visit is pending.

Pilot-scale testing at Laboratory Facilities

Pilot-scale systems will be designed and built in a year-round temperature controlled greenhouse at CSL's laboratories. These pilot systems will be closely monitored by trained technicians and will be used to optimize system performance. In some cases, laboratory "bench top" experiments may precede the pilots to test design assumptions. Plants will be collected from the Minto Mine site, and shipped by courier to CSL's greenhouse in Saskatoon. Potential soils will also be collected at site and shipped to CSL.

A pilot-scale CWTS will be built using approximately 60kg of substrate (hydrosoil) per treatment cell. Typically, there will be two to four treatment cells in a pilot series (one per type of plant being tested), with two replicates of each series. If four plant species were tested, this would result in 16–32 CWTS cells being evaluated. An example of a pilot-scale system is provided in schematic in Figure 4-11, and a photograph of other pilot-scale systems in one of CSL's greenhouses is shown in Figure 4-12.

Simulated water will be designed to mimic the SWD seepage water. This simulated water will be used for the greenhouse pilot-scale experiments. Once the plants are established, as part of the stress testing, the systems can be tested for effectiveness with fluctuations in water chemistry. Each series in the pilot CWTS will treat

approximately 300 L of simulated water per week. These pilot CWTS will be run for a minimum of 6 months and maximum of two years, depending on the extent of testing to be performed.

Plant-specific attributes will be evaluated such as suitability for transplanting, effects on water flow (e.g., short circuiting of water), uptake of CoPCs, effects of plant species on soil redox, tolerance to variations in water depth, accretion rates (detritus decomposition rates), and effects of nutrients on plant growth.

These systems will also be used to determine metal loading and sediment accretion rates as well as other factors to help ensure that concentrations within the sediment do not exceed site limits for hazardous materials. Toxicity testing will be completed to confirm the bioavailability of the constituents deposited in the sediments.

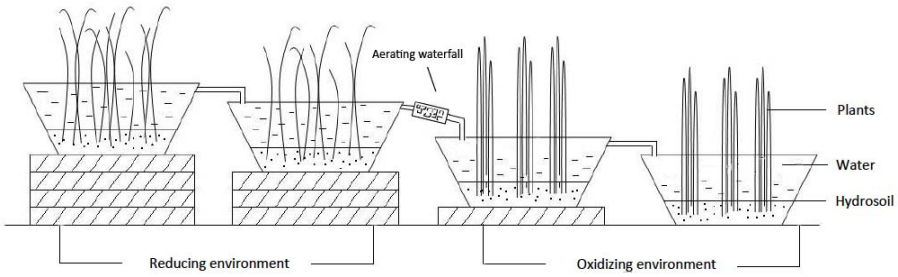


Figure 4-11 Example Layout of Greenhouse Setup for Pilot-scale CWTS.

Figure 4-12 Example Pilot-scale CWTS in Greenhouse

The work to be conducted during the laboratory pilot-scale testing can be summarized as follows:

1. Design of pilot-scale CWTS (one or more designs may be tested for optimization).
2. Assembly of pilot-scale CWTS in greenhouse at CSL.
3. Performance monitoring and stress testing.

On-site Pilot-scale Testing

Pilot-scale systems will be built on site. Water will be diverted before it reaches the natural wetland formed upstream of W15 to the pilot testing CWTS cells. An estimate of size of each cell is 2 m wide by 8 m long, however, the exact dimensions of the system will be determined based on available space and plants. Two to four plant species will be tested with two cells in each series. An example of an on-site pilot-scale system is provided in Figure 4-13.

Amenability to transplanting and plant density over time will be assessed. The timing of plant emergence in the spring as well as any invasion of species not included in the design will be monitored. The relationship of the plants to possible short-circuiting of water flow will also be evaluated during this phase. Once the system is established, local technicians will be trained to monitor explanatory parameters regularly. Additionally, periodicity of water flow, hydraulic retention times, and water depths will be monitored and characteristics of freeze and thaw events in relation to CWTS and water treatment will be evaluated. Thermistors will be used to determine whether year-round flow of water at the sediment interface is plausible. In situ redox probes will be installed to assess biogeochemical parameters throughout the year. Core samples will be collected seasonally and depth intervals sampled for metals content and microbial communities to determine depth of active zones.

Figure 4-13 Example of On-site Pilot-scale CWTS

The purpose of this research program is to identify the combination of conditions in the pilot-scale testing resulting in maximum removal of CoPCs and best outflow water quality possible. Based on the predicted water quality parameters for seepage and runoff water at the Minto site, and local topography, it is likely that more than one CWTS will be used to ensure passive post-closure water treatment. The CWTS may become

stand-alone treatment systems, or may be integrated with other technologies such as biochemical reactors to achieve a hybrid approach to water treatment on site.

Once information is gathered through site visits and pilot-scale trials, additional phases may include the following options (as appropriate for the project). These options are outlined in concepts below, and will be refined based on the outcomes of the initial phases of research.

Outdoor pilot-scale design and monitoring at laboratory facility:

- Assembly of outdoor pilot-scale CWTS in outdoor cold climate environment (based on information gathered from indoor pilot-scale findings).
- Performance and seasonal monitoring of the outdoor pilot-scale CWTS.

On-site demonstration-scale design and monitoring:

- Design of on-site demonstration-scale CWTS.
- Construction of demonstration-scale CWTS at the Minto site.
- Performance monitoring of demonstration-scale CWTS at site.

4.5.4.3 Biological Reactors

The bioreactor treatment process is a semi-passive treatment technology, with the primary activity required the replacement or replenishment of the media. The bioreactor process itself is relatively straightforward to evaluate, with the primary evaluation requirements related to site-specific conditions in which the system is designed to operate. A primary challenge with the design of bioreactors (and PRB systems), which can lead to poor performance, is the inadequate characterization of the in situ flow conditions within the permeable reactive media which results in the bioreactor failing to achieve suitable hydraulic performance and residence time. The nature of potential failures includes improper sizing of the reactor for the flow conditions at the site, and problems with the substrate composition. Examples of flow-related failures are cases where the range flow is too great, causing—at certain times of the year—situations where not all of the flow can be routed through the bioreactor (because of physical limitations of the media), or where the concentration of seepage varies through the year, and the mass loading exceeds the potential mass removal. Examples of these substrate-related failures includes insufficient inclusion of porous media (typically gravel), layered substrates where one layer becomes a flow barrier, and changes in hydraulic properties of organic substrates as they degrade. Other design considerations that affect the potential for bioreactors to work are the physical configuration of the reactor, with some configurations more susceptible to dead zones where substrate is partially or entirely unused for treatment because flow does not pass through these zones.

To avoid these potential pitfalls, the scope of work for evaluating the potential application of bioreactor technology at the Minto Site has been divided into several stages—beginning with detailed characterization of the seepage inputs and foundation conditions in the areas where bioreactors are being considered and advancing to laboratory characterization and bench scale testing of substrate mixtures before ultimately advancing to field scale pilot trials.

It is recognized that complementary field studies and monitoring programs are already underway at the Minto site: e.g., seepage monitoring and ongoing water quality monitoring. This will lead to defined flow and mass loading curves for the seepage areas. It is anticipated that it will be possible to incorporate this information directly into the bioreactor evaluation program as it becomes available and refined. It is also anticipated that it may be possible to enhance further the usefulness of the existing/ongoing sampling and monitoring programs in a cost-effective manner by incorporating some additional analysis and/or adjusting the timing and frequency of the sampling/monitoring programs. Additionally, synergies exist between the evaluation of the bioreactor treatment systems, and the constructed wetlands characterization program.

The following sections outline the first three phases of the research program and planned field trials for bioreactor treatment:

Information Gathering

Additional site and contaminant source characterization work is required in order to facilitate effective design of both bioreactors and constructed wetlands, which is as follows:

- Assimilate all available site information and identify information gaps.
- Field characterization program:
- Visual inspection along the toe of SW Dump, Main Dump, DSTSF and area down gradient of W37.
- Document primary seeps and collect basic parameters.
- Identify probable locations for constructed wetlands.
- Determine options for intercepting/routing seepage the bioreactor cell and ultimately into constructed wetlands.
- Evaluate native plants and tree stands for use as a compost/ solid phase organic carbon source for the bioreactor.
- Basic foundation investigation (test pitting / shallow bore holes).
- Install Eh and temperature probes along potential seepage interception.
- Construct field trial of an interception trench adjacent to significant seep, install Eh and temperature probes (with datalogger) and bury a portion of the instrumented trench under 3 m of granular fill to confirm that it is feasible to insulate the seepage interception trench and bioreactor cell to facilitate year round operation.
- Collect shallow soil samples along potential alignment of interception trench(s) and bioreactor sump area for laboratory characterization.
- Install a sampling port into interception trench.
- Collect local organics for use in laboratory/bench scale trials.
- Collect local granular fill materials for detailed characterization.

Laboratory Characterization / Bench Scale Trials

A successful bioreactor requires media that is permeable, to allow through-flow of water, and to maintain that permeability over time even as the organic phase of the media degrades. The media must also supply a carbon source and nutrients to maintain microbial reactions that improve water quality over the time of operation. This phase evaluates potential media with these requirements in mind. The tests and evaluations proposed in this phase include:

- Evaluate potential permeable media and carbon sources (both soluble and slower or faster release-insoluble carbon sources) in flow-through bioreactor test columns, to identify variable sulphate reduction rates based on media composition.
- Detailed characterization of physical properties of on-site granular fill which could be incorporated in the bioreactor.
- Evaluation of potential sources of wood chips and/or mulch that is locally available for their nutrient and carbon source characteristics.
- Evaluate long-term stability of the precipitated contaminants by leaching tests.

Large Scale Field Pilot Trials

As the results of the first two phases become available, a site-specific bioreactor design will become the focus of the research program. The results of this phase will be to place a realistic-scale bioreactor in a site setting that is similar to what would be encountered in closure. This will include flow rates and contaminant loading that is similar to what would be treated in closure. This may best be obtained by placing the reactor near a seep that has flow and loading characteristics that were defined in other investigations, or could instead receive flow from a pumpback/collection system. The work scope for this phase includes the following:

- Scope potential site for bioreactor field trial informed by site-specific investigations, site constraints, and bench scale trials. It is anticipated that the site must have the following characteristics:
    - Secure location for over 2 years;
    - near mill area;
    - water pumped back from W37 or other seepage collection site with consistently available flow; and
    - suitable footprint with respect to foundation conditions.
- Design field trial based on results of laboratory characterization program: flow rates and contaminant loading matched to substrate volumes expected to yield consistent contaminant removal.
- Construct pilot trial of bioreactor and implement monitoring program – the feasibility and timing of this task will depend entirely on the progress and results achieved in all the preceding tasks.

The composition of the media used in the larger scale bioreactor will be determined from the column studies performed during laboratory characterization. A preference will be given to locally available media if the performance is adequate to meet the treatment requirements, and only will be supplemented by media if a cost-benefit analysis of the importing more distant media shows that to be superior to a bioreactor that uses on-site materials only or primarily.

4.6 RECLAMATION KNOWLEDGE TO DATE

Based on the specific reclamation research results to date and on a review of other reclamation and trial projects – the following will guide reclamation activities during progressive and final closure:

- Chemical analysis of soils indicate that the overburden soils are deficient in macronutrients (Nitrogen, Carbon, Phosphate and Potassium), but have adequate micronutrients (Copper, Iron, Manganese, Molybdenum, Zinc). It is recommended that soils be amended with fertilizer and/or mulched to promote grass/plant growth after seeding.
- The nutrient uptake by northern native seed varieties on nutrient deficient soil is usually more effective than nutrient uptake by southern agronomic species. Seeding with agronomic species over most disturbed areas at the Minto mine site may be required because of the high cost and limited availability of northern native revegetation species.
- Where additional areas at the mine may be targeted for progressive reclamation, seed and fertilizer treatments should be formulated based on the monitoring results of the revegetation trials to date. Two seed mixes are recommended below:
    i. a dry area seed mix (Table 4-5), which would be applied to most disturbed sites in the area, and
    ii. a wet area seed mix (Table 4-6) for riparian sites.

Table 4-5 Dry Area Seed Mix

Species	Botanical Name	Application Rate (kg/ha)	Percentage
Violet Wheatgrass	*Agropyron violaceum*	12	40.0
Sheep Fescue	*Festuca ovina*	7	23.3
Rocky Mountain Fescue	*Festuca saximontana*	7	23.3
Glaucous Bluegrass	*Poa glauca*	4	13.4
Total		30	100

Table 4-6 Wet Area Seed Mix

Species	Botanical Name	Application Rate (kg/ha)	Percentage
Violet Wheatgrass	*Agropyron violaceum*	16	53.3
Fowl Bluegrass	*Poa palustris*	8	26.7
Tufted Hairgrass	*Deschampsia caespitosa*	6	20.0
Total		**30**	**100**

In addition to each grass mix, a nitrogen-fixing plant species will be added. If native species Yellow locoweed (Oxytropis campestris) and Arctic lupine (Lupinus arcticus) are available they can be applied at 2kg/ha. Agronomical species Medicago sp. (Rambler or Drylander) and Alsike clover at can also be applied at 2kg/ha. Rhizobium inoculant is needed for these legume seeds.

- Topsoil and logs (coarse woody debris) should be salvaged during stripping and clearing and stockpiled to the side. The topsoil as well as being a seed bank, contains microfauna and fungus necessary for nutrient cycling. The logs are carbon/moisture reservoirs and provide habitat and preferable re-growth microsites. This material is needed to jump start soil-building processes and to accelerate revegetation growth.
- Vegetation islands of shrubs, trees and coarse woody debris act as a seed banks, attract wildlife which transport seeds and nutrients into the grassed area and speed up vegetation succession. Vegetation islands should be incorporated into both the revegetation research program and the larger scale progressive reclamation efforts. Retention of islands of vegetation where possible within the Minto Mine future expansion plans will enhance landscape diversity and accelerate vegetation succession after mine closure.
- Local shrub/tree species can be salvaged and planted on corresponding aspects. Use ecosystem polygons already mapped to assist in finding local plant stock, and in determining species adapted to particular aspects and conditions.

5 IMPLEMENTATION SCHEDULE

As currently permitted, Phase IV surface mining is scheduled to cease early to mid-2014, underground mining in 2016, with milling cessation within 1 year. As stated in previous sections, Minto intends to continue to operate beyond the scope of Phase IV operations. The proposed Phase V/VI mine plan involves surface mining until 2017, underground mining until 2019, and milling until 2022. The phase V/VI proposal entered an evaluation by YESAB in June 2013 and a final decision on the project is not expected until August 2014.

Regardless of the mine plan, reclamation of disturbed areas will occur in a phased approach to match the overall mining schedule and after closure to reflect the reclamation and monitoring effort required. This phased approach to reclamation planning will assist Minto in achieving the overall objectives of progressive and final reclamation at the site.

An implementation schedule of proposed key reclamation and closure activities for Phase IV mining is presented below by year. If Phase V/VI mining activities are approved, the schedule would be adjusted according to a revised Phase V/VI Reclamation and Closure Plan..

2014

- Reclamation of DSTSF. Monitoring of the reclaimed DSTSF will commence to verify effectiveness of closure on reductions in source loadings;
- Reclamation research, on-site data collection, water quality analysis and bench-scale pilot systems begin for constructed wetland treatment systems and biological reactors;
- Commence the Southwest Waste Dump reclamation (cover placement and revegetation);

2015

- Commence Main Waste Dump reclamation, and final DSTSF/MVFE covers and revegetation;
- Reclamation of Main, Area 2 and Area 118 pits

2016 Start of final closure

- Processing of stockpiles is completed and reclamation of ore stockpile footprints begins;
- End of Phase IV milling;
- Active decommissioning and closure starts (3-year period);
- Continued reclamation of the Area 118 Pit, main waste dump, and southwest waste dump;
- Flooding of the Main Pit and Area 2 Pit;
- Commence Main Pit dump cover and revegetation;
- Ongoing monitoring of progressive reclamation.

2017

- Active decommissioning continues (mill decommissioning, recontouring, etc.);
- Ongoing site reclamation activities where still required;

- Initial diversion and conveyance channel construction
- Ongoing monitoring of progressive reclamation.

2018

- Final diversion channel construction;
- Dam deconstruction;
- Reclamation of the Mill Valley Fill Expansion;
- Completion of site reclamation activities;
- Beginning of post-closure period monitoring program.

2033

- Scheduled end of post-closure period monitoring program.

6 CLOSURE MEASURES FOR SITE RECLAMATION UNITS

This section outlines the proposed reclamation methodologies that will be applied to the different reclamation units present at the site. Each sub-section contains a description of the area in addition to discussion of the closure issues that help govern the closure methodologies chosen for that unit. References to previous reports or supporting documentation are also contained in each sub-section.

Figure 2-3 presents the overall site plan at the end of the Phase IV expansion project, in addition to a general summary of the various closure measures proposed for the reclamation units that will be present at the end of mining under the Phase IV application. This figure also identifies the currently proposed timeline for conducting the reclamation works at the site. Figure 6-2 in Section 6.8 shows the final site water management layout for the site based on the currently proposed closure plan, including proposed major diversion alignments, and pit flooding projections.

The disturbed area has been divided into reclamation units as follows:

- Waste Rock And Overburden Dumps;
- Ore stockpiles;
- Open Pits;
- Underground Workings;
- Dry Stack Tailings Storage Facility and Diversion Structures;
- Mill Valley Fill Extension;
- Haul Roads;
- Water Storage Pond Dam;
- Mill and Ancillary Facilities;
- Mill Pond;
- Access Road; and
- Miscellaneous Components.

Table 6-1 contains a summary of the expected site disturbance associated with each reclamation unit at the end of Phase IV mine life. This table lists the reclamation components and sub-components, the total area expected to be disturbed by each unit during the construction and operations phases and the final surface area of the reclamation unit that will require reclamation. The areas to be reclaimed contained in the table are based on three dimensional models of the facilities and as such reflect the actual areas as opposed to the disturbed footprint which does not account for slope.

It is estimated that a total of 316 hectares will be disturbed by the end of Phase IV mine development. Table 6-1 below presents calculated areas of disturbance requiring reclamation.

Table 6-1 Estimated Area of Disturbance Requiring Reclamation

Reclamation Component	Surface Area Requiring Reclamation (ha)
Main Waste Dump	43.5
South West Dump	74.0
Ice-Rich Overburden Dump	34.5
Reclamation Overburden Dump	30.0
Ore Stockpile Areas	15.7
Open Pits	n/a
Haul Roads	13.0
Portal Area	2.0
Tailings Area	41.3
Water Storage Pond Dam (including 4.7 ha impacted by impounded water)	6.0
Mill and Ancillary Facilities (Including MVFE surface)	10.5
Access Road (assuming full extent of access road reclamation)	26.2
Explosives Plant site	2.6
Mine Camp	2.2
Air Strip	n/a
Mine Contractor Laydown	2.5
Exploration Sites and Trails	n/a
Land Treatment & Solid Waste Facilities	1.0
Miscellaneous Components Subtotal	8.3
Total	**313.3**

6.1 WASTE ROCK AND OVERBURDEN DUMPS

This section addresses the reclamation of the waste rock and overburden dumps at the site which include the following reclamation units:

- Main Waste Dump;
- Southwest Waste Dump;
- Ice-Rich Overburden Dump; and
- Reclamation Overburden Dump.

The MWD and SWD are existing mine infrastructure that contain unclassified waste rock generated during earlier mine development. This material was not segregated by copper content and as a result contains some higher copper content materials. Updated geochemical modelling and water quality predictions indicate that, for most waste rock dump areas, rudimentary revegetated soil covers will be appropriate for mitigating the potential for contaminant migration from the waste rock dumps. However, as a precautionary measure, costing allowances have been made for the incorporation of a low permeability, engineered cover system to further

reduce metal loadings from the High Grade Waste area of the SWD (located at the very southwest corner of the SWD.)

6.1.1 Main Waste Dump

The Main Waste Dump (MWD) is located immediately northwest of the Main Pit, and has been constructed in sequential lifts as materials are extracted from the Main Pit. The MWD has been constructed according to EBA's Geotechnical Evaluation – Proposed Main Waste Dump, Minto Project, Yukon (EBA, 1998) which addresses physical stability design considerations such as maximum credible earthquake criteria so the likelihood of major failure of the facility is deemed to be low. Annual inspections of the MWD have taken place as per Section 9.3.2 of the Quartz Mining Licence QML-0001 and no physical stability issues have been identified to date. The MWD has not and will not receive any additional waste material from Phase IV; however, additional waste rock disposal is scheduled for the MWD in connection with Phase V/VI mine development of the Minto North Pit.

Waste materials placed in the facility contain copper concentrations ranging from 0–0.64% since the majority of the MWD was constructed prior to the development of specific material handling plans based on the copper content. Geochemical characterization of the materials as part of permit requirements has shown that the materials do not present an acid rock drainage concern. The average NP/AP ratio of materials placed into the MWD is 48.5 with an average paste pH of 8.61 (Minto, 2009). Neutral metal leaching has been identified as being a potential chemical concern associated with closure of this reclamation unit based on the ongoing geochemical characterization program (SRK, 2010) for the mine.

The proposed reclamation of the MWD will involve addressing physical stability concerns with geochemical concerns being addressed as part of the site-wide source control program described in Section 4 of this report. The slope of each lift will be reclaimed as per Figure 6-1, which shows typical standard reclamation measures of a dump slope. Slope crests will be rolled over using a tracked dozer with recontouring conducted in areas where the dump faces are greater than the long term angle of repose. This has been completed for a significant portion of the dump face already in progressive reclamation activities – see Section 4.3 Reclamation to Date.

Geochemical characterization of the waste materials previously disposed of in the MWD has shown that the materials do not present an acid rock drainage concern. Neutral pH metal leaching has been identified as being a potential geochemical concern associated with closure of the dump based on the ongoing geochemical characterization program (SRK, 2010) for the mine.

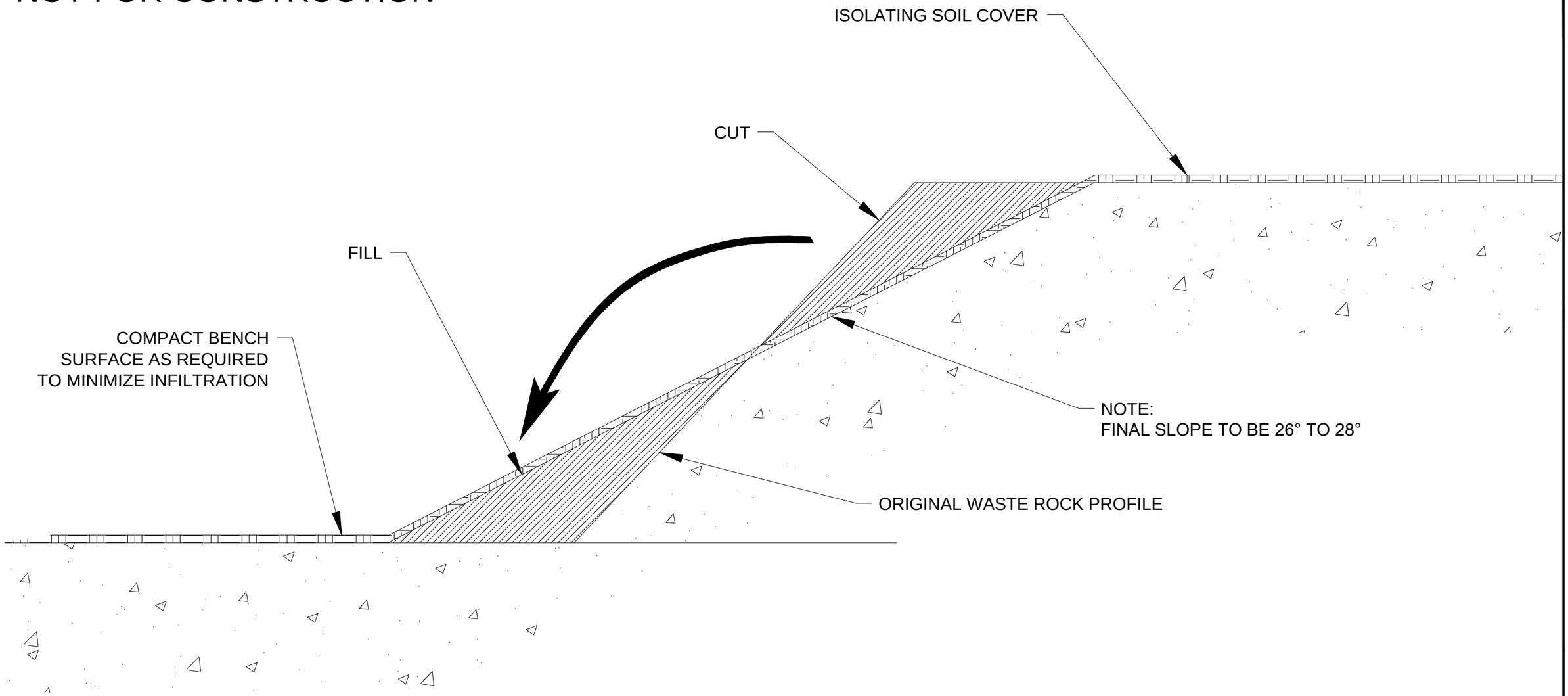
Both benched (i.e., relatively flat) and sloped surfaces of the MWD will be covered with a soil cover. Prior closure plans for this unit had proposed a soil cover thicknesses of 0.25 m for placement onto the MWD. The 0.25 m thickness is being re-evaluated based on the results of the predictive closure water quality model and the identified need for implementing source control. Research into optimal cover thickness is ongoing; however, based on our current understanding of cover material properties, the following assumptions have been made regarding the anticipated cover configuration. Bench areas will be covered with a minimum 0.5m thickness of soil cover with 20% of the bench areas to be covered with an average 2.0m cover thickness to facilitate the incorporation of deeper rooting vegetative cover. For costing purposes, all bench areas will be covered with an average 0.8m thickness of soil cover. All perimeter slopes are to be covered with a minimum 1.0m of soil cover.

The surface of the SWD shall not be scarified prior to placement of the cover as infiltration into the dump materials is not considered desirable based on the potential for neutral metal leaching of the waste materials. Compaction of the surface of the dump is considered to be favourable towards the intent of reducing infiltration.

Reclamation overburden will be loaded with an excavator and hauled by trucks from the reclamation overburden dump. Overburden will be placed with the trucks and further spread with a low ground pressure dozer. Compaction of the cover during spreading will be minimized by the use of low ground pressure equipment, however, areas observed to have compaction will be ripped to reduce compaction effects prior to seed and fertilizer application.

The current reclamation seed mixture and fertilizer application rates contained in the 2011 DRP for the Minto mine will be followed unless ongoing reclamation research programs show that changes to these are warranted.

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION



NOTES:

FIGURE REPRODUCED IN PART FROM FIGURE 6-4 OF MINTO MINE DECOMMISSIONING AND RECLAMATION PLAN ver. 3.2

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2013-09-13	ISSUED FOR REVIEW	00	KB	JT

ACCESS

capstone MINTO MINE

PROJECT NAME: Minto Mine Phase IV Reclamation and Closure Plan Revision 4.0

TITLE: TYPICAL SLOPE RECLAMATION MEASURES

DESIGNED BY:	ACCESS PROJECT NO:	CLIENT REF.:
EBA	MIN-11-01	
DRAWN BY: K. Boldt	SCALE: NOT TO SCALE	
CHECKED BY: J. Theriault	FIGURE: 6-1	REV.: 00

C:\Users\kboldt\Projects\MintoCAD\Drawings\MIN-11-01-F6-1.dwg

6.1.2 Southwest Waste Dump

The southwest waste dump (SWD) is located to the south of the MWD and was designed by EBA in 2008 in order to optimize operations and provide additional storage areas for waste rock and non-ice-rich overburden material. Construction began shortly after the design approval in October 2008 and is currently being developed as per the EBA report entitled Geotechnical Design, Proposed Southwest Waste Dump (EBA, 2008a). The Phase IV expansion of the SWD has been constructed in accordance with the Waste Management Plan (EBA, 2010a) which outlines the design criteria for this unit. The dump has been constructed in progressive lifts with ongoing monitoring of the stability of the SWD being conducted as recommended in the design report through a combination of visual inspections, deformation surveys and monitoring instrumentation (piezometers, ground temperature cables and survey hubs).

The majority of waste rock scheduled for surface disposal as a result of Phase IV was placed into the SWD. Segregation of waste on the basis of copper content was conducted, and the highest grade waste (HGW) which was originally destined for a Grade Bin Disposal Area (GBDA) south of the Main Pit was instead stockpiled in a segregated area in the southern-most extent of the SWD area. This was due to the instability and south wall failure of the Main Pit in the GBDA area. Medium grade waste (MGW) was also placed in an area separate from the rest of the waste in the dump. Some of the original portions of the SWD constructed as part of past mine workings have been covered as a result of the expansion of this unit. The covering of the older portions of the SWD, which are suspected to contain higher copper content waste rock materials, will help to reduce potential metal loadings from these materials.

The SWD is estimated to receive approximately 6.44 Mm^3 of waste materials with copper content less than 0.1% from the Phase IV development. Initial geochemical characterization of the waste materials scheduled for placement in the SWD has shown that the materials do not present an acid rock drainage concern. Neutral pH metal leaching has been identified as being a potential geochemical concern associated with closure of the dump based on the ongoing geochemical characterization program (SRK, 2010).

It is anticipated that the entire surface of the SWD, with the possible exception of the isolated area of high grade waste, will be covered with a rudimentary, revegetated isolation soil cover similar to that proposed for the MWD. Research into optimal cover thickness is ongoing; however, based on our current understanding of cover material properties, the following assumptions have been made regarding the anticipated cover configuration. Bench areas will be covered with a minimum 0.5m thickness of soil cover with 20% of the bench areas to be covered with an average 2.0m cover thickness to facilitate the incorporation of deeper rooting vegetative cover. For costing purposes, all bench areas will be covered with an average 0.8m thickness of soil cover. All perimeter slopes are to be covered with a minimum 1.0m of soil cover. A 'rough and loose' surface will be encouraged for erosion control, moisture retention and promotion of seed and propagule capturing.

While updated water quality predictions indicate that rudimentary soil cover is appropriate for the entire SWD surface, Minto has conservatively allowed for the placement of an engineered very low permeability cover over the area containing high grade waste. The closure costing has allowed for the installation of a bituminous geomembrane over the area of HGW.

Reclamation overburden will be loaded with an excavator and hauled by trucks from the reclamation overburden dump. Overburden will be placed with the trucks and further spread with a low ground pressure dozer. Compaction of the overburden during spreading will be minimized by the use of low ground pressure

equipment, however, areas observed to have compaction will be ripped to reduce compaction effects prior to seed and fertilizer application.

The current reclamation seed mixture and fertilizer application rates presented in Section 4.6 will be followed unless ongoing reclamation research programs show that changes to these are warranted.

6.1.3 Ice-Rich Overburden Dump

The ice-rich overburden dump (IROD) is the furthest west reclamation unit on the site and has been constructed immediately upgradient of the SWD. A toe berm has been constructed from waste rock to retain the ice-rich overburden and prevent migration of the material downslope as ice in the stockpiled materials melt. The IROD has been constructed according to EBA's Geotechnical Design, Ice-Rich Overburden Dump, Minto Mine, Minto YT (EBA, 2006) and has been inspected since as per the Quartz Mining Licence (QML-0001, Section 9.3.2) with no stability issues identified to date. Construction of the SWD around the margins of the IROD have significantly reduced the likelihood and potential consequences of IROD instability.

Materials from the IROD will be used as a source for growth media during reclamation of the SWD. Reclamation of the IROD will involve the placement of a 0.25 m layer of overburden on the toe berm as this unit is not deemed to require source control.

Any overburden remaining in the dump after closure and reclamation has been completed will be resloped to less than 2.5H:1V and revegetated. Revegetation test plots were established on the toe berm in 2007. Final revegetation seed mixtures and fertilization requirements for the IROD will be similar to those applied elsewhere on the site.

6.1.4 Reclamation Overburden Dump

The reclamation overburden dump (ROD) is located to the west of the MWD and north of the SWD. The ROD will be expanded as a result of Phase IV in order to stockpile reclamation materials stripped during construction and development of site infrastructure (eg. Area 2 and 118 open pits, Mill Valley Fill). The existing portions of the ROD have been constructed in accordance with EBA's Geotechnical Design, Proposed Reclamation Overburden Dump, Minto Mine, Yukon (EBA, 2008b). The proposed expansion of the ROD will be constructed in accordance with EBA's Phase IV Waste Management Plan (EBA, 2010a) which outlines the design criteria for this unit. Currently, the ROD contains 4.43 Mm^3 of overburden that would be available for soil cover construction at the end of Phase IV.

The overburden materials stockpiled in the ROD will be used as a source for growth media during reclamation of other units at the site. Any overburden remaining in the ROD after closure and reclamation has been completed will be resloped to less than 2.5H:1V and revegetated.

6.2 ORE STOCKPILES AND PADS

The Phase IV mine plan includes the milling of all stockpiled ore prior to final closure. The following stockpiles at the site will be treated in this fashion and therefore are not deemed to be an issue at closure:

- high grade sulphide ore stockpile and pad (located south of the mill); and
- low grade sulphide ore stockpile and oxide ore pad (located between the pit and the MWD).

Both the high and low grade sulphide stockpile pads were constructed from waste rock according to design criteria set out in EBA's Waste Rock Stability Evaluation, Minto Project, Yukon (EBA, 1996). The stockpile pads on site are designed in accordance with the recommendations in "Mined Rock and Overburden Piles Investigation and Design Manual" published by the BC Mine Waste Rock Pile Research Committee. In accordance with the above mentioned manual, all stockpile pads on site are designed to be stable up to a seismic event which results in peak ground accelerations which have a 10% probability of exceedance in 50 years (EBA and Access, 2011). The ore stockpiles have been inspected annually as per the Quartz Mining Licence (QML-0001) and there are no issues identified to date that suggest long term stability concerns for these units).

Reclamation of the stockpile pads will be conducted following the completion of milling of stockpiled ore materials. Compacted portions of the pads will not be scarified to promote drainage as the geochemical characterization program indicates that there is potential for neutral metal leaching from these materials. The pads will have a minimum of a 0.5 m soil layer of growth material applied followed by application of seed and fertilizer.

6.3 OPEN PITS

Phase IV involves the development of the Area 2 and Area 118 open pits. The Main Pit mining was completed in April 2011 and has been included in this plan based on the planned deposition of tailings and NP:AP>3 waste rock into this unit.

6.3.1 Main Pit

The Main Pit encompasses the original drainage channel for Minto Creek. The Main Pit was excavated according to Minto's Open Pit Design Plans (MintoEx, 2006). The north wall of the pit is benched in competent bedrock while the south wall is composed of bedrock and ice-rich overburden. Acid-base accounting indicates that the open pit wall rocks are net neutral to slightly acid consuming (non-acid generating). Results to date (SRK, Appendix A) indicate that the open pit wall geochemistry is consistent with the initial geochemical predictions put forward in the original geochemical characterization report (Mills, 1997).

The open pit was exhausted of ore during April 2011. An area of instability in the south wall of the pit failed shortly after completion of mining activities, and a stabilization buttress (South Wall Buttress) for the area is nearing completion.

During the operations period the storage capacity of the flooded pit will be sufficient to accommodate a storm volume of 975,000 m^3 which is required by the current water licence to be available at the end of each season of operation. According to the Phase IV Tailings Management Plan (EBA, 2010b), slurry tailings are being placed in the pit and will be placed to an elevation of approximately 8 m below the final spillway invert elevation.

The completion of tailings deposition into the Main Pit occurs while the mine is still in operations and construction of a final discharge channel from the pit to Minto Creek will not be possible until the end of milling activities currently scheduled for early 2016. Excess water accumulated in the Main Pit prior to the construction of the discharge channel will be either:

- Subject to treatment in the water treatment plant and discharged to the receiving environment; or
- Pumped into the Area 2 pit to accelerate flooding of that unit.

The pit will then be allowed to flood in order to cover the deposited tailings and waste rock. Water quality in the Main Pit will be monitored during flooding and the water treatment plant will be in place so that water can be treated prior to release off-site if required.

At closure, approximately 55% (10.6 ha) of the open pit walls will remain exposed above water following flooding of the Main Pit. Prior to flooding, any accessible benches in the pit excavated in overburden will be scarified to encourage natural revegetation, but no additional reclamation work will be done on the open pit high walls. Boulders, up to 1 m in size, will be placed on all potential access routes to prevent uncontrolled human access to the pit.

The Main Pit will be flooded until it overflows into the engineered drainage channel (ditch 400). It is expected that it will have an approximate final water elevation of 785 m. The proposed Main Pit lake will spill to the east at approximately the same elevation at the low point on the pit rim into a designed intake structure and drainage channel that will convey the flow from the pit. The discharge channel (ditch 400) from the Main Pit is discussed in Section 6.8.

6.3.2 Area 2 Pit

The Area 2 Pit is located to the west of the Dry Stack Tailings Storage Facility. The Area 2 open pit has been constructed using standard drill and blast mining techniques with the proposed excavation occurring primarily in competent bedrock. The Area 2 pit will be used to store tailings once the Main Pit has been filled to its design capacity.

Some of the upper benches will be excavated into overburden and there is the potential for shallow surficial instability to occur in the overburden unit. Any areas of instability noted during operations will be addressed during subsequent updates of this document. Acid-base accounting indicates that the open pit wall rocks are net neutral to slightly acid consuming (non-acid generating).

Following the cessation of operations, the Area 2 pit will be flooded until it overflows into the engineered drainage channel. To facilitate this, the existing Southwest Diversion Ditch (referred to as Ditch 100 in this RCP) will be diverted into the Area 2 Pit at closure. Minto will evaluate whether pumping water into the Area 2 pit is required in order to accelerate flooding at closure. Pumping into the Area 2 pit is currently considered a favourable measure to submerge non-acid generating sulphide materials that are exposed as a

result of the mining operations in this area. Accelerated flooding of the pit will act to reduce the oxidation of any exposed materials in the pit walls resulting in lower overall metal loadings due to less soluble secondary weathering products being produced from sulphide oxidation. The Area 2 pit lake will have an approximate depth of 35 m following flooding.

Due to the limited topography in Area 2 pit it is estimated that approximately 20% of the open pit walls will be exposed following flooding of this unit. The proposed Area 2 pit lake will spill to the north at an elevation of approximately 802 m into a designed intake structure and drainage channel that will convey the flow out of the pit. The conceptual intake structure invert elevation is estimated to be at approximately the same elevation as the low point on the pit rim, but the final invert elevation will be determined following development of that portion of the pit. The discharge channel (ditch 450) from the Area 2 pit is discussed in Section 6.8.

Prior to flooding, any accessible benches in the pit excavated in overburden will be scarified to encourage natural revegetation, but no additional reclamation work will be done on the open pit high walls. Boulders, up to 1 m in size, will be placed on all potential access routes to prevent uncontrolled human access to the pit

6.3.3 Area 118 Pit

The Area 118 pit is located upslope and to the west of the Area 2 pit and will be mined during 2014. The Area 118 open pit will be constructed using standard drill and blast mining techniques with the proposed excavation occurring mostly in competent bedrock. The upper benches will be excavated into overburden and there is the potential for shallow surficial instability to occur in the overburden unit. Any areas of instability noted during operations will be addressed during subsequent updates of this document. Acid-base accounting indicates that the open pit wall rocks are net neutral to slightly acid consuming (non-acid generating). The Area 118 Pit will be left in its final mined-out state at closure.

6.4 UNDERGROUND WORKINGS

The Phase IV mine plan includes underground mining below the Area 2 and Area 118 open pits. Development includes a portal (construction complete) and decline for underground access which required surface overburden excavation to expose bedrock prior to drilling and blasting of the portal. It is estimated that approximately 1,541 kt of ore and 341 kt of waste will be excavated from underground mining, which is commencing shortly.

The proposed mine plan includes disposal of waste materials by backfilling into the underground workings. The waste rock from the underground will follow the approved Waste Rock and Overburden Management Plan for phase IV.

To date, geochemical characterization for the underground waste rock recovered from core samples show that underground waste rocks are similar in geochemical properties to waste rock from Area 2 and Area 118 open pits.

Upon completion of underground mining, the underground workings will be allowed to flood. Recently updated hydrogeologic investigations indicate that in the post-closure period the groundwater table will not rise sufficiently to result in water discharging at the surface. In Accordance with the Yukon Quartz Mining

Act, at the completion of mining the portal to the underground workings will be sealed, preventing access by people and wildlife. The ventilation raise will also be sealed to prevent access.

The portal area will be backfilled and recontoured to a stable and natural slope. This will be followed by the application of appropriate seed and fertilizer to restore vegetation to the area.

6.5 HAUL ROADS

The haul roads on the site radiate out from the open pit to the mill, the ore stockpiles, the waste rock dumps and the ice-rich overburden dump. Haul roads, site roads and the main access road will be subject to standard road decommissioning and reclamation measures at closure, including culvert excavation, drainage recontouring, slope stabilization and surface scarification. Regrading/contouring of the roads will ensure that runoff sheds off the road surface and does not become ponded. Site reclamation experience indicates that road surfaces are not expected to require seeding, only surface scarification in order to encourage natural revegetation. Sediment management measures will be installed where drainage channels have been re-established in order to prevent sediment from entering streams while revegetation occurs. Short term sediment management measures may include installation of silt fencing and enviro-matting at select sites until vegetation becomes established.

6.6 DRY STACK TAILINGS STORAGE AREA AND DIVERSION STRUCTURES

All tailings placed in the DSTSF were dewatered using ceramic filters before being conveyed by truck for spreading and compaction in the Dry Stack Tailings Storage Facility (DSTSF). Construction of the facility was in accordance with EBA's Geotechnical Design Report, Dry Stack Tailings Storage Facility, Minto Mine, Yukon (EBA, 2007). Further details on the tailings handling procedures are available in Minto's Tailings Management Plan (TMP) and the related Operations, Maintenance and Surveillance Plan (OMS) for the DSTSF.

The DSTSF is located on a bench to the south of the mill and upslope from the Minto Creek channel. The facility has been constructed as per the specifications provided in the TMP and overseen by the Engineer of Record (EBA). Field compaction of placed dewatered tailings was regularly verified using a nuclear densometer, as per the quality control program. The last tailings placement in the DSTSF occurred in November of 2012, at which point issuance of the water licence amendment for Phase IV operations allowed for the switch to the placement of slurry tailings in the Main Pit. Monitoring of the stability of the tailings stack has been conducted through daily visual inspections and through monitoring the installed instrumentation (piezometers, ground temperature cables and settlement monuments). Regular field visits and an annual geotechnical inspection are conducted by the Engineer of Record as required under the Quartz Mining Licence QML-0001 (Section 9.3.2).

The Mill Valley Fill Extension which is described in the next section was designed to buttress the DSTSF and eliminate its movement, and although the MVFE is now built to design completion and movement is slowed, there is still some facility movement identified through the monitoring program.

The rate of movement varies across the dry stack; along the centerline of the facility, where tailings fill is thickest, it is approximately 3.0 mm/d (DSSH12), while the rate at the eastern edge measures 1.5 mm/d (DSSH17). The movement rates of these survey hubs peaked at 8.6 mm/d and 2.5 mm/d, respectively, suggesting that the MVFE has had a significant effect. In April 2013, nine new inclinometer holes were installed in and around the DSTSF to better characterize the rate of movement and the depths at which it is

occurring. This geotechnical drilling program provides additional data for an assessment of what, if any, further measures will be required to stop movement of the facility.

Minto submitted a risk assessment report on the DSTSF to the Department of Energy Mines and Resources (EMR) in March 2009 (SRK, 2009b). The report evaluated all conceivable failure modes for the facility using the Failure Modes and Effects Analysis (FMEA) method. The report recognizes the lowered physical risks associated with the DSTSF versus a conventional slurried tailings impoundment and noted that the regulatory requirements necessary to mitigate risks are currently in place. The preliminary FMEA exercise for the Minto Closure Planning conducted in January 2013 (Appendix C) acknowledged the ongoing uncertainty regarding the mechanism of instability and the potential need for further mitigation measures. Minto has engaged SRK to conduct a targeted investigation into the extent of continued movement at the site with a view towards the development of ultimate mitigation measures for the DSTSF instability. Minto and SFN have also engaged a 3rd party expert on geotechnical stability under mutually agreed upon terms of reference to assist in the evaluation of the facility movement and the development of appropriate mitigation. This evaluation is ongoing, and the results of this are not available for inclusion in this RCP, as stipulated in WUL QZ96-006 clause 103 c) ii). Minto will include the Yukon Water Board and YG EMR in the distribution of findings and final mitigation recommendations and designs as they are developed.

Geochemical characterization of the tailings has indicated there is no acid-rock drainage potential in this reclamation unit, however neutral metal leaching of copper and other elements has been identified. Closure measures for the DSTSF will focus on reduction of source loadings from the facility in addition to ensuring the physical stability of the facility. Managing water movement in and around the DSTF is seen as the key factor in the design of closures measures. The compacted tailings have a low permeability due to the mechanical compaction of the tailings following placement and spreading in the facility. Infiltration of precipitation and run-on water is not expected to have a significant influence on the DSTSF and surface grading will be utilized during the closure phase to assist in the shedding of water from the surface.

Progressive reclamation of the DSTSF is currently underway and a thick layer of overburden, ranging in thickness is in the process of being placed over the tailings surface, as released from Area 2 stripping activities. This thick overburden layer will obviate the risk of surficial erosion exposing the underlying tailings. The tailings surface will be recontoured to divert surface runoff efficiently off the tailings stack. The closure costing allows for an additional 0.5m of select overburden to ensure that the cover is suitable for revegetation. The current reclamation seed mixture and fertilizer application rates outlined in Section 4 will be followed unless ongoing reclamation research programs show that changes to these are warranted.

6.6.1 DSTSF Diversion Structures

Existing design components (upstream diversion ditches, finger drains and a toe berm) are currently intercepting and diverting some portion of surface runoff from upslope and filtering seepage from below the area. The south diversion ditch (SDD) is the primary diversion structure and is used to convey flow from the original tributary channel that previously ran through the DSTSF into the mill water pond. It is referred to as ditch 100 in the closure plan layout. It has an estimated discharge capacity of 13.3 m^3/s (SRK, 2013b). Such a discharge capacity is more than 4 times larger than the calculated 200-year design flood for ditch 100 of 3.5 m^3/s. The current dimensions of the SDD are more than adequate for closure. During closure the SDD will be consolidated if necessary (adequate size of riprap, proper grading of materials, longitudinal slope and ditch depth) to ensure its long term efficiency for the post-closure period. The operations Water

Management Plan bypass of the SDD around the Area 2 pit will be decommissioned at closure, allowing the SDD (ditch 100) to spill into the Area 2 pit.

Field observations have shown that the Tailings Diversion Ditch to the south of the facility required reconstruction to ensure that water is successfully captured and routed around the facility. This work is being conducted currently according to EBA's design document from October 2011 *Upstream Water Management for the Mill Valley Fill Expansion and Dry Stack Tailings Storage Facility* (EBA, 2011).

Secondary and tertiary ditches will direct any excessive direct precipitation from the DSTSF surface to the Ditch 400 for discharge off site.

6.7 MILL VALLEY FILL EXTENSION

The Mill Valley Fill Extension (MVFE) is located immediately downslope of the DSTSF and was designed to buttress the DSTSF due to stability concerns identified through the instrumentation monitoring program at the site. The MVFE has allowed for expansion of the camp pad and establishment of surface laydown areas during the operations phase. The MVFE construction is complete in accordance with the original (Stage 1) design, and was constructed from 1.3 M-m^3 of low copper content run-of-mine rock in order to limit the potential for neutral metal leaching into the receiving environment.

As indicated above in Section 6.6, a geotechnical evaluation is currently underway to further understand the creep movement potential of the DSTSF with a view towards evaluating if further buttressing of the facility is required. The results of that evaluation and associated recommendations are anticipated in late 2013.

Closure of the MVFE will be conducted at the end of Phase IV milling and will involve the removal of any temporary buildings and materials stored in the laydown areas. The location of the MVF in the main valley of Minto Creek means that it will be necessary to route the main site discharge channel alongside the MVF and a spillway down the face of the MVF. The main site discharge channel (called ditch 400 in the closure water management layout) will be designed to accommodate the 200-year event for the entire upstream catchment area including the routing provided by the two pits. Evaluation of the potential for the main site discharge channel to influence the geotechnical stability of the DSTSF will be evaluated during detailed design. The cost of the spillway design and associated geotechnical stability evaluation has been included in the closure costing for this unit. It is important to understand that the detailed design and associated geotechnical evaluations for this channel are not able to be finalized until after the ultimate configuration of the MVFE facility has been determined, so that final designs can be used.

Recontouring of areas of the MVFE not required for channel construction will be conducted in order to establish final drainage runoff patterns. The surface of the MVF is currently not expected to require source control so it will be covered with 0.25 metres of growth media prior to application of seed and fertilizer.

6.7.1 Seepage at Toe of MVFE

Currently, seepage from the toe of the MVFE, which includes seepage from the DSTSF via the finger drain channels beneath the facility, is collected at the Minto Creek Detention Structure and pumped back to the Main Pit prior to treatment for discharge. This will be continued through the active decommissioning stage as required until upstream and local reclamation works are completed to a stage that allows release of this

water without compromising the suitability of site discharge as measured by the existing site effluent discharge standards and MMER Schedule 4 criteria. Accordingly, water quality in this area will be monitored and any adverse trends in water quality will be addressed as per the AMP.

6.8 WATER MANAGEMENT STRUCTURES AND SYSTEMS

One main objective of the closure water management plan is to produce a preliminary design for the water conveyance structures, including sizing and protection against erosion, to safely route flow downstream of the mine site towards Minto Creek.

The design considerations and criteria, methodologies and results of the hydrological analysis and hydraulic design completed for Minto Mine closure are presented in the Minto Mine Phase IV Closure Hydrology Report, presented in Appendix B. A summary of the report is presented in the next sub-sections.

6.8.1 Site layout

The proposed site layout of water conveyance channels has been determined based on the layout proposed in the 2011 DRP, and the mine site topographical constraints at closure. The main objective is to safely convey water downstream of the site, avoiding erosion of waste rock dump covers, tailings and other remaining works at closure.

The proposed water conveyance ditch alignments are presented in Figure 6-2. These alignments will be refined at closure to adapt to site conditions and provide safe routing of surface water over and around waste dumps and the DSTSF.

A combination of primary, secondary and tertiary ditches are proposed. Primary water conveyance channels are the main channels that will route the accumulated overland flow through the mine site. Erosion protection measures will be incorporated to ensure the stability of the channels. Energy dissipation measures will be required to ensure that flow across steep slopes is managed safely and energy is dissipated in controlled locations. Five primary ditches have been incorporated into the water conveyance design, and are described below.

- The South Diversion Ditch (labelled Ditch 100) has been constructed as part of mine operations to intercept flow to protect the DSTSF from run-on flow. This ditch will be upgraded for closure, and will route flows into the Area 2 Pit. The ditch currently has the capacity to carry up to 13.3 m^3/s (SRK, 2013b). Regular flow is diverted around Area 2 pit by a pipe which has an estimated capacity of 1.1 m^3/s, while any additional flows enters the pit through a recently constructed spillway.

- Flows from the Main Waste Dump and the Reclamation Overburden Dump will be captured in Ditch 300. Ditch 350 will control flow predominantly originating from the Southwest Dump, out of the W15 area. Ditch 300 will discharge its flow into Ditch 350, routing flows into the Main Pit. The alignments of these ditches have been located to minimize flow over erodible buttress soils.

- The Main Pit and Area 2 Pit will provide detention for upper catchment flows in the form of pit lakes at closure. The outlets of these pits will direct flow into Ditch 400 and 450, respectively. Ditch 450 will discharge to Ditch 400 in the mill area. Thus, Ditch 400 will convey the majority of on-site flows. The Ditch 400 alignment will stay as far north as possible when crossing the MVFE, hugging the existing hillside, and will be routed down the MVFE NE slope and continuing in the valley bottom.

Secondary water conveyance channels are ditches that will route runoff water from elevated catchments (i.e. from the top of waste rock dumps and the DSTSF) into the primary ditches and/or energy dissipation and sediment control ponds. These will convey flow from much smaller catchment areas than primary ditches, but will route water down potentially steep slopes, up to 1.5H:1V. The design of secondary ditches will incorporate structures to drop water along the waste rock dump steep faces if required (i.e spillways, drop structure, baffles) in addition to energy dissipation/sediment control ponds at the base of steep slopes, to protect the channels against high flow velocities. The final alignment of secondary ditches will be determined at closure.

The Dry Stack Tailings Diversion Ditch is being upgraded in fall 2013 as part of operations, and has also been retained to assist in preventing run-on flows from entering the DSTSF. It is treated as a secondary ditch, and routes flows to the water storage pond. It will be upgraded as required for closure.

Tertiary water conveyance channels are relatively minor ditches and swales that will direct overland flow on the elevated catchment areas towards secondary ditches, protecting the steep slopes from concentrated surface flow. They will be designed to intercept flow before it can concentrate and potentially erode cover materials. These ditches will route small flows with low flow velocities due to the very small areas of surface runoff being managed.

capstone
MINTO MINE

MINTO MINE PHASE IV

RECLAMATION AND CLOSURE PLAN REVISION 4.0

FIGURE 6-2
CLOSURE WATER MANAGEMENT LAYOUT

SEPTEMBER 2013

- Proposed Diversion Structure (Primary Ditch)
- Proposed Diversion Structure (Secondary Ditch)
- Proposed Diversion Structure (Tertiary Ditch)
- Existing (Primary) Diversion Ditch (to be consolidated at closure)
- Existing Diversion Ditch
- Pit Lake
- Sediment Pond

THE LAYOUT OF THE DITCHES IS CONCEPTUAL AND WILL BE FINALIZED IN CONJUNCTION WITH THE DETAILED CLOSURE DESIGN. THE MAIN WASTE DUMP DITCHES ARE NOT SHOWN ON THIS FIGURE AND WILL BE DESIGNED AT CLOSURE

0 100 200 300 400 500 Meters

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14th 2012.

NAD 83 UTM Zone 8N

ACCESS

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. AccessMining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

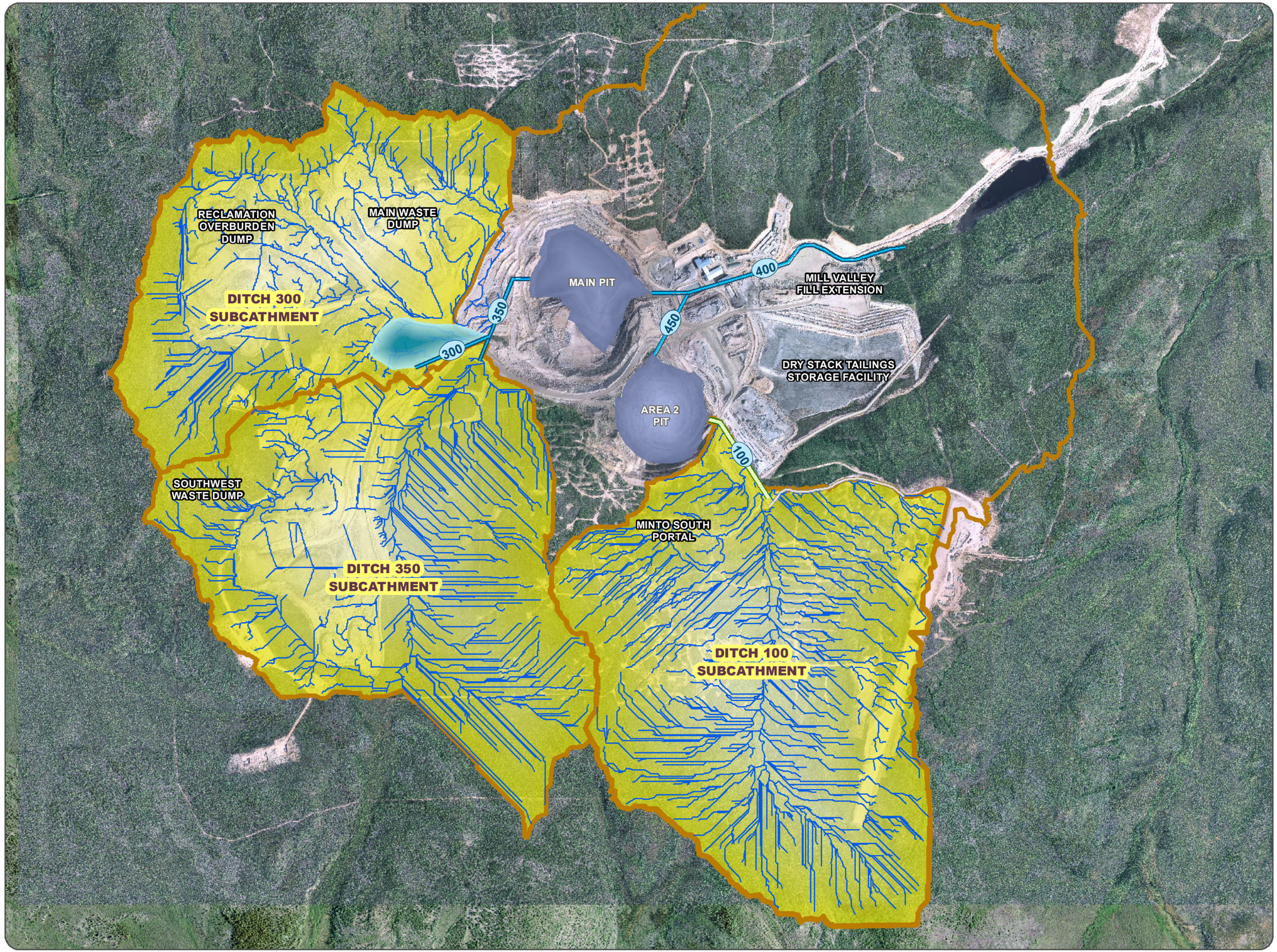
I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_6-2_ClosureWaterManagement_20130912.mxd
(*Last edited by: mducharme;13/09/2013;08:01 AM*)

6.8.2 Hydrological Study

A hydrological study (Appendix B) was undertaken to determine floods of various return periods for each sub-catchment within the Minto Mine site. Catchments were delineated for each proposed primary ditch to determine their surface area.

Three primary ditches (100, 300 and 350) will be located upstream from the Main Pit and Area 2 Pits and will flow into them. The surface area of the catchments for those three ditches vary between 1.7 and 3.9 km^2. The flood flows for those catchments have been determined using the Rational Method applied for the calculated time of concentration (varying between 45 and 75 minutes depending on the catchment). The time of concentration is a theoretical parameter that can be defined as the time required for all areas in the catchment to contribute to the flow at the outlet. Precipitation data (Intensity Duration Frequency curves) have been obtained from Environment Canada for the Pelly Ranch weather station, located in proximity to the mine site. Figure 6-3 shows the catchments of each of these three ditches.

Two primary ditches (ditch 400 and 450) will act as outflows from the Main Pit and Area 2 Pit and thus will experience significant routing of floods through pit lakes. Ditch 400 has a catchment area of 8.8 km^2, encompassing most of the mine site, while ditch 450 had a catchment area of 2.4 km^2. Flood flows were determined from the freshet period, since it is expected that the largest volume of runoff will yield the largest flows for both ditches. A constant base flow resulting from snowmelt was estimated and superimposed on a 24-hour rainfall event with a 200-year recurrence. Using this method, it is assumed that the inflows to the pits will be constant over a period of time and lead to a balance between inflows and outflows. Figure 6-4 shows the catchments of these two ditches.



capstone
MINTO MINE

MINTO MINE PHASE IV

RECLAMATION AND CLOSURE PLAN REVISION 4.0

FIGURE 6-3

UPPER PRIMARY DITCH CATCHMENTS

SEPTEMBER 2013

- Proposed Diversion Structure (Primary Ditch)
- Existing Primary Ditch
- Existing Secondary Ditches
- Modelled Water Flow
- SubCatchment
- Pit Lake
- Sediment Pond

THE LAYOUT OF THE DITCHES IS CONCEPTUAL AND WILL BE FINALIZED IN CONJUNCTION WITH THE DETAILED CLOSURE DESIGN.

0 100 200 300 400 500 Meters

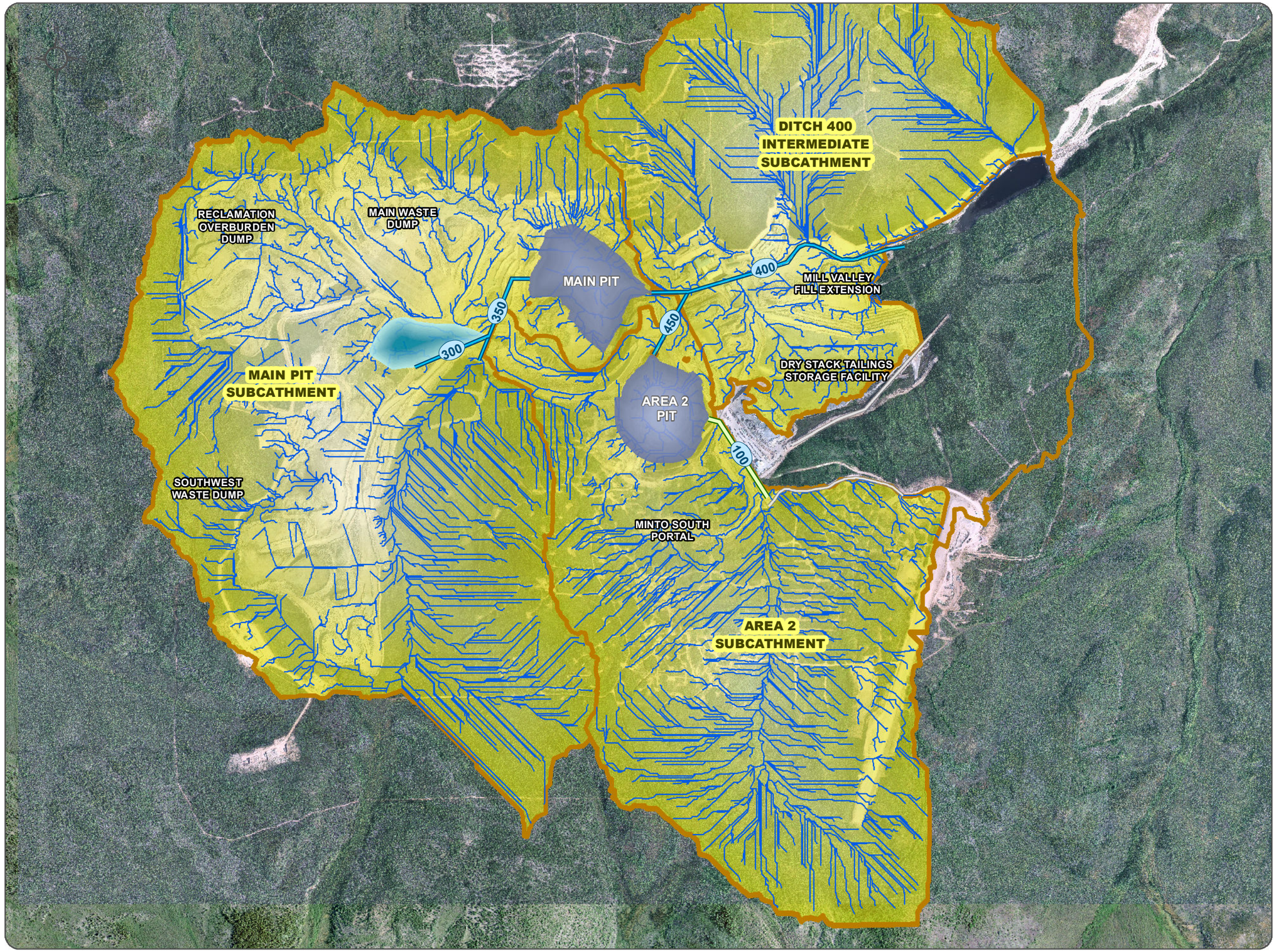
Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14th 2012.

NAD 83 UTM Zone 8N

ACCESS

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. AccessMining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_6-3_Primary_Upper_Catchment_20130912.mxd
(Last edited by: mduchame;13/09/2013;08:53 AM)



capstone
MINTO MINE

MINTO MINE PHASE IV

RECLAMATION AND CLOSURE PLAN REVISION 4

FIGURE 6-4

LOWER PRIMARY DITCH CATCHMENTS

SEPTEMBER 2013

- Proposed Diversion Structure (Primary Ditch)
- Existing Primary Ditch
- Existing Secondary Ditches
- Modelled Water Flow
- Sediment Pond
- Pit Lake
- Subcatchment

THE LAYOUT OF THE DITCHES IS CONCEPTUAL AND WILL BE FINALIZED IN CONJUNCTION WITH THE DETAILED CLOSURE DESIGN.

0 50 100 200 300 400 500 Meters

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14 th 2012.

NAD 83 UTM Zone 8N

ACCESS

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. AccessMining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_6-4_Primary_Lower_Catchment_20130912.mxd
(Last edited by: mducharme; 16/09/2013 14:58 PM)

The 200-year flood was used as the inflow design flood and the main design criteria to for ditch sizing. This design flow provides a reasonably conservative design flood for mine closure that is based on reliable site specific data. A larger flood recurrence would be highly hypothetical for small watersheds like for the Minto Mine Site and thus unreliable. The selected design criteria for the ditch sizing will provide a significant allowance for additional hydraulic capacity. Table 6-2 presents the selected design flows that will be used for each ditch, and for the two pit outlets.

Table 6-2 Design flows for primary ditches

Component	Drainage area (km²)	Design flow (m³/s)
Ditch 100	2.2	3.5
Ditch 300	1.7	5.0
Ditch 350	3.9	8.0
Ditch 400	8.8	6.6
Ditch 450	2.4	1.8
Main Pit outlet structure	5.0	3.4
Area 2 Pit outlet structure	2.4	1.8

The rational method was also applied to secondary ditches to determine a 200-year flood flow, based on an approximate catchment area for each waste rock dump and the DSTSF. Due to the very small catchment areas for secondary ditches and the associated uncertainty in calculated values, flows were rounded to the upper round number and grouped into categories. Table 6-3 presents the design flows for the secondary and tertiary ditches.

Table 6-3 Design flows for secondary and tertiary ditches

		Design flow (m³/s)
	- DSTSF	3.0
Secondary ditches	- Main Overburden Dump - Southwest Dump (South section)	2.0
	- Southwest Dump (Middle and North sections) - South Overburden Dump - Main Waste Dump - Tailings Diversion Ditch	1.0
Tertiary ditches		0.5

6.8.3 Design criteria for ditch sizing

The sizing of drainage ditches was based on additional design criteria and assumptions. They are outlined below.

Flow Velocity

A maximum flow velocity was set for ditches to limit the size of rip rap required. A maximum D_{50} of 300 and 150 mm was selected for primary and secondary ditches, respectively. The following maximum flow velocities were targeted:

- Primary ditches: 3.5 m/s
- Secondary ditches: 2.5 m/s

Channel geometry

- Side slopes of all drainage ditches set at 2.5H:1V;
- A minimum channel slope of 0.5 % selected for all ditches;
- A target ratio of 2 selected as the maximum ratio of base width over maximum water depth. It is deemed to provide an optimal ratio for functionality and cost efficiency.

Freeboard allowance

- Freeboard allowance will provide ditches with an additional margin of safety for calculated flows that present uncertainty due to the small catchment areas and the lack of local data. The following values are selected.
- Primary ditches: 0.5 m
- Secondary ditches: 0.3 m

The above design criteria are assumed to be optimal and economical to minimize cut and fill volumes, to limit the size of channels and of riprap elements required for erosion protection and to provide an adequate safety margin to the hydraulic capacity of ditches. Further optimization studies would be required when the closure plan is implemented to determine the optimal channel size and alignments. Design criteria could also be revisited if necessary.

The details of the ditch design if presented in the following section.

6.8.4 Channel sizing

6.8.4.1 Primary ditches

Preliminary sizing of primary ditches has been done using the Manning's equation, using a trapezoidal cross-section. The natural ground longitudinal profile for each primary ditch alignment has been extracted from the most recent topography. The proposed alignments generally travel through slopes that vary between 0 and 10%, with a few exceptions where slopes as steep as 40% are observed. A Manning's roughness coefficient of 0.035 was selected as it applies to engineered channels with rockfill elements.

The design work involved a two-step process that is as follows:

1) The minimum channel slope leads to the largest water depth in the channel. The depth of each ditch is sized based on the minimum slope.

2) The maximum channel slope leads to the fastest velocities. The maximum channel slope was defined based on the maximum allowable velocity of 3.5 m/s that was selected as the design criteria. The Isbash equation was used to relate the flow velocity to the required rip rap size.

Table 6-4 presents the selected base widths, slopes and the required rip rap mean diameters (D_{50}) for each primary ditch. The minimum channel depth should be equal to the maximum flow depth with an additional 0.5 m of freeboard.

Table 6-4 Design parameters for primary ditches

Ditch	Design flow (m^3/s)	Base width (m)	Minimum slope (%)	Maximum slope (%)	Maximum flow depth (m)	Maximum flow velocity (m/s)	Maximum rip rap size – D_{50} (mm)	Steep slopes/stilling basin
100	3.5	1	0.8	1.5	0.8	1.9	100	No*
300	5.0	1.5	2	6.5	0.7	3.5	300	Yes (at outlet)
350	8.0	2	1	4.5	0.9	3.4	300	No*
400	6.6	1.5	1	5	1.0	3.4	300	Yes (MVF)
450	1.8	1	1	10	0.6	3.2	250	No

Ditch 100

Ditch 100 already exists on the Minto site and is known as the South Diversion Ditch. This ditch will be upgraded and consolidated as needed at closure, but will remain the same dimensions. The current ditch has an estimated total capacity of 13.3 m^3/s (SRK, 2013b) which is nearly 4 times the calculated 200-year design flow of 3.5 m^3/s. The ditch can be constructed on a slope between 0.8 and 1.5%, which easily follows the current topography with only grading required and no significant excavation or fill.

Ditch 100 empties into the Area 2 Pit through an overflow spillway. Such a spillway is already constructed and should only be consolidated if required at closure. The spillway will empty into Area 2 pit which will act as an energy dissipation basin.

Ditch 300

Ditch 300 will collect water from the northwest corner of the mine site, i.e. from the Reclamation Overburden Dump and the Main Waste Dump. It will connect with Ditch 350 which flows into the Main Pit. A minimum base width of 1.5 m is required to convey the 5 m^3/s design flow. The depth of the ditch should be at least 1.2 m (0.7 m maximum flow depth and a 0.5 m freeboard allowance). Such a cross-section can be constructed on a slope varying between 2 and 6.5% to safely convey the flow. A minimum D_{50} of 300 mm is required for the rip rap.

Ditch 300 will require a steeper section at its outlet to join ditch 350. Larger riprap or another means of protection will be required in this location. An energy dissipation basin will also be required at the junction of the two ditches, and will be designed at closure.

Ditch 350

Ditch 350 is the primary ditch with the highest design flow at 8 m^3/s. It will convey water from the western half of the mine site, where the waste rock dumps are located. It captures flow from the southwest corner of the mine site (Overburden Dump and Southwest Waste Rock Dump), and also intercepts flow coming from Ditch 300. A minimum base width of 2 m is required along with a minimum depth of 1.4 m (0.9 m maximum flow depth and 0.5 m freeboard allowance). Such a cross-section can be constructed on a slope varying between 1 and 4.5 %. A minimum D_{50} of 300 mm is required for the rip rap.

Ditch 350 will empty into Main Pit through an overflow spillway. Such a spillway will be designed and constructed at closure. Main Pit will act as an energy dissipation pond for the flow coming from Ditch 350.

Ditch 400

Ditch 400 will convey most of the surface water out of the mine site. It acts as the outflow from Main Pit which captures the flow from Ditch 350. It also captures the outflows from Area 2 Pit (through Ditch 450) and flows coming from its intermediate watershed downstream of the Main Pit. It will run adjacent to the main access road downstream from Main Pit, to the north of the Mill Valley Fill Extension (MVFE). It will then drop on the MVF east face to reach the bottom of the main valley that leads to the water storage pond at the downstream end of the mine site.

A minimum base width of 1.5 m and a minimum depth of 1.5 m (1.0 m flow depth and 0.5 m freeboard allowance) is required for Ditch 400. The longitudinal slope of the constructed ditch can vary between 1 and 5%. A minimum D_{50} of 300 mm is required for the rip rap.

Ditch 400 will require the construction of an intake structure at the outlet of Main Pit. The invert elevation of the intake structure should be at approximately elevation 785 m, and provide a smooth transition from the pit lake to the shallow fast flowing channel. The confluence with Ditch 450 will also require another structure to properly merge the flows. If possible, those two structures could be combined in a single larger energy dissipation and intake basin for ditch 400. A spillway will also need to be designed along the MVFE east slope. A stilling basin will be constructed at its toe to dissipate energy coming from the spillway. All of these structures will be designed at closure.

Ditch 450

Ditch 450 will convey the routed outflows from Area 2 Pit. Area 2 Pit will only receive inflows from Ditch 100, such that the design flow of Ditch 450 is of 1.8 m^3/s. Ditch 450 will connect with Ditch 400 after 300 m. A minimum base width of 1 m and a minimum depth of 1.1 m is required (0.6 m maximum flow depth and 0.5 m freeboard). Such a cross-section is adequate for a longitudinal slope varying between 1 and 10%. A minimum D_{50} of 250 mm is required for the rip rap.

Ditch 450 will require the construction of an intake structure at the outlet of the Area 2 Pit. The invert elevation of the intake structure should be at approximately elevation 802 m, and provide a smooth transition from the pit lake to the shallow fast flowing channel. It will empty into Ditch 400 in an energy dissipation basin. These structure will be designed in detail at closure.

6.8.4.2 Secondary ditches

Secondary ditches will flow on top of covers and convey water from high flat ground down on the steep faces towards the primary ditches. Their design includes two parts:

- a typical channel cross-section on mild slopes (less than 10%)
- a steep section down the waste rock dump and DSTSF faces, with a slope up to 65% (1.5H:1V)

Secondary ditches will be laid out as a single main channel on the top of covers, but will be required in certain locations to be divided into numerous smaller parallel channels to drop from the steep faces to the primary ditches. Smaller channels will allow a reduction in discharge and flow velocities in each channel, and thus reduce the importance of the erosion protection measures required. Stilling basins at the toe of the steep faces will be required to dissipate the energy of the flow coming from higher ground, before it enters the primary ditches.

A single minimal cross-section was developed for all secondary ditches to meet the design criteria and safely convey the 200-year flood at a minimum. This cross-section is applicable to the reaches of secondary ditches flowing on top of covers, or on mild slopes. Water conveyance for secondary ditches down steep slopes will be designed at closure (for costing purposes it has been assumed that steep portions will be reinforced with channel lining of concrete in a flexible geosynthetic layer).

Since three different design flows were determined for secondary ditches (1, 2 and 3 m^3/s, see Section 6.8.2), the maximum slope limitation varies for each secondary ditch. Table 6-5 presents the calculated values.

Table 6-5 Design parameters for secondary ditches

Ditch	Design flow (m^3/s)	Base width (m)	Minimum slope (%)	Maximum slope (%)	Maximum flow depth (m)	Maximum flow velocity (m/s)	Maximum rip rap size – D_{50} (mm)
Secondary ditches	1	1	0.5	9	0.5	2.5	150
	2	1	0.5	5	0.7	2.5	150
	3	1	0.5	3.5	0.8	2.5	150

A cross-section with a minimum base width of 1 m and a minimum depth of 1.1 m (0.8 m maximum flow depth for 3 m^3/s and 0.3 m freeboard allowance) will work properly for all reaches of secondary ditches within the define slopes. This design will be finalized at closure,

6.8.4.3 Proposed ditch cross-sections and profiles

Conceptual drawings have been prepared for each primary ditch.

The natural ground profile and a potential proposed longitudinal profile for each ditch that optimizes the cut and fill volumes is presented. The proposed longitudinal ditch profile is based on the range of slopes that

were defined above. The optimal profile should be determined at closure, based on the final topography along the proposed alignments.

The cross-sections for each primary ditch were determined based on the results presented in Table 6-3. Each cross-section was made 0.5 m wider than the calculated minimum based with to provide an additional safety margin against potential obstruction with debris or ice. The depth of all primary ditches was set at 1.5 m, which matches the largest minimum depth required for all primary ditches. Ditch 400 has a calculated maximum water depth of 1.0 m, which leads to a 1.5 m channel depth with the 0.5 m freeboard design criteria. The selected cross-sections are shown in the conceptual design drawings.

The following conceptual design drawings were produced as part of the RCP and are presented in Appendix F.

- Drawing No. 00: Site Plan
- Drawing No. 01: Ditch 300 – Plan and Profile
- Drawing No. 02: Ditch 350 – Plan and Profile
- Drawing No. 03: Ditch 400 – Plan and Profile
- Drawing No. 04: Ditch 450 – Plan and Profile

Various areas of optimization and conservatism could be studied for the proposed ditch alignment and profiles if required later in the closure phase. The main ones include:

1) **Ditch alignment**: ditch alignments could be modified to better accommodate the topography at closure. If in certain locations longitudinal slopes are too steep to properly manage the design flows, alignments could be routed over a longer path to provide for milder slope.
2) **Ditch cross-section**: cross-sections could be widened or deepened if it is anticipated that they could be partially blocked either due to debris, ice jams, sediment deposition or settlement of foundations. The current freeboard does provide primary ditches with up to double the hydraulic capacity of a given cross-section at the calculated water level.
3) **Geosynthetic liner**: in steeper reaches with high flow velocities, synthetic liners could be used to reduce the risk of erosion. Larger riprap is another option although it may prove to be less economically attractive.
4) **Longitudinal slope**: longitudinal slopes should be kept to a minimum to limit flow velocities and the risk of erosion. The calculated maximum allowable slope for each ditch could be reduced by increasing cut and fill volumes, or adding drop structures (and stilling basin at their toe to dissipate energy).
5) **Drop structures/spillways**: in steep reaches, drop structures and/or spillways could be added to the design to limit high flow velocity in short reaches and ensure energy dissipation in controlled locations (stilling basin).

6.8.5 Water Storage Pond and Dam

The location of the Water Storage Pond Dam relative to other site developments is shown in Figure 2-3. The water dam on Minto Creek provides water retention for mill processes and various site uses during operations and is considered to be the furthest downstream point for discharge control at the site. The original project proposal initially predicted that excess water would meet the Water Use Licence (WUL) effluent criteria and be discharged passively to Lower Minto Creek over the dam spillway. Operational

experience based on heavy precipitation and snowpack years has shown that a water treatment plant, as per the current site Water Management Plan, is required. The treatment plant was installed and operational during the second quarter of 2010 and will remain in operation until WUL criteria can be achieved.

The dam will remain in place until such time that the water quality at the site has stabilized relative to water quality objectives. In the interim it will act as a settling pond where turbid runoff waters will undergo retention, monitoring and treatment if required. Physical stability of the Water Storage Pond Dam will be ensured during post closure by regular geotechnical inspections.

Once the water quality in Minto Creek reaches the acceptable effluent criteria, water will be allowed to move into the creek over the dam spillway for the remainder of the open flow season. The dam would then be decommissioned with any sediment in the facility being excavated and hauled to a suitable waste rock dump for disposal.

As a final treatment measure, this area will then be converted into a constructed passive treatment system that will accommodate a design flow consistent with the available area in the vicinity. During certain peak flow events, an overflow system may be required that routes excess runoff below the CWTS to avoid overwhelming and/or destruction of the system. This would most likely follow the current alignment of the access road along the Water Storage Pond. The design and construction of this CWTS will be advised by the pilot CWTSs in the W15 vicinity. By the time this final CWTS is constructed, there will be many years of site-specific operational performance data with which to optimize the design of this and other site CWTSs.

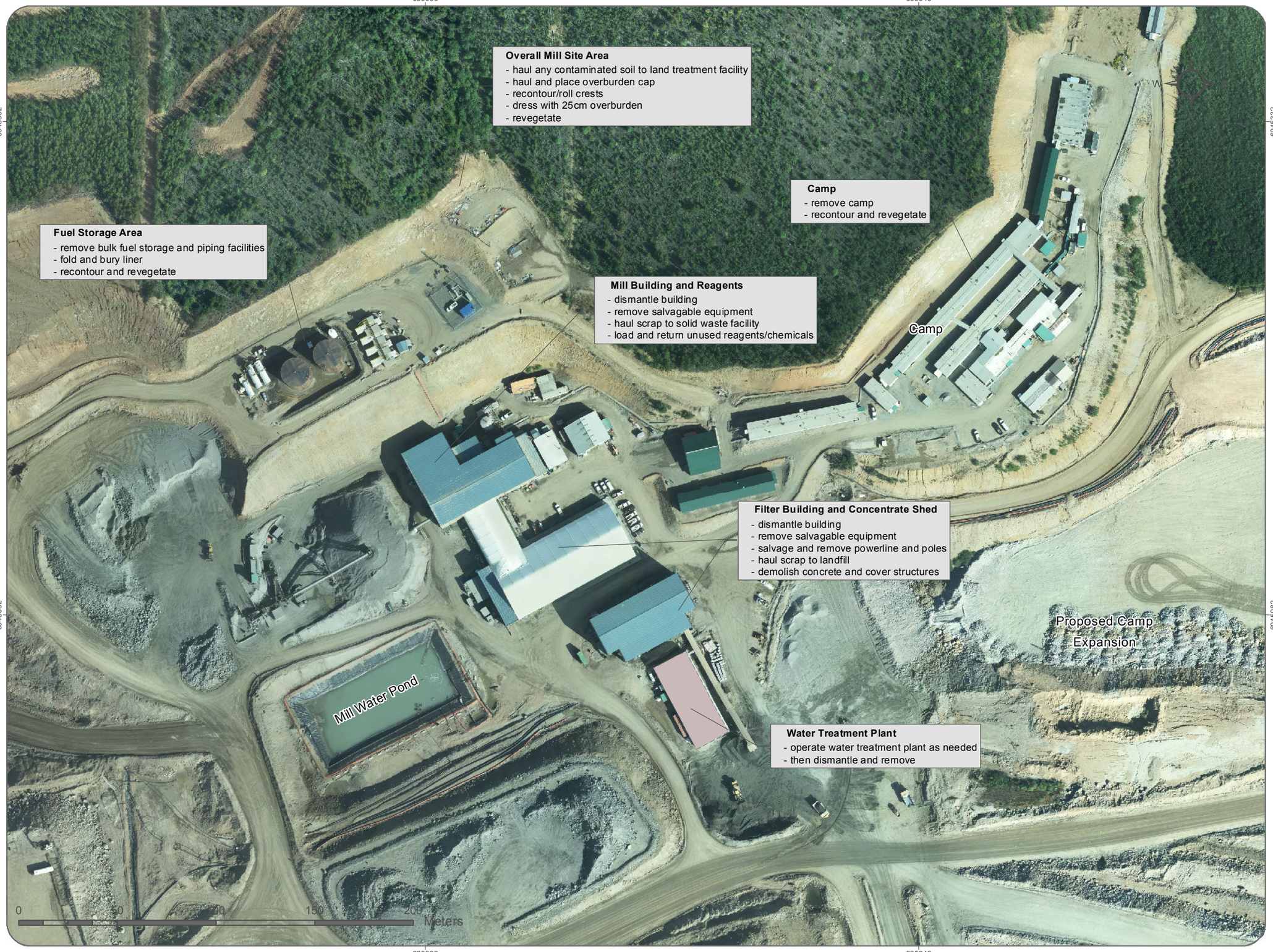
Drawing No. 05 in Appendix F shows the proposed dam removal layout.

6.9 MILL AND ANCILLARY FACILITIES

This section addresses the decommissioning measures for the mill and the ancillary facilities in the immediate vicinity that support the milling activities. The facilities addressed in this section include:

- Mill building;
- Generator building;
- Concentrate shed;
- Tailings filter building;
- Mill water pond;
- Mill reagents and chemicals; and
- Contractor's shop and work area.

Figure 6-5 shows details on the closure measures for these facilities.



capstone MINTO MINE

MINTO MINE PHASE IV

RECLAMATION AND CLOSURE PLAN REVISION 4.0

FIGURE 6-5

MILL AND ANCILLARY FACILITIES RECLAMATION MEASURES

SEPTEMBER 2013

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14 th 2012.

NAD 83 UTM Zone 8N

ACCESS

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. AccessMining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_6-5_Camps_Mill_&_Facilities.mxd
(<ita>Last edited by: mduchame;12/09/2013 16:08 PM</ita>)

Physical stability concerns for these structures at closure will be mitigated by their disassembly and removal from the site with the exception of the mill water pond which will require earthworks to mitigate physical stability issues. Environmental concerns for these areas will arise primarily from contamination of surrounding soils by fuel, chemicals or other wastes. Such instances will be documented through an environmental audit, conducted upon the completion of milling activities. Any contaminated soils identified will be remediated on site at the site's approved land treatment facility, and any recyclables and/or special wastes will be removed from the solid waste facility. Closure plans will be submitted to YG Environment prior to the final decommissioning of the land treatment facility and the solid waste facility.

A salvage program will be conducted towards the end of mine life to minimize the volume of scrap generated by the decommissioning of these facilities that will require in-situ disposal. It is expected that removal of these facilities, namely the camp and explosives plant site, will be done by auction or contractor for salvage value.

The reclaim line and all above ground power cables and overhead power line gear will be salvaged. Any buried services such as piping and wiring will remain buried. Concrete footings will be broken down to slightly below grade as required and covered with fill. Recontouring of areas will also be conducted as required in order to establish final drainage runoff patterns. Culverts will be removed and pertinent areas will be covered in approximately 0.5 metres (unless otherwise noted) of growth media prior to application of seed and fertilizer.

6.9.1 Mill Building

Closure measures for this reclamation unit will include the removal of salvageable mill components, such as the ball and SAG mills and other milling-related equipment within the structure. It is anticipated that the building and steel framework will also be salvageable and that there will be minimal materials requiring disposal onsite. Any recyclable materials will be shipped to an appropriate recycling facility and all wastes will be disposed of either in the site solid waste management facility or an approved offsite disposal facility.

The concrete foundations and building footprint will be reclaimed in the manner described at the start of this section. The toe slopes of the fill at both the mill and the campsite pads will be recontoured to assume a more rounded slope, limiting erosion as much as possible. The angle and subsequent stabilization/revegetation measures will be contingent upon reclamation research findings from variable slope trial plots.

6.9.2 Generator Buildings

The generator buildings will be removed from the site after the power hook-ups are disassembled. Site reclamation of the area occupied by the generator buildings will be conducted in the same manner described for the camp area.

6.9.3 Concentrate Shed

The concentrate shed will be dismantled and removed for sale or salvage at the end of mine life. The remaining concrete footings will be broken down to slightly below grade and covered in fill material.

Recontouring will also be conducted as required in order to establish final drainage runoff patterns and areas being reclaimed will be covered in 0.25 metres of growth media and revegetated using the approved reclamation seed mixture.

The southwest corner of the foundation may require complete removal to facilitate the excavation of the reclaimed drainage channel for Minto Creek in the vicinity of the mill water pond. This section of the foundation would be broken down and pushed into the interior of the remaining footings area, and all footings will be collapsed inward and buried with fill prior to surface reclamation.

6.9.4 Tailings Filter Building

The tailings filter building and associated tailings handling infrastructure (conveyors, etc.) will be dismantled and removed for sale or salvage at the end of mine life. Any recyclable materials will be shipped to an appropriate recycling facility and all wastes will be disposed of in an appropriate disposal area, either the site solid waste management facility or an approved off-site disposal facility.

Concrete footings will be broken down to slightly below grade and covered in fill material. Recontouring will also be conducted as required in order to establish final drainage runoff patterns and areas being reclaimed will be covered in 0.25 metres of growth media prior to application of seed and fertilizer.

6.9.5 Mill Water Pond

The mill water pond is a geosynthetic lined pond, constructed according to EBA's Final Preliminary Design – Mill Water Pond, Minto Property, Yukon Territory (EBA, 1997). Together, the mill water pond and the Water Storage Pond Dam contain enough water to make process water for milling activities, supplementing water from the pit dewatering wells and mill groundwater well.

The mill pond will be left in place as an interim holding area for water entering the water treatment plant during the initial closure period. Some clean-up of the mill pond may be necessary in order to prevent degradation of storm water entering the mill pond from the pit. Current water quality in the mill pond is within federal Metal Mine Effluent Regulations criteria but does not meet the WUL QZ96-006 effluent criteria for discharge.

The area of the mill pond will be evaluated to determine whether there is potential for construction of a passive treatment wetland to reduce the potential for water quality effects in the post-closure period. The requirement for the passive treatment wetland will be determined based on the results of reclamation research on source control to reduce metal loadings from site infrastructure. Progressive reclamation and post-closure monitoring of the DSTSF during Phase IV operations will also be used to help evaluate the need for a passive water treatment facility in this area.

6.9.6 Mill Reagents and Chemicals

Following the end of milling operations any unused mill reagent supplies will be returned to the supplier for credit. It is anticipated that all reagent product at the site will be properly contained/stored so that no

product will be considered as special waste. A closure inventory/investigation of reagents and hazardous materials on site will be conducted upon the cessation of milling activities. Should some product's containment be deemed suspect upon the closure inspection, that volume of materials will be added to an inventory of special wastes. As such, the material will be stored under Minto's Special Waste Permit # 43-040, and removed from the site for disposal in a permitted facility by a licenced contractor with other special wastes on site.

It is expected that the mine's inventory of hydrocarbon products will be consumed during the closure activities. Fuels and lubricants will be required during the implementation period of the closure plan following the end of milling activities. The inventory remaining on site once all activity has ceased will be removed from the site by one of three methods:

- returned to the original supplier for credit wherever possible;
- sold to a third party user; or
- trucked to an authorized disposal agency to be recycled or destroyed.

It should be noted that the operation of diesel powered vehicles and any electrical generators used on site will provide Minto with a method of reducing remaining inventory of diesel fuel as the mining operations cease. Gasoline will be similarly removed, and any remaining inventories of diesel and gasoline will be returned to suppliers or sold based on wide spread local use.

The propane supplier will remove the propane tanks. Associated propane delivery lines at the camp will be removed and disposed of in a manner similar to that of the gasoline and diesel fuels.

Other hydrocarbon products that are present at the mine site are primarily hydraulic fluids, lubricating oils, greases, antifreeze, and solvents packaged in either 1000 litre bulk containers, 205 litre drums or smaller packaging. In most cases the remaining inventory of these materials will be returned to the original suppliers for reuse or sold to other third party users in the local area. In certain circumstances, specialized products may have to be disposed of through a licenced waste disposal firm. It is anticipated that the volume of materials requiring disposal as special waste will be limited.

Any fuel storage areas and refueling stations, once decommissioned, will be assessed for hydrocarbon contamination of the underlying soils. A formal site assessment to identify hydrocarbon contaminated soils in other portions of the site will be conducted as part of the closure program and any soils identified by this assessment will be excavated and transported to Minto's permitted Land Treatment Facility (LTF).

It is anticipated that landfarming of soils in the LTF will be required for a period of several years following the completion of closure activities at the site.

6.9.7 Contractor's Shop and Work Area

The mining contractor's area, constructed on site adjacent to the toe of the MWD, serves as the base of operations for the mining contractor during active mining activities. At closure, the buildings in this area will be dismantled and removed, and any scrap will be recycled or hauled to the onsite permitted Solid Waste Facility.

Physical stability will not be a concern at closure for this area. This is a low elevation pad and will only require proper erosion control at closure. Environmental concerns for the contractor's shop and work area will arise primarily from contamination of surrounding soils by fuel, chemicals or other wastes. Such incidents will be documented through an environmental audit, conducted upon the completion of milling activities. Any contaminated soils identified will be remediated on site at the site's approved land treatment facility, and any recyclables and/or special wastes will be removed from the solid waste facility. Closure plans will be submitted to YG Environment prior to the final decommissioning of the land treatment facility and the solid waste facility.

6.10 MAIN ACCESS ROAD

The main access road to the property was constructed in 1996 and 1997. This road was constructed to facilitate 26-ton ore concentrate truck traffic. The road was constructed by cut and fill methods with a road width of 8 meters and associated ditch drainage and culvert installations. Figure 2-2 shows the alignment of the main access road. Minto expects that the determination of the extent to which the main access road is deactivated will be made in consultation primarily with SFN and secondarily with local trappers, the community, and government regulators. This closure plan recognizes three potential outcomes for road reclamation:

1. No road deactivation;
2. Road deactivation from Minto Creek to the mine site; or
3. Deactivation of the entire road.

In making a final decision about closing the main access road, consideration will also be given to the potential requirement for equipment access. Despite the identified closure timing and schedule, final access road removal (if selected) would only be undertaken once it is concluded that the site is stable and there is no need for heavy equipment access to the site.

The primary consideration for the physical stability of the main access road at closure will be slope stability where culverts have been removed and drainage channels have been established through the road alignments. Siltation of streams could occur during culvert removal and slope stability work. The road will be inspected during an environmental audit to take place at the end of mine life to identify any spills or contamination that was not addressed during operations. The results of the audit would be shared with and/or conducted by SFN Lands and Resources Department so that a scope of work for closure could be jointly developed.

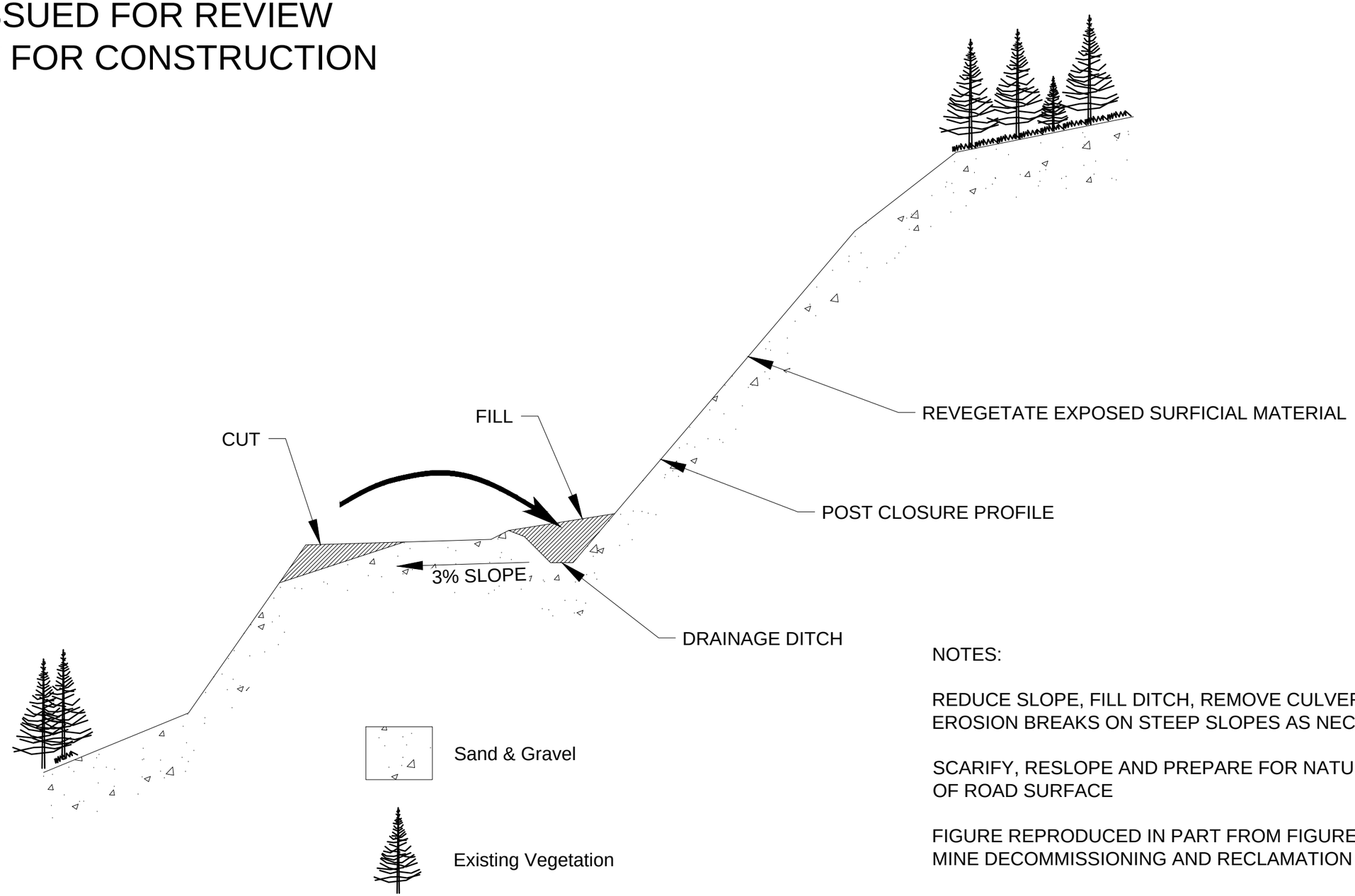
Should one of the two options involving deactivation of the road be chosen, then standard road decommissioning and reclamation measures at closure, including culvert excavation, drainage recontouring, slope stabilization and surface scarification will be applied.

Culvert removal work will be conducted in the late summer/early fall when flows are low or non-existent. Culvert removals and bank recontouring works at locations where there is still flow will include pump around or flow diversions to ensure that work is done in the dry and silt loads are not added to stream systems. Regrading/contouring the roads will ensure that runoff sheds off the road surface. The road surfaces are not expected to require seeding, only surface scarification to encourage natural revegetation.

The removal of culverts at stream crossings which are fish bearing is of primary concern. At these stream crossings, the roadbed would be cut down to the culvert and original streambed elevation with side slopes brought back to 2H:1V. Material removed during culvert removal will be spread loosely on adjacent road surface to promote revegetation. The stream channel would be stabilized as required and slopes revegetated. The Big Creek Bridge and all culverts will be removed once all heavy equipment has been removed from the mine and closure activities have been completed in the upper Minto Creek basin.

The disturbed footprint of the access road occupies only a portion of the cleared right-of way. Site experience shows that vegetation should re-establish itself in the 30 m wide right-of-way during the life of mine and only remedial revegetation work will likely be required. The preferred methodology is to encourage natural revegetation to occur, after first preparing the road surface by recontouring and scarifying. Temporary sediment management measures such as silt fencing will be installed as required in order to minimize sediment transport during establishment of a vegetative cover. Figure 6-6 shows the reclamation measures for the access road.

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION



NOTES:

REDUCE SLOPE, FILL DITCH, REMOVE CULVERTS AND INSTALL EROSION BREAKS ON STEEP SLOPES AS NECESSARY

SCARIFY, RESLOPE AND PREPARE FOR NATURAL REVEGETATION OF ROAD SURFACE

FIGURE REPRODUCED IN PART FROM FIGURE 6-21 OF MINTO MINE DECOMMISSIONING AND RECLAMATION PLAN ver. 3.2

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2013-09-13	ISSUED FOR REVIEW	00	KB	JT

ACCESS

capstone MINTO MINE

PROJECT NAME: Minto Mine Phase IV Reclamation and Closure Plan
Revision 4.0

TITLE: Haul Road and Site Road Typical Reclamation Cross-Section

DESIGNED BY:	ACCESS PROJECT NO:	CLIENT REF.:
EBA	MIN-11-01	
DRAWN BY: K. Boldt	SCALE: NOT TO SCALE	
CHECKED BY: J. Theriault	FIGURE: 6-6	REV.: 00

C:\Users\kboldt\Projects\Minto\CAD\Drawings\MIN-11-01-F6-6.dwg

6.11 MISCELLANEOUS SITES AND FACILITIES

This section addresses the decommissioning measures for miscellaneous facilities and sites around the property. These facilities include:

- Mine camp and related infrastructure;
- Airstrip;
- Exploration sites and trails;
- Land treatment facility;
- Solid waste facility
- Explosives plant site; and
- Site roads.

Figure 6-5 shows details on the closure measures for the camp area. Closure measures will focus on long term physical stability of these areas following closure and ensuring that any areas of contamination are identified and remediated in an appropriate manner. The physical stability of these structures/areas at closure will be mitigated for the most part by either:

- Disassembly and removal from the site; and/or
- Recontouring and revegetation of the area.

Environmental concerns for these areas will arise primarily from contamination of surrounding soils by fuel, chemicals or other wastes. Such incidents will be documented through an environmental audit, conducted upon the completion of milling activities. Any contaminated soils identified will be remediated on site at the site's approved land treatment facility, and any recyclables and/or special wastes will be removed from the solid waste facility. Closure plans will be submitted to YG Environment prior to the final decommissioning of the land treatment facility and the solid waste facility.

A salvage program will be conducted towards the end of mine life to minimize the volume of scrap that will require in-situ disposal. It is expected that removal of these facilities, namely the camp and explosives plant site, will be done by auction or contractor for salvage value.

Buried services such as piping and wiring will remain buried. Concrete footings will be broken down to slightly below grade, where required, and covered with fill. Recontouring of areas will also be conducted as required in order to establish final drainage runoff patterns. Culverts will be removed and pertinent areas will be covered in 0.25 metres of growth media prior to application of seed and fertilizer.

6.11.1 Mine Camp and Related Infrastructure

In 1999 Minto completed construction of a camp for mine staff that included living quarters for 42 persons – a seven-unit accommodation/kitchen/diner/change room complex. In 2006, the camp was expanded by the addition of trailers and other construction to provide capacity for 140 persons, including an office complex. The facility provides a potable water supply (drilled groundwater well, 1998), gas-fired heat, a local power supply, and sewage disposal to two adjacent septic fields. The septic system has now been converted to a packaged treatment plant, and the camp is being reconstructed again to allow for greater occupancy. Several structures behind the facility house the fuel supply to the furnaces, relay power from a diesel electrical generator, and pump fresh water.

Closure measures for the campsite include disassembly of the camp trailers and related infrastructure. All salvageable material will then be removed from the site. The remaining campsite landing will be scarified and recontoured, as required, to establish drainage patterns and then covered with 0.25 m of growth media and revegetated. Seed mixtures and fertilization specifications will be based on both revegetation trials and natural revegetation observations and success.

6.11.2 Airstrip

The airstrip area was noted to be subject to colonization by natural vegetation during a period of project inactivity from 1997 to 2005. Based on these observations, reclamation of the airstrip will focus on scarification of compacted surfaces. Natural revegetation will be allowed to occur in order to minimize the introduction of non-native species. Seeding of this reclamation unit is not deemed to be required as there is minimal erosion potential of the airstrip.

6.11.3 Exploration Sites and Trails

Current exploration activities being conducted on the site operate under a Class III Mining Land Use Authorization are subject to specific closure measures as identified in the Class III Authorization. These measures will be implemented as required by the exploration crew, and are not subject to closure planning in this plan.

6.11.4 Land Treatment Facility

The Minto land treatment facility (LTF) is located near the airstrip in an area originally excavated on bedrock for an equipment laydown area. This facility is permitted by YG, Department of Environment, Environmental Programs Branch under Permit #24-204 to treat a maximum volume of 700 m^3 of hydrocarbon contaminated soil. Contaminated soils from fuel/oil spills during operations will be treated in this facility to appropriate levels of remediation before being used as industrial fill as per permit requirements.

The closure of this facility is subject to the submission of a formal Closure Plan to YG, along with sampling results which demonstrate the final concentrations of contaminants in the soil being treated. It is expected that upon final closure of the entire site, dismantling and decommissioning activities may reveal or result in soil contamination requiring the relocation of contaminated soil to the LTF and an undetermined number of

months of treatment to achieve desired remediation levels. As such, the LTF Closure Plan and final sampling results will be prepared and submitted sometime after final closure of the mine site has begun.

Generally, once the desired contaminant levels have been reached in the final volumes of treated soil, and the Closure Plan has been approved by YG, the soils will be spread at approved locations at the site, recontoured in place and revegetated. If required, additional overburden may be hauled and used as cover material and growth media for revegetation.

6.11.5 Solid Waste Facility

Under Commercial Dump Permit # 81-005, issued to Minto Explorations Ltd. by YG, Department of Environment, Environmental Programs Branch, Minto has established a Solid Waste Facility adjacent to the Land Treatment Facility near the airport that includes:

- A burning pit for wood and paper waste;
- Construction waste disposal area;
- Metal and rubber tire disposal areas; and
- Incinerator ash disposal in old exploration trenches.

The solid waste facility will receive construction and operational waste throughout the operation of the mine, as permitted. At closure the area will be covered by fill and compacted in 'lifts' as per common landfill practice.

Scrap equipment will be stored in various lay down areas located on site and along the access road, including primarily scrapped equipment stored to be utilized on the mine site as a source of spare parts or good recyclable scrap material. Salvageable material from these sites will be sold as scrap and removed from the site at closure. Material that has no scrap value will be disposed of in the solid waste facility. Prior to disposal in the landfill, all of this material will be examined to ensure that all hazardous materials are removed.

Any hazardous materials identified in these areas will be removed and shipped off site to a licenced waste disposal site, along with other stored hazardous or special wastes, as permitted under Minto's Special Waste Permit # 43-040.

The submission of a formal Closure Plan to YG for the solid waste facility will be required at final closure. The formal closure plan will document the conditions and materials at final closure. Preceding the final reclamation of this facility, tires and salvageable scrap metal will be hauled off site for salvage/recycling. Once the closure plan is approved by YG, the facility will be covered by two compacted lifts of 200 mm thick compactable soil material obtained from local borrow sources. The cover material will be graded to prevent pooling of precipitation runoff and to encourage the shedding of water. The site will then be revegetated using a suitable seed mixture.

6.11.6 Explosives Plant Site

The ANFO explosives (ammonium nitrate – fuel oil) production area is comprised of the production plant and AN bag storage and powder magazine storage areas, located near the drainage boundary southwest of the mine site.

At closure, unused explosives that remain on site will be returned for credit and the explosives magazines and other equipment will be returned to the explosives supplier. The septic system at the site will be pumped of contents, broken down and backfilled. Fuel-contaminated soils will be excavated and hauled to the land treatment facility for remediation. Disturbed areas will be recontoured as required and covered with 0.25 m of overburden or growth media prior to application of seed and fertilizer. Seed mixtures and fertilization specifications will be based on both revegetation trials and natural revegetation observations and success.

6.12 MINE ROADS

All mine roads will be subject to standard road reclamation measures previously described in the haul roads and main access road sections of this report.

6.13 ADAPTIVE MANAGEMENT PLANNING

Minto is committed to an adaptive management plan (AMP) in the context of the Phase IV closure plan for the components which are deemed to have some uncertainty associated with their performance. These "uncertain" components were determined in part by the preliminary failure modes and effects analysis (FMEA) which was conducted in January 2013, with a focus on the closure and reclamation components of both Phases IV and V/VI. The preliminary FMEA analyzed site closure using a number of closure and reclamation mitigation options to determine the potential risks associated with these methods.

An AMP is an iterative process. This implies that an AMP is never complete in nature, but in a continuous state of refinement in response to feedback from monitoring, analysis of data, and changing conditions. The ideas presented within this document build on information gathered through the operations and environmental monitoring at Minto. Phase IV is part of a sequence of stages in the evolution of the life cycle of the Minto mine site. Until final closure, the project is anticipated to continue to evolve and change. The various components and activities related to the phases do not occur in isolation, and plans such as this AMP must be dynamic in order to effectively deal with change. As a result, any future developments that occur at the Minto mine site will necessitate updates to the AMP. Thus the AMP is considered a "living document". Subsequent iterations of the closure AMP will take these changes into account.

Since it is difficult to predict the specific environmental condition that may arise which requires a response from management, the AMP does not necessarily provide specific detailed descriptions of responses to a situation. The AMP provides a range of possible responses to use as a guide to respond to specific environmental conditions encountered. Management should use the information provided in the AMP and adapt the appropriate response from this guide.

The AMP aims to identify areas of uncertainty within the proposed Phase IV closure. This AMP, or subsequent iterations, will develop monitoring commitments, thresholds, triggers, and responses to underperforming elements or emerging risks within the Phase IV reclamation and closure process.

The primary objective of this AMP is to protect the quality of off-site water by isolating and controlling the on-site water, if necessary. A commitment to passive and active water treatment as a contingency is a major component of the Phase IV preliminary closure plan, and is also a significant response measure within the Phase IV AMP.

The approach presented in this AMP follows the Environmental Code of Practice for Metal Mines from Environment Canada. The preliminary AMP framework can be found in Appendix D.

The Minto project is subject to a number of operational monitoring programs, including but not limited to:

- Water Quality Surveillance for site and receiving waters;
- Physical Stability Monitoring of various site structures;
- ABA Testing;
- Water Monitoring;
- Tailings Stability Monitoring; and
- Geotechnical Inspections.

Data from these programs has been and will continue to be collected under these programs during the closure period with similar requirements to those in effect during the operational life of the mine. Section 7.0 of this report proposes the continuation (and progressive scaling back) of the majority of these monitoring initiatives during the period of active reclamation and through the post-closure period when there is minimal site presence.

The closure measures in the previous sections have been developed and proposed based on the most up to date information collected at the site, and on the best interpretations of this data, with respect to the projected conditions on site at final closure. Changes to the RCP will be required as conditions continue to change as the site progresses through operations and closure. The periodic revisions to this Plan as per the QML schedule will address these changing conditions moving through operations, but as closure activities progress and monitoring on the site continues, planning mechanisms that can account for and react to changes to the expected conditions governing the closure measures need to be in place.

Adaptive management planning (AMP) is a recognized and effective way to ensure that changing conditions during closure are not subject to static reclamation initiatives, and that closure programs can be adapted to these conditions to achieve desired performance. Minto is committed to AMP in the context of closure of some of the higher risk features on the site.

The Adaptive Management Plan will be refined over the remaining operational life of the mine with the goal of having them finalized for implementation at closure. They are modeled on accepted AMP features, such as performance monitoring programs, threshold levels for data from the monitoring programs and associated triggers for action items, and response actions for expanding or refining the monitoring initiatives, implementing extended closure measures, and/or conducting further studies to develop mitigation measures for conditions that are divergent from those expected.

7 POST-CLOSURE SITE MANAGEMENT

The closure phase of the Minto mine will commence with the cessation of economic mining of the open pit and the milling of ores and stockpiles. Once all mineable ore reserves have been processed, the mill and concentrator will be flushed and the tailings management facility (TMF) will be decommissioned. During the active decommissioning phase which is expected to last approximately 3 years, the number of personnel required will vary depending on site activities; however it is expected that as major decommissioning and reclamation tasks are completed the number of site personnel required will decline.

It is expected that a Water Use Licence or amendment will be required for the decommissioning phase of the operation as water use will continue on a limited basis and wastewater will be released from the WSPD in a controlled fashion, either treated or passively depending on the monitoring results. Decommissioning of the Big Creek Bridge along the main access road will be subject to community consultation and this activity may also require a Water Use Licence. The continued need for a Water Use Licence following the decommissioning phase will be dependent on site conditions, performance of closure measures in achieving stated objectives and legislated requirements. Post-closure management and monitoring of the site will be guided to some extent by the Water Use Licence, quartz mining licence or other permit requirements, the performance of physical structures remaining on site and the ability of achieving and demonstrating long term compliance with existing waste discharge standards.

Once overall closure performance has been demonstrated for all aspects of decommissioning, the necessity of maintaining licences or permits will be re-examined. At that point a Certificate of Closure, under the Quartz Mining Act would be requested. The following section provides a general outline of the site management approach that will be taken at the Minto mine during the closure phase.

7.1 ORGANIZATION, SITE ACCESS & SECURITY

A number of personnel will be required on site to implement the various decommissioning and closure tasks. Generally these tasks entail closure of mine workings, regrading of waste rock and overburden piles, decommissioning of the TMF, removal of the Water Storage Pond Dam, salvage and removal of infrastructure, equipment and reagents, decommissioning of access roads and reclamation and revegetation of disturbed lands. These activities would be undertaken on a seasonal basis and directed by an onsite manager responsible for decommissioning and reclamation of the Minto mine.

During site decommissioning, it is anticipated that at least a portion of the existing camp accommodations would remain on site to support site personnel. It is anticipated that during the initial post-closure phase, site security requirements will continue with a caretaker remaining on site following seasonal closure of the site. A site inspection schedule will continue for the period of closure implementation (3 years) and then move into a post-closure monitoring period (12 years) for a total of 15 years. Security personnel will no longer be required once decommissioning and reclamation activities are completed on the property. Once the majority of physical reclamation works are performed on the site, the number of employees or contractors required will be reduced. Minto is committed to having SFN members employed during implementation of the RCP and will continue to work with SFN to optimize long term closure monitoring requirements.

The main access road, barge landings and property security gate will be maintained during implementation of the post-closure phase. Site access along the main road, barge support and Big Creek Bridge will be required

for personnel and truck haulage requirements to and from the site. The security gate and fencing will be maintained while the main access road is in use. Decommissioning and reclamation of various haul and site access roads will be completed once closure measures have been completed at each facility and site access is no longer required.

Once decommissioning activities are completed onsite, and following a period of post-closure monitoring, a determination will be made about whether to permanently close the main site access road. This decision will be made in conjunction with SFN as the access road lays within SFN Category "A" settlement lands. Closure of the main access road is expected to be consistent with the RCP's closure philosophy; however, it is recognized that the performance of physical reclamation of the site must be assured before a final determination of the main access road closure is made. Government regulators and the local trapper will also be consulted regarding decommissioning plans for the road.

7.2 SUPERVISION AND DOCUMENTATION OF WORK

All decommissioning and reclamation works shall be supervised to ensure that works are constructed according to their design and that the work is properly carried out and documented. The project manager or the construction supervisor will be responsible for supervising all closure works. Daily inspection procedures would be completed to document work progress, deficiencies and completion. Existing plans for spill response or other site internal procedures for fuel handling, waste disposal, fire control and suppression, health and safety and environmental management systems would be used, developed and followed as necessary.

Environmental inspections and tests conducted prior to the implementation of closure measures would be used to confirm areas requiring clean up.

For the WRD and TMF, plans for all earth works and inspections would be prepared and submitted to the YWB and EMR for review prior to construction. These plans would be submitted in a timely manner to facilitate agency review and Board approval prior to implementation. A competent engineer following standard quality control and assurance procedures would inspect and document this construction work. As-built plans and drawings would be completed and the results of the closure work completed on the removed water dam and tailings management facility documented in a final RCP report. This report would then be submitted to the YWB and regulatory agencies upon completion of closure activities.

A competent environmental practitioner following standard quality control and assurance procedures would design, direct and document the following restoration work. For the Big Creek Bridge removal and Minto Creek culverts, plans for all restorative works would be prepared and submitted to the YWB prior to decommissioning. A summary report of the works would then be prepared and submitted to the YWB and regulatory agencies upon completion of closure activities.

Upon completion of the decommissioning and reclamation works, a final site plan report (summary text and drawings) would be prepared to outline the facilities or works remaining on the site following closure. This plan would identify the location of buried concrete structures or scrap and landfill disposal areas. It is expected that this plan would accompany an Application for a Certificate of Closure under the *Yukon Quartz Mining Act*.

7.3 MINE RECORDS

As noted in the previous section, all decommissioning and reclamation works would be documented. Active Mining period records showing the extent of open pit workings would be retained by Minto. Other site records, files and plans would also be archived at the site. Where plans or drawings are required for mine safety reasons, these plans would also be submitted to government mine safety offices. As-built reports for structures completed for closure and the final site closure report would be retained for record by Minto and submitted to government agencies and boards.

7.4 COMPLIANCE MONITORING AND REPORTING

Environmental compliance monitoring, internal monitoring of earthworks and independent geotechnical inspections are presently ongoing at the property. The environmental monitoring at the Minto mine employs several types of scheduled periodic inspections to ensure that the facility is meeting environmental performance objectives and complying with appropriate regulatory standards. These inspections entail:

- Scheduled inspections of the waste rock and overburden storage areas, tailings management facility, water retaining structures and mine components to monitor environmental performance;
- Scheduled water quality sampling and flow measurements of effluent streams and local receiving water streams;
- Scheduled receiving water programs for benthic invertebrates, stream sediments and fish to monitor downstream environmental quality;
- Scheduled piezometric monitoring of water levels in wells and the spillway structure at the Main Water Pond Dam (if still in place);
- Monitoring of other instrumentation installed in the DSTSF as per the Tailings Management Plan (thermistors, survey hubs, etc.);
- Annual inspections of the TMF by a qualified geotechnical engineer, diversion channel, waste rock and overburden storage areas, and Main Water Pond Dam for structural stability; and
- Scheduled environmental tours and audits of the property by Minto staff to look for environmental hazards and site stability. Minto will endeavour to invite various Government agencies' representatives as part of the environmental inspections.

At present, site personnel undertake the scheduled environmental monitoring and inspection programs with the exception of annual geotechnical inspections and the benthic invertebrates, stream sediment and fish monitoring programs, which are conducted by qualified professionals. All results are reported to the YWB, and YG EMR as monthly or annual reports.

During the active closure phase environmental and physical compliance monitoring and inspections will continue as required by the present Water Use Licence or Quartz Mining Licence monitoring programs utilizing site-based personnel. It is expected that the amount of environmental and physical monitoring and

inspection (frequency and quantity) will decline once all closure measures are implemented. The approach to closure monitoring will be to continue with the present licence monitoring and inspection programs until decommissioning and reclamation measures have been completed and then reduce the frequency of site monitoring and the number of monitoring stations over time as satisfactory closure performance is confirmed. Revisions to the current Water Use Licence requirements will be required upon closure to authorize the proposed monitoring programs.

The schedule for monitoring programs planned for the 15-year period immediately following cessation of active mining and milling operations are presented in Table 7-1. For the first 5 years following the cessation of mining, routine environmental monitoring will be completed to demonstrate the effectiveness of closure measures and their performance. Year 6 to 10 monitoring frequencies would be reduced to periodic inspections, with a further reduction of frequency for years 11 to 15. The purpose of these periodic inspections would be to ensure that waste discharges remain compliant, downstream receiving waters meet current Canadian Council of Ministers' of the Environment (CCME) Guidelines for the Protection of Freshwater Aquatic Life, and physical structures are performing as designed. Should these inspections identify issues of concern, then plans would be developed to address the concerns.

Based on the results of site monitoring for the 15-year post-closure monitoring period and discussion with the SFN and the appropriate regulators the need for and the frequency of additional site monitoring will be determined. If the results from monitoring indicate that the site is stable with acceptable geotechnical and environmental performance, then Minto would propose to decrease the frequency of monitoring further. If the results from monitoring indicate there are concerns with either geotechnical conditions or environmental issues, then the site would continue to require more frequent monitoring than otherwise proposed and possibly additional remedial work would be proposed.

As previously mentioned, Minto is interested in having the SFN participate actively in both the closure activities and in post-closure monitoring. Minto will work directly with SFN in this regard.

Environmental monitoring and inspections conducted during the post-closure period (years 4-15 after cessation of mining) will be undertaken by periodic visits to the site. Access to the property for post-closure monitoring would be via ATV, snowmobile, and/or helicopter if the road is decommissioned.

Table 7-1 Post-Closure Monitoring Program

		UTM LOCATION (m) ZONE 8		YEAR 1-5 FREQUENCY						YEAR 6-10 FREQUENCY					YEAR 11-15 FREQUENCY				
SITE	**DESCRIPTION**	**Easting**	**Northing**	**Surface Water**	**Ground water**	**Sediment**	**Benthos**	**Flows**	**Other**	**Surface Water**	**Ground water**	**Sediment**	**Benthos**	**Other**	**Surface Water**	**Ground water**	**Sediment**	**Benthos**	**Other**
	Receving Water Stations																		
W-2	Mainstem Minto Creek directly u/s Access Road Crossing	392616	6948477	W		A	BA	DCR, W		Q		BA	BA		A		A	BA	
W-3	Mainstem Minto Creek 50 m d/s toe of Dam (Final Point of Discharge)	386747	6945682	W		A	BA	DCR, W		M		BA	BA		Q		A	BA	
W-6	Tributary to Minto Creek	387544	6946420	Q		A	BA	Q		Q		BA	BA		A		A	BA	
W-7	Tributary to Minto Creek	387504	6946069	Q		A	BA	W		Q		BA	BA		A		A	BA	
W-10	Mainstem Minto Creek (south fork at headwaters)	383348	6943654	M				M		Q					A				
	Mine Site Stations																		
W-12	Discharge from Open Pit	384819	6944991	M						SA					A				
W-15	Minto Creek, downstream of the SWD	384286	6944754	M						SA					A				
W-16	Main Water Storage Pond Discharge (or Main Water Storage Pond if not discharging)	386538	6945573	W*							NLA					NLA			
W-17	Main Water Storage Pond Dam Seepage	386615	6945645	M*							NLA					NLA			
W-37	Seepage from toe of MVFE			M						SA					A				
W-8	Alternate Tailings Area Seepage/Runoff	385620	6945067	M						SA					A				
W-8A	Tailings Seepage/Runoff	385707	6945071	M						SA					A				
	Physical Inspection Elements																		
	Water Dam	-	-						A*					NLA					NLA
	DSTSF and MFFE	-	-						A					A					A
	Diversion Ditches	-	-						A					A					A
	Waste Rock Dumps	-	-						A					A					A
	Ice-Rich Overburden Dump	-	-						A					A					A
	Environmental Inspection Elements																		
	Revegetation Inspection	-	-						A					A					A
	Wildlife Use Survey	-	-						A					A					A

*** Unless structure has been decommissioned/reclaimed**

Frequency Description

W	Weekly
W2	Every 2 Weeks
M	Monthly
Q	Quarterly
SA	Semi-annually
A	Annually
BA	Bi-annually
NLA	No longer active
DCR	Daily Continuous Record during open season

During the post-closure period, reporting on all environmental and inspection programs carried out on the property will continue. These reports will be filed with the YWB, and EMR in accordance with conditions contained in the Water Use Licence, Quartz Mining Licence and other operating permits and approvals as they are.

Company personnel responsible for the management of the Minto mine would continue to meet with regulatory agencies, SFN, and the community (Pelly Crossing) on an as-needed basis to keep interested parties appraised of decommissioning activities and the results of post-closure monitoring.

It is expected that a review of the environmental performance of the mine following closure would be made with EMR and other interested parties. Once this review is completed, Minto would apply to the Minister of EMR for a Certificate of Closure for the Minto mine under the Yukon Quartz Mining Act Mine Production Regulations. The Certificate of Closure will confirm that Minto has fulfilled its closure obligations for the site.

7.5 LONG TERM MAINTENANCE

Provisions for maintenance of reclamation tasks such as erosion control and maintenance seeding have been included as part of the long-term closure requirements. Based on physical inspections and monitoring, maintenance works will be planned for and conducted as required to meet closure performance standards and objectives.

7.6 TEMPORARY CLOSURE

Temporary closure is defined in both the Quartz Mining License QML-0001 and the Water Use License QZ96-006 as the status of the project if no ore is processed through the mill for six consecutive months following start-up.

Minto's priority during any temporary closure scenario is to ensure that the site remain geochemically and physically stable, and monitored in compliance with applicable licenses and legislation. Generally, this will include both initial stabilization and then ongoing routine monitoring and maintenance of the site infrastructure and facilities. The current Water Use Licence QZ96-006 contains a temporary closure monitoring schedule (Part H – Interim Closure) that forms the basis for the proposed temporary closure monitoring plan. It has been augmented to include planning for project elements that were not in place and therefore not subject to the interim closure period monitoring, such as the mill, WSPD, water treatment plant, mill water pond, waste dumps, tailings storage area, and the explosives storage facility.

Table 7-2 provides a summary of the various project components and the inspection and maintenance activities for use during any temporary cessation of mining activities.

Table 7-2. Summary of Care and Maintenance Activities and Surveillance Program during Temporary Cessation of Mining Operations

Project Component		Area of Interest	Care/Maintenance Activities	Monitoring Activities	Monitoring Responsibility	Monitoring Timing/Frequency
Open Pits		Water Management/Treatment Physical Stability	Maintain creek diversions around pits Treat excess pit water and transfer to WSP if required Restrict access to hazardous areas with physical barriers	WUL Physical Monitoring Program	Caretaker	As per WUL
				Water Quality Monitoring for Treatment	Water Treatment Technician	As required
				Geotechnical Inspection of Creek diversion	Engineer	Annual
Ore Stockpiles	**High Grade**	Physical Stability	Reduce High Grade Stockpile Inventory	n/a	n/a	n/a
		Geochemical Stability	Monitor for seepage	WUL Water Quality Surveillance Program	Caretaker	As per WUL
	Low Grade	Physical Stability	Monitor for stability	WUL Physical Monitoring Program and Annual Geotechnical Inspection	Caretaker	As per WUL
		Geochemical Stability	Monitor for seepage	WUL Water Quality Surveillance Program	Caretaker	As per WUL
Waste Rock and Overburden Dumps		Physical stability	Runoff/Erosion/Sediment control, as required.	WUL Physical Monitoring Program	Caretaker	As per WUL
				Geotechnical Inspection	Engineer	Annual
		Geochemical Stability	Monitor for seepage	WUL Water Quality Surveillance Program	Caretaker	As per WUL
Dry Stack Tailings Storage Facility		Physical stability	Surface water diversion structure repair/maintenance, as required Runoff/Erosion/Sediment control, as required. Stability Monitoring as required	Visual inspection elements of Monitoring Program from Tailings Management Plan (TMP) WUL Physical Monitoring Program	Caretaker	As per TMP
				Geotechnical Inspection from WUL and TMP	Engineer	Annual
		Geochemical Stability	Monitor for seepage and water quality	WUL Water Quality Surveillance Program and TMP Monitoring Elements	Caretaker	As per WUL
Mill and Camp Site		Buildings, Equipment, and Infrastructure Physical Stability	Concentrate removed from site Secure buildings and maintain necessary equipment onsite for resumption of milling Inspect for site stability	Visual inspection periodically for signs of instability	Caretaker	Monthly
				Structural Inspection	Engineer	Twice Annually
		Mill Pond Physical Stability	Maintain pond liner, repair as required. Maintain culverts.	WUL Physical Monitoring Program	Caretaker	As per WUL
Water Storage Pond Dam		Water Management Physical stability	Maintain spillway and structure as required based on geotechnical inspections. Monitor pond levels and water quality. Maintain spring/early summer pumping drawdown equipment.	WUL Physical Monitoring Program	Caretaker	As per WUL
				Geotechnical Inspection	Engineer	Annual
		Geochemical Stability	Monitor for seepage water quality	WUL Water Quality Surveillance Program	Caretaker	As per WUL
Explosives Facility		Physical stability	Remove bulk explosives from site. As required, repair and replace infrastructure	Visual inspection periodically for signs of instability.	Caretaker	Monthly
Barge Landing		Access to Yukon River	As required, granular upgrade to landing site.	Visual inspection periodically for signs of instability.	Caretaker	Weekly
Access Road and Surface Drainage		Entire Route	As required, surface grading and granular amendments, ditch and culvert maintenance.	Visual inspection periodically for signs of instability/erosion	Caretaker	Weekly and after heavy precipitation events
Entire Site		Physical stability	Runoff/Erosion/Sediment control, as required. Road/culvert maintenance as required.	WUL Physical Monitoring Program	Caretaker	As per WUL
				Geotechnical Inspection	Engineer	Annual
		Water Quality/Management	Retain Water Treatment Plant and Operators Maintain storm water diversion systems Continue seasonal water treatment as required for excess pit and site water	Undertake expanded temporary closure monitoring and submit to the YWB pursuant to Water Use Licence QZ96-006 (see Tables 7-4 and 7-5 for expanded monitoring program sites and schedule.) Continue required monitoring under Metal Mining Effluent Regulations (MMER)	Caretaker	As per WUL and MMER
		Security	Full time site caretaker will check, repair and replace as required: • precautionary signage • security gate – installed on Access Road at Main Dam	Site Inspection and Security Monitoring of all infrastructure and site elements	Caretaker	Daily: Inspection Sheets included in Annual Reporting
		Miscellaneous Infrastructure	Shut down and winterize camp, except for caretaker facilities Inspect power line	Site Inspection and Security Monitoring of all infrastructure and site elements – report any changes to stability/condition of miscellaneous infrastructure.	Caretaker	Daily: Inspection Sheets included in Annual Reporting
		Reporting	Prepare and submit annual report to the Yukon Water Board pursuant to Water Use Licence QZ96-006, including details of temporary closure activities and monitoring. Prepare and submit annual report to YG Mineral Resources Branch pursuant to the Quartz Mining License QML-0001, including details of temporary closure activities and monitoring. Prepare and submit quarterly monitoring reports to Environment Canada under MMER.		Minto Explorations Ltd.	Annually, by July 30 Quarterly, Online RISS Registry

7.6.1 Physical Stability and Geochemical Stability

Stabilization of site works during any temporary closure will be based on a continuation of efforts during operations to ensure construction and performance of facilities in accordance with their engineered designs. At this stage in the mine's life, many operational monitoring and research programs are underway to better understand the site and achieve physical and geochemical stabilization through such measures as:

- Resloping and crest rolling to reduce slope angles on the waste dumps;
- Grading and contouring to direct surface water away from steeper slopes to reduce erosional impacts;
- Planting live willows in appropriate places throughout the site to help control erosion and reduce sediment in surface runoff water;
- Covering potentially unstable areas with overburden and revegetating to establish a stable cover, again reducing erosional impacts; and
- Augmenting revegetation efforts with bioengineering (planting of live cuttings/seedlings) efforts.

Site infrastructure, including buildings and process machinery, will be emptied/drained of hazardous reagents and process fluids where appropriate and stabilized for temporary closure based on recommendations from mechanical and chemical suppliers, contractors and engineers. This includes the removal of all hazardous wastes, including waste hydrocarbons, coolants, lubricants, mill reagents, and process chemicals. The bulk explosives inventory will be removed from site and explosives storage containers and facilities will be inspected regularly.

The significant exception to these activities will be water management and treatment infrastructure and reagents, which will remain in place and operational as required to maintain effluent quality compliance during any temporary closure. Water management and treatment activities will be continued in accordance with the existing Water Management Plan (MintoEx, 2009).

Temporary decommissioning of the rest of the infrastructure will only be conducted to a level whereby the infrastructure and systems are ensured to be stable in the short term (3 years) and such that mining and milling operations can be resumed in a timely manner should the decision be made to emerge from temporary closure to transition back into operations. The temporary decommissioning measures will include the following:

- The retention of essential equipment/assets onsite to maintain infrastructure; and
- The storage of reagents and other hazardous materials (not waste) in competent primary and secondary containment, to ensure compliance with applicable legislation.

7.6.2 Security and Monitoring

Uncontrolled access to the mine site could pose a risk to the public and to the site assets. As such, a full-time caretaker/monitor (at least 2 individuals trained for cross-shift) will be housed onsite in a serviced portion of the existing camp. Site equipment (grader/loader) and vehicles will be kept onsite for caretaker use in care and maintenance activities. Contingency equipment will also be kept onsite should more intensive earthworks be required during the temporary closure period.

A security gate shall be installed on the main access road adjacent to site in the event of the site being placed in temporary closure. This is a steep cut and fill location that will prohibit vehicle access around the gate. Snowmobile/ATV access cannot always be controlled, but warning signs will be erected indicating the risk of entry to the site at the main gate and at key locations around the site. Site buildings will be locked and secured.

The main access road will be maintained for caretaker and emergency access with equipment retained on site. Previous periods of inactivity at the site have shown that the access road remains relatively stable and allows access to site with little maintenance requirements. In winter, contractors will establish the ice road across the Yukon River at Minto Landing. In the summer the barge will be used only on an as needed basis during temporary closure, with a smaller boat being used when required for ferrying caretakers. Caretakers will remain at the site during periods when the ice bridge is not accessible.

The caretaker(s) will be responsible for:

- Regular inspections (Table 7.2) of the site to observe and document the condition of and note any changes in site security and public safety measures, infrastructure, mine works, etc., and to document any newly emerging environmental or public health and safety issues.
- Conducting routine physical monitoring activities;
- Regular water quality and flow monitoring and treatment if necessary (a skilled operator may be necessary to operate water treatment plant);
- Submitting of inspection and monitoring reports to managers on a regular basis;
- Responding to any security/safety issues as required; and
- Conducting routine site maintenance and basic repairs to infrastructure and works as required (snow removal, culvert and road maintenance, building maintenance).

Site inspections and monitoring will be conducted by vehicle when seasonally possible. During winter, some sites may only be accessible by snowmobile as snow removal will not be reasonable at all locations. Inspection results will be documented in an approved format. Any reports of changes in the physical status of any part of the site may warrant a follow-up investigation by managers and/or professional personnel.

Minto's Water Use Licence contains a comprehensive Physical Monitoring Program which the licensee must conduct and report upon on a regular basis. This program includes regular visual inspections (Table 7.2) of the following structures at different frequencies, varying from daily to annually:

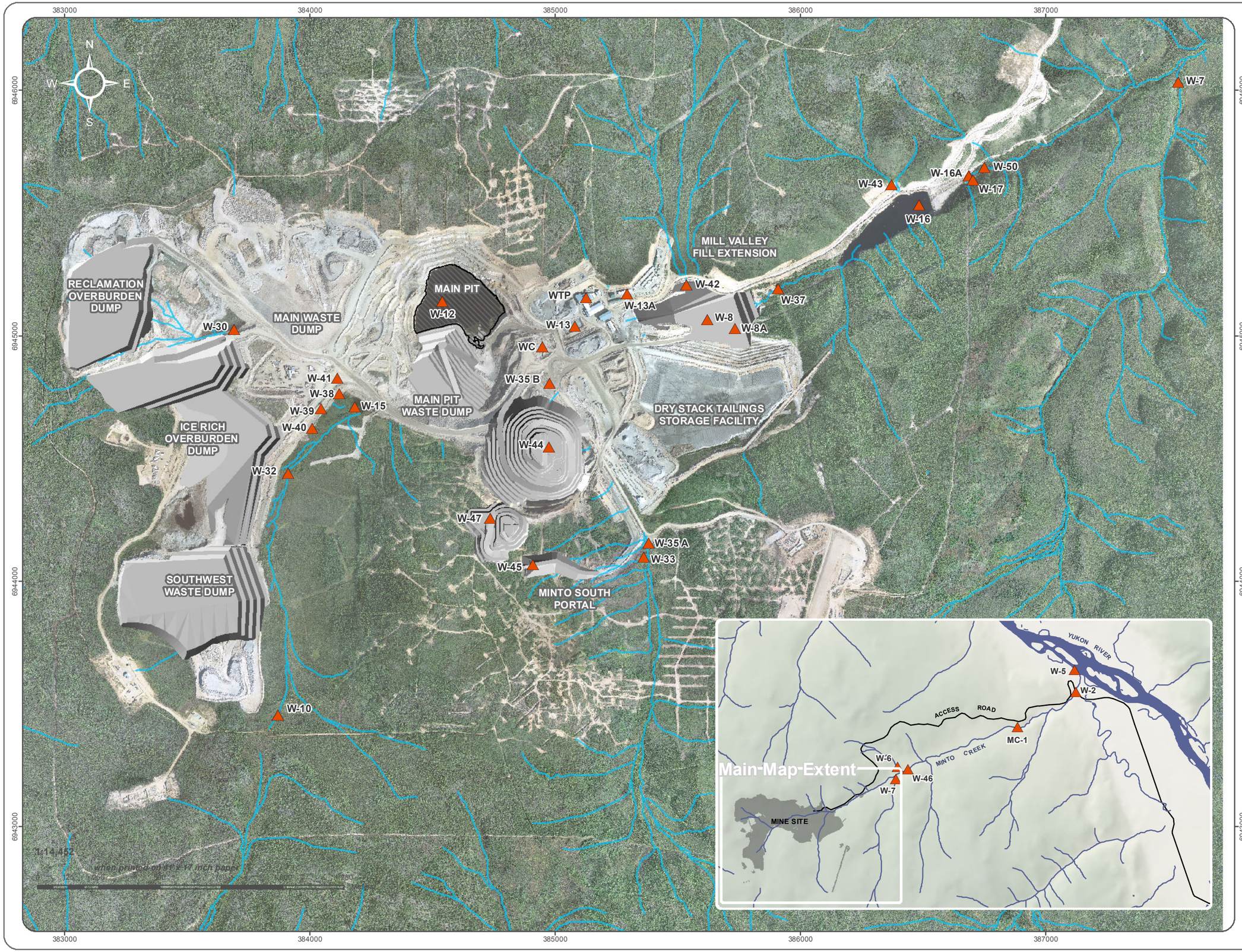
- Water Storage Pond Dam;
- Mill Water Pond;
- Waste Rock and Overburden Dumps; and
- Diversion Ditching.

In addition, Minto's Environmental Monitoring Plan further commits to structural monitoring of the elements listed above. These programs will continue in the event of any temporary closure, with results to be included in annual reporting under the water license.

Should temporary closure occur prior to the reclamation of the dry stack tailings facility then the monitoring program for the physical stability of the tailings pile as presented in Minto's Tailings Management Plan will be followed. Without ongoing tailings placement, the visual inspection elements of the stack stability monitoring will be conducted by the site caretaker, with any stability-related issues reported to the engineer immediately.

Some elements of the monitoring program (geotechnical and structural inspections and non-routine water quality and biological monitoring) will be conducted by appropriate professional personnel, and results of these inspections will be included in the annual reports and other required submissions.

Monitoring stations for the water quality surveillance program during any temporary closure are the same as those required during operations, as shown in Figure 7-1.



capstone
MINTO MINE

MINTO MINE PHASE IV

RECLAMATION AND CLOSURE PLAN REVISION 4.0

FIGURE 7-1

WATER QUALITY MONITORING STATIONS LOCATIONS

SEPTEMBER 2013

Surface Water Quality Monitoring Station

Watercourse

ACCESS

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14 th 2012.
Site contours derived from 2012 aerial imagery obtained from Challenger Geomatics.

Hydrology data provided by Minto Explorations Ltd, May 2009.

Datum: NAD 83 Projection: UTM Zone 8N

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_7-1_WQ_Stns_Loc_20130909.mxd
(*Last edited by: mducharme;13/09/2013/14:28 PM*)

7.6.3 Reporting

All monitoring and inspection data collected during a temporary site closure will be compiled and submitted according to the required annual reporting timeframes for both the Water Use Licence and the Quartz Mining Licence.

8 CLOSURE COSTS

Cost estimation for implementation of the proposed closure measures is the basis for establishing the financial security that will be required on the project. The Phase IV closure cost estimate has been prepared in accordance with recent costing guidance from YG EMR in the document *Reclamation and Closure Planning for Quartz Mining Projects: Plan Requirements and closure costing guidance*. This estimation is based on the final extent of disturbance for each of the infrastructure units described in this report using a Net Present Value (NPV) approach for costs beyond 5 years post-closure.

The tables of estimated costs to implement the decommissioning and reclamation measures described in this report are presented Tables 8-1 through 8-14 below. The costing has been prepared to provide an estimate of closure plan implementation for End of Mine Life, as the Phase IV mine life is scheduled to be complete before a scheduled 2-year RCP and security update.

The costs have been developed using a combination of current unit rates for available Yukon contractors' equipment, and custom unit rates specific to the project. These custom rates were updated in September of 2013 with input from the mine construction heavy equipment contractor and based on their experience on site during the construction activities, considering such factors as:

- Actual haul distance;
- Road grade (vertical rise and drop); and
- Material handling and volumes required.

The unit costs have been applied to levels of effort in sufficient detail to allow thorough scrutiny by the reader. As such, equipment rates have been used where the level of effort is well understood, and in other cases, unit area or volume rates have been employed.

- Table 8-1 provides a summary of cost estimates prepared for End of Mine;
- Table 8-2 contains a summary of the unit rates used in the calculations;
- Table 8-3 to Table 8-11 provide closure cost estimates for the specific site development reclamation components;
- Table 8-12 provides closure cost estimates reclamation research and revegetation activities;
- Table 8-13 outlines costs associated with the site management during closure implementation and presents post-closure costs for compliance monitoring and maintenance for the entire projected 15 year active closure and post-closure monitoring life; and
- Table 8-14 presents costs for various supporting studies as outlined in the closure measures Section 6.

The closure measures presented in this plan have been prepared at a preliminary level of engineering design. It is recognized that a certain level of detailed engineering will be required for major closure activities

including, dam removal, and conveyance or diversion ditches. The approach is to ensure that closure measures are sound and have undergone review before detailed engineering is undertaken. Detailed engineering is planned for major works prior to implementation, and where required the estimate costs for the development of these designs is included in the financial assurance costing estimation.

The closure plan costing allows for 10-years of Active Treatment during the transitional post-closure period after which time it is anticipated that all source control closure measures will be fully in place and the site conditions will have stabilized such that mine water will be suitable for discharge without the need for additional treatment. The closure costing also funds the ongoing reclamation research into passive/semi-passive supplemental treatment technologies (i.e., CWTS, bioreactors and batch treatment of open-pits) such that these technologies will be developed to the "proof of concept" level of design and therefore ready to implement as a contingency measure in the event that supplementary water treatment is required.

Long-term costs have been developed to 100 years as the closure planning has moved away from a "walk away" closure scenario. Additionally, the discount rate has been from 3% in the previous version of the RCP to 2.5% to be consistent with some recent BC examples.

For the purposes of closure costing an estimate of 7% of the capital cost of each closure measure was used for typical project management and engineering costs. An additional 18% Indirect Costs was added to the final calculated costs. The indirect costs have been revised upwards from 12% Indirect Costs allowed for in the previous version of the RCP. This increased allowance for indirect costs is consistent with recent guidance from EMR.

The short term (years 0-5) closure costs are estimated at $28,612,520. The long term closure costs (years 6+) are estimated with an NPV of $7,239,419, for a total financial security of $35,851,940 which assumes 10 years of active water treatment post-closure.

8.1 FINANCIAL SECURITY UPDATES

YG has developed a policy respecting mine site reclamation and closure with one of the stated principles being "adequate security must be provided by the project proponent at each stage of mine development reclamation and closure consistent with the requirements of relevant legislation and Yukon financial security guidelines" (YG, 2006). Typically requirements for mine security bonding are conditions of the Type A Water Use Licence or Yukon Quartz Mining Production Licence. Minto intends to adhere to the principles for mine reclamation and closure and security requirements in accordance with YG's policy which identifies that the security estimate be updated every second year.

Minto and YG will jointly determine a schedule for security payment scheduling.

Minto will discuss road decommissioning requirements with SFN, which will ultimately refine the final closure costs associated with the access road decommissioning.

Table 8-1

Summary Table of Estimated Closure Costs - 2013

Description of Cost	Estimated Cost: Existing Security (September 2012)	Estimated Cost: Proposed 2013
Short-Term Reclamation and Closure Costs (years 1-5)		
Waste Dumps	$8,286,594	$6,332,223
Pit and Haul Roads	$460,668	$271,268
Primary Water Conveyance Structures		$741,863
Tailings & MVFE	$2,615,559	$1,481,569
Main Dam	$615,033	$590,958
Mill and Facilities	$801,633	$802,356
Mill Pond	$177,524	$177,524
Access Road	$253,906	$253,906
Miscellaneous	$307,385	$383,373
Revegetation	$1,557,900	$1,557,900
Site Management	$1,234,660	$1,626,160
Supporting Studies	$510,500	$510,500
Reclamation and Closure Research Program		$1,450,000
Capital Costs		
Active Treatment		$2,000,000
Active Treatment Capital Replacement		$240,000
Passive Treatment	$202,658	$0
Passive Treatment Capital Replacement		$0
Operating Costs (total years 1-5)		
Active Treatment	$3,115,680	$3,115,680
Passive Treatment		$0
Site Access and Maintenance[1,2]	$391,500	$0
Monitoring[1]	$790,500	$710,500
Sub-total	$21,321,701	$22,245,778
Indirect Costs (%)	12%	18%
Indirect Costs	$2,607,204.06	$4,004,240.12
Cost Inflation (3%/year)	$0	$2,362,502
Total Short Term Costs	**$23,928,905**	**$28,612,520**
Long-Term Reclamation and Closure Costs		
Reclamation and Closure Research Program		$750,000
Capital Costs		
Active Treatment		$0
Active Treatment Capital Replacement		$300,000
Passive Treatment		$0
Passive Treatment Capital Replacement		$0
Operating Costs		
Active Treatment		$3,750,000
Passive Treatment		$0
Site Access and Maintenance		$2,400,000
Monitoring		$120,000
Sub-Total		$7,320,000
Sub-Total NPV (2.5% DROR)		$6,135,101
Indirect Costs (%)		18%
Indirect Costs		$1,104,318
Total (NPV)		$7,239,419
Total Financial Security (18% Indirect Costs)	**$23,928,905**	**$35,851,940**

[1] Existing FS includes maintenance and monitoring costs for years 6-15

[2] Site Access and Maintenance costs for years 1-5 are included in the Site Management line item

Table 8-2
Minto Mine Closure Unit Rates for 2013

Equipment Rates		
Equipment	**Unit Rates**	**Per Unit**
D9H Dozer	$350	per hr
D6D Dozer	$160	per hr
Haul Truck D250E	$250	per hr
Tandem Haul Truck	$150	per hr
Cat 235 Excavator	$250	per hr
Cat 235 Excavator w hammer	$275	per hr
Cat 16H grader	$250	per hr
988B Loader	$190	per hr
Tractor Trailer (lowbed)	$160	per hr
30 ton Crane	$190	per hr
Hiab Flatdeck truck	$160	per hr
Cat 950 loader	$140	per hr
Vibratory Roller	$150	per hr
Crane support	$190	per hr
Pickup Truck	$2,500	per mo
Personnel Rates		
Personnel	**Unit Rates**	**Per Unit**
Blaster	$62	per hr
General Labourer	$47	per hr
Trades Labourer	$83	per hr
Site Supervisor	$100	per hr
Design Engineer	$135	per hr
Environmental Scientist	$100	per hr
Project Manager	$9,700	per mo
Camp Labourer	$4,000	per mo
Site Caretaker	$6,100	per mo
Environmental Monitor	$5,000	per mo
Revegetation Rates	**Unit Rates**	**Per Unit**
Revegetation Seed Mix	$15	per kg
Revegetation Seed Mix - 50kg/ha	$750	per ha
Fertilizer	$1	per kg
Fertilizer - 250kg/ha	$250	per ha
Tree Seedlings (1,000 seedlings per ha)	$1,750	per ha
Seed/Fertilizer Application	$1,500	per ha
Erosion Barrier	$3	per sq.m
Revegetation cost per ha. Including application cost	**$2,500.00**	**per ha**
Contractor Unit Rates & Camp Costs	**Unit Rates**	**Per Unit**
Custom Rate A (Load, haul, place soil cover ROD-MWD)	$3.75	per cu.m
Custom Rate B (Load, haul, place soil cover ROD-SWD)	$4.25	per cu.m
Custom Rate C (Load, haul, place soil cover ROD-MWD / LGO)	$4.00	per cu.m
Custom Rate D (Load, haul, place soil cover ROD-MWD / HGO)	$4.00	per cu.m
Custom Rate E (Load, haul, place soil cover ROD-CSA)	$3.75	per cu.m
Custom Rate F (Load, haul, place soil cover ROD-MVFE)	$4.25	per cu.m
Custom Rate G (Load, haul, place soil cover ROD-DSTF)	$4.25	per cu.m
Custom Rate H (Load, haul, place fill SWD - MVFE)	$4.25	per cu.m
Custom Rate I (Load, haul, place soil cover ROD-WSP Dam)	$4.50	per cu.m
Custom Rate J (Push from WSP Dam - U/S WSP Dam)	$2.20	per cu.m
Load, haul & place mat'l underground	$7.00	per cu.m
Produce rip-rap	$13.00	per cu.m
Load, haul and place rip-rap	$13.00	per cu.m
Deliver and install geosynthetic membrane on prepared foundation	$20.00	per sq.m
Unit Basis (footing burial)	$5.00	each
GeoWeb - GW30V3	$5.60	per sq.m
GeoWeb - GW30V4	$7.10	per sq.m
GeoWeb - GW30V6	$10.60	per sq.m
Freight run to Whitehorse	$1,000.00	per load
Camp Cost	$70.00	per day per person
Power and Heat	$5,500.00	per month
Employee Transport Costs	$3,000.00	per month
Barge Operating Cost	$10,000.00	per month

Notes:
1) Custom Rates A through E previously developed specifically for Minto Mine, taking into account such factors as haul
2) Custom Rate F is new to this costing iteration and is based on experience and extrapolotion of other custom rates.

Table 8-3
Waste Rock and Overburden Dumps, Estimated Closure Costs - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
	WASTE ROCK AND OVERBURDEN DUMPS						
3.1	**Main Waste Dump (s 6.1.1)**						
	Roll crest and recontour	D9H Dozer	hrs	500	$350	$175,000	$175,000
	Additional compaction, as req'd	Vibratory Roller	hrs	60	$150	$9,000	$9,000
	Haul & place overburden for revegetation - Bench area (0.8 m thickness) (23.7 ha)	Custom Rate A (Load, haul, place soil cover ROD-MWD)	cu.m.	189,600	$3.75	$711,000	$711,000
	Haul & place overburden for revegetation - Slope area (1.0 m thickness) (13.4 ha)	Custom Rate A (Load, Haul, place soil cover ROD-MWD)	cu.m.	134,000	$3.75	$502,500	$502,500
	Project Management & Engineering	7% of Total Cost	%		7.00%	$97,825	$97,825
	Sub-Total						**$1,495,325**
3.1.1	**Main Waste Dump - Ditching Option 1 - Rip-rap**						
	Contour secondary ditching (1840 m)	Cat 235 Excavator	hrs	92	$250.00	$23,000	$23,000
	Provision for ditching rip-rap	Produce rip-rap	cu.m.	6,510	$13.00	$84,630	$84,630
		Load, haul and place rip-rap	cu.m.	6,510	$13.00	$84,630	$84,630
	Contour tertiary ditching (490 m)	Cat 235 Excavator	hrs	25	$250.00	$6,125	$6,125
	Sedimentation Pond	Misc.	l.s.	1	$100,000.00	$100,000	$100,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$20,887	$20,887
	Sub-Total						**$319,272**
3.1.2	**Main Waste Dump - Ditching Option 2 - GeoWeb**						
	Contour secondary ditching (1840 m)	Cat 235 Excavator	hrs	92	$250.00	$23,000	$23,000
	Provision for ditching erosion protection	Produce rip-rap	cu.m.	1,870	$13.00	$24,310	$24,310
		Load, haul and place rip-rap	cu.m.	1,870	$13.00	$24,310	$24,310
	GeoWeb	GeoWeb - GW30V4	sq.m	18,400	$7.10	$130,640	$130,640
	Contour tertiary ditching (490 m)	Cat 235 Excavator	hrs	25	$250.00	$6,125	$6,125
	Sedimentation Pond	Misc.	l.s.	1	$100,000.00	$100,000	$100,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$21,587	$21,587
	Sub-Total						**$329,972**
3.2	**Southwest Dump**						
	Roll crest and recontour	D9H Dozer	hrs	220	$350	$77,000	$77,000
	Additional compaction, as req'd	Vibratory Roller	hrs	160	$150	$24,000	$24,000
	Haul & place overburden for revegetation - Bench area (0.8 m thickness) (61.9 ha)	Custom Rate B (Load, haul, place soil cover ROD-SWD)	cu.m.	495,200	$4.25	$2,104,600	$2,104,600
	Haul & place overburden for revegetation - Slope area (1.0 m thickness) (8.3 ha)	Custom Rate B (Load, haul, place soil cover ROD-SWD)	cu.m.	83,000	$4.25	$352,750	$352,750
	Project Management & Engineering	7% of Total Cost	%		7.00%	$179,085	$179,085
	Sub-Total						**$2,737,435**
3.2.1	**Southwest Dump - Ditching Option 1 - Rip-rap**						
	Contour secondary ditching (1980 m)	Cat 235 Excavator	hrs	99	$250.00	$24,750	$24,750
	Provision for ditching rip-rap	Produce rip-rap	cu.m.	6,990	$13.00	$90,870	$90,870
		Load, haul and place rip-rap	cu.m.	6,990	$13.00	$90,870	$90,870
	Contour tertiary ditching (1830 m)	Cat 235 Excavator	hrs	92	$250.00	$22,875	$22,875
	Sedimentation Pond	Misc.	l.s.	1	$100,000.00	$100,000	$100,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$23,056	$23,056
	Sub-Total						**$352,421**
3.2.2	**Southwest Dump - Ditching Option 2 - GeoWeb**						
	Contour secondary ditching (1980 m)	Cat 235 Excavator	hrs	99	$250.00	$24,750	$24,750
	Provision for ditching erosion protection	Produce rip-rap	cu.m.	2,010	$13.00	$26,130	$26,130
		Load, haul and place rip-rap	cu.m.	2,010	$13.00	$26,130	$26,130
	GeoWeb	GeoWeb - GW30V4	sq.m	19,800	$7.10	$140,580	$140,580
	Contour tertiary ditching (1830 m)	Cat 235 Excavator	hrs	92	$250.00	$22,875	$22,875
	Sedimentation Pond	Misc.	l.s.	1	$100,000.00	$100,000	$100,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$23,833	$23,833
	Sub-Total						**$364,298**
3.3	**Ice-Rich Overburden Dump (s 6.1.3)**						
	Roll crest of berm and recontour	D9H Dozer	hrs	16	$350	$5,600	$5,600
	Excavate material for placement on berm	Cat 235 Excavator	hrs	40	$250	$10,000	$10,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$1,092	$1,092
	Sub-Total						**$16,692**
3.4	**Reclamation Overburden Dump (s 6.1.4)**						
	Blade pad after removal of material during reclamation	D6D Dozer	hrs	90	$160	$14,400	$14,400
	Project Management & Engineering	7% of Total Cost	%		7.00%	$1,008	$1,008
	Sub-Total						**$15,408**
3.2.1	**Reclamation Overburden Dump - Ditching Option 1 - Rip-rap**						
	Contour secondary ditching (3480 m)	Cat 235 Excavator	hrs	174	$250.00	$43,500	$43,500
	Provision for ditching rip-rap	Produce rip-rap	cu.m.	12,290	$13.00	$159,770	$159,770
		Load, haul and place rip-rap	cu.m.	12,290	$13.00	$159,770	$159,770
	Contour tertiary ditching (1900 m)	Cat 235 Excavator	hrs	95	$250.00	$23,750	$23,750
	Sedimentation Pond	Misc.	l.s.	1	$100,000.00	$100,000	$100,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$34,075	$34,075
	Sub-Total						**$520,865**
3.2.2	**Reclamation Overburden Dump - Ditching Option 2 - GeoWeb**						
	Contour secondary ditching (3480 m)	Cat 235 Excavator	hrs	174	$250.00	$43,500	$43,500
	Provision for ditching erosion protection	Produce rip-rap	cu.m.	3,510	$13.00	$45,630	$45,630
		Load, haul and place rip-rap	cu.m.	3,510	$13.00	$45,630	$45,630
	GeoWeb	GeoWeb - GW30V4	sq.m	34,800	$7.10	$247,080	$247,080
	Contour tertiary ditching (1900 m)	Cat 235 Excavator	hrs	95	$250.00	$23,750	$23,750
	Sedimentation Pond	Misc.	l.s.	1	$100,000.00	$100,000	$100,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$35,391	$35,391
	Sub-Total						**$540,981**
3.5	**Low Grade Ore Stockpile and Pad (s 6.2)**						
	Recontour Stockpile and Pad	D9H Dozer	hrs	40	$350	$13,825	$13,825
	Haul and place overburden for revegetation	Custom Rate C (Load, haul, place soil cover ROD-MWD / LGO)	cu.m.	16,250	$4.00	$65,000	$65,000
	Removal of bottom layer of material, move to pit.	Misc.	l.s.	1	$5,000	$5,000	$5,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$5,868	$5,868
	Sub-Total						**$89,693**
3.6	**High Grade Ore Stockpile Pad (s 6.2)**						
	Recontour stockpile and pad	D9H Dozer	hrs	54	$350	$18,900	$18,900
	Haul and place overburden for revegetation	Custom Rate D (Load, haul, place soil cover ROD-MWD / HGO)	cu.m.	24,000	$4.00	$96,000	$96,000
	Installation of geosynthetic membrane (e.g. BGM)	Price is delivered and installed on prepared foundation	sq.m	24,000	$20.00	$480,000	$480,000
	Removal of bottom layer of material, move to pit	Misc.	l.s.	1	$7,500	$7,500	$7,500
	Project Management & Engineering	7% of Total Cost			7.00%	$42,168	$42,168
	Sub-Total						**$644,568**
3.7	**Grade Bin Disposal Area**						
	Move material to Area 1 Pit	988B Loader	hrs	3,500	$190	$0	$0
		D9H Dozer	hrs	360	$350	$0	$0
		Haul Truck D250E	hrs	5,500	$250	$0	$0
	Project Management & Engineering	7% of Total Cost	%		7.00%	$0	$0
	Sub-Total						**$0**
3.8	**Contractor's Shop and Work Area (s 6.9.7)**						
	Remove salvageable equipment	General Labourer	hrs	75	$47	$3,525	$3,525
		Haul Truck D250E	hrs	25	$250	$6,250	$6,250
		Trades Labourer	hrs	60	$83	$4,980	$4,980
	Dismantle buildings	General Labourer	hrs	60	$47	$2,820	$2,820
		30 ton Crane	hrs	13	$190	$2,375	$2,375
		Cat 235 Excavator	hrs	38	$250	$9,375	$9,375
	Haul building pieces off site - equipment	Tractor Trailer (lowbed)	hrs	25	$160	$4,000	$4,000
	Scrap haul to site landfill	Haul Truck D250E	hrs	25	$250	$6,250	$6,250
	Excavate & haul contaminated materials to site LTF	Misc.	l.s.	1	$6,250	$6,250	$6,250
	Bury footings - haul and place fill, locally sourced	Unit Basis (footing burial)	each	3,125	$5	$15,625	$15,625
	Recontour	D9H Dozer	hrs	19	$350	$6,563	$6,563
	Haul and place overburden for revegetation	Custom Rate E (Load, haul, place soil cover ROD-CSA)	cu.m.	6,250	$4	$23,438	$23,438
	Project Management & Engineering	7% of Total Cost	%		7.00%	$6,402	$6,402
	Sub-Total						**$97,852**
Total Estimated Cost in Reclaiming Overburden and Waste Rock Dumps							
	Option 1 - assuming use of rip-rap lined ditches						**$6,289,530**
	Option 2 - assuming use of GeoWeb lined ditches						**$6,332,223**

Note:

Table 8-4
Open Pit and Haul Roads, Estimated Closure Costs - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
	OPEN PIT, UNDERGROUND AND HAUL ROADS						
4.1	**Main Pit**						
	Remove pit pumps and pipe column/general cleanup	General Labourer	hrs	80	$47	$3,760	
		Trades Labourer	hrs	20	$83	$1,660	
		Support equipment	l.s.	1	$1,000	$1,000	$6,420
	Secure pit access - boulder placement	Cat 235 Excavator	hrs	20	$250	$5,000	
		Haul Truck D250E	hrs	20	$250	$5,000	
	Highwall perimeter safety berm/trench (~1km)	Cat 235 Excavator	hrs	40	$250	$10,000	$20,000
	Construct inflow spillway from upgradient of pit	Cat 235 Excavator	hrs	40	$250	$10,000	
		Haul Truck D250E	hrs	20	$250	$5,000	
		Produce rip-rap	cu.m	200	$13	$2,600	
		Load, haul and place rip-rap	cu.m	200	$13	$2,600	$20,200
	Construct exit channel into Mill Pond system	Cat 235 Excavator	hrs	20	$250	$5,000	
		Produce rip-rap	cu.m	200	$13	$2,600	
	rip-rap shoulder exiting pit-spillway	Load, haul and place rip-rap	cu.m	200	$13	$2,600	
		General Labourer	hrs	10	$47	$470	$10,670
	Project Management & Engineering	7% of Total Cost	%		7.00%	$17,268	$17,268
	Sub-Total						**$74,558**
4.2	**Area 2 Pit**						
	Remove pit pumps and pipe column/general cleanup	General Labourer	hrs	40	$47	$1,880	
		Trades Labourer	hrs	10	$83	$830	
		Support equipment	l.s.		$1,000	$1,000	$3,710
	Secure pit access - boulder placement	Cat 235 Excavator	hrs	20	$250	$5,000	
		Haul Truck D250E	hrs	20	$250	$5,000	$10,000
	Construct exit channel into Mill Pond system	Cat 235 Excavator	hrs	40	$250	$10,000	
	rip-rap shoulder exiting pit	Load, haul and place rip-rap	cu.m	50	$13	$650	
	Exit Spillway construction	General Labourer	hrs	40	$47	$1,880	
		Produce rip-rap	cu.m	250	$13	$3,250	
		Load, haul and place rip-rap	cu.m	250	$13	$3,250	$19,030
	Project Management & Engineering	7% of Total Cost	%		7.00%	$2,292	$2,292
	Sub-Total						**$35,032**
4.3	**Area 118 Pit**						
	Remove pit pumps and pipe column/general cleanup	General Labourer	hrs	30	$47	$0	
		Trades Labourer	hrs	7.5	$83	$0	
		Support equipment	l.s.		$750	$0	$0
	Secure pit access - boulder placement	Cat 235 Excavator	hrs	15	$250	$0	
		Haul Truck D250E	hrs	15	$250	$0	$0
	Construct exit channel into Mill Pond system	Cat 235 Excavator	hrs	30	$250	$0	
		Produce rip-rap	cu.m	30	$13	$0	
	rip-rap shoulder exiting pit	Load, haul and place rip-rap	cu.m	37.5	$13	$0	
	Exit Spillway construction	General Labourer	hrs	30	$47	$0	
		Produce rip-rap	cu.m	188	$13	$0	
		Load, haul and place rip-rap	cu.m	187.5	$13	$0	$0
	Haul and place overburden for revegetation	Load, Haul and place soil cover	cu.m.	7500	$4.25	$0	$0
	Project Management & Engineering	7% of Total Cost	%		7.00%	$0	$0
	Sub-Total						**$0**
4.4	**Haul Roads (s 6.5) (15 ha)**						
	Remove culverts and haul away	General Labourer	hrs	55	$47	$2,585	
		Cat 235 Excavator	hrs	28	$250	$7,000	
		Haul Truck D250E	hrs	28	$250	$7,000	$16,585
	Recontour slopes	D9H Dozer	hrs	208	$350	$72,800	$72,800
	Scarify surfaces	Cat 16H grader	hrs	208	$250	$52,000	
		General Labourer	hrs	28	$47	$1,316	$53,316
	Stabilize slopes - erosion barriers - material	Unit Cost Basis	sq.m	2,800	$3	$8,400	$8,400
	Project Management & Engineering	7% of Total Cost	%		7.00%	$10,577	$10,577
	Sub-Total						**$161,678**
4.5	**Underground**						
	Backfill underground waste	Load, haul & place mat'l underground	cu.m	70000	$7	$0	$0
	Recontour slopes	D9H Dozer	hrs	20	$350	$0	$0
	Seal off underground portal		l.s.	1	$10,000	$0	$0
	Seal off ventilation raise		l.s.	1	$5,000	$0	$0
	Scarify road	Cat 16H grader	hrs	8	$250	$0	$0
	Project Management & Engineering	7% of Total Cost	%		7.00%	$0	$0
	Sub-Total						**$0**
Total Estimated Cost in Reclaiming Open Pit and Haul Roads							**$271,268**

Note:
Linear disturbances to be scarified / decompacted and allowed to naturally revegetate

Table 8-5
Primary Water Conveyance Structures, Estimated Closure Costs - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
5.1	**Decomission 100 Surface Drainage Channel**						
	Remove redundant infrastructure	Misc.	l.s.	1	$25,000	$25,000	$25,000
	Upgrade for final closure	Misc.	l.s.	1	$50,000	$50,000	$50,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$5,250	$5,250
	Sub-Total						**$80,250**
5.2.1	**200 Surface Drainage Channel (1120 m length) - Ditching Option 1 - Rip-rap**						
	Contour ditching (1120 m)	Cat 235 Excavator	hrs	56	$250.00	$14,000	$14,000
	Provision for ditching rip-rap	Produce rip-rap	cu.m.	3,960	$13.00	$51,480	$51,480
		Load, haul and place rip-rap	cu.m.	3,960	$13.00	$51,480	$51,480
	Project Management & Engineering	7% of Total Cost	%		7.00%	$8,187	$8,187
	Sub-Total						**$125,147**
5.2.2	**200 Surface Drainage Channel (1120 m length) - Ditching Option 2 - GeoWeb**						
	Contour secondary ditching (1120 m)	Cat 235 Excavator	hrs	56	$250.00	$14,000	$14,000
	Provision for ditching erosion protection	Produce rip-rap	cu.m.	1,700	$13.00	$22,100	$22,100
		Load, haul and place rip-rap	cu.m.	1,700	$13.00	$22,100	$22,100
	GeoWeb	GeoWeb - GW30V6	sq.m	11,200	$10.60	$118,720	$118,720
	Project Management & Engineering	7% of Total Cost	%		7.00%	$12,384	$12,384
	Sub-Total						**$189,304**
5.3.1	**300 Surface Drainage Channel (370 m length) - Ditching Option 1 - Rip-rap**						
	Contour ditching (370 m)	Cat 235 Excavator	hrs	19	$250.00	$4,625	$4,625
	Provision for ditching rip-rap	Produce rip-rap	cu.m.	1,310	$13.00	$17,030	$17,030
		Load, haul and place rip-rap	cu.m.	1,310	$13.00	$17,030	$17,030
	Project Management & Engineering	7% of Total Cost	%		7.00%	$2,708	$2,708
	Sub-Total						**$41,393**
5.3.2	**300 Surface Drainage Channel (370 m length) - Ditching Option 2 - GeoWeb**						
	Contour secondary ditching (370 m)	Cat 235 Excavator	hrs	56	$250.00	$14,000	$14,000
	Provision for ditching erosion protection	Produce rip-rap	cu.m.	560	$13.00	$7,280	$7,280
		Load, haul and place rip-rap	cu.m.	560	$13.00	$7,280	$7,280
	GeoWeb	GeoWeb - GW30V6	sq.m	3,700	$10.60	$39,220	$39,220
	Project Management & Engineering	7% of Total Cost	%		7.00%	$4,745	$4,745
	Sub-Total						**$72,525**
5.4.1	**350 Surface Drainage Channel (510 m length) - Ditching Option 1 - Rip-rap**						
	Contour ditching (510 m)	Cat 235 Excavator	hrs	26	$250.00	$6,375	$6,375
	Provision for ditching rip-rap	Produce rip-rap	cu.m.	1,800	$13.00	$23,400	$23,400
		Load, haul and place rip-rap	cu.m.	1,800	$13.00	$23,400	$23,400
	Project Management & Engineering	7% of Total Cost	%		7.00%	$3,722	$3,722
	Sub-Total						**$56,897**
5.4.2	**350 Surface Drainage Channel (510 m length) - Ditching Option 2 - GeoWeb**						
	Contour secondary ditching (510 m)	Cat 235 Excavator	hrs	26	$250.00	$6,375	$6,375
	Provision for ditching erosion protection	Produce rip-rap	cu.m.	780	$13.00	$10,140	$10,140
		Load, haul and place rip-rap	cu.m.	780	$13.00	$10,140	$10,140
	GeoWeb	GeoWeb - GW30V6	sq.m	5,100	$10.60	$54,060	$54,060
	Project Management & Engineering	7% of Total Cost	%		7.00%	$5,650	$5,650
	Sub-Total						**$86,365**
5.5	**400 - Surface Drainage Channel Over MVFE (1380 m length)**						
	Contour secondary ditching (1380 m)	Cat 235 Excavator	hrs	69	$250.00	$17,250	$17,250
	Provision for ditching rip-rap (1060 m)	Produce rip-rap	cu.m.	1,610	$13.00	$20,930	$20,930
		Load, haul and place rip-rap	cu.m.	1,610	$13.00	$20,930	$20,930
	Concrete	Poured concrete	cu.m.	120	$500.00	$60,000	$60,000
	Insertion of baffles	General Labourer	hrs	20	$47.00	$940	$940
	GeoWeb	GeoWeb - GW30V6	sq.m	10,600	$10.60	$112,360	$112,360
		GeoWeb - GW30V3	sq.m	1,500	$5.60	$8,400	$8,400
	Project Management & Engineering	7% of Total Cost	%		7.00%	$16,857	$16,857
	Sub-Total						**$257,667**
5.6.1	**450 Surface Drainage Channel (330 m length) - Ditching Option 1 - Rip-rap**						
	Contour ditching (330 m)	Cat 235 Excavator	hrs	17	$250.00	$4,125	$4,125
	Provision for ditching rip-rap	Produce rip-rap	cu.m.	1,170	$13.00	$15,210	$15,210
		Load, haul and place rip-rap	cu.m.	1,170	$13.00	$15,210	$15,210
	Project Management & Engineering	7% of Total Cost	%		7.00%	$2,418	$2,418
	Sub-Total						**$36,963**
5.6.2	**450 Surface Drainage Channel (330 m length) - Ditching Option 2 - GeoWeb**						
	Contour secondary ditching (330 m)	Cat 235 Excavator	hrs	17	$250.00	$4,125	$4,125
	Provision for ditching erosion protection	Produce rip-rap	cu.m.	500	$13.00	$6,500	$6,500
		Load, haul and place rip-rap	cu.m.	500	$13.00	$6,500	$6,500
	GeoWeb	GeoWeb - GW30V6	sq.m	3,300	$10.60	$34,980	$34,980
	Project Management & Engineering	7% of Total Cost	%		7.00%	$3,647	$3,647
	Sub-Total						**$55,752**
Total Estimated Cost in Constructing Primary Drainage Ditches							
	Option 1 - assuming use of rip-rap lined ditches						**$598,317**
	Option 2 - assuming use of GeoWeb lined ditches						**$741,863**

Note:

Table 8-6
DSTSF and MVFE, Estimated Closure Costs - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
	DSTSF						
6.1	**Tailings Deposit - Entire Area (41.3 ha)**						
	Roll crest of starter bench and recontour	D9H Dozer	hrs	50	$350	$17,500	$17,500
	Haul overburden ROD - DSTF (0.5 m)	Custom Rate G (Load, haul, place soil cover ROD-DSTF)	cu.m	224,000	$4	$952,000	$952,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$67,865	$67,865
	Sub-Total						**$1,037,365**
6.2.1	**Dry Stacked Tailings - Ditching Option 1 - Rip-rap**						
	Contour secondary ditching (720 m)	Cat 235 Excavator	hrs	36	$250.00	$9,000	$9,000
	Provision for ditching rip-rap	Produce rip-rap	cu.m.	2,540	$13.00	$33,020	$33,020
		Load, haul and place rip-rap	cu.m.	2,540	$13.00	$33,020	$33,020
	Impervious barrier	Impervious liner	sq.m	4,320	$20.00	$86,400	$86,400
	Contour tertiary ditching (780 m)	Cat 235 Excavator	hrs	39	$250.00	$9,750	$9,750
	Project Management & Engineering	7% of Total Cost	%		7.00%	$11,983	$11,983
	Sub-Total						**$183,173**
6.2.2	**Dry Stacked Tailings - Ditching Option 2 - GeoWeb**						
	Contour secondary ditching (720 m)	Cat 235 Excavator	hrs	36	$250.00	$9,000	$9,000
	Provision for ditching erosion protection	Produce rip-rap	cu.m.	730	$13.00	$9,490	$9,490
		Load, haul and place rip-rap	cu.m.	730	$13.00	$9,490	$9,490
	GeoWeb	GeoWeb - GW30V4	sq.m	7,200	$7.10	$51,120	$51,120
	Impervious barrier	Impervious liner	sq.m	4,320	$20.00	$86,400	$86,400
	Contour tertiary ditching (780 m)	Cat 235 Excavator	hrs	39	$250.00	$9,750	$9,750
	Project Management & Engineering	7% of Total Cost	%		7.00%	$12,268	$12,268
	Sub-Total						**$187,518**
6.3	**South Diversion Ditch (length cut by 50%)**						
	Widen south diversion ditch	D9H Dozer	hrs	50	$350	$17,500	$17,500
		Cat 235 Excavator	hrs	20	$250	$5,000	$22,500
		Produce rip-rap	cu.m	1,200	$13	$15,600	$15,600
	Haul and place rip-rap	Load, haul and place rip-rap	cu.m	1,200	$13	$15,600	$15,600
	Construct spillway into Area 2 Pit	Cat 235 Excavator	hrs	40	$250	$10,000	$10,000
		Haul Truck D250E	hrs	20	$250	$5,000	$5,000
		Produce rip-rap	cu.m	200	$13	$2,600	$2,600
		Load, haul and place rip-rap	cu.m	200	$13	$2,600	$20,200
	HDPE liner	Unit rate	sq.m	2,400	$10	$24,000	$24,000
		General Labourer	hrs	80	$47	$3,760	$3,760
	Project Management & Engineering	7% of Total Cost	%		7.00%	$7,116	$7,116
	Sub-Total						**$143,876**
6.4	**Mill Valley Fill Facility (s. 6.7)**						
	Roll crest and recontour	D9H Dozer	hrs	30	$350	$10,500	$10,500
	Haul and place overburden for revegetation	Custom Rate F (Load, haul, place soil cover ROD-MVFE)	cu.m.	23,900	$4	$101,575	$101,575
	Project Management & Engineering	7% of Total Cost			7.00%	$735	$735
	Sub-Total						**$112,810**
Total Estimated Cost in Reclaiming Tailings Area							
	Option 1 - assuming use of rip-rap lined ditches						**$1,477,225**
	Option 2 - assuming use of GeoWeb lined ditches						**$1,481,569**

Note:

Table 8-7
Water Storage Pond Dam, Estimated Closure Costs - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
	WATER STORAGE POND DAM						
7.1	**Reclaim System**						
	Remove salvageable equipment - pipeline/pumps	General Labourer	hrs	48	$47	$2,256	
		Trades Labourer	hrs	98	$83	$8,134	$10,390
	Remove pipeline	Haul Truck D250E	hrs	100	$250	$25,000	
		Cat 235 Excavator	hrs	100	$250	$25,000	
		General Labourer	hrs	200	$47	$9,400	$59,400
	Dismantle Building	Cat 235 Excavator	hrs	16	$250	$4,000	
		Trades Labourer	hrs	10	$83	$830	
		General Labourer	hrs	20	$47	$940	$5,770
	Misc. Supplies & Tools	Misc.	l.s.	1	$1,000	$1,000	$1,000
	Recontour alignment	D9H Dozer	hrs	16	$350	$5,600	$5,600
	Project Management & Engineering	7% of Total Cost	%		7.00%	$5,751	$5,751
	Sub-Total						**$87,911**
7.2	**Water Storage Pond Dam**						
	Pump down impounded water, over spillway (using reclaim pumps)	General Labourer	hrs	96	$47	$4,512	$4,512
	Misc. Supplies & Tools	Misc.	l.s.	1	$5,000	$5,000	$5,000
	Engineering design for final structure include appropriate flow determination, channel designs, etc.	Misc.	l.s.	1	$20,000	$20,000	$20,000
	Build coffer dam and install pump-around system Operate system until new structure is ready	Misc.	l.s.	1	$10,000	$10,000	$10,000
	Stockpile rip-rap from downstream shell	Unit Cost Basis	cu.m	10,000	$10	$100,000	$100,000
	Breach Dam: push material using dozer into new areas	Custom Rate J (Push from WSP Dam - U/S WSP Dam)	cu.m	25,000	$2.20	$55,000	
	and load, haul & dump and contour material in new area	Custom Rate I (Load, haul, place soil cover ROD-WSP Dam)	cu.m	31,000	$4.50	$139,500	
		Environmental Scientist	hrs	60	$100.00	$6,000	$200,500
	Construct stream channel at original grade - load, haul & place rip-rap (salvage from old WSP Dam stockpile)	Load, Haul and Place rip-rap	cu.m	1,125	$13.00	$14,625	$14,625
	Load, haul, place & contour overburden on slopes of new area u/s of WSP Dam	Custom Rate I (Load, haul, place soil cover ROD-WSP Dam)	cu.m	15,000	$4.50	$67,500	$67,500
	Stabilize slopes with erosion barriers	Unit Rates	sq. m	15,000	$3	$45,000	$45,000
	Misc. Supplies & Tools	Misc.	l.s.		$3,000	$3,000	$3,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$32,910	$32,910
	Sub-Total						**$503,047**
Total Estimated Cost in Reclaiming Water Dam							**$590,958**

NOTES:

Table 8-8
Mill & Ancillary Facilities, Estimated Closure Costs - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
	MILL AND ANCILLARY FACILITIES						
7.1	**Mill Building**						
	Remove salvageable equipment	General Labourer	hrs	550	$47	$25,850	
		Trades Labourer	hrs	600	$83	$49,800	
		Crane Support	hrs	40	$190	$7,600	$83,250
	Decontaminate Building-hosing and clean-up	Trades Labourer	hrs	160	$83	$13,280	$13,280
	Dismantle Building	General Labourer	hrs	1000	$47	$47,000	
		Trades Labourer	hrs	600	$83	$49,800	
		Cat 235 Excavator w hammer	hrs	120	$275	$33,000	
		Crane Support	hrs	60	$190	$11,400	$141,200
	Concrete Demolition	Blaster	hrs	40	$62	$2,480	
		Cat 235 Excavator	hrs	20	$250	$5,000	
		D9H Dozer	hrs	30	$350	$10,500	$17,980
	Misc. Supplies & Tools	Misc.	l.s.	1	$11,000	$11,000	$11,000
	Scrap haul to solid waste facility	Cat 235 Excavator	hrs	50	$250	$12,500	
		Haul Truck D250E	hrs	100	$250	$25,000	$37,500
	Project Management & Engineering	7% of Total Cost	%		7.00%	$21,295	$21,295
	Subtotal:						**$325,505**
						Subtract 50% for Salvage Value	**$162,752**
8.2	**Generator & Filter Buildings & Concentrate Shed**						
	Remove salvageable equipment	General Labourer	hrs	240	$47	$11,280	
		Trades Labourer	hrs	240	$83	$19,920	$31,200
		Crane Support	hrs	24	$190	$4,560	
	Salvage and remove powerline and poles		l.s.	1	$27,500	$27,500	$32,060
	Dismantle Buildings	General Labourer	hrs	160	$47	$7,520	
		Trades Labourer	hrs	80	$83	$6,640	
		Cat 235 Excavator w hammer	hrs	40	$275	$11,000	
		Crane Support	hrs	30	$190	$5,700	$30,860
	Concrete Demolition	Blaster	hrs	40	$62	$2,480	
		Cat 235 Excavator	hrs	20	$250	$5,000	
		D9H Dozer	hrs	20	$350	$7,000	$14,480
	Misc. Supplies & Tools	Misc.	l.s.	1	$10,000	$10,000	$10,000
	Scrap haul to solid waste facility	Cat 235 Excavator	hrs	10	$250	$2,500	
		Haul Truck D250E	hrs	20	$250	$5,000	$7,500
	Project Management & Engineering	7% of Total Cost	%		7.00%	$8,827	$8,827
	Subtotal:						**$134,927**
						Subtract 50% for Salvage Value	**$67,464**
8.3	**Fuel Storage Area**						
	Cleanout tanks-remove sludge, pressure wash	General Labourer	hrs	60	$47	$2,820	
		Removal to Licensed facility	l.s.	1	$10,000	$10,000	$12,820
	Remove bulk fuel storage and piping facilities	General Labourer	hrs	100	$47	$4,700	
		Trades Labourer	hrs	120	$83	$9,960	
		Crane Support	hrs	30	$190	$5,700	
		Support Equipment	l.s.	1	$2,500	$2,500	
		Cat 235 Excavator	hrs	40	$250	$10,000	
		General Labourer	hrs	40	$47	$1,880	
		Tractor Trailer (lowbed)	hrs	30	$160	$4,800	$39,540
	Fold and Bury Liner	Cat 235 Excavator	hrs	20	$250	$5,000	
		D9H Dozer	hrs	100	$350	$35,000	$40,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$6,465	$6,465
	Subtotal:						**$98,825**
8.4	**Mill Reagents**						
	Load and return extra reagents/chemicals	General Labourer	hrs	100	$47	$4,700	
		Support Equipment	l.s.	1	$2,500	$2,500	
		Disposal Cost-bulk materials	l.s.	1	$5,000	$5,000	
		Disposal Cost-lab pacs	pallets	2	$2,000	$4,000	$16,200
	Removal of drums, steel, oils, glycol & batteries, as per 09July quote from General Waste Management to MEL	Contractor quote	l.s.		$50,900	$50,900	$50,900
	Project Management & Engineering	7% of Total Cost	%		7.00%	$4,697	$4,697
	Subtotal:						**$71,797**
8.5	**Reclaim Entire Mill Site Area**						
	Test soils for contamination	Environmental Scientist	hrs	35	$100	$3,500	
		Analytical Costs	l.s.	1	$6,000	$6,000	$9,500
	Haul any contaminated soils to Land Treatment Facility	Cat 235 Excavator	hrs	15	$250	$3,750	
		Haul Truck D250E	hrs	15	$250	$3,750	$7,500
	Re-contour area and slopes to bury footings and establish drainage	D9H Dozer	hrs	175	$350	$61,250	$61,250
	Haul and place overburden cap **(0.5m thickness)**	Unit Rate	cu.m	54000	$5.50	$297,000	$297,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$26,268	$26,268
	Subtotal:						**$401,518**
Total Estimated Cost in Reclaiming Mill and Ancillary Facilities							**$802,356**

Table 8-9
Mill Water Pond, Estimated Closure Costs - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
	MILL POND						
9.1	**Reclaim Mill Pond**						
	Remove upstream culvert	General Labourer	hrs	10	$47	$470	
		Cat 235 Excavator	hrs	10	$250	$2,500	$2,970
	Construct channel	Cat 235 Excavator	hrs	100	$250	$25,000	
		D9H Dozer	hrs	20	$350	$7,000	$32,000
		Produce rip-rap	cu.m	5,000	$13	$65,000	$65,000
		Load, haul and place rip-rap	cu.m	5,000	$13	$65,000	$65,000
		General Labourer	hrs	20	$47	$940	$940
	Project Management & Engineering	7% of Total Cost	%		7.00%	$11,614	$11,614
	Subtotal:						**$177,524**
Total Estimated Cost in Reclaiming Mill Pond							**$177,524**

Note:

Table 8-10
Main Access Road, Estimated Closure Costs - 2013

Scenario 1 - No Road Deactivation

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
10.1	**NO ROAD DECOMMISSIONING REQUIRED**						
10.1.1	**Road Surface**						
	Install road barrier at west side of Minto Creek	Misc	l.s.	1	$2,000	$2,000	$2,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$140	$140
	Subtotal:						
Total Estimated Cost for Access Road Closure (Scenario 1)							**$2,140**

Scenario 2 - Decommission Access Road From Minto Creek to Mine Site (11 KM)

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total Adjusted
10.2	**ACCESS ROAD - 11 KM SECTION**						
10.2.1	**Road Surface**						
	Scarify - 11 km	Cat 16H grader	hrs	70	$250	$17,500	$17,500
	Recontour slopes and drainages	D9H Dozer	hrs	25	$350	$8,750	$8,750
	Project Management & Engineering		%		7.00%	$1,838	$1,838
	Subtotal:						**$28,088**
10.2.2	**Culverts**						
	Culvert excavation (40 small culverts)	Cat 235 Excavator	hrs	100	$250	$25,000	$25,000
	Culvert removal	General Labourer	hrs	140	$47	$6,580	
		Haul Truck D250E	hrs	100	$250	$25,000	$31,580
	Minto Creek Culvert Removal & Streambank Restoration	Trades Labourer	hrs	40	$83	$3,320	
		General Labourer	hrs	75	$47	$3,525	
		Cat 235 Excavator	hrs	40	$250	$10,000	$16,845
	Recontour slopes and drainage	D9H Dozer	hrs	70	$350	$24,500	$24,500
	Stabilize slopes	General Labourer	hrs	200	$47	$9,400	
	Erosion barriers	Erosion Barrier	per sq. m	500	$3	$1,500	$10,900
	Project Management & Engineering	7% of Total Cost	%		7.00%	$7,618	$7,618
	Subtotal:						**$116,443**
Total Estimated Cost for Access Road Closure (Scenario 2)							**$144,530**

Scenario 3 - Decommission Entire Access Road (27 KM)

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total Adjusted
10.3	**ACCESS ROAD - 27 KM SECTION**						
10.3.1	**Road Surface**						
	Scarify - 27 km	Cat 16H grader	hrs	150	$250	$37,500	$37,500
	Recontour slopes and drainage	D9H Dozer	hrs	50	$350	$17,500	$17,500
	Project Management & Engineering	7% of Total Cost	%		7.00%	$3,850	$3,850
	Subtotal:						**$58,850**
10.3.2	**Big Creek Bridge**						
	Remove bridge decking and span	General Labourer	hrs	50	$47	$2,350	
		Crane support	hrs	40	$190	$7,600	
		Cat 235 Excavator	hrs	40	$250	$10,000	
		Tractor Trailer (lowbed)	hrs	20	$160	$3,200	$23,150
	Cut off piles	General Labourer	hrs	50	$47	$2,350	$2,350
	Re-contour	Cat 235 Excavator	hrs	30	$250	$7,500	
		D9H Dozer	hrs	30	$350	$10,500	$18,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$3,045	$3,045
	Subtotal:						**$46,545**
10.3.3	**Barge Ramps**						
	Remove all gravel	Cat 235 Excavator	hrs	20	$250	$5,000	$5,000
	Re-countour areas and scarify	D9H Dozer	hrs	30	$350	$10,500	$10,500
	Shoreline restoration	Misc.	l.s.		$5,000	$5,000	$5,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$1,435	$1,435
	Subtotal:						**$21,935**
10.3.4	**Culverts**						
	Culvert excavation (45 small culverts)	Cat 235 Excavator	hrs	115	$250	$28,750	$28,750
	Culvert removal	General Labourer	hrs	150	$47	$7,050	
		Haul Truck D250E	hrs	115	$250	$28,750	$35,800
	Minto Creek Culvert Removal & Streambank Restoration	Trades Labourer	hrs	40	$83	$3,320	
		General Labourer	hrs	75	$47	$3,525	
		Cat 235 Excavator	hrs	40	$250	$10,000	$16,845
	Recontour slopes and drainage	D9H Dozer	hrs	70	$350	$24,500	$24,500
	Stabilize slopes	General Labourer	hrs	200	$47	$9,400	
	Erosion barriers	Erosion Barrier	per sq. m	1,000	$3	$3,000	$12,400
	Project Management & Engineering	7% of Total Cost	%		7.00%	$8,281	$8,281
	Subtotal:						**$126,576**
Total Estimated Cost for Access Road Closure (Scenario 3)							**$253,906**

Note:

Table 8-11
Miscellaneous Sites and Facilities, Estimated Closure Costs - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
	MISCELLANEOUS SITES AND FACILITIES						
11.1	**Airstrip**						
	Scarify airstrip and adjacent laydown areas	Cat 16H Grader	hrs	40	$250	$10,000	$10,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$700	$700
	Subtotal:						**$10,700**
11.2	**Mine Camp and Related Infrastructure (Expanded)**						
	Disconnect Services	Trades Labourer	hrs	120	$83	$9,960	$9,960
	Remove salvageable equipment	General Labourer	hrs	1056	$47	$49,632	$49,632
	Dismantle buildings	General Labourer	hrs	1800	$47	$84,600	
		Cat 235 Excavator	hrs	180	$250	$45,000	$129,600
	Haul scrap to Solid Waste Facility	Haul Truck D250E	hrs	30	$250	$7,500	
		Cat 235 Excavator	hrs	15	$250	$3,750	$11,250
	Reclaim Septic System	General Labourer	hrs	15	$47	$705	
		Cat 235 Excavator	hrs	3	$250	$750	$1,455
	Site Clean-Up	General Labourer	hrs	750	$47	$35,250	$35,250
	Project Management & Engineering	7% of Total Cost	%		7.00%	$16,600	$16,600
	Subtotal:						**$253,747**
11.3	**Explosives Plant Site**						
	Remove salvageable equipment	General Labourer	hrs	100	$47	$4,700	
		Trades Labourer	hrs	50	$83	$4,150	$8,850
	Dismantle buildings	General Labourer	hrs	200	$47	$9,400	
		Cat 235 Excavator	hrs	30	$250	$7,500	$16,900
	Disconnect Services	Trades Labourer	hrs	20	$83	$1,660	$9,160
	Crane services	30 ton Crane	hrs	5	$190	$950	$2,610
	Haul scrap to Solid Waste Facility	Haul Truck D250E	hrs	30	$250	$7,500	
		Cat 235 Excavator	hrs	10	$250	$2,500	$10,000
	Project Management & Engineering	7% of Total Cost	%		7.00%	$2,685	$2,685
	Subtotal:						**$50,205**
11.4	**Exploration Sites and Trails**						
	Natural revegetation	n/a	n/a				
	Subtotal:						**$0**
11.5	**Land Treatment Facility**						
	Prepare and submit closure plan	Misc	l.s.		$2,000	$2,000	$2,000
	Characterize final soil hydrocarbon concentrations	Misc	l.s.		$4,000	$4,000	$4,000
	Recontour	D9H Dozer	hrs	3	$350	$1,050	$1,050
	Haul and place coverburden cover from nearby	Cat 235 Excavator	hrs	20	$250	$5,000	
		Haul Truck D250E	hrs	20	$250	$5,000	
		D9H Dozer	hrs	6	$350	$2,100	$12,100
	Project Management & Engineering	7% of Total Cost	%		7.00%	$1,341	$1,341
	Subtotal:						**$20,491**
11.6	**Solid Waste Facility**						
	Prepare detailed closure plan	Misc	l.s.		$2,000	$2,000	$2,000
	Characterize final waste area	Misc	l.s.		$2,000	$2,000	$2,000
	Remove recyclables and special waste materials	Tractor Trailer (lowbed)	hrs	40	$160	$6,400	$6,400
	Recontour	D9H Dozer	hrs	2	$350	$700	$700
	Haul and cover with adjacent fill and place overburden cap	Cat 235 Excavator	hrs	20	$250	$5,000	
		Haul Truck D250E	hrs	20	$250	$5,000	
	Compaction of cover	D9H Dozer	hrs	6	$350	$2,100	$12,100
	Project Management & Engineering	7% of Total Cost	%		7.00%	$1,624	$1,624
	Subtotal:						**$24,824**
11.7	**Site Roads**						
	Recontour	Cat 235 Excavator	hrs	**37.5**	$250	$9,375	$9,375
	Scarify	Cat 16H Grader	hrs	**50**	$250	$12,500	$12,500
	Project Management & Engineering	7% of Total Cost	%		7.00%	$1,531	$1,531
	Subtotal:						**$23,406**
Total Estimated Cost in Reclaiming Miscellaneous Sites and Facilities							**$383,373**

Note:

Table 8-12

Reclamation Research and Revegetation, Estimated Closure Costs - 2013

Item No.	Work Item Description	Units	Quantity	Unit Rates	Cost	Total
12.1	**REVEGETATION ACTIVITIES**					
12.1.0	**Determination of Revegetation Plan for Current Site**					
	Issuance of a plan for all site areas for regulatory review and approval	Misc	1		$20,000	$20,000
	Sub-Total					**$20,000**
12.1.1	**Main and Southwest Dumps (total surface area of 102.1 ha)**					
	Seed and fertilize w/ labour	ha	107.3	$2,500	$268,250	
	Re-seed and fertilize (1/2 of total area)	ha	53.7	$2,500	$134,125	
	Re-forest	ha	107.3	$1,750	$187,775	$590,150
	Sub-Total					**$590,150**
12.1.2	**Ice-Rich Overburden Dump (toe berm surface area of 6.1ha)**					
	Seed and fertilize w/ labour	ha	6.1	$2,500	$15,250	
	Re-seed and fertilize (1/2 of total area)	ha	3.1	$2,500	$7,625	
	Re-forest	ha	6.1	$1,750	$10,675	$33,550
	Sub-Total					**$33,550**
12.1.3	**Reclamation Overburden Dump (total surface area of 31.8 ha)**					
	Seed and fertilize w/ labour	ha	31.8	$2,500	$79,500	
	Re-seed and fertilize (1/2 of total area)	ha	15.9	$2,500	$39,750	
	Re-forest	ha	31.8	$1,750	$55,650	$174,900
	Sub-Total					**$174,900**
12.1.4	**Ore Stockpiles and Pads (final total surface area of 31.6 ha)**					
	Seed and fertilize w/ labour	ha	31.6	$2,500	$79,000	
	Re-seed and fertilize (1/2 of total area)	ha	15.8	$2,500	$39,500	
	Re-forest	ha	31.6	$1,750	$55,300	$173,800
	Sub-Total					**$173,800**
12.1.5	**Mill Valley Fill and DSTF Front Face (disturbed area of 23.9 ha)**					
	Seed and fertilize w/ labour	ha	23.9	$2,500	$59,750	
	Re-seed and fertilize (1/2 of total area)	ha	12.0	$2,500	$29,875	
	Re-forest	ha	23.9	$1,750	$41,825	$131,450
	Sub-Total					**$131,450**
12.1.6	**Contractor's Shop and Office Area (disturbed area of 2.5 ha)**					
	Seed and fertilize w/ labour	ha	2.5	$2,500	$6,250	
	Re-seed and fertilize (1/2 of total area)	ha	1.3	$2,500	$3,125	
	Re-forest	ha	2.5	$1,750	$4,375	$13,750
	Sub-Total					**$13,750**
12.1.7	**Tailings Surface Area (current disturbed area of 20.9 ha)**					
	Seed and fertilize w/ labour	ha	30.2	$2,500	$75,500	
	Re-seed and fertilize (1/2 of total area)	ha	15.1	$2,500	$37,750	
	Re-forest	ha	30.2	$1,750	$52,850	$166,100
	Sub-Total					**$166,100**
12.1.8	**Water Storage Pond Dam (total dam surface area 3.3 ha)**					
	Seed and fertilize w/ labour	ha	3.3	$2,500	$8,250	
	Re-seed and fertilize (1/2 of total area)	ha	1.7	$2,500	$4,125	
	Re-forest	ha	3.3	$1,750	$5,775	$18,150
	Sub-Total					**$18,150**
12.1.9	**Mill Area (total surface area of 7.6 ha)**					
	Seed and Fertilize w/ labour	ha	10.8	$2,500	$27,000	
	Re-seed and fertilize (1/2 of total area)	ha	5.4	$2,500	$13,500	
	Re-forest	ha	10.8	$1,750	$18,900	$59,400
	Subtotal:					**$59,400**
12.1.10	**Haul Road (total surface area of 15 ha)**					
		ha	15.0	$2,500	$37,500	**$37,500**
12.1.11	**Underground Portal Excavation (total surface area of 6.1 ha)**					
	Seed and Fertilize w/ labour	ha	6.1	$2,500	$15,250	
	Re-seed and fertilize (1/2 of total area)	ha	3.1	$2,500	$7,625	
	Re-forest	ha	6.1	$1,750	$10,675	$33,550
	Subtotal:					**$33,550**
12.1.12	**Miscellaneous Sites - Camp, Airstrip, Waste Facilities, Explosives Site (area for reclamation of 14 ha)**					
	Seed and fertilize w/ labour	ha	14.0	$2,500	$35,000	
	Re-seed and fertilize (1/2 of total area)	ha	7.0	$2,500	$17,500	
	Re-forest	ha	14.0	$1,750	$24,500	$77,000
	Subtotal:					**$77,000**
12.1.13	**Access Road**					
	Scenario 1 - No Deactivation					
	No revegetation					
	Subtotal:					**$0**
	Scenario 2 - Deactivate from Minto Creek to Mine Site (11 km)					
	Revegetate and fertilize banks at culvert excavations, including labour	ha	2.0	$2,500	$5,000	$5,000
	Subtotal:					**$5,000**
	Scenario 3 - Deactivate Entire Road (27 km)					
	Hydroseed roadside banks & slopes (~0.25ha per km of road, along 50% of its length)	ha	3.4	$4,000	$13,600	$13,600
	Revegetate and fertilize banks at culvert excavations, including labour	ha	6.0	$2,500	$15,000	$15,000
	Subtotal:					**$28,600**

Total Estimated Cost for Reclamation Research and Revegetation		
	Scenario 1 - No Access Road Deactivation	**$1,529,300**
	Scenario 2 - Deactivate Access Road from Minto Creek to Mine Site	**$1,534,300**
	Scenario 3 - Deactivate Entire Access Road	**$1,557,900**

Note:

Table 8-13
Site Management and Monitoring, Estimated Closure Costs - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
	SITE MANAGEMENT						
13.1	**Onsite Management**						
	Project Management and Engineering - Included in PME Costs in each Closure Component						
	Pickup truck	Light truck	monthly	50	$2,500	$125,000	$125,000
	Sundry equipment maintenance	Unit Cost Basis	yearly	10	$5,000	$50,000	$50,000
	Power and heat	Unit Cost Basis	monthly	30	$5,500	$165,000	$165,000
	General Administrative expenses	Unit Cost Basis	monthly	50	$2,000	$100,000	$100,000
	Camp Costs (5 year period)	Unit Cost Basis	man-day	6,138	$70	$429,660	$429,660
	Subtotal:						**$869,660**
13.2	**Transport Costs**						
	Employee transport costs	Unit Cost Basis	monthly	50	$3,000	$150,000	$150,000
	Barge operating costs	Unit Cost Basis	monthly	20	$10,000	$200,000	$200,000
	Subtotal:						**$350,000**
13.3	**Water Treatment**						
	Labour - Water Treatment Operators (5 years @ 4 mo/yr)	Unit Cost Basis	monthly	20	$31,584	$631,680	$631,680
	Cost per cubic metre of compliant water (5 years @ 360,000 m3/yr)		cu.m	1,800,000	$1.38	$2,484,000	$2,484,000
	Subtotal:						**$3,115,680**
13.4	**Water Quality Monitoring (Post Mine Closure) (50:50 sampling labour/analyses costs split) & Reporting**						
	Years 1-5 (monthly during open season)	Misc.	monthly	30	$4,000	$120,000	
	Years 6-10 (quarterly - spring/summer/fall)	Misc.	quarterly	15	$4,000	$60,000	
	Years 11-15 (once annually - post spring freshet)	Misc.	yearly	5	$4,000	$20,000	$200,000
	Disbursements (non-labour/non-analytical)	Misc.	yearly	15	$4,000	$60,000	$60,000
	LTF Monitoring and Maintenance (years 1-5)	Misc.	yearly	5	$4,000	$20,000	$20,000
	Enhanced Groundwater/Foundation monitoring below DSTF and Waste Rock Dumps	Misc.	yearly	15	$15,000	$225,000	$225,000
	Geo-technical Inspections (annually yrs 1-5, bi-annual yrs 6-15)	Misc.	each	10	$15,000	$150,000	$150,000
	Reclamation Inspections (annually yrs 1-5, bi-annual yrs 6-15)	Misc.	each	10	$7,500	$75,000	$75,000
	Biological Monitoring - Closure implementation	Misc.	l.s.	1	$10,000	$10,000	
	Years 1-5 (Annually)	Misc.	yearly	5	$4,000	$20,000	
	Years 6-10 (Annually)	Misc.	yearly	5	$4,000	$20,000	
	Years 11-15 (Every two years)	Misc.	bi-annual	3	$3,500	$10,500	$60,500
	Subtotal:						**$790,500**
13.5	**Post Closure Maintenance - Water Storage Pond Dam**						
	Monitoring of piezometers, thermistors						
	Years 1-5 (quarterly)	Misc.	quarterly	20	$3,000	$60,000	
	Years 6-10 (bi-annually)	Misc.	bi-annually	8	$3,000	$24,000	
	Years 11-15 (annually)	Misc.	annual	5	$2,500	$12,500	
	Annual Inspection + report	Misc.	annual	15	$3,000	$45,000	
	Carry out inspection recommendations/maintenance	Misc.	annual	15	$10,000	$150,000	$291,500
	Misc. maintenance work related to the site after closure (Yr1-5)	Misc.	yearly	5	$10,000	$50,000	$50,000
	Misc. maintenance work related to the site after closure (Yr6-15)	Misc.	per year	10	$5,000	$50,000	$50,000
	Subtotal:						**$391,500**
13.6	**Ultimate Removal of wells and instrumentation**	Misc.	unit basis		$15,000		**$15,000**
Total Estimated Cost for Post Closure Site Management							**$1,626,160**

Note:

Itemss13.3 and 13.4 are used under scenarios with no long term operations and are therefore not included in the Total cost calculation on this woorksheet. In scenarios where long term operations are to be included, costs for water treatment and monitoring are calculated seperately with a NPV. This calculation is found on a separate worksheet.

Table 8-14
Supporting Studies - 2013

Item No.	Work Item Description	Equipment / Labour	Units	Quantity	Unit Rates	Cost	Total
14.1	**Permafrost Foundation Monitoring**						
14.1.1	Enhanced subsurface monitoring program in and below waste rock dumps (WRD)						
	Preparing detailed monitoring program	Misc.	l.s.	1	$8,000	$8,000	
	Enhanced Adaptive Management Plan for WRD	Misc.	l.s.	1	$8,000	$8,000	$8,000
14.1.2	Enhanced subsurface monitoring program in and below DSTSF						
	Preparing detailed monitoring program	Misc.	l.s.	1	$4,000	$4,000	
	Enhanced Adaptive Management Plan for DSTSF	Misc.	l.s.	1	$4,000	$4,000	$4,000
	Sub-Total						**$12,000**
14.2	**Kinetic Tailings and Waste Rock Materials Testing**						
14.2.1	Monitoring program and field test to enhance long term water quality prediction related to drystack tailings facility and materials in WRDs						
	preparing composite sample over several months of production	Misc.	l.s.	1	$5,000	$5,000	
	undertaking field test	Misc.	l.s.	1	$12,000	$12,000	
	initiate parallel laboratory analysis	Misc.	l.s.	1	$10,000	$10,000	
	monitoring field apparatus (columns)	Misc.	l.s.	1	$4,000	$4,000	
	reporting	Misc.	l.s.	1	$5,000	$5,000	$36,000
	Sub-Total						**$36,000**
14.3	**Other Adaptive Management Plans Required**						
	Changes in WTP input water quality or quantity	Misc.	l.s.	1	$22,500	$22,500	$22,500
	Sludge Management Plan - for material from WTP	Misc.	l.s.	1	$15,000	$15,000	$15,000
	Site testing ML ARD	Misc.	l.s.	1	$45,000	$45,000	$45,000
	Groundwater Management Plan	Misc.	l.s.	1	$15,000	$15,000	$15,000
	Long term reclamation of contaminated soils	Misc.	l.s.	1	$22,500	$22,500	$22,500
	Physical Monitoring program - prior to closure	Misc.	l.s.	1	$60,000	$60,000	$60,000
	Modeling of pit lake water qualities prior to flooding	Misc.	l.s.	1	$22,500	$22,500	$22,500
	Sub-Total						**$202,500**
14.4	**Closure Specific Studies and Field Trials**						
	Main Site Discharge Channel Geotechnical Design and Stability Evaluation	Engineering/Design	l.s.	1	$30,000	$30,000	$30,000
	Passive Treatment Evaluations	Engineering/Design	l.s.	1	$100,000	$100,000	$100,000
	Engineered Cover Evaluations	Engineering/Design	l.s.	1	$75,000	$75,000	$75,000
	Site contamination surveys (pre $35K, post $20K)		l.s.	1	$55,000	$55,000	$55,000
	Sub-Total						**$260,000**
Total Estimated Cost for Supporting Studies							**$510,500**

Note:

9 LIMITATIONS OF REPORT

This report was prepared for the exclusive use of Minto Explorations Ltd.. Access Mining Consultants Ltd. (doing business as Access Consulting Group) has attempted to exercise professional procedures while providing reclamation services to prepare the contents of this report. The material in the report reflects Access Consulting Group's best judgment in light of the information available at the time of the preparation of this report. Any use that a third party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of the third parties. Access Consulting Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. Access Consulting Group believes that the contents of this report are substantively correct.

Although every effort has been made to confirm that all such information and data is factual, complete and accurate, Access Consulting Group offers no guarantees or warranties, either expressed or implied, with respect to such information or data.

10 REFERENCES

Access Consulting Group, 2013. Minto Ecosystem and Vegetation Baseline Report. Prepared for Minto Explorations Ltd, Vancouver, BC.

Access Consulting Group (ACG), 2013a. Minto Climate Baseline Report.

Bastian, R.K. and D.A. Hammer. 1993. The use of constructed wetlands for wastewater treatment and recycling. In: G.A. Moshiri (Ed.), Constructed Wetlands for Water Quality Improvement, Lewis Publishers, Boca Raton, FL, pp. 59-68.

Bastian, R.K., P.E. Shanaghan, and B.P. Thompson. 1989. Use of wetlands for municipal wastewater treatment disposal – regulatory issues and EPA policies. In: D.A. Hammer (Ed.), Constructed Wetlands for Wastewater Treatment. Lewis Publishers, Chelsea, MI, pp. 265-278.

Boyd, J., O. McDonald, D. Hatcher, R.J. Portier, and R.B. Conway. 1993. Interfacing constructed wetlands with traditional wastewater biotreatment systems. In: G.A. Moshiri (Ed.), Constructed Wetlands for Water Quality Improvement, Lewis Publishers, Boca Raton, FL, pp. 453-459.

Brodie, G.A. 1993. Staged, aerobic constructed wetlands to treat acid drainage: Case history of Fabius Impoundment 1 and overview of the Tennessee Valley Authority's program. In: G.A. Moshiri (Ed.), Constructed Wetlands for Water Quality Improvement, Lewis Publishers, Boca Raton, FL, pp. 157-165.

Clearwater Consultants Ltd, 2010. Minto Mine – Site Water Balance Update 2010. Prepared for Minto Explorations Ltd, Vancouver, BC.

Davies, T.H. and P.D. Cottingham. 1994. The use of constructed wetlands for treating industrial effluent (textile dyes). Water Sci. Technol. 29(4):227-232.

Dunbabin, J.R. and K.H. Browmer. 1992. Potential use of constructed wetlands for treatment of industrial wastewaters containing metals. Sci. Total Environ. 111:151-168.

Eger, F. G. Melchert, D. Antonson, and J. Wagner. 1993. The use of wetland treatment to remove trace metals from mine drainage In: G.A. Moshiri (Ed.), Constructed Wetlands for Water Quality Improvement, Lewis Publishers, Boca Raton, FL, pp. 171-178.

Eger, P., & J. Wagner. 2003. *Wetland Treatment Systems: How long will they really work?* Minnesota Department of Natural Resources.

EBA Engineering Consultants Ltd, 2011. Upstream Water Management for the Mill Valley Fill Expansion and Dry Stack Tailings Storage Facility – Minto Mine, YT. Prepared for Minto Explorations Ltd, Vancouver, BC.

EBA Engineering Consultants Ltd, 2010a. Phase IV Waste Management Plan – Minto Mine, YT. Prepared for Minto Explorations Ltd, Vancouver, BC.

EBA Engineering Consultants Ltd, 2010b. Phase IV Tailings Management Plan – Minto Mine, YT. Prepared for Minto Explorations Ltd, Vancouver, BC.

EBA Engineering Consultants Ltd, 2010c. Minto Mine 2010 Climate Baseline Report. Report prepared for Minto Exploration Inc. 14pp.

EBA Engineering Consultants Ltd, 2008a. Geotechnical Design, Proposed Southwest Waste Dump, Minto Mine, Yukon. Prepared for Minto Explorations Ltd, Vancouver, BC.

EBA Engineering Consultants Ltd, 2008b. Geotechnical Design, Proposed Reclamation Overburden Dump, Minto Mine, Yukon. Prepared for Minto Explorations Ltd, Vancouver, BC.

EBA Engineering Consultants Ltd, 2007. Geotechnical Design Report, Dry Stack Tailings Storage Facility, Minto Mine, Yukon. Prepared for Minto Explorations Ltd, Vancouver, BC.

EBA Engineering Consultants Ltd, 2006. Geotechnical Design, Ice-Rich Overburden Dump, Minto Mine, Yukon. Prepared for Sherwood Mining Corporation, Vancouver, BC.

EBA Engineering Consultants Ltd, 1998. Geotechnical Evaluation, Proposed Main Waste Dump, Minto Project, Yukon Territory. Prepared for Sherwood Mining Corporation, Vancouver, BC.

EBA Engineering Consultants Ltd, 1997. Final Preliminary Design – Mill Water Pond, Minto Property, Yukon Territory. Prepared for Sherwood Mining Corporation, Vancouver, BC.

EBA Engineering Consultants Ltd, 1996. Waste Rock Stability Evaluation, Minto Project, Yukon Territory. Prepared for Sherwood Mining Corporation, Vancouver, BC.

[EBA/ACG] EBA Engineering Consultants Ltd. and Access Consulting Group, 2011. Minto Mine Decommissioning and Reclamation Plan Rev.3.2. Prepared for Minto Explorations Ltd.

Ferlow, D.L. 1993. Stormwater runoff retention and renovation: A black lot function or integral part of the landscape? In: G.A. Moshiri (Ed.), Constructed Wetlands for Water Quality Improvement, Lewis Publishers, Boca Raton, FL. pp 373-379.

Gammons, C., & Frandsen, A. 2001. Fate and Transport of metals in H2S-rich waters at a treatment wetland. *Geochemical Transactions. 2*(1):1-15.

Gillespie, W.B. Jr., W.B. Hawkins, J.H. Rodgers, Jr., M.L. Cano, and P.B. Dorn. 2000. Transfer and transformations of zinc in constructed wetlands: Mitigation of a refinery effluent. Ecol. Eng. 14:279-292.

Gillespie, W.B. Jr., W.B. Hawkins, J.H. Rodgers, Jr., M.L. Cano, and P.B. Dorn. 1999. Transfer and transformations of zinc in flow-through wetland microcosms. Ecotoxicol. Environ. Saf. 43:126-132.

Gusek, J. 2000. Reality Check: Passive Treatment of Mine Drainage an Emerging Technolgy or Proven Methodology? *SME Annual Meeting 28 February–1 March.* Preprint 00-43.

Hammer, D.A. 1989. Constructed Wetlands for Wastewater Treatment: Municipal, Industrial and Agricultural. Lewis Publishers, Inc., Chelsea, MI.

Harrington, J., Gobla, M., Francendese, L., and Bates, E. 2009. Low Cost Treatment of a Highly Contaminated Pit Lake Using Innovative Technology, Barite Hill Mine McCormick, SC.

Hawkins, W.B., J.H. Rodgers, Jr., A.W. Dunn, P.B. Dorn, and M.L. Cano. 1997. Design and construction of wetlands for aqueous transfers and transformations of selected metals. Ecotoxicology and Environment Safety. 36:238-248.

Hedin, R.S., R.W. Nairn, and R.L.P. Kleinmann. 1994. Passive treatment of coal mine drainage. Information Circular 9389, U.S. Bureau of Mines, Pittsburgh, PA. p. 35

Higgins, M.J., C.A. Rock, R. Bouchard, and B. Wengrezynek. 1993. Controlling agricultural runoff by use of constructed wetlands. In: G.A. Moshiri (Ed.), Constructed Wetlands for Water Quality Improvement, Lewis Publishers, Boca Raton, FL, pp 359-367.

Huddleston, G.M., W.B. Gillespie, and J.H. Rodgers, Jr. 2000. Using constructed wetlands to treat biochemical oxygen demand and ammonia associated with a refinery effluent. Ecotoxicology and Environmental Safety. 45:188-193.

[INAP] International Network for Acid Prevention. 2010. Passive treatment technologies. In Global Acid Rock Drainage Guide (GARD Guide) (p. Section 7.5.2). http://www.gardguide.com/.

[INAC] Indian and Northern Affairs Canada. 1992. Mine Reclamation in Northwest Territories and Yukon. Northern Water Resources Studies, Indian and Northern Affairs Canada.

[ITRC] Interstate Technology and Regulatory Council. 2003. Technical and Regulatory Guidance Document for Constructed Treatment Wetlands.

[ITRC] Interstate Technology and Regulatory Council. 2010. Technology Overviews. Retrieved October 24, 2012, from Mining Waste Treatment Technology Selection: http://www.itrcweb.org/miningwaste-guidance/technology_overviews.htm

[ITRC] Interstate Technology and Regulatory Council. 2011. Technical/Regulatory Guidance: Permeable Reactive Barrier: Techniology Update.

[ITRC] Interstate Technology and Regulatory Council. 2012. Mining Waste Treatment Technology Selection: An ITRC Web-based Technical and Regulatory Guidance Document. US EPA Clean Up Information Network.

Kent, D.M. 1994. Applied Wetlands Science and Technology. CRC Press, Inc., Boca Raton, FL.

Kilbourn Inc. 1999. MEND Report 3.14.1: Review of Passive Systems for the Treatment of Acid Mine Drainage. Prepared for Mine Environmental Neutral Drainage (MEND) program.

Litchfield, D.K. and D.D. Schatz. 1989. Constructed wetlands for wastewater treatment at Amoco Oil Company's Mandan, North Dakota Refinery. In: D.A. Hammer (Ed.), Constructed wetlands for wastewater treatment. Lewis Publishers, Chelsea, MI, pp. 233-238.

Mander, U. and P.D. Jenssen, eds. 2002. Constructed wetlands for wastewater treatment in cold climates. WIT Press/ Computational Mechanics, Advances in Ecological Sciences. 11: 344

Mills, C. 1997. An Assessment of the Acid Base Accounting (ABA) and Mineralogical Test Work on Eight Samples from the Proposed Minto Project, Yukon Territory. Vancouver, BC.Minto Explorations Ltd. 2009. Minto Mine - Detailed Decommissioning and Closure Plan Revision 2.

Minto Explorations Ltd., 2006. Minto Mine – Open Pit Design Plan.

Mitsch, W.J. and J.G. Gosslink. 1993. Wetlands, 2nd edition. Van Nostrand Reinhold, New York, NY.

Moore, J.A., S.M. Skarda, and R. Sherwood. 1994. Wetland treatment of pulp mill wastewater. Water Science and Technology. 29(4):241-247.

Moore, M.T., J.H. Rodgers, Jr., C.M. Cooper, and S. Smith. 2000. Constructed wetlands for mitigation of atrazine-associated agricultural runoff. Environmental Pollution 110:393:399.

Moshiri, G.A. (Ed.). 1993. Constructed Wetlands for Water Quality Improvement. Lewis Publishers, Boca Raton, FL.

Pulles, W., & et al. 2004. Development of a high-rate passive sulphate reduction technology for mine waters. Proceedings of IMWA Conference, September 19-23, Newcastle, UK. pp. 253-265.

Rodgers, J.H. Jr., and A. Dunn. 1992. Developing design guidelines for constructed wetlands to remove pesticides from agricultural runoff. Ecol. Eng. 1:88-95.

Sherwood, R. 1992. Wetland treatment. TAPPI Environ. Conf. Proc., Richmond, Va., Book 2, pp. 705-720.

Sinicrope, T.L., R. Langis, R.M. Gersberg, M.J. Busnardo, and J.B. Zedler. 1992. Metal removal by wetland mesocosms subjected to different hydroperiods. Ecol. Eng. 1:309-322.

SRK Consulting Inc. 2009a. Pre-feasibility Geotechnical Evaluation, Phase IV, Minto Mine. Prepared for Minto Explorations Ltd, Vancouver, BC.

SRK Consulting Inc. 2009b. Tailings Risk Assessment - Minto Project, Yukon Territory. Prepared for Minto Explorations Ltd, Vancouver, BC.

SRK Consulting Inc. 2010. Minto Mine Expansion – Phase IV, ML/ARD Assessment and Post-closure Water Quality Prediction. Prepared for Minto Explorations Ltd, Vancouver, BC.

SRK Consulting Inc. 2012a. Memo: Component of Information Request Response #1 to Yukon Water Board, January 2012.

SRK Consulting Inc. 2012b. Memo: Precipitation Analysis for the Minto Mine.

SRK Consulting Inc. 2013a. Scoping Level Cover Assessment for Minto Closure Covers. Prepared for Minto Explorations Lrd, Vancouver, BC.

SRK Consulting Inc. 2013b. Memo: South Diversion Ditch Realignment and Overflow Spillway.

Thut, R.N., 1993. Feasibility of treating pulp mill effluent with a constructed wetland. In: G.A. Moshiri (Ed.), Constructed Wetlands for Water Quality Improvement, Lewis Publishers, Boca Raton, FL, pp. 441-447.

YG, 2006. Yukon Mine Site Reclamation and Closure Policy.

APPENDIX A

MINTO MINE: PHASE V/VI EXPANSION WATER BALANCE AND WATER QUALITY PREDICTION

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Prepared for

Minto Explorations Ltd.

Prepared by

SRK Consulting (Canada) Inc.
1CM002.003
July 2013

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

July 2013

Prepared for

Minto Explorations Ltd.
Suite 900-99 West Hastings Street
Vancouver, BC V6C 2W2

Tel: +1 604 684 8894
Web: www.capstonemining.com

Prepared by

SRK Consulting (Canada) Inc.
2200–1066 West Hastings Street
Vancouver, BC V6E 3X2
Canada

Tel: +1 604 681 4196
Web: www.srk.com

Project No: 1CM002.003

File Name: PhaseV&VI_MLARD_1CM002-003_Report_sjn_dbm_kss_20130705_FNL

Copyright © SRK Consulting (Canada) Inc., 2013

srk consulting

Table of Contents

1 Introduction 7

2 Background 7

2.1 Geological Setting 7

2.1.1 Regional Geology 7

2.1.2 Property Geology and Lithological Description 7

2.1.3 Veining 9

2.2 Deposit Types 9

2.3 Mineralization 10

2.3.1 Mineralization 10

2.3.2 Alteration, Weathering and Oxidation 11

2.4 Exploration and Mining History 13

2.4.1 Pre-production Exploration 13

2.4.2 Initial Phase of Production 13

2.4.3 Exploration During Production 13

2.4.4 Phase IV Overview 13

2.5 Phase V/VI Expansion Plan 15

2.5.1 Phase V/VI Mining 15

2.5.2 Phase V/VI Waste Management 16

2.5.3 Phase V/VI Closure Plan 18

2.6 Geochemical Characterization and Monitoring 19

2.6.1 Mine Rock 19

2.6.2 Tailings 21

3 Methods 22

3.1 Phase V/VI Mine Rock 22

3.1.1 Static Tests 22

3.1.2 Kinetic Testing: Humidity Cell Tests 25

3.1.3 Kinetic Testing: Barrel Tests 28

3.2 Phase V/VI Tailings 29

3.2.1 Static Tests 29

3.2.2 Kinetic Tests – Subaqueous Column Tests 30

4 Results and Discussion 31

4.1 Phase V/VI Mine Rock 31

4.1.1 Static Tests 31

4.1.2 Kinetic Tests 34

4.1.3 Implications for Waste Rock Management 38

4.2 Phase V/VI Tailings 38
4.2.1 Static Test Results 38
4.2.2 Kinetic Tests 39
4.2.3 Implications for Tailings Management 40
5 Source Terms for Minto Creek Water Quality Prediction 41
5.1 Approach 41
5.2 Geochemical Inputs to Water Quality Prediction-Minto Creek 42
5.2.1 Source Terms - Tailings 42
5.2.2 Source Terms- Waste Rock 45
5.2.3 Source Terms- Other Sources 45
6 Source Terms for McGinty Creek Water Quality Prediction 49
6.1 Approach 49
6.2 Conceptual Loading Model 49
6.3 Geochemical Inputs to Water Quality Prediction-McGinty Creek 50
6.3.1 Source Terms 50
7 References 52

List of Tables

Table 3-1: Summary of Phase V/VI Mine Rock Pre-production Static Testing..... 23
Table 3-2: Phase IV/V/VI Humidity Cell Samples 27
Table 3-3: Barrel Test Sample Selection Characteristics 29
Table 4-1: Ridgetop Waste Rock: Summary of Selected Elemental Content from Exploration Assays.... 32
Table 5-1: Source Terms for Nitrogen Species..... 48

List of Figures

Figure 1 Yukon Geology
Figure 2 Regional Geology
Figure 3 General Arrangement, End of Phase IV
Figure 4 General Arrangement, End of Phase V/VI
Figure 5 McGinty Creek Watershed and Proposed Minto North Pit
Figure 6 Plan and Perspective Views of Phase V/VI Underground
Figure 7 Main Pit, Area 2 Pit Operational Monitoring: Results From Off-site ABA Testing
Figure 8 Area 2 (Phase IV) Operational Monitoring: Results From On-site ABA Testing
Figure 9 Tailings Operational Monitoring: ABA Results
Figure 10 Phase V/VI Waste Rock: Sulphide Sulphur vs. Total Sulphur
Figure 11 Phase V/VI Waste Rock: Sulphide Sulphur vs. Copper
Figure 12 Phase V/VI Waste Rock: NP_{TIC} vs. NP
Figure 13 Phase V/VI Waste Rock: NP_{BCR} vs. NP_{TIC}
Figure 14 Phase V/VI Waste Rock: NP_{TIC} vs. AP
Figure 15 Phase V/VI Waste Rock: Sobek NP vs. AP
Figure 16 Humidity Cell Tests: Leachate pH Results
Figure 17 Humidity Cell Tests: Sulphate Release Rates
Figure 18 Humidity Cell Tests: Copper Release Rates
Figure 19 Humidity Cell Tests: Cadmium Release Rates
Figure 20 Humidity Cell Tests: Selenium Release Rates
Figure 21 Field Barrel Tests: Selected Results
Figure 22 Tailings: Sulphide Sulphur vs. Total Sulphur
Figure 23 Tailings: NP_{TIC} vs. NP
Figure 24 Tailings: NP_{TIC} vs. AP
Figure 25 Tailings: Sobek NP vs. AP
Figure 26 DSTSF: Water Quality Monitoring and 2012 Seepage Survey Stations
Figure 27 DSTSF Selected Water Quality Results
Figure 28 MWD and SWD: Water Quality Monitoring and 2012 Seepage Survey Stations
Figure 29 MWD and SWD Selected Water Quality Results
Figure 30 Main Pit: Final Wall
Figure 31 Area 2 Pit: Final Wall
Figure 32 Nitrate, Nitrite and Ammonia Concentrations at W3 and Related Stations

List of Appendices

Appendix A: Memo: Volume Estimate for Phase V/VI NP:AP<3 Waste Rock

Appendix B: Ridgetop Exploration Assay Results: Statistical Summaries

Appendix C: Phase V/VI Waste Rock: Static Test Results

Appendix D: Phase V/VI Waste Rock: Humidity Cell Test Results
- Appendix D1: Sample Origin
- Appendix D2: Static Characteristics
- Appendix D3: Humidity Cell Operating Parameters
- Appendix D4: Phase V/VI HCT Results: Tables
- Appendix D5: Phase V/VI HCT Results: Charts- Release Rates

Appendix E: On-Site Waste Rock Barrel Test Results

Appendix F: Phase V/VI Tailings: Static Test Results

Appendix G: Phase V/VI Tailings: Saturated Column Test Results
- Appendix G1: Sample Origin
- Appendix G2: Saturated Column Operating Parameters
- Appendix G3: Phase V/VI Tailings Saturated Column Test Results: Tables
- Appendix G4: Phase V/VI Tailings Saturated Column Test Results: Charts

Appendix H: Source Terms for Use as Inputs to Water Quality Predictions: Minto Creek

Appendix I: Source Terms for Use as Inputs to Water Quality Predictions: McGinty Creek

List of Abbreviations

Types of Tests:

HCT	Humidity Cell Test

Acid Base Accounting:

ABA	Acid Base Accounting
NP	Neutralization Potential
AP	Acid Potential
TIC	Total Inorganic Carbon
NP_{TIC}	Neutralization Potential derived from Total Inorganic Carbon content
NP_{BCR}	Neutralization Potential determined by the BC Research Method
NPR	Neutralization Potential Ratio (NP:AP)
NPR_{TIC}	Neutralization Potential Ratio derived from NP_{TIC}:AP
PAG	Potentially Acid Generating
ARD	Acid Rock Drainage
S(T)	Total sulphur
$S(S^{2-})$	Sulphide sulphur
$S(SO_4)$	Sulphate sulphur

Water Quality Predictions:

WLB	Water and Load Balance

Mine Site Facilities:

DSTSF	Dry Stack Tailings Storage Facility
MWD	Main Waste Dump
MWDE	Main Waste Dump Expansion
SWD	Southwest Waste Dump
RWD	Ridgetop Waste Dump
MVF	Mill Valley Fill
MVFE	Mill Valley Fill Expansion

1 Introduction

As part of plans to expand the Minto Mine, Minto Explorations Ltd. (Minto) asked SRK to carry out an assessment of the metal leaching and acid rock drainage (ML/ARD) potential of the waste rock and tailings that will be produced during mining of new deposits. This report covers ML/ARD assessment of the Minto Mine Expansion- Phase V/VI, which consists of open pit mining of near-surface portions of the Area 2, Ridgetop, and Minto North deposits, and underground exploration and mining of related mineralization at greater depths. Finally, this report also describes the derivation of geochemical source terms that have been used in developing Phase V/VI water quality predictions.

2 Background

2.1 Geological Setting

Section 2.1 is adapted from Section 7 of Minto (2012).

2.1.1 Regional Geology

The Minto Project is found in the north-northwest trending Carmacks Copper Belt along the eastern margin of the Yukon-Tanana Composite Terrain, which is comprised of several metamorphic assemblages and batholiths (Figure 1). The Belt is host to several intrusion-related Cu-Au mineralized hydrothermal systems. The Yukon-Tanana Composite Terrain is the easternmost and largest of the pericratonic terranes accreted to the Paleozoic northwestern margin of North America (e.g., Colpron et al., 2005). It is regarded to be the product of a continental arc and back-arc system, preserving meta-igneous and metasedimentary rocks of Permian age on top of a pre-Late Devonian metasedimentary basement (e.g., Piercey et al. 2002).

The Minto Property and surrounding area are underlain by plutonic rocks of the Granite Mountain Batholith (Early Mesozoic Age) (Figure 2) that have intruded into the Yukon-Tanana Composite Terrain. They vary in composition from quartz diorite and granodiorite to quartz monzonite. The batholith is unconformably overlain by clastic sedimentary rocks thought to be the Tantalus Formation and andesitic to basaltic volcanic rocks of the Carmacks Group. Both are assigned a Late Cretaceous age. Immediately flanking the Granite Mountain Batholith to the east is a package of undated mafic volcanic rocks which outcrop in the banks of the Yukon River. The structural relationship between the batholith and the undated mafic volcanics is poorly understood because the contact zone is not exposed.

2.1.2 Property Geology and Lithological Description

Much of the geological understanding of the rock around the Minto deposits is based on observations from diamond drill core and extrapolation from regional observations. The reason for this is poor outcrop exposure(less than 5% coverage), as well as the deep weathering and oxidation of the exposed outcrop. The terrain was not glaciated during the last ice age event.

The hypogene copper sulphide mineralization at Minto is hosted wholly within the Minto pluton, which intrudes near the boundary between the Stikinia and Yukon-Tanana terrains, however since the contact is not exposed it is unclear if the pluton stitches the two terrains. The Minto pluton is predominantly of granodiorite composition. Hood et al. (2008) distinguish three varieties of the intrusive rocks in the pluton. The first variety is a megacrystic K-feldspar granodiorite. It gradually ranges in mineralogy to quartz diorite and rarely to quartz monzonite or granite, typically maintaining a massive igneous texture. An exception occurs locally where weakly to strongly foliated granodiorite is seen in distinct sub-parallel zones several metres to tens of metres thick.

A second variety of igneous rock is a folded quartzofeldspathic gneiss with centimeter-thick compositional layering and folded by centimetre to decimetre-scale disharmonic, gentle to isoclinal folds (Hood et al., 2008). The third variety of intrusive is a biotite-rich gneiss. Minto geologists consider all units to be similar in origin and are variously deformed equivalents of the same intrusion.

Copper sulphide mineralization is found in the rocks that have a structurally imposed fabric, ranging from a weak foliation to strongly developed gneissic banding. For this reason all core logging by the past and present operators separates the foliated to gneissic textured granodiorite as a distinctly discernable unit. It is generally believed by Minto geologists that this foliated granodiorite is the variably strained equivalent of the two primary granodiorite textures and not a separate lithology.

The contact relationship between the foliated deformation zones and the massive phases of granodiorite is generally very sharp. These contacts do not exhibit chilled margins and are considered by Minto geologists to be structural in nature, separating the variably strained equivalents of the same rock type. Tafti and Mortensen (2004) had interpreted the sharp contacts to be zones of deformed rock within the unfoliated rock (i.e rafts or roof pendants). Supergene mineralization occurs proximal to near-surface extensions of primary mineralization.

Conglomerate and volcanic flows have been logged in drill core by past operators. New drilling has confirmed the presence of conglomerate, but not the volcanic flows. The latter cannot be confirmed by the authors as the drill core from historic campaigns was largely destroyed in forest fires and no new drilling has intersected such rocks. However, undated volcanic rocks are mapped by Hood, near the southwest margin of the property, south of a fault that is inferred from geophysics to separate them from the Jurassic Age intrusive rocks. The conglomerate has been dated (unpublished date pers. com. Dr. Maurice Colpron- Yukon Geological Survey) as Cretaceous Age. It is now recognized as an outcrop within a borrow pit exposure located west of the airstrip as well as in numerous recent drill holes. Observations of foliated and even copper mineralized cobbles in drilling indicate that “Minto-type” mineralization was exposed, eroded and reincorporated in sedimentary deposits by the Cretaceous Age.

Other rock types, albeit volumetrically insignificant, include dykes of simple quartz-feldspar pegmatite, aplite; and an aphanitic textured intermediate composition rock. Bodies of all of these units are relatively thin and rarely exceed the one meter core intersections. These dykes are relatively late, and observed contact relationships suggest they generally postdate the peak

ductile deformation event; however some pegmatite and aplite bodies observed in a rock cut located north of the mill complex are openly folded.

It is unclear if this folding is contemporaneous with foliation development in the deformed rocks or post-dates the foliation development. Observations from drill core and open cut benches in the mine show examples where the foliation and the pegmatitic/aplitic intrusions are both folded, as well as examples where the intrusions are not folded, suggesting two populations of minor dykes.

2.1.3 Veining

Veins in the Minto Deposit appear to have been emplaced after the copper sulphide mineralization and are therefore not economically significant. The most common veins are very narrow (less than 30 cm) steeply dipping, simple quartz-feldspar pegmatite veins that often contain cavities that are indicative of shallow emplacement. The veins crosscut foliation in the deformation zones and the sulphide mineralization, and this cross-cutting is interpreted to be evidence of their post-sulphide mineral emplacement. Other types of late veins found in the deposit include thin (less than 2 mm) calcite, epidote, hematite and gypsum stringers, and fracture coatings. Quartz veining is extremely rare and economically insignificant.

2.2 Deposit Types

Section 2.2 is adapted from Section 8 of Minto (2012).

The host rocks to the Minto deposit were emplaced in a deep batholitic setting (exceeding 9 km deep to perhaps as much as 18-20 km deep), which is not considered to be the typical porphyry environment. The host is a moderately oxidized magma (Tafti and Mortensen, 2004) with widespread iron oxide (magnetite and hematite) mineralization. At least some of the hematite is supergene in origin but it is unclear if some hematite is also primary. There are very strong structural controls on ore mineral emplacement and there is no apparent genetic link to a specific phase of intrusion. Typical porphyry-type alteration zoning such as widespread propylitization, argillization, barren silicic core, or large barren pyritic halo are not recognized. Stockwork style, fracture or vein mineralization is also not present.

Minto geologists have been advised (in personal communications) that some examples of IOCG mineralization exhibit some similar characteristics and setting to Minto including Copperstone in Arizona, Candelaria in Chile, and Ernest Henry in Australia (Williams et al., 2005). From a genetic and structural prospective, albeit not size wise, the Sossego Deposit in Brazil may be a reasonable analog. While an IOCG origin for the Minto Deposit cannot be unequivocally demonstrated, Minto geologists are of the opinion that this style of deposit provides the most consistent model for their current level of understanding. However, the unique nature of this mineralization style and apparent lack of close analogs elsewhere suggests the Minto Copper-Gold deposits may represent an unrecognized mineral deposit type.

2.3 Mineralization

Section 0 is adapted from Section 7 of Minto (2012).

2.3.1 Mineralization

The Minto deposits have essentially no surface exposure with the exception of minimal exposure in historical trenches of the shallow partially oxidized zones associated with the Ridgetop deposit. Observations for the deposits are therefore based almost entirely on hand-specimen and petrographic studies of drill core. The primary hypogene sulphide mineralization consists of chalcopyrite, bornite, euhedral chalcocite, and minor pyrite. Metallurgical testing also indicates the presence of covellite, although this sulphide species has never been positively logged macroscopically. Texturally, sulphide minerals predominantly occur as disseminations and foliaform stringers along foliation planes in the deformed granodiorite (i.e. sulphide stringers tend to follow the foliation planes). However, sulphide mineral content tends to increase where this foliation is disrupted by intense folding. In addition, semi-massive to massive mineralization is also observed; this style of mineralization tends to obliterate the foliation altogether. Silver telluride (hessite) is observed in polished samples but has not been logged macroscopically. Native gold and electrum have both been reported as inclusions within bornite and accounts for the high gold recoveries in test copper concentrates. Occasionally, coarse free gold is observed associated with chloritic or epidote lined fractures that cross-cut the sulphide mineralization. The free gold may be due to secondary enrichment during a later hydrothermal process overprinting the main copper sulphide-gold event. Sulphide mineralization is almost always accompanied by variable amounts of magnetite mineralization and biotite alteration. While these minerals occur in the non-deformed rocks they are present in the mineralized horizons in a much greater abundance in the range of an order of magnitude greater than background.

The Minto Main deposit exhibits crude zoning from west to east. The bornite zone is dominant in the west while a thicker, lower grade chalcopyrite zone is dominant on the east side of the deposit. The bornite zone is defined by the metallic mineral assemblage magnetite-chalcopyrite-bornite. Bornite mineralization is conspicuous, but chalcopyrite is the dominant sulphide species. Stringers and massive lenses of chalcopyrite with various quantities of bornite are typical. Massive mineralization occurs locally over intervals exceeding 0.5 m in thickness and semi-massive mineralization over several metres in thickness may occur. In these sulphide rich areas, textures often resemble those seen in magmatic sulphide zones with sulphide mineralization interstitial to the rock forming silicate minerals. The higher grade portion of the Minto Main deposits roughly corresponds to the bornite zone. Local concentrations of bornite of up to 8% are seen. The precious metal grades are elevated in the bornite zone (very fine gold and electrum occur as inclusions in bornite) and occurrences of coarse grained native gold are noted almost exclusively in bornite-rich material. The chalcopyrite zone is characterized by the metallic mineral assemblage of chalcopyrite-pyrite ± very minor bornite and magnetite.

Empirical observations indicate the highest concentrations of bornite are associated with coarse grained, disseminated and stringer-style magnetite mineralization, up to 20% by volume locally. The stringers of magnetite are often folded or boudinaged, suggesting that at least some of the magnetite mineralization predates peak ductile deformation.

Sulphide mineralization on the other hand, shows both evidence and absence of ductile deformation locally and is interpreted to have formed contemporaneous with, or late in the ductile deformation history.

The Minto North and Minto East Deposits also exhibit a zoning from west to east. High-grade bornite-dominant mineralization is observed in the west with lower grade chalcopyrite-dominant mineralization in the east. The bornite zone is defined by the metallic mineral assemblage bornite-magnetite-chalcopyrite. Bornite mineralization occurs as strong disseminations and foliaform stringers locally >10% to occasional semi-massive to massive lenses up to 2 m in thickness. Chalcopyrite concentrations are typically within the 1 to 2% range, but locally can reach concentrations of 10%. Precious metal grades are elevated in the bornite zone, and visible gold has been observed on occasion.

Mineralization at the Area 2/118/Copper Keel resource sub-domains is distinct in that mineralization is predominantly disseminated (plus occasional foliaform stringers) and that semimassive to massive sulphide mineralization is absent; as a whole, the mineralization is more homogenous and consistent as compared to Minto Main and Minto North. The primary mineral assemblage in the Area 2/118/Copper Keel resource sub-domains includes chalcopyrite-bornite-magnetite with minor amounts of pyrite; and a crude zoning is present in that the higher grade northern half of the Minto South Deposit shows increased bornite concentrations up to 8% locally.

Mineralization at both the Ridgetop deposit and the Wildfire resource sub-domain are subdivided into the near surface horizons that have been affected by supergene oxidation and the more typical primary sulphide mineralization of the deeper zones. The lower zones are defined by a mineral assemblage of chalcopyrite-magnetite with minor amounts of pyrite. Chalcopyrite is the dominant sulphide in the lower zones, and bornite is only observed in minor amounts. Texturally, chalcopyrite occurs as disseminations and foliaform stringers, and is rarely observed as semimassive to massive bands. Magnetite is coarse grained, disseminated, stringer-style, and can occur in bands up to 0.3 m in thickness, up to 20% volume locally.

These empirical observations of bornite/chalcopyrite relative abundances are supported by a copper and gold grade trend in mineral resources discovered to date where the Ridgetop deposit and the southern extent of the Minto South Deposit sit at the lower grade southern end and Minto North sits at the much higher grade northern end of the currently defined trend.

2.3.2 Alteration, Weathering and Oxidation

Pervasive, strong potassic alteration occurs within the flat lying zones of mineralization, and is the predominant alteration assemblage observed in all of the Minto deposits. The potassic alteration assemblage is characterized by elevated biotite content and minor secondary k-feldspar overgrowth on plagioclase relative to the more massive textured country rock. Biotite concentrations range up to 30 to 70% by volume locally, compared to about 5 to 8% in waste rock. Additional alteration includes the replacement of mafic minerals by secondary chlorite, epidote, or sericite observed both in mineralized and waste rock interstitially or fracture/vein proximal, as well as variable degrees of hematization of feldspars. Uncommon but locally

pervasive sericite-muscovite alteration is observed associated with post-mineral brittle faults; this type of alteration is most common within the Area 2/118 resource sub-domains.

Hematization is the most pervasive at the Minto Main deposit proximal to the DEF fault, whereas in the other deposits it is predominantly fracture controlled within narrow alteration selvages. It is interpreted to be supergene in origin. Minor carbonate overprint is occasionally observed associated with secondary biotite. The contacts between the altered and unaltered rocks are sharp, as are the contacts between mineralized rocks and waste rocks.

Silicification is present but not pervasive nor uniform in distribution in the Minto deposits. At Minto Main, Minto East, and Minto North it is sporadic within the bornite zone (west) and lacking in the chalcopyrite zone (east). Within the Area 2/118/Copper Keel resource sub-domains, silicification intensity is variable in all ore zones. On rare occasions, silicification is pervasive enough to almost entirely overprint both primary and deformation textures (Area 2) while it is essentially absent at Ridgetop and Wildfire. The relationship between silicification and the mineralization is unclear due to inconsistent core logging over three decades, although in most cases higher grade sulphide mineralization is coincident with silicification.

Copper oxide mineralization, like the hematization seen at surface in float, trenches, and in the upper mineralized zones at Ridgetop and Wildfire is the result of supergene oxidation processes. This near surface mineralization represents either the erosion remnants of foliated horizons that are located above the deposits or is vertical remobilization of copper up late brittle faults and fracture zones that intersect primary sulphide mineralization at depth. Chalcocite is the prime mineral in these horizons along with secondary malachite, minor azurite, and rare native copper. The mineralization is found as fracture fill and joint coatings and more rarely interstitial to rock forming silicate minerals.

At the Ridgetop deposit and the Wildfire resource sub-domain, the upper near surface mineralized zones are unique in that the dominant oxide facies mineral is the sulphide chalcocite rather than chalcopyrite or bornite, and it is believed to be a secondary supergene enrichment associated with a paleo water table, or fault proximal oxidation via circulating groundwater. Minor malachite, azurite, remnant chalcopyrite-bornite, and native copper are also present within these near-surface mineralized zones.

Cobbles and pebbles of this supergene chalcocite mineralization in Cretaceous age (unpublished data) conglomerate that unconformably overlies the plutonic rocks of the Granite Mountain Batholith indicate that the upper parts of the Minto System were on surface and being partially oxidized and eroded in the Late Cretaceous.

In addition to the obvious copper oxide minerals, oxidation is also evident by pervasive iron staining (limonite), earthy hematite, clay alteration of feldspars, and a significant loss in bulk density. The degree and distribution of copper oxide minerals appears to be directly related to the depth of the water table. For the most part this is confined to about -30 m (but up to -90 m) beneath the surface and is generally sub parallel with the present topographic surface. The Minto Main zone has experienced relatively little oxidation since it is generally more than 60 m below the surface except at its southern end where it crops out directly beneath unconsolidated

overburden in the Minto Creek Valley. Very locally this oxidation may be drawn deeper along late brittle faults cutting primary sulphide mineralization.

2.4 Exploration and Mining History

2.4.1 Pre-production Exploration

The Minto deposit was first identified during the 1970s through exploration that followed up on a stream sediment anomaly in Minto Creek. Drilling by several operators was carried out during the 1970s, '80s, and '90s, and resulted in the definition of the Minto deposit as a mineable resource.

2.4.2 Initial Phase of Production

The permit to mine the deposit was granted in 1995, and construction began in 1997 only to be halted by an extended period of low copper prices. Minto re-started mine construction in 2005 and commenced production in 2007.

Mining in the Main Pit was carried out by conventional truck and shovel methods. Waste rock was placed initially in the Main Waste Dump (MWD), and later in the Southwest Waste Dump (SWD). Overburden was placed in the Overburden Stockpile. Stockpiles of low grade ore and mixed oxide/sulphide ore were stored in the Blue Stockpile and the Oxide Stockpile, respectively, adjacent to and east of the MWD and west of the Main Pit. All of the stockpiles and dumps noted above are located upgradient of the Main Pit. Ore processing consisted of crushing, grinding and froth flotation. Tailings were dewatered through filtration, hauled, placed and roller-compacted in the Dry Stack Tailings Storage Facility (DSTSF) located southeast (and downgradient) of the Main Pit.

2.4.3 Exploration During Production

Exploration by Minto in the time since construction recommenced in 2005 has identified a number of mineable deposits within the Minto claim block, as well as several prospects that remain the subject of further evaluation. Deposits that have been demonstrated to contain economic reserves to date include Area 2, Area 118, Copper Keel, Wildfire, Ridgetop, Minto East and Minto North. Planning has proceeded to the point that expansion to extract portions of the Area 2 and Area 118 deposits is authorized under the Phase IV expansion. The Phase V/VI expansion proposal (for which this document provides supporting information) seeks authorization to develop additional resources from the Area 2/ Area 118 deposits and to put Copper Keel, Wildfire, Ridgetop, Minto East and Minto North into production.

2.4.4 Phase IV Overview

The Phase IV expansion received final regulatory authorizations in 2012, and the Phase IV mine plan is a key input into the process of planning the next phase of expansion (Phase V/VI). Although the remaining portion of the Phase IV plan will merge with the Phase V/VI mine plan on receipt of Phase V/VI authorizations (thereby make the discrete distinction between Phase IV and Phase V/VI somewhat artificial), it is nevertheless useful to describe selected components of the Phase IV mine plan in advance of the overview of the Phase V/VI.

The Phase IV site components that relate to the management of Phase V/VI waste rock and overburden are shown on the Phase IV plan of arrangement (Figure 3) and briefly described here.

Mill

The mill is located on the north side of the Minto Creek valley east of Main Pit and west of the camp. The mill processes stockpiled and run-of-mine ore at a nominal rate of 3850 tonnes per day and produces slurry tailings that are discharged to Main Pit.

Main Pit

The Main Pit is centered in the Minto Creek valley west of the mill area. It hosted the Minto deposit, which was the first deposit mined at the Minto Mine. Mining in the Main pit ended in April 2011. The tailings management plan for Phase IV entails filling the Main Pit with slurry tailings, the deposition of which began on November 1, 2012.

Area 2 Pit

The Area 2 Pit is located south of the mill area and southeast of the Main Pit. As part of the Phase IV mine plan, the pit is mined in two stages, the first of which was started in April 2011. The second stage, and the final one approved as part of Phase IV, pushes back the walls and deepens the pit; it is expected to be completed in Q1 2014. Once open pit mining of Area 2 Stage 2 is complete, it is scheduled to receive slurry tailings under the final stages of the Phase IV mine plan.

Area 118 Pit

The Area 118 pit is a small pit that is scheduled to be the final open pit mining under the Phase IV mine plan. It will be located uphill and southwest of the Area 2 Stage 2 pit, and is scheduled to be backfilled with waste rock as part of the Phase IV reclamation activities.

Main Waste Dump (MWD)

The MWD is located west of the Main pit, and was the first waste rock storage facility constructed at Minto. The MWD contains waste rock from the initial phases of mining in the Main pit, and is at its original design capacity.

Southwest Waste Dump (SWD)

Construction of the SWD began in March 2009; it has received waste rock continuously since that time, initially from the final stages of mining of the ` pit, and later from mining of Area 2 pit (Stage 1 and Stage 2). Expansions of the dump's height and footprint were permitted as part of Phase IV.

Dry Stack Tailings Storage Facility (DSTSF)

The DSTSF received the mine's tailings output until the licensing of Phase IV authorized Minto to begin using the completed Main pit for tailings storage. Tailings placement in the DSTSF ended on October 31, 2012. The DSTSF contains all tailings from milling of Main pit ore as well as tailings from approximately seven months of milling of Area 2 ore.

Mill Valley Fill Extension (MVFE)

This dump is located at the toe of the DSTSF in the Minto Creek valley, immediately east of the original Mill Valley fill that was constructed early in the mine life to provide space for milling and related activities. Construction of the MVFE was proposed as part of the Phase IV mine plan as a buttress to mitigate the down-slope movement of the DSTSF.

South Wall Buttress (SWB)

The SWB is a rock fill structure that is designed to buttress the south wall of the Main Pit and preserve the remaining volume in the Main pit for tailings, waste rock and water storage purposes. Construction of the SWB began in May 2011 and it has received rock from the Area 2 Stage 2 Pit since that time. It is scheduled for completion to its design capacity during the period of open pit mining under the Phase IV mine plan.

Reclamation Overburden Dump (ROD)

The ROD is located west of the MWD, and contains overburden materials released from both the Area 2 Pit and the Main Pit. The ROD has capacity to store additional overburden material that will be released during Phase V/VI.

2.5 Phase V/VI Expansion Plan

Details of the Phase V/VI expansion plan are provided in the Project Proposal (Minto 2013b). A summary of details that are relevant to the Phase V/VI ML/ARD assessment and water quality prediction are included here for reference.

2.5.1 Phase V/VI Mining

Phase V/VI mining will include open pit components and underground mining components. On receipt of the necessary authorizations by Minto, the remaining components of the Phase IV mine plan will be rolled into the Phase V/VI mine plan, and the following provides a brief description of only those Phase V/VI components that are not currently subject to Phase IV authorizations.

Open pit mining will consist of development of Minto North Pit (MNP), Area 2 Stage 3 Pit (A2S3P), Ridgetop South Pit (RSP) and Ridgetop North Pit (RNP). The pits are scheduled to be mined in the order listed and are shown in Figure 4.

Underground mining will take place via three portals:

- The Minto South Portal is located south of the Area 2 Stage 2 Pit and has been developed as part of Phase IV works. The Minto South Portal will be used to access underground ore reserves in the Minto East zone, the Area 2/ Area 118 zone and Copper Keel zone. Development access will be via decline from the portal.

- The Wildfire Portal will be developed to access the underground ore reserves in the Wildfire zone via a decline. The portal will be located near the Airport Access Road, near the north end of the ridge occupied by the airstrip.

- Portal 3 will be developed to as another access to the underground ore reserves in the Minto East zone via a decline. The portal will be located northwest of the crusher within the existing disturbance footprint.

Both portals will be located at or near the highest elevations of the respective underground workings (with the exception of raises constructed as part of the ventilation system). Figure 6 provides an overview of the underground workings to be developed by the end of Phase V/VI (along with the pit rims for Area 2/Area 118 and Ridgetop North and Ridgetop South pits for spatial reference).

A detailed schedule of Phase V/VI mining and processing activities is included in the Phase V/VI Project Description (Minto 2013b).

2.5.2 Phase V/VI Waste Management

Management of Phase V/VI overburden and waste rock is detailed in the Waste Rock and Overburden Management Plan (Minto 2013c) and management of Phase V/VI tailings is detailed in the Tailings Management Plan (Minto 2013d). Information from these two plans that is relevant to the Phase V/VI ML/ARD assessment and water quality predictions is summarized below.

Waste rock and overburden

Overburden produced during Phase V/VI mining will be used as cover material for concurrent reclamation of completed facilities or stored in one of several locations (Figure 4): Area 118 Backfill Dump; Main Pit Dump; Ridgetop Waste Dump; Ridgetop South Backfill Dump; Reclamation Overburden Dump; Main Waste Dump Expansion.

Bulk waste rock produced during Phase V/VI mining will be stored in several locations as described in the Waste Rock and Overburden Management Plan (the WROMP- (Minto 2013c)). Each location is briefly summarized here for ease of reference.

- Main Waste Dump Expansion

    - The Main Waste Dump will be expanded in Phase V/VI with waste rock and overburden from Minto North. The expansion will increase the footprint area (by 10 ha) and the volume stored (by 4.3 Mm^3 of waste rock and 0.9 Mm^3 of overburden). No segregation of Minto North waste rock is planned.

- Main Pit Dump
    - The Main Pit dump will be constructed on top of the South Wall Buttress. It will receive waste rock and overburden from Area 2 Stage 3 Pit, Ridgetop North Pit, Ridgetop South Pit, and underground development. Planned volumes are 2.7 Mm^3 of bulk waste rock and 0.35 Mm^3 of overburden. The Main Pit Dump footprint is entirely within the existing disturbance area and construction will not result in any incremental disturbance.
- Mill Valley Fill Extension Stage 2
    - The existing Mill Valley Fill Extension (Stage 1) was designed as a buttress to arrest the movement of the slope underlying the DSTSF. Evaluation of whether expansion of the buttress is necessary is in progress; for purposes of environmental assessment, it has been assumed that the buttress will be expanded to the Stage 2 design described in the WROMP. If the MVFE Stage 2 buttress is constructed to the full design extent, it will require 2.9 Mm^3 of bulk waste rock and will create 4.7 ha of new disturbance. It should be noted that any volume placed in the MVFE Stage 2 buttress will reduce the volume of the Main Pit Dump and potentially the Ridgetop Waste Dump.
- Ridgetop Waste Dump
    - The Ridgetop Waste Dump is planned as a new dump to be located on the west side of the ridge hosting the Ridgetop mineralization. This dump has a planned capacity of 3.4 Mm^3 and a total footprint area of 28.8 ha. Topographically, 25.4 ha of the footprint is upgradient of the Main Pit, however the portions of the design footprint that spill over the surface catchment divide to the east will contain. Although there will be minor quantities of overburden placed in this dump, for purposes of environmental assessment is has been assumed that the entire dump volume is composed of bulk waste rock.

Minto will segregate Phase V/VI waste rock based on ABA characteristics using the same approach that has been during Phase IV operations. The Phase IV protocol has adopted the NP:AP value of 3 that is referenced in the site's water use licence as an interim threshold for defining the lower limit of the bulk waste rock category, and Minto plans to carry this interim threshold forward into Phase V/VI waste management practices. Waste rock that is determined to have NP:AP values lower than the threshold value (interim value NP:AP<3) will be stored in locations that will be saturated over the long term. The primary storage location for NP:AP<3 waste rock will be within the Main Pit Tailings Management Facility (TMF) and the Area 2 Pit TMF, with a small portion of NP:AP waste rock stored in underground workings as backfill. The TMFs have been designed with allowance for 20% of Phase V/VI waste rock to be stored under saturated conditions (Minto 2013c and –d). Additional detail on evaluation of the lower threshold value for defining bulk waste rock and on estimation of the quantity of Phase V/VI waster rock requiring saturated storage can be found in Section 4 and in Appendix A.

Underground mining will produce a relatively small volume of waste rock that will be disposed on surface, mostly from initial development prior to availability of mined-out areas underground where waste can be used as backfill. The underground rock slated for surface disposal will be managed using the same protocols as Phase V/VI open pit waste rock.

Tailings

Phase V/VI tailings disposal will continue to follow the Phase IV strategy of hydraulic deposition of tailings slurry into mined out pits. Slurry will be piped to one of three tailings management facilities (TMFs), with anticipated deposition as follows:

- 2013 to Q1 2014: to Main Pit TMF;
- Q1 2014 to Q2 2015: to Area 2 Pit TMF (Stage 2);
- Q2 2015 to Q1 2018: to Main Pit TMF;
- Q1 2018 to Q4 2019: to Ridgetop North Pit TMF;
- Q4 2019 to Q2 2021: to Main Pit TMF;
- Q2 2021 to Q3 2022: Area 2 Pit TMF (Stage 3).

The capacity of the Main Pit TMF will be increased in 2014 by constructing a dam on the east side (the Main Dam). The conceptual design for the Main Dam calls for a low-permeability fine-grained soil core, a final crest elevation of 806m, a full supply level of 804m, development of a tailings beach along the dam and the adjacent south pit wall, a spillway which will route water to the Area 2 Pit in post-closure, and tailings deposition to maximize tailings storage and yield a final post-closure tailings surface that is shaped to allow conveyance of runoff from the upgradient catchment to Area 2 Pit and to provide little to no water storage (SRK 2013a).

2.5.3 Phase V/VI Closure Plan

The preliminary Phase V/VI closure plan (ACG 2013) calls for the following elements that relate to the Phase V/VI water quality predictions.

- Tailings reclamation:
    - The subaerial tailings in the Dry Stack Tailings Storage Facility, the Main Pit TMF and the Ridgetop North Pit TMF will be covered with isolation soil covers.
    - The Area 2 Pit TMF will be flooded and closed as a flow-through pit. Water from both the Main Pit TMF (and its upgradient catchment) and from the subcatchment south of the Area 2 Pit will report through Area 2 Pit. Once the Area 2 Pit fills, there will be greater than 5 m of water over the deposited tailings and waste rock.
- Waste rock reclamation:

- All subaerial waste rock will be covered with isolation soil covers. The main facilities to be covered are the Main Waste Dump, Main Waste Dump Expansion, Southwest Waste Dump, Ridgetop Waste Dump, Main Pit Dump, and the Mill Valley Fill Expansion.

- Water management :
  - Construction of facilities that limit sediment release to lower Minto Creek to less than 15 mg/L. These sediment control facilities will include wetlands at various locations including within the footprint of the current water storage pond; all water leaving site will pass through this wetland before reporting to lower Minto Creek.

2.6 Geochemical Characterization and Monitoring

2.6.1 Mine Rock

Pre-production Testing: Main Pit

During initial review of the Minto Mine project proposal, eight drill core samples were retrieved and subjected to ABA testing, whole rock analysis and petrographic examination (Mills 1997).

The primary conclusions of the pre-production test were that Main Pit waste rock was expected to be net acid neutralizing, and that the main acid neutralizing mineral was calcite (calcium carbonate, $CaCO_3$). Recommendations arising from this work were incorporated into the operational monitoring requirements of the original water license and have been re-affirmed in all subsequent licence amendments up to and including the Phase IV amendment (Amendment 8).

Pre-production Testing: Phase IV

In planning for the Phase IV expansion, Minto carried out pre-production testing on 56 drill core samples from the Area 2/ Area 118 deposit areas and 27 drill core samples from the anticipated alignment of underground workings (SRK 2010a).

Samples for the Area 2/ Area 118 deposit areas tested both unmineralized (bulk) and mineralized granodiorite waste rock, and also included a limited number of ore samples.

The primary conclusions of both the Area 2/ Area 118 and underground development pre-production tests were that bulk granodiorite waste rock was expected to be net acid neutralizing, and that some mineralized waste rock was expected to have NP:AP values less than the threshold value of 3 specified by the water use license (YWB 2012 and its predecessors).

Operational Testing of Waste Rock- External Laboratory

Since mining commenced at Minto, operational ABA monitoring has been carried out on composite samples of blast hole cuttings from each waste blast since mining commenced according to the BC Research Standard Method, as specified by Water Use Licence QZ96-006. Results to date include all Main Pit results along with samples from the parts of Stage 1 and Stage 2 of Area 2 Pit that have already been mined. Samples have been collected by mine

geologists and delivered to SGS (formerly SGS CEMI) of Burnaby BC for ABA testing by the BC Research method. Semi-annual waste rock monitoring reports have been prepared on a rolling basis and have been submitted to regulators as part of the mine's compliance reporting.

Results of off-site operational ABA monitoring of waste rock are shown graphically in Figure 7. The results show that Main Pit waste rock generally had low AP and NP:AP[1] ratios greater than the threshold value of 3. Results for Area 2 Pit waste rock were mixed- most samples had NP:AP values greater than 3, there were sufficient samples with NP:AP less than 3 that Minto altered the waste rock management strategy, as discussed in the following section.

Operational Testing of Waste Rock- On-site Laboratory

As noted above, initial results from off-site ABA analysis of compliance monitoring samples for Area 2 waste rock included several samples than the threshold value (NP:AP>3) defined in the water use licence. Although this had been anticipated from pre-production testing, Minto decided to revise its waste rock handling procedure to include segregation of waste rock based on ABA criteria and storage of waste rock with NP:AP<3 in locations that were expected to be saturated over the long term to minimize the potential for oxidation of contained sulphide minerals. To allow classification of waste rock to occur with the time frame of the mine's material handling cycle, it was necessary to develop on-site analytical capabilities and integrate results into the mining process.

The Phase IV waste management plan was adapted by introducing operational characterization of waste rock ABA characteristics into the mine's work flow as part of the grade control program starting in August 2012. To provide ABA results in the short turn-around times required for operational characterization and dispatching, Minto purchased and commissioned an Eltra CS-800 induction furnace that allowed on-site measurement of total carbon and total sulphur content. Prior results from testing of samples from Main Pit and Area 2 at an off-site commercial laboratory showed that total carbon and total sulphur content was nearly identical to total inorganic carbon and total sulphide sulphur content, respectively, and that therefore the relatively-simple total carbon and total sulphur analyses were appropriate for operational ABA characterization.

Operational NP and AP values (NP-C(T) and AP-S(T)) are calculated from the total carbon and total sulphur results, respectively, and then used to calculate NP-C(T):AP-S(T). It should be noted that this approach makes the de facto assumption that all sulphur is hosted in the mineral pyrite (FeS_2); in the case of Minto, pyrite is generally less abundant than copper sulphides.

Samples for on-site ABA testing are split from blast-hole samples collected for grade control purposes. Cuttings from every blasthole are collected and analyzed, and both assay and ABA results are then imported into the mine's grade control software. Using the results, mine geologists define ore and waste polygons for each blast (including delineating NP-C(T):AP-S(T)<3 waste polygons) and then the results are provided to the pit operations staff for staking of ore and waste boundaries and subsequent dispatching of ore and waste to appropriate stockpiles and waste storage facilities.

[1]NP:AP ratios for operational monitoring are based on NP determined by the BC Research method.

The on-site waste rock ABA results for the August 2012 through May 2013 are shown in Figure 8. The results are shown separately for the four copper grade categories (Zero-, Low-, Medium- and High Grade Waste) defined in the Phase IV waste management plan. Over the period of record over 13,800 waste rock samples were analysed, with 12% of the samples returning results corresponding to NP-C(T):AP-S(T)<3. Over 50% of the samples were classified as Zero Grade Waste (Cu<0.03%), and the overwhelming majority of those samples had NP-C(T):AP-S(T)<3.

2.6.2 Tailings

Pre-production Testing

No pre-production characterization tests were carried out on tailings from Main Pit ore. For the Phase IV deposits (Area 2 and Area 118), a range of preproduction tests were carried out on residues from locked cycle testing. Residues from metallurgical testing carried out on Area 2 and Area 118 ore samples were subjected to additional testing for purposes of ML/ARD characterization. For both deposits, locked cycle testing was carried out by G&T Metallurgical Services (G&T) of Kamloops, BC.

Area 2 ore samples consisted of drill core from each of the ore horizons that make up the Area 2 deposit (G&T, 2007). The core samples used to prepare the ore composites were selected by Minto personnel. Each of the seven ore horizons that make up the Area 2 deposit were tested separately, and the cleaner and rougher tails from each were reserved as separate products. To evaluate the acid-generating potential and trace metal content of the tailings, aliquots of rougher and cleaner tails from each ore horizon were combined, according to the ‘as-produced’ mass ratio. A combined sample (37% L Zone tails, 63% M Zone tails) was also tested to evaluate the ML/ARD characteristics of a mixed tailings product that would result from mixing of the tailings from the two main ore horizons (representing approximately 90% of the Area 2 ore) at the expected proportions in the final tailings mass (SRK, 2007).

Two Area 118 ore samples were subject to metallurgical testing. Ore samples consisted of drill core from the upper and lower portions of the Area 118 deposit (G&T (2009) and SRK (2009a)). As for Area 2 samples, aliquots of rougher and cleaner tails from each ore sample were combined, according to the ‘as-produced’ mass ratio.

Results of the pre-production testing on Phase IV tailings indicated that the material would be not potentially acid generating and that risks of neutral pH metal leaching were similar to those for Main Pit tailings from full-scale operations (SRK 2010a).

Operational Testing- Main Pit Tailings

Operational monitoring of Main Pit tailings was carried out to track the ABA characteristics of the tailings produced over the operating period, and to verify that the as-produced tailings remain appropriate for dry-stack disposal of tailings from Main Pit ore. Testing was carried out according to the BC Research Standard Method, as specified by Water Use Licence QZ96-006. Samples for testing consisted of 1 to 2 kg monthly composite samples, prepared from 200 to 500 gram tailings samples which were collected daily and stored in sealed plastic bags prior to preparation of the monthly composite sample.

The monthly composite was sent to Minto's accredited laboratory (SGS) where ABA analysis was conducted. The Acid Potential (AP) is determined from percent sulphide sulphur (obtained by subtracting percent sulphate sulphur from percent total sulphur). Additionally, paste pH and total inorganic carbon (TIC) were determined. Results have been reported to regulators, together with waste rock ABA results, in a semi-annual monitoring report (e.g. Minto Explorations Ltd. (2010)).

Results of operational ABA monitoring of Main Pit and Area 2 Pit (Stages 1 and 2) tailings are shown graphically in Figure 9. The excess of neutralization potential (NP) over acid potential (AP) has confirmed that the tailings produced to date are not expected to be net acid generating.

Operational Testing- Area 2 Stage 2 Pit Tailings

Operational monitoring of tailings from milling of Area 2 Stage 2 Pit ore was carried out using methods and procedures described above for Main Pit tailings from start of processing through the completion of placement of tailings in the DSTSF (May 2012 through October 2012). Similar to results for Main Pit tailings, the Area 2 Stage 2 Pit tailings tested to date have had a substantial excess of NP over AP (Figure 9) and are not expected to be net acid generating.

3 Methods

3.1 Phase V/VI Mine Rock

3.1.1 Static Tests

Exploration Assays

During exploration programs that coincided with early stages of mining at Minto (2005 through 2007), all drill core from the Minto property was split and half of the core was sent for multi-element analyses. However, as Minto's exploration team grew more familiar with the visual characteristics of the mineralization and the host rock at the property, assays were reduced to capture only mineralized zones and to focus only on the metals of economic interest (copper, silver and gold). As a result, there are no exploration multi-element assay results for drilling that occurred post-2007. In terms of Phase V/VI deposits, this results in multi-element assay results only being available from initial (2006 and 2007) drilling in the Ridgetop deposit area. No multi-element assays are available from exploration programs for the Minto North or Area 2 Stage 3 deposits.

For the Ridgetop deposit, there were 136 samples within the pit shells. Multi-element determination was carried out by aqua regia digestion followed by ICP-MS finish. Analyses were carried out at ALS Chemex (North Vancouver BC) and its predecessors.

Acid Base Accounting Testing

Over a period of five years, from 2007 to 2011, a total of 108 Phase V/VI pre-production core samples have undergone acid base accounting (ABA) testing.

Table 3-1 classifies these samples by mine area, material type, and year of analysis. All of the Phase V/VI mine rock samples that underwent ABA analyses also underwent multi-element determination by aqua regia digestion with ICP-MS finish. In 2008 this analysis was carried out at ALS Chemex and from 2009 to 2013 it was carried out at SGS (Burnaby, BC).

Table 3-1: Summary of Phase V/VI Mine Rock Pre-production Static Testing

Mine Area	Material Type	Number of Samples	Year of Analysis
Area 2 Stage 3	Bulk Waste	16	2011 + 2013
Minto North	Hanging Wall	18	2009
Minto North	Footwall	5	2009
Minto North	Dyke	9	2011
Ridgetop	Bulk Waste	36	2008 + 2013
Ridgetop	Mineralized	2	2008
Ridgetop	Ore	2	2008
Ridgetop	Conglomerate	12	2010
Wildfire	Conglomerate	8	2011

Source: T:\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\020_Tables\[Table3-1_Summary_PhV-VI_ABASampleSources.xlsx]

ABA Testing – Area 2 Stage 3

As part of Phase IV pre-production characterization, 56 drill core samples from within the Area 2 Stage 2 pit shell were tested (SRK 2010a). The Phase IV pre-production testing included bulk waste, mineralized waste, and ore samples.

To expand the coverage into Area 2 Stage 3 in preparation for Phase V/VI, an additional 16 drill core samples were tested in two rounds (2011 and 2013). All 16 samples targeted bulk waste to verify whether this volumetrically-important waste class contained the expected excess of neutralization potential, and therefore be suitable for disposal in upland waste dumps. Samples were selected jointly by a Minto geologist and an SRK geochemist to achieve appropriate spatial coverage within the Area 2 Stage 3 pit shell and to target bulk waste; the selections were made by viewing exploration drilling results together with model ore horizons and planned pit shells using the GEMS software package.

ABA Testing – Minto North

In 2009, ABA testing was carried out at SGS on eighteen hanging wall and five footwall samples from Minto North. Three methods of neutralization potential (NP) determination were used: total inorganic carbon was determined as a measure of carbonate content, and two titration methods were also used (Sobek NP (Sobek et al.,1978) and Modified NP (MEND 1991)). The ABA analysis also included total sulphur determination by induction furnace, sulphate sulphur determination by hydrochloric acid leach, paste pH, and fizz rating (all per MEND 1991 protocols).

The following excerpt from the Minto North initial waste rock characterization sample selection memorandum (SRK 2009b) describes the process that was followed to select the twenty-three hanging wall and footwall samples:

Minto provided a spreadsheet containing available drill logs, summary assay data, and collar locations for diamond drillholes (DDH) in the Minto North deposit area. This file contained selections of DDH and intervals to be used for testing of metallurgical performance.

Minto advised that the bulk of the country rock overlying the mineralization consisted of lithologies logged as unit pG and unit eG. SRK reviewed the summary lithology logs provided and selected intervals for initial ML/ARD characterization by ABA testing and multi-element analysis.

Composite intervals were identified that targeted the majority of the waste rock overlying the ore grade intervals, while avoiding crossing lithological boundaries. In addition, composite intervals immediately underlying the ore grade rock were selected from each DDH to define the ML/ARD characteristics of footwall rock. Intervals were selected for compositing over a distance of approximately 6 m to reflect minimum widths that could be managed by the mining fleet.

Ore and proximal hanging wall waste have not been identified for testing at this time. When ICP results are available for these materials for all Minto North DDH, the results will be reviewed and a limited number of samples will be selected for ABA testing. Assay pulps or crushed rejects will be acceptable for this testing- there will be no need for additional core samples for these tests.

More recently, in 2011, nine drill core samples were selected from intersections of the unmineralized felsic dike that cuts through the proposed Minto North Pit underwent ABA testing at SGS by the same methods as were used for the 2009 Minto North samples. Dike samples were selected from available core intersections by Minto geologists and are considered to be representative of the in-pit dike material.

ABA Testing – Ridgetop

In 2008, sixteen bulk waste, two mineralized waste, and two ore samples from the Ridgetop deposit underwent ABA testing at ALS Chemex. Testing in 2008 was carried out at ALS Chemex according to an in-house method analogous to the Sobek method (Sobek et al., 1978) which included paste pH, fizz rating, Sobek NP, total sulphur, sulphate sulphur, and total inorganic carbon. The BC Research method was not used because it is an uncommon method that has been largely avoided by industry in recent years, and because senior staff at SGS (the only laboratory in western Canada that provides the ABA testing services using the BC Research method) recommended that alternate methods be employed. Selection of the twenty samples was based on similar criteria to those described for the 2009 Minto North selections.

In 2010, ABA testing was conducted on twelve conglomerate samples from the Ridgetop deposit area. The testing was carried out at SGS by the same methods that were used for the Area 118 and Minto North samples.

In 2013, an additional 20 bulk waste samples from within the Ridgetop pit shells were subjected to the same ABA tests as described above for the 2010 Ridgetop samples. The additional tests were undertaken to improve the spatial ABA sample coverage in the Ridgetop deposit area. The testing was carried out at SGS.

ABA Testing – Wildfire

In 2011, eight conglomerate samples from the Wildfire deposit underwent ABA testing at SGS by the same methods that were used for the Minto North, and 2010 Ridgetop samples. The eight Wildfire conglomerate samples were selected by Minto geologists from available core samples to provide respresentative coverage of the conglomerate in the Wildfire area at time when open pit mining was still being considered for a portion of the Wildfire resource.

ABA Testing- Underground

As part of Phase IV pre-production characterization, 27 drill core samples from locations near the initial planned Phase IV underground development were tested (SRK 2010a). As expected, results of this testing were similar in character and in variability to pre-production and operational monitoring results of pit waste rock.

However, the process of identifying drill core intersections of the planned workings had several drawbacks (including drill intersections being 10s of metres away from the planned development, and initial development plans being subsequently revised to locate workings remotely from the tested intervals). Because of these drawbacks, and supported by the expected similarity of pit waste and underground waste, no preproduction testing of underground waste rock was carried out for Phase V/VI. All underground waste rock that is permanently stored in surface facilities will be subject to the same segregation protocols as pit waste rock.

3.1.2 Kinetic Testing: Humidity Cell Tests

Description – Humidity Cell Tests

Four humidity cell tests (HCTs) were started in July 2009 and an additional eight HCTs (as well as a blank and a duplicate for quality control purposes) were started in March 2011. All HCTs were conducted at SGS and were ongoing as of July 2013. The objective of these tests is to evaluate the release rates of weathering products, including major and trace elements, under laboratory weathering conditions. A range of copper and sulphur content was targeted during sample selection in order to provide a broad indication of variation of release rates related to degree of mineralization.

Sample Selection – Humidity Cell Tests

At the time of sample selection for the initial four HCTs (HC1 through HC4), the mine plan envisioned accessing Phase 3 of the Area 2 deposit via an open pit (Phase 3 encompasses what is now referred to as Area 2 Stage 1 and Stage 2, i.e. the Phase IV portions of Area 2 Pit). The exploration ICP database (2005 - 2008) was queried to yield a list of core intervals that were both

within the Phase 3 pit shell and contained less than 0.5% copper (i.e were below the ore cutoff grade). The resulting list of 363 core intervals was taken to represent the Area 2 waste rock.

Summary statistics were calculated for the 363 Area 2 waste rock core intervals, including 50th, 75th, and 95th percentile concentrations of copper and sulphur. It was decided that four separate populations would be targeted for testing:

1. 50th percentile concentrations of both copper and sulphur;
2. 50th percentile copper, 75th percentile sulphur;
3. 75th percentile copper, 50th percentile sulphur; and
4. 95th percentile copper and 95th percentile sulphur.

A shortlist of drill core intervals that approximately met each of the above criteria was forwarded to site staff for retrieval from archived diamond drill core from exploration drilling. Samples were collected and forwarded to SGS to commence HCTs. Table 3-2 summarizes the core intervals that were retrieved and the corresponding relative copper and sulphur contents. Note that the HC1 sample was targeted to include rock with 95th percentile copper and sulphur content, but that the actual sample retrieved contained copper and sulphur at roughly 90th percentile concentrations.

The origin and characteristics of the Minto North and Ridgetop HCT samples are also summarized in Table 3-2; samples for testing were selected based on review of assay data (where available) and targeting typical and moderately anomalous waste intervals within the expected pit limits.

- HC5, HC7, and HC8 were chosen from bulk waste of the Minto North deposit by Minto geologists based on recommendations from SRK. Assay data was not available to guide selection, as unmineralized core from Minto North was not assayed. HC5 and HC7 both contained low copper content (0.0004 and 0.0006 % respectively) and sulphur content below the analytical detection limit of 0.02% and were selected as representative of typical Minto North bulk waste. HC8 contained higher copper and sulphur contents (0.05 % Cu and 0.04 % S) and was chosen to represent moderately anomalous or mineralized waste from Minto North. HC6 was established as a duplicate of HC5.

- HC9 and HC10 were chosen from bulk waste of the Ridgetop North deposit based on core available at the time of collection. Both contained moderate copper content (~0.01 %) and sulphur content below the analytical detection limit; within the Ridgetop waste rock population, these samples contain between 25th and 50th percentile copper values and typical sulphur content, and are considered to be representative of bulk unmineralized granodiorite at Minto .

- HC11 and HC12 were selected to evaluate the conglomerate lithology that constitutes a minor component of the Ridgetop North host rock. The selected intervals contain

conglomerate rock with moderate copper content (0.01 and 0.02 % respectively) and low sulphur content (0.03 and <0.02 % respectively).

- HC13 was chosen from bulk waste of the Ridgetop South deposit and contained 0.005% copper content and sulphur below the analytical detection limit, similar to HC9 and HC10, this sample represents another variant of the typical unmineralized granodiorite waste rock.

Table 3-2: Phase IV/V/VI Humidity Cell Samples

HCT	Hole ID	From (m)	To (m)	Cu (%)	S (%)	Selection Characteristics	Deposit
HC1	07SWC211	83	86	0.21	0.51	~90th percentile Cu, ~90th percentile S	Area 2
HC2	07SWC196	54	55	0.01	0.01	50th percentile Cu, 50th percentile S	Area 2
HC3	07SWC196	46	47	0.1	0.02	~75th percentile Cu, ~50th percentile S	Area 2
HC4	07SWC211	71	74	0.01	0.08	~50th percentile Cu, ~75th percentile S	Area 2
HC5	09SWC506	30	33	0.0004	<0.02	Bulk waste	Minto North
HC6	09SWC506	30	33	0.0004	<0.02	Bulk waste (dup)	Minto North
HC7	09SWC484	40	43	0.0006	<0.02	Bulk waste	Minto North
HC8	09SWC498	54	57	0.0474	0.04	Moderately anomalous waste	Minto North
HC9	07SWC258	20	23	0.0136	<0.02	Bulk waste	Ridgetop North
HC10	08SWC337	10	13	0.0145	<0.02	Bulk waste	Ridgetop North
HC11	08SWC348	12	15	0.0108	0.03	Conglomerate	Ridgetop North
HC12	08SWC370	10	13	0.0177	<0.02	Conglomerate	Ridgetop North
HC13	09SWC419	15	18	0.0047	<0.02	Bulk waste	Ridgetop South
HC14	n/a	n/a	n/a	n/a	n/a	Method blank	Method blank

Source: T:\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\020_Tables\[Table3-1_HCT_SampleSources.xlsx]

Test Method – Humidity Cell Tests

The HCTs were established at SGS according to methods defined in ASTM D5744 (ASTM, 2007). For each test, a one kilogram charge of material (crushed to pass a 6.3 mm (¼") sieve) was placed in a Plexiglas column (25.5 cm long, with an inner diameter of 10.2 cm). Each sample was subjected to consecutive 3 day cycles of moist and dry air, and the final day of the weekly cycle consisted of leaching of the sample by flooding with 500 mL (first flush: 750 mL for the initial four HCTs, and 500 mL for the additional ten HCTs) of water and allowing the flood leach to drain into a collection container through a perforated acrylic disk topped with nylon mesh. Laboratory temperatures are maintained between 20 and 22° C.

For the initial four HCTs, monitoring of pH, conductivity, oxidation reduction potential (ORP), and dissolved oxygen (DO) was carried out weekly from July 2009 to January 2011. During this time period, biweekly sampling was carried out to monitor sulphate, chloride, fluoride, acidity, alkalinity, and a suite of elements by ICP-MS. From February 2011 to the time of preparation of

this report, sampling frequency for all parameters was reduced to once every three months. The weekly operating protocol remained unchanged during this period of reduced analytical frequency.

For the additional ten HCTs, weekly sampling of pH, conductivity, ORP, and DO as well as biweekly sampling of sulphate, chloride, fluoride, acidity, alkalinity, and a suite of elements by ICP-MS has been ongoing since March 2011.

3.1.3 Kinetic Testing: Barrel Tests

Description – Barrel Tests

Barrel tests are intended to be site-based weathering tests that permit evaluation of rates of release of weathering products under site temperature and precipitation conditions. These tests also provide a larger scale of testing than is typically carried out in a laboratory setting and at the same time provide more certainty regarding the sample characteristics and the related drainage chemistry (unlike a full scale waste rock dump, for which integrated geochemical characteristics and degree of drainage capture are not readily determined to the same degree).

Sample Selection – Barrel Tests

Initial efforts to understand the ML/ARD potential of Area 2 waste rock noted that there were two broad categories of Area 2 waste rock. The first category, containing by far the largest tonnage, was referred to as ‘Bulk Waste’ and was defined as all rock with less than 0.1% sulphur content (as determined by ICP). The second, and much smaller, category, was referred to as ‘Mineralized Waste’ and consisted of all rock with sulphur greater than 0.1% and copper less than 0.5% (as an approximation of mine cut-off grade). The Mineralized Waste material was identified as having a higher risk for ML/ARD, and barrel tests were proposed to evaluate samples of Mineralized Waste.

Exploration diamond drill core intervals within the Area 2 Phase III pit shell that had sulphur content corresponding to four statistical categories were identified. Table 3-3 lists these categories, the target sulphur content, and the number of drill core intervals that met the criteria for selection.

Table 3-3: Barrel Test Sample Selection Characteristics

Barrel ID	Target S (%)	Selection Characteristics	Cu range (%)	S Range (%)	No. of Intervals in S Range
BAR-10	0.15	10th percentile S amongst Mineralized Waste population with S >0.1%	0.005 - 0.45	0.14 - 0.16	292
BAR-50	0.37	50th percentile S amongst Mineralized Waste population with S >0.1%	0.005 - 0.49	0.36 - 0.40	170
BAR-75	0.79	75th percentile S amongst Mineralized Waste population with S >0.1%	0.005 - 0.49	0.74 - 0.84	167
BAR-90	1.41	90th percentile S amongst Mineralized Waste population with S >0.1%	0.05 - 0.49	1.28 - 1.54	159
BAR-B	n/a	blank for quality control	n/a	n/a	n/a

P:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\!080_Deliverables\Phase V&VI MLARD & WQ Prediction Report - 2013\020_Tables\[Table3-3_Barrel_SampleSources_2013.xlsx]

The barrels are open to the atmosphere and incident precipitation falls on them. Rainfall and snowmelt percolate through the rock and accumulate in the drain tube and in bottom of the barrel between sampling events. Sampling of the leachate from the barrels began in June 2010 and has been carried out several times each open-water season since that time. Samples are collected directly from the tubing by opening the ball valve, and the remaining accumulated volume of water is drained during each sampling event. Leachate samples are collected for determination of laboratory pH and conductivity, acidity, alkalinity, anions (chloride, fluoride, and sulphate) and trace-level dissolved metals by ICP-MS/OES.

3.2 Phase V/VI Tailings

3.2.1 Static Tests

Sample Source

Residues from four metallurgical testing programs carried out on ore samples relevant to Phase V/VI were subjected to static testing. A total of 18 tailings samples were available for testing:

- Eight samples from Area 2 (G&T 2007);
- One tailings sample from Minto North (G&T 2009a);
- Five tailings samples from Area 118 and Ridgetop (G&T 2009b);
- Three tailings samples, one each from Wildfire, Copper Keel, & Minto East (G&T 2010).

Test Methods

Tailings residues from metallurgical testing were submitted to ALS Chemex (Area 2 samples) and SGS (all other samples) for further analysis. ABA testing was carried out on all samples, consisting of determination of total sulphur by induction furnace, sulphate- sulphur by hydrochloric acid leach, total inorganic carbon (TIC) by evolved gas analysis, and neutralization potential (NP) by the Sobek method (Sobek et al., 1978). Acid potential (AP) was calculated by multiplying total sulphur less sulphate sulphur by the conventional factor of 31.25.

Elemental analysis of tailings products was by aqua regia digestion followed by determination of major and trace element content by a combination of ICP-MS and ICP-AES.

3.2.2 Kinetic Tests – Subaqueous Column Tests

Description – Subaqueous Column Tests

Two subaqueous tailings columns were started in September 2009 at SGS; these tests were ongoing at the time of preparation of this report. The objective of these tests is to evaluate the porewater chemistry that would develop over a long period of contact with tailings solids under a water cover.

Sample Source – Subaqueous Column Tests

The tailings being tested in these subaqueous columns were produced during metallurgical testing of Area 118 and Ridgetop ore samples. Details are as follows:

- Column 1: is a composite of upper and lower Area 118 ore tails produced in G&T tests 2351-33 and 2351-34 (G&T, 2009a).
- Column 2: is a composite of upper and lower Ridgetop ore tails produced in G&T tests 2351-35 and 2351-36 (G&T, 2009a).

Test Methods – Subaqueous Column Tests

The subaqueous tailings columns were constructed of 5.08 cm (2”) internal diameter Plexiglas columns with an acrylic perforated disk topped with nylon mesh at the base of the column to retain the tailings solids, yet allow drainage for sampling. Approximately 2.5 kg (dry weight) of tailings solids were placed in each column, yielding a height of tailings of roughly 1 m in each column. Sampling ports were installed in the base of the column and in the side of the column above the tailings/ water interface.

Columns were initially saturated by slowly adding deionized water through the bottom sampling port. Once the tailings column was saturated, an additional volume of water was gently added from the top of the column to establish a 30cm column of water above the tailings/ water interface.

Operation of the subaqueous column tests consists of circulation of water in the water cover using a peristaltic pump to ensure fully oxygenated conditions are maintained at the tailings

interface. From September 2009 to the time of preparation of this report, sampling has been carried out weekly from both bottom and side ports to determine pH, conductivity, oxidation reduction potential (ORP) and dissolved oxygen (DO). Additionally, from September 2009 to January 2011 biweekly sampling was carried out from both ports to monitor sulphate, chloride, fluoride, acidity, alkalinity, and a suite of elements by ICP-MS. After January 2011 the biweekly sampling and analysis of water chemistry was reduced to sampling and analysis once every 12 weeks. For each sampling round, the minimum amount of water required for analysis is removed. Deionized water is added to the water cover each week to maintain 30 cm of water above the tailings interface.

4 Results and Discussion

4.1 Phase V/VI Mine Rock

4.1.1 Static Tests

Elemental Determinations - Exploration Assays

Summary statistics of exploration assay results for waste rock within the Ridgetop pit shells are provided in Appendix B and summaries for copper and other selected parameters are shown in Table 4-1. Waste rock includes some higher-than-cutoff-grade material where isolated higher copper intercepts could not be laterally modelled to define mineable ore horizons. The large decrease in copper content between the maximum and 90th percentile values indicates that degree to which the maximum values are anomalous. The cadmium content of the Area 2 waste core intervals showed a similar skewed distribution, with the 90th percentile value of 0.25 ppm being equal to the detection limit. Other trace element concentrations in Ridgetop waste core intervals were somewhat less skewed to high values. Selenium determinations were not included in the reported exploration assay results. Results for elemental determinations on pre-production waste characterization samples do include selenium concentrations (see Appendix C).

Table 4-1: Ridgetop Waste Rock: Summary of Selected Elemental Content from Exploration Assays

Mine Area	Summary Statistic	Total Cu %	Cd_ppm	Cr_ppm	Mn_ppm	Zn_ppm
Ridgetop	Count	136	136	136	136	136
	Average	0.074	0.29	6	698	119
	Max	1.8	1.6	23	2590	726
	90th percentile	0.13	0.25	8	1315	245
	50th percentile	0.02	0.25	5	517	76
	10th percentile	0.005	0.25	3	323	51
	Min	0.005	0.25	1	100	10

Source: T:\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\020_Tables\[u_Table4-2_WR_Element_SummaryStats_2013.xlsx]

Acid Base Accounting

Results of the Phase V/VI waste rock ABA testing are provided in Appendix C. In the figures accompanying the following discussion, results from the Area 2 and Area 118 deposits are included to allow the Phase V/VI waste rock (Area 2 Stage 3, Ridgetop, Minto North and Wildfire) to be put into the context of the operating mine.

Acid Potential

Sulphur in mine rock from the Phase V/VI deposits is dominantly in the sulphide form, as is illustrated by the strong 1:1 correlation in Figure 10. The Minto North, Wildfire, and Area 118 results are all clustered at the origin on the chart because they all had total sulphur below the level of analytical detection of 0.02% (detection levels were adopted for plotting purposes).

The Area 2 ore samples had the highest total sulphur content, ranging from below the level of analytical detection (<0.01%) to 4.4%. The Area 2 bulk waste samples ranged from <0.01 to 0.11%. The Area 2 Stage samples had total sulphur below the level of analytical detection for all except one sample, which had 0.07% total sulphur and sulphide below detection level.

The Ridgetop mineralized waste and ore samples had similar total sulphur contents in the range of 0.1 to 0.4%. The bulk waste samples had a low, narrow range, with a minimum of 0.01% and a maximum of 0.06%. The Ridgetop conglomerate samples were all below the level of analytical detection except for one sample, which had 0.02% total sulphur.

A comparison of sulphide sulphur and copper content showed that the copper mineral chalcopyrite ($CuFeS_2$) could account for much of the sulphide sulphur in the Area 2 and Ridgetop samples (Figure 11). Chalcopyrite is widely observed in Minto rocks, so it is likely an important sulphur host.

Neutralization Potential

In order to evaluate the proportion of neutralization potential (NP) measured by titration that is likely to be derived from carbonate minerals, the NP values were compared with total inorganic carbon content (NP_{TIC}) converted to common units of kg $CaCO_3$/tonne. Figure 12 shows the results of this comparison for the Phase V/VI waste rock samples. NP and NP_{TIC} are generally well correlated at higher concentrations; however, below approximately 30 kg $CaCO_3$/tonne, NP

systematically exceeds NP_{TIC}, with relative differences increasing as NP decreases. The typical conclusion when NP is systematically greater than NP_{TIC} is that silicate minerals (such as clays) are contributing a component of the neutralization that is measured in the NP titration. In two exceptional Area 2 samples, the NP_{TIC} is approximately double the NP. This may be due to the presence of siderite ($FeCO_3$), which does not contribute to net neutralization (SRK 2010a).

A conservative and common interpretation is that silicate minerals are insufficiently reactive to maintain circumneutral pH weathering conditions. It is assumed that only calcium and magnesium carbonate minerals can reactive quickly enough to maintain circumneutral pH, which is important for limiting leaching of trace elements like copper. However, for materials with low total sulphur concentrations (like those measured in most Phase V/VI rock) silicate weathering can generate alkalinity at rates that are sufficient to neutralize acidity arising from sulphide oxidation.

For purposes of comparing method performance, operational monitoring results were also charted in a similar fashion, with NP determined by the BC Research method (NP_{BCR}) plotted against NP_{TIC} (Figure 13). During Main Pit monitoring, the BC Research method commonly indicated a higher value for neutralization potential than was indicated by TIC, with NP_{BCR} exceeding NP_{TIC} more than five-fold in some cases. The correlation between the two methods was better for the more recent Area 2 Pit monitoring, although at higher NP values the NP_{TIC} exceeded appeared to be skewed higher than the NP_{BCR}.

Overall Acid Rock Drainage Potential

The current permit for the Minto Mine classifies rock with NP:AP ratio (NPR) greater than 3 as non-potentially acid generating (Non-PAG). It is common practice to categorize rock with a NPR between 1 and 3 as having uncertain potential for acid generation (Uncertain), and to categorize rock with a NPR ratio of less than 1 as potentially acid generating (PAG). These three categories (Non-PAG, Uncertain, and PAG) are adopted here for purposes of discussion.

It should be noted that specifying a NPR of 3 as the lower limit of the Non-PAG category is conservative. Theoretically, if grain-scale weathering is occurring at neutral pH and all NP is in the form of calcium and magnesium carbonates that are available to react, a NPR of 2 is the limit that is required to ensure neutral weathering conditions persist indefinitely. This upper limit is sometimes referred to as the ‘critical NPR’ because it defines the transition from theoretically PAG to Non-PAG. If grain-scale weathering occurs under acidic pH conditions, the ‘critical NPR’ is less than 2 and can be as low as 1. The rationale for adopting a NPR of 3 as the lower limit of the Non-PAG category is to account for uncertainty related to interpreting ABA results. For example, uncertainty can arise from not knowing the mineral form of NP at the screening stage, or from scale effects such as concentration of sulphide grains in the blast fines (which has occurred at some mines, thereby causing the NPR of the blast fines to be lower than the bulk rock NPR). Defining Non-PAG as NPR > 3 provides some insurance, in light of the uncertainty, that Non-PAG rock will not develop dump-scale acidic weathering conditions.

Figure 14 illustrates the NP_{TIC}:AP ratio (NPR_{TIC}) for the Phase V/VI waste rock samples. Of the 200 samples characterized as part of this program, three Area 2 mineralized waste samples and one Area 2 ore sample were classified as PAG; four Area 2 mineralized waste samples and one

Ridgetop ore sample were classified as Uncertain; and the remaining samples, including all of the Minto North, Wildfire, and Area 118 samples, were classified as Non-PAG. It is expected that ore and mineralized waste from the Phase V/VI deposits will display the same range of ABA characteristics as those observed for Area 2 waste rock.

Similarly, Figure 15 shows the NPR (based on Sobek NP) for the Phase V/VI waste rock samples. Of the 200 samples characterized as part of this program, one Area 2 mineralized waste sample is classified as PAG; four Area 2 mineralized waste samples, two Area 2 ore samples, and one Ridgetop ore sample are classified as uncertain; and the remaining samples are classified as Non-PAG.

It should be noted that the results from operational monitoring indicate similar ARD potential (based on NPR_{TIC}), with the great majority of samples being classified as Non-PAG, a minority of samples classified as Uncertain, and two samples classified as PAG (Figure 7 and Figure 8).

4.1.2 Kinetic Tests

Humidity Cell Tests

Results to date for the four Area 2 humidity cell tests (HCTs), the four Minto North HCTs, the five Ridgetop HCTs, and the blank HCT are provided in Appendix D. Results for pH, sulphate, copper, cadmium, and selenium are shown in Figure 16 to Figure 20. For clarity, the HCT results have been plotted separate, with the Area 2 HCTs (start date July 2009) on separate charts from the HCTs started in 2011. The following points discuss selected aspects of the HCT results for pH, sulphate, and the three trace elements that are noteworthy in these tests (i.e., copper, cadmium and selenium).

The leachate pH in all four of the Area 2 HCTs has remained circumneutral for 178 weeks of testing. After an initial slight decrease, from a range of 7.5 – 8 to a range of 7 - 7.8, the pH values have been stable (Figure 16a). Historically, HC1 had marginally greater variability that the other three Area 2 cells, but since cycle 130 all four have been similar. The higher variability prior to cycle 130 is likely due to HC1 having the highest copper and sulphur concentrations of the four cells.

Circumneutral leachate pH levels in the 7.5 to 8 range have remtained stable throughout the duration of testing in five of the tests (HC7, HC8, HC9, HC10, and HC13), (Figure 16b). These five cells have the lowest pH variability. HC6 and HC12 have marginally greater variability and have a stable range that is shifted more towards 7. HC5 and HC11 have notable greater variability with a wider range of 6.5 to 8. HC5 appeared to have a gentle declining trend until cycle 70, after which point the variability increased and the range shifted upwards (Figure 16c). The blank cell (HC14) had somewhat similar results to HC5 and HC11, although it had greater variability and reached a lower limit below 6.5 (which is consistent with operating a blank cell using deionized water).

The leachate pH results do not appear to be strongly related to the solid contents of copper and sulphur in the samples. HC11 has relatively high copper and sulphur content, but HC5 has below

average copper and below analytical detection limit sulphur. Furthermore, HC8 has the highest copper and sulphur content but has retained stable pH levels between 7.5 and 8 for the duration of the test.

Sulphate release rates from Area 2 tests HC2, HC3, and HC4 have been below 5 mg/kg/wk and relatively stable over the duration of testing to date. HC1 initially had elevated rates (around 30 mg/kg/week), but over approximately 45 cycles its sulphate release declined to below 5 mg/kg/wk. Since cycle 45, release rates from HC1 have been relatively stable, although slightly higher and more variable that the other three cells (Figure 17a).

Sulphate release in the Minto North and Ridgetop HCTs had similar results to HC2, HC3, and HC4. All nine of them had their highest sulphate release rates during the initial flushing stages of testing (Figure 17b). HC11 had the maximum rate at 4 mg/kg/wk. The cells all stabilised from week 14 onwards between 0.8 and 1.5 mg/kg/wk with occasional spikes reaching 2 mg/kg/wk. The lower limit of this stable range is determined by calculations that are based on adopted detection limits because the sulphate concentrations were below the analytical detection level.

The source deposit of the samples did not have a distinguishable effect on the sulphate release rates. The higher rates observed from HC1 are likely due to its higher degree of mineralization (90th percentile copper and sulphur concentrations) resulting in high sulphide oxidation rates.

Copper release rates from the HCTs appear to be related to the solid copper content of each sample. Release rates from HC1 were an order-of-magnitude higher than the rates from the other cells for the duration of testing to date. The remaining three Area 2 cells, as well as HC8, HC9, HC10, HC11, and HC12, had similar solid copper content and similar ranges and variability of copper release rates. HC5, HC6, HC7, and HC13 all had lower solid copper content and also had the lowest, most variable copper release rates.

With the exception of HC5, HC6, HC7, and HC13, all of the cells had elevated release rates during the initial flushing stages of the testing. HC1 had a maximum rate of 0.05 mg/kg/wk, and the others had initial ranges of approximately 0.001 to 0.01 mg/kg/wk. The release rates from these cells had declining trends until around cycle 10 to 15, after which stage the trends stabilised (Figure 18).

To date, the release rates from the Area 2 HCTs have continued to be stable; HC1 maintained rates just below 0.01 mg/kg/wk, and the remaining three cells were within the 0.0001 to 0.001 mg/kg/wk range. The release rates from HC8, HC9, HC10, HC11, and HC12 started to decline again after about cycle 80, but further testing is required to determine if the decline will continue further.

Copper release rates from HC5, HC6, HC7, and HC13 have been relatively stable for the duration of testing, but their variability was generally higher than the variability from the other cells (Figure 18c). These four cells had similar rates and variability: fluctuating within an approximate range of 0.0001 to 0.001 mg/kg/wk to the blank cell (HC14). The Cu levels in the blank cell are an indication of low level copper contamination, which is likely affecting the waste rock cells. The

analytical lab ran experiments on their air filter system and the Plexiglas used to construct the HCTs, but they were unable to isolate the source of copper contamination.

Cadmium concentrations were frequently below the analytical detection limit for all of the HCTs except HC1 and HC11. As a result, the presented cadmium release rates are largely based on adoption of the detection limit, which generates a release rate of approximately 0.000002 mg/kg/wk. With the exception of some spikes, the cadmium release rates from all of the tests except HC1 and HC11 were consistently at or near 0.000002 mg/kg/wk (Figure 19).

Cadmium release rates from HC1 were initially elevated, with a maximum of 0.00004 mg/kg/wk, and have been declining over the duration of testing (Figure 19a). Release rates from HC11 have been relatively stable in a wide range (generally between 0.000002 and 0.00001 mg/kg/wk with some spiking up to 0.00007 mg/kg/wk) for most of the testing; since cycle 80 the variability looks to be reducing and release rates are stable within 0.000004 to 0.000006 mg/kg/wk (Figure 19c).

Selenium concentrations were initially above detection levels for all HCTS, and most cells developed near- or below-detection limit leachate selenium concentrations over time (Figure 20). The notable exceptions include HC1 (the most mineralized of the Area 2 mineralized waste samples) and HC8 (the moderately anomalous Minto North sample). As a result, the presented selenium release rates are largely based on adoption of the detection limit, which generates a release rate of approximately 0.00002 mg/kg/wk. With the exception of some spikes, the selenium release rates from all of the tests except HC1 and HC11 were consistently at or near 0.00002 mg/kg/wk (Figure 20).

Overall, other parameters showed generally stable or declining trends over time.

Barrel Tests

The one blank and four waste rock field barrel tests have been sampled during the non-frozen months since 2010. As discussed in Section 3.1.3, the samples selected for the barrel tests represented the more mineralized waste rock with sulphur contents greater than 0.1%. The BAR-10 barrel targeted the 10th percentile sulphur content of the more mineralized rock (i.e. 0.15% S) , BAR-50 targetted the 50th percentile (0.37% S), BAR-75 targeted the 75th percentile (0.79% S), and BAR-90 targetted the 90th percentile (1.4% S). The full set of barrel test results is available in Appendix E. Selected results are also shown graphically in Figure 21.

- The leachate pH levels from all of the barrels have been consistently circumneutral for the duration of sampling. As expected given the target sulphur content of the samples, BAR-10 had the most variability and generally the highest pH, fluctuating between 7.5 and 8.2. The other three barrels showed similar levels and variability, and were relatively stable between 7.3 and 8. The blank barrel had more acidic leachate with levels dropping from 6.7 to 5.6 over the 2010 sampling season and may reflect flushing of the apparatus by incident precipitation (rainwater in equilibrium with atmospheric carbon dioxide has a pH of around 5.5).

- Sulphate concentrations have been very stable in all four of the barrels over the monitoring record. BAR-10 had the lowest concentrations (40 to 60 mg/L); BAR-50 had order of magnitude higher concentrations (400 to 800 mg/L); and BAR-75 and BAR-90 had the highest concentrations (1100 to 1600 mg/L). The blank barrel had negligible concentrations, around 1 mg/L.

  Sulphate comprises a very small proportion of the solid sulphur content, so most of the sulphate in the leachate is likely derived from sulphide oxidation. Acid production from this sulphide oxidation is being neutralized (as evidenced by the stable circumneutral leachate pH) by calcium and magnesium carbonates. Although BAR-90 has significantly higher solid sulphur content, its leachate sulphate concentrations were almost identical to BAR-75. This may be due to formation of gypsum [$CaSO_4(2H_2O)_s$], which can precipitate if concentrations of calcium and sulphate reach saturation levels; although no evaluation of equilibrium conditions has been carried out, the calcium and sulphate concentrations in BAR-75 and BAR-90 leachate are consistent with gypsum control.

- The calcium and magnesium concentrations reflect the same pattern as the sulphate concentrations and support the hypothesis that sulphide oxidation products are being neutralized by calcium- and magnesium-bearing carbonate minerals. All four barrels have had stable calcium and magnesium concentrations throughout sampling (with the exception of the initial sample points from BAR-10 and BAR-50). BAR-10 had the lowest concentrations, with calcium stable around 20 to 50 mg/L and magnesium stable around 5 to 10 mg/L. BAR-50 had order of magnitude higher concentrations, with calcium stable around 100 to 200 mg/L and magnesium stable around 10 to 30 mg/L. Finally, BAR-75 and BAR-90 had the highest concentrations with calcium stable around 500 mg/L and magnesium stable around 30 to 60 mg/L. For calcium, the BAR-75 and BAR-90 concentrations are nearly identical, as with sulphate (suggesting gypsum control, as noted in the preceding bullet); however, BAR-75 has magnesium concentrations that are approximately 10 mg/L higher than BAR-90 which may indicate the sulphide oxidation and carbonate dissolution rates are highest in BAR-75.

- Copper concentrations in the barrel leachate appear to be loosely related to the sulphur percentile of each sample, although BAR-10 had higher concentrations than might have been expected. BAR-90 had the highest copper concentrations with a maximum of 0.15 mg/L and a median of 0.07 mg/L. BAR-75 had a median of 0.06 mg/L, and BAR-10 was not much lower with a median of 0.05 mg/L. BAR-50 had the lowest concentrations with a median of 0.03 mg/L.

  Generally, the copper concentrations appear to decrease over the sampling season with the highest concentrations recorded around freshet and the lowest recorded in the fall. This higher freshet- lower fall pattern may reflect continued oxidation (but no flushing) over winter months, followed by higher rates of flushing with the initial flows during the onset of the flowing water period. This seasonal pattern is commonly reflected in full-scale seepage monitoring from waste dumps (at Minto and at other sites with similar

seasonal climate variation). No clear trend in copper leaching is apparent over the three sampling years.

- Relative cadmium concentrations in the barrel leachates were correlated to the sulphur percentile of each sample. BAR-90 had the highest concentration with a maximum of 0.0004 mg/L and a median of 0.0003 mg/L. BAR-75 had a median of 0.0002 mg/L, BAR-50 had a median of 0.0001 mg/L, and BAR-10 had a median of 0.00004 mg/L. The chart shown in Figure 21f shows concentration on a logarithmic scale; although the apparent decrease in cadmium concentrations between the 2011 and 2012 monitoring seasons is subtle (and may simply reflect variations in sampling date or seasonal effects), it does suggest that cadmium release was fastest from the freshest rock and that release rates are declining with time. This evidence is consistent with the established theory that weathering rates decline over time under stable pH conditions.

- Selenium concentrations show also show a degree of seasonal variability, and an order-of magnitude range between the barrels (roughly 0.003 to 0.03 mg/L). Over the three monitoring seasons to date, selenium concentrations have remained within a stable range and do not appear to exhibit the same declining rates of release over time that were noted for cadmium in the preceding bullet.

Concentrations of other parameters show stable or declining trends within the framework of seasonal variation noted in the preceding discussion points.

4.1.3 Implications for Waste Rock Management

The ABA characterization of Phase V/VI waste rock has shown that Minto North waste rock is expected to have low sulphur content and moderate neutralization potential, and therefore has little to no potential to develop acid weathering conditions. The majority of the granodiorite waste rock from Area 2 Stage 3, Ridgetop North, and Ridgetop South pits is expected to be Non-PAG and suitable for bulk disposal, however the observed release of NP:AP<3 waste rock from the Phase IV Area 2 Stage 2 Pit is expected to be repeated for the Phase V/VI pits to the south of Area 2 Stage 2. As such, operational characterization will be necessary, along with a continuation of the waste segregation program that has been developed for Phase IV. Disposal of waste rock classified as Uncertain or PAG (based on an interim NP:AP threshold of 3) in locations where it will be saturated in the long term (co-disposed in TMFs, or placed in mined-out voids underground) should continue in Phase V/VI.

4.2 Phase V/VI Tailings

4.2.1 Static Test Results

Complete results of Phase V/VI tailings static testing are included in Appendix F.

Total sulphur (S(T)) and sulphide sulphur ($S(S^{2-})$) content (calculated as the difference between S(T) and sulphate sulphur ($S(SO_4)$) for the Phase V/VI tailings are shown in Figure 22. For samples with S(T)<0.2%, most of the sulphur is in the sulphide form. For the three samples with

S(T)>0.2%, S(T) was measurably greater than $S(S^{2-})$ due to the measurable $S(SO_4)$ content, which suggests the test samples may have contained gypsum or other sulphate mineral.

Figure 23 shows a plot of neutralization potential calculated from inorganic carbon content (NP_{TIC}) vs. NP for Phase V/VI tailings samples. All Area 2, Minto North, and Minto East samples had NP_{TIC} < NP, while in contrast Area 118, Copper Keel, Ridgetop and Wildfire samples had NP_{TIC}>NP. These results suggest that both silicate minerals and iron or manganese carbonates contribute to the various NP measurements for the Phase V/VI tailings.

Plots of NP_{TIC} versus AP and NP versus AP are shown in Figure 24 and Figure 25. All Phase V/VI samples had NP:AP ratios greater than 2, and all but one sample had NP_{TIC}:AP ratios greater than 2. Whichever measure is used, the low sulphide sulphur content and the moderate neutralization potential in the Phase V/VI tailings indicate that acidic conditions are unlikely to develop in these materials (under either saturated or unsaturated storage conditions).

4.2.2 Kinetic Tests

Column Test Results

At the time of report preparation, 192 weeks of subaqueous tailings column testing had been received. Results are provided in both tabular and chart form in Appendix G.

Monitoring of water cover pH from both Column 1 (Area 118 tails) and Column 2 (Ridgetop tails) showed an initial decline from circum-neutral pH levels to slightly acidic values (between pH 5.5 and 6.5) to around week 50, followed by a return to circum-neutral pH conditions for the duration of testing. Concentrations of sulphate and major cations in the surface water display an initial decline, and then remain within a stable range over the duration of testing. Trace element concentrations are uniformly low over time in the water cover in both columns. Of note, the manganese concentrations in the surface water in both columns over time suggest that there is a flux of manganese from the tails into the overlying water (although concentrations remain low (~0.03 mg/L or lower).

Monitoring of bottom port leachate showed pH values typically ranging from pH 7 to pH 8 for both columns over the course of testing to date. Sulphate concentrations peaked in Week 6 of testing for both columns (Column 1 peak value of 67 mg/L; Column 2 peak value of 101 mg/L), before rapidly declining to < 20 mg/L by Week 15 and remaining within a stable range for the duration of testing. Similarly, alkalinity concentrations for both columns peaked in Week 8, then declined to long term stable values, with Column 2 (Ridgetop tails) having higher alkalinity concentrations over the duration of testing. Major cations showed a similar pattern, with early peaks and lower stable concentrations in latter weeks of testing.

Most trace elements had similar concentrations in both surface water and bottom port leachate. The following points discuss notably elevated concentrations of trace elements in bottom port water (compared to surface water) from the subaqueous tailings columns:

- Barium increased dramatically in Column 1 leachate beginning in Week 14, and remained at concentrations over 2 mg/L from Week 34 through the duration of testing. Inspection of

sulphate concentrations shows an apparent inverse relationship, with a corresponding dramatic decline of sulphate concentrations. The increase in barium concentrations is thought to result from equilibrium dissolution of the sparingly-soluble mineral barite (barium sulphate) when sulphate concentrations became favourable.

- Manganese concentrations for both bottom ports peaked in Week 6, with a maximum concentration of 0.085 mg/L, before declining. In latter weeks, manganese concentrations in Column 2 leachate were observed to increase to roughly 2/3 of initial peak concentrations. There is no obvious correlation with behaviour of other parameters, and the late-stage increase in manganese concentrations remains unexplained.
- Molybdenum concentrations in bottom port leachate from Column 1 stabilized around 0.01 mg/L after Week 22, while Column 2 concentrations peaked at ~0.04 mg/L in Week 56 before declining. Late stage molybdenum concentrations in Column 2 leachate approach coincident concentrations in Column 1.

Over 192 weeks of testing, concentrations of most parameters in both cover and leachate water for both tests showed early peaks followed by generally stable or declining values. Variability over the mid- to late-stage test period ranged across parameters from minimal to ~order of magnitude- this degree of variability is commonly observed in both long term laboratory weathering tests and in full scale operational monitoring. Overall, the differences in porewater geochemistry from the two tailings samples, as represented by column bottom port leachate, are minor, and the results can be considered together when evaluating long term geochemical loadings from saturated tailings.

4.2.3 Implications for Tailings Management

Phase V/VI tailings are expected to be similar to tailings already produced from the Minto and Area 2 ore bodies. Test results indicate that there is minimal risk of acid conditions developing within the Phase V/VI tailings due to a large excess of neutralizing potential over acid potential. Operational monitoring of the DSTSF has shown that there is a potential for neutral pH leaching of selenium, and copper and other metals from the unsaturated tails, and it is expected that the Phase V/VI tails would behave in a geochemically-similar fashion under unsaturated conditions.

Disposal of Phase V/VI tailings as a slurry tails product in the proposed Phase V/VI Tailings Management Facilities (TMFs) will serve to minimize neutral pH metal leaching. Two factors will be significant in considering implications for long-term loadings from Phase V/VI tailings:

- disposal of the bulk of the tailings in a permanently-saturated state will minimize oxidation of contained metal-bearing sulphide minerals, and subsequent leaching of soluble oxidation products; and
- unsaturated tailings beaches in the final Main Pit TMF and Ridgetop North Pit TMF are expected to exhibit leaching characteristics similar to those of the existing unsaturated tailings in the DSTSF.

5 Source Terms for Minto Creek Water Quality Prediction

5.1 Approach

"Source terms" refer to predicted concentrations or loadings in waters that are in contact with various types of geologically-sourced waste materials, under the expected disposal conditions at the site. The source term predictions were key inputs into the Minto Phase V/VI water and load balance model (WLB), which was used to develop water quality predictions for Minto Creek monitoring stations W3 and W1, and the Area 2 pit lake. Predictions were completed for aluminum, ammonia, arsenic, cadmium, chromium, copper, fluoride, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, nitrite, selenium, silver, sulphate, thallium and zinc. A detailed description of the Phase V/VI water and load balance model is provided in a companion report titled "*Minto Mine Phase V/VI Expansion: Water and Load Balance Report*" (SRK 2013b).

This document describes the geochemical source terms that were used as input to the Minto Creek water quality predictions for the period beginning in operations and extending into the post-closure period. For the purposes of the water quality prediction, the post-closure period is assumed to be the period following reclamation and decommissioning of the mine site when steady state conditions have been established. In the context of the Phase V/VI mine plan, a key aspect of these steady state conditions will be the filling of the Area 2 Pit to the spill point and the development of stable chemical loadings to the Area 2 Pit from the site components.

The aim in developing the site wide WLB was to arrive at conservative, but reasonable, estimates of water chemistry in Minto Creek. In practical terms, this aim was met through the selection of appropriate source terms for the various mine components. Where there was uncertainty in the inputs used to develop the source terms, conservative (typically higher) values were selected for use as model inputs. For the major sources of load (those sources related to waste rock and to tailings), two source terms were developed:

- Best Estimate source terms, which were intended to cover the range of typical loading rates from the existing mine components and to allow those rates to be applied on a unit basis (surface area or mass/volume) to existing and future site components;
- Reasonable Worst Case source terms, which were intended to reflect extreme loadings at the upper end of what has been observed from the existing facilities, and to allow those rates to be applied on a unit basis to existing and future site components.

In the context of actual project performance, the predicted 'expected case' concentrations should be considered to be typical performance values (including the range of variability observed over operations at the Minto Mine). The predictions which represent the 'Reasonable Worst Case' scenario are considered to be highly unlikely to occur, and should be considered to represent the extreme upper end of the range of potential water quality performance of the mine. In the unlikely event that water quality concentrations in the range of the 'Reasonable Worst Case' values occur, it is expected that this condition would be transient and of short duration (as observed with the upper range of water quality concentrations in the site monitoring results to date) (SRK 2013b).

In general, the approach used for the Minto source terms was to use data from the site monitoring programs wherever possible, supplemented as required by incorporating laboratory test results and scale up calculations.

5.2 Geochemical Inputs to Water Quality Prediction-Minto Creek

5.2.1 Source Terms - Tailings

Dry Stack Tailings Storage Facility

To appropriately estimate long-term chemical loadings from the Dry Stack Tailings Storage Facility (DSTSF), estimates of tailings pore water chemistry are required. No samples of tailings porewater have been collected to date, but operational monitoring of seepage water quality from finger drains constructed in the foundation of the DSTSF has occurred (stations W8 and W8A). Additionally, seepage surveys downgradient of the DSTSF were conducted in 2012 in which two seeps were identified and sampled (SS9 and SS10). The location of the monitoring stations and the 2012 seeps are presented in Figure 26. The results for these stations are presented in the 2012 annual report (Minto 2013a), and are summarized as follows.

A review of the results from W8 and W8A (from 2005 to present) and from the 2012 seepage survey was carried out. Monitoring results from W8 and W8A show considerable variation in concentrations over time (Figure 27). Generally, the results of the 2012 seepage survey were similar to the 2012 results from W8A. Between the 2011 and 2012 sampling seasons, the base of the DSTSF where W8 and W8A are located was filled in and vertical culverts were installed to allow sampling to continue. Despite this effort, sampling at W8 was not possible in 2012.

For the majority of parameters, the maximum concentrations observed in water downgradient of the DSTSF term have not increased since the Phase IV water quality predictions were developed (SRK 2010a), because the maximum concentrations occurred in or before 2010. The exceptions are molybdenum, selenium, thallium, and zinc, which have marginally increased (Figure 27 shows zinc and selenium concentrations over the period of monitoring). Zinc concentrations at W8a in 2012 are of particular note due to increases in concentrations by more than two orders of magnitude. These 2012 concentrations are uncharacteristic of any water previously observed at Minto and are believed to reflect leaching of zinc from the galvanized culvert that was installed to allow sampling access through the waste rock fill material, rather than leaching from waste rock or the DSTSF. Therefore, these were not considered in the updated source term predictions.

The DSTSF source terms used in the WLB were defined based on the observed water chemistry at station W8, which has experienced the highest concentrations of copper, cadmium, selenium and sulphate of the relevant monitoring stations over the period of record. The following points describe the source terms:

- Best Estimate source term: 50th percentile dissolved concentrations from the complete W8 record;
- Reasonable Worst Case source term: 95th percentile dissolved concentrations from the complete W8 record.

The values for both source terms are included in Appendix H.

Other assumptions made in defining the DSTSF source term include:

- In the post-closure period, tailings seepage will contain minimal suspended solids, and dissolved concentrations will be equal to total concentrations; and
- Tailings seepage will have circumneutral pH.

Tailings Slurry Water

During active milling, soluble load from the processed ore reports to the tailings slurry, and this load can be an important source during the operational period. Operational monitoring of tailings slurry can provide a good indication of actual loading rates, but interpretation of operational monitoring results can be confounded by recycling of process water (as occurred at Minto during the period in which tailings were filtered and dry-stacked) or by reclaim from a TMF pond (as is occurring at Minto presently).

During the transition from filtered tailings to slurry tailings disposal, there was a 5 month period (November 2012 through March 2013) when fresh water was drawn from the Water Storage Pond and discharged to the Main Pit TMF as tailings slurry. The monitoring results from this period therefore provide a good indication of the loading that occurs from ore processing, as no recycling or reclaim was occurring.

The tailings thickener overflow is monitored as station W-14 as part of the routine monitoring program. Average concentrations from W-14 monitoring over the November 2012 to March 2013 period were adopted as the tailings slurry source term and are provided in Appendix H.

Main Pit Tailings Management Facility

The final configuration of the completed Main Pit TMF (MPTMF) will consist of a thin (few metre thick) zone of unsaturated tailings overlying a large saturated mass of tailings. During closure, a soil cover will be constructed on the final tailings surface.

The saturated tailings are not expected to contribute material loadings to Minto Creek over the long term. Proof-of-concept calculations based on groundwater flow estimates and concentrations from saturated column tests showed that loadings via seepage pathways will not be significant[2].

To estimate the future loadings from the unsaturated tailings, operational monitoring results from station W37 (seepage collection sump downgradient of the DSTSF- Figure 4) were used to calculate loadings from the DSTSF, and those loadings were normalized to a mass basis. The following points summarize the estimation process.

[2] Proof-of concept calculations: Darcy flux estimates (400 m * 13 m cross section, 13 m gradient, flux controlled by hydraulic conductivity of tailings (expected: $9.7*10^{-6}$ cm/sec; upper bound : $9.7*10^{-5}$ cm/sec)) and maximum concentrations from saturated column tests (see Appendix G for column test results).

1. Pumped volumes from W37 (111,000 m^3 in 2012) and average or 95th percentile 2012 W37 concentrations were used to develop expected case or worst case load estimates (mg/yr).

2. Load estimates were divided by total mass of DSTSF tailings (5.1 million tonnes) to yield load per unit mass (mg/tonne/yr).

3. Tonnage of unsaturated tails in the final MPTMF configuration was estimated (2 m thick unsaturated tails at 1.3 t/m^3 over the entire footprint (15.2 ha)).

4. Expected case (worst case) source terms for the MPTMF were defined as expected case (worst case) load per unit mass multiplied by unsaturated mass (mg/yr).

These source terms were applied for the operational, closure and post-closure periods.

Loadings from the ore stockpiles, the mill area, and the Mill Valley Fill Extension all report to W37, in addition to loadings from the DSTSF. It is therefore considered conservative to attribute all W37 load to the DSTSF in the derivation of the unsaturated tailings source terms.

The values for both the expected case and worst case source terms are included in Appendix H.

Ridgetop North Pit Tailings Management Facility

The Ridgetop North Pit TMF (RNPTMF) source terms were developed as described above for the MPTMF, using the final footprint area of the RNPTMF (8.2 ha).

The values for both source terms are included in Appendix H.

Area 2 Pit Tailings Storage Facility

Tailings in the Area 2 Pit TMF will be saturated and overlain by a pit lake in the post-closure period. During operations, loadings from deposited tailings are reflected in the tailings slurry source term.

In large tailings facilities, consolidation of slurry-deposited tailings can persist for many years after final tailings deposition. This consolidation process expels tailings porewater and can be an important source of loading.

Minto tailings are relatively coarse, which results in rapid consolidation and a shorter time to a fully-consolidated state relative to finer grained tailings. A scoping evaluation of expected consolidation rates and loadings at the start of the post-closure period (e.g. 3 years after final tailings deposition) indicated that loadings due to ongoing consolidation will be low (scoping results indicate <1% of total site loads) and therefore no consolidation loadings were included in the WLB.

5.2.2 Source Terms- Waste Rock

Waste rock from the Main Pit placed in the Main Waste Dump (MWD) and in the Southwest Waste Dump (SWD), and Area 2 Pit (Stage 1 and 2) waste rock has also been placed in the SWD. Water chemistry of drainage from these facilities has been monitored at several routine monitoring stations (W15, W30, W31, W32, W38, W39, and W40) since 2007, as well as through semi-annual seepage surveys (three seeps were monitored in 2012- SS1, SS3, SS4).

All surface drainage from the MWD and SWD catchment areas reports to routine monitoring station W15 and is transferred to the Main Pit by pumping. Pumped volumes are tracked by the mine for water management purposes, and water chemistry at W15 is regularly monitored. These records were used to develop a waste rock volume- based source term as described in the following steps.

1. Water quality records from 2007 through 2012 were compiled, and average and 95th percentile concentrations were calculated.

2. Average and 95th percentile total catchment loadings were estimated using average and 95th percentile concentrations (from step 1) together with flows estimated based on the mean annual runoff (329 mm) and runoff coefficient (0.3) and catchment area of station W15 (253 ha) (SRK 2013b).

3. Loads estimated in step 2 were assumed to be entirely derived from the SWD and the MWD. Estimates of loading rates per volume of waste rock were made by dividing the total step 2 catchment load by the volume of rock that had been placed at end-of-year 2011 (the latest year records were available).

The results of step 3 were then adopted as the expected case and reasonable worst case source terms for volume-based loadings from bulk waste rock. The advantage of source terms based on units of rock volume is that they can be readily applied to existing and proposed new or expanded waste facilities to estimate future loadings.

5.2.3 Source Terms- Other Sources

Undisturbed Catchment Areas

Access Consulting Group and Minnow Environmental Inc. evaluated background water chemistry by reviewing monitoring records from reference streams within the Minto Creek catchment and from the main stem of Minto Creek. The reviewed records span the pre-operational and operational periods through the end of 2009. One of the outcomes of this review was a recommendation the different water chemistry be used to represent background water quality (also referred to as undisturbed catchment runoff) for the upper and lower portions of the Minto Creek catchment (in this case, upper refers to upstream of the Water Storage Dam (WSD) and lower refers to downstream of the WSD). This recommendation was adopted and implemented in the WLB model.

The seasonally-variable concentrations adopted for runoff from undisturbed upper and lower Minto Creek catchments are provided in Appendix H.

Main Pit and Area 2 Pit Walls

Loadings from the pit walls exposed above the final lake elevations were estimated using results of humidity cell testing (Appendix D) along with estimates of reactive rock mass in the pit walls. This is the same procedure used for the Phase IV water quality prediction (SRK 2010a). Nearly all the mineralized material exposed in pit walls will be well below the final tailings (Main Pit) or lake (Area 2 Pit) elevations.

An average of release rate from all humidity cell tests was adopted as an expected case source term input to estimating loads from pit walls, and the average of the maximum release rates was adopted as the reasonable worst case source term input. Laboratory release rates were multiplied by three scaling factors to estimate equivalent field release rates. These factors were:

- A temperature factor of 0.2, to account for lower rates of chemical reactions under field conditions. Typical lab operating temperatures were 20°C and average site ground temperatures were assumed to be 0°C; application of the Arrhenius equation (assuming an activation energy of 60 kJ/mol) suggests a factor of 0.17 would be justified.
- A particle size factor of 0.2, to account for the difference in reactive surface area between the crushed HCT sample and the blasted rock that will be present at full scale.
- A contact or flushing factor of 0.5, to account incomplete flushing of weathering products from the full scale waste dumps (HCT operating procedure ensure complete flushing of weathering products).

Reactive rock mass was estimated for each pit wall by multiplying the approximate wall rock surface area by a thickness of 2 m. Loadings from the resulting reactive rock mass were then estimated by multiplying rock mass by estimates of field release rates.

Assumptions inherent to the estimates of loadings from Main Pit and Area 2 pit walls were as follows:

- Loading rates remain constant over time, as fresh weathering surfaces are exposed by ravelling of walls; and
- Pit lakes reach final elevation quickly and long-term loadings from pit walls below the final lake elevation are minimal.

The values for both source terms are included in Appendix H.

Area 118 Backfill Dump

The Area 118 Backfill Dump will be constructed entirely with overburden from mining of Area 2 Stage 3 Pit. For water quality prediction purposes, this was assigned the same source term as undisturbed catchment areas.

Ridgetop South Backfill Dump

The Ridgetop South Backfill Dump will be constructed entirely with overburden from mining of Ridgetop North Pit. For water quality prediction purposes, this was assigned the same source term as undisturbed catchment areas.

Ore Stockpile Areas

Separate source terms were developed for the operational and post-closure periods for the ore stockpile areas.

The operational source terms were based on seepage monitoring around the ore stockpiles in 2012 (stations SS5, SS6, SS7, SS8 (Minto 2013a)). Monitoring results were pooled, with the average concentrations adopted as the expected case source term and maximum concentrations as the worst case source term.

The post-closure source terms were estimated based on scale up of humidity cell release rates in a manner similar to that described above for the Main Pit and Area 2 Pit walls (using the same humidity cell test results for expected case and worst case sour case terms). A mine rock thickness of 2 m was assumed to exist over the footprint of the ore stockpile areas to make allowance for any residual loadings that make occur from the ore stockpile footprints.

The values for both source terms are included in Appendix H.

Mill Area

Expected case and worst case source terms were estimated based on scale up of humidity cell release rates in a manner similar to that described above for the Main Pit and Area 2 Pit walls (using the same humidity cell test results for expected case and worst case sour case terms). A mine rock thickness of 2 m was assumed to exist over the footprint of the mill area.

The values for both source terms are included in Appendix H.

Nitrogen Loadings

Residual ammonium nitrate/fuel oil (ANFO) explosives in tailings and water rock contribute the vast majority of nitrogen species to the mine water. Once mining is complete and ANFO use ends, there will be no new sources of nitrate and ammonia loadings.

Explosives use will decline during operations from a projected 3.4 million kg in 2014 to 0.3 million kg in 2019. There will be no explosives use after mining is complete in 2019. During mining, loadings of nitrogen species are expected to within the range observed to date (Figure 32) and to decline thereafter. In order to evaluate effects in lower Minto Creek, the pooled monitoring results from station W3 and related stations W16, W17 and W50 were queried for appropriate source terms:

- Expected case: maximum concentrations observed from July 2011 through the end of 2012;

- Reasonable worst case: maximum concentrations over the entire record, after removal of anomalous outliers (see isolated high concentrations in Figure 32).

The adopted nitrogen species source terms are shown in Table 5-1.

Table 5-1: Source Terms for Nitrogen Species

N-Species	Units	Expected Case	Reasonable Worst Case
N_NH3	mg/L	0.642	1.04
N-NO2	mg/L	0.11	0.64
N-NO3	mg/L	8.77	22.7

Source: T:\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\020_Tables\[Table5-1_N-SpeciesSourceTerm.xlsx]

Underground Workings

No source term or load has been attributed to the underground workings. The underground workings are expected to be at least partially flooded following the cessation of mining, although there may not be discharge from the portal given the relatively high elevation of the portals (there are no obvious natural springs near the proposed portal areas). The workings themselves are not expected to be a significant source of load, given the small exposed surface area, the low expected rates of water flux, and the geochemical similarity of the underground rocks to the surface-disposed waste rock.

Particulate Loadings from Suspended Solids

To estimate total concentrations of the parameters of interest, operational monitoring records from W3 from 2008 onwards were evaluated to determine the concentrations of metals associated with the suspended sediment. Median elemental concentrations of suspended sediment were calculated from total suspended solids (TSS) results and from the associated elemental load (based on the difference between total (unfiltered) and dissolved (filtered) water chemistry). The suspended metal concentrations were then calculated assuming that the site discharge (at W3) would contain 15 mg/L TSS (the upper limit allowed under the current water licence), and incremental loadings due to suspended solids were calculated for each month. It is important to recognize that this is a technique for conservative estimation of particulate concentrations, and not an expression of the mine's intention to discharge at the licence limit for TSS.

In the GoldSim model, the incremental loadings from suspended solids were added as a discrete source to the dissolved load reporting to W3. For runoff entering Minto Creek between W3 and W1, the source term was calculated from actual catchment monitoring data; since the total concentrations from undisturbed ground runoff were used, no allowance for additional loading due to suspended solids was necessary.

The particulate loading source term is included in Appendix H.

6 Source Terms for McGinty Creek Water Quality Prediction

6.1 Approach

There is presently no mine development within the McGinty Creek watershed. During Phase V/VI, Minto North Pit (MNP) will be developed in the headwaters of the easternmost of two major tributaries that join to form lower McGinty Creek (Figure 4). To evaluate the potential effects of developing MNP on water quality in McGinty Creek, a scoping level water quality assessment was carried out (SRK 2013b). This document describes the geochemical source terms that were used in that assessment.

6.2 Conceptual Loading Model

During active mining, any water that accumulates in MNP will be transferred to the Minto Creek catchment and managed with other mine water. As a result, loadings to McGinty Creek from the operational phase of MNP are expected to be minimal, and for this reason the water quality evaluation described in the following sections was carried out as a worst case snapshot for the post-operational period only.

To develop the scoping-level evaluation of post-mining water quality in McGinty Creek, a conceptual model of loadings from MNP was required. As loadings from MNP are expected to be a function of the surface area of exposed (i.e. unsaturated) pit walls that remain following mining, it was assumed for evaluation purposes that the pit would not fill with water in the long term and that therefore the entire pit shell would be exposed and generating load. This is considered a conservative approach, since records from a near-by monitoring well (09MW-03) have shown that the groundwater table is typically within a few metres of the ground surface (SRK 2013c) and the most likely post-mining outcome is that MNP will be partially flooded with a water level similar to the pre-mining groundwater table at the low point in the pit rim.

For assessment purposes, it was assumed that loads generated in MNP will report to McGinty Creek instantaneously (in other words, there were no allowances built in for travel time) and that transport is conservative (i.e. no load attenuation occurs along the flow path).

The post-operational estimates of did not consider any residual nitrogen loadings from MNP to McGinty Creek. This was considered appropriate since, during operations, the majority of blasting residues would be exported to Minto Creek with the waste rock and overburden, or with the pit sump water, and only trace quantities of blasting residues would remain in the McGinty Creek catchment following completion of mining.

6.3 Geochemical Inputs to Water Quality Prediction-McGinty Creek

6.3.1 Source Terms

Undisturbed Catchment Areas

Access Consulting Group evaluated background water chemistry in McGinty Creek and developed monthly average total concentrations measured during baseline monitoring at station MN4.5 (located near the mouth of McGinty Creek) for use as the source term for undisturbed catchment runoff (ACG 2013). These values were adopted for the water quality prediction, and the adopted source term is provided in Appendix I.

Minto North Pit Walls

Loadings from the Minto North Pit walls were estimated using results of laboratory humidity cell tests along with estimates of reactive rock mass. Results from Minto North humidity cells HC6, HC7, and HC8 were pooled, and the maximum laboratory release rate for each parameter from the pooled data set was adopted for use in the source term calculations.

Laboratory release rates were scaled to field release rates as described previously for the Area 2 Pit and Main Pit walls (Section 5.2.3).

Reactive rock mass was estimated for the Minto North pit wall by multiplying the three dimensional pit wall surface area (15.7 ha) by an assumed reactive thickness of 2 m and multiplying by an in-situ rock density of 2.7 t/m^3 to convert volume to mass. Loadings from the resulting reactive pit wall mass were then estimated by multiplying reactive wall mass by estimates of field release rates.

Assumptions inherent to the scoping estimates of loadings from Minto North Pit walls include:

- Pit walls consist entirely of rock (no allowance for reduced loadings from overburden, which is expected to make up nearly 20% of the final wall area);
- Loading rates remain constant over time, as fresh weathering surfaces are exposed by ravelling of walls; and
- The pit remains empty and none of the wall area is flooded.

The Minto North pit wall source term is provided in Appendix I.

This report, **Minto Mine Phase V/VI Expansion: Phase V/VI ML/ARD Assessment and Inputs to Water Quality Predictions**, was prepared by

Saskia Nowicki,
Staff Consultant (Geochemistry)

Dylan MacGregor, PGeo (BC)
Principal Consultant (Geochemistry)

and reviewed by

Kelly Sexsmith, PGeo (BC)
Practice Leader and Principal Consultant

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

Disclaimer—SRK Consulting (Canada) Inc. has prepared this document for Minto Explorations Ltd.. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

7 References

Access Consulting Group. 2013. Minto Mine Phase V/VI Expansion, Preliminary Reclamation and Closure Plan.

Access Consulting Group and Minnow Environmental Inc. 2013. Minto Creek Water Quality Characterization: YESAB Project Proposal Phase V/VI. Report prepared for Minto Explorations Ltd.

Access Consulting Group and Minnow Environmental Inc. 2013. McGinty Creek Water Quality Characterization, May 2009- July 2012: YESAB Project Proposal Phase V/VI. Report prepared for Minto Explorations Ltd.

ASTM, 2007. Standard Test Method for Laboratory Weathering of Solid Materials Using a Humidity Cell. Publication date Oct. 1, 2007.

BC Research Incorporated. 1995. Test Procedures to Evaluate The Acid Production Potential Of Ore and Waste Rock (BC Research Method). Project No. 0-05-644, August 1995.

Colpron, M., Gladwin, K., Johnston, S.T., Mortensen, J.K. and Gehrels, G.E., 2005. Geology and juxtaposition history of the Yukon-Tanana, Slide Mountain, and Cassiar terranes in the Glenlyon

GoldSim Technology Group, 2010. User's Guide, GoldSim, Probabilistic Simulation Environment (Version 10.1). Issaquah, WA.

G&T Metallurgical Services Ltd. 2007. Metallurgical Performance Of Area 2 Ore Zones, Minto Explorations Ltd. Yukon, Canada. Report KM1966, prepared for Minto Explorations Ltd., June 2007.

G&T Metallurgical Services Ltd. 2009a. Preliminary Metallurgical Testing on a Master Composite from the Minto North Deposit Yukon, Canada. Report KM2420, prepared for SRK Consulting, January 2009.

G&T Metallurgical Services Ltd. 2009b. Pre-Feasibility Metallurgical Testing On Samples From The Area 118 And Ridgetop East Zones At The Minto Mine, Yukon, Canada. Report KM2351, prepared for SRK Consulting, May 2009.

G&T Metallurgical Services Ltd. 2010. Preliminary Metallurgical Testing Wildfire, Copper Keel, & Minto East Zones; Minto Mine. Report KM2751.

Hood, S., Hickey, K., Colpron, M. and Mercer, B., 2008. High-grade hydrothermal copper-gold mineralization in foliated granitoids at the Minto mine, central Yukon. Yukon Exploration and Geology.

MEND (Mine Environment Neutral Drainage Program). 1991. Acid Rock Drainage Prediction Manual, MEND Project 1.16.1 (b). Prepared by Coastech Research Inc., North Vancouver, B.C. March 1991.

Mills,C. (1997). An Assessment of the Results of Acid base Accounting (ABA) and Mineralogical Testwork on Eight Samples form the Proposed Minto, Yukon Territory, Mine Site. Prepared February 1997 for the Selkirk First Nation.

Minto Explorations Ltd. 2010. Report on ABA Testing for Minto Mine Projecct, QZ96-006, Period Ending October 31, 2009. Prepared April 2010.

Minto Explorations Ltd. 2012. Minto Phase VI Preliminary Feasibility Study Technical Report. July 2012.

Minto Explorations Ltd. 2013a. 2012 Annual Water Licence Report. March 2013.

Minto Explorations Ltd. 2013b. Minto Mine Phase V/VI Expansion, Project Proposal: Phase V/VI Expansion of Mining and Milling, Minto Mine, Yukon.

Minto Explorations Ltd. 2013c. Minto Mine- Phase V/VI Expansion: Waste Rock and Overburden Management Plan.

Minto Explorations Ltd. 2013d. Minto Mine- Phase V/VI Expansion: Tailings Management Plan

Pearson, W.N. and Clark, A.H., 1979. The Minto Copper Deposit, Yukon Territory, A Metamorphosed Orebody in the Yukon Crystalline Terrane. Economic Geology, Vol. 74, p. 1577-1599.

Piercey, S.J., Mortensen, J.K., Murphy, D.C., Paradis, S. and Creaser, R.A., 2002. Geochemisty and tectonic significance of alkali mafic magmatism in the Yukon-Tanana terrane, Finlayson Lake region, Yukon. Canadian Journal of Earth Sciences, 39(12), 1729-1744.

Price, W.A. (1997), DRAFT Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia, British Columbia Ministry of Employment and Investment, Energy and Minerals Division, Smithers, BC, (April), 143p.

Sobek A A, Schuller W A, Freeman J R, and Smith R M., 1978. Field and laboratory methods applicable to overburden and minesoils. USEPA Report No. 600/2-78-054, 203 pp.

SRK Consulting (2007). Area 2 Pre-feasibility Study Minto Mine, Yukon. Prepared for Minto Explorations Ltd. November 2007.

SRK Consulting (2009a). Minto Phase IV Pre-Feasibility Technical Report. Prepared for Minto Explorations Ltd., December 2009.

SRK Consulting (2009b). Minto North: Sample selection for initial waste rock characterization memorandum. Prepared for Minto Explorations Ltd., April 2009.

SRK Consulting (2010a). Minto Mine Expansion – Phase IV ML/ARD Assessment and Post-closure Water Quality Prediction. Prepared for Minto Explorations Ltd., August 2010.

SRK Consulting. 2013a. Main Dam Conceptual Design Report. Prepared for Minto Explorations Ltd..

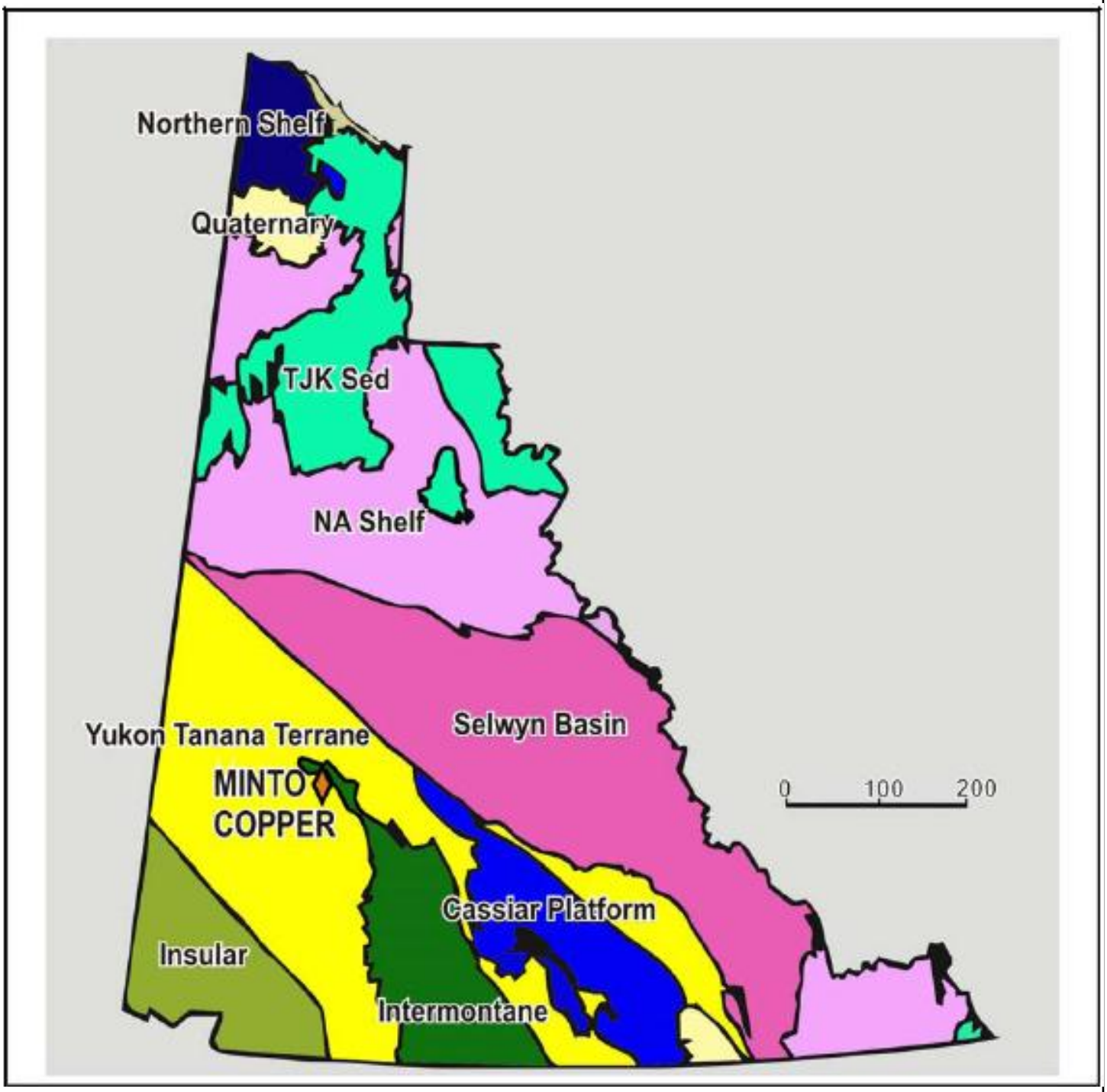
SRK Consulting. 2013b. Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report. Prepared for Minto Explorations Ltd..

SRK Consulting. 2013c. Minto Mine Phase V/VI Expansion: Hydrogeological Characterization Report. Prepared for Minto Explorations Ltd.

Tempelman-Kluit, D.J., 1984. Maps of Laberge (105 E) and Carmacks (115 I) map sheets; with legends. Geological Survey of Canada Open File 1101.

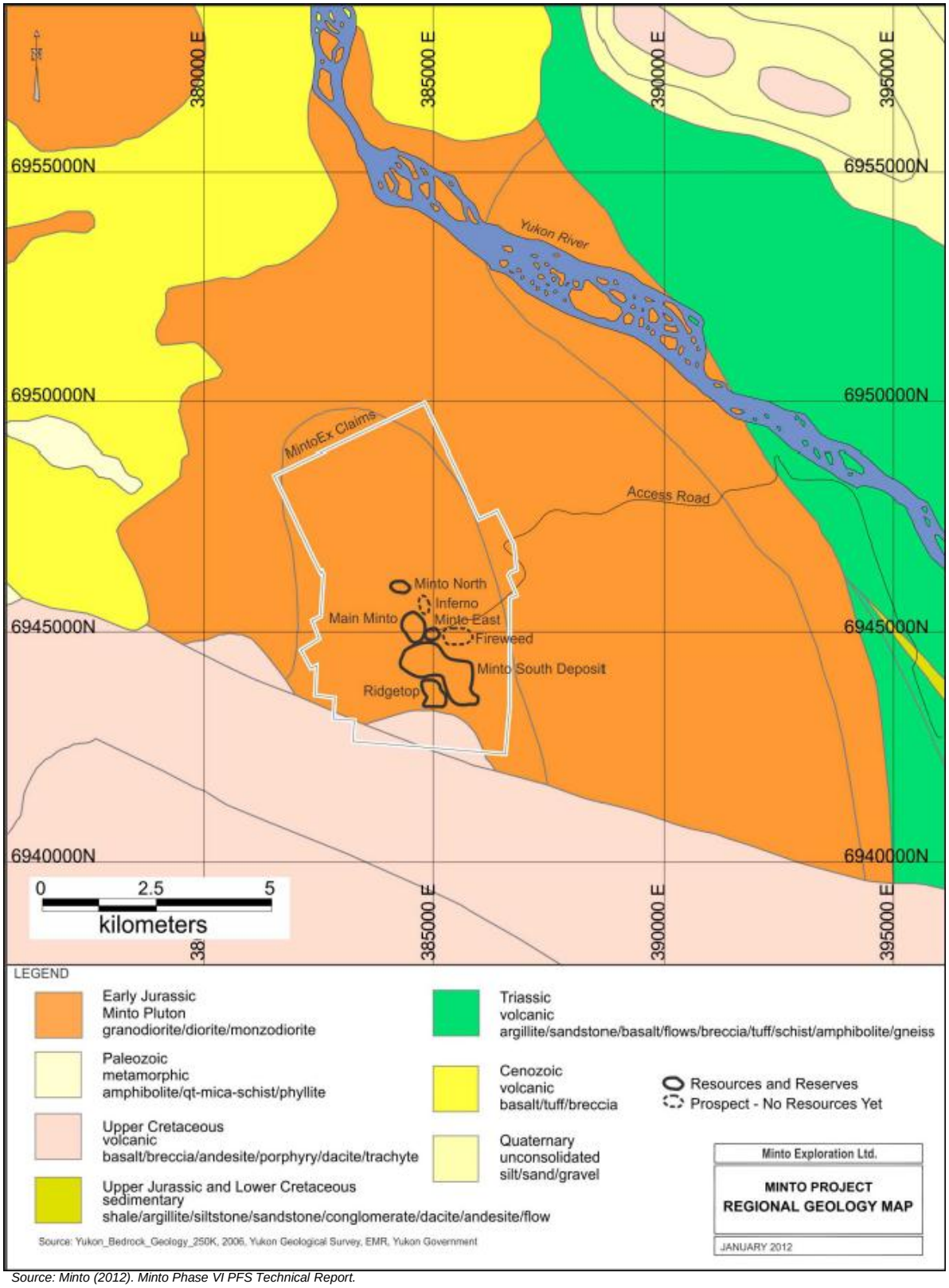
Williams, P.J., Barton, M.D., Johnson, D.A., Fontboté, L., De Haller, A., Mark, G., Oliver, N.H.S., and Marschik, R., 2005. Iron Oxide Copper-Gold Deposits: Geology, Space-Time Distribution and Possible Modes of Origin. In Economic Geology, 100th Anniversary Volume, J.W. Hedenquist, J.F.H. Thompson, R.J. Goldfarb, and J.P. Richards (eds.), p.371-405.

Yukon Water Board. 2012. Water Use License QZ96-006 Amendment 8. Issued to Minto Explorations Ltd. on October 18, 2012.



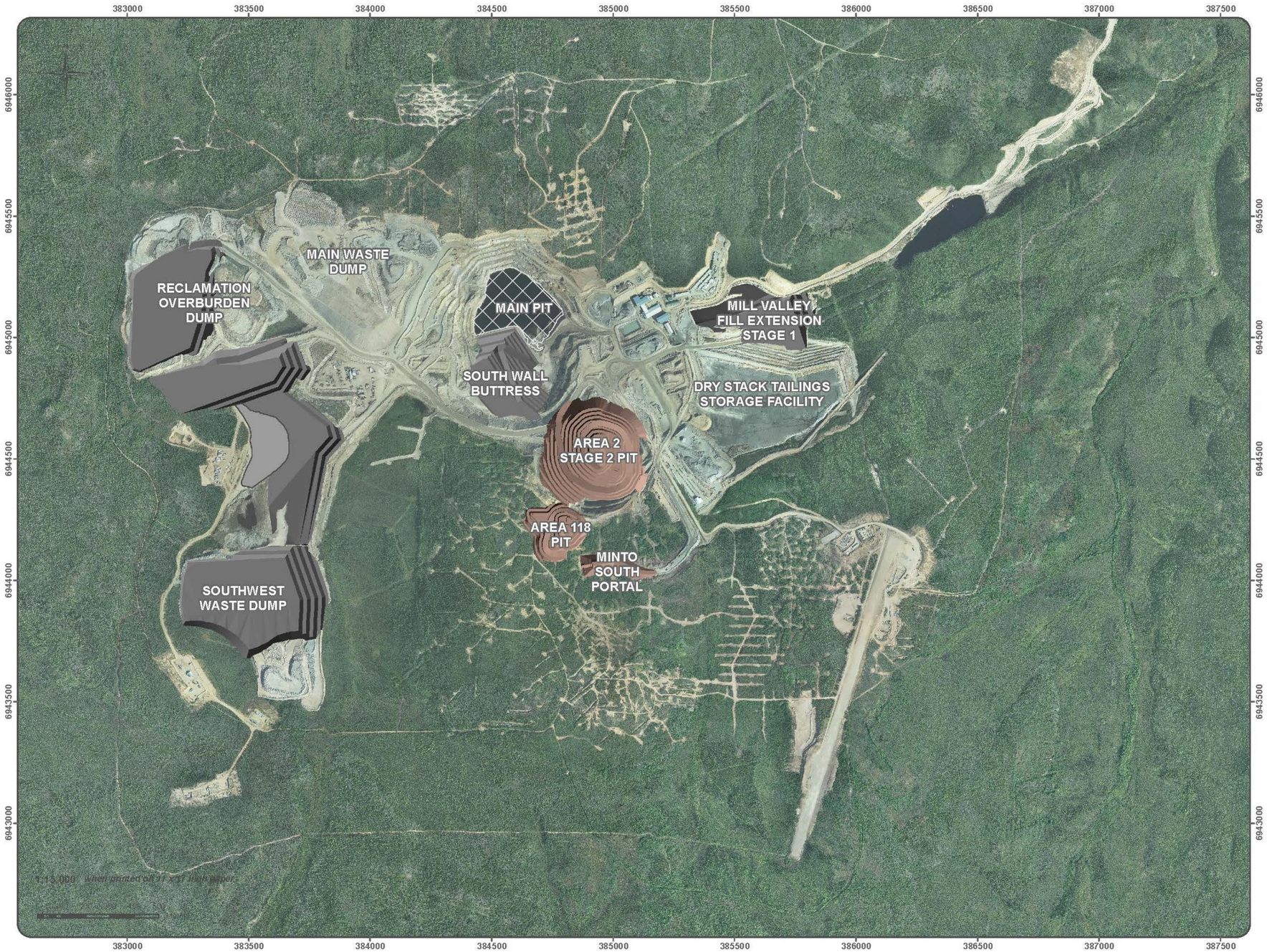
Source: Minto (2012). Minto Phase VI PFS Technical Report.

srk consulting	Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions			
CAPSTONE MINING CORP. MINTO MINE	**Yukon Geology**			
	PROJECT: 1CM002.003	DATE: June 2013	APPROVED: DBM	FIGURE: **1**



Source: Minto (2012). Minto Phase VI PFS Technical Report.

srk consulting	Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions			
CAPSTONE MINING CORP. MINTO MINE	**Regional Geology**			
	PROJECT: 1CM002.003	DATE: June 2013	APPROVED: DBM	FIGURE: **2**



Phase IV Tailings
Phase IV Dumps
Phase IV Pits

Source: Adapted from original figure in Minto Explorations Ltd. 2013a. Minto Mine Phase V/VI Expansion, Project Proposal: Phase V/VI Expansion of Mining and Milling, Minto Mine, Yukon.

srk consulting

Job No: 1CM002.003
Filename: Fig_3_PhaseIV_GeneralArrangement.pptx

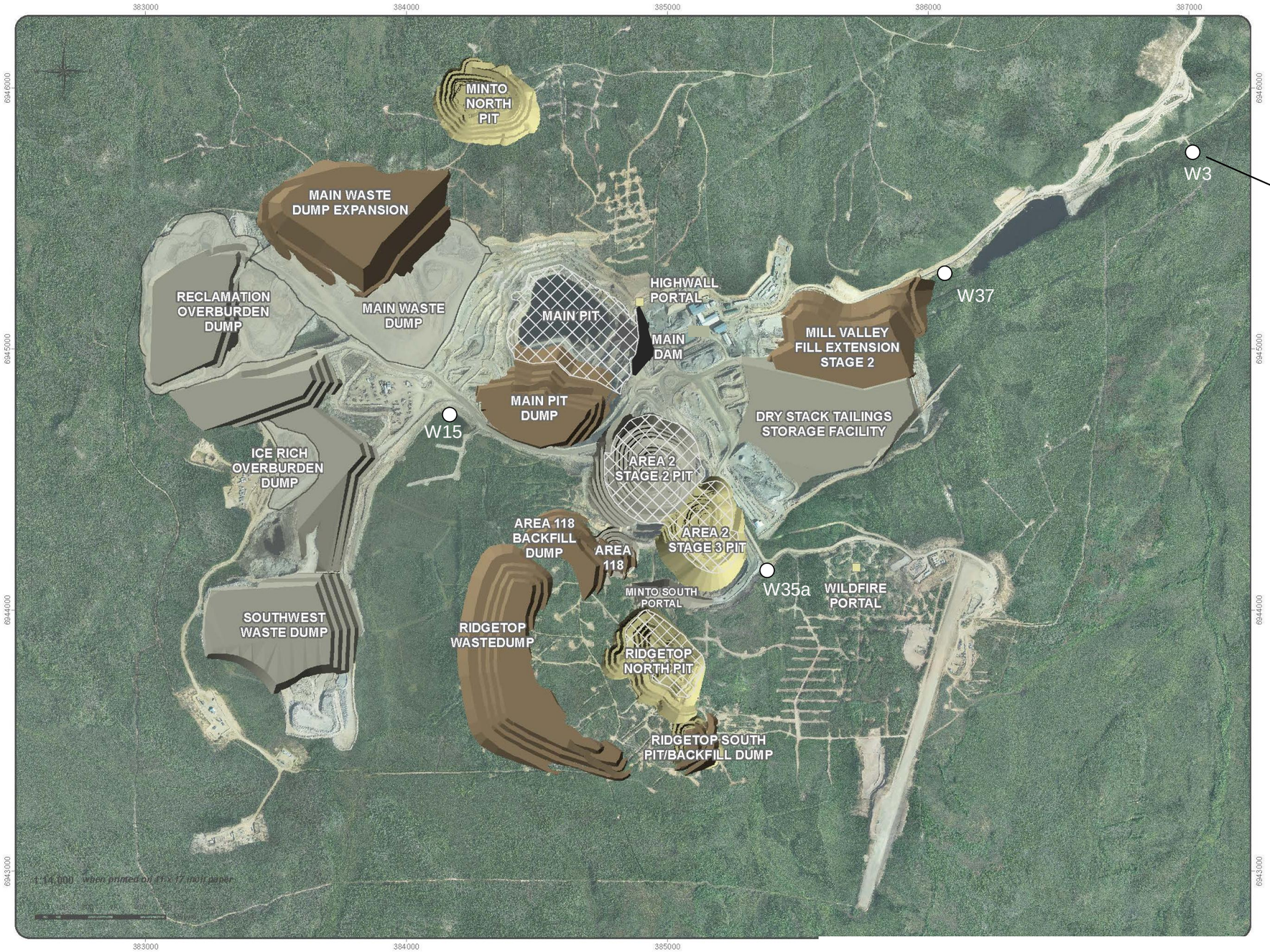
CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

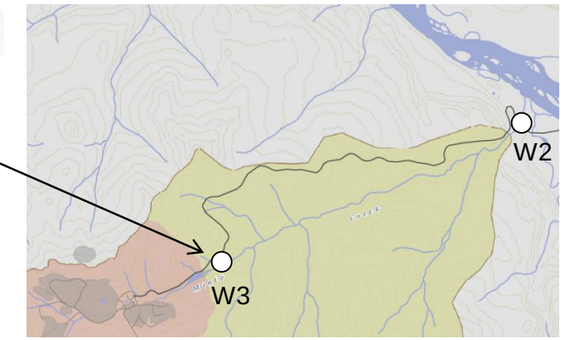
Minto Mine

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

General Arrangement- End of Phase IV

Date:	Approved:	Figure:
June 2013	DBM	3



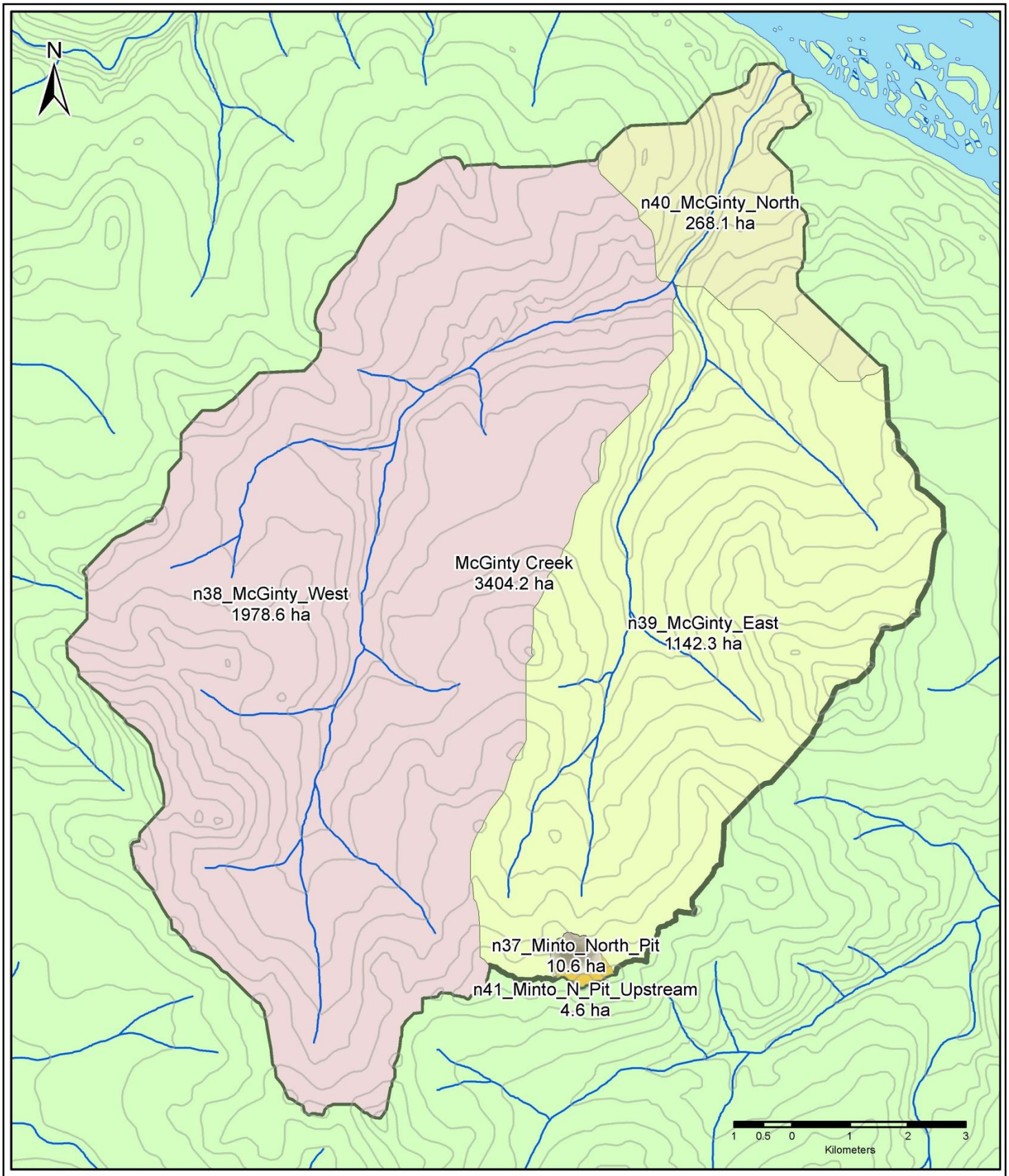


Legend

- W3 — Routine water quality monitoring station
- Phase V/VI Tailings
- Phase V/VI Pits
- Phase V/VI Dumps
- Phase V/VI Dam
- Phase IV Features

Source: Adapted from Figure 1-1 (prepared by Access Consulting Group) in Minto Explorations Ltd. 2013a. Minto Mine Phase V/VI Expansion, Project Proposal: Phase V/VI Expansion of Mining and Milling, Minto Mine, Yukon.

srk consulting	CAPSTONE MINING CORP. MINTO MINE OPERATED BY MINTO EXPLORATIONS LTD.	Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions
Job No: 1CM002.003	Minto Mine	**General Arrangement- End of Phase V/VI**
Filename: Fig_4_PhaseV-VI_GeneralArrangement.pptx		Date: June 2013 · Approved: DBM · Figure: 4



srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

McGinty Creek Watershed and Proposed Minto North Pit

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	5

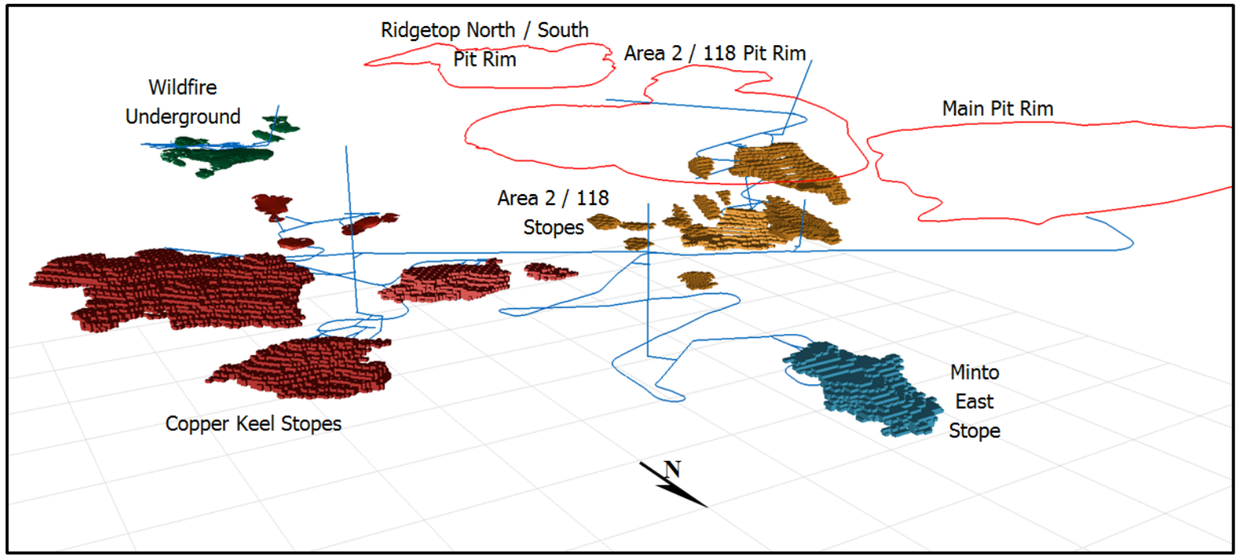


Figure 3-8: Perspective View, Looking Southwest, of Underground Stopes and Development.

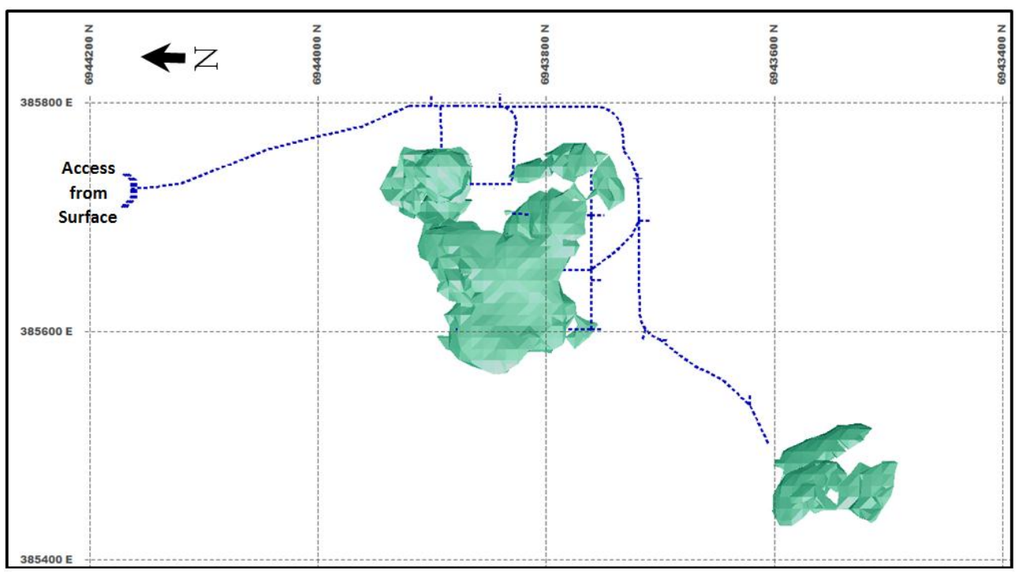


Figure 3-10: Plan View of Wildfire Underground.

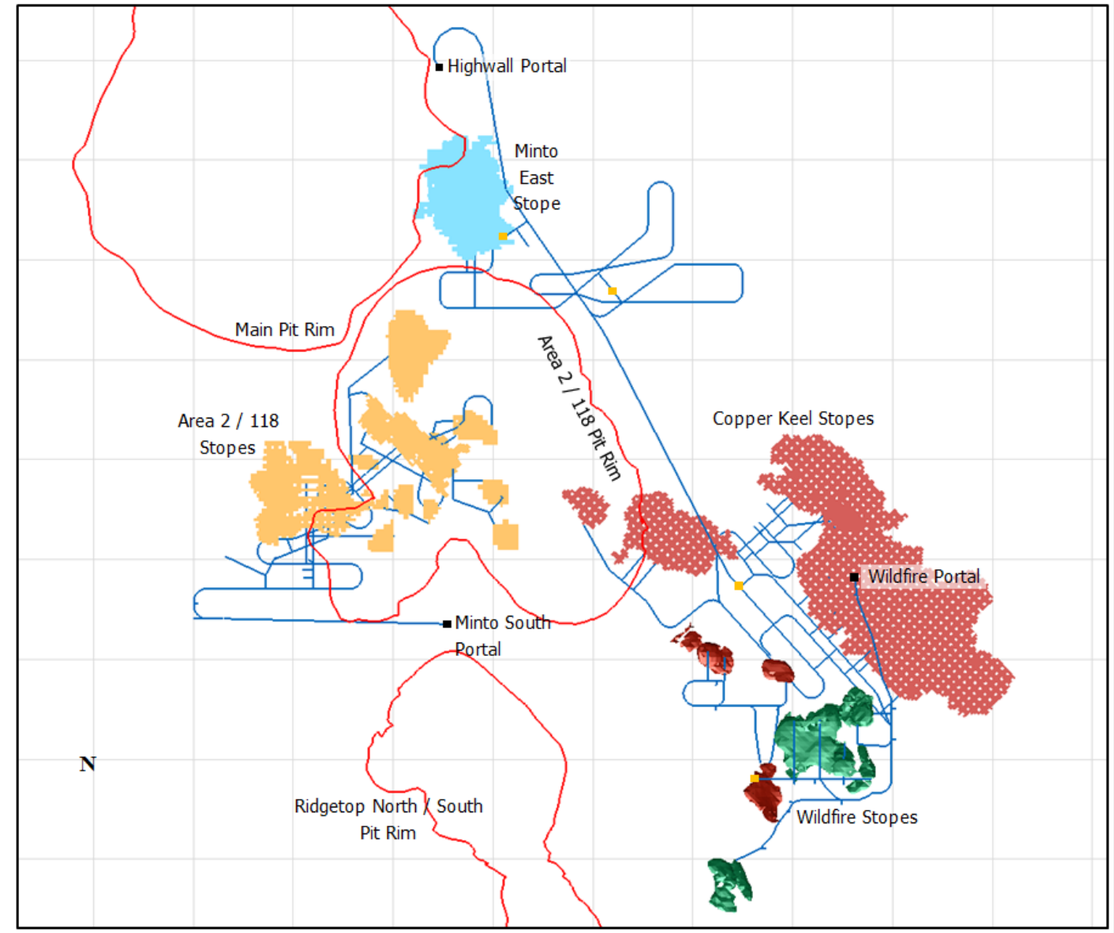
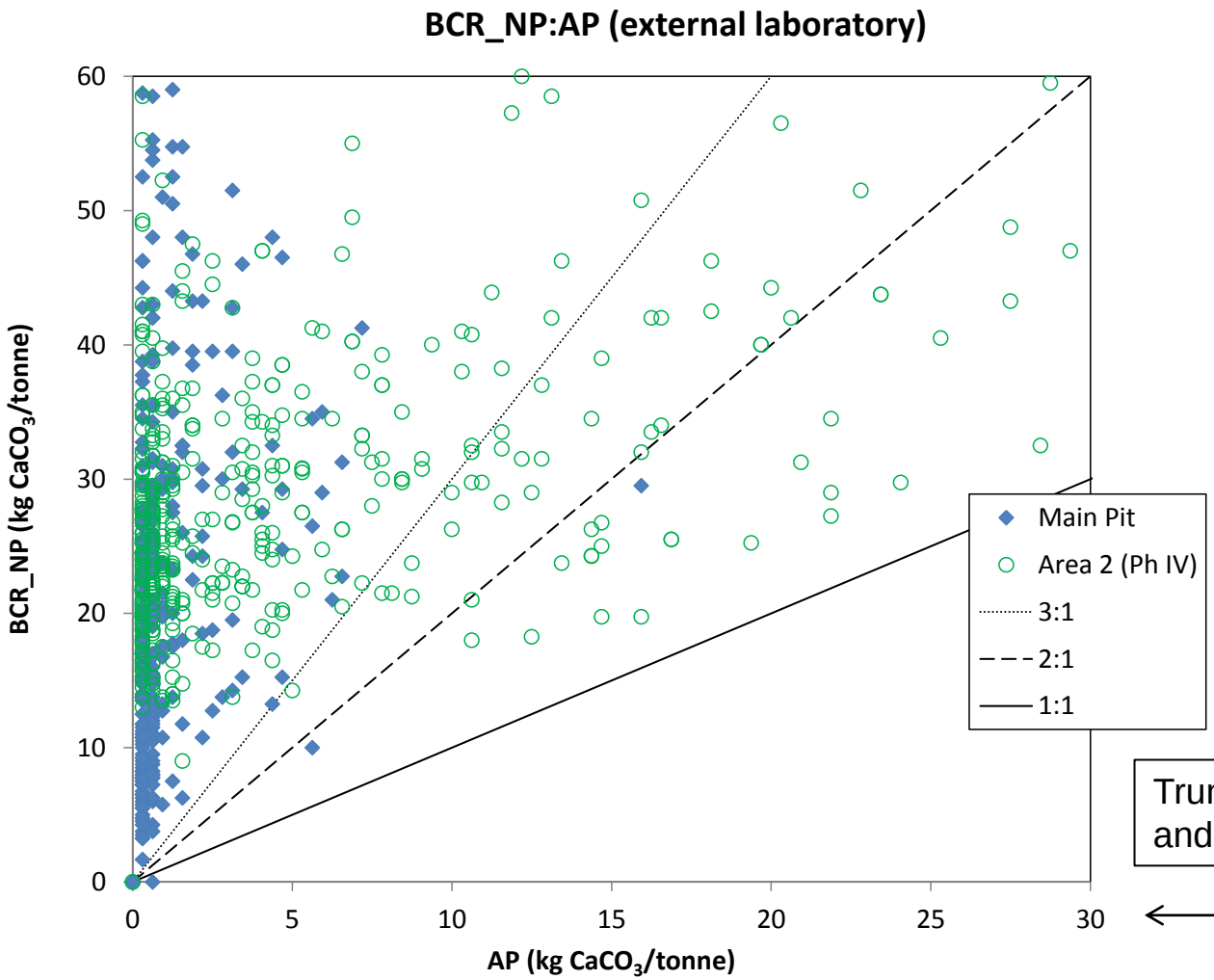
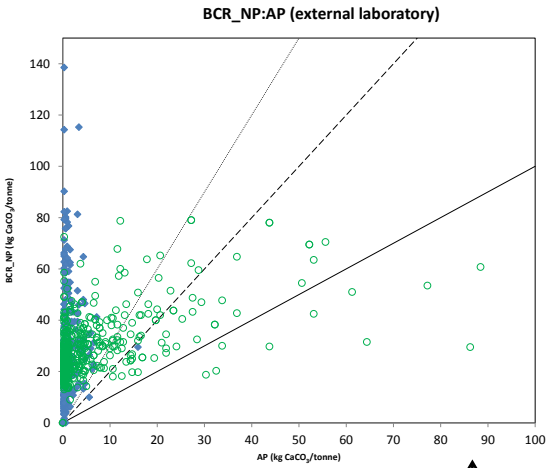


Figure 3-9: Plan View of the Minto South Underground Deposit and Wildfire Underground.

Source: Minto Explorations Ltd. 2013a. Minto Mine Phase V/VI Expansion, Project Proposal: Phase V/VI Expansion of Mining and Milling, Minto Mine, Yukon.

srk consulting	CAPSTONE MINING CORP. MINTO MINE OPERATED BY MINTO EXPLORATIONS LTD.	Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions
		Plan and Perspective Views of Phase V/VI Underground
Job No: 1CM002.003	Minto Mine	Date: June 2013 / Approved: DBM / Figure: 6
Filename: Fig_6_PhaseV-VI_GeneralArrangement_Underground.pptx		





Full vertical and horizontal scale

Truncated vertical and horizontal scale

T:\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\Operational_Monitoring\Minto_Pit\[Minto_OperationalABAmonitoring-off-site_results_July2013_rev00.xlsx]

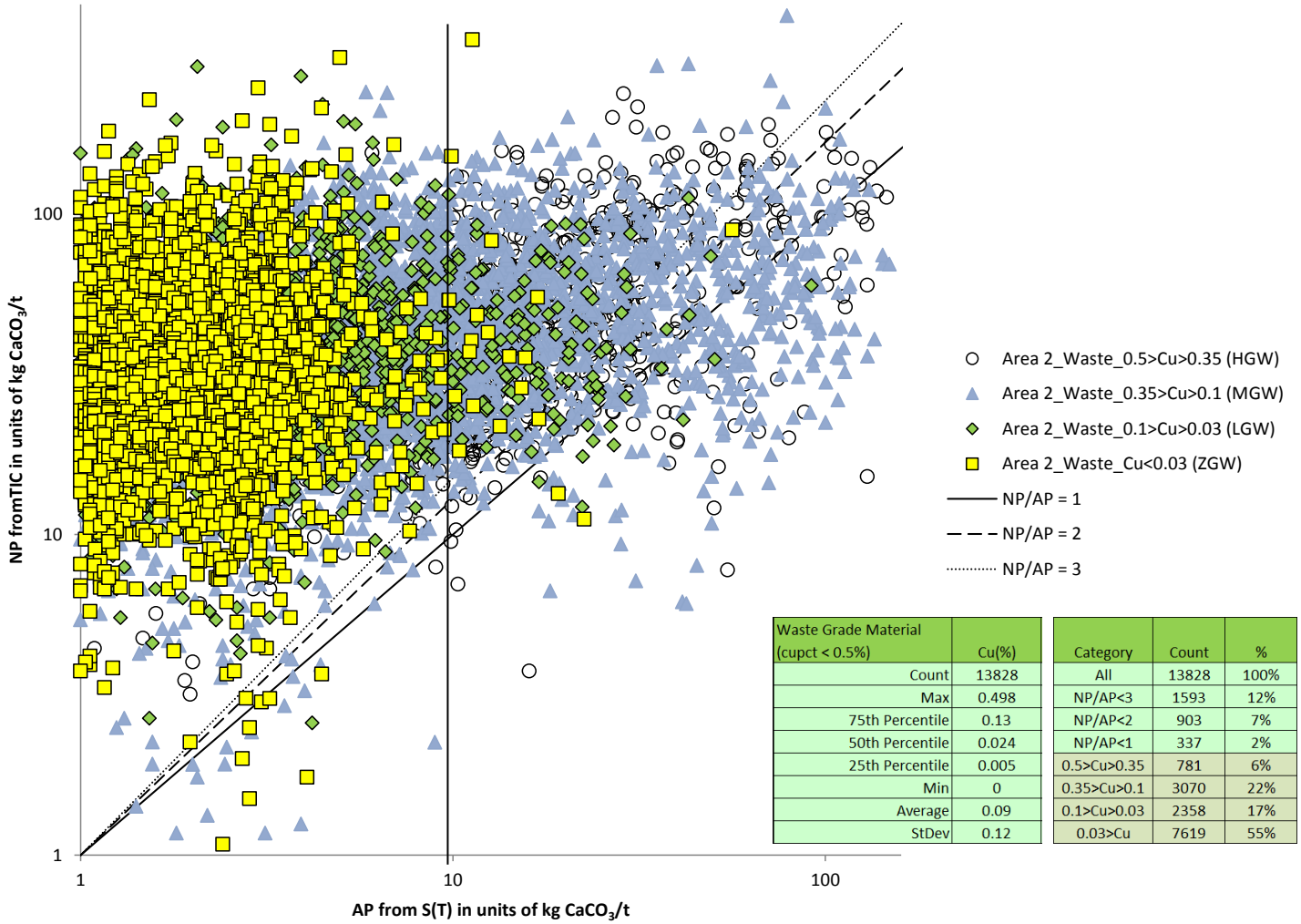
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Main Pit, Area 2 Pit Operational Monitoring: Results From Off-site ABA Testing

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	7



Waste Grade Material (cupct < 0.5%)	Cu(%)
Count	13828
Max	0.498
75th Percentile	0.13
50th Percentile	0.024
25th Percentile	0.005
Min	0
Average	0.09
StDev	0.12

Category	Count	%
All	13828	100%
NP/AP<3	1593	12%
NP/AP<2	903	7%
NP/AP<1	337	2%
0.5>Cu>0.35	781	6%
0.35>Cu>0.1	3070	22%
0.1>Cu>0.03	2358	17%
0.03>Cu	7619	55%

T:\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\Operational_Monitoring\Area2_Pit\Results_2013June24\[Minto Mine Drillhole Data with ARD_srk_rev03.xlsx]

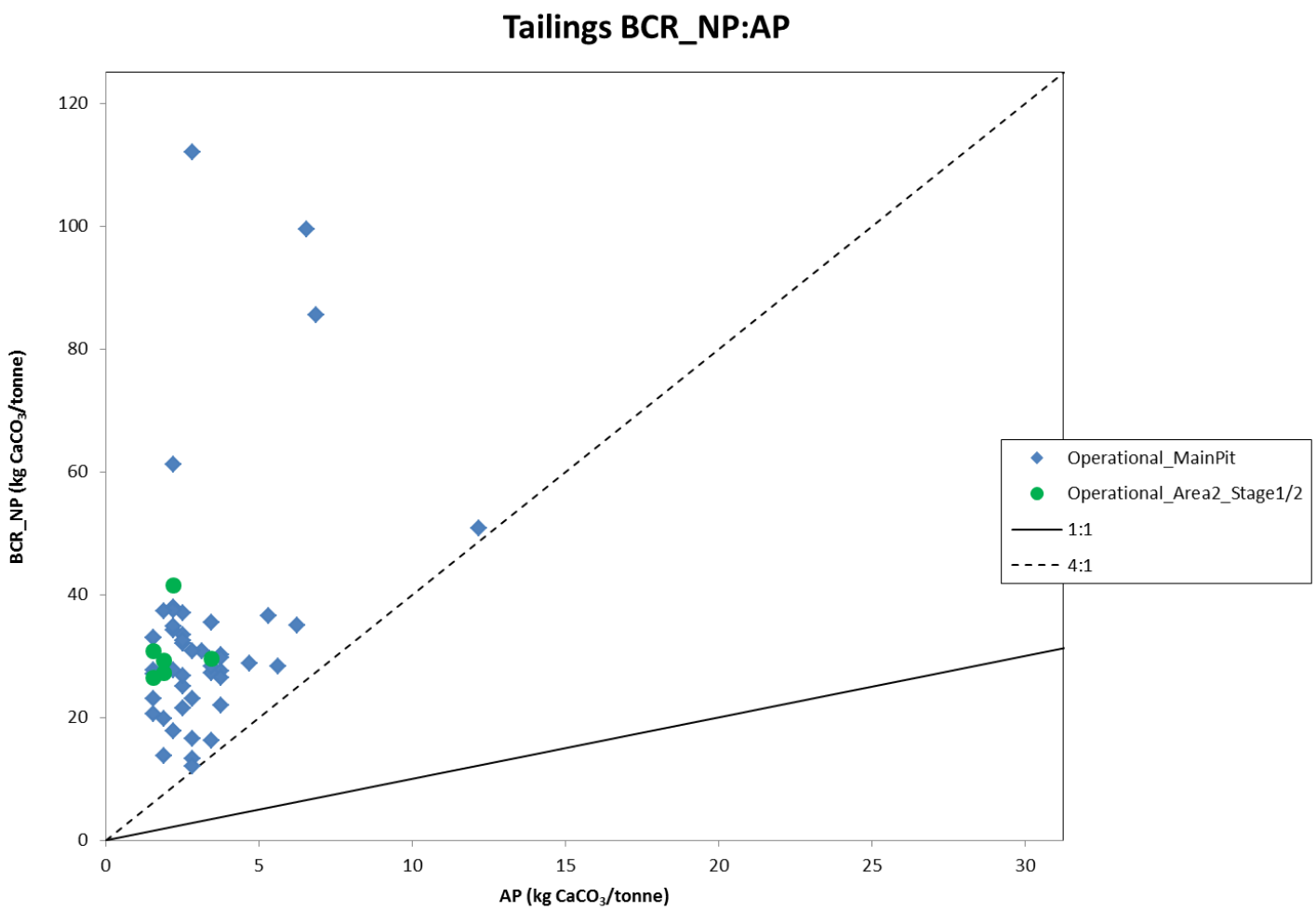
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Area 2 (Phase IV) Operational Monitoring: Results From On-site ABA Testing

PROJECT:	DATE:	APPROVED:	FIGURE::
1CM002.003	June 2013	DBM	8



T:\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Tailings\Operational_Monitoring\[Tailings_ABA_Operational_Compiled_1CM002_003_dbm_REV00.xlsx]

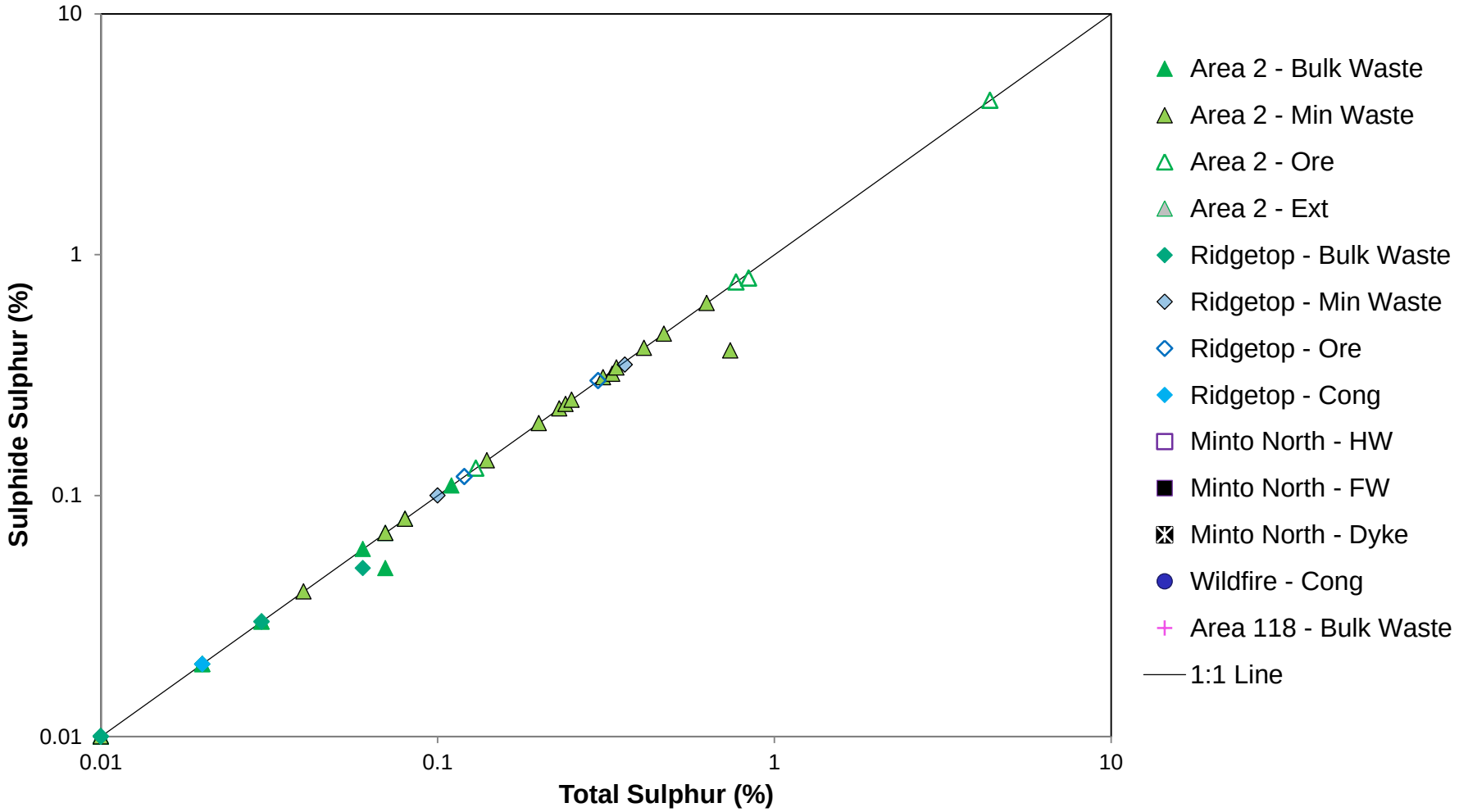
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/V Expansion:
ML/ARD Assessment and Inputs to Water Quality Predictions

Tailings Operational Monitoring: ABA Results

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	9



P:\01 SITES\Minto\!020 Site Wide Data\ML-ARD\Lab Testing\Waste Rock\Static Testing\[1CM002.003 WR PhaseV-VI Static Compiled dbm rev00.xlsx]

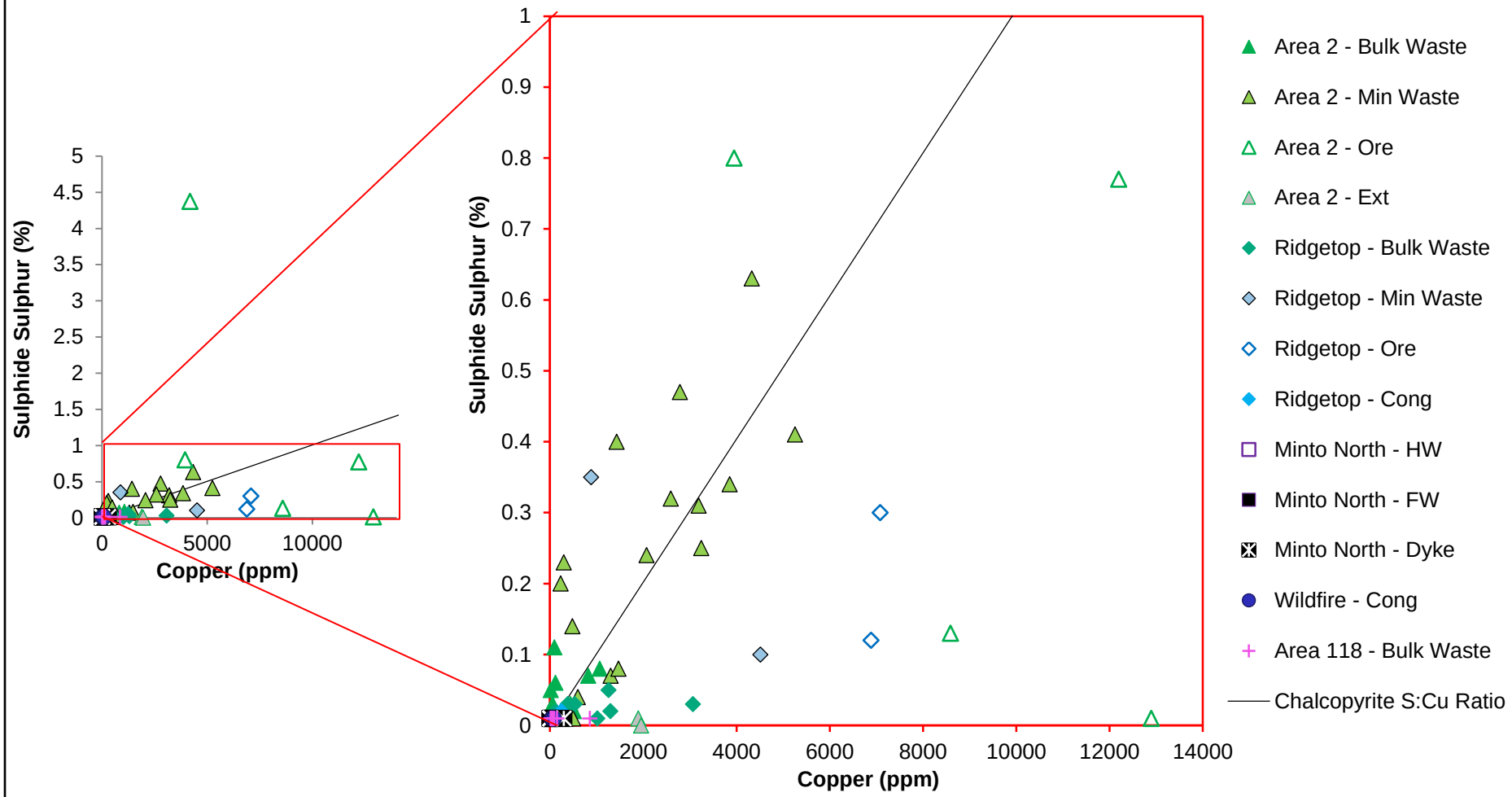
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD
Assessment and Inputs to Water Quality Predictions

Phase V/VI Waste Rock:
Sulphide Sulphur vs. Total Sulphur

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	**10**



P:\01 SITES\Minto\!020 Site Wide Data\ML-ARD\Lab Testing\Waste Rock\Static Testing\[1CM002.003 WR PhaseV-VI Static Compiled dbm rev00.xlsx]

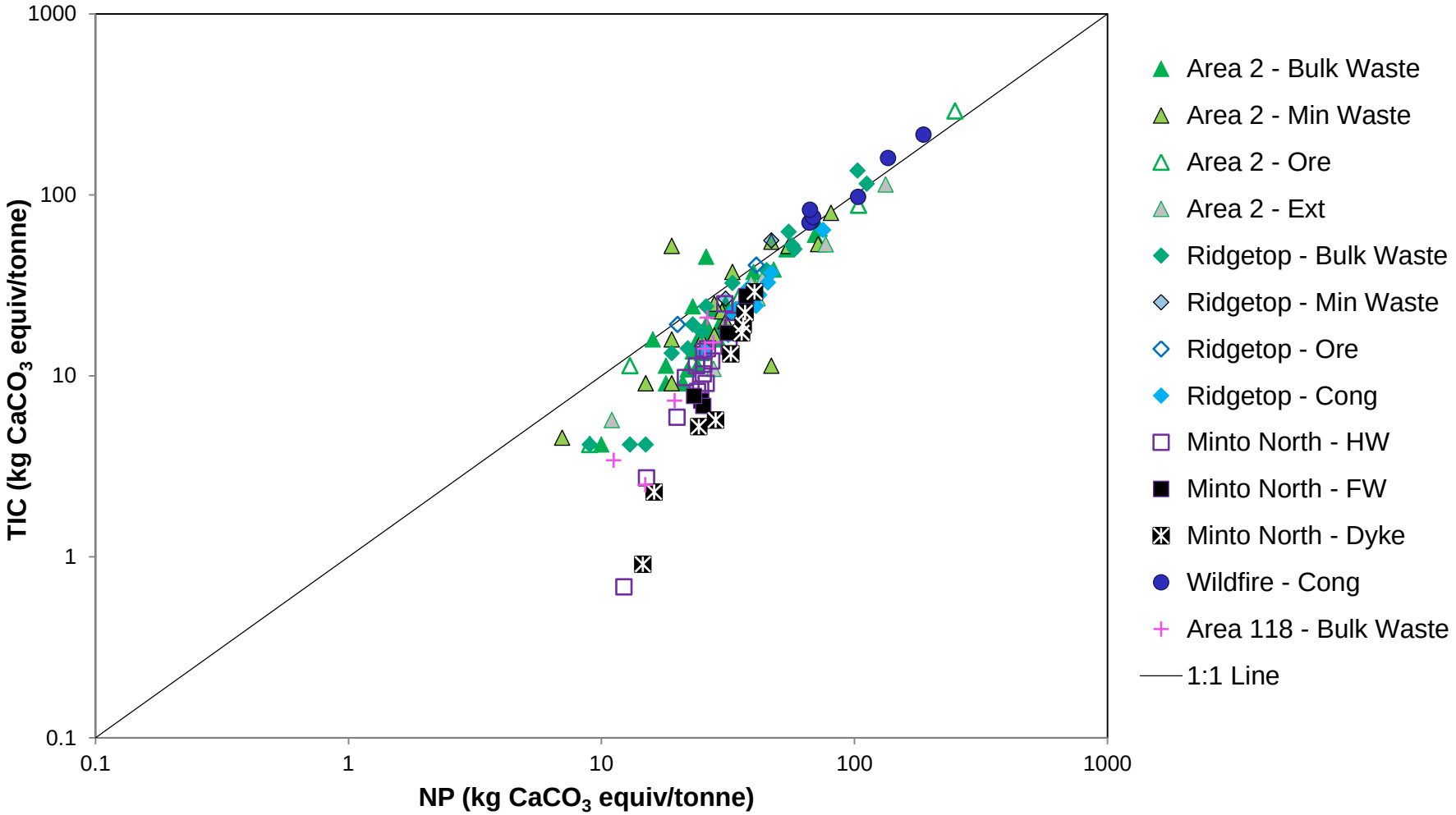
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD
Assessment and Inputs to Water Quality Predictions

Phase V/VI Waste Rock: Sulphide Sulphur vs. Copper

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	11



P:\01 SITES\Minto\!020 Site Wide Data\ML-ARD\Lab Testing\Waste Rock\Static Testing\[1CM002.003 WR PhaseV-VI Static Compiled dbm rev00.xlsx]

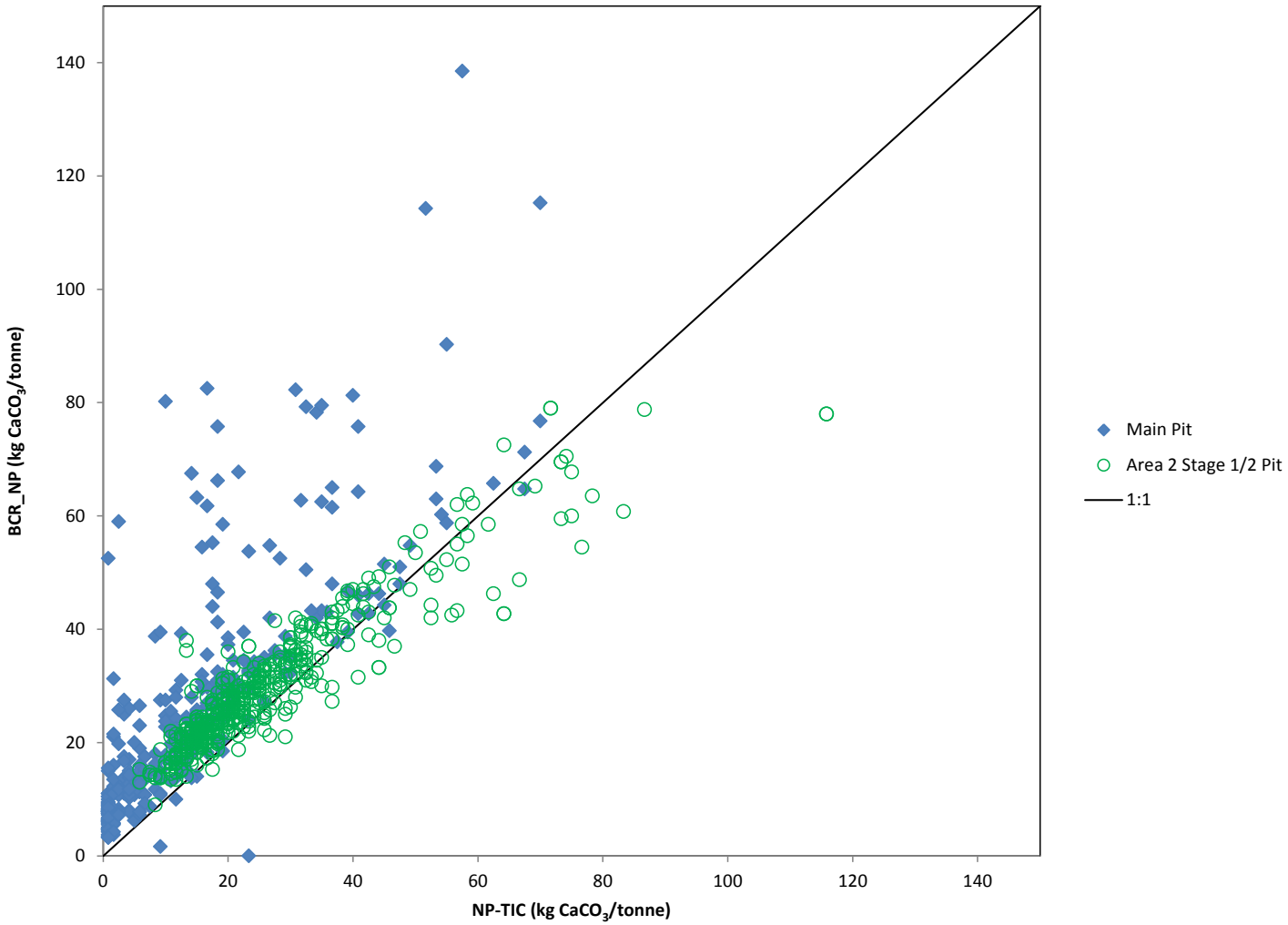
srk consulting

CAPSTONE MINING CORP. MINTO MINE OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Phase V/VI Waste Rock: NP_{TIC} vs. NP

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	12



T:\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\Operational_Monitoring\Minto_Pit\[Minto_OperationalABAmonitoring-off-site_results_July2013_rev00.xlsx]

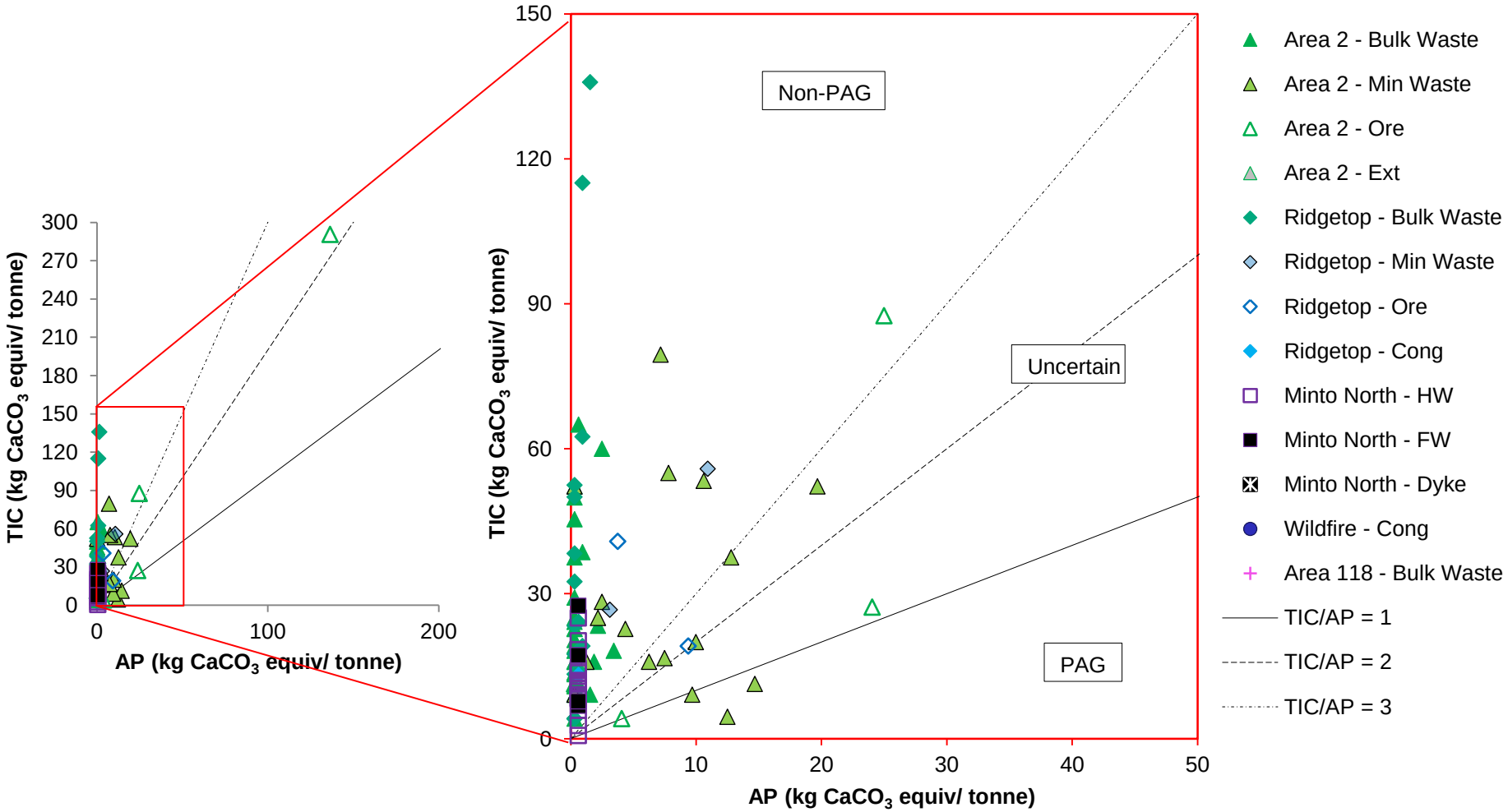
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Prediction

Main Pit and Area 2: NP_{BCR} vs. NP_{TIC}

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	13



P:\01 SITES\Minto\!020 Site Wide Data\ML-ARD\Lab Testing\Waste Rock\Static Testing\[1CM002.003 WR PhaseV-VI Static Compiled dbm rev00.xlsx]

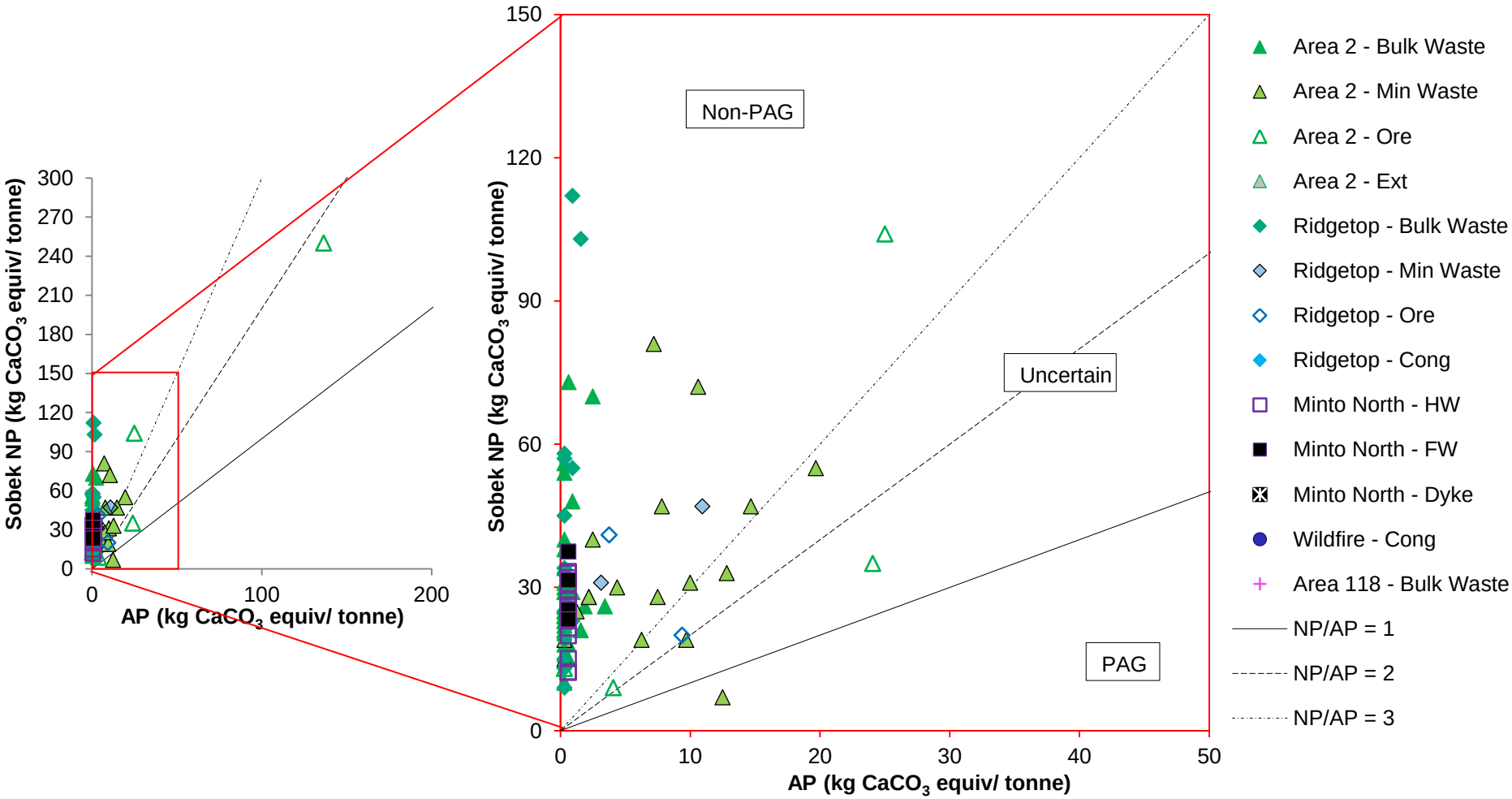
srk consulting

CAPSTONE MINING CORP. MINTO MINE OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Phase V/VI Waste Rock: NP_{TIC} vs. AP

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	14



P:\01 SITES\Minto\!020 Site Wide Data\ML-ARD\Lab Testing\Waste Rock\Static Testing\[1CM002.003 WR PhaseV-VI Static Compiled dbm rev00.xlsx]

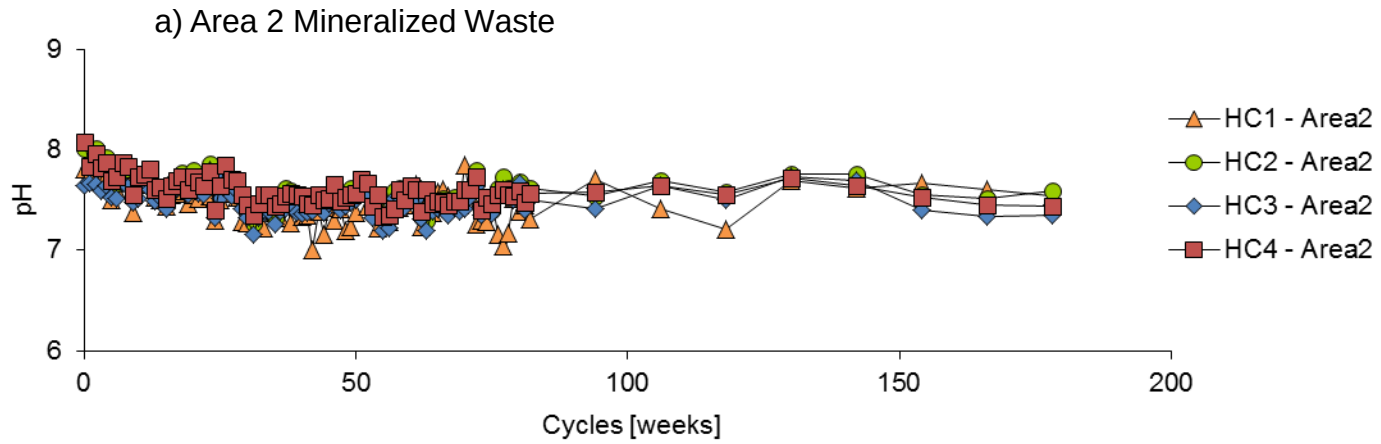
srk consulting

CAPSTONE MINING CORP. MINTO MINE OPERATED BY MINTO EXPLORATIONS LTD.

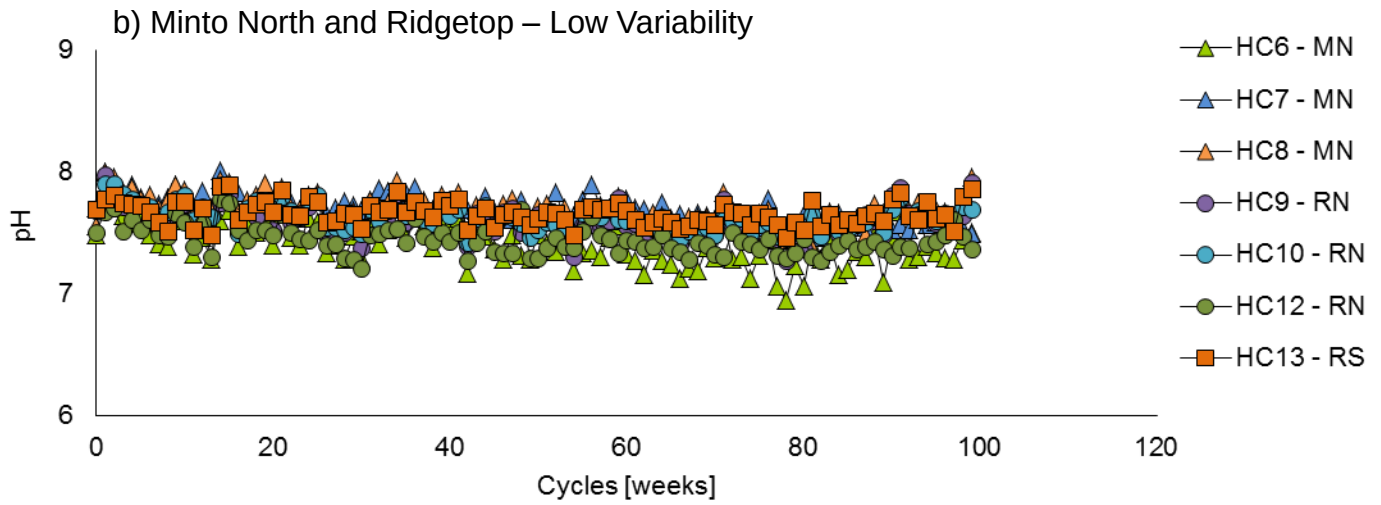
Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Phase V/VI Waste Rock: Sobek NP vs. AP

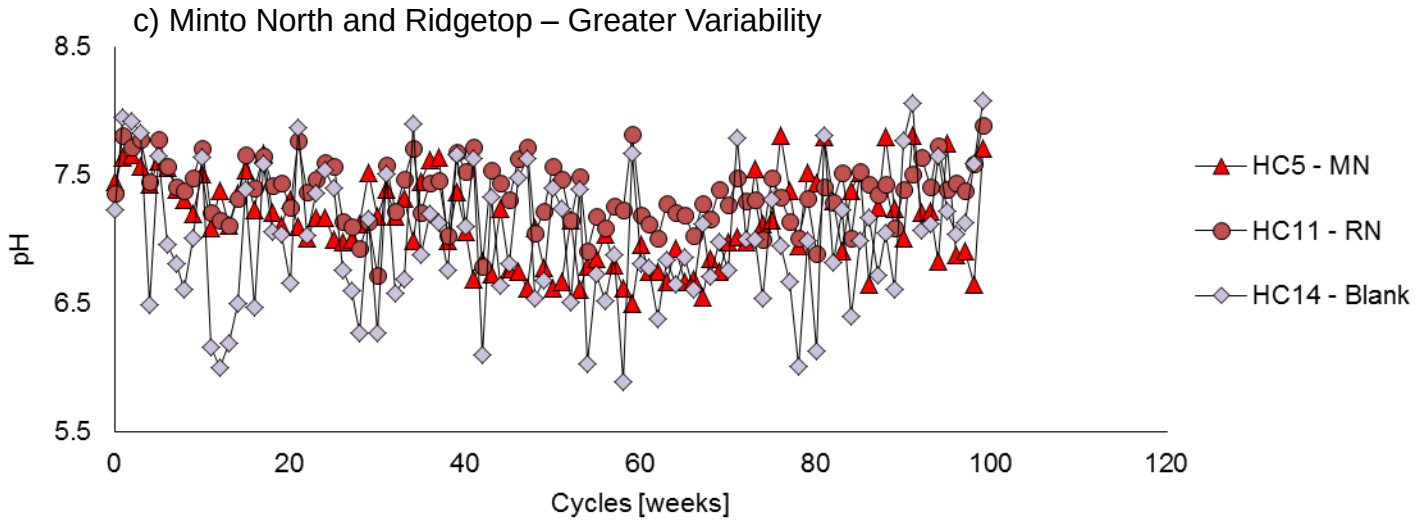
PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	15



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase4_Loadings_2CM022.006.dbm.rev03.xlsx]

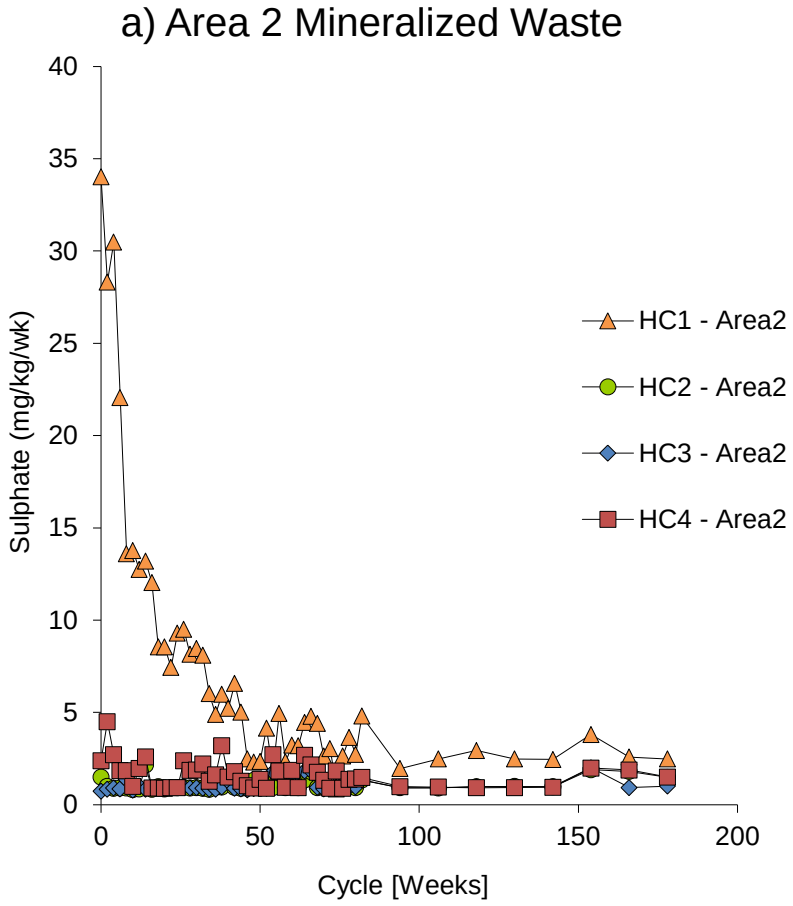


P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

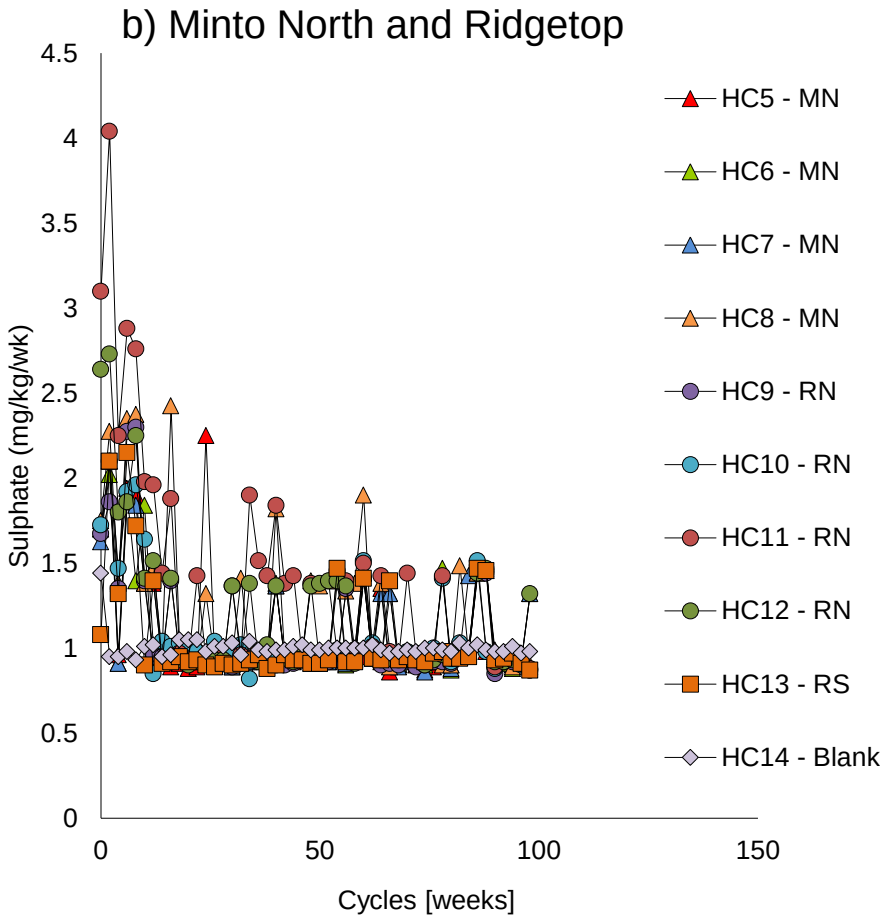


P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

srk consulting	Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions			
CAPSTONE MINING CORP. MINTO MINE	**Humidity Cell Tests: Leachate pH Results**			
	PROJECT: 1CM002.003	DATE: June 2013	APPROVED: DBM	FIGURE: **16**



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase4_Loadings_2CM022.006.dbm.rev03.xlsx]



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

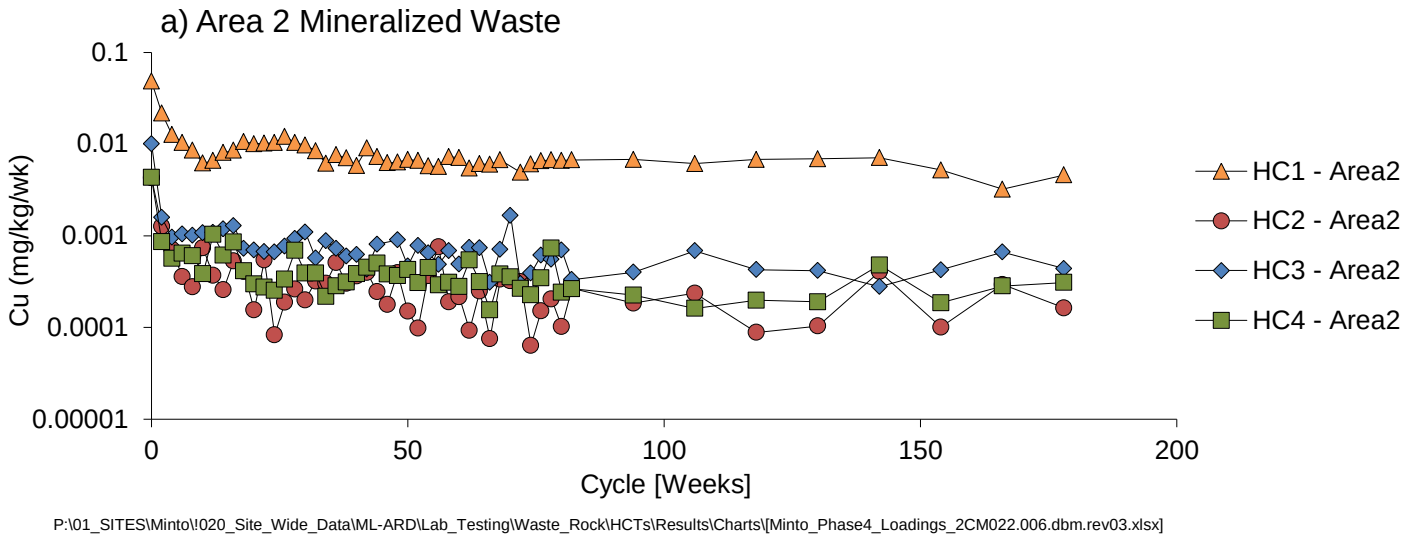
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

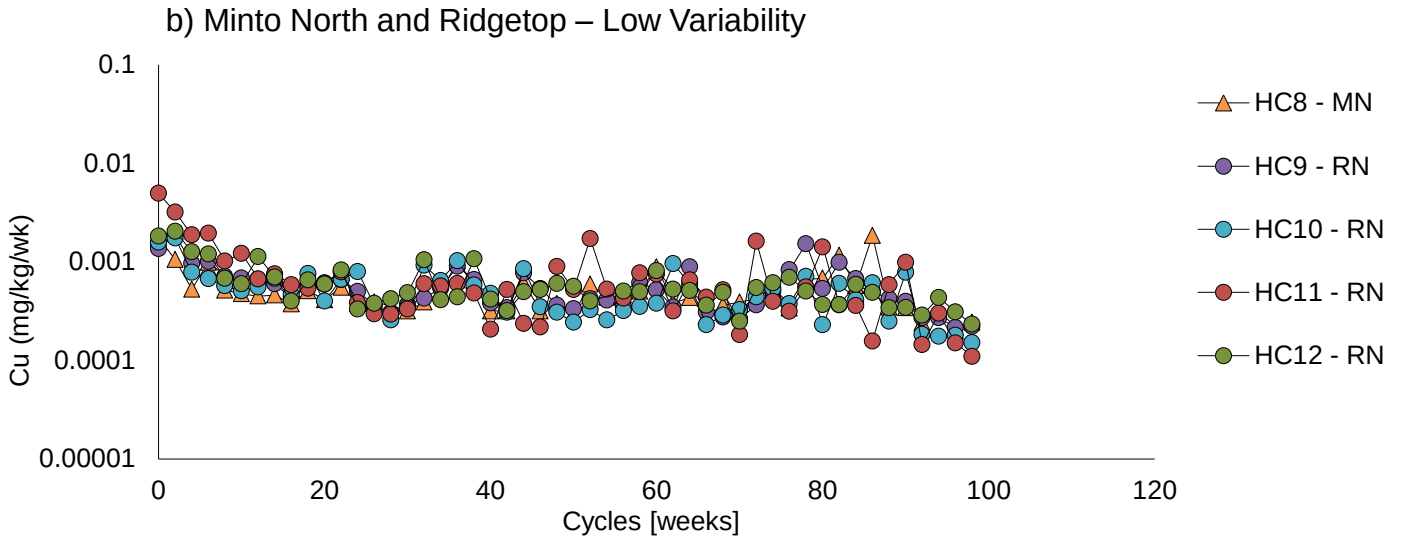
Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Humidity Cell Tests: Sulphate Release Rates

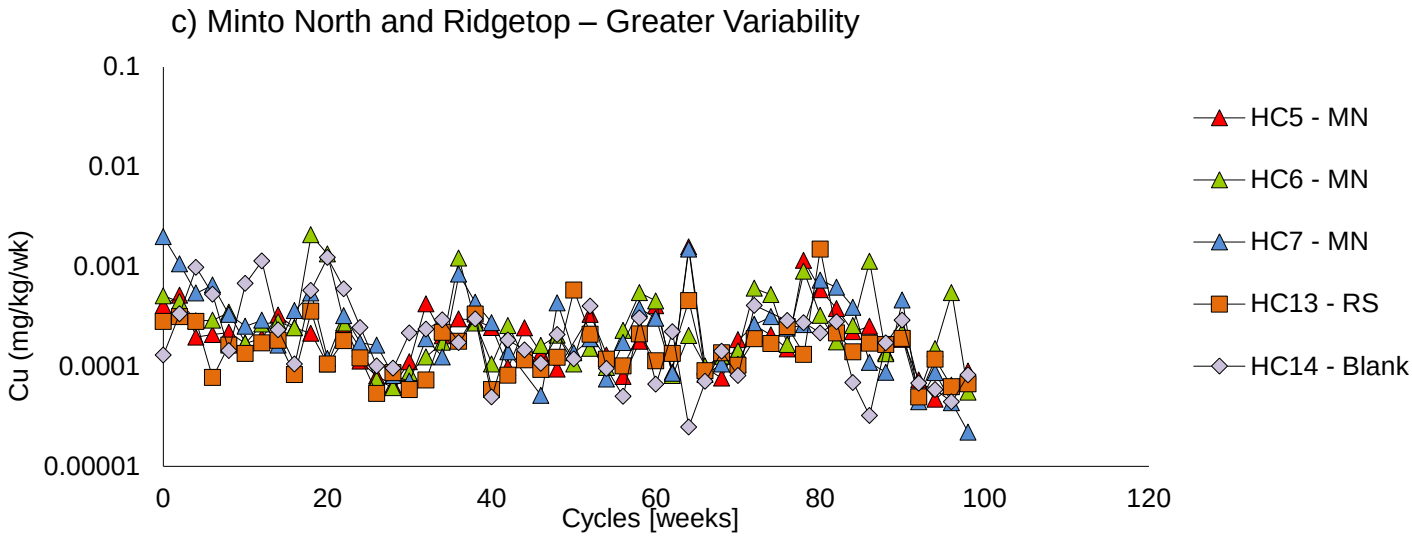
PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	17



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase4_Loadings_2CM022.006.dbm.rev03.xlsx]



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

srk consulting

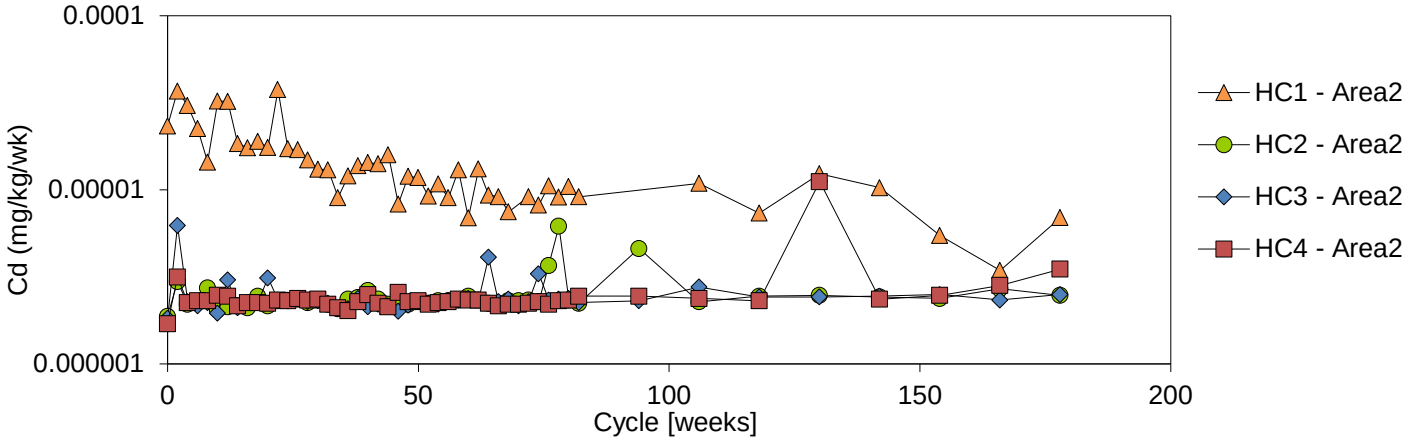
CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Humidity Cell Tests: Copper Release Rates

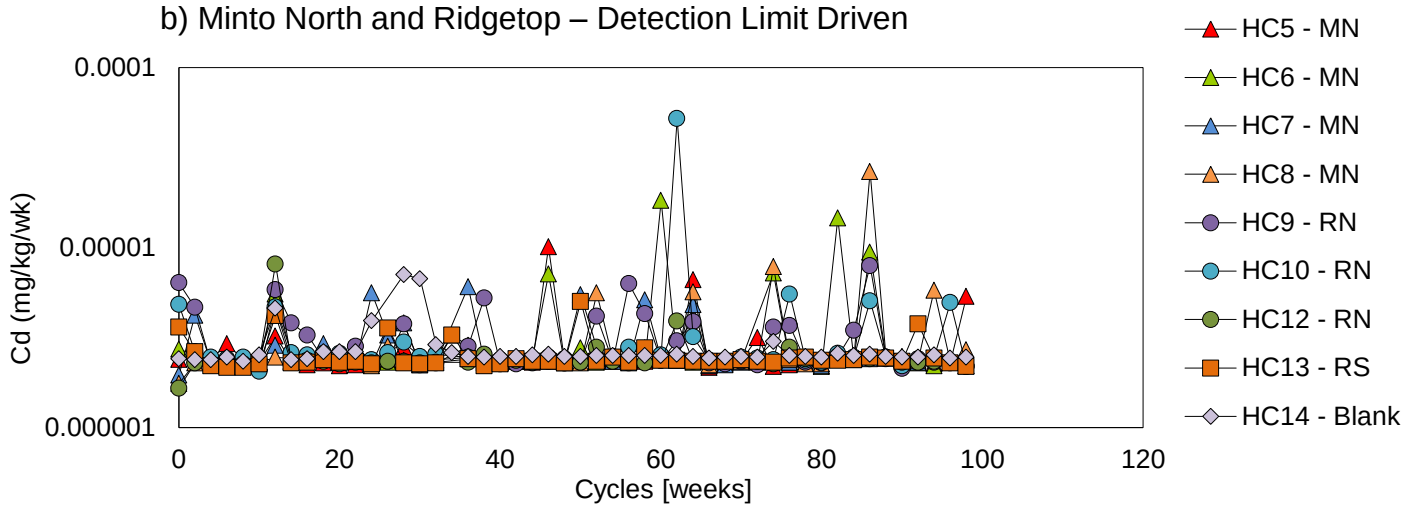
PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	18

a) Area 2 Mineralized Waste



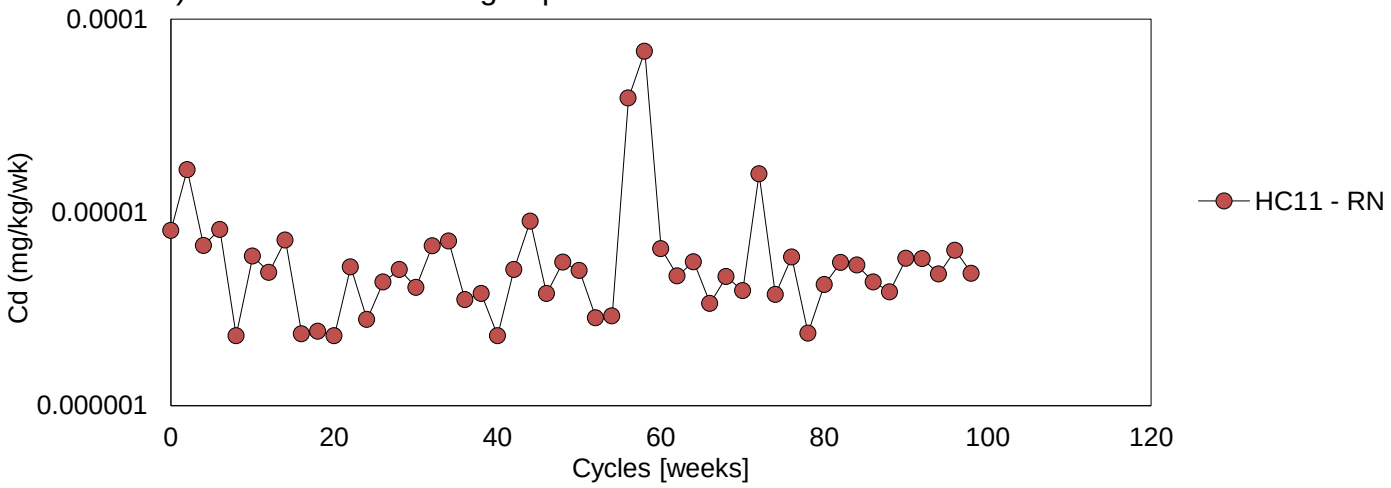
P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase4_Loadings_2CM022.006.dbm.rev03.xlsx]

b) Minto North and Ridgetop – Detection Limit Driven



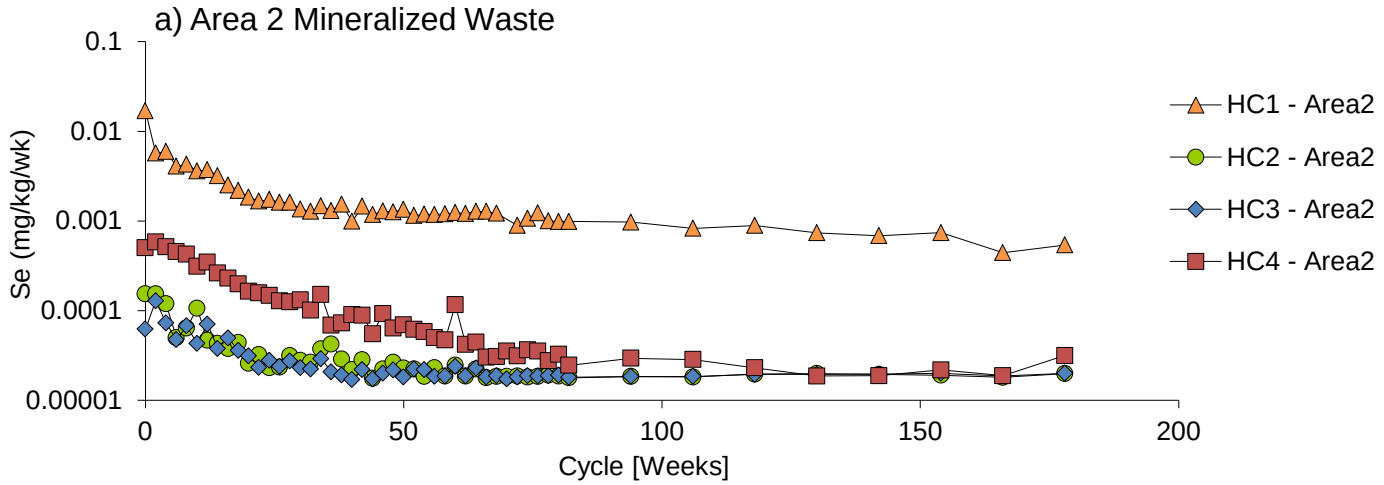
P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

c) Minto North and Ridgetop – HC11

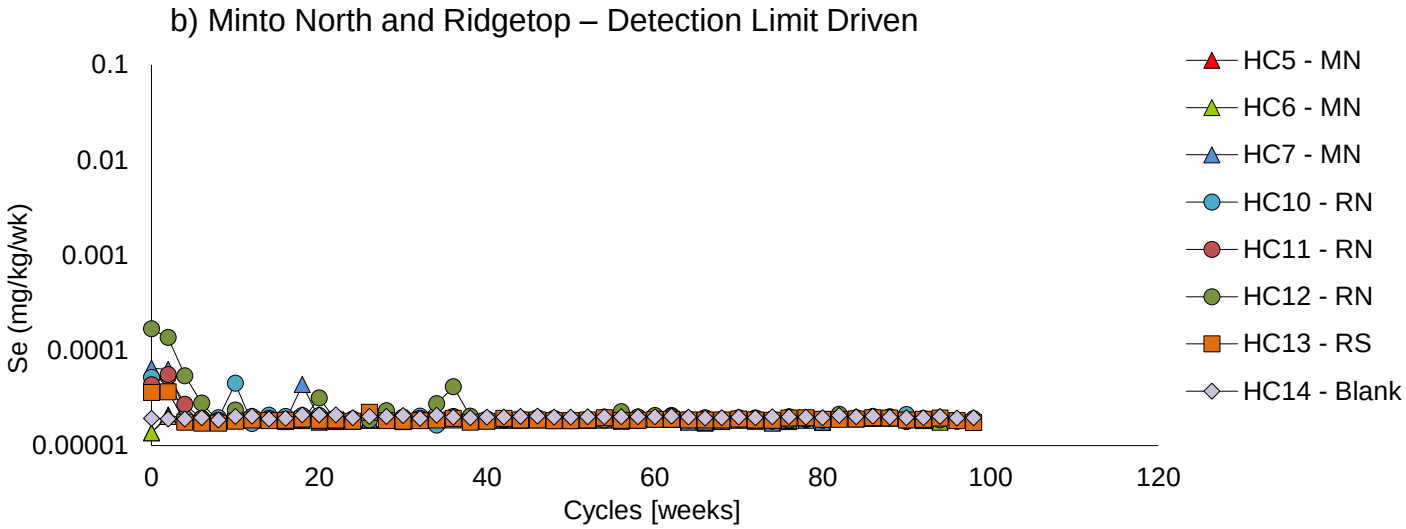


P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

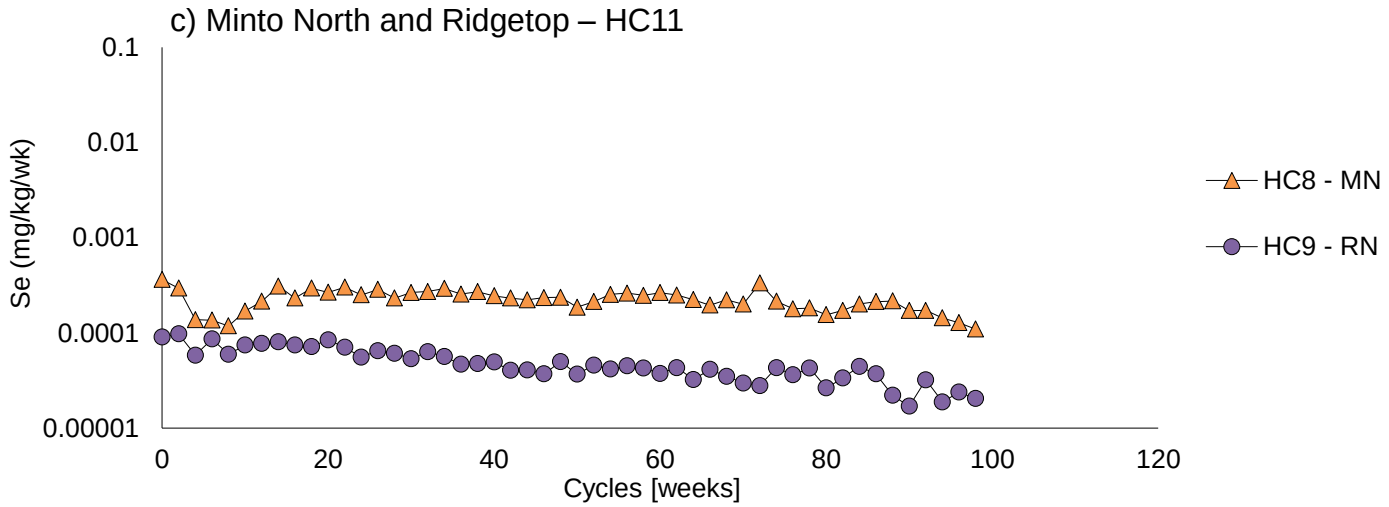
srk consulting	Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions			
CAPSTONE MINING CORP. MINTO MINE	**Humidity Cell Tests: Cadmium Release Rates**			
	PROJECT: 1CM002.003	DATE: June 2013	APPROVED: DBM	FIGURE: **19**



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase4_Loadings_2CM022.006.dbm.rev03.xlsx]



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\Results\Charts\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

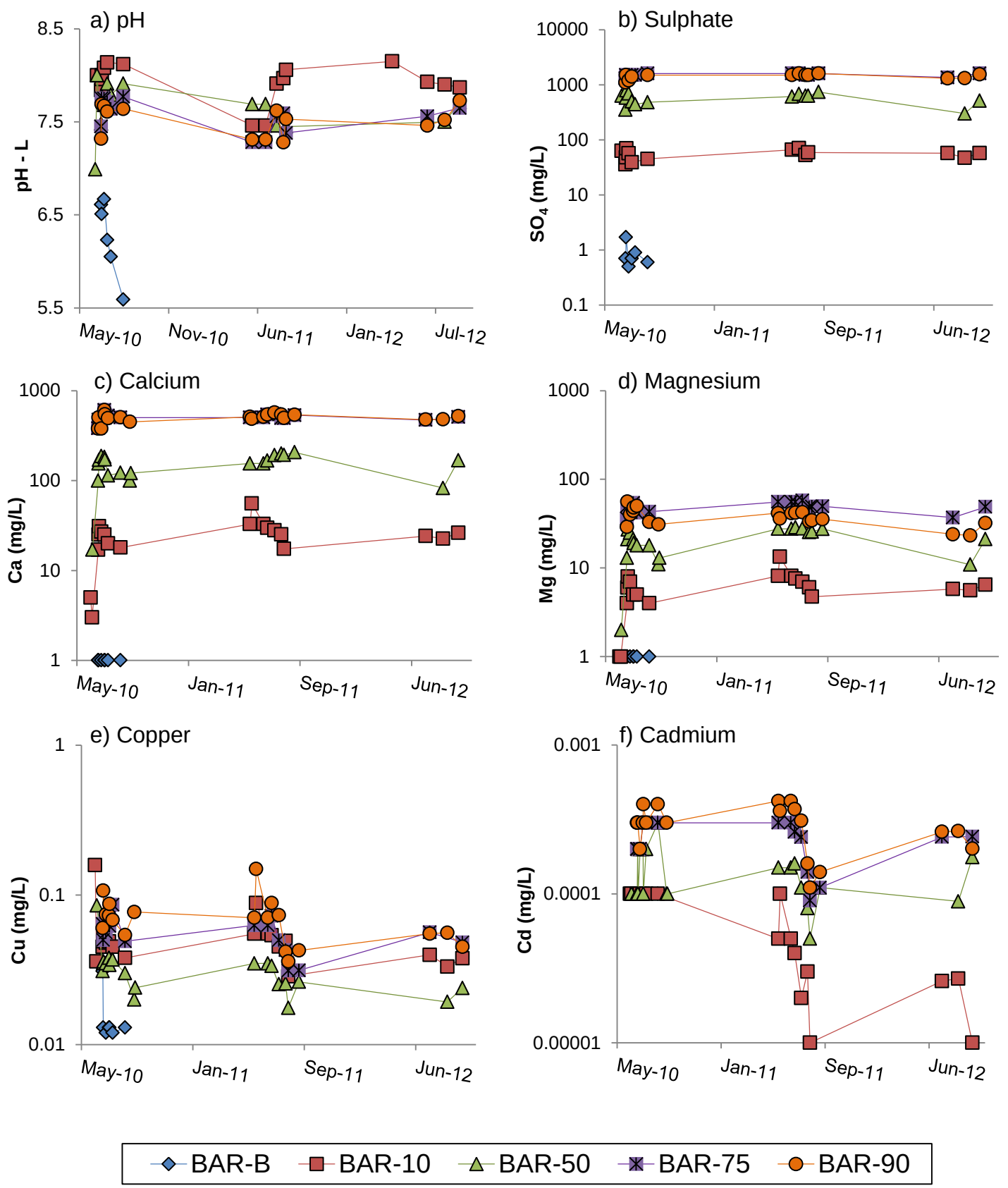
srk consulting

CAPSTONE MINING CORP. MINTO MINE

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Humidity Cell Tests: Selenium Release Rates

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	20



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Field_Testing\Waste_Rock\Barrels\Results\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]

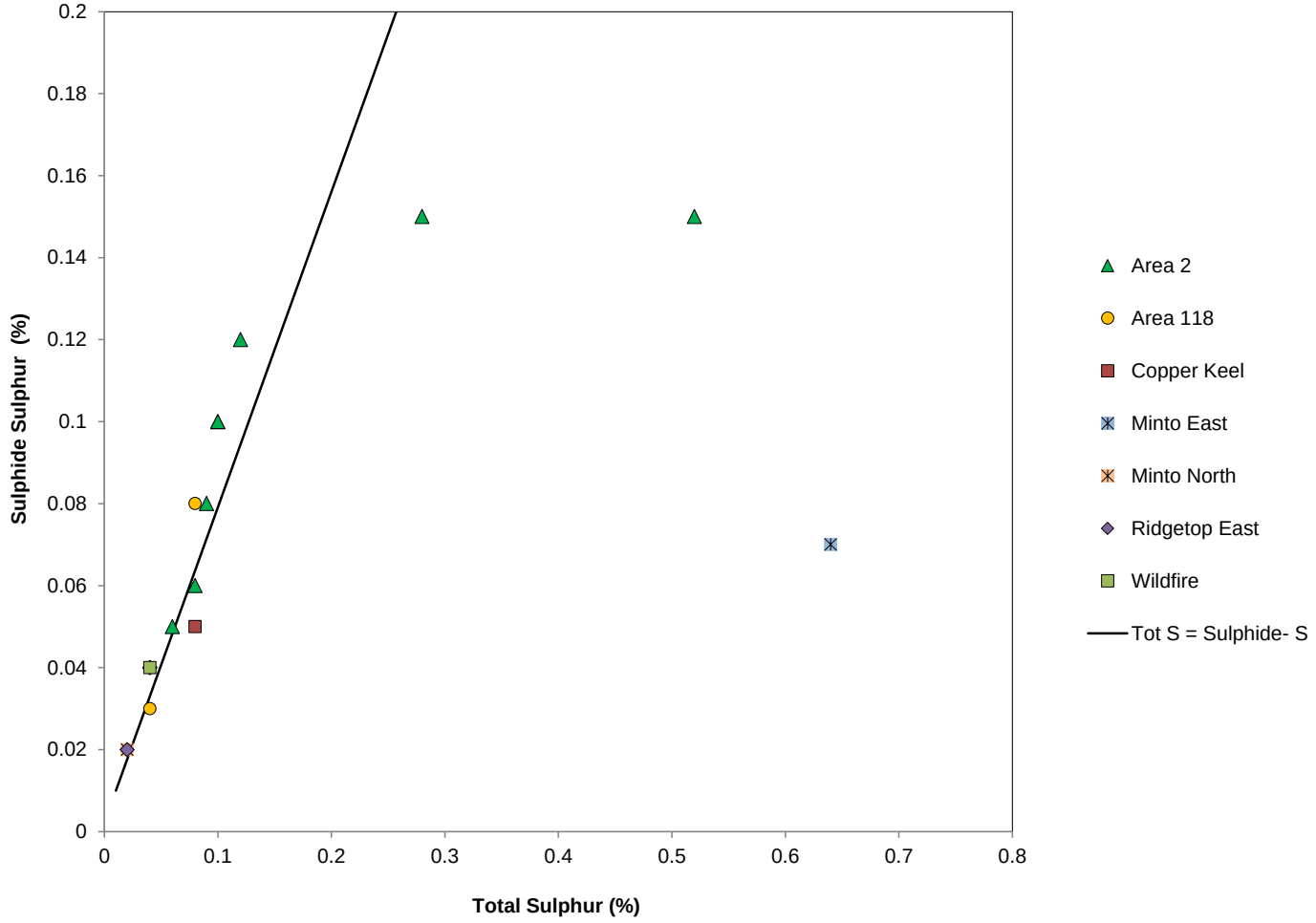
srk consulting

CAPSTONE MINING CORP. MINTO MINE

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Field Barrel Tests: Selected Results

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	21



T:\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Tailings\Static_Testing\[Minto_Tailings_PhaseV_ML-ARD_Results_Compiled_Mar2013.xlsx]

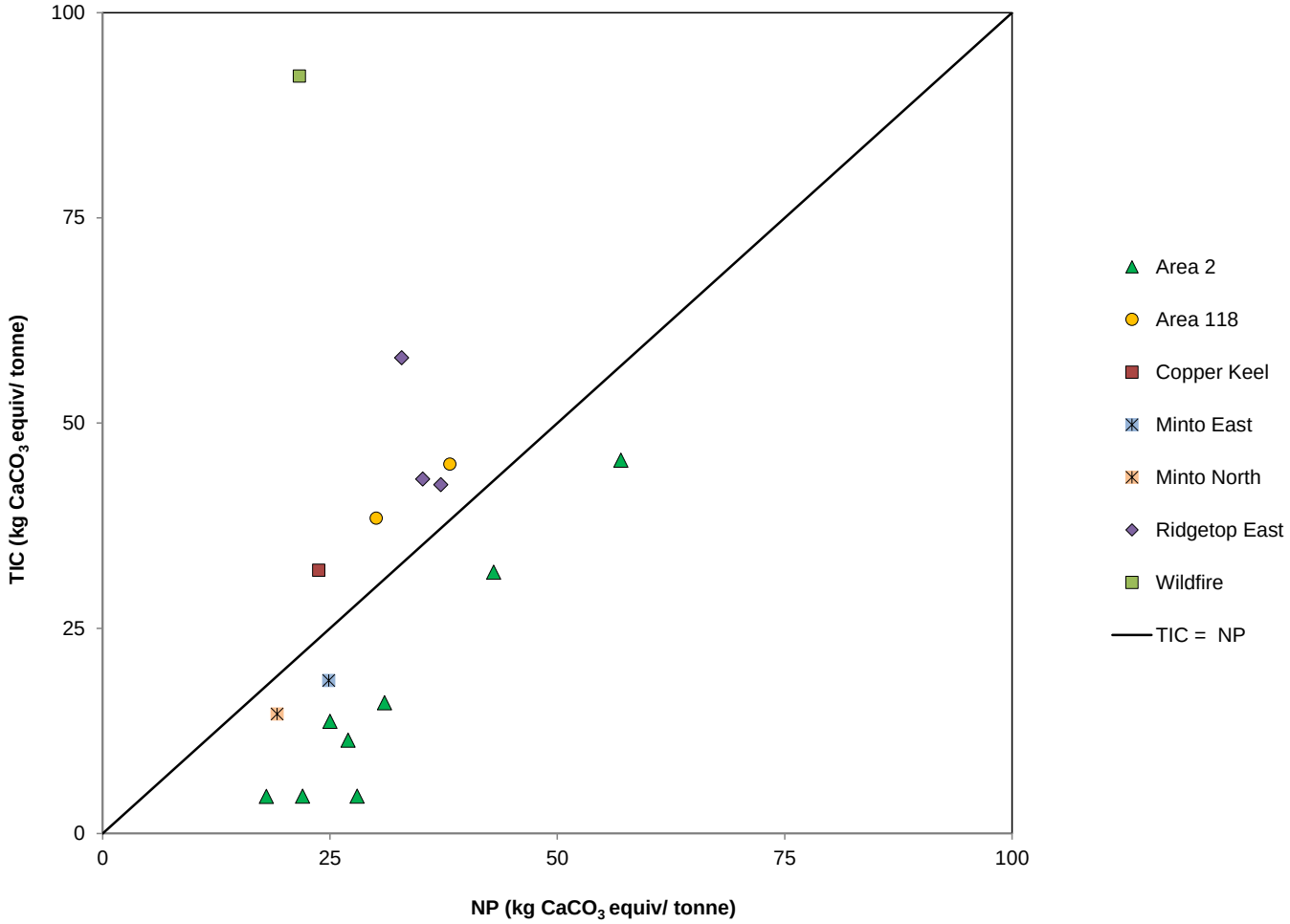
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Tailings:
Sulphide Sulphur vs. Total Sulphur

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	22



T:\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Tailings\Static_Testing\[Minto_Tailings_PhaseV_ML-ARD_Results_Compiled_Mar2013.xlsx]

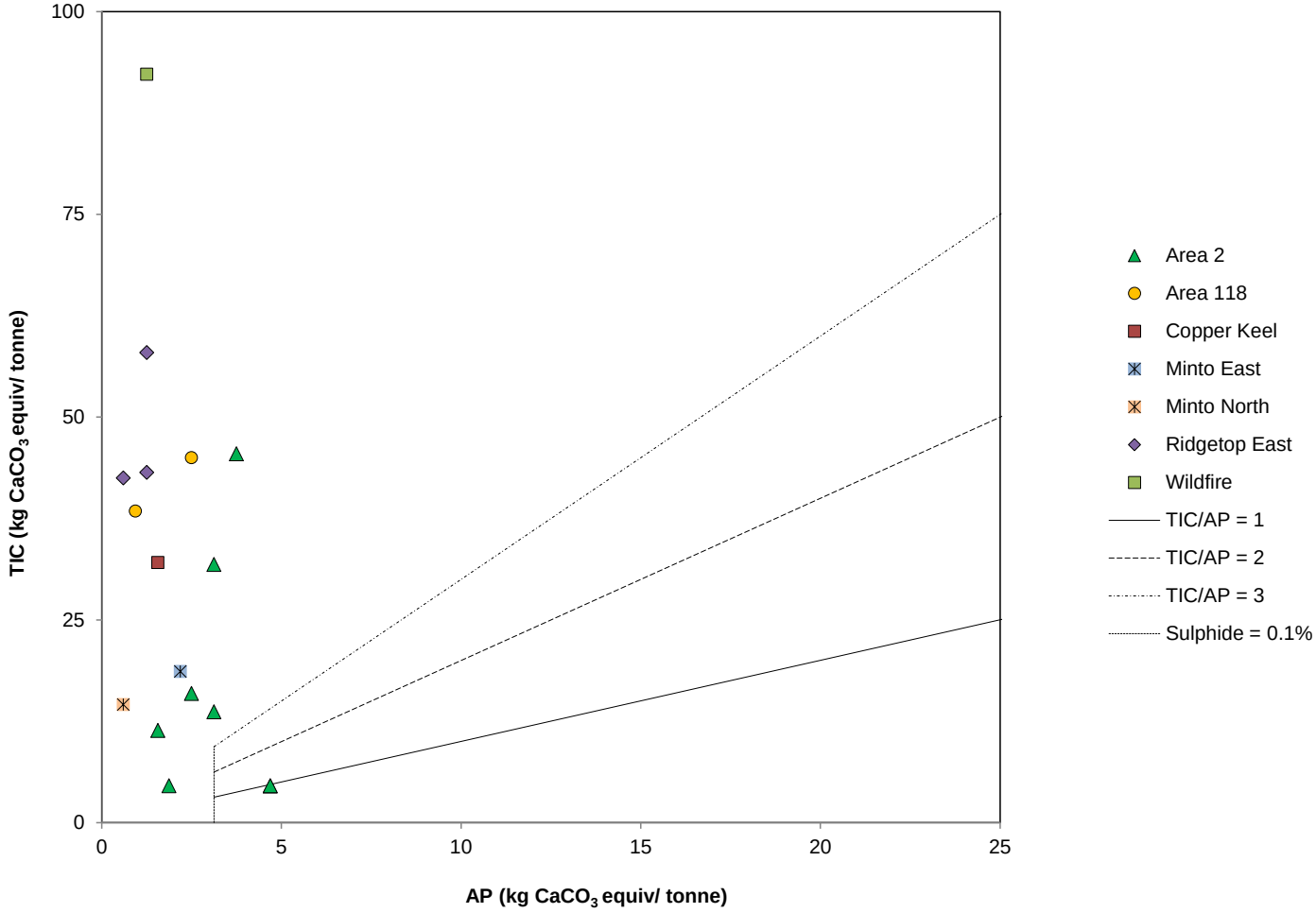
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Tailings:
NP_{TIC} vs. NP

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	23



T:\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Tailings\Static_Testing\[Minto_Tailings_PhaseV_ML-ARD_Results_Compiled_Mar2013.xlsx]

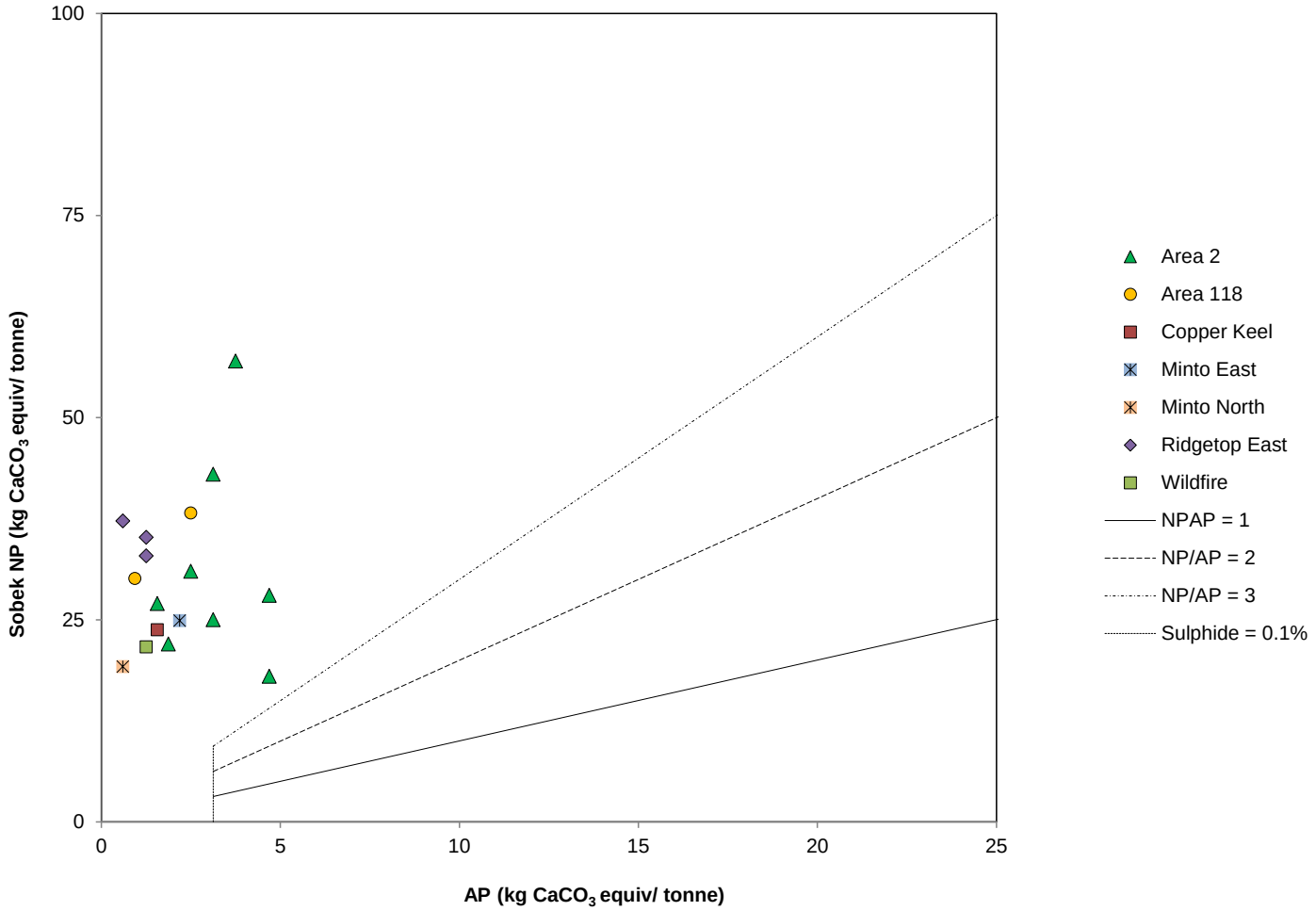
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Tailings:
NP_{TIC} vs. AP

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	24



T:\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Tailings\Static_Testing\[Minto_Tailings_PhaseV_ML-ARD_Results_Compiled_Mar2013.xlsx]

srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Tailings:
Sobek NP vs. AP

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	25

Base orthophoto provided by Minto Mine; compiled from aerial photos flown August 2012.

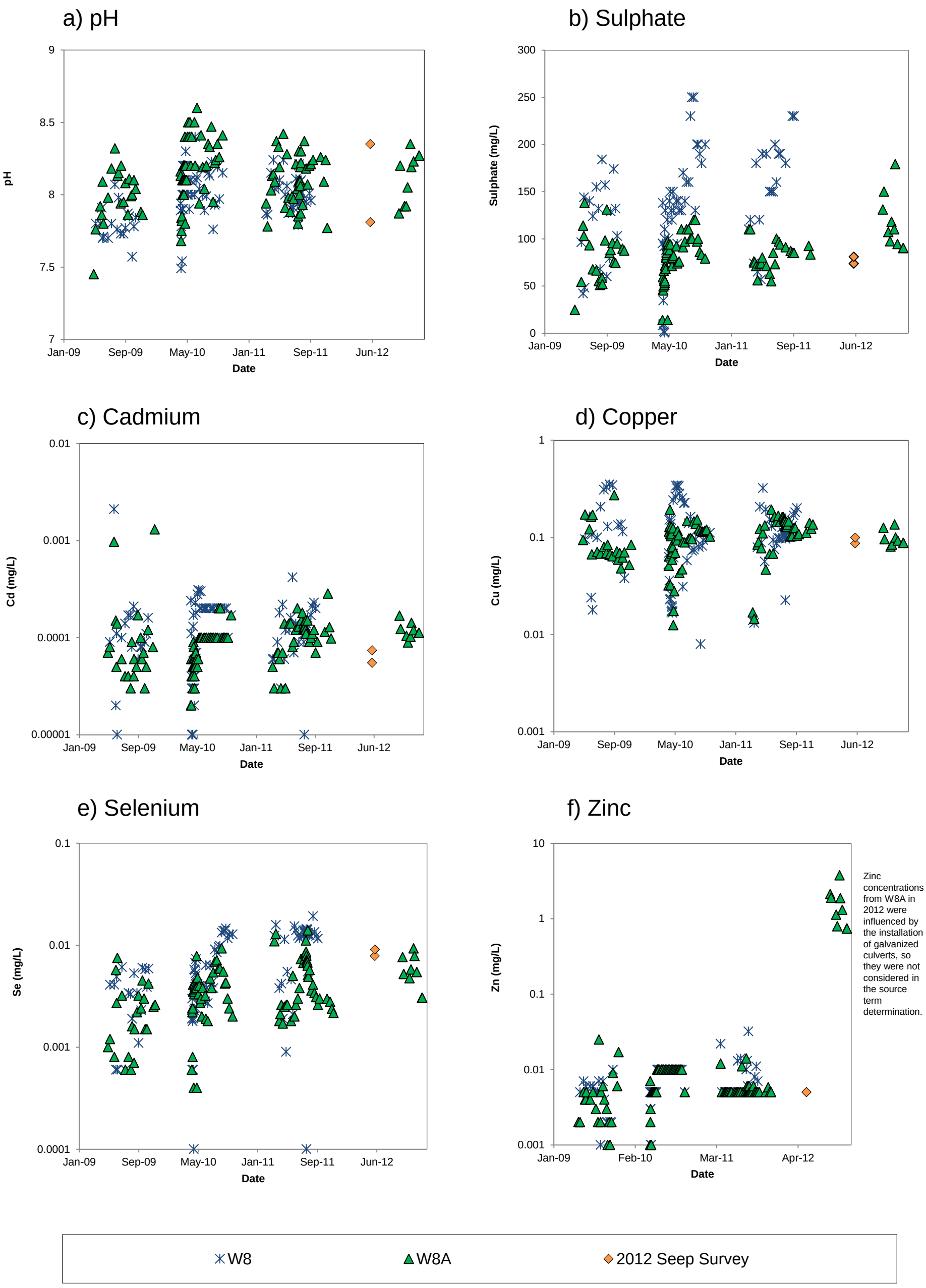
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

DSTSF: Water Quality Monitoring and 2012 Seepage Survey Stations

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	26



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Field_Testing\Tailings\DSTF_Seepage\[1CM002.003_DSTF_Seepage_Charts_sjn_rev00.xlsx]

srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

DSTSF Selected Water Quality Results

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	27

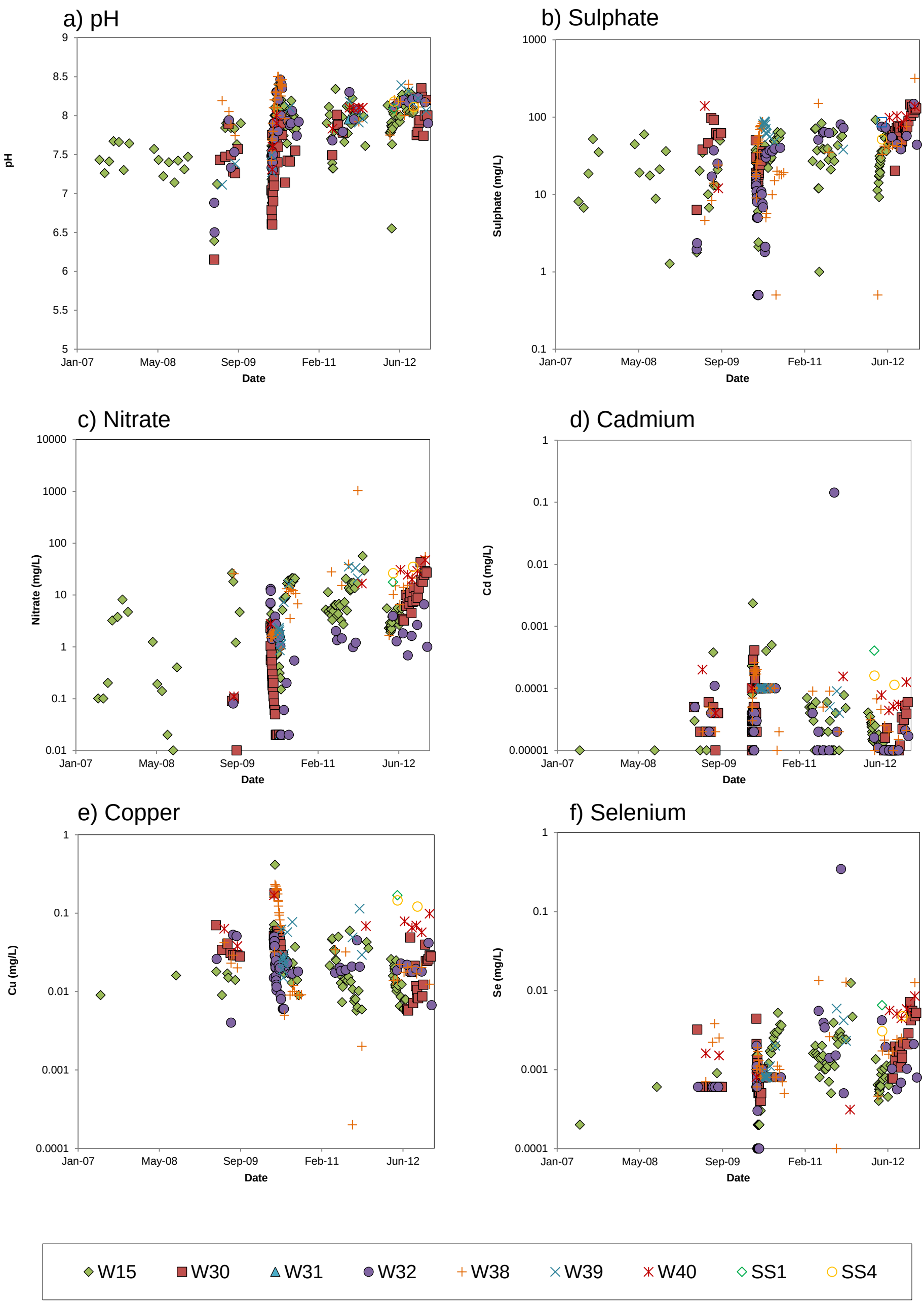
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

MWD and SWD: Water Quality Monitoring and 2012 Seepage Survey Stations

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	28



P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Field_Testing\Waste_Rock\Dump_Seeps\Results\[1CM002.003_WR_M&SW_Dumps_Seepage_Charts_sjn_rev01.xlsx]

srk consulting

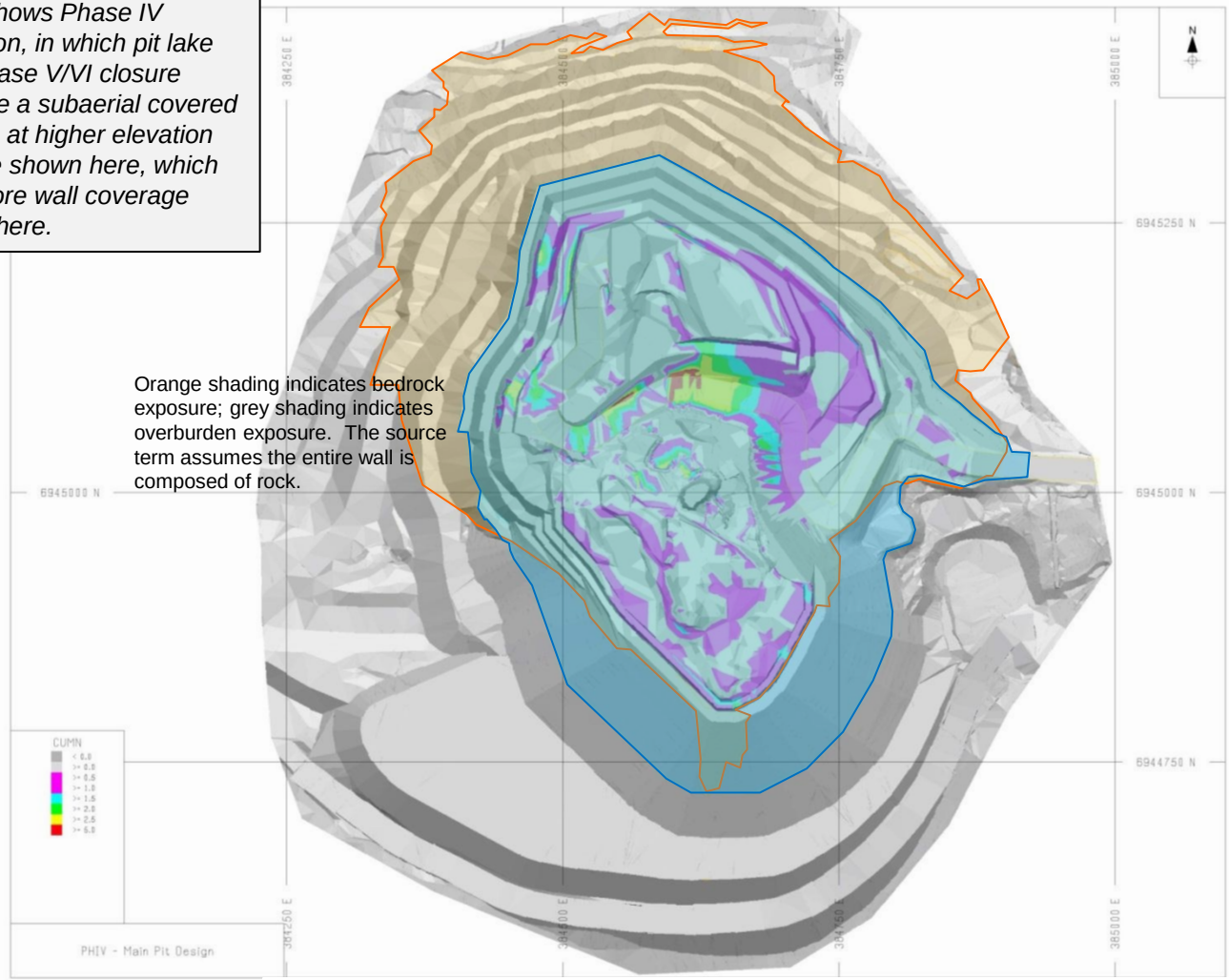
CAPSTONE MINING CORP. MINTO MINE OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

MWD and SWD Selected Water Quality Results

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	29

Note: image shows Phase IV closure condition, in which pit lake forms. The Phase V/VI closure condition will be a subaerial covered tailings surface at higher elevation that the pit lake shown here, which will result in more wall coverage than indicated here.



srk consulting

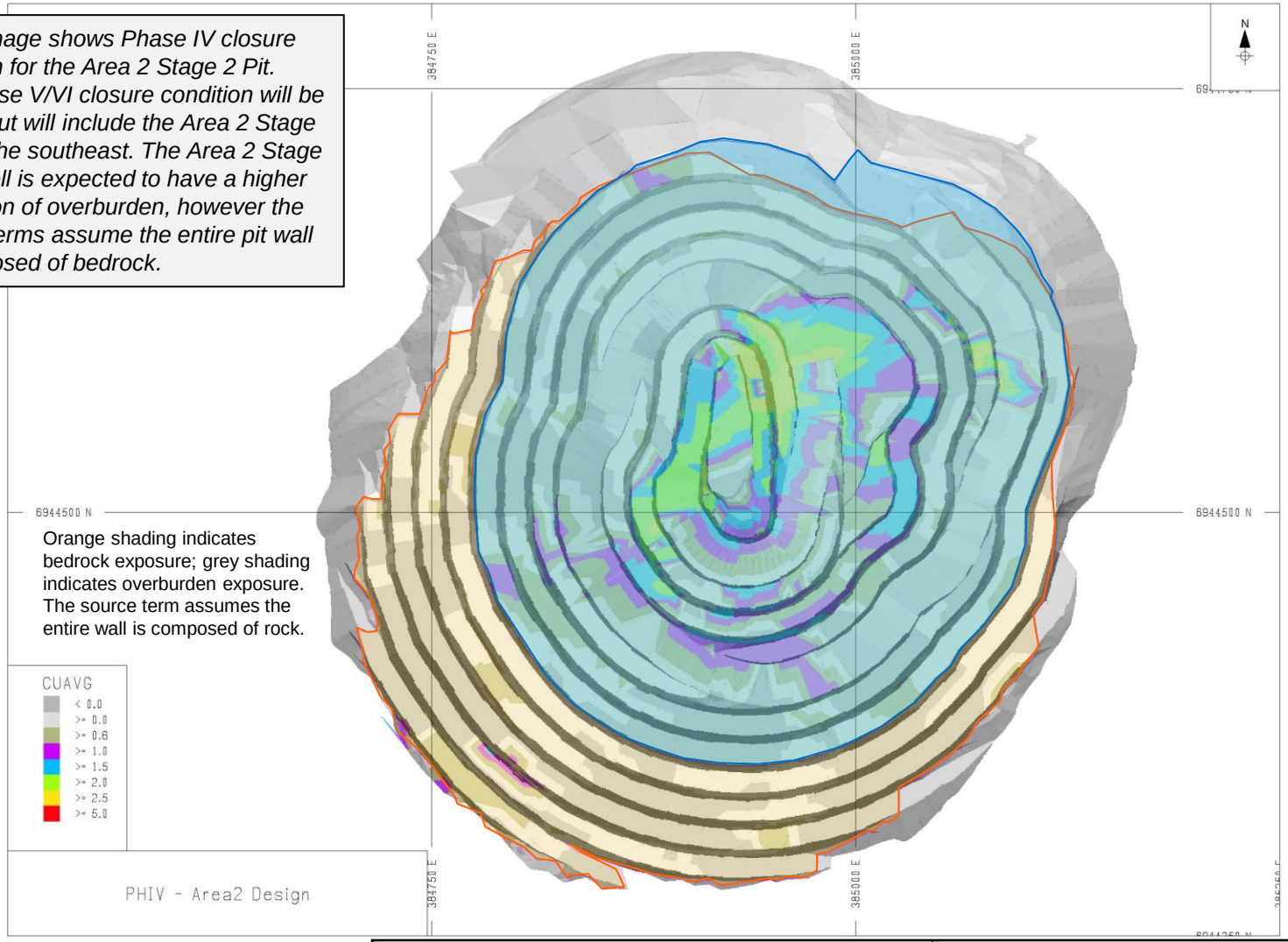
CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Main Pit: Final Wall

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	30

Note: image shows Phase IV closure condition for the Area 2 Stage 2 Pit. The Phase V/VI closure condition will be similar but will include the Area 2 Stage 3 Pit to the southeast. The Area 2 Stage 3 Pit shell is expected to have a higher proportion of overburden, however the source terms assume the entire pit wall is composed of bedrock.



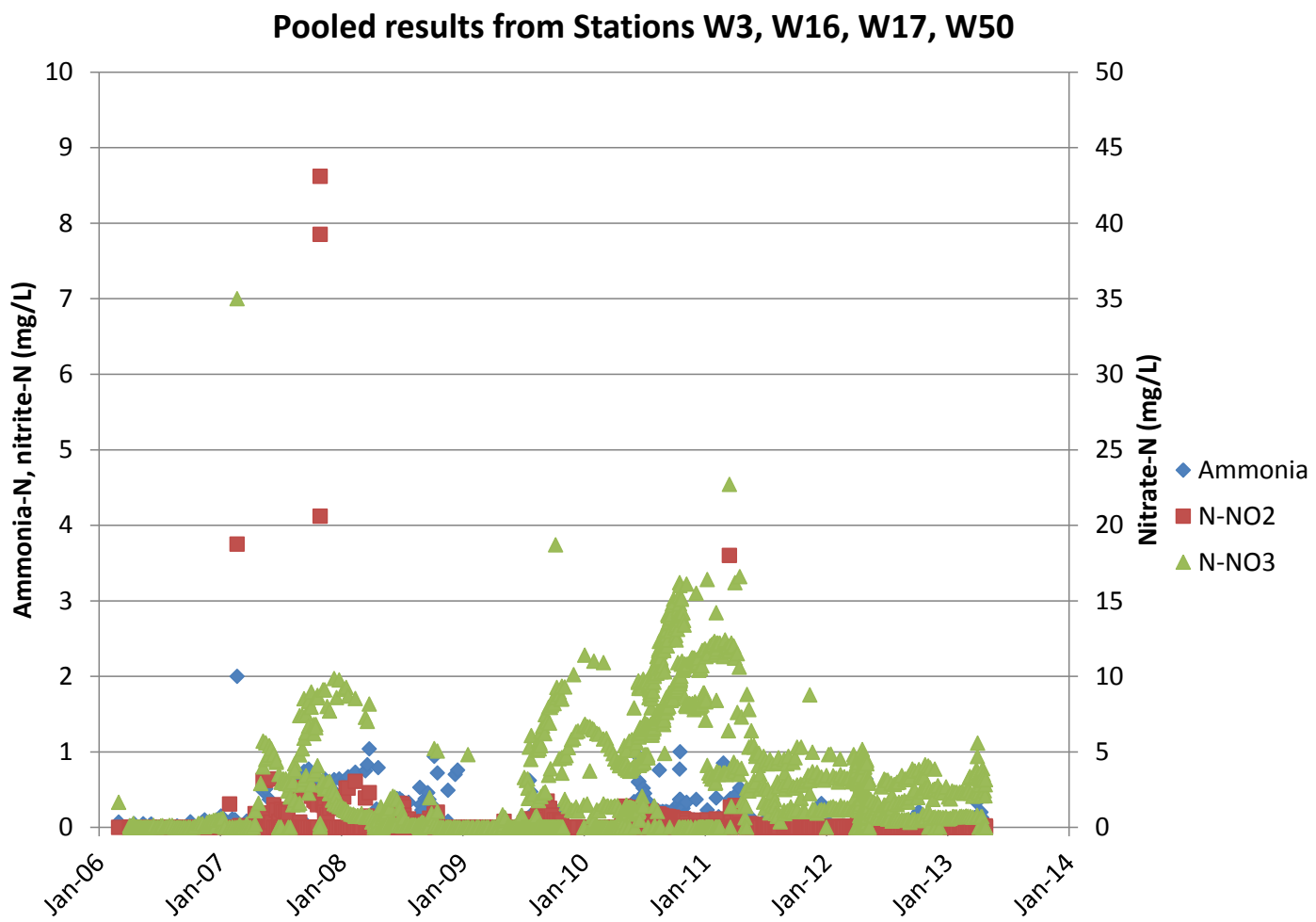
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Area 2 Pit: Final Wall

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	31



T:\!020_Site_Wide_Data\ML-ARD\Source_Terms_PhV_VI\N_Species\[1CM002-003_PhV-VI_N-Species_Source_Term_dbm_rev00.xlsx]

srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions

Nitrate, Nitrite and Ammonia Concentrations at W3 and Related Stations

PROJECT:	DATE:	APPROVED:	FIGURE:
1CM002.003	June 2013	DBM	32

Appendix A
Memo: Volume Estimate for Phase V/VI NP:AP<3 Waste Rock

SRK Consulting (Canada) Inc.
Suite 2200–1066 West Hastings Street
Vancouver, BC V6E 3X2

T: +1.604.681.4196
F: +1.604.687.5532

vancouver@srk.com
www.srk.com

Memo

To:	Pooya Mohseni, Chief Engineer, Minto Mine	**Client:**	Capstone Mining Corporation
From:	Dylan MacGregor	**Project No:**	1CM002.003
Cc:		**Date:**	July 5, 2013
Subject:	Minto Mine Phase V/VI Expansion: Volume Estimate for Phase V/VI NP/AP<3 Waste Rock		

1 Introduction

The original Minto Explorations Ltd. (Minto) water use license QZ96-006 (WUL) (and subsequent amendments) noted that material having "(*a)n NP/AP ratio of 3 or greater is generally considered to indicate non-acid generating material*" (Appendix 6 of YWB (2012)). For Phase V/VI waste management planning purposes, a volumetric allowance was made for a volume of NP/AP [1]< 3 waste rock to be stored under conditions that are expected to be saturated in the long term to minimize oxidation of contained sulphide minerals. This memorandum summarizes the method used to develop the volume allowance.

2 Background

2.1 Historical ABA Results

During mining of the Main Pit, operational monitoring of waste rock for acid base accounting (ABA) parameters was carried out in accordance with water license conditions. The results of that operational monitoring confirmed that the ABA characteristics of Main Pit waste rock were consistent with expectations based on pre-production testing (i.e. NP/AP values were consistently greater than 3).

During the metal leaching and acid rock drainage (ML/ARD) investigations that formed the basis of the Phase IV waste management strategy, a small proportion of drill core samples from the future Area 2 Stage 2 pit were identified as having NP/AP<3. Due to the large proportion of samples with NP/AP>3, it was concluded that bulk disposal of waste rock was appropriate and that no allowance for separate disposal of NP/AP<3 material was required.

Once Phase IV mining began, operational monitoring of Area 2 waste rock in 2012 (using an off-site commercial laboratory) indicated that a proportion of as-produced waste rock had NP/AP<3; this result was consistent with the pre-production testing, but after further consideration Minto

[1] NP: neutralization potential; AP: acid potential

elected to revise its waste rock disposal approach. To minimize the long-term risk of development of acidic leaching conditions and associated high metal loadings, the mine adapted the waste rock management strategy to include on-site classification, and separate storage of waste rock with NP/AP>3 and NP/AP<3.

2.2 Adaptation of Phase IV Waste Rock Management Strategy

The Phase IV waste management plan was adapted by introducing operational characterization of waste rock ABA characteristics into the mine's work flow as part of the grade control program starting in August 2012. To provide ABA results in the short turn-around times required for operational characterization and dispatching, Minto purchased and commissioned an Eltra CS-800 induction furnace that allowed on-site measurement of total carbon and total sulphur content. Prior results from testing of samples from Main Pit and Area 2 at an off-site commercial laboratory showed that total carbon and total sulphur content was nearly identical to total inorganic carbon and total sulphide sulphur content, respectively, and therefore the relatively-simple total carbon and total sulphur analyses were appropriate for operational ABA characterization.

Operational NP and AP values (NP-C(T) and AP-S(T)) are calculated from the total carbon and total sulphur results, respectively, and then used to calculate NP-C(T):AP-S(T). It should be noted that this approach makes the de facto assumption that all sulphur is hosted in the mineral pyrite (FeS_2); in the case of Minto, pyrite is generally less abundant than copper sulphides.

Samples for on-site ABA testing are split from blast-hole samples collected for grade control purposes. Cuttings from every blasthole are collected and analyzed, and both assay and ABA results are then imported into the mine's grade control software. Using the results, mine geologists define ore and waste polygons for each blast (including delineating NP-C(T):AP-S(T)< 3 waste polygons) and then the results are provided to the pit operations staff for staking of ore and waste boundaries and subsequent dispatching of ore and waste to appropriate stockpiles and waste storage facilities.

To ensure that waste rock with NP/AP<3 would be stored in a location that would be saturated over the long term, the mine initiated dispatching of waste rock with NP/AP<3 to the mined-out Main Pit, placing it below the final expected water table elevation.

2.3 Phase V/VI Pre-production ABA Results

The Phase V/VI pre-production testing on drill core samples presented a similar range of results for the Area 2 Stage 3 pit (A2S3), the Ridgetop North pit, and the Ridgetop South pit as were found for the Phase IV deposits (i.e. there would not be significant waste rock volumes having NP/AP<3). However, based on the Phase IV mining results, Minto elected to plan for a certain volume of NP:AP <3 waste rock from the Phase V/VI developments to ensure that sufficient storage volume below final water table elevations was reserved.

Drill core from the waste rock intervals within the planned Minto North pit had uniformly low total sulphur content and NP/AP>3, and on that basis, no allowance for waste rock with NP/AP<3 is made for Minto North.

2.4 Classification Criteria

As noted in Section 1, the current Minto WUL notes that waste rock with NP/AP>3 is generally considered to indicate non-acid generating material. This is true in the strictest sense, but it should not be taken to indicate that an NP:AP value of 3 defines a sharp boundary between non-acid generating material and acid generating material. There are cases at individual mining projects in which detailed studies have determined that NP:AP values approaching 1 are appropriate for use as a threshold criterion for segregating non-acid generating waste rock; in the absence of detailed site-specific mineralogical study, it is common to refer to waste rock with NP:AP values between 1 and 3 as having "Uncertain" acid generating potential, and to define up to two additional categories (Potentially Acid Generating and Acid Generating) as summarized in Table 1.

Table 1 Generic Classification of ARD Potential of Mine Wastes

NP:AP Value (X)	Descriptive Classification	ARD Class Designation
X > 3	Not potentially acid generating	NPAG or NAG
1 ≤ X ≤ 3	Uncertain potential to develop acidic weathering conditions	Uncertain
X < 1, paste pH > 5	Potentially Acid Generating	PAG
X < 1, paste pH < 5	Acid Generating	AG

In order to develop the Phase V/VI waste rock management plan, Minto adopted the criterion specified in the current WUL (i.e. NPAG defined as rock with NP:AP > 3) for estimation of the volume of Phase V/VI waste rock with NP:AP ≤ 3. The company may conduct detailed studies in the future to develop a site-specific value for the criterion used to define NPAG waste rock- to the extent that the threshold criterion is lowered, more efficient use of the storage capacity within the in-pit TMFs will be realized.

3 Phase V/VI Estimates of NP:AP<3 Waste Rock Volumes

Two independent methods were used to estimate saturated storage volumes that should be reserved for waste rock storage. These methods are described elsewhere in detail (SRK 2013a) and are summarized here for completeness.

1. The first method was to review the production data from Phase IV mining in the Area 2 pit and calculate the proportion of total waste rock volume that was determined to have NP-C(T):AP-S(T) < 3. This approach was based on samples collected and analysed (on-site) from every blasthole beginning in August 2012.

a. This approach indicated that roughly 17% of the waste rock assessed had NP-C(T):AP-S(T) < 3.

2. The second method was to create a sulphur block model for the Phase V/VI Minto South pits (A2S3, Ridgetop North, and Ridgetop South) based on sulphur assays from exploration drill core. This approach consisted of estimating sulphur grades for all rock within the ultimate pit shells and calculating the volume of rock that was both below ore grade for copper (and therefore classified as waste) and higher that 0.3% total sulphur (rock with lower than 0.3% sulphur was found to correlate well with rock with NP/AP>3).

   a. This approach indicated that roughly 13% of the A2S3, Ridgetop North and Ridgetop South waste rock could be expected to have sulphur content high than 0.3%, and by correlation this was considered a reasonable proxy for the proportion of NP/AP<3 waste rock.

For planning purposes, Minto has chosen to allow for 20% of the waste rock from the Minto South pits to be stored in locations that will be saturated post-closure. This approach is considered to be appropriately conservative in that it will ensure that more volume will be reserved for NP/AP<3 waste rock than will likely be produced. Actual dispatching of waste rock from the Minto South pits will be done on the basis of blasthole analyses (as currently practised as part of Phase IV operations), not on the basis of pre-production estimates.

Table 2 summarizes the volumetric allowances that have been made for NP/AP<3 waste rock in Phase V/VI.

Table 2: Allowance for NP/AP<3 waste rock volumes in Phase V/VI waste management planning.

Source Location	Total Phase V/VI Waste Rock Volume (m^3)	Estimated Quantity of NP/AP<3 Waste Rock Volume (m^3)
Minto North	4,250,000	0
Area 2 Stage 3	1,905,000	381,000
Ridgetop South	627,000	125,400
Ridgetop North	3,416,000	683,200
Underground	133,000	26,600
Total Waste Rock (Phase V/VI)	**10,331,000**	
Total NP/AP<3 (Phase V/VI)		**1,216,200**

4 References

Yukon Water Board. 2012. Water Use License QZ96-006 Amendment 8. Issued to Minto Explorations Ltd. on October 18, 2012.

Appendix B
Ridgetop Exploration Assay Results: Statistical Summaries

	Total Cu %	Au_ppm	Ag ppm ICP	Al_%ICP	As_ppmICP	B_ppmICP	Ba_ppmICP	Be_ppmICP	Bi_ppmICP	Ca_%ICP	Cd_ppmICP	Co_ppmICP	Cr_ppmICP	Fe_%ICP	Ga_ppmICP	Hg_ppmICP	K_%ICP	La_ppmICP
Count	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136
Average	0.074	0.018	0.329	1.276	6.654	5.809	428.750	0.349	1.154	1.091	0.290	6.515	6.000	2.725	7.941	0.555	0.776	10.368
Max	1.81	0.471	4.9	2.03	176	10	2140	1.5	7	4.95	1.6	15	23	5.19	10	2	1.63	30
P90	0.13	0.05	0.55	1.86	11.00	10.00	700.00	0.60	2.00	2.17	0.25	9.00	8.00	4.07	10.00	0.50	1.25	20.00
P50	0.02	0.0025	0.2	1.335	4	5	370	0.25	1	0.88	0.25	6	5	2.455	10	0.5	0.8	10
P10	0.005	0.0025	0.1	0.685	1	5	180	0.25	1	0.315	0.25	4	3	1.885	5	0.5	0.34	5
Min	0.005	0.0025	0.1	0.38	1	5	50	0.25	1	0.2	0.25	1	1	0.97	5	0.5	0.19	5

	Mg_%ICP	Mn_ppmICP	Mo_ppmICP	Na_%ICP	Ni_ppmICP	P_ppmICP	Pb_ppmICP	S_%ICP	Sb_ppmICP	Sc_ppmICP	Sr_ppmICP	Ti_%ICP	Tl_ppmICP	U_ppmICP	V_ppmICP	W_ppmICP	Zn_ppmICP
Count	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136	136
Average	0.640	698.096	2.018	0.068	2.232	822.794	8.051	0.035	1.221	5.397	55.647	0.133	5.441	5.110	66.735	5.000	118.676
Max	1.76	2590	52	0.16	8	1700	67	0.59	7	12	225	0.28	10	10	135	5	726
P90	1.03	1315.00	3.50	0.10	4.00	1210.00	17.00	0.06	2.00	8.00	90.00	0.23	5.00	5.00	100.50	5.00	244.50
P50	0.58	516.5	1	0.06	2	765	5	0.01	1	5.5	47	0.15	5	5	59	5	76
P10	0.23	323	0.5	0.04	0.5	490	2	0.005	1	2	29.5	0.005	5	5	35	5	51
Min	0.04	100	0.5	0.01	0.5	170	1	0.005	1	1	16	0.005	5	5	15	5	10

Appendix C
Phase V/VI Waste Rock: Static Test Results

HOLE ID	FROM (m)	TO (m)	Length (m)	SAMPLE DESCRIPTION	OA-ELE07 pH Unity	OA-VOL08 FIZZ RATING Unity	OA-VOL08 MPA tCaCO3/1000t ore	OA-VOL08 NNP tCaCO3/1000t ore	Calc AP 0	OA-VOL08 NP tCaCO3/1000t ore	OA-VOL08 Ratio (NP:MPA) Unity	Calc Ratio (NP:AP) Unity
07SWC254	2.04	8.45	6.41	RT_ABA-1	8.4	1	0.3	9	0.3	9	29	29
07SWC254	19.95	27.17	7.22	RT_ABA-2	8.9	2	0.3	19	0.3	19	61	61
07SWC251	19.61	26.47	6.86	RT_ABA-3	8.8	2	0.6	21	0.6	22	35	35
07SWC251	66.09	72.08	5.99	RT_ABA-6	8.7	2	0.3	33	0.3	33	106	106
07SWC250	1.77	6.71	4.94	RT_ABA-7	8.4	2	0.3	57	0.3	57	182	182
07SWC250	14.53	20.53	6.00	RT_ABA-8	8.5	2	0.3	58	0.3	58	186	186
07SWC250	30.67	36.40	5.73	RT_ABA-9	9.1	2	0.9	54	0.9	55	59	59
07SWC246	1.46	6.83	5.37	RT_ABA-10	8.6	2	0.9	22	0.9	23	25	25
07SWC244	2.00	6.80	4.80	RT_ABA-11	8.5	1	0.3	13	0.3	13	42	42
07SWC183	5.93	10.90	4.97	RT_ABA-12	8.8	1	0.3	15	0.3	15	48	48
07SWC183	23.61	30.06	6.45	RT_ABA-14	9	2	0.6	25	0.6	26	42	42
07SWC182	4.87	12.23	7.36	RT_ABA-15	8.7	2	0.9	44	0.3	45	48	144
07SWC182	25.64	31.30	5.66	RT_ABA-16	8.4	3	1.9	101	1.6	103	55	66
07SWC182	32.80	38.73	5.93	RT_ABA-17	8.8	3	0.9	111	0.9	112	119	119
07SWC181	3.05	9.20	6.15	RT_ABA-18	8.5	2	0.3	34	0.3	34	109	109
07SWC181	9.20	14.66	5.46	RT_ABA-19	8.5	2	<0.3	25	0.3	25	160	80
07SWC251	48.39	53.16	4.77	RT_ABA-5	8.9	2	11.3	36	10.9	47	4.2	4.3
07SWC181	14.66	20.57	5.91	RT_ABA-20	8.9	2	3.1	28	3.1	31	10	10
07SWC251	40.19	45.80	5.61	RT_ABA-4	8.5	2	3.8	37	3.8	41	11	11
07SWC183	15.88	21.11	5.23	RT_ABA-13	8.2	2	9.4	11	9.4	20	2.1	2.1

HOLE ID	FROM (m)	TO (m)	Length (m)	SAMPLE DESCRIPTION	S-IR08 S %	S-GRA06a S %	S-CAL06a S %	C-GAS05 C %	C-GAS05 CO2 %	Calc TIC-NP tCaCO3/1000t ore	Calc Ratio (TIC-NP:AP) Unity	Composite Class 0
07SWC254	2.04	8.45	6.41	RT_ABA-1	0.01	<0.01	0.01	<0.05	<0.2	4	13	B
07SWC254	19.95	27.17	7.22	RT_ABA-2	0.01	<0.01	0.01	0.16	0.6	13	42.7	B
07SWC251	19.61	26.47	6.86	RT_ABA-3	0.02	<0.01	0.02	0.17	0.6	14	22.7	B
07SWC251	66.09	72.08	5.99	RT_ABA-6	0.01	<0.01	0.01	0.39	1.4	33	104	B
07SWC250	1.77	6.71	4.94	RT_ABA-7	0.01	<0.01	0.01	0.63	2.3	53	168.0	B
07SWC250	14.53	20.53	6.00	RT_ABA-8	0.01	<0.01	0.01	0.6	2.2	50	160	B
07SWC250	30.67	36.40	5.73	RT_ABA-9	0.03	<0.01	0.03	0.75	2.8	63	67	B
07SWC246	1.46	6.83	5.37	RT_ABA-10	0.03	<0.01	0.03	0.23	0.8	19	20	B
07SWC244	2.00	6.80	4.80	RT_ABA-11	0.01	<0.01	0.01	<0.05	<0.2	4	13	B
07SWC183	5.93	10.90	4.97	RT_ABA-12	0.01	<0.01	0.01	<0.05	<0.2	4	13	B
07SWC183	23.61	30.06	6.45	RT_ABA-14	0.02	<0.01	0.02	0.29	1.1	24	38.7	B
07SWC182	4.87	12.23	7.36	RT_ABA-15	0.03	0.03	<0.01	0.46	1.7	38	123	B
07SWC182	25.64	31.30	5.66	RT_ABA-16	0.06	0.01	0.05	1.63	6	136	87	B
07SWC182	32.80	38.73	5.93	RT_ABA-17	0.03	<0.01	0.03	1.38	5	115	123	B
07SWC181	3.05	9.20	6.15	RT_ABA-18	0.01	<0.01	0.01	0.28	1	23	75	B
07SWC181	9.20	14.66	5.46	RT_ABA-19	0.01	<0.01	<0.01	0.21	0.8	18	56	B
07SWC251	48.39	53.16	4.77	RT_ABA-5	0.36	0.01	0.35	0.67	2.4	56	5	M
07SWC181	14.66	20.57	5.91	RT_ABA-20	0.1	<0.01	0.1	0.32	1.2	27	9	M
07SWC251	40.19	45.80	5.61	RT_ABA-4	0.12	<0.01	0.12	0.49	1.8	41	10.9	O
07SWC183	15.88	21.11	5.23	RT_ABA-13	0.3	<0.01	0.3	0.23	0.8	19	2	O

HOLE ID	FROM (m)	TO (m)	Length (m)	SAMPLE DESCRIPTION	Length-weighted average elemental content from ICP assay database															
					Total Cu %	NS Cu %	Au_ppm	Ag ppm ICP	Al_%ICP	As_ppm ICP	B_ppm ICP	Ba_ppm ICP	Be_ppm ICP	Bi_ppm ICP	Ca_%ICP	Cd_ppm ICP	Co_ppm ICP	Cr_ppm ICP	Cu_ppm ICP	Fe_%ICP
07SWC254	2.04	8.45	6.41	RT_ABA-1	0.015	0.005	0.005	0.3	1.9	15	5	693	0.44	1	0.4	0.31	10	6	152	4.8
07SWC254	19.95	27.17	7.22	RT_ABA-2	0.010	0.005	0.008	0.2	1.6	7	7	550	0.25	2	0.8	0.25	7	7	94	2.6
07SWC251	19.61	26.47	6.86	RT_ABA-3	0.125	0.049	0.006	0.2	1.6	3	5	511	0.25	2	0.8	0.25	8	7	1297	3.0
07SWC251	66.09	72.08	5.99	RT_ABA-6	0.005	0.001	0.003	0.1	0.8	1	5	198	0.25	1	0.8	0.25	6	5	23	2.2
07SWC250	1.77	6.71	4.94	RT_ABA-7	0.021	0.011	0.040	0.2	1.5	5	8	361	0.61	1	2.2	0.25	7	5	279	2.5
07SWC250	14.53	20.53	6.00	RT_ABA-8	0.095	0.067	0.064	0.1	1.8	4	7	297	0.61	1	2.2	0.65	8	6	1017	3.3
07SWC250	30.67	36.40	5.73	RT_ABA-9	0.050	0.012	0.004	0.1	1.7	3	7	212	0.45	2	1.5	0.71	7	4	530	3.9
07SWC246	1.46	6.83	5.37	RT_ABA-10	0.310	0.204	0.045	0.3	1.4	3	5	307	0.25	1	0.8	0.25	5	14	3068	2.5
07SWC244	2.00	6.80	4.80	RT_ABA-11	0.027	0.007	0.005	0.2	1.1	50	5	376	0.25	1	0.3	0.25	7	6	124	2.5
07SWC183	5.93	10.90	4.97	RT_ABA-12	0.024	0.012	0.004	1.0	1.2	6	5	422	0.25	1	0.3	0.25	6	6	205	2.3
07SWC183	23.61	30.06	6.45	RT_ABA-14	0.015	0.002	0.005	0.3	1.1	10	5	447	0.25	1	0.8	0.25	5	7	126	2.2
07SWC182	4.87	12.23	7.36	RT_ABA-15	0.012	0.006	0.003	0.2	0.6	6	10	1165	0.56	1	1.8	0.25	6	2	139	1.9
07SWC182	25.64	31.30	5.66	RT_ABA-16	0.120	0.070	0.002	0.6	0.7	11	10	963	0.84	1	3.2	0.25	8	2	1255	2.8
07SWC182	32.80	38.73	5.93	RT_ABA-17	0.039	0.019	0.002	0.2	0.7	1	8	679	0.52	1	2.9	0.33	7	3	380	2.6
07SWC181	3.05	9.20	6.15	RT_ABA-18	0.027	0.011	0.003	0.2	1.3	5	5	258	0.31	1	1.3	0.25	9	4	271	3.3
07SWC181	9.20	14.66	5.46	RT_ABA-19	0.005	0.002	0.003	0.3	1.1	3	5	168	0.25	1	1.0	0.25	6	5	37	2.4
07SWC251	48.39	53.16	4.77	RT_ABA-5	0.079	0.011	0.003	0.4	1.5	4	5	322	0.25	1	1.2	0.59	10	5	884	4.2
07SWC181	14.66	20.57	5.91	RT_ABA-20	0.451	0.276	0.140	1.5	1.0	1	5	154	0.29	1	1.1	0.36	5	5	4514	2.4
07SWC251	40.19	45.80	5.61	RT_ABA-4	0.665	0.243	0.057	0.4	1.0	2	6	237	0.39	1	1.2	0.25	6	3	6889	2.4
07SWC183	15.88	21.11	5.23	RT_ABA-13	0.708	0.335	0.047	1.5	1.1	32	6	394	0.25	2	0.7	0.43	8	5	7085	2.7

HOLE ID	FROM (m)	TO (m)	Length (m)	SAMPLE DESCRIPTION	Ga_ppm ICP	Hg_ppm ICP	K_%ICP	La_ppm ICP	Mg_%ICP	Mn_ppm ICP	Mo_ppm ICP	Na_%ICP	Ni_ppm ICP	P_ppm ICP	Pb_ppm ICP	S_%ICP	Sb_ppm ICP	Sc_ppm ICP	Sr_ppm ICP	Ti_%ICP	Tl_ppm ICP
07SWC254	2.04	8.45	6.41	RT_ABA-1	10	1	1.3	12	0.9	1304	2	0.05	6	1027	10	0.01	1	7	37	0.23	6
07SWC254	19.95	27.17	7.22	RT_ABA-2	10	1	1.1	5	0.9	388	1	0.08	3	1158	5	0.01	1	3	57	0.23	5
07SWC251	19.61	26.47	6.86	RT_ABA-3	10	1	1.2	5	0.8	545	1	0.08	1	1041	7	0.02	1	6	39	0.23	5
07SWC251	66.09	72.08	5.99	RT_ABA-6	5	1	0.5	13	0.5	383	1	0.04	1	592	5	0.01	1	2	35	0.09	5
07SWC250	1.77	6.71	4.94	RT_ABA-7	9	1	0.7	12	0.6	866	4	0.07	5	764	10	0.01	1	7	77	0.12	6
07SWC250	14.53	20.53	6.00	RT_ABA-8	10	0	1.0	17	1.0	674	3	0.07	5	1032	7	0.01	1	9	79	0.20	10
07SWC250	30.67	36.40	5.73	RT_ABA-9	10	1	1.0	17	1.2	1926	1	0.08	5	937	19	0.04	1	8	93	0.15	7
07SWC246	1.46	6.83	5.37	RT_ABA-10	10	1	0.8	10	0.7	265	1	0.07	2	845	4	0.03	2	6	53	0.17	5
07SWC244	2.00	6.80	4.80	RT_ABA-11	8	1	0.6	11	0.4	477	1	0.08	1	716	4	0.01	1	6	28	0.11	5
07SWC183	5.93	10.90	4.97	RT_ABA-12	8	1	0.8	7	0.5	434	1	0.08	2	634	35	0.01	1	5	34	0.13	5
07SWC183	23.61	30.06	6.45	RT_ABA-14	5	1	0.8	9	0.5	462	1	0.08	2	554	18	0.01	3	6	41	0.14	5
07SWC182	4.87	12.23	7.36	RT_ABA-15	5	1	0.3	8	0.1	478	2	0.05	1	854	6	0.04	1	1	35	0.01	5
07SWC182	25.64	31.30	5.66	RT_ABA-16	5	0	0.4	12	0.9	1111	16	0.04	2	797	13	0.08	1	2	84	0.00	5
07SWC182	32.80	38.73	5.93	RT_ABA-17	5	1	0.3	10	0.8	970	3	0.05	2	620	8	0.04	1	2	64	0.00	5
07SWC181	3.05	9.20	6.15	RT_ABA-18	8	1	0.8	18	0.6	1478	1	0.05	2	1041	16	0.02	1	7	49	0.13	5
07SWC181	9.20	14.66	5.46	RT_ABA-19	7	1	0.4	12	0.5	575	1	0.07	2	700	5	0.01	1	7	97	0.06	5
07SWC251	48.39	53.16	4.77	RT_ABA-5	10	1	1.2	20	1.2	1655	1	0.05	1	1198	15	0.41	1	8	55	0.21	5
07SWC181	14.66	20.57	5.91	RT_ABA-20	6	1	0.4	10	0.5	499	1	0.07	2	824	4	0.11	1	7	84	0.06	5
07SWC251	40.19	45.80	5.61	RT_ABA-4	7	1	0.8	12	0.7	318	1	0.03	1	886	7	0.09	1	6	63	0.15	5
07SWC183	15.88	21.11	5.23	RT_ABA-13	6	1	0.6	6	0.5	435	29	0.08	3	901	4	0.35	2	4	64	0.08	5

HOLE ID	FROM (m)	TO (m)	Length (m)	SAMPLE DESCRIPTION	U_ppm ICP	V_ppm ICP	W_ppm ICP	Zn_ppm ICP
07SWC254	2.04	8.45	6.41	RT_ABA-1	5	103	5	231
07SWC254	19.95	27.17	7.22	RT_ABA-2	5	78	5	62
07SWC251	19.61	26.47	6.86	RT_ABA-3	5	84	5	73
07SWC251	66.09	72.08	5.99	RT_ABA-6	5	43	5	62
07SWC250	1.77	6.71	4.94	RT_ABA-7	5	83	5	84
07SWC250	14.53	20.53	6.00	RT_ABA-8	5	112	5	82
07SWC250	30.67	36.40	5.73	RT_ABA-9	5	86	5	523
07SWC246	1.46	6.83	5.37	RT_ABA-10	5	83	5	50
07SWC244	2.00	6.80	4.80	RT_ABA-11	5	63	5	78
07SWC183	5.93	10.90	4.97	RT_ABA-12	5	55	5	54
07SWC183	23.61	30.06	6.45	RT_ABA-14	5	52	5	75
07SWC182	4.87	12.23	7.36	RT_ABA-15	5	21	5	63
07SWC182	25.64	31.30	5.66	RT_ABA-16	7	30	5	143
07SWC182	32.80	38.73	5.93	RT_ABA-17	5	31	5	100
07SWC181	3.05	9.20	6.15	RT_ABA-18	5	86	5	235
07SWC181	9.20	14.66	5.46	RT_ABA-19	5	46	5	70
07SWC251	48.39	53.16	4.77	RT_ABA-5	5	105	5	406
07SWC181	14.66	20.57	5.91	RT_ABA-20	5	49	5	68
07SWC251	40.19	45.80	5.61	RT_ABA-4	5	98	5	67
07SWC183	15.88	21.11	5.23	RT_ABA-13	5	79	5	95

Sample Source						ABA Results													
						Sample ID	Paste pH	Fizz Test	AP	Net Sobek NP	Sobek NP	Sobek NP/AP	Total S	Sulphate	Sulphur Diff.	CO2	Equiv. CaCO3	Modified NP	Net Modified NP
							Std. Units	Visual	kg CaCO3/t	kg CaCO3/t	kg CaCO3/t	Ratio	% S	% S	% S	% CO2	kg CaCO3/t	kg CaCO3/t	kg CaCO3/t
						LOD	0.01	#N/A	#N/A	#N/A	0.2	#N/A	0.02	0.01	#N/A	0.02	#N/A	0.2	#N/A
						Method Code	Sobek	Sobek	Calc.	Calc.	Modified NP	Calc.	Leco	HCl Leach	Calc.	HCl Leach	Calc.	Modified NP	Calc.
Hole ID	from (m)	to (m)	Interval	Litho	Waste Category														
09SWC393	6.1	11.9	5.8	pG	HW waste	G0755001	8.41	Slight	<0.6	21.5	21.5	35.8	<0.02	<0.01	<0.02	0.43	9.8		
09SWC393	12.3	18.3	6	pG	HW waste	G0755002	8.58	Slight	<0.6	25.3	25.3	42.2	<0.02	<0.01	<0.02	0.45	10.2		
09SWC393	31.01	37.01	6	pG	HW waste	G0755003	8.80	Slight	<0.6	25.4	25.4	42.3	<0.02	<0.01	<0.02	0.51	11.6		
09SWC393	45.47	51.47	6	pG	HW waste	G0755004	9.18	Slight	<0.6	19.9	19.9	33.2	<0.02	<0.01	<0.02	0.26	5.9		
09SWC393	80.4	86.4	6	multiple	FW waste	G0755005	8.82	Slight	<0.6	31.5	31.5	52.5	<0.02	<0.01	<0.02	0.76	17.3	19.7	19.7
09SWC404	10.84	16.84	6	pG	HW waste	G0755006	8.70	Slight	<0.6	33.0	33.0	55.0	<0.02	<0.01	<0.02	0.81	18.4	22.9	22.9
09SWC404	34.58	40.58	6	pG	HW waste	G0755007	8.73	Slight	<0.6	32.0	32.0	53.3	<0.02	<0.01	<0.02	0.64	14.5	19.1	19.1
09SWC404	52.22	58.22	6	pG	HW waste	G0755008	8.61	Slight	<0.6	33.3	33.3	55.5	<0.02	<0.01	<0.02	0.89	20.2	23.4	23.4
09SWC404	86.35	92.35	6	multiple	FW waste	G0755009	9.20	Slight	<0.6	24.8	24.8	41.3	<0.02	<0.01	<0.02	0.32	7.3	13.6	13.6
09SWC408	21	27	6	pG	HW waste	G0755010	8.85	None	<0.6	12.2	12.2	20.3	<0.02	<0.01	<0.02	<0.02	<0.5		
09SWC408	46.93	52.93	6	pG	HW waste	G0755011	8.63	Slight	<0.6	26.3	26.3	43.8	<0.02	<0.01	<0.02	0.62	14.1		
09SWC408	65.81	71.81	6	pG	HW waste	G0755012	8.88	Slight	<0.6	26.0	26.0	43.3	<0.02	<0.01	<0.02	0.4	9.1		
09SWC408	101.9	107.9	6	G (FW waste	FW waste	G0755013	8.90	Slight	<0.6	23.3	23.3	38.8	<0.02	<0.01	<0.02	0.34	7.7		
09SWC 459	3.14	9.14	6	pG	HW waste	G0755014	9.02	None	<0.6	12.3	12.3	20.5	<0.02	<0.01	<0.02	0.03	0.7		
09SWC 459	30	36	6	pG	HW waste	G0755015	8.95	None	<0.6	15.1	15.1	25.2	<0.02	<0.01	<0.02	0.12	2.7		
09SWC 459	59.35	65.35	6	pG	HW waste	G0755016	8.89	Slight	<0.6	27.3	27.3	45.5	<0.02	<0.01	<0.02	0.53	12.0		
09SWC 459	75.4	81.4	6	pG	HW waste	G0755017	8.92	Slight	<0.6	24.7	24.7	41.2	<0.02	<0.01	<0.02	0.37	8.4		
09SWC 459	109.2	115.2	6	multiple	FW waste	G0755018	9.28	Slight	<0.6	25.3	25.3	42.2	<0.02	<0.01	<0.02	0.3	6.8		
09SWC465	9.14	15.14	6	pG	HW waste	G0755019	8.77	Slight	<0.6	24.0	24.0	40.0	<0.02	<0.01	<0.02	0.36	8.2		
09SWC465	30	36	6	pG	HW waste	G0755020	8.91	Slight	<0.6	23.8	23.8	39.7	<0.02	<0.01	<0.02	0.5	11.4		
09SWC465	49.92	55.92	6	pG	HW waste	G0755021	8.65	Slight	<0.6	30.8	30.8	51.3	<0.02	<0.01	<0.02	1.1	25.0		
09SWC465	73.75	79.75	6	pG	HW waste	G0755022	8.90	Slight	<0.6	25.4	25.4	42.3	<0.02	<0.01	<0.02	0.6	13.6		
09SWC465	88.52	94.52	6	multiple	HW waste	G0755023	8.42	Slight	<0.6	37.5	37.5	62.5	<0.02	<0.01	<0.02	1.21	27.5		

Modified NP/AP Ratio
#N/A
Calc.
32.8
38.2
31.8
39.0
22.7

Metals Results

Sample ID	Mo	Cu	Pb	Zn	Ag	Ni	Co	Mn	Fe	As	U	Au	Th	Sr	Cd	Sb	Bi	V	Ca	P	La	Cr	Mg	Ba	Ti	B	Al	Na	K	W	Hg	Sc	Tl	S	Ga	Se
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppb	ppm	ppm	ppm	ppm	ppm	ppm	%	%	ppm	ppm	%	ppm	%	ppm	%	%	%	ppm	ppm	ppm	ppm	%	ppm	ppm
LOD	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
G0755001	0.2	2.4	1.6	60	<0.1	3.6	6	437	1.9	<0.5	0.1	<0.5	1	71	<0.1	<0.1	<0.1	41	0.69	0.071	6	56	0.63	235	0.104	<20	1.02	0.079	0.48	<0.1	<0.01	2.4	0.1	<0.05	4	<0.5
G0755002	0.2	4.4	2.1	60	<0.1	4.1	6	483	2.01	0.5	0.1	<0.5	1.4	44	<0.1	<0.1	<0.1	41	0.87	0.069	8	59	0.66	175	0.099	<20	1.08	0.085	0.32	<0.1	<0.01	2.6	<0.1	<0.05	5	<0.5
G0755003	0.2	4.2	1.7	63	<0.1	3.5	5.6	473	1.97	<0.5	0.1	<0.5	1.8	71	<0.1	<0.1	<0.1	41	0.79	0.068	9	61	0.61	196	0.098	<20	1.04	0.065	0.5	<0.1	<0.01	2.9	0.1	<0.05	4	<0.5
G0755004	0.2	28.7	1.8	68	<0.1	3.5	5	422	1.91	0.7	0.1	0.8	2.9	39	<0.1	<0.1	<0.1	35	0.49	0.061	10	65	0.63	195	0.12	<20	1.03	0.054	0.55	<0.1	<0.01	1.6	0.1	<0.05	5	<0.5
G0755005	0.2	48.4	2	54	<0.1	2.8	5.8	475	1.91	<0.5	0.2	2.6	2.9	63	<0.1	<0.1	<0.1	37	0.95	0.068	12	58	0.62	153	0.065	<20	1	0.049	0.33	<0.1	<0.01	2.5	0.1	<0.05	4	<0.5
G0755006	0.2	2.9	3.1	47	<0.1	2.3	5.7	442	1.82	1.2	0.2	2.8	1.4	105	<0.1	<0.1	<0.1	33	1.13	0.069	8	42	0.64	54	0.04	<20	1.09	0.041	0.06	<0.1	<0.01	2.8	<0.1	<0.05	5	<0.5
G0755007	0.2	3.8	2.7	61	<0.1	3.1	6.5	484	2.01	1.1	0.2	0.7	1.3	90	<0.1	<0.1	<0.1	36	1.01	0.071	7	48	0.79	60	0.062	<20	1.17	0.044	0.12	<0.1	<0.01	2.6	<0.1	<0.05	6	<0.5
G0755008	0.2	6.4	1.7	55	<0.1	3.2	5.5	415	1.79	0.8	0.1	0.7	1.9	131	<0.1	<0.1	<0.1	27	1.04	0.067	8	58	0.53	128	0.03	<20	0.88	0.042	0.18	<0.1	<0.01	2.4	<0.1	<0.05	4	<0.5
G0755009	8.8	179.1	1.3	58	<0.1	2.9	6.3	440	2.11	1.3	0.5	3	4.2	44	<0.1	<0.1	<0.1	49	0.62	0.084	13	59	0.66	187	0.125	<20	1	0.057	0.62	<0.1	<0.01	2.6	0.2	<0.05	4	<0.5
G0755010	0.3	8.3	1.5	48	0.1	2.9	5.8	429	1.94	0.9	0.1	1.2	1.2	68	<0.1	<0.1	<0.1	43	0.56	0.076	7	59	0.62	161	0.114	<20	1	0.072	0.36	<0.1	<0.01	2.6	<0.1	<0.05	4	<0.5
G0755011	0.2	5.3	3.1	58	<0.1	2.6	6	449	2	0.8	0.1	1	1.2	140	<0.1	<0.1	<0.1	38	1.07	0.077	7	48	0.67	110	0.058	<20	1.12	0.051	0.16	<0.1	<0.01	2.8	<0.1	<0.05	5	<0.5
G0755012	0.2	3.7	2.7	62	<0.1	2.8	6	463	2.01	0.5	0.2	0.8	2.2	84	<0.1	<0.1	<0.1	41	0.87	0.076	10	58	0.74	150	0.1	<20	1.12	0.056	0.28	<0.1	<0.01	2.6	<0.1	<0.05	5	<0.5
G0755013	0.2	9.4	2	66	<0.1	3.1	6.1	467	2.11	0.6	0.2	0.7	1.4	54	<0.1	<0.1	<0.1	45	0.71	0.074	7	61	0.69	173	0.118	<20	1.13	0.062	0.45	<0.1	<0.01	2.1	<0.1	<0.05	5	<0.5
G0755014	0.2	3.2	1.1	41	<0.1	3	5.3	405	1.85	<0.5	0.2	<0.5	1.4	35	<0.1	<0.1	<0.1	43	0.44	0.077	7	65	0.6	177	0.111	<20	0.95	0.075	0.47	<0.1	<0.01	2.4	<0.1	<0.05	4	<0.5
G0755015	0.3	3.4	2	52	<0.1	3.2	6	462	2.04	3	0.2	0.9	1.1	39	<0.1	<0.1	<0.1	46	0.68	0.083	7	60	0.68	108	0.114	<20	1.02	0.069	0.29	<0.1	<0.01	2.9	<0.1	<0.05	5	<0.5
G0755016	0.1	2.4	2.7	58	<0.1	3	5.8	457	2	0.6	2	1.1	1.1	108	<0.1	<0.1	<0.1	39	0.91	0.073	7	57	0.67	127	0.068	<20	1.02	0.06	0.26	<0.1	<0.01	2.8	<0.1	<0.05	5	<0.5
G0755017	0.2	77.9	3.1	62	<0.1	3.3	6.2	525	2.1	<0.5	0.2	0.7	2.9	70	<0.1	<0.1	<0.1	44	0.69	0.076	9	60	0.68	230	0.11	<20	1.09	0.062	0.55	<0.1	<0.01	2.5	0.2	<0.05	5	<0.5
G0755018	0.2	5.9	2	64	<0.1	3	5.9	491	2.04	0.7	0.2	<0.5	1.3	46	<0.1	<0.1	<0.1	42	0.76	0.075	7	54	0.73	107	0.106	<20	1.11	0.062	0.3	<0.1	<0.01	2.3	<0.1	<0.05	6	<0.5
G0755019	0.2	2.1	2.3	47	<0.1	3	5.6	424	1.84	0.6	0.1	<0.5	1.2	63	<0.1	<0.1	<0.1	37	0.85	0.079	7	55	0.64	92	0.074	<20	0.94	0.055	0.21	<0.1	<0.01	2.4	<0.1	<0.05	5	<0.5
G0755020	0.2	2.9	0.8	67	<0.1	3.4	6.4	497	2.3	<0.5	0.1	<0.5	1.3	87	<0.1	<0.1	<0.1	52	0.63	0.087	7	59	0.73	334	0.135	<20	1.16	0.061	0.75	<0.1	<0.01	3.5	0.1	<0.05	5	<0.5
G0755021	2.3	3.1	1.3	54	<0.1	5.1	6.4	486	2.03	<0.5	0.1	<0.5	1.1	63	<0.1	<0.1	<0.1	50	1.01	0.082	6	63	0.57	234	0.093	<20	0.94	0.054	0.52	<0.1	<0.01	3.5	0.1	<0.05	4	<0.5
G0755022	0.2	8.2	2.2	86	<0.1	3.7	6.4	616	2.4	<0.5	0.2	<0.5	3.5	59	<0.1	<0.1	<0.1	50	0.72	0.079	12	64	0.75	296	0.133	<20	1.2	0.053	0.77	<0.1	<0.01	3.2	0.2	<0.05	5	<0.5
G0755023	0.2	231.7	3.6	77	<0.1	3.3	5.3	465	2.08	0.7	0.3	6.8	3.8	112	0.2	<0.1	<0.1	25	1.39	0.06	12	54	0.63	109	0.014	<20	1.14	0.035	0.2	<0.1	<0.01	1	<0.1	<0.05	5	<0.5

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting**
Date : **September 30, 2010**

Hole ID	Sample ID	Paste pH Std. Units	CO2 % CO2	Equiv. CaCO3 kg CaCO3/t	Total S % S	Sulphate % S	Sulphur Diff. % S	AP kg CaCO3/t	NP kg CaCO3/t	Net NP kg CaCO3/t	NP/AP Ratio	Fizz Test Visual	Mo ppm	Cu ppm
	LOD	0.01	0.02	#N/A	0.02	0.01	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	0.1	0.1
	Method Code	Sobek	HCl Leach	Calc.	Leco	HCl Leach	Calc.	Calc.	Sobek NP	Calc.	Calc.	Sobek	1DX	1DX
08SWC351	Ridgetop 7.70-14-84 m	8.33	1.12	25.5	<0.02	<0.01	<0.02	<0.6	37.2	37.2	62.0	Slight	1.5	126.7
08SWC374	Ridgetop 9.10-14.87 m	8.37	1.63	37.0	<0.02	<0.01	<0.02	<0.6	47.0	47.0	78.3	Slight	0.6	130.7
09SWC555	Ridgetop 10.00-16.00 m	8.28	0.58	13.2	0.02	<0.01	0.02	0.6	25.7	25.1	41.1	Slight	1.9	246.6
08SWC355	Ridgetop 10.36-16.36 m	8.54	1.33	30.2	<0.02	<0.01	<0.02	<0.6	37.9	37.9	63.2	Slight	0.8	119.1
09SWC553	Ridgetop 13.00-19.00 m	8.48	1.07	24.3	<0.02	<0.01	<0.02	<0.6	40.9	40.9	68.2	Slight	1.1	150.3
08SWC370	Ridgetop 16.00-22.00 m	8.31	1.23	28.0	<0.02	<0.01	<0.02	<0.6	42.1	42.1	70.2	Slight	2.3	315
07SWC256	Ridgetop 18.00-24.00 m	8.71	1.03	23.4	<0.02	<0.01	<0.02	<0.6	34.5	34.5	57.5	Slight	1.1	223.8
08SWC353	Ridgetop 19.00-26.14 m	8.44	0.74	16.8	<0.02	0.01	<0.02	<0.6	31.8	31.8	53.0	Slight	0.9	155.5
08SWC349	Ridgetop 20.50-26.50 m	8.81	0.98	22.3	<0.02	<0.01	<0.02	<0.6	32.8	32.8	54.7	Slight	0.7	91.1
08SWC355	Ridgetop 28.36-35.90 m	8.64	2.81	63.9	<0.02	<0.01	<0.02	<0.6	75.3	75.3	125.5	Slight	0.8	180.9
08SWC351	Ridgetop 29.65-35.68 m	8.79	0.61	13.9	<0.02	0.01	<0.02	<0.6	25.6	25.6	42.7	Slight	1.2	213.8
09SWC553	Ridgetop 34.00-40.00 m	8.50	1.44	32.7	<0.02	<0.01	<0.02	<0.6	45.6	45.6	76.0	Slight	1.4	128.2
	Duplicates													
08SWC351	Ridgetop 7.70-14-84 m	8.49							37.0			Slight		
08SWC374	Ridgetop 9.10-14.87 m		1.59											

Note:

Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting**
Date : **September 30, 2010**

Hole ID	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppb	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm
	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1
	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
08SWC351	4.6	74	0.8	5.4	6.8	609	2.78	6.3	0.1	2.9	0.9	63	<0.1	<0.1	<0.1	64	1.24	0.022	3	70
08SWC374	4.6	71	<0.1	4.3	8.1	702	2.55	4.8	0.1	5.3	1.3	79	<0.1	<0.1	<0.1	62	1.72	0.041	3	57
09SWC555	3.6	76	<0.1	5.1	9.8	594	3.64	5.2	<0.1	10.6	1.1	31	0.1	<0.1	<0.1	106	0.75	0.026	3	60
08SWC355	8.2	73	0.2	4.8	7.2	462	2.91	7.6	0.1	10.4	0.9	86	<0.1	<0.1	<0.1	72	1.39	0.019	2	63
09SWC553	5.3	73	<0.1	4.2	6.9	543	3.16	7.8	<0.1	12.9	1	98	<0.1	<0.1	<0.1	76	1.48	0.026	3	59
08SWC370	6.4	76	<0.1	4.3	7.7	579	3.04	5.3	0.2	24.4	1.3	59	<0.1	<0.1	0.1	74	1.55	0.037	3	54
07SWC256	6.8	94	<0.1	4.3	8.4	564	3.34	4.5	<0.1	6.9	0.6	63	<0.1	<0.1	<0.1	81	1.34	0.045	2	61
08SWC353	10.8	81	0.2	5	8.4	407	3.09	7.7	0.2	18	1.1	89	<0.1	<0.1	<0.1	82	1.13	0.022	2	55
08SWC349	9.3	71	0.1	4.4	6.4	391	2.86	7.7	0.2	3.2	1.1	73	<0.1	<0.1	<0.1	70	1.39	0.02	2	56
08SWC355	5	87	<0.1	4	8.4	816	2.95	5.6	0.1	14.4	1.3	61	0.1	<0.1	<0.1	71	2.61	0.053	3	49
08SWC351	3.7	84	0.1	3.6	7.4	557	2.79	3	<0.1	3.7	0.7	47	<0.1	<0.1	<0.1	69	0.86	0.064	2	62
09SWC553	4.5	62	<0.1	4.3	6.2	472	2.49	6	0.2	17.5	1.6	43	<0.1	<0.1	<0.1	67	1.63	0.031	4	62

08SWC351
08SWC374

Note:

Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting**
Date : **September 30, 2010**

Hole ID	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Hg ppm	Sc ppm	Tl ppm	S %	Ga ppm	Se ppm	Te ppm
	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5	0.2
	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
08SWC351	0.51	659	0.149	<20	1.17	0.031	0.8	0.4	<0.01	4.9	0.2	<0.05	6	<0.5	<0.2
08SWC374	0.4	570	0.102	<20	0.98	0.024	0.59	<0.1	<0.01	6.2	0.2	<0.05	5	<0.5	<0.2
09SWC555	0.86	654	0.261	<20	1.64	0.028	1.26	<0.1	<0.01	5.9	0.4	<0.05	8	<0.5	0.2
08SWC355	0.49	692	0.148	<20	1.17	0.026	0.76	<0.1	<0.01	6	0.2	<0.05	6	<0.5	<0.2
09SWC553	0.58	707	0.17	<20	1.32	0.024	0.9	<0.1	<0.01	5.4	0.3	<0.05	7	<0.5	<0.2
08SWC370	0.41	527	0.113	<20	1.02	0.021	0.6	<0.1	0.02	8	0.2	<0.05	5	<0.5	<0.2
07SWC256	0.65	601	0.163	<20	1.33	0.027	0.96	<0.1	<0.01	6.6	0.3	<0.05	8	<0.5	<0.2
08SWC353	0.57	877	0.165	<20	1.28	0.024	0.85	<0.1	0.01	6.6	0.3	<0.05	7	<0.5	<0.2
08SWC349	0.48	694	0.135	<20	1.15	0.024	0.76	<0.1	<0.01	5.8	0.3	<0.05	6	<0.5	<0.2
08SWC355	0.67	712	0.144	22	1.22	0.028	0.82	<0.1	<0.01	4.8	0.2	<0.05	7	<0.5	<0.2
08SWC351	0.61	942	0.176	<20	1.21	0.03	0.93	0.1	<0.01	5.5	0.3	<0.05	7	<0.5	<0.2
09SWC553	0.51	635	0.139	<20	1.11	0.023	0.71	<0.1	<0.01	6.7	0.2	<0.05	5	<0.5	<0.2

08SWC351
08SWC374

Note:

Equivalent $CaCO_3$ is calculated from the CO_2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.

NET NP = NP - AP

CLIENT : **SRK Consulting**
PROJECT : **Minto (Wildfire Project)**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting**
Date : **November 4, 2011**

	ABA										
Sample ID	**Paste pH Std. Units**	**CO2 % CO2**	**Equiv. CaCO3 kg CaCO3/t**	**Total S % S**	**Sulphate % S**	**Sulphur Diff. % S**	**AP kg CaCO3/t**	**Sobek NP kg CaCO3/t**	**Net Sobek NP kg CaCO3/t**	**Sobek NP/AP Ratio**	**Fizz Test Visual**
Method Code	Sobek	2A11HCl	Calc.	2A Leco	CSA07V	Calc.	Calc.	Sobek NP	Calc.	Calc.	Sobek
LOD	0.01	0.02	#N/A	0.02	0.01	#N/A	#N/A	0.5	#N/A	#N/A	#N/A
10SWC645 45&48 Composite	8.80	4.29	97.5	<0.02	<0.01	<0.02	<0.6	103.6	103.6	172.7	Moderate
10SWC645 70&73 Composite	8.89	3.19	72.5	<0.02	<0.01	<0.02	<0.6	67.6	67.6	112.7	Slight
10SWC645 93&96 Composite	8.87	3.14	71.4	<0.02	<0.01	<0.02	<0.6	67.9	67.9	113.2	Slight
10SWC645 108&111 Composite	8.94	7.02	159.5	<0.02	<0.01	<0.02	<0.6	135.9	135.9	226.5	Moderate
10SWC658 75&78 Composite	8.92	3.09	70.2	<0.02	0.02	<0.02	<0.6	66.5	66.5	110.8	Slight
10SWC658 87&90 Composite	8.95	3.31	75.2	<0.02	0.01	<0.02	<0.6	68.8	68.8	114.7	Slight
10SWC658 93&96 Composite	9.00	9.46	215.0	<0.02	<0.01	<0.02	<0.6	188.0	188.0	313.3	Moderate
10SWC658 102&105 Composite	9.11	3.64	82.7	<0.02	<0.01	<0.02	<0.6	66.8	66.8	111.3	Slight

CLIENT : **SRK Consulting**
PROJECT : **Minto (Wildfire Project)**
SGS Project # : **0907**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **November 23, 2011**

	Metals																	
Sample ID	**Mo**	**Cu**	**Pb**	**Zn**	**Ag**	**Ni**	**Co**	**Mn**	**Fe**	**As**	**Au**	**Th**	**Sr**	**Cd**	**Sb**	**Bi**	**V**	**Ca**
	ppm	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**	**ppb**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
LOD	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.5	0.1	1	0.1	0.1	0.1	2	0.01
10SWC645 45&48 Composite	0.4	46.5	2.9	46	<0.1	5.5	8	1046	2	2.2	4.9	1.4	66	<0.1	<0.1	<0.1	55	3.37
10SWC645 70&73 Composite	0.3	51.9	2.6	38	<0.1	4.8	5.7	378	1.81	3.4	2.2	1.7	101	<0.1	<0.1	<0.1	59	2.24
10SWC645 93&96 Composite	0.4	54.9	1.5	46	<0.1	8.1	9.2	507	2.4	4	0.5	1.5	86	<0.1	<0.1	<0.1	79	1.96
10SWC645 108&111 Composite	0.3	38.5	3.5	63	<0.1	11	13.3	1092	3.2	2.2	1.5	1.3	152	0.3	<0.1	<0.1	107	3.72
10SWC658 75&78 Composite	0.3	38	2.2	36	<0.1	7.2	7.2	432	2.29	1.4	<0.5	1.9	111	0.1	<0.1	<0.1	76	1.8
10SWC658 87&90 Composite	0.4	68.6	3.1	45	0.1	6.7	8.5	423	2.45	1.4	15	2.1	130	<0.1	<0.1	<0.1	80	1.98
10SWC658 93&96 Composite	0.2	56.7	3.5	49	0.1	6.9	10.6	863	2.87	1.4	<0.5	1.8	220	<0.1	<0.1	<0.1	68	4.74
10SWC658 102&105 Composite	0.2	86.4	3.4	43	<0.1	4.2	6.7	517	2.26	1.2	1.1	2.5	131	<0.1	<0.1	<0.1	59	1.83

CLIENT : **SRK Consulting**
PROJECT : **Minto (Wildfire Project)**
SGS Project # : **0907**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **November 23, 2011**

	Metals																	
Sample ID	**P**	**La**	**Cr**	**Mg**	**Ba**	**Ti**	**B**	**Al**	**Na**	**K**	**W**	**Hg**	**Sc**	**Tl**	**S**	**Ga**	**Se**	**Te**
	%	**ppm**	**ppm**	**%**	**ppm**	**%**	**ppm**	**%**	**%**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**	**ppm**	**ppm**
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
LOD	0.001	1	1	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5	0.2
10SWC645 45&48 Composite	0.019	7	74	0.17	343	0.024	<20	0.39	0.034	0.19	<0.1	<0.01	6.8	<0.1	<0.05	2	<0.5	<0.2
10SWC645 70&73 Composite	0.039	4	77	0.32	248	0.029	<20	0.49	0.033	0.23	<0.1	<0.01	6.5	<0.1	<0.05	3	<0.5	<0.2
10SWC645 93&96 Composite	0.051	7	84	0.62	213	0.039	<20	0.73	0.032	0.38	<0.1	<0.01	9.9	<0.1	<0.05	3	<0.5	<0.2
10SWC645 108&111 Composite	0.036	8	197	0.65	307	0.023	<20	0.44	0.034	0.21	<0.1	<0.01	15.3	<0.1	<0.05	3	<0.5	<0.2
10SWC658 75&78 Composite	0.066	7	71	0.55	719	0.032	<20	0.57	0.033	0.24	<0.1	<0.01	9.2	<0.1	<0.05	3	<0.5	<0.2
10SWC658 87&90 Composite	0.051	7	82	0.51	478	0.044	<20	0.58	0.037	0.29	<0.1	<0.01	8.7	<0.1	<0.05	3	0.5	<0.2
10SWC658 93&96 Composite	0.031	9	79	1.18	203	0.024	<20	0.42	0.04	0.18	<0.1	<0.01	9.2	<0.1	<0.05	2	<0.5	<0.2
10SWC658 102&105 Composite	0.055	6	71	0.62	401	0.059	<20	0.6	0.038	0.34	<0.1	0.01	7.1	0.1	<0.05	3	<0.5	<0.2

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting and Modified NP**
Date : **March 4-18, 2011**

	Sample ID	**Paste pH Std. Units**	**CO2 % CO2**	**Equiv. CaCO3 kg CaCO3/t**	**Total S % S**	**Sulphate % S**	**Sulphur Diff. % S**	**AP kg CaCO3/t**	**Sobek NP kg CaCO3/t**	**Modified NP kg CaCO3/t**	**Net Sobek NP kg CaCO3/t**
	Method Code	Sobek	2A11HCl	Calc.	2A Leco	CSA07V	Calc.	Calc.	Sobek NP	Modified NP	Calc.
	LOD	0.01	0.02	#N/A	0.02	0.01	#N/A	#N/A	0.2	0.2	#N/A
Minto North Dyke	09SWC408 71.81-75.24	8.58	0.76	17.3	<0.02	0.02	<0.02	<0.6	35.9	24.1	35.9
Minto North Dyke	09SWC478 6.64-10.64	8.88	0.1	2.3	<0.02	0.01	<0.02	<0.6	16.2	8.1	16.2
Minto North Dyke	09SWC483 3.00-6.91	8.64	0.04	0.9	<0.02	0.01	<0.02	<0.6	14.6	7.3	14.6
Minto North Dyke	09SWC497 27.10-32.12	8.43	0.58	13.2	<0.02	0.02	<0.02	<0.6	32.5	18.1	32.5
Minto North Dyke	09SWC502 49.72-53.40	8.36	0.98	22.3	<0.02	0.02	<0.02	<0.6	37.0	25.7	37.0
Minto North Dyke	09SWC504 6.00-10.15	8.35	1.28	29.1	<0.02	0.02	<0.02	<0.6	40.3	27.7	40.3
Minto North Dyke	09SWC505 45.50-50.02	9.02	0.25	5.7	<0.02	0.01	<0.02	<0.6	28.3	11.4	28.3
Minto North Dyke	09SWC515 17.36-23.25	8.36	0.84	19.1	<0.02	0.02	<0.02	<0.6	36.4	22.3	36.4
Minto North Dyke	09SWC517 25.30-29.60	9.13	0.23	5.2	<0.02	<0.01	<0.02	<0.6	24.3	10.3	24.3

Note:

Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting and Modified NP**
Date : **March 4-18, 2011**

	Sample ID	**Net Modified NP kg CaCO3/t**	**Sobek NP/AP Ratio**	**Modified NP/AP Ratio**	**Fizz Test Visual**	**Mo ppm**	**Cu ppm**	**Pb ppm**	**Zn ppm**	**Ag ppm**	**Ni ppm**	**Co ppm**	**Mn ppm**
	Method Code	Calc.	Calc.	Calc.	Sobek	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
	LOD	#N/A	#N/A	#N/A	#N/A	0.1	0.1	0.1	1	0.1	0.1	0.1	1
Minto North Dyke	09SWC408 71.81-75.24	24.1	59.8	40.2	Slight	0.2	200.3	2.9	59	0.1	5.1	7.7	482
Minto North Dyke	09SWC478 6.64-10.64	8.1	27.0	13.5	None	0.2	9.9	2.9	55	<0.1	4.6	7.3	453
Minto North Dyke	09SWC483 3.00-6.91	7.3	24.3	12.2	None	0.3	8.9	3	52	<0.1	4.2	6.9	453
Minto North Dyke	09SWC497 27.10-32.12	18.1	54.2	30.2	Slight	0.2	11.7	1.6	55	<0.1	5	7.2	494
Minto North Dyke	09SWC502 49.72-53.40	25.7	61.7	42.8	Slight	0.1	7.8	2.3	57	<0.1	4.4	7.6	515
Minto North Dyke	09SWC504 6.00-10.15	27.7	67.2	46.2	Slight	0.1	17	2.4	59	0.1	4.6	8	489
Minto North Dyke	09SWC505 45.50-50.02	11.4	47.2	19.0	Slight	0.2	8.3	1.6	51	<0.1	4.3	7.1	468
Minto North Dyke	09SWC515 17.36-23.25	22.3	60.7	37.2	Slight	0.2	10	1.9	56	<0.1	4.8	7.7	472
Minto North Dyke	09SWC517 25.30-29.60	10.3	40.5	17.2	Slight	0.2	296.2	1.1	54	0.1	4.1	7	434

Note:

Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting and Modified NP**
Date : **March 4-18, 2011**

	Sample ID	**Fe**	**As**	**Au**	**Th**	**Sr**	**Cd**	**Sb**	**Bi**	**V**	**Ca**	**P**	**La**	**Cr**	**Mg**	**Ba**	**Ti**	**B**
		%	**ppm**	**ppb**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**%**	**ppm**	**ppm**	**%**	**ppm**	**%**	**ppm**
	Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
	LOD	0.01	0.5	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01	1	0.001	20
Minto North Dyke	09SWC408 71.81-75.24	2.17	1.1	7.8	4.1	98	<0.1	<0.1	<0.1	42	1.32	0.082	12	58	0.86	44	0.052	<20
Minto North Dyke	09SWC478 6.64-10.64	2.19	1.3	<0.5	4.7	57	<0.1	<0.1	<0.1	50	0.71	0.083	12	58	0.75	154	0.106	<20
Minto North Dyke	09SWC483 3.00-6.91	2.15	1.8	<0.5	4.8	51	<0.1	<0.1	<0.1	49	0.74	0.086	13	45	0.71	98	0.105	<20
Minto North Dyke	09SWC497 27.10-32.12	2.23	1	<0.5	4.7	83	<0.1	<0.1	<0.1	50	0.95	0.081	13	57	0.73	262	0.074	<20
Minto North Dyke	09SWC502 49.72-53.40	2.27	0.9	<0.5	4.4	62	<0.1	<0.1	<0.1	45	1.26	0.084	13	52	0.61	229	0.063	<20
Minto North Dyke	09SWC504 6.00-10.15	2.3	1.9	<0.5	4.6	100	<0.1	<0.1	<0.1	40	1.39	0.085	14	54	0.67	159	0.044	<20
Minto North Dyke	09SWC505 45.50-50.02	2.17	1	<0.5	5.1	41	<0.1	<0.1	<0.1	52	0.69	0.084	13	56	0.74	268	0.098	<20
Minto North Dyke	09SWC515 17.36-23.25	2.24	1.4	<0.5	4.4	52	<0.1	<0.1	<0.1	45	1.19	0.084	14	48	0.71	141	0.043	<20
Minto North Dyke	09SWC517 25.30-29.60	2.18	1	3.5	4.6	36	<0.1	<0.1	<0.1	50	0.57	0.087	12	54	0.73	276	0.102	<20

Note:

Equivalent $CaCO_3$ is calculated from the CO_2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.

NET NP = NP - AP

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting and Modified NP**
Date : **March 4-18, 2011**

	Sample ID	**Al**	**Na**	**K**	**W**	**Hg**	**Sc**	**Tl**	**S**	**Ga**	**Se**	**Te**
		%	**%**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**	**ppm**	**ppm**
	Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
	LOD	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5	0.2
Minto North Dyke	09SWC408 71.81-75.24	1.29	0.046	0.11	<0.1	<0.01	2.1	<0.1	<0.05	6	<0.5	<0.2
Minto North Dyke	09SWC478 6.64-10.64	1.08	0.077	0.25	<0.1	<0.01	1.6	<0.1	<0.05	6	<0.5	<0.2
Minto North Dyke	09SWC483 3.00-6.91	1.06	0.065	0.15	<0.1	<0.01	2	<0.1	<0.05	6	<0.5	<0.2
Minto North Dyke	09SWC497 27.10-32.12	1.08	0.051	0.4	<0.1	<0.01	2.3	0.1	<0.05	6	<0.5	<0.2
Minto North Dyke	09SWC502 49.72-53.40	1	0.049	0.38	<0.1	<0.01	2.7	<0.1	<0.05	5	<0.5	<0.2
Minto North Dyke	09SWC504 6.00-10.15	0.96	0.049	0.21	<0.1	<0.01	2.4	<0.1	<0.05	5	<0.5	<0.2
Minto North Dyke	09SWC505 45.50-50.02	1.04	0.084	0.47	<0.1	<0.01	2	0.1	<0.05	5	<0.5	<0.2
Minto North Dyke	09SWC515 17.36-23.25	1.01	0.04	0.24	<0.1	<0.01	2.2	<0.1	<0.05	6	<0.5	<0.2
Minto North Dyke	09SWC517 25.30-29.60	0.97	0.072	0.48	<0.1	<0.01	1.7	0.1	<0.05	5	<0.5	<0.2

Note:

Equivalent $CaCO_3$ is calculated from the CO_2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.

NET NP = NP - AP

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting and Modified NP**
Date : **January 29, 2013**

														Additions by SRK			
Field1	**HOLE-ID**	**FROM**	**TO**	**Sample ID** 0	**Paste pH Std. Units**	**CO2 % CO2**	**Equiv. CaCO3 kg CaCO3/t**	**Total S % S**	**Sulphate % S**	**Sobek NP kg CaCO3/t**	**Modified NP kg CaCO3/t**	**Fizz Test Visual**	**AP kg CaCO3/t**	**Sobek NP/AP ratio**	**Modified NP/AP ratio**	**CO3-NP/AP ratio**
				Method Code	Sobek	2A11HCl	Calc.	2A Leco	CSA07V	Sobek NP	Modified NP	Sobek	SRK calc	SRK calc	SRK calc	SRK calc
				LOD	0.20	0.02	#N/A	0.02	0.01	0.5	0.5	#N/A				
Area 2 Stage 3	07SWC269	1.73	8.95	Composite #1	8.48	0.03	0.7	0.06	<0.01	11.9	6.1	None	1.9	6.3	3.3	0.4
Area 2 Stage 3	09SWC416	31.46	37.22	Composite #2	8.59	0.78	17.7	<0.02	<0.01	32.8	23.3	Slight	0.6	52.5	37.3	28.4
Area 2 Stage 3	10SWC602	51.06	56.71	Composite #3	9.01	0.9	20.5	<0.02	<0.01	27.0	17.7	Slight	0.6	43.2	28.3	32.7
Area 2 Stage 3	10SWC621	61.38	67.4	Composite #4	9.12	0.52	11.8	0.02	<0.01	28.2	16.7	Slight	0.6	45.1	26.7	18.9
Area 2 Stage 3	10SWC602	43.3	49.25	Composite #28	8.87	0.69	15.7	0.08	<0.01	32.1	21.7	Slight	2.5	12.8	8.7	6.3
Area 2 Stage 3	10SWC602	59.56	66.35	Composite #29	8.93	0.88	20.0	0.02	<0.01	30.7	22.5	Slight	0.6	49.1	36.0	32.0
Area 2 Stage 3	10SWC621	33.35	49.55	Composite #30	8.62	0.37	8.4	0.02	<0.01	21.8	15.9	Slight	0.6	34.9	25.4	13.5
Ridgetop	10SWC621	12.19	18.46	Composite #8	8.49	0.69	15.7	<0.02	0.01	24.4	20.6	Slight	0.6	39.0	33.0	25.1
Ridgetop	10SWC621	24.46	29.96	Composite #9	8.50	1.54	35.0	0.08	0.01	38.4	35.4	Slight	2.5	15.4	14.2	14.0
Ridgetop	07SWC269	25.3	31.38	Composite #10	8.91	2.97	67.5	<0.02	0.02	58.9	53.3	Slight	0.6	94.2	85.3	108.0
Ridgetop	07SWC269	13	18.96	Composite #11	8.54	0.92	20.9	0.21	0.04	25.9	25.6	Slight	6.6	3.9	3.9	3.2
Ridgetop	07SWC269	20.45	26.92	Composite #12	8.66	1.21	27.5	0.04	0.03	35.5	32.3	Slight	1.3	28.4	25.8	22.0
Ridgetop	07SWC269	29.59	35.59	Composite #13	8.68	0.96	21.8	0.04	0.01	30.0	29.5	Slight	1.3	24.0	23.6	17.5
Ridgetop	07SWC269	55.89	61.89	Composite #14	8.54	1.25	28.4	<0.02	<0.01	33.8	31.2	Slight	0.6	54.1	49.9	45.5
Ridgetop	07SWC269	9.2	15.5	Composite #15	8.83	0.87	19.8	0.19	<0.01	35.1	28.2	Slight	5.9	5.9	4.7	3.3
Ridgetop	09SWC416	19.3	25.16	Composite #16	8.92	0.63	14.3	<0.02	<0.01	30.9	21.6	Slight	0.6	49.4	34.6	22.9
Ridgetop	09SWC416	25.16	31.15	Composite #17	9.00	0.54	12.3	<0.02	<0.01	29.1	18.7	Slight	0.6	46.6	29.9	19.6
Ridgetop	09SWC416	33.95	41	Composite #18	8.94	0.38	8.6	0.03	<0.01	28.0	16.7	Slight	0.9	29.9	17.8	9.2
Ridgetop	09SWC416	41	48.5	Composite #19	9.05	0.2	4.5	0.06	<0.01	24.3	13.9	Slight	1.9	13.0	7.4	2.4
Ridgetop	09SWC417	14.34	21.16	Composite #20	8.80	0.57	13.0	0.04	<0.01	29.3	20.2	Slight	1.3	23.4	16.2	10.4
Ridgetop	09SWC434	11.15	17.71999931	Composite #21	8.75	0.97	22.0	<0.02	<0.01	34.8	29.0	Slight	0.6	55.7	46.4	35.3
Ridgetop	09SWC434	25.3	31.3	Composite #22	8.52	2	45.5	<0.02	<0.01	49.8	48.0	Slight	0.6	79.7	76.8	72.7
Ridgetop	09SWC436	6.9	12.55	Composite #23	8.47	0.23	5.2	<0.02	<0.01	20.5	13.5	Slight	0.6	32.8	21.6	8.4
Ridgetop	09SWC436	31.5	37.37	Composite #24	8.79	0.54	12.3	0.04	<0.01	27.7	19.6	Slight	1.3	22.2	15.7	9.8
Ridgetop	09SWC440	6.17	10.37	Composite #25	9.22	0.19	4.3	0.05	<0.01	19.2	11.5	Slight	1.6	12.3	7.4	2.8
Ridgetop	09SWC440	20.98	27.84	Composite #26	8.86	0.62	14.1	<0.02	<0.01	28.8	20.5	Slight	0.6	46.1	32.8	22.5
Ridgetop	09SWC440	30.84	36.34	Composite #27	8.87	0.55	12.5	<0.02	<0.01	27.8	18.9	Slight	0.6	44.5	30.2	20.0

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting and Modified NP**
Date : **January 29, 2013**

		Metals on ABA Composites																							
Field1	**HOLE-ID**	**Mo**	**Cu**	**Pb**	**Zn**	**Ag**	**Ni**	**Co**	**Mn**	**Fe**	**As**	**Au**	**Th**	**Sr**	**Cd**	**Sb**	**Bi**	**V**	**Ca**	**P**	**La**	**Cr**	**Mg**	**Ba**	**Ti**
		ppm	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**ppm**	**ppb**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**%**	**ppm**	**ppm**	**%**	**ppm**	**%**
		1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
		0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01	1	0.001
Area 2 Stage 3	07SWC269	1.5	496.8	2.6	76	0.1	3.3	7.3	573	2.62	2.7	12.2	6.7	19	<0.1	0.2	<0.1	65	0.32	0.083	33	74	0.65	393	0.142
Area 2 Stage 3	09SWC416	1.5	64.3	2.6	66	<0.1	2.7	7.2	610	2.24	0.8	5.9	3.8	71	<0.1	0.1	<0.1	48	1.16	0.084	15	73	0.66	188	0.066
Area 2 Stage 3	10SWC602	1.3	25	2.6	62	<0.1	3.6	6	589	2.26	0.8	0.9	3.4	55	<0.1	0.1	<0.1	53	0.68	0.063	15	79	0.62	255	0.134
Area 2 Stage 3	10SWC621	1.2	9.3	2.5	62	<0.1	3.1	7.1	614	2.28	0.7	0.8	2.7	57	<0.1	0.1	<0.1	51	0.79	0.072	11	68	0.78	338	0.123
Area 2 Stage 3	10SWC602	1.4	6.5	1.9	65	<0.1	3.5	6.9	549	2.43	0.6	1.5	3.5	41	<0.1	0.1	<0.1	51	0.89	0.075	15	69	0.72	255	0.099
Area 2 Stage 3	10SWC602	1	29.8	2.9	66	<0.1	2.6	4.9	457	2.01	0.7	2.1	2.4	49	<0.1	<0.1	<0.1	38	0.94	0.061	9	64	0.55	231	0.059
Area 2 Stage 3	10SWC621	2.1	602.6	3.5	63	0.1	2.8	6.6	614	2.4	1.8	1.8	4	29	0.1	<0.1	<0.1	50	0.66	0.078	11	62	0.34	328	0.076
Ridgetop	10SWC621	1.8	106.8	3	51	0.1	2.3	4.9	288	1.81	3	18	1.1	29	<0.1	0.5	<0.1	39	1.02	0.077	4	67	0.09	505	0.007
Ridgetop	10SWC621	1.7	103.5	5.6	85	0.5	3.4	7.4	526	2.64	2.1	28.8	0.4	43	0.3	0.5	<0.1	59	1.42	0.064	4	69	0.22	551	0.017
Ridgetop	07SWC269	1.5	99.8	5	74	0.1	2.5	6.7	524	1.97	1.3	1.8	3.6	42	<0.1	<0.1	<0.1	25	1.89	0.063	11	49	0.32	659	0.002
Ridgetop	07SWC269	1.9	126.5	3.8	45	<0.1	2.7	4.3	388	2.03	9.9	2.6	2.6	29	0.2	0.2	<0.1	27	1.19	0.06	5	58	0.04	1707	0.007
Ridgetop	07SWC269	2.1	97.9	3.4	42	0.2	2.4	4.6	495	1.69	5.5	241.8	0.7	33	0.1	0.2	<0.1	27	1.42	0.049	3	72	0.07	1443	0.011
Ridgetop	07SWC269	1.6	49.3	4.6	58	0.1	2.5	5	419	1.64	5.2	7.8	1.3	27	0.1	0.2	<0.1	23	1.27	0.061	4	59	0.06	622	0.006
Ridgetop	07SWC269	5.3	621.1	2.5	78	<0.1	2.4	6.2	783	2.12	2.1	4.8	3.1	43	0.2	0.1	<0.1	33	1.14	0.057	11	48	0.16	477	0.002
Ridgetop	07SWC269	1.7	276.8	2.2	66	0.3	2.9	7.6	641	2.21	7.3	5.4	1.8	69	<0.1	38.5	<0.1	54	1.16	0.068	11	78	0.48	306	0.107
Ridgetop	09SWC416	1.2	16.2	1.3	68	0.1	3.6	6.7	688	2.3	1.5	1.5	2	51	<0.1	3	<0.1	51	0.96	0.066	11	81	0.61	327	0.121
Ridgetop	09SWC416	1.3	273.2	3.7	97	<0.1	3	7.8	870	2.4	3	<0.5	5.3	47	0.1	1.4	<0.1	59	0.87	0.084	17	76	0.71	234	0.128
Ridgetop	09SWC416	1.7	631.9	4.2	142	0.2	2.6	8.4	866	2.78	1.2	4	4.4	34	<0.1	0.7	<0.1	63	0.72	0.077	14	72	0.75	273	0.147
Ridgetop	09SWC416	1.6	899.4	2.7	66	0.3	3	6.7	623	2.36	1.2	9	5.8	30	0.2	0.5	<0.1	60	0.62	0.095	14	70	0.73	239	0.132
Ridgetop	09SWC417	1.5	34.1	2.5	74	<0.1	3.4	6.7	613	2.33	2.3	<0.5	2.8	37	<0.1	<0.1	<0.1	55	0.86	0.066	14	72	0.5	313	0.114
Ridgetop	09SWC434	0.8	25.1	2.4	51	<0.1	2.6	6.5	533	2.05	2.2	<0.5	1.7	64	<0.1	<0.1	<0.1	41	1.26	0.071	9	61	0.55	112	0.046
Ridgetop	09SWC434	1.3	460.4	6.2	136	0.2	2.6	7.8	993	2.54	5	30.2	3.3	50	0.1	0.3	<0.1	57	1.78	0.067	11	57	0.19	146	0.007
Ridgetop	09SWC436	3.3	120.6	2.4	68	0.2	3.1	7.2	691	2.33	2.1	<0.5	2.9	35	<0.1	<0.1	<0.1	44	0.59	0.062	15	64	0.48	231	0.042
Ridgetop	09SWC436	1.7	290.7	2.8	70	0.1	3	6.9	626	2.2	1.6	2.6	4	37	0.1	<0.1	<0.1	52	0.86	0.07	14	64	0.56	175	0.084
Ridgetop	09SWC440	1.1	40.5	3.9	94	<0.1	3.2	6.6	714	2.54	2.7	2.7	4.7	27	<0.1	<0.1	<0.1	64	0.47	0.069	11	71	0.69	512	0.18
Ridgetop	09SWC440	0.8	36	1.7	76	<0.1	3.1	6	632	2.18	2.4	<0.5	2.6	77	<0.1	<0.1	<0.1	45	0.91	0.071	11	72	0.52	244	0.084
Ridgetop	09SWC440	0.8	28.3	1.6	68	<0.1	2.8	5.8	565	2.2	1.4	0.7	3.3	76	<0.1	<0.1	<0.1	46	0.83	0.064	12	69	0.53	278	0.095

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting and Modified NP**
Date : **January 29, 2013**

Field1	HOLE-ID	B ppm	Al %	Na %	K %	W ppm	Hg ppm	Sc ppm	Tl ppm	S %	Ga ppm	Se ppm	Te ppm
		1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
		20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5	0.2
Area 2 Stage 3	07SWC269	<20	1.13	0.045	0.82	<0.1	0.02	3.6	0.3	<0.05	5	<0.5	<0.2
Area 2 Stage 3	09SWC416	<20	1.03	0.046	0.46	<0.1	0.02	5	0.2	<0.05	5	<0.5	<0.2
Area 2 Stage 3	10SWC602	<20	0.99	0.05	0.77	<0.1	0.01	4.5	0.2	<0.05	4	<0.5	<0.2
Area 2 Stage 3	10SWC621	<20	1.23	0.062	0.73	<0.1	0.01	3.6	0.2	<0.05	6	<0.5	<0.2
Area 2 Stage 3	10SWC602	<20	1.11	0.042	0.57	<0.1	<0.01	2.3	0.2	<0.05	6	<0.5	<0.2
Area 2 Stage 3	10SWC602	<20	0.87	0.039	0.38	<0.1	<0.01	2.2	0.1	<0.05	5	<0.5	<0.2
Area 2 Stage 3	10SWC621	<20	0.78	0.041	0.52	<0.1	<0.01	6.3	0.2	<0.05	4	<0.5	<0.2
Ridgetop	10SWC621	<20	0.43	0.033	0.27	<0.1	<0.01	2.3	<0.1	<0.05	3	<0.5	<0.2
Ridgetop	10SWC621	<20	0.47	0.034	0.29	<0.1	0.03	3.3	<0.1	<0.05	3	<0.5	<0.2
Ridgetop	07SWC269	<20	0.3	0.034	0.25	<0.1	<0.01	2	<0.1	<0.05	1	<0.5	<0.2
Ridgetop	07SWC269	<20	0.36	0.032	0.21	<0.1	<0.01	3.1	<0.1	<0.05	2	<0.5	<0.2
Ridgetop	07SWC269	<20	0.34	0.033	0.2	<0.1	0.01	1.6	<0.1	<0.05	2	<0.5	<0.2
Ridgetop	07SWC269	<20	0.38	0.035	0.24	<0.1	0.01	1.9	<0.1	<0.05	2	<0.5	<0.2
Ridgetop	07SWC269	<20	0.33	0.038	0.17	<0.1	0.01	2.9	<0.1	<0.05	1	<0.5	<0.2
Ridgetop	07SWC269	<20	0.9	0.05	0.63	1.9	0.01	3.9	0.1	<0.05	5	<0.5	<0.2
Ridgetop	09SWC416	<20	1.04	0.053	0.75	0.2	<0.01	4.9	0.2	<0.05	5	<0.5	<0.2
Ridgetop	09SWC416	<20	1.15	0.052	0.82	<0.1	0.01	4.1	0.4	<0.05	5	<0.5	<0.2
Ridgetop	09SWC416	<20	1.32	0.053	0.88	<0.1	<0.01	4	0.2	<0.05	6	<0.5	<0.2
Ridgetop	09SWC416	<20	1.16	0.063	0.76	<0.1	<0.01	3.1	0.2	<0.05	5	<0.5	<0.2
Ridgetop	09SWC417	<20	0.94	0.045	0.74	<0.1	<0.01	6.5	0.2	<0.05	4	<0.5	<0.2
Ridgetop	09SWC434	<20	0.8	0.053	0.27	<0.1	<0.01	3.7	<0.1	<0.05	5	<0.5	<0.2
Ridgetop	09SWC434	<20	0.32	0.034	0.15	<0.1	0.01	4.6	<0.1	<0.05	2	<0.5	<0.2
Ridgetop	09SWC436	<20	0.91	0.043	0.31	<0.1	<0.01	4.7	<0.1	<0.05	5	<0.5	<0.2
Ridgetop	09SWC436	<20	0.92	0.045	0.52	<0.1	<0.01	4	0.1	<0.05	5	<0.5	<0.2
Ridgetop	09SWC440	<20	1.22	0.048	1	<0.1	<0.01	7.8	0.4	<0.05	6	<0.5	<0.2
Ridgetop	09SWC440	<20	0.92	0.04	0.63	<0.1	0.01	5.8	0.2	<0.05	5	<0.5	<0.2
Ridgetop	09SWC440	<20	0.91	0.043	0.62	<0.1	<0.01	6.4	0.2	<0.05	5	<0.5	<0.2

Appendix D
Phase V/VI Waste Rock: Humidity Cell Test Results

Appendix D1
Sample Origin

HCT	Hole ID	From (m)	To (m)	Cu (%)	S (%)	Selection Characteristics	Deposit
HC1	07SWC211	83	86	0.21	0.51	~90th percentile Cu, ~90th percentile S	Area 2
HC2	07SWC196	54	55	0.01	0.01	50th percentile Cu, 50th percentile S	Area 2
HC3	07SWC196	46	47	0.1	0.02	~75th percentile Cu, ~50th percentile S	Area 2
HC4	07SWC211	71	74	0.01	0.08	~50th percentile Cu, ~75th percentile S	Area 2
HC5	09SWC506	30	33	0.00043	<0.02	Bulk waste	Minto North
HC6	09SWC506	30	33	0.00043	<0.02	Bulk waste (dup)	Minto North
HC7	09SWC484	40	43	0.00064	<0.02	Bulk waste	Minto North
HC8	09SWC498	54	57	0.04735	0.04	Moderately anomalous waste	Minto North
HC9	07SWC258	20	23	0.01359	<0.02	Bulk waste	Ridgetop North
HC10	08SWC337	10	13	0.01448	<0.02	Bulk waste	Ridgetop North
HC11	08SWC348	12	15	0.01078	0.03	Conglomerate	Ridgetop North
HC12	08SWC370	10	13	0.01773	<0.02	Conglomerate	Ridgetop North
HC13	09SWC419	15	18	0.00471	<0.02	Bulk waste	Ridgetop South
HC14	n/a	n/a	n/a	n/a	n/a	Method blank	Method blank

P:\01_SITES\Minto\!020_Site_Wide_Data\ML-ARD\Lab_Testing\Waste_Rock\HCTs\[Minto_HCT_sample_sources_dbm_rev00.xlsx]

Appendix D2
Static Characteristics

CLIENT : SRK Consulting
PROJECT : Minto Mine: Phase IV Expansion
CEMI Project # : 0907
Test : Size Fraction Analysis
Date : August 4, 2009

Hole 196 45.64-47.14

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	5.39	5.4%	5.4%
-3/8" + 1/4"	6.300	21.53	21.6%	27.0%
-1/4" + 6	3.360	21.36	21.4%	48.4%
-6 + 10	1.700	12.72	12.7%	61.1%
-10 + 35	0.425	16.82	16.9%	78.0%
-35 + 100	0.150	10.73	10.8%	88.7%
-100 + 270	0.053	6.77	6.8%	95.5%
-270	-0.053	4.49	4.5%	100.0%
TOTAL		99.81	100.0%	

Hole 196 53.94-55.44

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	8.28	8.3%	8.3%
-3/8" + 1/4"	6.300	22.26	22.3%	30.6%
-1/4" + 6	3.360	22.09	22.2%	52.8%
-6 + 10	1.700	15.47	15.5%	68.3%
-10 + 35	0.425	17.97	18.0%	86.3%
-35 + 100	0.150	7.40	7.4%	93.8%
-100 + 270	0.053	3.02	3.0%	96.8%
-270	-0.053	3.20	3.2%	100.0%
TOTAL		99.69	100.0%	

Hole 211 70.79-73.79

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	2.11	2.1%	2.1%
-3/8" + 1/4"	6.300	25.56	25.6%	27.7%
-1/4" + 6	3.360	21.42	21.5%	49.2%
-6 + 10	1.700	12.06	12.1%	61.3%
-10 + 35	0.425	19.16	19.2%	80.5%
-35 + 100	0.150	9.80	9.8%	90.3%
-100 + 270	0.053	4.09	4.1%	94.4%
-270	-0.053	5.54	5.6%	100.0%
TOTAL		99.74	100.0%	

Hole 211 83.08-86.03

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	4.57	4.6%	4.6%
-3/8" + 1/4"	6.300	17.55	17.6%	22.2%
-1/4" + 6	3.360	18.30	18.3%	40.5%
-6 + 10	1.700	12.42	12.4%	52.9%
-10 + 35	0.425	23.05	23.1%	76.0%
-35 + 100	0.150	13.07	13.1%	89.1%
-100 + 270	0.053	5.54	5.5%	94.7%
-270	-0.053	5.32	5.3%	100.0%
TOTAL		99.82	100.0%	

CLIENT : **SRK Consulting**
PROJECT : **Minto Mine: Phase IV Expansion**
CEMI Project # : **0907**
Test : **Sobek Acid-Base Accounting**
Date : **July 15, 2009**

Sample ID	**Paste pH Std. Units**	**CO2 % CO2**	**Equiv. CaCO3 kg CaCO3/t**	**Total S % S**	**Sulphate % S**	**Sulphur Diff. % S**	**AP kg CaCO3/t**	**NP kg CaCO3/t**	**Net NP kg CaCO3/t**	**NP/AP Ratio**	**Fizz Test Visual**
LOD	0.01	0.02	#N/A	0.02	0.01	#N/A	#N/A	0.2	#N/A	#N/A	#N/A
Method Code	Sobek	HCl Leach	Calc.	Leco	HCl Leach	Calc.	Calc.	Sobek NP	Calc.	Calc.	Sobek
Hole 196 45.64-47.14	8.43	0.1	2.3	<0.02	<0.01	<0.02	<0.6	11.4	11.4	19.0	None
Hole 196 53.94-55.44	8.36	0.72	16.4	<0.02	<0.01	<0.02	<0.6	27.0	27.0	45.0	Slight
Hole 211 70.79-73.79	8.76	0.36	8.2	0.13	<0.01	0.13	4.1	20.0	15.9	4.9	Slight
Hole 211 83.08-86.03	8.06	0.79	18.0	1.75	<0.01	1.75	54.7	28.2	-26.5	0.5	Slight
Duplicates											
Hole 196 45.64-47.14	8.50				<0.01			10.8			None
Hole 211 83.08-86.03				1.64							

Note:

Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

CLIENT : SRK Consulting
PROJECT : Minto Mine: Phase IV Expansion
CEMI Proje : 0907
Test : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : July 20, 2009

CLIENT : SRK Consulting
PROJECT : Minto Mine: Phase IV Expansion
CEMI Proje : 0907
Test : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : July 20, 2009

Sample ID	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppb	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %
LOD	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01	1	0.001	20	0.01	0.001
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Hole 196 45.64-47.14	3.7	549.2	2.6	105	0.2	3.3	8.1	550	2.93	1	0.4	9.6	8.4	26	0.1	<0.1	<0.1	66	0.37	0.093	16	106	0.77	194	0.175	<20	1.37	0.05
Hole 196 53.94-55.44	2.3	65.5	1.8	68	<0.1	3.5	6.6	600	2.43	0.6	0.3	0.5	2.4	39	<0.1	<0.1	<0.1	53	0.88	0.075	13	115	0.65	437	0.135	<20	1.17	0.055
Hole 211 70.79-73.79	2.3	178	3.3	50	<0.1	3.9	5.8	408	2.34	2.6	0.2	<0.5	2.3	29	<0.1	<0.1	<0.1	51	0.46	0.066	11	111	0.69	432	0.142	<20	1.25	0.066
Hole 211 83.08-86.03	94.4	4151.3	7.4	34	0.5	3.2	13.5	225	2.62	<0.5	0.5	10.1	3.5	54	0.3	<0.1	<0.1	20	1.06	0.071	22	87	0.44	66	0.003	<20	0.94	0.024

Sample ID	K	W	Hg	Sc	Tl	S	Ga	Se
	%	ppm	ppm	ppm	ppm	%	ppm	ppm
LOD	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Hole 196 45.64-47.14	1.02	<0.1	<0.01	3.8	0.4	<0.05	6	<0.5
Hole 196 53.94-55.44	0.81	<0.1	<0.01	3.7	0.2	<0.05	5	<0.5
Hole 211 70.79-73.79	0.83	<0.1	<0.01	5.1	0.3	0.12	6	<0.5
Hole 211 83.08-86.03	0.14	<0.1	0.02	1.1	<0.1	1.63	3	4.2

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Size Fraction Analysis**
Date : **February 25, 2011**

07SWC258 20-23

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	2.69	2.7%	2.7%
-3/8" + 1/4"	6.300	17.94	18.0%	20.7%
-1/4" + 10	1.700	35.01	35.1%	55.7%
-10 + 35	0.425	22.87	22.9%	78.6%
-35 + 100	0.150	11.08	11.1%	89.7%
-100 + 270	0.053	6.00	6.0%	95.7%
-270	-0.053	4.28	4.3%	100.0%
TOTAL		99.87	100.0%	

09SWC419 15-18

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	4.70	4.7%	4.7%
-3/8" + 1/4"	6.300	9.84	9.9%	14.6%
-1/4" + 10	1.700	33.96	34.1%	48.7%
-10 + 35	0.425	31.53	31.7%	80.3%
-35 + 100	0.150	11.21	11.3%	91.6%
-100 + 270	0.053	5.38	5.4%	97.0%
-270	-0.053	3.00	3.0%	100.0%
TOTAL		99.62	100.0%	

08SWC337 10-13

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	1.37	1.4%	1.4%
-3/8" + 1/4"	6.300	14.17	14.2%	15.6%
-1/4" + 10	1.700	37.94	38.1%	53.8%
-10 + 35	0.425	31.18	31.3%	85.1%
-35 + 100	0.150	8.84	8.9%	94.0%
-100 + 270	0.053	3.77	3.8%	97.8%
-270	-0.053	2.20	2.2%	100.0%
TOTAL		99.47	100.0%	

09SWC484 40-43

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	2.24	2.2%	2.2%
-3/8" + 1/4"	6.300	8.24	8.3%	10.5%
-1/4" + 10	1.700	30.24	30.3%	40.8%
-10 + 35	0.425	29.93	30.0%	70.8%
-35 + 100	0.150	15.28	15.3%	86.2%
-100 + 270	0.053	8.63	8.7%	94.8%
-270	-0.053	5.18	5.2%	100.0%
TOTAL		99.74	100.0%	

08SWC348 12-15

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	1.68	1.7%	1.7%
-3/8" + 1/4"	6.300	12.29	12.3%	14.0%
-1/4" + 10	1.700	32.26	32.3%	46.3%
-10 + 35	0.425	28.67	28.7%	75.1%
-35 + 100	0.150	12.20	12.2%	87.3%
-100 + 270	0.053	7.17	7.2%	94.5%
-270	-0.053	5.50	5.5%	100.0%
TOTAL		99.77	100.0%	

09SWC498 54-57

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	3.76	3.8%	3.8%
-3/8" + 1/4"	6.300	9.98	10.0%	13.8%
-1/4" + 10	1.700	19.60	19.7%	33.5%
-10 + 35	0.425	32.55	32.7%	66.2%
-35 + 100	0.150	16.90	17.0%	83.2%
-100 + 270	0.053	10.02	10.1%	93.3%
-270	-0.053	6.66	6.7%	100.0%
TOTAL		99.47	100.0%	

08SWC370 10-13

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	2.05	2.1%	2.1%
-3/8" + 1/4"	6.300	12.19	12.2%	14.3%
-1/4" + 10	1.700	26.64	26.7%	41.0%
-10 + 35	0.425	33.13	33.2%	74.2%
-35 + 100	0.150	14.11	14.2%	88.4%
-100 + 270	0.053	7.11	7.1%	95.5%
-270	-0.053	4.45	4.5%	100.0%
TOTAL		99.68	100.0%	

09SWC506 30-33

Sieve Designation	Aperture (mm)	Weight Retained (g)	(%)	Cumulative (%)
+3/8"	9.500	3.86	3.9%	3.9%
-3/8" + 1/4"	6.300	9.45	9.5%	13.4%
-1/4" + 10	1.700	21.59	21.7%	35.1%
-10 + 35	0.425	30.07	30.2%	65.3%
-35 + 100	0.150	16.81	16.9%	82.2%
-100 + 270	0.053	10.49	10.5%	92.7%
-270	-0.053	7.26	7.3%	100.0%
TOTAL		99.53	100.0%	

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Sobek Acid-Base Accounting and Modified NP**
Date : **March 4-18, 2011**

Sample ID	Paste pH Std. Units	CO2 % CO2	Equiv. CaCO3 kg CaCO3/t	Total S % S	Sulphate % S	Sulphur Diff. % S	AP kg CaCO3/t	Sobek NP kg CaCO3/t	Modified NP kg CaCO3/t
Method Code	Sobek	2A11HCl	Calc.	2A Leco	CSA07V	Calc.	Calc.	Sobek NP	Modified NP
LOD	0.01	0.02	#N/A	0.02	0.01	#N/A	#N/A	0.2	0.2
07SWC258 20-23	8.96	0.19	4.3	<0.02	0.01	<0.02	<0.6	12.1	7.8
08SWC337 10-13	8.48	2.39	54.3	<0.02	0.03	<0.02	<0.6	56.0	56.7
08SWC348 12-15	7.87	0.04	0.9	0.03	0.05	<0.02	<0.6	4.3	2.6
08SWC370 10-13	8.11	1.16	26.4	<0.02	0.03	<0.02	<0.6	28.9	25.6
09SWC419 15-18	8.30	2.28	51.8	<0.02	0.03	<0.02	<0.6	65.3	52.6
09SWC484 40-43	8.40	1.23	28.0	<0.02	0.02	<0.02	<0.6	35.4	23.9
09SWC498 54-57	8.19	0.99	22.5	0.04	0.04	<0.02	<0.6	36.0	25.0
09SWC506 30-33	8.99	0.07	1.6	<0.02	0.01	<0.02	<0.6	15.7	6.7

Note:

Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Net Sobek NP kg CaCO3/t	Net Modified NP kg CaCO3/t	Sobek NP/AP Ratio	Modified NP/AP Ratio	Fizz Test Visual
Calc.	Calc.	Calc.	Calc.	Sobek
#N/A	#N/A	#N/A	#N/A	#N/A
12.1	7.8	20.2	13.0	None
56.0	56.7	93.3	94.5	Moderate
4.3	2.6	7.2	4.3	None
28.9	25.6	48.2	42.7	Slight
65.3	52.6	108.8	87.7	Moderate
35.4	23.9	59.0	39.8	Slight
36.0	25.0	60.0	41.7	Slight
15.7	6.7	26.2	11.2	None

CLIENT : **SRK Consulting**
PROJECT : **Minto**
SRK Project # : **2CM022.016.0007**
SGS Project # : **0907**
Test : **Metals by Aqua Regia Digestion with ICP-MS Finish**
Date : **March 3, 2011**

Sample ID	**Mo ppm**	**Cu ppm**	**Pb ppm**	**Zn ppm**	**Ag ppm**	**Ni ppm**	**Co ppm**	**Mn ppm**	**Fe %**	**As ppm**	**Au ppb**
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
LOD	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.5
07SWC258 20-23	0.5	135.9	2.2	59	<0.1	3.5	6.6	491	2.38	5	2.9
08SWC337 10-13	1	144.8	5.8	72	0.3	3.8	8.2	845	2.2	5.7	1.4
08SWC348 12-15	1.4	107.8	12.4	77	0.3	3.8	7.5	512	2.62	4.5	8
08SWC370 10-13	0.7	177.3	4.6	71	<0.1	4.2	6.8	369	2.45	2.5	11.6
09SWC419 15-18	0.2	47.1	3.3	83	<0.1	3	7.4	684	2.53	9.2	0.6
09SWC484 40-43	0.2	6.4	1.1	51	<0.1	3.3	6	471	2.01	<0.5	<0.5
09SWC498 54-57	0.2	473.5	1.6	67	0.3	3.5	7.4	573	2.5	<0.5	9.6
09SWC506 30-33	0.2	4.3	1.2	46	<0.1	3.3	5.7	418	1.89	0.5	<0.5

CLIENT : SRK Con
PROJECT : Minto
SRK Project # : 2CM022.(
SGS Project # : 0907
Test : Metals by
Date : March 3,

Sample ID	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
LOD	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01
07SWC258 20-23	2.2	22	<0.1	<0.1	<0.1	61	0.32	0.072	6	64	0.72
08SWC337 10-13	3.1	40	0.1	0.1	<0.1	39	2.1	0.072	11	48	0.14
08SWC348 12-15	0.9	36	0.2	0.1	<0.1	58	0.1	0.019	2	39	0.39
08SWC370 10-13	0.9	70	<0.1	<0.1	<0.1	60	1.1	0.043	3	47	0.37
09SWC419 15-18	2.6	98	0.2	0.1	<0.1	52	2.06	0.072	14	53	0.3
09SWC484 40-43	1.2	53	<0.1	<0.1	<0.1	39	1.09	0.077	7	62	0.54
09SWC498 54-57	1.6	67	<0.1	<0.1	<0.1	48	1.17	0.079	8	60	0.67
09SWC506 30-33	1.1	37	<0.1	<0.1	<0.1	43	0.64	0.085	7	66	0.62

sulting

)16.0007

' Aqua Regia Digestion with ICP-MS Finish
2011

Sample ID	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Hg ppm	Sc ppm	Tl ppm	S %
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
LOD	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05
07SWC258 20-23	600	0.188	<20	1.3	0.056	1.04	<0.1	<0.01	4.4	0.3	<0.05
08SWC337 10-13	250	0.005	<20	0.34	0.03	0.17	<0.1	<0.01	4.6	<0.1	<0.05
08SWC348 12-15	1815	0.095	<20	0.94	0.024	0.58	<0.1	<0.01	5.9	0.2	<0.05
08SWC370 10-13	438	0.08	<20	0.88	0.024	0.5	<0.1	0.01	6.2	0.1	<0.05
09SWC419 15-18	178	0.041	<20	0.58	0.033	0.39	<0.1	<0.01	6.1	0.2	<0.05
09SWC484 40-43	159	0.061	<20	0.88	0.047	0.4	<0.1	<0.01	3.1	<0.1	<0.05
09SWC498 54-57	226	0.076	<20	1.23	0.041	0.55	<0.1	<0.01	2.7	0.1	<0.05
09SWC506 30-33	136	0.105	<20	0.97	0.072	0.29	<0.1	<0.01	2.2	<0.1	<0.05

Sample ID	Ga ppm	Se ppm	Te ppm
Method Code	1DX	1DX	1DX
LOD	1	0.5	0.2
07SWC258 20-23	6	<0.5	<0.2
08SWC337 10-13	2	<0.5	<0.2
08SWC348 12-15	6	<0.5	<0.2
08SWC370 10-13	5	<0.5	<0.2
09SWC419 15-18	4	<0.5	<0.2
09SWC484 40-43	4	<0.5	<0.2
09SWC498 54-57	6	0.8	<0.2
09SWC506 30-33	4	<0.5	<0.2

Appendix D3
Humidity Cell Operating Parameters

Cell No.	Sample ID	Sample Type	Method Reference	Column Dimensions			Column Packing			Pore Volume	Total Volume of Initial Flushings	Flushing Rate/Weekly Input*	Temp	Sampling Frequency	Start-up Date	Sampling Day	Operation Procedure	Sample Prep for Flushings
				Inner Diameter (cm)	Length (cm)	Distance from Top of Column to Sample (cm)	Dry Wt. of Sample (kg)	Other Materials Used	Column Material	(mL)	(mL)	(mL)	(°C)		**2009/2011**			
HC 1	Hole 211 83.08-86.03	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		750	500	20-22 °C	Weekly	3-Jul	Friday	Flood Leach	None
HC 2	Hole 196 53.94-66.44	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		750	500	20-22 °C	Weekly	3-Jul	Friday	Flood Leach	None
HC 3	Hole 196 45.64-47.14	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		750	500	20-22 °C	Weekly	3-Jul	Friday	Flood Leach	None
HC 4	Hole 211 70.79-73.79	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		750	500	20-22 °C	Weekly	3-Jul	Friday	Flood Leach	None
HC 5	09SWC506 30-33	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None
HC 6	09SWC506 30-33 DUP	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None
HC 7	09SWC484 40-43	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None
HC 8	09SWC498 54-57	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None
HC 9	07SWC258 20-23	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None
HC 10	08SWC337 10-13	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None
HC 11	08SWC348 12-15	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None
HC 12	08SWC370 10-13	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None
HC 13	09SWC419 15-18	Waste Rock	MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None
HC 14	Blank		MEND	10.20	25.50		1.00	Acrylic perforated disk & nylon mesh	Plexiglas		500	500	20-22 °C	Weekly	18-Mar	Friday	Flood Leach	None

Appendix D4
Phase V/VI HCT Results: Tables

HC 1

CONFIDENTIAL *DRAFT*

Sample = Hole 211
83.08-86.03

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
3-Jul-09	0	750	315	7.81	580	#N/A	3.3	102.3	108	25	2.94	125	0.041	0.00901	0.00086	0.0232	-0.00001	-0.000005	-0.05	0.000074	33.1	-0.0001	0.000105	0.154	0.002	0.00006	0.014	10.4	0.0184	0.1	0.199	0.00062	0.008	6.78	0.0537	2.35	-0.000005	70.6	0.773	40	0.000012	0.00026	-0.0005	0.000595	0.001	0.0006	-0.0001
10-Jul-09	1	500	455	7.77	296																																										
17-Jul-09	2	500	480	7.88	250	#N/A	2.8	68.6	59	0.8	1.23	72	0.0221	0.00291	0.00031	0.0287	-0.00001	-0.000005	-0.05	0.000077	19	-0.0001	0.000086	0.0455	0.004	0.00007	0.0088	5.95	0.0186	-0.01	0.117	0.00009	0.002	5.13	0.0119	3.24	-0.000005	27.5	0.441	23	0.000011	0.00007	-0.0005	0.000372	0.0007	0.0009	-0.0001
24-Jul-09	3	500	470	7.69	251																																										
31-Jul-09	4	500	455	7.75	236	#N/A	2.6	48.5	67	1	0.49	109	0.0239	0.00206	0.0002	0.0334	-0.00001	-0.000005	-0.05	0.000067	30	-0.0001	0.000076	0.0279	0.002	0.000042	0.0064	8.29	0.0224	-0.01	0.0608	-0.00002	0.005	5.28	0.0131	2.3	-0.000005	13.2	0.617	28	0.000012	0.00004	-0.0005	0.000103	0.0003	0.0004	-0.0001
7-Aug-09	5	500	485	7.51	198																																										
14-Aug-09	6	500	450	7.61	191	#N/A	3.2	45.3	49	0.6	0.76	96.5	0.0137	0.00193	0.0002	0.0314	-0.00001	-0.000005	-0.05	0.00005	27	-0.0001	0.000068	0.0232	0.002	0.000049	0.0039	7.09	0.0201	-0.01	0.0442	0.00008	0.002	3.77	0.00905	1.81	-0.000005	4.39	0.555	22	0.000011	0.00028	-0.0005	0.000055	-0.0002	0.0019	-0.0001
21-Aug-09	7	500	465	7.77	172																																										
28-Aug-09	8	500	425	7.71	144	#N/A	2.6	44.1	32	0.6	0.91	75.4	0.0583	0.00189	0.00016	0.0264	-0.00001	-0.000005	-0.05	0.000034	20.3	-0.0001	0.00004	0.0201	0.005	0.000063	0.0026	6.03	0.0103	-0.01	0.0399	0.00008	0.003	3.01	0.0101	2.09	-0.000005	2.63	0.432	13	0.000009	0.00008	-0.0005	0.000047	0.0002	0.0006	-0.0001
4-Sep-09	9	500	445	7.37	134																																										
11-Sep-09	10	500	405	7.73	135	#N/A	2.3	41.9	34	0.6	0.92	65.2	0.0387	0.0017	0.00012	0.0238	-0.00001	-0.000005	-0.05	0.00008	17.5	-0.0001	0.000038	0.0153	0.004	0.00181	0.002	5.24	0.00913	-0.01	0.0262	0.00016	0.003	2.24	0.00891	1.69	-0.000005	1.82	0.397	10	0.000015	0.00006	0.0006	0.000024	0.0003	0.0038	-0.0001
18-Sep-09	11	500	455	7.66	134																																										
25-Sep-09	12	500	425	7.66	122	#N/A	2.6	44.9	30	0.9	0.75	63.1	0.0283	0.00135	0.00011	0.0277	-0.00001	-0.000005	-0.05	0.000076	17.4	-0.0001	0.000036	0.0156	0.003	0.000199	0.0017	4.77	0.00936	0.01	0.0225	0.00011	-0.002	1.6	0.00878	1.61	-0.000005	1.24	0.36	9	0.000007	0.00001	0.0005	0.000024	-0.0002	0.0019	-0.0001
2-Oct-09	13	500	425	7.53	131																																										
9-Oct-09	14	500	440	7.50	129	#N/A	4.8	42.1	30	-0.5	0.71	68.6	0.1	0.00146	0.00017	0.0288	-0.00001	-0.000005	-0.05	0.000042	18.7	-0.0001	0.000039	0.0184	0.005	0.000115	0.0016	5.32	0.00898	-0.01	0.0233	0.00005	0.012	1.44	0.00724	1.56	-0.000005	1.31	0.378	11	0.000006	0.00001	0.0005	0.000029	0.0004	0.001	-0.0001
16-Oct-09	15	500	420	7.44	147																																										
23-Oct-09	16	500	415	7.56	135	#N/A	3.8	48.7	29	-0.5	0.84	72.4	0.0266	0.00153	0.00008	0.0303	-0.00001	-0.000005	-0.05	0.000042	19.6	-0.0001	0.000042	0.0206	0.004	0.000036	0.0017	5.71	0.00906	-0.01	0.0237	0.00018	0.003	1.32	0.00605	1.65	0.000008	1.04	0.415	9	0.000006	0.0001	-0.0005	0.000054	-0.0002	0.001	-0.0001
30-Oct-09	17	500	445	7.57	120																																										
6-Nov-09	18	500	475	7.59	135	#N/A	4.8	50.3	18	-0.5	0.79	71.4	0.0193	0.00117	0.00005	0.0318	-0.00001	-0.000005	-0.05	0.00004	19.5	-0.0001	0.000048	0.0224	0.003	0.00004	0.0013	5.5	0.00903	-0.01	0.0225	0.00012	0.004	1.08	0.00462	1.57	-0.000005	0.82	0.402	9	0.000006	0.00001	-0.0005	0.000067	0.0002	0.0006	-0.0001
13-Nov-09	19	500	470	7.47	122																																										
20-Nov-09	20	500	450	7.56	133	#N/A	5.3	46.6	19	-0.5	0.72	66.8	0.0291	0.00108	0.00006	0.0331	-0.00001	-0.000005	-0.05	0.000039	18.4	-0.0001	0.000106	0.0224	0.007	0.000152	0.0012	5.07	0.00834	-0.01	0.0219	0.00044	0.005	0.91	0.00408	1.41	-0.000005	0.72	0.379	8	0.000007	0.00009	-0.0005	0.00002	-0.0002	0.0034	-0.0001
27-Nov-09	21	500	460	7.52	126																																										
4-Dec-09	22	500	465	7.59	128	#N/A	3.8	50.8	16	-0.5	0.73	67.6	0.0182	0.00096	0.00005	0.0338	-0.00001	-0.000005	-0.05	0.000081	19	-0.0001	0.000044	0.022	0.003	0.000036	0.001	4.92	0.00836	-0.01	0.0208	0.00013	0.004	0.82	0.00358	1.31	-0.000005	0.67	0.376	9	0.000006	0.00074	-0.0005	0.000027	-0.0002	0.0004	-0.0001
11-Dec-09	23	500	455	7.54	116																																										
18-Dec-09	24	500	465	7.30	122	#N/A	5.5	46.5	20	-0.5	0.66	60.9	0.0247	0.00094	0.00006	0.0354	-0.00001	-0.000005	-0.05	0.000037	16.8	-0.0001	0.000041	0.0223	0.003	0.000028	0.001	4.58	0.00772	-0.01	0.02	0.00006	-0.002	0.74	0.00373	1.46	-0.000005	0.56	0.353	7	0.000004	-0.00001	-0.0005	0.000034	-0.0002	0.0001	-0.0001
25-Dec-09	25	500	460	7.51	101																																										
1-Jan-10	26	500	500	7.57	118	#N/A	2.6	47.5	19	0.6	0.65	65.2	0.0157	0.00093	0.00009	0.0354	-0.00001	-0.000005	-0.05	0.000034	18.7	-0.0001	0.000046	0.0242	0.002	0.000033	0.0008	4.48	0.00847	0.02	0.0197	0.00002	-0.002	0.67	0.00323	1.3	-0.000005	0.51	0.351	6	0.000005	-0.00001	-0.0005	0.000028	-0.0002	0.0005	-0.0001
8-Jan-10	27	500	490	7.74	118																																										
15-Jan-10	28	500	480	7.53	110	#N/A	6.6	44.1	17	-0.5	0.65	59.4	0.0173	0.00085	0.0001	0.0355	-0.00001	-0.000005	-0.05	0.000031	17	-0.0001	0.000038	0.0216	0.002	0.000027	0.0008	4.12	0.00715	-0.01	0.0186	0.00003	-0.002	0.65	0.00335	1.24	-0.000005	0.5	0.305	7	0.000004	-0.00001	-0.0005	0.000031	-0.0002	0.0003	-0.0001
22-Jan-10	29	500	490	7.29	98																																										
29-Jan-10	30	500	470	7.27	89	#N/A	5.4	40.5	18	-0.5	0.66	53.2	0.0277	0.0007	0.00006	0.0322	-0.00001	-0.000005	-0.05	0.000028	15.3	-0.0001	0.000037	0.0207	0.006	0.000054	0.0007	3.62	0.00645	0.02	0.0186	0.00006	0.002	0.55	0.0029	1.12	0.000015	0.45	0.288	5	0.000004	0.00017	0.0008	0.000019	-0.0002	0.0003	-0.0001
5-Feb-10	31	500	450	7.42	86																																										
12-Feb-10	32	500	450	7.47	102	#N/A	2.9	39.5	18	-0.5	0.62	57.2	0.018	0.00066	0.00006	0.0342	-0.00001	-0.000005	-0.05	0.000029	16.6	-0.0001	0.00004	0.0188	0.002	0.000035	0.0008	3.86	0.00602	-0.01	0.0172	0.00014	-0.002	0.62	0.00284	1.2	0.000008	0.49	0.301	6	0.000005	-0.00001	-0.0005	0.000139	-0.0002	0.0003	-0.0001
19-Feb-10	33	500	410	7.22	95																																										
26-Feb-10	34	500	430	7.40	87	#N/A	3.3	38.8	14	-0.5	0.67	54.1	0.0226	0.00081	0.00005	0.0342	-0.00001	-0.000005	-0.05	0.000021	15.5	-0.0001	0.000077	0.0143	0.003	0.000037	0.0008	3.76	0.00513	-0.01	0.0177	0.00024	0.002	0.67	0.00343	1.28	-0.000005	0.54	0.286	6	0.000008	0.00008	-0.0005	0.000012	-0.0002	0.0019	-0.0001
5-Mar-10	35	500	400	7.37	92																																										
12-Mar-10	36	500	445	7.33	94	#N/A	4.8	43.6	11	-0.5	0.59	51.2	0.0169	0.00065	0.00006	0.0336	-0.00001	-0.000005	-0.05	0.000027	14.6	-0.0001	0.000024	0.0172	0.003	0.000035	0.0008	3.56	0.00554	-0.01	0.0161	0.0001	0.002	0.55	0.00294	1.06	-0.000005	0.45	0.274	-10	0.000006	0.00002	-0.0005	0.00002	-0.0002	0.0005	-0.0001
19-Mar-10	37	500	450	7.57	97																																										
26-Mar-10	38	500	460	7.27	94	#N/A	3.7	40.1	13	-0.5	0.7	48	0.0151	0.00068	0.00009	0.0327	-0.00001	-0.000005	-0.05	0.00003	13.5	0.0001	0.00003	0.0154	0.002	0.000029	0.0008	3.48	0.0054	-0.01	0.0181	0.00013	-0.002	0.52	0.00333	1.09	-0.000005	0.48	0.28	5	0.000004	-0.00001	-0.0005	0.000013	-0.0002	0.0004	-0.0001
2-Apr-10	39	500	435	7.55	95																																										
9-Apr-10	40	500	435	7.34	89	#N/A	3.6	37.9	12	-0.5	0.54	47.3	0.0174	0.00051	0.00006	0.0321	-0.00001	-0.000005	-0.05	0.000033	13.8	-0.0001	0.000034	0.0134	0.002	0.00006	0.0006	3.11	0.00563	-0.01	0.0136	0.00023	0.005	0.53	0.00228	0.997	-0.000005	0.4	0.24	-10	0.000003	0.00003	-0.0005	0.000024	-0.0002	0.0011	-0.0001
16-Apr-10	41	500	445	7.35	113																																										
23-Apr-10	42	500	470	7.00	104	#N/A	7.1	44.0	14	-0.5	0.63	52.4	0.0179	0.00074	0.00006	0.0377	-0.00001	-0.000005	-0.05	0.00003	14.9	-0.0001	0.000036	0.0193	0.003	0.000048	0.0008	3.68	0.00597	-0.01	0.0162	0.00029	-0.002	0.54	0.0031	1.18	-0.000005	0.46	0.283	-10	0.000002	-0.00001	-0.0005	0.000013	-0.0002	0.0007	-0.0001
30-Apr-10	43	500	460	7.39	110																																										
7-May-10	44	500	455	7.16	90	#N/A	5.6	40.0	11	-0.5	0.55	50.1	0.0158	0.00062	0.00005	0.0358	-0.00001	-0.000005	-0.05	0.000035	15	-0.0001	0.000028	0.0161	0.001	0.000029	0.0007	3.1	0.00576	-0.01	0.0135	0.00017	-0.002	0.53	0.00259	1.12	-0.000005	0.4	0.247	-10	-0.000002	-0.00001	-0.0005	0.000011	-0.0002	0.0002	-0.0001
14-May-10	45	500	440	7.43	89																																										
21-May-10	46	500	415	7.30	91	#N/A	3.5	40.2	6	-0.5	0.65	53.6	0.0297	0.00073	0.00007	0.0421	-0.00001	-0.000005	-0.05	0.00002	15.8	-0.0001	0.000034	0.0151	0.019	0.000035	0.0007	3.43	0.00474	-0.01	0.0146	0.00031	-0.002	0.58	0.00311	1.42	-0.000005	0.5	0.279	-10	0.000003	0.00002	-0.0005	0.000011	-0.0002	0.0006	-0.0001
28-May-10	47	500	445	7.42	91																																										
4-Jun-10	48	500	460	7.20	85	#N/A	4.7	38.8	5	-0.5	0.59	43.8	0.0148	0.00052	0.00008	0.0352	-0.00001	-0.000005	-0.05	0.000026	12.6	-0.0001	0.000024	0.0138	-0.001	0.000023	0.0007	3.01	0.00401	-0.01	0.012	0.00018	-0.002	0.47	0.00273	1.17	-0.000005	0.42	0.225	-10	0.000004	-0.00001	-0.0005	0.000013	-0.0002	0.0003	-0.0001
11-Jun-10	49	500	455	7.24	97																																										
18-Jun-10	50	500	470	7.38	92	#N/A	4.4	44.8	5	-0.5	0.7	49.5	0.0149	0.00061	0.00006	0.041	-0.00001	-0.000005	-0.05	0.000025	14	0.0001	0.000025	0.0145	0.002	0.000032	0.0007	3.5	0.00444	-0.01	0.0135	0.00016	0.002	0.56	0.00286	1.32	-0.000005	0.51	0.254	-10	0.000003	0.00001	-0.0005	0.000016	-0.0002	0.0003	-0.0001
25-Jun-10	51	500	455	7.61	95																																										
2-Jul-10	52	500	460	7.44	85	#N/A	2.7	42.3	9	-0.5	0.58	44.7	0.0184	0.00047	0.00003	0.0392	-0.00001	-0.000005	-0.05	0.00002	12.6	-0.0001	0.000025	0.0144	-0.001	0.000022	0.0007	3.19	0.00388	-0.01	0.0118	-0.00002	-0.002	0.48	0.0025	1.14	-0.000005	0.42	0.236	-10	0.000003	0.00028	-0.0005	0.000012	-0.0002	-0.0001	-0.0001
9-Jul-10	53	500	440	7.57	85																																										
16-Jul-10	54	500	450	7.22	68	#N/A	4.1	32.2	4	-0.5	0.4	37.9	0.0085	0.00043	0.00005	0.0302	-0.00001	-0.000005	-0.05	0.000024	11.6	-0.0001	0.000028	0.0129	-0.001	0.000017	-0.0005	2.19	0.00353	-0.01	0.00829	0.00014	-0.002	0.31	0.00264	0.876	-0.000005	0.32	0.18	-10	0.000003	0.00004	-0.0005	0.000008	-0.0002	0.0001	-0.0001
23-Jul-10	55	500	435	7.40	89																																										
30-Jul-10	56	500	450	7.29	85	#N/A	3.9	39.5	11	-0.5	0.6	43.2	0.0147	0.0005	0.00011	0.0396	-0.00001	-0.000005	-0.05	0.00002	12.7	-0.0001	0.000026	0.0126	0.001	0.000035	0.0006	2.78	0.00343	-0.01	0.0103	0.00015	-0.002	0.43	0.00263	1.12	0.000007	0.4	0.227	-10	0.000009	-0.00001	-0.0005	0.000022	0.0002	0.0004	-0.0001
6-Aug-10	57	500	460	7.57	82																																										
13-Aug-10	58	500	465	7.43	90	#N/A	4.7	44.7	5	-0.5	0.56	45.9	0.0132	0.00052	0.00006	0.0438	-0.00001	-0.000005	-0.05	0.000028	13.4	-0.0001	0.000029	0.0157	0.001	0.000026	0.0006	3.02	0.00384	-0.01	0.00998	0.00035	-0.002	0.44	0.00258	1.02	-0.000005	0.42	0.24	-10	0.000004	-0.00001	-0.0005	0.000013	-0.0002	0.0003	-0.0001
20-Aug-10	59	500	460	7.45	81																																										
27-Aug-10	60	500	460	7.58	93	#N/A	3.1	47.9	7	-0.5	0.56	49.7	0.0117	0.00052	-0.00002	0.0503	-0.00001	-0.000005	-0.05	0.000015	14.4	0.0001	0.000024	0.0155	0.001	0.00008	0.0006	3.35	0.00401	-0.01	0.0106	0.0002	-0.002	0.49	0.00269	1.09	-0.000005	0.46	0.256	-10	0.000003	-0.00001	-0.0005	0.00002	-0.0002	0.0006	-0.0001
3-Sep-10	61	500	465	7.66	83																																										
10-Sep-10	62	500	455	7.24	87	#N/A	4.7	40.1	7	-0.5	0.57	43.8	0.0415	0.00042	0.00016	0.0422	-0.00001	-0.000005	-0.05	0.000029	13.2	0.0003	0.00003	0.012	0.008	0.000017	-0.0005	2.64	0.0033	-0.01	0.0101	#N/A	-0.002	0.4	0.00266	1.07	-0.000005	0.38	0.217	-10	0.000003	0.00004	-0.0005	#N/A	-0.0002	0.0002	-0.0001
17-Sep-10	63	500	505	7.49	88																																										
24-Sep-10	64	500	445	7.38	76	#N/A	3.5	42.0	10	-0.5	0.57	46.6	0.0112	0.00054	0.00005	0.0467	-0.00001	-0.000005	-0.05	0.000021	14	0.0001	0.00004	0.0137	0.012	0.000117	0.0006	2.83	0.00367	-0.01	0.0106	0.00015	-0.002	0.51	0.00287	1.16	-0.000005	0.41	0.235	-10	0.000004	0.00002	-0.0005	0.000021	0.0002	0.001	-0.0001
1-Oct-10	65	500	435	7.58	68																																										
8-Oct-10	66	500	435	7.60	100	#N/A	3.1	48.8	11	-0.5	0.63	48.6	0.0173	0.00058	0.00002	0.0509	-0.00001	-0.000005	-0.05	0.000021	14.5	0.0001	0.000022	0.0138	0.002	0.000025	0.0007	3.04	0.00328	-0.01	0.0106	0.00015	-0.002	0.53	0.00294	1.28	-0.000005	0.41	0.254	-10	0.000005	-0.00001	-0.0005	0.000024	-0.0002	0.0003	-0.0001
15-Oct-10	67	500	440	7.54	93																																										
22-Oct-10	68	500	440	7.45	101	#N/A	3.8	52.0	10	-0.5	0.6	51.7	0.0085	#N/A	0.00005	0.0516	-0.00001	-0.000005	-0.05	0.000017	15.4	-0.0001	0.000029	0.0153	-0.001	0.000099	0.0007	3.23	0.00369	0.01	0.0108	0.00019	-0.002	0.5	0.00277	1.13	-0.000005	0.43	0.252	-10	0.000009	-0.00001	-0.0005	0.000016	-0.0002	0.0017	-0.0001
29-Oct-10	69	500	430	7.45	93																																										
5-Nov-10	70	500	440	7.85	81	#N/A	2.8	72.5	6	-0.5	0.53	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
12-Nov-10	71	500	450	7.55	#N/A							#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
19-Nov-10	72	500	435	7.26	96	#N/A	4.1	43.2	7	-0.5	0.5	38.6	0.0078	0.00042	0.00003	0.0443	-0.00001	-0.000005	-0.05	0.000021	11.6	-0.0001	0.00002	0.0113	0.003	0.000027	-0.0005	2.34	0.00325	0.02	0.00855	0.00007	0.003	1.19	0.00205	0.989	-0.000005	0.54	0.204	-10	0.000005	0.00001	-0.0005	0.000021	-0.0002	0.0003	-0.0001
26-Nov-10	73	500	440	7.30	95																																										
3-Dec-10	74	500	430	7.29	94	#N/A	5.2	49.0	2	0.6	0.46	46.1	0.0057	0.00048	0.0002	0.0497	-0.00001	-0.000005	-0.05	0.000019	14.2	-0.0001	0.000027	0.0141	0.001	0.000055	0.0006	2.58	0.00402	-0.01	0.00916	-0.00002	-0.002	1.12	0.00248	1.22	-0.000005	0.51	0.232	-10	0.000004	-0.00001	0.0009	#N/A	-0.0002	-0.0001	-0.0001
10-Dec-10	75	500	445	7.51	95																																										
17-Dec-10	76	500	440	7.16	95	#N/A	6.3	50.7	6	-0.5	#N/A	50	0.0046	0.00051	0.00005	0.051	-0.00001	-0.000005	-0.05	0.000024	15.6	-0.0001	0.000026	0.015	-0.001	0.000034	-0.0005	2.67	0.00388	-0.01	0.00875	0.00014	-0.002	0.96	0.0028	1.23	-0.000005	0.48	0.232	-10	0.000005	-0.00001	-0.0005	0.000019	0.0002	0.0001	-0.0001
24-Dec-10	77	500	455	7.05	85																																										
31-Dec-10	78	500	455	7.17	78	#N/A	6.4	46.9	8	-0.5	0.45	43.2	0.0089	0.00039	0.00004	0.0469	-0.00001	-0.000005	-0.05	0.00002	13.3	0.0002	0.000023	0.0148	0.002	0.000025	0.0005	2.42	0.00374	-0.01	0.00825	0.00019	-0.002	0.79	0.0022	1.05	0.000021	0.4	0.211	-10	0.000006	0.00002	-0.0005	0.000022	-0.0002	0.0005	#N/A
7-Jan-11	79	500	465	7.52	66																																										
14-Jan-11	80	500	455	7.39	68	#N/A	3.2	47.3	6	-0.5	0.43	44.1	0.0096	0.00042	0.00004	0.0471	-0.00001	-0.000005	-0.05	0.000023	13.6	-0.0001	0.000025	0.0146	0.002	0.000021	-0.0005	2.45	0.00384	-0.01	0.00738	0.00005	-0.002	0.68	0.00217	1.06	0.000007	0.33	0.211	-10	0.000002	-0.00001	-0.0005	0.000016	0.0002	0.0001	0.0002
21-Jan-11	81	500	465	7.45	75																																										
28-Jan-11	82	500	480	7.31	72	#N/A	4.9	49.9	10	-0.5	0.45	46.6	0.0065	0.00041	#N/A	0.0492	-0.00001	-0.000005	-0.05	0.000019	14.7	-0.0001	0.000023	0.014	-0.001	0.000015	-0.0005	2.41	0.0038	-0.01	0.00812	0.00019	-0.002	0.63	0.00206	1.02	0.000006	0.33	0.218	-10	0.000005	-0.00001	-0.0005	#N/A	-0.0002	0.0002	-0.0001
4-Feb-11	83	500	475																																												
11-Feb-11	84	500	470																																												
18-Feb-11	85	500	445																																												
25-Feb-11	86	500	465																																												
4-Mar-11	87	500	475																																												
11-Mar-11	88	500	480																																												
18-Mar-11	89	500	490																																												
25-Mar-11	90	500	480																																												
1-Apr-11	91	500	485																																												
8-Apr-11	92	500	470																																												
15-Apr-11	93	500	470																																												
22-Apr-11	94	500	490	7.71	91	#N/A	2.7	45.2	4	-0.5	0.4	41.6	0.0047	0.00031	0.00003	0.0504	-0.00001	-0.000005	-0.05	#N/A	13.5	-0.0001	0.000026	0.0139	-0.001	0.000062	-0.0005	1.92	0.00435	-0.01	0.00591	0.00011	-0.002	0.49	0.00198	0.935	-0.000005	0.27	0.181	-10	0.000002	0.00001	-0.0005	0.000012	-0.0002	#N/A	-0.0001
29-Apr-11	95	500	460																																												
6-May-11	96	500	485																																												
13-May-11	97	500	470																																												
20-May-11	98	500	500																																												
27-May-11	99	500	480																																												
3-Jun-11	100	500	490																																												
10-Jun-11	101	500	490																																												
17-Jun-11	102	500	485																																												
24-Jun-11	103	500	505																																												
1-Jul-11	104	500	490																																												
8-Jul-11	105	500	505																																												
15-Jul-11	106	500	495	7.41	81	#N/A	6.6	38.2	5	-0.5	0.36	36	0.006	0.00023	0.00012	0.0431	-0.00001	-0.000005	-0.05	0.000022	12.2	0.0001	#N/A	0.0124	-0.001	0.000039	-0.0005	1.37	0.00454	-0.01	0.00545	#N/A	-0.002	0.38	0.00167	0.845	-0.000005	0.24	0.149	-10	0.000002	0.00022	-0.0005	0.000015	-0.0002	0.0008	-0.0001
22-Jul-11	107	500	495																																												
29-Jul-11	108	500	490																																												
5-Aug-11	109	500	500																																												
12-Aug-11	110	500	490																																												
19-Aug-11	111	500	485																																												
26-Aug-11	112	500	490																																												
2-Sep-11	113	500	485																																												

HC 1

CONFIDENTIAL *DRAFT*

Sample = Hole 211
83.08-86.03

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
9-Sep-11	114	500	495																																													
16-Sep-11	115	500	490																																													
23-Sep-11	116	500	495																																													
30-Sep-11	117	500	500																																													
7-Oct-11	118	500	490	7.21	86	#N/A	6.6	43.9	6	-0.5	0.32	43.1	0.0092	0.00027	0.0002	0.0504	-0.00001	-0.000005	-0.05	0.000015	14.8	-0.0001	0.000025	0.0139	-0.001	0.00002	-0.0005	1.47	0.00456	-0.01	0.00483	0.00003	-0.002	0.41	0.00182	0.988	-0.000005	0.22	0.153	-10	0.000004	0.00012	-0.0005	0.000013	-0.0002	0.0002	-0.0001
14-Oct-11	119	500	490																																													
21-Oct-11	120	500	490																																													
28-Oct-11	121	500	500																																													
4-Nov-11	122	500	500																																													
11-Nov-11	123	500	490																																													
18-Nov-11	124	500	495																																													
25-Nov-11	125	500	495																																													
2-Dec-11	126	500	485																																													
9-Dec-11	127	500	495																																													
16-Dec-11	128	500	480																																													
23-Dec-11	129	500	495																																													
30-Dec-11	130	500	495	7.69	77	#N/A	5.4	47.1	5	-0.5	0.28	42	0.0089	0.0002	0.00006	0.049	-0.00001	-0.000005	-0.05	0.000025	14.8	-0.0001	0.00002	0.014	0.002	0.000054	-0.0005	1.23	0.00509	-0.01	0.00561	0.00002	-0.002	0.38	0.00149	0.886	-0.000005	0.19	0.128	-10	0.000004	0.00015	-0.0005	0.000021	-0.0002	0.0003	-0.0001
6-Jan-12	131	500	485																																													
13-Jan-12	132	500	490																																													
20-Jan-12	133	500	500																																													
27-Jan-12	134	500	480																																													
3-Feb-12	135	500	495																																													
10-Feb-12	136	500	495																																													
17-Feb-12	137	500	500																																													
24-Feb-12	138	500	495																																													
2-Mar-12	139	500	490																																													
9-Mar-12	140	500	495																																													
16-Mar-12	141	500	485																																													
23-Mar-12	142	500	490	7.62	84	#N/A	6.2	44.1	5	-0.5	0.25	37.9	0.0065	0.00019	0.00005	0.0473	-0.00001	-0.000005	-0.05	0.000021	13.5	-0.0001	0.000023	0.0145	-0.001	#N/A	-0.0005	1.06	0.00518	-0.01	0.00559	0.00014	-0.002	0.34	0.0014	0.775	-0.000005	0.23	0.119	-10	0.000003	-0.0002	-0.0005	0.000013	-0.0002	0.0005	-0.0001
30-Mar-12	143	500	505																																													
6-Apr-12	144	500	485																																													
13-Apr-12	145	500	490																																													
20-Apr-12	146	500	465																																													
27-Apr-12	147	500	455																																													
4-May-12	148	500	455																																													
11-May-12	149	500	460																																													
18-May-12	150	500	455																																													
25-May-12	151	500	460																																													
1-Jun-12	152	500	445																																													
8-Jun-12	153	500	475																																													
15-Jun-12	154	500	475	7.67	87	#N/A	3.6	41.9	8	-0.5	0.25	37.3	0.00874	0.000205	0.000222	0.046	-0.00001	-0.000005	-0.05	0.0000115	13.4	-0.0001	0.0000202	0.011	-0.001	0.000061	-0.0005	0.903	0.00398	-0.01	0.00487	0.000021	-0.002	0.332	0.00156	0.929	-0.000005	0.195	0.107	-10	0.0000043	-0.0002	-0.0005	0.0000131	-0.0002	0.00024	-0.0001
22-Jun-12	155	500	445																																													
29-Jun-12	156	500	455																																													
6-Jul-12	157	500	455																																													
13-Jul-12	158	500	465																																													
20-Jul-12	159	500	455																																													
27-Jul-12	160	500	460																																													
3-Aug-12	161	500	460																																													
10-Aug-12	162	500	460																																													
17-Aug-12	163	500	430																																													
24-Aug-12	164	500	440																																													
31-Aug-12	165	500	450																																													
7-Sep-12	166	500	430	7.60	58	#N/A	4.7	#N/A	6	0.75	0.13	27.4	0.0138	0.00013	0.000082	0.0339	-0.00001	-0.000005	-0.05	0.000008	#N/A	0.0001	0.000025	0.00749	0.0059	0.000012	-0.0005	#N/A	0.00307	-0.01	0.00352	0.000085	-0.002	0.272	0.00103	0.596	-0.000005	#N/A	#N/A	-10	0.000002	-0.0002	-0.0005	0.00001	-0.0002	0.00045	-0.0001
14-Sep-12	167	500	460																																													
21-Sep-12	168	500	435																																													
28-Sep-12	169	500	455																																													
5-Oct-12	170	500	455																																													
12-Oct-12	171	500	450																																													
19-Oct-12	172	500	465																																													
26-Oct-12	173	500	455																																													
2-Nov-12	174	500	460																																													
9-Nov-12	175	500	455																																													
16-Nov-12	176	500	460																																													
23-Nov-12	177	500	495																																													
30-Nov-12	178	500	495	7.54	75	#N/A	4.7	39.0	5	-0.5	0.16	37.3	0.0123	0.000175	0.00004	0.0437	-0.00001	-0.000005	-0.05	0.000014	13.7	-0.0001	0.00001	0.00932	0.003	0.000047	-0.0005	0.788	0.0033	-0.01	0.00507	0.000022	-0.002	0.303	0.00109	0.888	-0.000005	0.171	0.103	-3	0.000003	0.00025	-0.0005	0.00006	-0.0002	0.00088	-0.0001
7-Dec-12	179	500	475																																													
14-Dec-12	180	500	485																																													
21-Dec-12	181	500	465																																													
28-Dec-12	182	500	440																																													
4-Jan-13	183	500	430																																													
11-Jan-13	184	500	470																																													
18-Jan-13	185	500	470																																													
25-Jan-13	186	500	465																																													
1-Feb-13	187	500	440																																													
8-Feb-13	188	500	455																																													
15-Feb-13	189	500	465																																													
22-Feb-13	190	500	425	7.19	76	#N/A	7.4	41.4	7	0.53	0.12	37.6	0.0143	0.000155	0.000152	0.0458	-0.00001	-0.000005	-0.05	0.000009	13.9	-0.0001	0.000019	0.0352	0.0024	0.000194	-0.0005	0.695	0.00443	-0.01	0.00409	0.000069	-0.002	0.322	0.00112	0.773	0.000006	0.195	0.0897	-3	0.000002	0.00101	-0.0005	0.000014	-0.0002	0.00025	-0.0001
1-Mar-13	191	500	455																																													
8-Mar-13	192	500	460																																													
15-Mar-13	193	500	435																																													
22-Mar-13	194	500	440																																													
29-Mar-13	195	500	425																																													
5-Apr-13	196	500	435																																													
12-Apr-13	197	500	450																																													
19-Apr-13	198	500	445																																													
26-Apr-13	199	500	400																																													
3-May-13	200	500	430																																													
10-May-13	201	500	390																																													
17-May-13	202	500	435	7.77	78	#N/A	10.8	41.7	7	-0.5	0.12	39.6	0.0174	0.000155	0.000046	0.0481	-0.00001	-0.000005	-0.05	0.000009	14.7	-0.0001	0.000018	0.0091	0.0026	0.000021	-0.0005	0.709	0.00427	-0.01	0.00463	0.000068	-0.002	0.329	0.00109	0.825	-0.000005	0.174	0.091	-3	0.000003	-0.0002	-0.0005	0.000017	-0.0002	0.00024	-0.0001
24-May-13	203	500	435																																													

Sept 10/10 U 0.000383 and Ni 0.00291. Repeat = Sample Discarded.
Oct 22/10 Sb 0.00138. Repeat = 0.00138. Data confirmed. Suspect contamination.
Nov 5/10 Most metals have high bias. Repeat. Data confirmed. Data suggests metals were contaminated. Data removed.
Nov 12/10 Conductivity 181. Suspect analytical error. Cannot repeat.
Dec 3/10 U 0.0028; repeat = sample discarded.
Dec 17/10 F 0.03. Repeat = 0.03. Suspect sample mix-up with HC 2.
Dec 31/10 Zr 0.0083. Repeat = 0.0083. Suspect contamination.
Jan 28/11 As 0.00071 and U 0.00092. Cannot repeat. Sample discarded.
Feb 4/11 Change in analytical schedule.
April 22/11 Cd 0.000065; Zn 0.0015. Repeat Cd=0.000065, Zn= 0.0037 data confirmed suspect contamination
July 15/11 Co 0.00014 and Ni 0.00064. Repeat: Co 0.000143 and Ni 0.00061. Data confirmed. Suspect contamination..
Mar 23/12 Pb=0.000256, repeat=0.000268. Data confirmed, suspect contamination
Jun 15 12 Pb=0.00543, repeat=0.000061. Data accepted
Sept 7/12 Alkalinity=29.4. Cannot repeat suspect titrator error
Sept 7/12 Ca=9.89, Mg=0.657, Sr=0.0768, Na=0.452. repeat confirms original result, suspect contamination

HC 2 *CONFIDENTIAL* *DRAFT*

Sample = Hole
196 53.94-55.44

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L
3-Jul-09	0	750	375	8.02	164	#N/A	1.5	53.8	4	3.5	0.69	50.7
10-Jul-09	1	500	455	7.86	82							
17-Jul-09	2	500	495	8.01	65	#N/A	1.7	43.0	-2	0.8	0.84	24.9
24-Jul-09	3	500	455	7.89	54							
31-Jul-09	4	500	440	7.92	53	#N/A	1.6	35.1	-2	-0.5	0.64	23.4
7-Aug-09	5	500	435	7.71	41							
14-Aug-09	6	500	455	7.67	44	#N/A	2.3	29.3	-2	0.6	0.44	21.8
21-Aug-09	7	500	465	7.80	44							
28-Aug-09	8	500	455	7.81	43	#N/A	1.8	28.4	-2	-0.5	0.36	21.5
4-Sep-09	9	500	450	7.58	38							
11-Sep-09	10	500	410	7.67	38	#N/A	1.9	25.8	-2	-0.5	0.38	18.6
18-Sep-09	11	500	460	7.73	41							
25-Sep-09	12	500	425	7.81	41	#N/A	1.9	29.0	-2	0.8	0.26	19.9
2-Oct-09	13	500	425	7.57	42							
9-Oct-09	14	500	430	7.60	41	#N/A	3.6	29.9	5	-0.5	0.2	21.4
16-Oct-09	15	500	415	7.54	45							
23-Oct-09	16	500	420	7.67	43	#N/A	3.0	30.4	-2	-0.5	0.17	22.4
30-Oct-09	17	500	430	7.67	39							
6-Nov-09	18	500	490	7.77	43	#N/A	3.7	31.0	-2	-0.5	0.13	23.5
13-Nov-09	19	500	460	7.65	39							
20-Nov-09	20	500	430	7.80	43	#N/A	3.8	29.6	-2	-0.5	0.12	19.9
27-Nov-09	21	500	455	7.68	44							
4-Dec-09	22	500	460	7.61	43	#N/A	3.0	29.6	-2	-0.5	0.1	21.2
11-Dec-09	23	500	440	7.86	41							
18-Dec-09	24	500	460	7.41	42	#N/A	4.7	26.6	-2	-0.5	0.11	20.2
25-Dec-09	25	500	460	7.61	36							
1-Jan-10	26	500	470	7.84	42	#N/A	2.0	29.2	-2	-0.5	0.07	21.5
8-Jan-10	27	500	505	7.68	46							
15-Jan-10	28	500	450	7.70	41	#N/A	4.3	29.7	-2	-0.5	0.11	20.9
22-Jan-10	29	500	480	7.52	36							
29-Jan-10	30	500	465	7.38	31	#N/A	4.9	28.2	2	-0.5	0.1	20.2
5-Feb-10	31	500	445	7.27	27							
12-Feb-10	32	500	440	7.41	37	#N/A	2.4	25.2	-2	-0.5	0.06	19.8
19-Feb-10	33	500	425	7.51	36							
26-Feb-10	34	500	415	7.49	31	#N/A	2.7	23.6	2	-0.5	0.07	18.1
5-Mar-10	35	500	395	7.33	35							
12-Mar-10	36	500	470	7.50	37	#N/A	3.8	26.1	2	-0.5	0.05	30.1
19-Mar-10	37	500	450	7.62	39							
26-Mar-10	38	500	480	7.59	36	#N/A	3.1	25.7	-2	-0.5	0.05	18.6
2-Apr-10	39	500	435	7.52	34							
9-Apr-10	40	500	440	7.50	36	#N/A	2.7	23.7	3	-0.5	0.04	17.7
16-Apr-10	41	500	465	7.51	38							
23-Apr-10	42	500	470	7.49	40	#N/A	5.0	27.7	-2	-0.5	0.04	18.6
30-Apr-10	43	500	465	7.56	37							
7-May-10	44	500	440	7.47	35	#N/A	4.5	25.5	2	-0.5	0.04	18.2
14-May-10	45	500	460	7.56	35							
21-May-10	46	500	445	7.58	33	#N/A	2.8	24.0	-2	-0.5	0.04	18.4
28-May-10	47	500	425	7.49	33							
4-Jun-10	48	500	440	7.49	32	#N/A	3.7	22.7	3	-0.5	0.04	15.4
11-Jun-10	49	500	455	7.62	33							
18-Jun-10	50	500	455	7.58	34	#N/A	3.9	26.2	-2	-0.5	0.04	16.9
25-Jun-10	51	500	465	7.68	33							
2-Jul-10	52	500	445	7.66	33	#N/A	2.3	24.1	3	-0.5	0.04	16.5
9-Jul-10	53	500	450	7.46	34							
16-Jul-10	54	500	460	7.52	33	#N/A	3.4	23.3	-2	-0.5	0.04	15.7
23-Jul-10	55	500	430	7.34	31							
30-Jul-10	56	500	460	7.35	33	#N/A	3.4	24.1	4	-0.5	0.04	17.1
6-Aug-10	57	500	470	7.59	34							
13-Aug-10	58	500	465	7.62	35	#N/A	3.9	26.8	-2	-0.5	0.03	17.7
20-Aug-10	59	500	510	7.53	39							
27-Aug-10	60	500	490	7.63	40	#N/A	2.4	29.2	2	-0.5	0.03	20.3
3-Sep-10	61	500	500	7.63	37							
10-Sep-10	62	500	465	7.34	34	#N/A	3.8	24.1	-2	-0.5	0.03	16.1
17-Sep-10	63	500	450	7.30	30							
24-Sep-10	64	500	445	7.47	26	#N/A	3.0	23.5	3	-0.5	0.05	15.8
1-Oct-10	65	500	455	7.48	23							
8-Oct-10	66	500	445	7.52	35	#N/A	2.4	26.0	4	-0.5	0.04	15.5
15-Oct-10	67	500	445	7.41	34							
22-Oct-10	68	500	460	7.53	35	#N/A	2.7	26.2	2	-0.5	0.04	18.9
29-Oct-10	69	500	465	7.51	36							
5-Nov-10	70	500	460	7.59	39	#N/A	2.1	26.4	-2	-0.5	0.09	16.5
12-Nov-10	71	500	495	7.60	29							
19-Nov-10	72	500	465	7.80	38	#N/A	3.1	28.5	-2	-0.5	0.05	19.5
26-Nov-10	73	500	460	7.43	38							
3-Dec-10	74	500	455	7.51	35	#N/A	4.3	25.8	-2	-0.5	0.03	17.3
10-Dec-10	75	500	450	7.40	33							
17-Dec-10	76	500	460	7.62	33	#N/A	4.3	25.8	-2	-0.5	#N/A	16.8
24-Dec-10	77	500	470	7.73	33							
31-Dec-10	78	500	475	7.62	32	#N/A	4.8	26.5	-2	-0.5	0.02	17.8
7-Jan-11	79	500	465	7.57	26							
14-Jan-11	80	500	465	7.68	26	#N/A	2.4	24.8	-2	-0.5	0.04	16.5
21-Jan-11	81	500	475	7.46	31							
28-Jan-11	82	500	445	7.62	25	#N/A	3.9	24.6	3	-0.5	0.05	16.4
4-Feb-11	83	500	450									
11-Feb-11	84	500	440									
18-Feb-11	85	500	460									
25-Feb-11	86	500	445									
4-Mar-11	87	500	465									
11-Mar-11	88	500	470									
18-Mar-11	89	500	475									
25-Mar-11	90	500	460									
1-Apr-11	91	500	465									
8-Apr-11	92	500	495									
15-Apr-11	93	500	470									
22-Apr-11	94	500	460	7.54	35	#N/A	2.2	24.6	-2	-0.5	0.03	16
29-Apr-11	95	500	460									
6-May-11	96	500	455									
13-May-11	97	500	440									
20-May-11	98	500	485									
27-May-11	99	500	460									
3-Jun-11	100	500	445									
10-Jun-11	101	500	460									
17-Jun-11	102	500	460									
24-Jun-11	103	500	450									
1-Jul-11	104	500	455									
8-Jul-11	105	500	460									
15-Jul-11	106	500	455	7.70	33	#N/A	5.2	25.1	-2	-0.5	#N/A	15.7
22-Jul-11	107	500	465									
29-Jul-11	108	500	475									
5-Aug-11	109	500	460									

Date	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
3-Jul-09	0.139	0.00006	0.00021	0.0127	-0.00001	-0.000005	-0.05	-0.000005	14.5	-0.0001	0.000106	0.0115	0.013	0.000138	0.0017	3.49	0.012	-0.01	0.0133	0.00085	0.005	3.34	0.00041	1.44	-0.000005	10.4	0.181	-3	0.000004	0.00023	-0.0005	0.000224	0.0013	0.0009	-0.0001
17-Jul-09	0.0816	0.00009	0.00017	0.00628	-0.00001	-0.000005	-0.05	0.000006	7	-0.0001	0.000026	0.00256	0.011	0.000041	0.0008	1.81	0.0131	-0.01	0.0236	0.00004	-0.002	2.14	0.00031	1.89	-0.000005	5.88	0.092	-3	0.000002	0.00006	-0.0005	0.000817	0.0022	0.0003	-0.0001
31-Jul-09	0.125	0.00004	0.00014	0.0062	-0.00001	-0.000005	-0.05	-0.000005	6.87	-0.0001	0.000025	0.00161	0.044	0.000042	0.0005	1.51	0.0154	-0.01	0.0103	0.00011	0.003	1.95	0.00027	2.02	-0.000005	3.34	0.0749	-3	-0.000002	0.00003	0.002	0.000466	0.0024	0.0002	-0.0001
14-Aug-09	0.0502	0.00004	0.00018	0.00402	-0.00001	-0.000005	-0.05	-0.000005	6.39	-0.0001	0.000012	0.00079	0.005	0.000012	0.0006	1.42	0.0129	-0.01	0.00517	0.00002	-0.002	1.78	0.00011	1.32	-0.000005	1.78	0.0717	-3	-0.000002	0.00016	-0.0005	0.000347	0.0015	0.0001	-0.0001
28-Aug-09	0.075	0.00006	0.00015	0.00478	-0.00001	-0.000005	-0.05	0.000006	6.15	-0.0001	0.000011	0.00061	0.009	0.000015	-0.0005	1.5	0.0115	0.01	0.0034	0.00003	-0.002	1.73	0.00014	1.51	-0.000005	1.12	0.0729	-3	0.000003	0.00003	-0.0005	0.000316	0.0016	0.0002	-0.0001
11-Sep-09	0.141	0.00002	0.00019	0.00569	-0.00001	-0.000005	-0.05	-0.000005	5.13	-0.0001	0.000046	0.0018	0.039	0.000038	-0.0005	1.41	0.00918	-0.01	0.00233	0.00008	0.004	1.71	0.00026	1.63	-0.000005	0.97	0.0647	-3	0.000003	0.00006	0.0014	0.00025	0.0023	0.0006	-0.0001
25-Sep-09	0.0896	0.00004	0.0001	0.00498	-0.00001	-0.000005	-0.05	-0.000005	5.74	-0.0001	0.000014	0.00087	0.021	0.000028	-0.0005	1.36	0.0106	0.01	0.00171	0.00011	0.002	1.7	0.00011	1.32	-0.000005	0.66	0.0653	-3	0.000003	-0.00001	0.0008	0.000218	0.0016	0.0003	-0.0001
9-Oct-09	0.0684	0.00004	0.00011	0.00484	-0.00001	-0.000005	-0.05	-0.000005	6.14	-0.0001	0.000009	0.0006	0.007	0.000031	-0.0005	1.47	0.012	-0.01	0.00185	0.00002	-0.002	1.78	0.0001	1.35	0.00002	0.49	0.0707	-3	-0.000002	0.00002	0.0009	0.000244	0.0015	0.0004	-0.0001
23-Oct-09	0.0665	0.00002	0.00005	0.00475	-0.00001	-0.000005	-0.05	-0.000005	6.46	-0.0001	0.000014	0.00127	0.011	0.000136	0.0005	1.53	0.0109	-0.01	0.00143	0.00013	0.003	1.83	0.00009	1.26	-0.000005	0.44	0.0737	-3	-0.000002	0.00009	0.0006	0.000248	0.0014	0.0004	-0.0001
6-Nov-09	0.0478	-0.00002	0.00004	0.00488	-0.00001	-0.000005	-0.05	-0.000005	6.73	-0.0001	0.000007	0.00083	0.003	0.000012	-0.0005	1.62	0.00966	-0.01	0.00109	0.00007	0.003	1.65	0.00009	1.25	-0.000005	0.36	0.0794	-3	-0.000002	0.00002	-0.0005	0.000269	0.0013	0.0004	-0.0001
20-Nov-09	0.0539	0.00002	0.00006	0.00408	-0.00001	-0.000005	-0.05	-0.000005	5.69	-0.0001	0.000007	0.00036	0.007	0.000025	-0.0005	1.39	0.00888	-0.01	0.00083	0.00011	0.004	1.58	0.00006	1.06	-0.000005	0.29	0.0691	-3	-0.000002	0.00003	-0.0005	0.000205	0.0013	0.0012	-0.0001
4-Dec-09	0.0403	-0.00002	0.00004	0.0044	-0.00001	-0.000005	-0.05	-0.000005	6.14	-0.0001	0.000008	0.00118	0.004	0.000014	-0.0005	1.43	0.00767	-0.01	0.00076	0.00012	0.003	1.55	0.00007	0.991	-0.000005	0.34	0.0718	-3	-0.000002	0.00041	-0.0005	0.000214	0.0011	0.0003	-0.0001
18-Dec-09	0.0496	-0.00002	0.00007	0.00436	-0.00001	-0.000005	-0.05	-0.000005	5.81	-0.0001	-0.000005	0.00018	0.004	-0.000005	0.0005	1.39	0.00874	-0.01	0.00069	0.00011	-0.002	1.49	0.00005	1.07	-0.000005	0.27	0.069	-3	-0.000002	0.00002	-0.0005	0.000204	0.001	-0.0001	-0.0001
1-Jan-10	0.0528	-0.00002	0.00004	0.00453	-0.00001	-0.000005	-0.05	-0.000005	6.29	-0.0001	-0.000005	0.0004	0.006	0.00005	-0.0005	1.4	0.00761	-0.01	0.00062	0.00002	-0.002	1.49	0.00005	1.05	-0.000005	0.2	0.0703	-3	0.000002	-0.00001	-0.0005	0.000205	0.001	0.0004	-0.0001
15-Jan-10	0.0526	-0.00002	0.00011	0.00425	-0.00001	-0.000005	-0.05	-0.000005	6.1	-0.0001	0.000005	0.00058	0.005	0.000017	-0.0005	1.37	0.00708	-0.01	0.00078	0.00002	-0.002	1.52	0.00007	0.982	-0.000005	0.2	0.0663	-3	-0.000002	0.00001	-0.0005	0.000224	0.0009	0.0002	-0.0001
29-Jan-10	0.0591	0.00002	0.00012	0.00431	-0.00001	-0.000005	-0.05	-0.000005	5.93	-0.0001	0.000007	0.00043	0.008	0.000025	-0.0005	1.32	0.00655	-0.01	0.0005	0.00006	-0.002	1.44	0.00006	0.953	0.000006	0.19	0.0665	-3	-0.000002	0.00012	0.0005	0.000199	0.0009	0.0004	-0.0001
12-Feb-10	0.0561	0.00002	0.00004	0.00415	-0.00001	-0.000005	-0.05	-0.000005	5.87	-0.0001	0.000009	0.00073	0.006	0.000103	-0.0005	1.24	0.00687	-0.01	0.00056	0.00013	-0.002	1.52	0.00006	0.975	0.000007	0.2	0.0627	-3	-0.000002	-0.00001	-0.0005	0.00017	0.001	0.0005	-0.0001
26-Feb-10	0.114	-0.00002	0.00004	0.00505	-0.00001	-0.000005	-0.05	-0.000005	5.27	-0.0001	0.000044	0.00073	0.027	0.00002	-0.0005	1.2	0.00602	-0.01	0.0006	0.00017	-0.002	1.59	0.00009	1.11	-0.000005	0.24	0.0563	-3	-0.000002	0.00004	0.0013	0.000143	0.0013	0.0006	-0.0001
12-Mar-10	0.0426	-0.00002	0.00007	0.00407	-0.00001	-0.000005	-0.05	-0.000005	9.89	-0.0001	0.000008	0.00109	0.008	0.00004	-0.0005	1.31	0.00525	-0.01	0.00068	0.0001	-0.002	1.45	0.00009	0.962	-0.000005	0.21	0.0646	-10	-0.000002	0.00002	-0.0005	0.000192	0.001	0.0006	-0.0001
26-Mar-10	0.0423	0.00002	0.00007	0.00389	-0.00001	-0.000005	-0.05	0.000005	5.45	-0.0001	0.000007	0.00063	0.002	0.000012	-0.0005	1.21	0.00596	-0.01	0.00062	0.00017	0.002	1.45	0.00006	0.851	-0.000005	0.2	0.0611	-2	0.000003	-0.00001	-0.0005	0.000159	0.001	0.0007	-0.0001
9-Apr-10	0.0513	-0.00002	0.0002	0.00466	-0.00001	-0.000005	-0.05	0.000006	5.38	-0.0001	0.000011	0.00083	0.01	0.00004	-0.0005	1.05	0.00658	-0.01	0.00046	0.00025	0.005	1.49	0.00005	0.872	-0.000005	0.19	0.0532	-10	-0.000002	0.00003	-0.0005	0.000124	0.0011	0.0018	-0.0001
23-Apr-10	0.0409	0.00002	0.00005	0.00462	-0.00001	0.000009	-0.05	-0.000005	5.56	0.0001	-0.000005	0.00085	0.002	0.000011	-0.0005	1.16	0.00635	-0.01	0.00055	0.00008	-0.002	1.53	0.00006	0.9	-0.000005	0.21	0.0621	-10	-0.000002	0.00001	-0.0005	0.000143	0.0008	0.0022	-0.0001
7-May-10	0.0403	-0.00002	0.00005	0.00392	-0.00001	-0.000005	-0.05	-0.000005	5.56	-0.0001	0.000008	0.00056	0.002	0.000016	-0.0005	1.04	0.00712	-0.01	0.0005	0.00011	-0.002	1.43	-0.00004	0.84	-0.000005	0.17	0.0546	-10	-0.000002	-0.00001	-0.0005	0.000115	0.0009	0.0003	-0.0001
21-May-10	0.0509	-0.00002	0.00006	0.00367	-0.00001	-0.000005	-0.05	-0.000005	5.6	-0.0001	0.00001	0.0004	0.002	-0.000005	-0.0005	1.07	0.00578	-0.01	0.00055	0.00018	-0.002	1.46	0.00005	0.926	-0.000005	0.18	0.0557	-10	-0.000002	0.00002	-0.0005	0.000116	0.0009	0.0002	-0.0001
4-Jun-10	0.0432	-0.00002	0.00007	0.00355	-0.00001	-0.000005	-0.05	-0.000005	4.56	-0.0001	0.000005	0.0009	0.001	0.000022	-0.0005	0.98	0.00623	-0.01	0.00052	0.0001	-0.002	1.35	0.00006	0.794	-0.000005	0.19	0.0471	-10	-0.000002	-0.00001	-0.0005	0.000098	0.0009	0.0002	-0.0001
18-Jun-10	0.0412	-0.00002	0.00006	0.00378	-0.00001	-0.000005	-0.05	-0.000005	4.95	0.0002	0.000008	0.00033	0.004	0.000009	-0.0005	1.11	0.00463	-0.01	0.00046	0.00017	0.002	1.45	0.00005	0.898	-0.000005	0.21	0.052	-10	-0.000002	0.00001	-0.0005	0.000102	0.001	0.0003	-0.0001
2-Jul-10	0.0547	-0.00002	0.00002	0.0039	-0.00001	-0.000005	-0.05	-0.000005	4.88	-0.0001	-0.000005	0.00022	0.003	0.000006	-0.0005	1.04	0.00493	-0.01	0.00051	-0.00002	-0.002	1.32	0.00005	0.805	-0.000005	0.16	0.052	-10	-0.000002	0.00013	-0.0005	0.000107	0.0007	-0.0001	-0.0001
16-Jul-10	0.0342	-0.00002	0.00004	0.00353	-0.00001	-0.000005	-0.05	-0.000005	4.8	-0.0001	0.000008	0.0008	-0.001	-0.000005	-0.0005	0.9	0.00441	-0.01	0.0004	0.00015	-0.002	1.21	0.00004	0.755	-0.000005	0.16	0.0557	-10	-0.000002	-0.00001	-0.0005	0.000119	0.0008	-0.0001	-0.0001
30-Jul-10	0.0385	-0.00002	0.00008	0.00419	-0.00001	-0.000005	-0.05	-0.000005	5.13	-0.0001	0.000007	0.00164	0.001	0.000022	-0.0005	1.03	0.00437	-0.01	0.0004	0.00015	-0.002	1.24	0.00005	0.813	-0.000005	0.16	0.0535	-10	0.000004	-0.00001	-0.0005	0.000113	0.0008	0.0003	-0.0001
13-Aug-10	0.035	-0.00002	0.00003	0.00387	-0.00001	-0.000005	-0.05	-0.000005	5.35	-0.0001	0.000019	0.00041	-0.001	0.000008	-0.0005	1.05	0.00405	-0.01	0.00036	#N/A	-0.002	1.27	-0.00004	0.686	-0.000005	0.53	0.0563	-10	-0.000002	-0.00001	-0.0005	0.00013	0.0007	0.0002	-0.0001
27-Aug-10	0.03	-0.00002	-0.00002	0.00466	-0.00001	-0.000005	-0.05	-0.000005	6.13	-0.0001	0.00001	0.00044	0.001	0.000007	-0.0005	1.2	0.00297	-0.01	0.00037	0.00017	-0.002	1.3	0.00005	0.75	-0.000005	0.17	0.066	-10	-0.000002	0.00001	-0.0005	0.000126	0.0005	0.001	-0.0001
10-Sep-10	0.0319	-0.00002	-0.00002	0.00391	-0.00001	-0.000005	-0.05	-0.000005	4.89	-0.0001	0.000008	0.0002	0.003	0.000012	-0.0005	0.95	0.00263	-0.01	0.0004	0.00019	-0.002	1.27	-0.00004	0.679	-0.000005	0.16	0.0539	-10	-0.000002	0.00006	-0.0005	0.000108	0.0004	0.0002	-0.0001
24-Sep-10	0.0442	-0.00002	0.00003	0.0038	-0.00001	-0.000005	-0.05	-0.000005	4.79	-0.0001	0.000012	0.00056	-0.001	0.000017	-0.0005	0.92	0.00286	-0.01	0.00055	0.00013	-0.002	1.47	0.00005	0.736	-0.000005	0.17	0.0515	-10	-0.000002	0.00002	-0.0005	0.000101	0.0009	0.0003	-0.0001
8-Oct-10	0.0509	-0.00002	0.00014	0.00401	-0.00001	-0.000005	-0.05	-0.000005	4.74	0.0002	0.00001	0.00017	0.001	-0.000005	-0.0005	0.88	0.00257	-0.01	0.00046	0.00019	-0.002	1.31	-0.00004	0.742	-0.000005	0.15	0.054	-10	-0.000002	-0.00001	-0.0005	0.000104	0.0008	0.0003	-0.0001
22-Oct-10	0.0396	-0.00002	-0.00002	0.00408	-0.00001	-0.000005	-0.05	-0.000005	5.94	-0.0001	-0.000005	0.00073	-0.001	0.000046	-0.0005	0.98	0.00248	-0.01	0.00047	0.00013	-0.002	1.35	-0.00004	0.808	-0.000005	0.17	0.0544	-10	0.000003	0.00002	-0.0005	0.000102	0.0007	0.0006	-0.0001
5-Nov-10	0.0409	-0.00002	0.00003	0.00381	-0.00001	-0.000005	-0.05	-0.000005	5.19	-0.0001	0.000005	0.0007	-0.001	0.000008	-0.0005	0.87	0.0027	-0.01	0.00027	0.00011	-0.002	1.33	-0.00004	0.812	-0.000005	0.15	0.0516	-10	-0.000002	0.00001	-0.0005	0.000095	0.0008	0.0002	-0.0001
19-Nov-10	0.0299	-0.00002	0.00004	0.00408	-0.00001	-0.000005	-0.05	-0.000005	6.34	-0.0001	0.000018	0.00068	0.002	0.000016	-0.0005	0.88	0.00192	-0.01	0.00019	0.00019	-0.002	1.14	-0.00004	0.807	-0.000005	0.15	0.0545	-10	-0.000002	0.00001	-0.0005	0.00015	0.0006	0.0002	-0.0001
3-Dec-10	0.034	-0.00002	0.00002	0.00423	-0.00001	-0.000005	-0.05	-0.000005	5.43	-0.0001	-0.000005	0.00014	-0.001	-0.000005	-0.0005	0.91	0.00212	-0.01	0.00029	-0.00002	-0.002	1.29	-0.00004	0.679	-0.000005	0.12	0.0563	-10	-0.000002	-0.00001	0.0008	0.000116	0.0007	-0.0001	-0.0001
17-Dec-10	0.0364	-0.00002	0.00006	0.00456	-0.00001	-0.000005	-0.05	0.000008	5.29	-0.0001	0.000007	0.00033	-0.001	0.000041	-0.0005	0.87	0.00195	-0.01	0.00032	0.00014	-0.002	1.13	-0.00004	0.658	-0.000005	0.13	0.0511	-10	0.000002	0.00003	-0.0005	0.00025	0.0007	0.0008	-0.0001
31-Dec-10	0.0326	-0.00002	-0.00002	0.00433	-0.00001	-0.000005	-0.05	0.000013	5.67	-0.0001	-0.000005	0.00043	-0.001	0.000023	-0.0005	0.88	0.00236	-0.01	0.00032	0.00014	-0.002	1.22	-0.00004	0.694	0.000008	0.12	0.0562	-10	0.000004	0.00001	-0.0005	0.000111	0.0006	0.0003	-0.0001
14-Jan-11	0.0312	-0.00002	-0.00002	0.00407	-0.00001	-0.000005	-0.05	-0.000005	5.21	-0.0001	-0.000005	0.00022	-0.001	0.000007	-0.0005	0.85	0.002	-0.01	0.0002	0.00002	-0.002	1.16	0.00004	0.57	-0.000005	0.1	0.0517	-10	0.000002	-0.00001	-0.0005	0.000219	0.0004	0.0001	-0.0001
28-Jan-11	0.0307	-0.00002	0.00003	0.00408	-0.00001	-0.000005	-0.05	-0.000005	5.3	-0.0001	-0.000005	0.0006	0.001	-0.000005	-0.0005	0.77	0.00257	-0.01	0.00026	0.00008	-0.002	1.13	-0.00004	0.579	-0.000005	0.12	0.0504	-10	0.000002	0.00001	-0.0005	0.000088	0.0005	-0.0001	-0.0001
22-Apr-11	0.0382	-0.00002	-0.00002	0.00459	-0.00001	-0.000005	-0.05	0.00001	5.23	-0.0001	-0.000005	0.0004	0.002	0.000011	-0.0005	0.71	0.00162	-0.01	0.00036	0.00009	-0.002	1.15	-0.00004	0.559	-0.000005	0.1	0.0497	-10	-0.000002	-0.00001	-0.0005	0.000079	0.0006	#N/A	-0.0001
15-Jul-11	0.0329	-0.00002	0.00007	0.00382	-0.00001	-0.000005	-0.05	-0.000005	5.27	-0.0001	0.000005	0.00052	-0.001	0.000016	-0.0005	0.61	0.00153	-0.01	0.00024	0.00019	-0.002	1.03	-0.00004	0.556	-0.000005	0.11	0.0469	-10	-0.000002	0.00011	-0.0005	0.000073	0.0004	0.0003	-0.0001

HC 2

CONFIDENTIAL *DRAFT*

Sample = Hole
196 53.94-55.44

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
12-Aug-11	110	500	490																																												
19-Aug-11	111	500	465																																												
26-Aug-11	112	500	475																																												
2-Sep-11	113	500	490																																												
9-Sep-11	114	500	485																																												
16-Sep-11	115	500	475																																												
23-Sep-11	116	500	465																																												
30-Sep-11	117	500	480																																												
7-Oct-11	118	500	490	7.58	38	#N/A	4.9	25.2	-2	-0.5	0.02	18.7	0.0393	-0.00002	0.00002	0.00478	-0.00001	-0.000005	-0.05	-0.000005	6.31	-0.0001	-0.000005	0.00018	0.001	0.000008	-0.0005	0.71	0.00035	-0.01	0.00022	0.00003	-0.002	1.22	-0.00004	0.586	-0.000005	0.08	0.0527	-10	0.000002	0.00017	-0.0005	0.000084	0.0005	0.0002	-0.0001
14-Oct-11	119	500	485																																												
21-Oct-11	120	500	495																																												
28-Oct-11	121	500	485																																												
4-Nov-11	122	500	490																																												
11-Nov-11	123	500	480																																												
18-Nov-11	124	500	490																																												
25-Nov-11	125	500	480																																												
2-Dec-11	126	500	475																																												
9-Dec-11	127	500	480																																												
16-Dec-11	128	500	495																																												
23-Dec-11	129	500	480																																												
30-Dec-11	130	500	495	7.76	40	#N/A	4.5	31.5	2	-0.5	0.019	22.1	0.0358	-0.00002	0.0001	0.00647	-0.00001	-0.000005	-0.05	-0.000005	7.7	-0.0001	-0.000005	0.00021	0.002	0.000012	-0.0005	0.7	0.00098	-0.01	0.00021	-0.00002	0.003	1.34	-0.00004	0.59	-0.000005	0.07	0.0573	-10	0.000003	0.0001	-0.0005	0.000089	0.0004	0.0001	-0.0001
6-Jan-12	131	500	490																																												
13-Jan-12	132	500	480																																												
20-Jan-12	133	500	495																																												
27-Jan-12	134	500	485																																												
3-Feb-12	135	500	485																																												
10-Feb-12	136	500	490																																												
17-Feb-12	137	500	485																																												
24-Feb-12	138	500	480																																												
2-Mar-12	139	500	485																																												
9-Mar-12	140	500	475																																												
16-Mar-12	141	500	485																																												
23-Mar-12	142	500	485	7.76	40	#N/A	5.4	28.0	-2	-0.5	0.019	17.1	0.0285	-0.00002	-0.00002	0.00493	-0.00001	-0.000005	-0.05	-0.000005	5.95	-0.0001	-0.000005	0.00084	0.002	-0.000005	-0.0005	0.55	0.00081	-0.01	0.00014	0.0001	-0.002	1.1	-0.00004	0.426	-0.000005	0.13	0.0465	-10	-0.000002	-0.0002	-0.0005	0.000066	0.0003	0.0004	-0.0001
30-Mar-12	143	500	485																																												
6-Apr-12	144	500	485																																												
13-Apr-12	145	500	490																																												
20-Apr-12	146	500	470																																												
27-Apr-12	147	500	460																																												
4-May-12	148	500	450																																												
11-May-12	149	500	470																																												
18-May-12	150	500	450																																												
25-May-12	151	500	455																																												
1-Jun-12	152	500	465																																												
8-Jun-12	153	500	470																																												
15-Jun-12	154	500	475	7.55	43	#N/A	3.1	28.4	4	-0.5	0.017	17.5	0.034	-0.00002	0.000028	0.00494	-0.00001	-0.000005	-0.05	-0.000005	6.2	-0.0001	-0.000005	0.00021	-0.001	-0.000005	-0.0005	0.495	0.00059	-0.01	0.000166	-0.00002	-0.002	1.14	-0.00004	0.521	-0.000005	0.092	0.048	-10	-0.000002	-0.0002	-0.0005	0.0000657	0.00036	0.00013	-0.0001
22-Jun-12	155	500	455																																												
29-Jun-12	156	500	470																																												
6-Jul-12	157	500	460																																												
13-Jul-12	158	500	460																																												
20-Jul-12	159	500	475																																												
27-Jul-12	160	500	455																																												
3-Aug-12	161	500	460																																												
10-Aug-12	162	500	470																																												
17-Aug-12	163	500	455																																												
24-Aug-12	164	500	445																																												
31-Aug-12	165	500	470																																												
7-Sep-12	166	500	450	7.52	32	#N/A	4.1	23.9	4	-0.5	0.014	15.6	0.0341	-0.00002	0.000037	0.00484	-0.00001	-0.000005	-0.05	0.000006	5.55	-0.0001	0.000006	0.00065	0.0018	0.000023	-0.0005	0.427	0.00092	-0.01	0.000128	0.000089	-0.002	1.06	-0.00004	0.42	-0.000005	0.124	0.0389	-10	0.000002	-0.0002	-0.0005	0.00005	0.00032	0.00062	-0.0001
14-Sep-12	167	500	500																																												
21-Sep-12	168	500	440																																												
28-Sep-12	169	500	445																																												
5-Oct-12	170	500	465																																												
12-Oct-12	171	500	465																																												
19-Oct-12	172	500	445																																												
26-Oct-12	173	500	4455																																												
2-Nov-12	174	500	455																																												
9-Nov-12	175	500	445																																												
16-Nov-12	176	500	450																																												
23-Nov-12	177	500	490																																												
30-Nov-12	178	500	495	7.59	40	#N/A	3.9	28.6	3	-0.5	0.017	18.6	0.0303	-0.00002	0.00004	0.00545	-0.00001	-0.000005	-0.05	-0.000005	6.7	-0.0001	0.000006	0.00033	0.0012	0.00001	-0.0005	0.456	0.00049	-0.01	0.000406	-0.00002	-0.002	1.05	-0.00004	0.445	-0.000005	0.059	0.0454	-3	0.000002	0.00022	-0.0005	0.00007	0.00023	0.00072	-0.0001
7-Dec-12	179	500	485																																												
14-Dec-12	180	500	500																																												
21-Dec-12	181	500	465																																												
28-Dec-12	182	500	435																																												
4-Jan-13	183	500	445																																												
11-Jan-13	184	500	445																																												
18-Jan-13	185	500	465																																												
25-Jan-13	186	500	460																																												
1-Feb-13	187	500	465																																												
8-Feb-13	188	500	455																																												
15-Feb-13	189	500	455																																												
22-Feb-13	190	500	435	7.71	32	#N/A	5.5	27.5	4	0.58	0.014	14.8	0.0516	-0.00002	0.000078	0.00438	-0.00001	-0.000005	-0.05	-0.000005	5.33	-0.0001	-0.000005	0.00057	0.0045	0.000008	-0.0005	0.36	0.00147	-0.01	0.000144	0.000064	-0.002	1.1	5.6E-05	0.389	-0.000005	0.111	0.0361	-3	0.000003	-0.0002	-0.0005	0.000046	0.0003	0.00014	-0.0001
1-Mar-13	191	500	440																																												
8-Mar-13	192	500	465																																												
15-Mar-13	193	500	440																																												
22-Mar-13	194	500	425																																												
29-Mar-13	195	500	440																																												
5-Apr-13	196	500	430																																												
12-Apr-13	197	500	455																																												
19-Apr-13	198	500	475																																												
26-Apr-13	199	500	400																																												
3-May-13	200	500	435																																												
10-May-13	201	500	405																																												
17-May-13	202	500	435	7.81	32	#N/A	8.0	23.6	4	-0.5	0.016	13.7	0.0343	-0.00002	0.000031	0.00399	-0.00001	-0.000005	-0.05	-0.000005	4.92	-0.0001	-0.000005	0.00019	0.0024	-0.000005	-0.0005	0.329	0.00137	-0.01	0.000076	0.000058	-0.002	1.11	-0.00004	0.344	-0.000005	0.08	0.0323	-3	0.000002	-0.0002	-0.0005	0.000048	0.00025	0.00033	-0.0001
24-May-13	203	500	450																																												

Aug 13/10 Ni 0.00072. Sample discarded cannot repeat.
Oct 22/10 Sb 0.00031. Repeat = -0.00002.
Dec 17/10 F 0.48. Repeat = 0.55. Suspect sample mix-up with HC 1.
Feb 4/11 Change in analytical schedule.
April 22/11 Zn 0.0007. Repeat =0.0007 data confirmed suspect contamination
Jul 15, 2011 F=0.18, cannot repeat suspect contamination or analytical error

HC 3

CONFIDENTIAL ***DRAFT***

Sample = Hole
196 45.64-47.14

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L
3-Jul-09	0	750	365	7.65	130	#N/A	2.1	37.4	2	2.2	0.4	43.5
10-Jul-09	1	500	450	7.67	66							
17-Jul-09	2	500	415	7.66	41	#N/A	1.9	24.2	2	0.8	0.44	15.9
24-Jul-09	3	500	435	7.59	38							
31-Jul-09	4	500	455	7.64	39	#N/A	2.0	25.7	-2	-0.5	0.34	17.1
7-Aug-09	5	500	430	7.53	32							
14-Aug-09	6	500	430	7.52	38	#N/A	2.3	24.5	-2	0.9	0.26	17.9
21-Aug-09	7	500	460	7.67	39							
28-Aug-09	8	500	450	7.63	38	#N/A	2.1	24.8	3	0.7	0.24	18.2
4-Sep-09	9	500	440	7.48	33							
11-Sep-09	10	500	390	7.52	31	#N/A	1.9	22.4	-2	-0.5	0.22	14.3
18-Sep-09	11	500	435	7.67	42							
25-Sep-09	12	500	505	7.60	53	#N/A	2.5	32.3	-2	0.5	0.17	22.6
2-Oct-09	13	500	410	7.49	37							
9-Oct-09	14	500	420	7.53	37	#N/A	3.8	26.3	2	-0.5	0.14	18.2
16-Oct-09	15	500	380	7.42	41							
23-Oct-09	16	500	450	7.56	42	#N/A	2.8	29.7	-2	-0.5	0.1	21.5
30-Oct-09	17	500	435	7.62	39							
6-Nov-09	18	500	450	7.69	38	#N/A	3.7	26.8	-2	-0.5	0.08	19.4
13-Nov-09	19	500	465	7.55	37							
20-Nov-09	20	500	445	7.67	38	#N/A	4.0	25.6	-2	-0.5	0.08	17.4
27-Nov-09	21	500	445	7.57	40							
4-Dec-09	22	500	465	7.56	41	#N/A	3.2	27.9	-2	-0.5	0.06	20.2
11-Dec-09	23	500	470	7.80	40							
18-Dec-09	24	500	465	7.32	38	#N/A	4.7	24.8	-2	-0.5	0.04	17.7
25-Dec-09	25	500	465	7.52	33							
1-Jan-10	26	500	475	7.75	39	#N/A	2.1	26.8	-2	0.5	0.04	18.9
8-Jan-10	27	500	465	7.54	37							
15-Jan-10	28	500	455	7.59	37	#N/A	5.2	26.0	-2	-0.5	0.04	18.1
22-Jan-10	29	500	500	7.42	32							
29-Jan-10	30	500	460	7.32	28	#N/A	4.5	25.0	-2	-0.5	0.04	17.9
5-Feb-10	31	500	470	7.16	25							
12-Feb-10	32	500	445	7.33	33	#N/A	2.6	23.7	-2	-0.5	0.04	17.4
19-Feb-10	33	500	400	7.40	29							
26-Feb-10	34	500	415	7.39	25	#N/A	2.7	17.3	-2	-0.5	0.04	13.8
5-Mar-10	35	500	490	7.26	33							
12-Mar-10	36	500	415	7.39	30	#N/A	3.8	21.2	2	-0.5	0.04	13.6
19-Mar-10	37	500	445	7.41	30							
26-Mar-10	38	500	475	7.46	29	#N/A	3.2	22.1	-2	-0.5	0.03	14.5
2-Apr-10	39	500	425	7.37	23							
9-Apr-10	40	500	425	7.36	28	#N/A	2.9	18.2	3	-0.5	0.03	13.9
16-Apr-10	41	500	440	7.37	32							
23-Apr-10	42	500	440	7.39	33	#N/A	5.1	24.1	2	-0.5	0.04	15.4
30-Apr-10	43	500	460	7.48	36							
7-May-10	44	500	430	7.37	31	#N/A	4.3	22.3	-2	-0.5	0.03	14.8
14-May-10	45	500	450	7.46	27							
21-May-10	46	500	400	7.53	24	#N/A	2.8	16.5	-2	-0.5	0.03	12.4
28-May-10	47	500	410	7.40	27							
4-Jun-10	48	500	435	7.44	30	#N/A	3.6	22.5	-2	-0.5	0.03	13.3
11-Jun-10	49	500	440	7.48	31							
18-Jun-10	50	500	455	7.50	27	#N/A	3.9	20.8	2	-0.5	0.02	13.8
25-Jun-10	51	500	455	7.55	28							
2-Jul-10	52	500	445	7.54	27	#N/A	2.4	20.7	-2	-0.5	0.02	14.2
9-Jul-10	53	500	450	7.32	26							
16-Jul-10	54	500	440	7.49	28	#N/A	3.2	20.8	4	-0.5	0.02	14.3
23-Jul-10	55	500	450	7.20	29							
30-Jul-10	56	500	460	7.22	26	#N/A	3.6	17.5	4	-0.5	0.02	12.9
6-Aug-10	57	500	455	7.52	30							
13-Aug-10	58	500	465	7.53	30	#N/A	3.6	22.0	3	-0.5	0.03	14.5
20-Aug-10	59	500	465	7.43	24							
27-Aug-10	60	500	475	7.50	28	#N/A	2.3	22.7	3	-0.5	0.02	13.4
3-Sep-10	61	500	485	7.50	27							
10-Sep-10	62	500	465	7.31	34	#N/A	3.7	24.6	-2	-0.5	0.03	15.6
17-Sep-10	63	500	465	7.20	26							
24-Sep-10	64	500	455	7.39	22	#N/A	3.1	21.6	4	-0.5	0.03	13.5
1-Oct-10	65	500	465	7.41	22							
8-Oct-10	66	500	455	7.42	29	#N/A	2.3	22.0	4	-0.5	0.03	13.5
15-Oct-10	67	500	470	7.35	31							
22-Oct-10	68	500	470	7.43	29	#N/A	3.1	23.2	2	-0.5	0.03	15.1
29-Oct-10	69	500	455	7.39	28							
5-Nov-10	70	500	430	7.42	11	#N/A	2.2	15.2	-2	-0.5	0.03	10.4
12-Nov-10	71	500	460	7.53	23							
19-Nov-10	72	500	455	7.63	30	#N/A	3.0	23.5	-2	-0.5	0.02	13
26-Nov-10	73	500	460	7.35	31							
3-Dec-10	74	500	470	7.40	29	#N/A	4.0	22.3	-2	-0.5	0.07	13.6
10-Dec-10	75	500	465	7.36	29							
17-Dec-10	76	500	465	7.55	28	#N/A	4.1	22.3	2	-0.5	0.03	13.7
24-Dec-10	77	500	465	7.60	30							
31-Dec-10	78	500	470	7.52	29	#N/A	4.5	24.8	-2	-0.5	0.03	14.7
7-Jan-11	79	500	485	7.51	24							
14-Jan-11	80	500	475	7.67	25	#N/A	2.5	23.9	-2	-0.5	0.03	14.5
21-Jan-11	81	500	475	7.40	26							
28-Jan-11	82	500	450	7.50	19	#N/A	3.8	20.9	3	0.5	0.03	12.6
4-Feb-11	83	500	455									
11-Feb-11	84	500	435									
18-Feb-11	85	500	450									
25-Feb-11	86	500	455									
4-Mar-11	87	500	460									
11-Mar-11	88	500	465									
18-Mar-11	89	500	495									
25-Mar-11	90	500	465									
1-Apr-11	91	500	500									
8-Apr-11	92	500	455									
15-Apr-11	93	500	465									
22-Apr-11	94	500	460	7.41	25	#N/A	2.1	16.8	-2	#N/A	0.02	10.9
29-Apr-11	95	500	455									
6-May-11	96	500	460									
13-May-11	97	500	445									
20-May-11	98	500	485									
27-May-11	99	500	450									
3-Jun-11	100	500	455									
10-Jun-11	101	500	465									
17-Jun-11	102	500	455									
24-Jun-11	103	500	520									
1-Jul-11	104	500	455									
8-Jul-11	105	500	465									
15-Jul-11	106	500	460	7.64	27	#N/A	5.4	20.4	-2	-0.5	#N/A	12
22-Jul-11	107	500	470									
29-Jul-11	108	500	475									
5-Aug-11	109	500	480									
12-Aug-11	110	500	485									
19-Aug-11	111	500	480									

Date	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
3-Jul-09	0.108	0.00005	0.00032	0.0345	-0.00001	-0.000005	-0.05	-0.000005	12.4	-0.0001	0.000022	0.0276	0.003	0.000047	0.0019	3.04	0.0257	-0.01	0.0163	0.00063	0.006	4.39	0.00017	1.26	-0.000005	5.13	0.129	-3	0.000005	0.00023	-0.0005	0.000013	0.0005	0.0005	-0.0001
17-Jul-09	0.105	0.00006	0.00044	0.0101	-0.00001	-0.000005	-0.05	0.000015	4.46	-0.0001	0.000014	0.00381	0.019	0.00004	0.0006	1.15	0.0136	-0.01	0.033	-0.00002	0.003	2.41	0.00031	1.51	-0.000005	2.98	0.0463	-3	-0.000002	0.00008	0.0005	0.000121	0.0011	0.0007	-0.0001
31-Jul-09	0.0679	0.00006	0.00037	0.0106	-0.00001	-0.000005	-0.05	-0.000005	4.92	-0.0001	0.000008	0.00211	0.007	0.000114	0.0005	1.18	0.0133	-0.01	0.0161	0.00006	0.006	2.31	0.00016	1.62	-0.000005	1.99	0.0489	-3	-0.000002	0.00006	-0.0005	0.000152	0.0011	0.0005	-0.0001
14-Aug-09	0.0655	0.00005	0.0005	0.0123	-0.00001	-0.000005	-0.05	-0.000005	5.19	-0.0001	0.000013	0.00243	0.006	0.000016	0.0007	1.19	0.0134	-0.01	0.00875	0.00006	0.002	2.31	0.00011	1.59	-0.000005	1.39	0.0526	-3	-0.000002	0.00016	-0.0005	0.000151	0.0008	0.0004	-0.0001
28-Aug-09	0.0885	0.00006	0.00051	0.0134	-0.00001	-0.000005	-0.05	-0.000005	5.11	-0.0001	0.000012	0.00224	0.008	0.000016	-0.0005	1.32	0.0114	-0.01	0.00506	0.00004	-0.002	2.33	0.00015	1.91	-0.000005	1	0.0541	-3	0.000002	0.00006	-0.0005	0.00016	0.0011	0.0002	-0.0001
11-Sep-09	0.138	-0.00002	0.00054	0.0106	-0.00001	-0.000005	-0.05	-0.000005	3.95	-0.0001	0.000019	0.00277	0.027	0.000032	-0.0005	1.07	0.0074	-0.01	0.00305	0.00006	0.003	2.09	0.00011	1.78	-0.000005	0.74	0.0432	-3	0.000002	0.00008	0.0013	0.000107	0.0013	0.0004	-0.0001
25-Sep-09	0.0741	0.00005	0.00049	0.0178	-0.00001	-0.000005	-0.05	0.000006	6.5	-0.0001	0.000012	0.00216	0.008	0.000197	0.0006	1.53	0.00907	0.02	0.00296	0.0001	-0.002	2.55	0.00014	2.02	-0.000005	0.56	0.0647	-3	0.000003	0.00002	-0.0005	0.000191	0.0012	0.0005	-0.0001
9-Oct-09	0.121	0.00004	0.00056	0.0149	-0.00001	-0.000005	-0.05	-0.000005	5.12	-0.0001	0.00001	0.00282	0.017	0.000049	0.0006	1.31	0.00734	-0.01	0.00215	-0.00002	0.004	2.49	0.00009	2.14	-0.000005	0.52	0.0559	-3	-0.000002	0.00003	0.0009	0.000155	0.0014	0.0008	-0.0001
23-Oct-09	0.081	0.00003	0.00044	0.0165	-0.00001	-0.000005	-0.05	-0.000005	6.05	0.0001	0.000011	0.00287	0.013	0.000042	0.0006	1.55	0.00836	-0.01	0.00184	0.00028	0.003	2.29	0.00011	1.77	0.000017	0.41	0.0648	-3	-0.000002	0.0001	0.0005	0.000203	0.0012	0.0008	-0.0001
6-Nov-09	0.079	0.00002	0.00038	0.0152	-0.00001	-0.000005	-0.05	0.000005	5.44	-0.0001	0.000008	0.00162	0.008	0.000014	-0.0005	1.41	0.00683	-0.01	0.00141	0.00011	0.003	2.18	0.00008	1.68	-0.000005	0.33	0.0595	-3	-0.000002	0.00002	0.0006	0.000164	0.0013	0.0005	-0.0001
20-Nov-09	0.0777	0.00003	0.00036	0.0141	-0.00001	-0.000005	-0.05	0.000007	4.94	-0.0001	0.00001	0.00157	0.01	0.000041	-0.0005	1.24	0.00654	-0.01	0.00113	0.00008	0.005	2.03	0.00007	1.49	-0.000005	0.29	0.0535	-3	-0.000002	0.00002	0.0006	0.000126	0.0011	0.0006	-0.0001
4-Dec-09	0.0698	-0.00002	0.0003	0.0162	-0.00001	-0.000005	-0.05	-0.000005	5.91	-0.0001	0.000008	0.00144	0.011	0.000016	-0.0005	1.33	0.00731	-0.01	0.00103	0.00012	0.002	2.08	0.00005	1.45	-0.000005	0.24	0.0605	-3	-0.000002	0.00023	-0.0005	0.000133	0.001	0.0003	-0.0001
18-Dec-09	0.0816	0.00002	0.00036	0.0153	-0.00001	-0.000005	-0.05	-0.000005	5.12	-0.0001	0.000006	0.00143	0.009	0.000009	-0.0005	1.19	0.00633	-0.01	0.00091	0.00005	-0.002	1.86	0.00006	1.49	-0.000005	0.24	0.0555	-3	-0.000002	0.00002	-0.0005	0.000118	0.0008	-0.0001	-0.0001
1-Jan-10	0.0702	-0.00002	0.00027	0.0158	-0.00001	-0.000005	-0.05	-0.000005	5.64	-0.0001	0.000007	0.00162	0.009	0.000055	-0.0005	1.18	0.00684	-0.01	0.00078	-0.00002	-0.002	1.79	0.00005	1.38	-0.000005	0.19	0.0551	-3	-0.000002	-0.00001	-0.0005	0.000123	0.0008	0.0004	-0.0001
15-Jan-10	0.0776	-0.00002	0.00035	0.015	-0.00001	-0.000005	-0.05	-0.000005	5.35	-0.0001	-0.000005	0.00205	0.007	0.000062	-0.0005	1.16	0.00656	-0.01	0.00087	-0.00002	-0.002	1.9	0.00006	1.52	-0.000005	0.2	0.0529	-3	-0.000002	0.00002	0.0005	0.000121	0.0008	0.0008	-0.0001
29-Jan-10	0.0962	0.00002	0.00031	0.0153	-0.00001	-0.000005	-0.05	-0.000005	5.38	0.0002	0.000018	0.00238	0.02	0.000083	-0.0005	1.08	0.00641	0.01	0.00073	0.00011	0.004	1.68	0.00005	1.33	0.000011	0.23	0.054	-3	0.000002	0.00021	0.0011	0.000149	0.001	0.0005	-0.0001
12-Feb-10	0.0673	0.00002	0.00028	0.0154	-0.00001	-0.000005	-0.05	-0.000005	5.25	-0.0001	0.000007	0.00128	0.004	0.000013	-0.0005	1.05	0.00624	-0.01	0.00062	0.00014	-0.002	1.82	0.00005	1.29	-0.000005	0.21	0.0501	-3	-0.000002	-0.00001	-0.0005	0.000125	0.0007	0.0004	-0.0001
26-Feb-10	0.12	-0.00002	0.00032	0.0128	-0.00001	-0.000005	-0.05	-0.000005	4.1	-0.0001	0.000011	0.00212	0.019	0.000019	-0.0005	0.86	0.0049	-0.01	0.00069	0.00034	-0.002	1.83	0.00007	1.39	-0.000005	0.23	0.0404	-3	-0.000002	0.00005	0.0011	0.000082	0.001	0.0027	-0.0001
12-Mar-10	0.094	-0.00002	0.00031	0.013	-0.00001	0.00001	-0.05	-0.000005	4.09	0.0002	0.000016	0.00175	0.016	0.000043	-0.0005	0.82	0.00475	-0.01	0.00058	0.00028	-0.002	1.6	0.00005	1.2	-0.000005	0.19	0.0431	-10	-0.000002	0.00002	0.0007	0.000087	0.0008	0.0018	-0.0001
26-Mar-10	0.0626	-0.00002	0.00023	0.013	-0.00001	-0.000005	-0.05	-0.000005	4.4	0.0002	0.000005	0.00126	0.006	0.000016	-0.0005	0.85	0.00464	-0.01	0.00057	0.00015	-0.002	1.55	0.00004	1.01	-0.000005	0.2	0.043	-2	-0.000002	-0.00001	-0.0005	0.000071	0.0007	0.0004	-0.0001
9-Apr-10	0.0708	-0.00002	0.00028	0.0118	-0.00001	-0.000005	-0.05	-0.000005	4.26	-0.0001	0.000015	0.00147	0.008	0.000014	-0.0005	0.8	0.00489	-0.01	0.00052	0.00014	0.004	1.67	-0.00004	1.14	-0.000005	0.19	0.0393	-10	-0.000002	0.00002	0.0006	0.000076	0.0008	0.0005	-0.0001
23-Apr-10	0.0636	-0.00002	0.00029	0.0141	-0.00001	-0.000005	-0.05	-0.000005	4.72	-0.0001	-0.000005	0.00098	0.01	0.000011	-0.0005	0.89	0.00464	-0.01	0.00052	0.00011	-0.002	1.81	0.00005	1.35	-0.000005	0.26	0.0463	-10	-0.000002	-0.00001	-0.0005	0.000019	0.0004	0.0007	-0.0001
7-May-10	0.0789	-0.00002	0.00025	0.0128	-0.00001	-0.000005	-0.05	-0.000005	4.63	-0.0001	0.000009	0.00188	0.009	0.000013	-0.0005	0.8	0.00446	-0.01	0.00056	0.00013	-0.002	1.7	-0.00004	1.29	-0.000005	0.18	0.0414	-10	-0.000002	0.00002	-0.0005	0.000064	0.0008	0.0004	-0.0001
21-May-10	#N/A	-0.00002	0.0003	0.0151	-0.00001	-0.000005	-0.05	-0.000005	3.83	-0.0001	0.000034	#N/A	#N/A	0.000072	-0.0005	0.7	0.0057	-0.01	0.00046	0.00017	-0.002	1.69	0.00005	1.48	-0.000005	0.25	0.0361	-10	-0.000002	0.00004	0.0027	0.000057	0.001	0.0008	-0.0001
4-Jun-10	0.0872	-0.00002	0.00032	0.0116	-0.00001	-0.000005	-0.05	-0.000005	4.05	-0.0001	0.000009	0.00207	0.015	0.00002	-0.0005	0.78	0.00376	-0.01	0.00065	0.00013	-0.002	1.65	0.00005	1.34	-0.000005	0.25	0.0395	-10	-0.000002	0.00004	0.0006	0.000068	0.001	0.0006	-0.0001
18-Jun-10	0.0704	-0.00002	0.00024	0.0123	-0.00001	-0.000005	-0.05	-0.000005	4.25	-0.0001	0.000007	0.00103	0.004	0.000014	-0.0005	0.78	0.00351	-0.01	0.00052	0.00012	-0.002	1.71	-0.00004	1.25	-0.000005	0.2	0.0382	-10	-0.000002	0.00001	-0.0005	0.000062	0.0008	0.0001	-0.0001
2-Jul-10	0.101	-0.00002	0.00022	0.0128	-0.00001	-0.000005	-0.05	-0.000005	4.38	-0.0001	0.00001	0.00176	0.014	0.000013	-0.0005	0.78	0.004	-0.01	0.00052	-0.00002	-0.002	1.53	0.00005	1.24	-0.000005	0.2	0.0403	-10	-0.000002	0.00008	0.0008	0.00006	0.0006	0.0002	-0.0001
16-Jul-10	0.0565	-0.00002	0.0002	0.0123	-0.00001	-0.000005	-0.05	-0.000005	4.59	-0.0001	0.00001	0.00148	0.004	0.000013	-0.0005	0.68	0.00349	-0.01	0.00049	0.00011	-0.002	1.38	0.00005	1.14	-0.000005	0.18	0.0415	-10	-0.000002	0.00003	-0.0005	0.000068	0.0007	0.0001	-0.0001
30-Jul-10	0.058	-0.00002	0.00023	0.0121	-0.00001	-0.000005	-0.05	-0.000005	4.04	-0.0001	0.000008	0.00106	0.003	0.00001	-0.0005	0.67	0.00332	-0.01	0.00044	0.00012	-0.002	1.25	-0.00004	1.1	-0.000005	0.16	0.0377	-10	0.000003	-0.00001	-0.0005	0.000053	0.0007	0.0002	-0.0001
13-Aug-10	0.0594	-0.00002	0.00017	0.0134	-0.00001	-0.000005	-0.05	-0.000005	4.56	-0.0001	0.000008	0.00148	0.003	0.000008	-0.0005	0.74	0.00373	-0.01	0.00041	0.00023	-0.002	1.45	-0.00004	1.01	-0.000005	0.18	0.0421	-10	-0.000002	-0.00001	-0.0005	0.000064	0.0007	0.0002	-0.0001
27-Aug-10	0.0641	-0.00002	0.00021	0.0127	-0.00001	-0.000005	-0.05	-0.000005	4.18	0.0002	0.000007	0.00103	0.003	0.000062	-0.0005	0.73	0.00372	-0.01	0.00042	0.00013	-0.002	1.48	0.00005	0.944	-0.000005	0.19	0.0406	-10	-0.000002	-0.00001	-0.0005	0.000053	0.0006	0.0004	-0.0001
10-Sep-10	0.0552	-0.00002	0.00014	0.014	-0.00001	-0.000005	-0.05	-0.000005	4.94	0.0002	0.000025	0.0016	0.005	-0.000005	-0.0005	0.79	0.00414	-0.01	0.00037	0.00022	-0.002	1.53	-0.00004	0.961	-0.000005	0.17	0.0449	-10	-0.000002	0.00002	-0.0005	0.000069	0.0003	0.0003	-0.0001
24-Sep-10	0.0681	-0.00002	0.0002	0.0128	-0.00001	-0.000005	-0.05	0.000009	4.35	-0.0001	0.000009	0.00163	0.002	0.000065	-0.0005	0.63	0.00285	-0.01	0.00041	0.00017	-0.002	1.49	0.00005	1.09	-0.000005	0.19	0.0381	-10	0.000002	-0.00001	-0.0005	0.000061	0.0008	0.0002	-0.0001
8-Oct-10	0.0753	-0.00002	0.00017	0.0128	-0.00001	-0.000005	-0.05	-0.000005	4.39	0.0001	-0.000005	0.00068	0.003	-0.000005	-0.0005	0.61	0.00268	-0.01	0.00043	0.00014	0.003	1.48	-0.00004	1.13	-0.000005	0.16	0.0392	-10	-0.000002	-0.00001	-0.0005	0.000054	0.0007	0.0002	-0.0001
22-Oct-10	0.0592	-0.00002	0.00017	0.0131	-0.00001	-0.000005	-0.05	-0.000005	5	-0.0001	-0.000005	0.00151	0.001	0.000028	-0.0005	0.64	0.00287	-0.01	0.0004	0.00012	-0.002	1.45	-0.00004	1.04	-0.000005	0.16	0.0395	-10	0.000002	-0.00001	-0.0005	0.000052	0.0005	0.0008	-0.0001
5-Nov-10	#N/A	-0.00002	0.00022	0.0119	-0.00001	-0.000005	-0.05	-0.000005	3.36	-0.0001	0.000018	0.00388	#N/A	0.000044	-0.0005	0.48	0.00312	-0.01	0.00039	0.00013	-0.002	1.49	0.00004	1.31	0.000007	0.21	0.0296	-10	0.000002	0.00002	0.0018	0.00008	0.0008	0.0003	-0.0001
19-Nov-10	0.0556	-0.00002	0.00015	0.0121	-0.00001	-0.000005	-0.05	-0.000005	4.22	0.0003	-0.000005	0.00066	0.003	0.00001	-0.0005	0.58	0.00191	-0.01	0.0003	0.00016	-0.002	1.43	-0.00004	0.876	-0.000005	0.17	0.038	-10	-0.000002	-0.00001	-0.0005	0.000046	0.0005	-0.0001	-0.0001
3-Dec-10	0.0602	-0.00002	0.00014	0.0132	-0.00001	-0.000005	-0.05	0.000007	4.47	-0.0001	0.000005	0.00083	0.004	0.000126	-0.0005	0.6	0.00272	-0.01	0.0003	-0.00002	-0.002	1.46	-0.00004	0.953	-0.000005	0.13	0.0401	-10	-0.000002	-0.00001	0.0009	0.000065	0.0006	0.0003	-0.0001
17-Dec-10	0.0685	-0.00002	0.00015	0.0133	-0.00001	-0.000005	-0.05	-0.000005	4.54	0.0001	0.000006	0.00132	0.006	0.000044	-0.0005	0.56	0.00217	-0.01	0.00034	0.00012	-0.002	1.37	-0.00004	0.928	-0.000005	0.16	0.0361	-10	0.000002	-0.00001	-0.0005	0.000042	0.0006	0.0001	-0.0001
31-Dec-10	0.0761	-0.00002	0.00018	0.0149	-0.00001	-0.000005	-0.05	-0.000005	4.88	-0.0001	0.000008	0.00118	0.005	0.00003	-0.0005	0.6	0.00231	-0.01	0.00035	0.00015	-0.002	1.59	-0.00004	0.981	0.000007	0.14	0.0425	-10	0.000003	0.00002	0.0006	0.000068	0.0007	0.0002	-0.0001
14-Jan-11	0.0653	-0.00002	0.00016	0.0148	-0.00001	-0.000005	-0.05	-0.000005	4.85	-0.0001	-0.000005	0.00147	0.003	0.000008	-0.0005	0.57	0.00316	-0.01	0.00025	0.00024	-0.002	1.43	-0.00004	0.834	-0.000005	0.17	0.0414	-10	-0.000002	-0.00001	-0.0005	0.000111	0.0006	0.0003	-0.0001
28-Jan-11	0.0677	-0.00002	0.00016	0.0126	-0.00001	-0.000005	-0.05	-0.000005	4.29	-0.0001	0.000007	0.00074	0.004	0.000006	-0.0005	0.46	0.00248	-0.01	0.00028	0.00009	-0.002	1.37	-0.00004	0.887	-0.000005	0.12	0.0346	-10	0.000002	-0.00001	-0.0005	0.000034	0.0005	-0.0001	-0.0001
22-Apr-11	0.0631	-0.00002	0.00013	0.0115	-0.00001	-0.000005	-0.05	0.000005	3.78	-0.0001	-0.000005	0.00087	0.004	0.000043	-0.0005	0.35	0.0016	-0.01	0.00034	0.00011	-0.002	1.2	-0.00004	0.753	-0.000005	0.1	0.0295	-10	-0.000002	0.00001	-0.0005	0.000033	0.0004	#N/A	-0.0001
15-Jul-11	0.0991	-0.00002	0.00013	0.0126	-0.00001	-0.000005	-0.05	0.000006	4.27	-0.0001	0.000017	0.00149	0.007	0.000017	-0.0005	0.32	0.00137	-0.01	0.00026	0.00021	-0.002	1.22	-0.00004	0.865	-0.000005	0.14	0.0331	-10	0.000002	0.00006	-0.0005	0.000029	0.0005	0.0004	-0.0001

HC 3

CONFIDENTIAL *DRAFT*

Sample = Hole 196 45.64-47.14

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
26-Aug-11	112	500	475																																													
2-Sep-11	113	500	480																																													
9-Sep-11	114	500	490																																													
16-Sep-11	115	500	490																																													
23-Sep-11	116	500	485																																													
30-Sep-11	117	500	490																																													
7-Oct-11	118	500	485	7.51	28	#N/A	4.6	20.2	-2	-0.5	0.02	13.5	0.105	-0.00002	0.00024	0.014	-0.00001	-0.000005	-0.05	-0.000005	4.86	-0.0001	0.000006	0.00088	0.006	0.000013	-0.0005	0.34	0.00109	-0.01	0.00025	0.00002	-0.002	1.25	-0.00004	0.881	-0.000005	0.1	0.0332	-10	-0.000002	0.0001	-0.0005	0.000029	0.0005	0.0002	-0.0001
14-Oct-11	119	500	495																																													
21-Oct-11	120	500	480																																													
28-Oct-11	121	500	480																																													
4-Nov-11	122	500	490																																													
11-Nov-11	123	500	485																																													
18-Nov-11	124	500	485																																													
25-Nov-11	125	500	480																																													
2-Dec-11	126	500	480																																													
9-Dec-11	127	500	490																																													
16-Dec-11	128	500	505																																													
23-Dec-11	129	500	490																																													
30-Dec-11	130	500	485	7.73	28	#N/A	4.2	23.5	2	-0.5	0.02	14.1	0.0888	-0.00002	0.00015	0.0143	-0.00001	-0.000005	-0.05	-0.000005	5.12	-0.0001	0.000006	0.00086	0.007	0.00001	-0.0005	0.32	0.00156	-0.01	0.00025	0.00003	-0.002	1.36	-0.00004	0.79	-0.000005	0.08	0.0315	-10	0.000002	0.00015	-0.0005	0.000026	0.0004	0.0004	-0.0001
6-Jan-12	131	500	490																																													
13-Jan-12	132	500	480																																													
20-Jan-12	133	500	490																																													
27-Jan-12	134	500	490																																													
3-Feb-12	135	500	490																																													
10-Feb-12	136	500	490																																													
17-Feb-12	137	500	495																																													
24-Feb-12	138	500	475																																													
2-Mar-12	139	500	490																																													
9-Mar-12	140	500	490																																													
16-Mar-12	141	500	480																																													
23-Mar-12	142	500	490	7.70	29	#N/A	4.9	21.6	-2	-0.5	0.024	12.1	0.0804	-0.00002	0.00009	0.014	-0.00001	-0.000005	-0.05	-0.000005	4.43	-0.0001	-0.000005	0.00057	0.003	-0.000005	-0.0005	0.25	0.00116	-0.01	0.00021	-0.00002	-0.002	1.15	-0.00004	0.676	-0.000005	0.07	0.0278	-10	0.000003	-0.0002	-0.0005	0.000024	0.0003	0.0002	-0.0001
30-Mar-12	143	500	490																																													
6-Apr-12	144	500	485																																													
13-Apr-12	145	500	505																																													
20-Apr-12	146	500	465																																													
27-Apr-12	147	500	485																																													
4-May-12	148	500	475																																													
11-May-12	149	500	450																																													
18-May-12	150	500	475																																													
25-May-12	151	500	470																																													
1-Jun-12	152	500	455																																													
8-Jun-12	153	500	480																																													
15-Jun-12	154	500	500	7.40	25	#N/A	3.0	15.2	4	0.53	0.025	9.54	0.0905	-0.00002	0.000205	0.0107	-0.00001	-0.000005	-0.05	-0.000005	3.52	-0.0001	-0.000005	0.00085	0.0049	8.6E-06	-0.0005	0.183	0.00083	-0.01	0.00024	-0.00002	-0.002	1.05	-0.00004	0.743	-0.000005	0.077	0.022	-10	0.0000023	-0.0002	-0.0005	0.0000128	0.00027	0.00029	-0.0001
22-Jun-12	155	500	470																																													
29-Jun-12	156	500	465																																													
6-Jul-12	157	500	490																																													
13-Jul-12	158	500	470																																													
20-Jul-12	159	500	485																																													
27-Jul-12	160	500	505																																													
3-Aug-12	161	500	475																																													
10-Aug-12	162	500	475																																													
17-Aug-12	163	500	480																																													
24-Aug-12	164	500	460																																													
31-Aug-12	165	500	475																																													
7-Sep-12	166	500	465	7.34	19	#N/A	3.9	13.0	-2	-0.5	0.025	8.47	0.0698	-0.00002	0.000073	0.0105	-0.00001	-0.000005	-0.05	-0.000005	3.1	-0.0001	0.000005	0.00143	0.0083	0.00002	-0.0005	0.175	0.00114	-0.01	0.00021	0.000085	0.0022	0.992	-0.00004	0.607	-0.000005	0.101	0.0199	-10	0.000002	0.00023	-0.0005	0.000013	0.00023	0.00125	-0.0001
14-Sep-12	167	500	495																																													
21-Sep-12	168	500	500																																													
28-Sep-12	169	500	450																																													
5-Oct-12	170	500	460																																													
12-Oct-12	171	500	465																																													
19-Oct-12	172	500	460																																													
26-Oct-12	173	500	470																																													
2-Nov-12	174	500	465																																													
9-Nov-12	175	500	455																																													
16-Nov-12	176	500	460																																													
23-Nov-12	177	500	480																																													
30-Nov-12	178	500	500	7.35	18	#N/A	3.6	12.5	-2	-0.5	0.031	9.41	0.0753	-0.00002	0.00007	0.00973	-0.00001	-0.000005	-0.05	-0.000005	3.5	-0.0001	-0.000005	0.00088	0.0055	0.000027	-0.0005	0.163	0.00095	-0.01	0.00028	0.000091	-0.002	0.976	-0.00004	0.784	-0.000005	0.096	0.0186	-3	0.000003	0.00029	-0.0005	0.000013	-0.0002	0.0025	-0.0001
7-Dec-12	179	500	470																																													
14-Dec-12	180	500	495																																													
21-Dec-12	181	500	460																																													
28-Dec-12	182	500	475																																													
4-Jan-13	183	500	460																																													
11-Jan-13	184	500	485																																													
18-Jan-13	185	500	475																																													
25-Jan-13	186	500	470																																													
1-Feb-13	187	500	475																																													
8-Feb-13	188	500	460																																													
15-Feb-13	189	500	470																																													
22-Feb-13	190	500	440	7.63	14	#N/A	4.5	11.8	3	-0.5	0.024	6.5	0.0744	-0.00002	0.000064	0.00833	-0.00001	-0.000005	-0.05	-0.000005	2.4	-0.0001	-0.000005	0.0009	0.0089	0.000034	-0.0005	0.121	0.00096	-0.01	0.00015	0.000064	-0.002	0.883	-0.00004	0.662	0.000005	0.118	0.0146	-3	0.000003	-0.0002	-0.0005	0.000006	0.00028	0.00055	-0.0001
1-Mar-13	191	500	475																																													
8-Mar-13	192	500	470																																													
15-Mar-13	193	500	470																																													
22-Mar-13	194	500	445																																													
29-Mar-13	195	500	450																																													
5-Apr-13	196	500	470																																													
12-Apr-13	197	500	475																																													
19-Apr-13	198	500	475																																													
26-Apr-13	199	500	425																																													
3-May-13	200	500	460																																													
10-May-13	201	500	425																																													
17-May-13	202	500	450	7.90	13	#N/A	5.9	11.7	4	-0.5	0.03	6.08	0.14	-0.00002	0.000062	0.00965	-0.00001	-0.000005	-0.05	-0.000005	2.25	-0.0001	0.000006	0.00182	0.0191	0.000043	-0.0005	0.114	0.00142	-0.01	0.00016	0.000085	-0.002	0.932	-0.00004	1	-0.000005	0.119	0.0134	-3	0.000003	-0.0002	0.00077	0.000006	-0.0002	0.00055	-0.0001
24-May-13	203	500	455																																													

May 21/10 Al 0.23, Cu 0.00829 and Fe 0.068. Repeat = 0.273, 0.00863, and 0.077, respectively. Data confirmed, suspect contamination.
Oct 22/10 Sb 0.00019. Repeat = -0.00002.
Nov 5/10 Al 0.172 and Fe 0.038. Repeat = 0.226 and 0.044, respectively. Data confirmed. Suspect contamination.
Feb 4/11 Change in analytical schedule.
April 22/11 Zn 0.0028. Repeat =0.0025, data confirmed suspect contamination
Apr 22/11 Cl 2.0 Cannot repeat, suspect contamination or analytical error.
Jul 15, 2011 F=0.15, Cannot repeat suspect contamination or analytical error

HC 4

CONFIDENTIAL *DRAFT*

Sample = Hole
211 70.79-73.79

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L
3-Jul-09	0	750	340	8.08	203	#N/A	1.2	58.4	7	6.1	1.13	44.8	0.198	0.00018	0.00048	0.0358
10-Jul-09	1	500	455	7.83	123											
17-Jul-09	2	500	450	7.97	84	#N/A	1.3	44.5	10	-0.5	1.01	34.9	0.197	0.00026	0.00045	0.0374
24-Jul-09	3	500	450	7.82	85											
31-Jul-09	4	500	450	7.87	82	#N/A	1.7	40.4	6	-0.5	1.02	39.2	0.21	0.00018	0.00035	0.0467
7-Aug-09	5	500	460	7.69	66											
14-Aug-09	6	500	460	7.73	72	#N/A	2.2	36.3	4	0.9	0.81	37.8	0.141	0.00011	0.00032	0.0508
21-Aug-09	7	500	475	7.87	71											
28-Aug-09	8	500	460	7.84	71	#N/A	1.8	36.9	4	0.5	0.74	36.6	0.197	0.00011	0.0003	0.054
4-Sep-09	9	500	475	7.56	63											
11-Sep-09	10	500	495	7.74	38	#N/A	1.5	25.6	2	0.6	0.42	19.6	0.286	-0.00002	0.00032	0.0276
18-Sep-09	11	500	460	7.76	61											
25-Sep-09	12	500	490	7.81	66	#N/A	2.1	40.2	4	0.5	0.7	34.3	0.151	0.00009	0.00023	0.0557
2-Oct-09	13	500	440	7.60	64											
9-Oct-09	14	500	430	7.63	61	#N/A	3.5	33.9	6	-0.5	0.69	33.3	0.216	0.00006	0.00026	0.0544
16-Oct-09	15	500	405	7.52	65											
23-Oct-09	16	500	450	7.65	60	#N/A	3.2	34.1	2	-0.5	0.65	31.2	0.167	0.00005	0.00018	0.0529
30-Oct-09	17	500	465	7.70	56											
6-Nov-09	18	500	450	7.74	59	#N/A	3.4	32.5	2	-0.5	0.67	30.8	0.204	0.00002	0.00015	0.0519
13-Nov-09	19	500	470	7.61	57											
20-Nov-09	20	500	445	7.73	62	#N/A	3.9	31.5	-2	-0.5	0.61	28.7	0.191	0.00003	0.00014	0.049
27-Nov-09	21	500	450	7.68	62											
4-Dec-09	22	500	465	7.65	63	#N/A	3.1	34.5	2	-0.5	0.64	32.6	0.157	0.00002	0.00012	0.0548
11-Dec-09	23	500	475	7.79	62											
18-Dec-09	24	500	460	7.40	62	#N/A	4.6	32.8	2	-0.5	0.61	29.7	0.18	0.00003	0.00014	0.0574
25-Dec-09	25	500	460	7.64	55											
1-Jan-10	26	500	475	7.85	59	#N/A	1.9	31.9	5	-0.5	0.55	30	0.138	0.00003	0.00011	0.0525
8-Jan-10	27	500	445	7.71	67											
15-Jan-10	28	500	465	7.69	61	#N/A	5.9	31.7	4	-0.5	0.66	30.9	0.174	-0.00002	0.00018	0.055
22-Jan-10	29	500	500	7.55	59											
29-Jan-10	30	500	470	7.45	50	#N/A	4.2	30.6	4	-0.5	0.66	30.5	0.195	0.00003	0.00018	0.0542
5-Feb-10	31	500	445	7.35	43											
12-Feb-10	32	500	440	7.47	56	#N/A	2.6	28.8	5	-0.5	0.61	29.3	0.149	0.00003	0.0001	0.0528
19-Feb-10	33	500	500	7.56	62											
26-Feb-10	34	500	420	7.56	50	#N/A	2.5	29.6	3	-0.5	0.66	29.2	0.199	0.00002	0.0001	0.0498
5-Mar-10	35	500	450	7.44	41											
12-Mar-10	36	500	405	7.47	46	#N/A	3.5	26.8	4	-0.5	0.59	22.5	0.153	-0.00002	0.00009	0.0434
19-Mar-10	37	500	385	7.54	48											
26-Mar-10	38	500	455	7.57	48	#N/A	3.3	26.1	7	-0.5	0.66	23.4	0.154	0.00002	0.0001	0.0428
2-Apr-10	39	500	430	7.56	47											
9-Apr-10	40	500	500	7.54	55	#N/A	2.9	31.1	3	-0.5	0.69	27	0.15	0.00002	0.0002	0.0489
16-Apr-10	41	500	445	7.47	51											
23-Apr-10	42	500	445	7.45	57	#N/A	5.4	29.3	4	-0.5	0.66	26.2	0.166	0.00002	0.00007	0.0505
30-Apr-10	43	500	455	7.56	54											
7-May-10	44	500	425	7.51	52	#N/A	4.1	28.7	3	-0.5	0.57	25.9	0.153	-0.00002	0.00007	0.0492
14-May-10	45	500	430	7.52	48											
21-May-10	46	500	515	7.66	54	#N/A	3.1	29.4	-2	-0.5	0.65	28.9	0.16	0.00003	0.0001	0.0525
28-May-10	47	500	520	7.49	53											
4-Jun-10	48	500	455	7.53	49	#N/A	3.4	26.0	2	-0.5	0.61	23.1	0.169	-0.00002	0.00008	0.0442
11-Jun-10	49	500	440	7.56	50											
18-Jun-10	50	500	460	7.57	47	#N/A	4.3	27.5	3	-0.5	0.68	24.1	0.181	0.00002	0.00012	0.0482
25-Jun-10	51	500	460	7.71	48											
2-Jul-10	52	500	440	7.67	45	#N/A	2.3	28.0	2	-0.5	0.6	20.9	0.178	-0.00002	0.00013	0.0464
9-Jul-10	53	500	455	7.44	42											
16-Jul-10	54	500	450	7.55	46	#N/A	3.4	27.6	6	-0.5	0.59	24.2	0.107	0.00002	0.00008	0.0464
23-Jul-10	55	500	425	7.34	40											
30-Jul-10	56	500	455	7.35	40	#N/A	3.4	23.3	4	-0.5	0.55	19.5	0.137	-0.00002	0.00012	0.0421
6-Aug-10	57	500	450	7.41	47											
13-Aug-10	58	500	470	7.61	44	#N/A	3.8	27.6	2	-0.5	0.56	21.3	0.119	-0.00002	0.00008	0.0462
20-Aug-10	59	500	470	7.50	43											
27-Aug-10	60	500	465	7.64	45	#N/A	2.3	28.4	4	-0.5	0.55	22.2	0.14	-0.00002	0.00003	0.0486
3-Sep-10	61	500	480	7.61	42											
10-Sep-10	62	500	465	7.39	46	#N/A	3.9	27.3	2	-0.5	0.56	21.5	0.108	-0.00002	0.00004	0.0499
17-Sep-10	63	500	455	7.61	39											
24-Sep-10	64	500	445	7.46	32	#N/A	2.9	23.6	6	-0.5	0.66	19.2	0.154	-0.00002	0.00006	0.0423
1-Oct-10	65	500	445	7.49	32											
8-Oct-10	66	500	430	7.48	38	#N/A	2.2	23.2	5	-0.5	0.61	17.6	0.147	-0.00002	0.00004	0.041
15-Oct-10	67	500	455	7.45	43											
22-Oct-10	68	500	440	7.49	41	#N/A	3.1	27.3	4	-0.5	0.61	20.7	0.138	-0.00002	0.00005	0.044
29-Oct-10	69	500	440	7.49	44											
5-Nov-10	70	500	440	7.60	43	#N/A	2.1	28.2	3	-0.5	0.48	22	0.156	-0.00002	0.00005	0.048
12-Nov-10	71	500	450	7.60	37											
19-Nov-10	72	500	445	7.74	46	#N/A	3.3	28.3	-2	-0.5	0.5	21.3	0.122	-0.00002	0.00006	0.0471
26-Nov-10	73	500	440	7.40	47											
3-Dec-10	74	500	455	7.53	47	#N/A	3.7	30.6	4	-0.5	0.63	21	0.189	-0.00002	0.00007	0.0519
10-Dec-10	75	500	445	7.46	48											
17-Dec-10	76	500	440	7.56	42	#N/A	4.4	28.3	2	-0.5	0.55	21.3	0.139	-0.00002	0.00011	0.0446
24-Dec-10	77	500	445	7.60	39											
31-Dec-10	78	500	460	7.56	38	#N/A	5.0	28.8	3	-0.5	0.53	20.1	0.117	-0.00002	0.00004	0.0473
7-Jan-11	79	500	460	7.54	31											
14-Jan-11	80	500	465	7.59	35	#N/A	2.9	29.6	3	-0.5	0.53	21.5	0.134	-0.00002	0.00003	0.0518
21-Jan-11	81	500	465	7.48	38											
28-Jan-11	82	500	490	7.57	32	#N/A	3.9	28.5	3	-0.5	0.48	19.5	0.1	-0.00002	0.00004	0.0471
4-Feb-11	83	500	435													
11-Feb-11	84	500	490													
18-Feb-11	85	500	480													
25-Feb-11	86	500	485													
4-Mar-11	87	500	490													
11-Mar-11	88	500	490													
18-Mar-11	89	500	470													
25-Mar-11	90	500	490													
1-Apr-11	91	500	475													
8-Apr-11	92	500	470													
15-Apr-11	93	500	475													
22-Apr-11	94	500	490	7.58	49	#N/A	2.0	28.2	-2	-0.5	0.48	21.3	0.14	-0.00002	0.00004	0.05
29-Apr-11	95	500	465													
6-May-11	96	500	485													
13-May-11	97	500	460													
20-May-11	98	500	500													
27-May-11	99	500	480													
3-Jun-11	100	500	485													
10-Jun-11	101	500	480													
17-Jun-11	102	500	480													
24-Jun-11	103	500	475													
1-Jul-11	104	500	475													
8-Jul-11	105	500	475													
15-Jul-11	106	500	475	7.64	49	#N/A	5.6	28.7	2	-0.5	0.44	22.6	0.199	-0.00002	0.0001	0.0492
22-Jul-11	107	500	490													
29-Jul-11	108	500	465													

Date	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L
3-Jul-09	-0.00001	-0.000005	-0.05	-0.000005	13.1	-0.0001	0.000031	0.0127	0.004	0.000052	0.0045	2.94	0.00422	-0.01	0.00524	0.00071	0.01	7.79
17-Jul-09	-0.00001	-0.000005	-0.05	0.000007	10	-0.0001	0.000011	0.00192	0.011	0.000113	0.0029	2.39	0.00699	-0.01	0.00258	0.00003	-0.002	5.2
31-Jul-09	-0.00001	-0.000005	-0.05	-0.000005	11.9	-0.0001	0.000007	0.00126	0.014	0.000073	0.0022	2.27	0.00869	-0.01	0.00089	0.00012	0.005	4.06
14-Aug-09	-0.00001	-0.000005	-0.05	-0.000005	11.7	-0.0001	0.000005	0.0014	0.004	0.000021	0.0017	2.09	0.00887	-0.01	0.00049	0.00005	-0.002	3.31
28-Aug-09	-0.00001	-0.000005	-0.05	-0.000005	11.3	-0.0001	0.000007	0.00131	0.008	0.000037	0.0015	2.05	0.00929	0.01	0.0004	-0.00002	-0.002	2.81
11-Sep-09	-0.00001	-0.000005	-0.05	-0.000005	6.2	-0.0001	0.000006	0.00078	0.004	0.000026	-0.0005	0.99	0.00396	-0.01	0.00008	-0.00002	0.002	1.53
25-Sep-09	-0.00001	-0.000005	-0.05	-0.000005	11.1	-0.0001	-0.000005	0.00211	0.004	0.00004	0.0011	1.61	0.00631	0.03	0.00032	0.00013	-0.002	2
9-Oct-09	-0.00001	-0.000005	-0.05	-0.000005	10.8	-0.0001	0.000007	0.00143	0.007	0.000053	0.0009	1.55	0.00522	-0.01	0.0003	-0.00002	0.005	1.95
23-Oct-09	-0.00001	-0.000005	-0.05	-0.000005	10.1	-0.0001	0.000009	0.0019	0.01	0.000246	0.0009	1.45	0.00499	-0.01	0.00027	0.0002	-0.002	1.68
6-Nov-09	-0.00001	-0.000005	-0.05	-0.000005	10.1	-0.0001	-0.000005	0.00092	0.006	0.000026	0.0006	1.37	0.00412	-0.01	0.00022	0.00009	0.003	1.64
20-Nov-09	-0.00001	-0.000005	-0.05	-0.000005	9.49	-0.0001	-0.000005	0.00067	0.005	0.000038	0.0007	1.22	0.00388	-0.01	0.00025	0.00013	0.004	1.48
4-Dec-09	-0.00001	-0.000005	-0.05	-0.000005	11	-0.0001	0.000006	0.00059	0.005	0.00002	0.0006	1.25	0.00392	-0.01	0.00027	0.00007	-0.002	1.53
18-Dec-09	-0.00001	-0.000005	-0.05	-0.000005	10.1	-0.0001	-0.000005	0.00055	0.006	0.000022	0.0007	1.12	0.00405	-0.01	0.00026	0.00007	-0.002	1.41
1-Jan-10	-0.00001	-0.000005	-0.05	-0.000005	10.4	-0.0001	-0.000005	0.00071	0.005	0.000019	-0.0005	0.98	0.00358	-0.01	0.00032	0.00003	-0.002	1.25
15-Jan-10	-0.00001	-0.000005	-0.05	-0.000005	10.7	-0.0001	-0.000005	0.00149	0.004	0.000101	-0.0005	1.01	0.00337	-0.01	0.00039	0.00004	-0.002	1.45
29-Jan-10	-0.00001	-0.000005	-0.05	-0.000005	10.7	-0.0001	0.000006	0.00083	0.008	0.000043	-0.0005	0.9	0.00312	-0.01	0.00037	0.00004	0.003	1.34
12-Feb-10	-0.00001	-0.000005	-0.05	-0.000005	10.3	-0.0001	-0.000005	0.00089	0.005	0.000046	-0.0005	0.84	0.00284	-0.01	0.00035	0.00017	-0.002	1.31
26-Feb-10	-0.00001	-0.000005	-0.05	-0.000005	10.4	-0.0001	-0.000005	0.00052	0.004	0.000021	-0.0005	0.8	0.00239	-0.01	0.0004	0.0002	-0.002	1.37
12-Mar-10	-0.00001	0.000006	-0.05	-0.000005	8.01	-0.0001	0.000006	0.0007	0.007	0.000033	-0.0005	0.61	0.00519	-0.01	0.00028	0.00019	-0.002	1.06
26-Mar-10	-0.00001	-0.000005	-0.05	-0.000005	8.37	-0.0001	-0.000005	0.00069	0.003	0.000024	-0.0005	0.61	0.00194	-0.01	0.00035	0.00015	0.003	1.16
9-Apr-10	-0.00001	-0.000005	-0.05	-0.000005	9.86	-0.0001	-0.000005	0.00077	0.007	0.000027	-0.0005	0.58	0.00169	-0.01	0.00027	0.0001	0.004	1.17
23-Apr-10	-0.00001	0.000014	-0.05	0.000005	9.54	-0.0001	-0.000005	0.00102	0.004	0.00002	-0.0005	0.59	0.00203	-0.01	0.00035	0.00013	-0.002	1.24
7-May-10	-0.00001	-0.000005	-0.05	-0.000005	9.52	-0.0001	-0.000005	0.00118	0.003	0.000022	-0.0005	0.53	0.00222	-0.01	0.00028	0.00012	-0.002	1.23
21-May-10	-0.00001	-0.000005	-0.05	-0.000005	10.7	-0.0001	-0.000005	0.00074	0.002	0.000016	-0.0005	0.54	0.00132	-0.01	0.00032	0.00011	-0.002	1.21
4-Jun-10	-0.00001	-0.000005	-0.05	-0.000005	8.53	-0.0001	-0.000005	0.00081	0.002	0.000022	-0.0005	0.44	0.00141	-0.01	0.00028	0.0001	-0.002	1.05
18-Jun-10	-0.00001	-0.000005	-0.05	-0.000005	8.88	0.0001	-0.000005	0.00093	0.005	0.00002	-0.0005	0.48	0.00165	-0.01	0.00025	0.00019	0.002	1.26
2-Jul-10	-0.00001	-0.000005	-0.05	-0.000005	7.72	-0.0001	-0.000005	0.0007	0.006	0.000045	-0.0005	0.39	0.00162	-0.01	0.00022	0.00006	-0.002	0.96
16-Jul-10	-0.00001	-0.000005	-0.05	-0.000005	9.07	-0.0001	-0.000005	0.001	0.001	0.000017	-0.0005	0.36	0.00175	-0.01	0.0002	0.00013	-0.002	0.98
30-Jul-10	-0.00001	-0.000005	-0.05	-0.000005	7.28	-0.0001	-0.000005	0.00064	0.003	0.000017	-0.0005	0.32	0.00176	-0.01	0.00015	0.00009	-0.002	0.9
13-Aug-10	-0.00001	-0.000005	-0.05	-0.000005	7.96	-0.0001	-0.000005	0.00066	0.002	0.000013	-0.0005	0.36	0.00195	-0.01	0.00016	0.00028	-0.002	0.98
27-Aug-10	-0.00001	-0.000005	-0.05	-0.000005	8.35	0.0001	-0.000005	0.0006	0.003	0.000018	-0.0005	0.33	0.00193	-0.01	0.00014	0.00012	-0.002	1.01
10-Sep-10	-0.00001	-0.000005	-0.05	-0.000005	8.11	-0.0001	0.000005	0.00117	0.003	0.000019	-0.0005	0.3	0.00198	-0.01	0.00015	0.00013	-0.002	0.93
24-Sep-10	-0.00001	-0.000005	-0.05	-0.000005	7.22	-0.0001	-0.000005	0.00071	0.001	0.000041	-0.0005	0.27	0.00159	-0.01	0.00015	0.00011	-0.002	1.05
8-Oct-10	-0.00001	-0.000005	-0.05	-0.000005	6.66	0.0001	-0.000005	0.00036	0.005	0.000091	-0.0005	0.24	0.00166	-0.01	0.00016	0.00015	-0.002	0.94
22-Oct-10	-0.00001	-0.000005	-0.05	-0.000005	7.82	-0.0001	-0.000005	0.00087	-0.001	0.000034	-0.0005	0.27	0.00175	-0.01	0.00016	0.00013	-0.002	1.05
5-Nov-10	-0.00001	-0.000005	-0.05	-0.000005	8.4	-0.0001	-0.000005	0.00081	0.002	0.000019	-0.0005	0.26	0.00173	-0.01	0.00011	0.0001	-0.002	1.09
19-Nov-10	-0.00001	-0.000005	-0.05	-0.000005	8.09	0.0004	0.000007	0.0006	0.003	0.000013	-0.0005	0.26	0.00165	-0.01	0.00008	0.00019	-0.002	0.96
3-Dec-10	-0.00001	-0.000005	-0.05	-0.000005	7.99	-0.0001	-0.000005	0.0005	0.004	0.000118	-0.0005	0.27	0.00171	-0.01	0.00012	-0.00002	-0.002	1.07
17-Dec-10	-0.00001	-0.000005	-0.05	-0.000005	8.14	-0.0001	-0.000005	0.00079	0.002	0.000208	-0.0005	0.24	0.00149	-0.01	0.00014	0.00012	-0.002	0.93
31-Dec-10	-0.00001	0.00004	-0.05	-0.000005	7.68	-0.0001	0.00001	0.00159	0.003	0.000021	-0.0005	0.22	0.00165	-0.01	0.00013	0.00013	-0.002	0.93
14-Jan-11	-0.00001	-0.000005	-0.05	-0.000005	8.23	-0.0001	-0.000005	0.00052	0.003	0.000021	-0.0005	0.23	0.00209	-0.01	0.00007	-0.00002	-0.002	0.93
28-Jan-11	-0.00001	-0.000005	-0.05	-0.000005	7.52	-0.0001	-0.000005	0.00054	0.001	0.000008	-0.0005	0.19	0.00228	-0.01	0.00012	0.0001	-0.002	0.81
22-Apr-11	-0.00001	-0.000005	-0.05	0.000005	8.26	-0.0001	-0.000005	0.00046	0.002	0.000037	-0.0005	0.15	0.00167	-0.01	0.00018	0.00011	0.002	0.95
15-Jul-11	-0.00001	-0.000005	-0.05	-0.000005	8.84	-0.0001	-0.000005	0.00034	0.002	0.000025	-0.0005	0.12	0.0017	-0.01	0.00014	-0.00002	-0.002	0.9

Date	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
3-Jul-09	0.00148	1.93	-0.000005	19.6	0.242	-3	0.00001	0.00043	-0.0005	0.000138	0.0037	0.0016	-0.0001
17-Jul-09	0.00129	2.39	-0.000005	5.38	0.191	3	0.000005	0.00006	0.0011	0.00138	0.0049	0.0011	-0.0001
31-Jul-09	0.00114	2.51	-0.000005	1.93	0.195	4	0.000004	0.0001	0.0008	0.00117	0.0037	0.0004	-0.0001
14-Aug-09	0.00099	1.97	-0.000005	1.05	0.188	4	0.000003	0.00022	-0.0005	0.000969	0.003	0.0002	-0.0001
28-Aug-09	0.00093	2.14	-0.000005	0.78	0.185	-3	0.000004	0.00002	0.0008	0.000796	0.0033	0.0003	-0.0001
11-Sep-09	0.00063	1.47	-0.000005	0.32	0.0942	-3	0.000002	0.00002	-0.0005	0.00027	0.0035	0.0003	-0.0001
25-Sep-09	0.00071	1.97	-0.000005	0.54	0.161	-3	0.000004	-0.00001	0.0006	0.000554	0.0027	0.0004	-0.0001
9-Oct-09	0.00061	1.91	-0.000005	0.51	0.151	-3	0.000002	0.00001	-0.0005	0.000421	0.0031	0.0005	-0.0001
23-Oct-09	0.00051	1.64	-0.000005	0.45	0.145	-3	0.000003	-0.00001	0.0008	0.000386	0.0024	0.003	-0.0001
6-Nov-09	0.00044	1.7	-0.000005	0.39	0.139	-3	-0.000002	-0.00001	0.0008	0.00032	0.0027	0.0005	-0.0001
20-Nov-09	0.00037	1.44	-0.000005	0.37	0.13	-3	0.000002	0.00001	0.0008	0.000259	0.0023	0.0003	-0.0001
4-Dec-09	0.00034	1.48	-0.000005	0.31	0.14	-3	0.000002	0.00018	0.0008	0.000266	0.0019	0.0002	-0.0001
18-Dec-09	0.00032	1.53	-0.000005	0.32	0.132	-3	-0.000002	-0.00001	-0.0005	0.000245	0.0017	-0.0001	-0.0001
1-Jan-10	0.00027	1.26	-0.000005	0.25	0.116	-3	0.000004	-0.00001	-0.0005	0.000251	0.0015	0.0004	-0.0001
15-Jan-10	0.00027	1.31	-0.000005	0.29	0.12	-3	0.000003	-0.00001	0.0007	0.000204	0.0018	0.0008	-0.0001
29-Jan-10	0.00028	1.39	-0.000005	0.26	0.12	-3	0.000003	0.00014	0.001	0.000233	0.0016	0.0002	-0.0001
12-Feb-10	0.00023	1.33	-0.000005	0.27	0.11	-3	0.000003	-0.00001	0.0007	0.000166	0.0014	0.0009	-0.0001
26-Feb-10	0.00036	1.58	-0.000005	0.31	0.105	-3	0.000002	0.00004	-0.0005	0.000147	0.0017	0.0021	-0.0001
12-Mar-10	0.00017	1.07	-0.000005	0.22	0.0855	-10	0.000004	0.00001	-0.0005	0.000118	0.0013	0.0004	-0.0001
26-Mar-10	0.00016	1.01	0.000012	0.26	0.0895	-2	0.000004	0.00001	-0.0005	0.000123	0.0015	0.0004	-0.0001
9-Apr-10	0.00018	1.25	-0.000005	0.25	0.093	-10	-0.000002	0.00002	0.0006	0.000141	0.0014	0.0006	-0.0001
23-Apr-10	0.0002	1.28	-0.000005	0.3	0.0958	-10	-0.000002	-0.00001	-0.0005	0.000149	0.0013	0.0006	-0.0001
7-May-10	0.00013	1.21	-0.000005	0.26	0.0856	-10	-0.000002	-0.00001	-0.0005	0.000119	0.0014	0.0005	-0.0001
21-May-10	0.00018	1.35	-0.000005	0.28	0.096	-10	-0.000002	0.00003	-0.0005	0.000148	0.0015	0.0004	-0.0001
4-Jun-10	0.00014	1.25	-0.000005	0.27	0.0715	-10	0.000002	-0.00001	-0.0005	0.000101	0.0014	0.0002	-0.0001
18-Jun-10	0.00015	1.34	-0.000005	0.32	0.0755	-10	-0.000002	0.00001	-0.0005	0.000122	0.0015	0.0006	-0.0001
2-Jul-10	0.00014	1.04	-0.000005	0.25	0.0728	-10	0.000002	-0.00001	-0.0005	0.00011	0.0011	0.0004	-0.0001
16-Jul-10	0.00013	1.17	-0.000005	0.25	0.0726	-10	0.000002	0.00003	-0.0005	0.00011	0.0011	0.0001	-0.0001
30-Jul-10	0.00011	1.01	-0.000005	0.24	0.0595	-10	0.000004	-0.00001	0.0005	0.0001	0.0012	0.0001	-0.0001
13-Aug-10	0.0001	0.878	-0.000005	0.26	0.0651	-10	0.000003	-0.00001	-0.0005	0.000112	0.0011	0.0002	-0.0001
27-Aug-10	0.00025	1.14	-0.000005	0.26	0.0663	-10	0.000003	-0.00001	-0.0005	0.000092	0.0011	0.0005	-0.0001
10-Sep-10	0.00009	0.908	-0.000005	0.23	0.063	-10	-0.000002	0.00002	-0.0005	0.000082	0.0005	-0.0001	-0.0001
24-Sep-10	0.0001	1.05	-0.000005	0.26	0.0547	-10	0.000004	-0.00001	-0.0005	0.000082	0.0015	0.0002	-0.0001
8-Oct-10	0.00007	1.04	-0.000005	0.23	0.0526	-10	0.000003	-0.00001	-0.0005	0.000078	0.0012	-0.0001	-0.0001
22-Oct-10	0.00007	1.03	-0.000005	0.27	0.0545	-10	0.000003	-0.00001	-0.0005	0.000083	0.0012	0.0004	-0.0001
5-Nov-10	0.00008	1.14	-0.000005	0.25	0.0582	-10	0.000003	-0.00001	-0.0005	0.000085	0.0013	0.0002	-0.0001
19-Nov-10	0.00007	0.99	-0.000005	0.28	0.0569	-10	0.000004	-0.00001	-0.0005	0.000097	0.0009	0.0001	-0.0001
3-Dec-10	0.00008	1.09	-0.000005	0.24	0.0617	-10	0.000003	-0.00001	0.0015	0.000112	0.0014	0.0002	-0.0001
17-Dec-10	0.00008	0.945	-0.000005	0.23	0.0499	-10	0.000002	-0.00001	-0.0005	0.000162	0.0011	0.0003	-0.0001
31-Dec-10	0.00006	0.878	0.00001	0.2	0.0528	-10	0.000003	-0.00001	-0.0005	0.00008	0.0009	0.0004	0.0008
14-Jan-11	0.00007	0.918	-0.000005	0.21	0.0549	-10	0.000002	-0.00001	-0.0005	0.000065	0.0008	0.0001	-0.0001
28-Jan-11	0.00005	0.785	-0.000005	0.17	0.0467	-10	0.000003	-0.00001	-0.0005	0.000064	0.0007	-0.0001	-0.0001
22-Apr-11	0.00006	0.836	-0.000005	0.18	0.0436	-10	-0.000002	0.00001	-0.0005	0.000066	0.0009	#N/A	-0.0001
15-Jul-11	0.00006	0.955	-0.000005	0.14	0.0402	-10	0.000002	0.00006	-0.0005	0.000062	0.0009	-0.0001	-0.0001

HC 4

CONFIDENTIAL *DRAFT*

Sample = Hole 211 70.79-73.79

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
5-Aug-11	109	500	460																																												
12-Aug-11	110	500	475																																												
19-Aug-11	111	500	470																																												
26-Aug-11	112	500	480																																												
2-Sep-11	113	500	470																																												
9-Sep-11	114	500	480																																												
16-Sep-11	115	500	465																																												
23-Sep-11	116	500	455																																												
30-Sep-11	117	500	455																																												
7-Oct-11	118	500	460	7.56	44	#N/A	5.4	27.8	-2	-0.5	0.39	22.6	0.182	-0.00002	0.00005	0.0472	-0.00001	-0.000005	-0.05	-0.000005	8.85	-0.0001	-0.000005	0.00043	0.002	0.00002	-0.0005	0.11	0.00212	-0.01	0.00012	0.00003	-0.002	0.94	0.00005	0.948	-0.000005	0.17	0.0329	-10	0.000003	0.0002	-0.0005	0.000055	0.0008	0.0001	-0.0001
14-Oct-11	119	500	505																																												
21-Oct-11	120	500	470																																												
28-Oct-11	121	500	465																																												
4-Nov-11	122	500	475																																												
11-Nov-11	123	500	470																																												
18-Nov-11	124	500	470																																												
25-Nov-11	125	500	475																																												
2-Dec-11	126	500	470																																												
9-Dec-11	127	500	495																																												
16-Dec-11	128	500	495																																												
23-Dec-11	129	500	470																																												
30-Dec-11	130	500	465	7.72	49	#N/A	4.3	35.3	2	-0.5	0.38	26.3	0.163	-0.00002	0.00009	0.0549	-0.00001	-0.000005	-0.05	0.000024	10.3	-0.0001	-0.000005	0.00041	0.002	0.000016	-0.0005	0.11	0.00312	-0.01	0.00012	-0.00002	-0.002	1.04	-0.00004	0.869	-0.000005	0.14	0.034	-10	0.000004	0.00022	-0.0005	0.000057	0.0007	0.0002	-0.0001
6-Jan-12	131	500	475																																												
13-Jan-12	132	500	465																																												
20-Jan-12	133	500	460																																												
27-Jan-12	134	500	480																																												
3-Feb-12	135	500	460																																												
10-Feb-12	136	500	480																																												
17-Feb-12	137	500	475																																												
24-Feb-12	138	500	465																																												
2-Mar-12	139	500	470																																												
9-Mar-12	140	500	470																																												
16-Mar-12	141	500	480																																												
23-Mar-12	142	500	470	7.65	45	#N/A	5.3	28.9	2	-0.5	0.29	21.5	0.11	-0.00002	0.00003	0.0489	-0.00001	-0.000005	-0.05	-0.000005	8.46	-0.0001	-0.000005	0.00102	-0.001	#N/A	-0.0005	0.08	0.00415	-0.01	0.00011	0.00012	-0.002	0.83	-0.00004	0.61	-0.000005	0.14	0.0244	-10	0.000005	-0.0002	-0.0005	0.000041	0.0004	0.0005	-0.0001
30-Mar-12	143	500	480																																												
6-Apr-12	144	500	460																																												
13-Apr-12	145	500	495																																												
20-Apr-12	146	500	485																																												
27-Apr-12	147	500	450																																												
4-May-12	148	500	485																																												
11-May-12	149	500	460																																												
18-May-12	150	500	465																																												
25-May-12	151	500	475																																												
1-Jun-12	152	500	465																																												
8-Jun-12	153	500	470																																												
15-Jun-12	154	500	495	7.53	52	#N/A	3.3	28.6	4	0.87	0.3	20.3	0.145	-0.00002	5.7E-05	0.0479	-0.00001	-0.000005	-0.05	-0.000005	8	-0.0001	-0.000005	0.00038	-0.001	0.0000051	-0.0005	0.071	0.00356	-0.01	0.00019	-0.00002	-0.002	0.842	4.4E-05	0.724	-0.000005	0.12	0.0238	-10	0.0000034	-0.0002	-0.0005	0.0000497	0.00062	0.00016	-0.0001
22-Jun-12	155	500	455																																												
29-Jun-12	156	500	470																																												
6-Jul-12	157	500	480																																												
13-Jul-12	158	500	485																																												
20-Jul-12	159	500	475																																												
27-Jul-12	160	500	485																																												
3-Aug-12	161	500	465																																												
10-Aug-12	162	500	475																																												
17-Aug-12	163	500	455																																												
24-Aug-12	164	500	465																																												
31-Aug-12	165	500	470																																												
7-Sep-12	166	500	470	7.45	45	#N/A	4.3	26.7	4	-0.5	0.25	21.7	0.18	-0.00002	0.0001	0.0464	-0.00001	-0.000005	-0.05	0.000006	8.56	-0.0001	-0.000005	0.0006	0.0043	#N/A	-0.0005	0.075	0.00351	-0.01	0.00015	0.000073	0.0022	0.847	-0.00004	0.742	-0.000005	0.166	0.0233	-10	0.000004	0.00029	-0.0005	0.00004	0.00054	0.00091	-0.0001
14-Sep-12	167	500	490																																												
21-Sep-12	168	500	465																																												
28-Sep-12	169	500	445																																												
5-Oct-12	170	500	465																																												
12-Oct-12	171	500	465																																												
19-Oct-12	172	500	470																																												
26-Oct-12	173	500	465																																												
2-Nov-12	174	500	450																																												
9-Nov-12	175	500	480																																												
16-Nov-12	176	500	465																																												
23-Nov-12	177	500	495																																												
30-Nov-12	178	500	500	7.44	43	#N/A	3.8	26.0	3	-0.5	0.2	20.8	0.176	-0.00002	0.00015	0.041	-0.00001	-0.000005	-0.05	0.000007	8.2	-0.0001	-0.000005	0.00062	0.0026	0.00002	-0.0005	0.066	0.00279	-0.01	0.0002	0.000065	-0.002	0.779	6.3E-05	0.718	-0.000005	0.129	0.0201	-3	0.000004	-0.0002	-0.0005	0.000046	0.00066	0.00137	-0.0001
7-Dec-12	179	500	488																																												
14-Dec-12	180	500	485																																												
21-Dec-12	181	500	470																																												
28-Dec-12	182	500	435																																												
4-Jan-13	183	500	450																																												
11-Jan-13	184	500	470																																												
18-Jan-13	185	500	485																																												
25-Jan-13	186	500	460																																												
1-Feb-13	187	500	430																																												
8-Feb-13	188	500	460																																												
15-Feb-13	189	500	440																																												
22-Feb-13	190	500	430	7.68	33	#N/A	5.3	22.8	5	-0.5	0.15	15.3	0.0927	-0.00002	0.00013	0.0376	-0.00001	-0.000005	-0.05	-0.000005	6.01	-0.0001	0.000006	0.00036	0.0023	0.00002	-0.0005	0.064	0.00336	-0.01	0.00013	0.000183	-0.002	0.717	7.2E-05	0.474	-0.000005	0.147	0.0167	-3	0.000005	-0.0002	-0.0005	0.000029	0.0004	0.00017	-0.0001
1-Mar-13	191	500	435																																												
8-Mar-13	192	500	450																																												
15-Mar-13	193	500	455																																												
22-Mar-13	194	500	435																																												
29-Mar-13	195	500	425																																												
5-Apr-13	196	500	435																																												
12-Apr-13	197	500	460																																												
19-Apr-13	198	500	435																																												
26-Apr-13	199	500	410																																												
3-May-13	200	500	430																																												
10-May-13	201	500	415																																												
17-May-13	202	500	445	7.54	30	#N/A	7.6	17.9	4	-0.5	0.13	15.3	0.078	-0.00002	3.1E-05	0.0314	-0.00001	-0.000005	-0.05	-0.000005	6.11	-0.0001	-0.000005	0.00036	0.0018	0.000008	-0.0005	-0.05	0.00247	-0.01	0.00011	0.000039	-0.002	0.654	-0.00004	0.529	-0.000005	0.09	0.014	-3	0.000003	-0.0002	-0.0005	0.000029	0.00023	-0.0001	-0.0001
24-May-13	203	500	405																																												

Oct 22/10 Sb 0.00016. Repeat = -0.00002.
Dec 31/10 Bi 0.00004. Repeat = 0.000037. Data confirmed.
Feb 4/11 Change in analytical schedule.
April 22/11 Zn 0.0008. Repeat =0.0009, data confirmed suspect contamination
July 15/11 F 1.6. Repeat =0.44, data confirmed
Mar 23/12 Pb=0.000137, repeat=0.000139. Data confirmed, suspect contamination
Sept 7/12 Pb=0.000306, repeat confirms original result, data removed suspect contamination

HC 5

CONFIDENTIAL *DRAFT*

Sample =
09SWC506 30-33

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L
18-Mar-11	0	500	340	7.45	80	#N/A	2.4	25.3	5	3.2	0.14	25.4	0.215	0.00003	0.00148	0.00451	-0.00001	-0.000005	-0.05	0.000007	8.96	-0.0001	0.000024	0.00119	0.001	0.000025	-0.0005	0.73	0.00289	-0.01	0.00457	0.00016	0.007
25-Mar-11	1	500	520	7.64	88																												
1-Apr-11	2	500	525	7.66	51	#N/A	5.0	27.9	4	0.9	0.24	16.9	0.101	0.00003	0.00076	0.00307	-0.00001	-0.000005	-0.05	-0.000005	5.88	-0.0001	0.000013	0.00098	0.004	0.000021	-0.0005	0.54	0.00228	-0.01	0.00313	0.00017	-0.002
8-Apr-11	3	500	525	7.57	36																												
15-Apr-11	4	500	480	7.43	24	#N/A	2.0	14.3	-2	-0.5	0.15	10.7	0.0849	0.00002	#N/A	0.00238	-0.00001	-0.000005	-0.05	-0.000005	3.61	-0.0001	0.000008	0.00041	0.003	0.000028	-0.0005	0.4	0.0019	-0.01	0.00079	0.00039	-0.002
22-Apr-11	5	500	455	7.61	31																												
29-Apr-11	6	500	485	7.56	23	#N/A	3.2	14.8	4	-0.5	0.08	9.1	0.0825	0.00003	0.00098	0.002	-0.00001	-0.000005	-0.05	0.000006	3.13	-0.0001	-0.000005	0.00043	0.004	0.000025	-0.0005	0.32	0.00149	-0.01	0.00039	0.00009	-0.002
6-May-11	7	500	455	7.39	22																												
13-May-11	8	500	475	7.31	21	#N/A	2.9	13.3	4	-0.5	0.07	8.7	0.0808	-0.00002	0.00071	0.00274	-0.00001	-0.000005	-0.05	-0.000005	2.96	-0.0001	-0.000005	0.00046	0.001	0.000018	-0.0005	0.32	0.00133	-0.01	0.00025	0.00008	-0.002
20-May-11	9	500	450	7.20	24																												
27-May-11	10	500	460	7.51	22	#N/A	4.9	13.9	3	1.3	0.07	9.1	0.0895	-0.00002	0.00081	0.00184	-0.00001	-0.000005	-0.05	-0.000005	3.12	-0.0001	-0.000005	0.00037	0.002	0.000015	-0.0005	0.33	0.00128	-0.01	0.00021	-0.00002	-0.002
3-Jun-11	11	500	430	7.09	24																												
10-Jun-11	12	500	460	7.38	27	#N/A	2.3	16.0	3	0.7	0.07	10.7	0.106	0.00002	0.00085	0.00327	-0.00001	-0.000005	-0.05	0.000007	3.64	-0.0001	-0.000005	0.00042	0.004	0.000031	-0.0005	0.38	0.00115	-0.01	0.00016	0.00009	-0.002
17-Jun-11	13	500	450	7.11	25																												
24-Jun-11	14	500	465	7.36	25	#N/A	2.2	15.7	2	0.7	0.04	11.9	0.124	-0.00002	0.00066	0.00389	-0.00001	-0.000005	-0.05	-0.000005	4.09	-0.0001	-0.000005	0.0007	0.007	0.000039	-0.0005	0.4	0.00113	-0.01	0.00017	-0.00002	-0.002
1-Jul-11	15	500	450	7.54	23																												
8-Jul-11	16	500	445	7.23	25	#N/A	2.9	13.5	2	-0.5	0.03	10.1	0.104	-0.00002	0.00049	0.00274	-0.00001	-0.000005	-0.05	-0.000005	3.54	0.0001	0.000006	0.00055	0.005	0.000032	-0.0005	0.31	0.00055	-0.01	0.0001	0.00017	-0.002
15-Jul-11	17	500	430	7.67	26																												
22-Jul-11	18	500	455	7.21	24	#N/A	3.6	13.5	-2	0.8	0.04	10.3	0.107	-0.00002	0.00053	0.00432	-0.00001	-0.000005	-0.05	-0.000005	3.5	0.0002	0.000009	0.00047	0.005	0.000029	-0.0005	0.39	0.00055	-0.01	0.00011	#N/A	-0.002
29-Jul-11	19	500	445	7.11	23																												
5-Aug-11	20	500	440	7.31	24	#N/A	3.0	13.6	-2	-0.5	0.03	9.8	0.125	-0.00002	0.00053	0.00347	-0.00001	-0.000005	-0.05	-0.000005	3.35	0.0002	-0.000005	0.00024	0.005	0.00003	-0.0005	0.36	0.00028	-0.01	0.00009	-0.00002	-0.002
12-Aug-11	21	500	450	7.10	25																												
19-Aug-11	22	500	445	7.01	23	#N/A	3.8	12.2	-2	0.6	0.03	9.1	0.113	0.00002	0.00051	0.00321	-0.00001	-0.000005	-0.05	-0.000005	3.14	0.0001	0.000008	0.00059	0.006	0.000035	-0.0005	0.3	0.00037	-0.01	0.00009	#N/A	-0.002
26-Aug-11	23	500	440	7.17	22																												
2-Sep-11	24	500	450	7.17	21	#N/A	3.7	12.4	5	0.6	0.03	-10	0.11	-0.00002	0.0005	0.0027	-0.00001	-0.000005	-0.05	-0.000005	2.99	-0.0001	0.000014	0.00025	0.004	0.000028	-0.0005	0.28	0.00054	-0.01	0.00012	0.00008	-0.002
9-Sep-11	25	500	445	7.00	23																												
16-Sep-11	26	500	470	6.98	25	#N/A	4.1	14.8	-2	0.8	0.03	10.3	0.0984	-0.00002	0.00043	0.00302	-0.00001	-0.000005	-0.05	-0.000005	3.68	-0.0001	0.000006	0.00017	0.004	0.000018	-0.0005	0.28	0.00017	-0.01	0.00009	-0.00002	-0.002
23-Sep-11	27	500	450	7.00	23																												
30-Sep-11	28	500	465	7.12	23	#N/A	2.7	13.5	-2	0.6	0.03	10.2	0.0812	-0.00002	0.00043	0.00292	-0.00001	-0.000005	-0.05	0.000006	3.61	-0.0001	0.000005	0.00014	0.002	0.000021	-0.0005	0.27	0.00016	-0.01	-0.00005	-0.00002	-0.002
7-Oct-11	29	500	460	7.52	21																												
14-Oct-11	30	500	445	7.18	24	#N/A	3.0	14.2	-2	-0.5	0.04	10.7	0.104	-0.00002	0.00045	0.00346	-0.00001	-0.000005	-0.05	-0.000005	3.8	-0.0001	-0.000005	0.00025	0.002	0.000017	-0.0005	0.29	0.00013	-0.01	0.00007	0.00003	-0.002
21-Oct-11	31	500	475	7.39	24																												
28-Oct-11	32	500	475	7.18	25	#N/A	3.5	14.7	-2	-0.5	0.03	11	0.104	-0.00002	0.00041	0.00338	-0.00001	0.000015	-0.05	-0.000005	3.94	0.0001	-0.000005	0.00089	0.005	0.00003	-0.0005	0.29	0.00017	-0.01	0.00009	0.00016	-0.002
4-Nov-11	33	500	465	7.32	23																												
11-Nov-11	34	500	460	6.99	21	#N/A	5.3	13.9	-2	-0.5	0.02	9.8	0.104	0.00002	0.00043	0.00333	-0.00001	-0.000005	-0.05	#N/A	3.5	-0.0001	-0.000005	0.00044	0.004	#N/A	-0.0005	0.26	0.00037	-0.01	0.00008	0.00004	-0.002
18-Nov-11	35	500	475	7.45	28																												
25-Nov-11	36	500	490	7.62	24	#N/A	3.0	16.3	-2	-0.5	0.023	10.2	0.0871	-0.00002	0.00037	0.00305	-0.00001	-0.000005	-0.05	-0.000005	3.69	-0.0001	-0.000005	0.00061	0.006	0.000025	-0.0005	0.24	0.00034	-0.01	0.0001	0.00015	-0.002
2-Dec-11	37	500	465	7.64	26																												
9-Dec-11	38	500	485	6.99	23	#N/A	4.9	13.5	2	-0.5	0.015	9.9	0.0715	-0.00002	0.00029	0.00314	-0.00001	-0.000005	-0.05	-0.000005	3.57	0.0001	-0.000005	0.0006	0.003	0.000023	-0.0005	0.23	0.00017	-0.01	0.00008	0.0001	-0.002
16-Dec-11	39	500	465	7.37	25																												
23-Dec-11	40	500	455	7.06	20	#N/A	3.9	13.4	3	-0.5	0.02	9.3	0.0784	-0.00002	0.00028	0.00367	-0.00001	-0.000005	-0.05	-0.000005	3.34	#N/A	0.000015	0.00054	0.004	0.000034	-0.0005	0.23	0.00071	-0.01	-0.00005	0.00023	-0.002
30-Dec-11	41	500	475	6.69	18																												
6-Jan-12	42	500	465	6.83	18	#N/A	3.5	11.7	2	-0.5	0.018	8	0.0843	-0.00002	0.00032	0.00319	-0.00001	-0.000005	-0.05	-0.000005	2.89	-0.0001	-0.000005	0.00021	0.004	0.000021	-0.0005	0.19	0.00021	-0.01	-0.00005	0.00002	-0.002
13-Jan-12	43	500	485	6.73	22																												
20-Jan-12	44	500	460	7.24	20	#N/A	2.4	13.9	-2	-0.5	0.024	8.3	0.0635	-0.00002	0.00035	0.00299	-0.00001	-0.000005	-0.05	-0.000005	3.01	0.0002	0.000012	0.00053	0.006	0.00005	-0.0005	0.18	0.00033	-0.01	0.00006	0.00019	-0.002
27-Jan-12	45	500	475	6.77	18																												
3-Feb-12	46	500	480	6.75	18	#N/A	5.5	12.1	2	-0.5	0.024	8.4	0.0808	-0.00002	0.0003	0.00251	-0.00001	-0.000005	-0.05	0.000021	3.08	0.0001	-0.000005	0.00028	0.003	0.000036	-0.0005	0.18	0.0002	-0.01	0.00008	0.00007	0.003
10-Feb-12	47	500	465	6.62	19																												
17-Feb-12	48	500	470	7.09	20	#N/A	2.6	11.6	-2	0.5	0.02	9.1	0.0829	-0.00002	0.00036	0.00289	-0.00001	-0.000005	-0.05	-0.000005	3.35	-0.0001	-0.000005	0.0002	0.003	0.00001	-0.0005	0.19	0.0006	-0.01	0.00006	0.00017	-0.002
24-Feb-12	49	500	455	6.78	20																												
2-Mar-12	50	500	465	6.62	19	#N/A	6.5	12.4	-2	-0.5	0.018	8.2	0.0759	-0.00002	0.00032	0.00391	-0.00001	-0.000005	-0.05	#N/A	2.98	-0.0001	0.000034	#N/A	0.01	#N/A	-0.0005	0.18	0.00109	-0.01	0.00006	0.00009	#N/A
9-Mar-12	51	500	475	6.67	17																												
16-Mar-12	52	500	465	7.15	18	#N/A	2.9	10.4	-2	-0.5	0.018	7.7	0.078	-0.00002	0.00028	0.00289	-0.00001	-0.000005	-0.05	-0.000005	2.83	-0.0001	0.00001	0.00071	0.003	0.000024	-0.0005	0.15	0.00022	-0.01	0.00006	0.00019	-0.002
23-Mar-12	53	500	480	6.61	17																												
30-Mar-12	54	500	465	6.79	15	#N/A	3.9	10.1	-2	-0.5	0.018	7.3	0.064	-0.00002	0.00019	0.00341	-0.00001	-0.000005	-0.05	-0.000005	2.7	-0.0001	-0.000005	0.00028	0.004	0.000028	-0.0005	0.13	0.00025	-0.01	-0.00005	0.00003	-0.002
6-Apr-12	55	500	465	6.85	15																												
13-Apr-12	56	500	465	7.04	14	#N/A	2.3	8.8	2	-0.5	0.015	6.3	0.0588	-0.00002	0.0003	0.00341	-0.00001	-0.000005	-0.05	#N/A	2.32	-0.0001	0.000008	0.00017	0.002	0.00001	-0.0005	0.11	0.00024	-0.01	0.00006	0.00009	-0.002
20-Apr-12	57	500	470	6.80	15																												
27-Apr-12	58	500	465	6.62	12	#N/A	4.4	7.8	2	-0.5	0.013	5.6	0.052	-0.00002	0.0003	0.00252	-0.00001	-0.000005	-0.05	-0.000005	2.08	0.00011	-0.000005	0.00038	0.0022	0.000016	-0.0005	0.1	0.00026	-0.01	-0.00005	#N/A	-0.002
4-May-12	59	500	470	6.50	16																												
11-May-12	60	500	475	6.96	11	#N/A	3.1	6.8	2	-0.5	0.018	5.07	0.0431	-0.00002	0.00038	0.00253	-0.00001	-0.000005	-0.05	-0.000005	1.89	0.00012	0.000033	0.00085	0.0022	0.000032	-0.0005	0.083	0.00056	-0.01	0.000084	#N/A	-0.002
18-May-12	61	500	470	6.75	14																												
25-May-12	62	500	480	6.75	11	#N/A	3.4	7.4	2	-0.5	0.016	5.36	0.0722	-0.00002	0.00035	0.00284	-0.00001	-0.000005	-0.05	-0.000005	1.98	-0.0001	0.0000101	0.00018	0.0068	0.00005	-0.0005	0.104	0.00041	-0.01	-0.00005	0.000041	-0.002
1-Jun-12	63	500	515	6.67	12																												
8-Jun-12	64	500	450	6.93	7	#N/A	3.3	6.4	3	0.7	0.011	3.9	0.0355	-0.00002	0.0002	0.0021	-0.00001	-0.000005	-0.05	0.0000147	1.44	-0.0001	-0.000005	0.00349	0.0017	0.00162	-0.0005	0.071	0.00035	-0.01	-0.00005	0.000092	0.0028
15-Jun-12	65	500	480	6.67	11																												
22-Jun-12	66	500	430	6.69	10	#N/A	4.2	6.7	2	-0.5	0.015	4.54	0.0839	-0.00002	0.00047	0.00288	-0.00001	-0.000005	-0.05	-0.000005	1.67	-0.0001	0.0000061	0.00023	0.0049	0.0000304	-0.0005	0.09	0.00024	-0.01	0.000146	0.00004	-0.002
29-Jun-12	67	500	450	6.55	8																												
6-Jul-12	68	500	450	6.85	8	#N/A	4.2	6.1	2	-0.5	0.013	3.72	0.0615	-0.00002	0.00052	0.00235	-0.00001	-0.000005	-0.05	-0.000005	1.39	-0.0001	-0.000005	0.00017	0.0027	0.0000141	-0.0005	0.064	0.00038	-0.01	0.000059	0.000026	-0.002
13-Jul-12	69	500	470	6.75	13																												
20-Jul-12	70	500	470	6.98	13	#N/A	4.1	9.3	2	-0.5	0.013	6	#N/A	-0.00002	0.0004	0.00246	-0.00001	-0.000005	-0.05	-0.000005	2.23	-0.0001	0.0000077	0.00039	0.0042	0.0000295	-0.0005	0.106	0.00014	-0.01	-0.00005	0.000112	-0.002

HC 5

Sample =
09SWC506 30-33

Date	Cycle No.	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	2.31	-0.00004	1.33	-0.000005	4.55	0.0769	-10	-0.000002	0.00004	-0.0005	0.000012	0.0006	0.0002	-0.0001
25-Mar-11	1														
1-Apr-11	2	1.51	-0.00004	1.58	-0.000005	2.57	0.054	-10	-0.000002	0.00023	-0.0005	0.000059	0.0008	0.0005	-0.0001
8-Apr-11	3														
15-Apr-11	4	1.26	-0.00004	1.29	-0.000005	1.37	0.042	-10	-0.000002	0.00015	-0.0005	#N/A	0.0009	0.0004	-0.0001
22-Apr-11	5														
29-Apr-11	6	1.04	-0.00004	1.33	-0.000005	0.85	0.0297	-10	-0.000002	0.00011	-0.0005	0.000055	0.0008	0.0002	-0.0001
6-May-11	7														
13-May-11	8	1.08	-0.00004	1.22	-0.000005	0.6	0.0291	-10	0.000002	0.00009	-0.0005	0.000038	0.0008	0.0002	-0.0001
20-May-11	9														
27-May-11	10	1.06	-0.00004	1.25	0.000006	0.45	0.0308	-10	-0.000002	0.00008	-0.0005	0.000041	0.0008	0.0002	-0.0001
3-Jun-11	11														
10-Jun-11	12	1.26	-0.00004	1.19	0.000007	0.39	0.0419	-10	0.000002	0.00008	-0.0005	0.000061	0.0009	0.0001	-0.0001
17-Jun-11	13														
24-Jun-11	14	1.36	-0.00004	1.38	-0.000005	0.38	0.0384	-10	-0.000002	0.00008	0.0005	0.000036	0.0008	0.0003	-0.0001
1-Jul-11	15														
8-Jul-11	16	1.15	-0.00004	1.15	0.000007	0.31	0.0353	-10	-0.000002	0.00004	0.0005	0.000029	0.0007	0.0017	-0.0001
15-Jul-11	17														
22-Jul-11	18	1.28	-0.00004	1.01	-0.000005	0.31	0.0364	-10	-0.000002	0.00006	-0.0005	0.000028	0.0007	0.0004	-0.0001
29-Jul-11	19														
5-Aug-11	20	1.3	-0.00004	1.02	0.000016	0.27	0.0348	-10	-0.000002	0.00004	-0.0005	0.000024	0.0008	0.0003	-0.0001
12-Aug-11	21														
19-Aug-11	22	1.31	-0.00004	0.885	0.000007	0.32	0.033	-10	-0.000002	0.00003	0.0005	0.000018	0.0007	0.0005	-0.0001
26-Aug-11	23														
2-Sep-11	24	1.15	-0.00004	0.95	-0.000005	0.27	0.0308	-10	-0.000002	0.00004	-0.0005	0.00002	0.0009	0.0004	-0.0001
9-Sep-11	25														
16-Sep-11	26	1.2	-0.00004	0.984	-0.000005	0.14	0.0345	-10	-0.000002	0.00004	-0.0005	0.000024	0.0009	0.0003	-0.0001
23-Sep-11	27														
30-Sep-11	28	1.21	-0.00004	0.86	0.000006	0.16	0.0338	-10	0.000008	0.00009	0.0006	0.00002	0.0002	-0.0001	-0.0001
7-Oct-11	29														
14-Oct-11	30	1.34	-0.00004	1.01	-0.000005	0.19	0.0349	-10	-0.000002	0.00002	-0.0005	0.00002	0.0007	0.0005	-0.0001
21-Oct-11	31														
28-Oct-11	32	1.29	-0.00004	0.959	-0.000005	0.2	0.0396	-10	0.000003	0.00028	-0.0005	0.000021	0.0008	0.0005	-0.0001
4-Nov-11	33														
11-Nov-11	34	1.14	-0.00004	0.96	-0.000005	0.18	0.032	-10	0.000007	0.00027	-0.0005	0.00003	0.0006	0.0009	-0.0001
18-Nov-11	35														
25-Nov-11	36	1.13	-0.00004	0.919	-0.000005	0.19	0.0313	-10	0.000002	0.00023	-0.0005	0.000073	0.0006	0.0006	-0.0001
2-Dec-11	37														
9-Dec-11	38	1.02	-0.00004	0.751	-0.000005	0.15	0.0321	-10	-0.000002	0.00013	-0.0005	0.000012	0.0005	0.0005	-0.0001
16-Dec-11	39														
23-Dec-11	40	1.15	-0.00004	0.782	-0.000005	0.37	0.0296	-10	-0.000002	-0.00001	-0.0005	0.000013	0.0004	0.0006	-0.0001
30-Dec-11	41														
6-Jan-12	42	0.98	-0.00004	0.756	-0.000005	0.15	0.0262	-10	-0.000002	0.0001	-0.0005	0.000008	0.0005	0.0002	-0.0001
13-Jan-12	43														
20-Jan-12	44	0.96	-0.00004	0.712	-0.000005	0.19	0.0272	-10	0.000003	-0.0002	-0.0005	0.000012	0.0008	0.0009	-0.0001
27-Jan-12	45														
3-Feb-12	46	1.01	-0.00004	0.841	-0.000005	0.18	0.0257	-10	-0.000002	-0.0002	-0.0005	0.000009	0.0004	0.0003	-0.0001
10-Feb-12	47														
17-Feb-12	48	1.08	-0.00004	0.885	-0.000005	0.16	0.0271	-10	-0.000002	-0.0002	-0.0005	0.000026	0.0006	-0.0001	-0.0001
24-Feb-12	49														
2-Mar-12	50	#N/A	-0.00004	0.723	#N/A	0.42	0.0266	-10	#N/A	-0.0002	-0.0005	0.000014	0.0004	#N/A	-0.0001
9-Mar-12	51														
16-Mar-12	52	0.92	-0.00004	0.796	-0.000005	0.19	0.0222	-10	-0.000002	-0.0002	-0.0005	0.000004	0.0003	0.0002	-0.0001
23-Mar-12	53														
30-Mar-12	54	0.83	-0.00004	0.69	-0.000005	0.13	0.0212	-10	-0.000002	-0.0002	-0.0005	0.000007	-0.0002	0.0002	-0.0001
6-Apr-12	55														
13-Apr-12	56	0.85	-0.00004	0.718	-0.000005	0.13	0.0175	-10	0.000003	0.0005	-0.0005	0.000004	0.0004	0.0016	-0.0001
20-Apr-12	57														
27-Apr-12	58	0.803	-0.00004	0.569	-0.000005	0.15	0.017	-10	-0.000002	0.0003	-0.0005	0.000005	0.00139	0.00012	-0.0001
4-May-12	59														
11-May-12	60	0.705	-0.00004	0.61	-0.000005	0.119	0.0136	-10	0.000002	-0.0002	-0.0005	0.000004	0.00029	0.00034	-0.0001
18-May-12	61														
25-May-12	62	0.755	-0.00004	0.739	-0.000005	0.122	0.0151	-10	0.000002	-0.0002	-0.0005	0.0000059	0.00041	0.0005	-0.0001
1-Jun-12	63														
8-Jun-12	64	0.536	-0.00004	0.529	-0.000005	0.125	0.0108	-10	0.0000022	-0.0002	-0.0005	0.0000038	0.00023	0.00092	-0.0001
15-Jun-12	65														
22-Jun-12	66	0.711	-0.00004	0.713	-0.000005	0.123	0.0145	-10	0.0000025	-0.0002	-0.0005	0.0000037	0.00064	0.00026	-0.0001
29-Jun-12	67														
6-Jul-12	68	0.676	-0.00004	0.676	-0.000005	0.132	0.0107	-10	-0.000002	-0.0002	-0.0005	0.0000027	0.00048	0.00013	-0.0001
13-Jul-12	69														
20-Jul-12	70	0.79	-0.00004	0.975	-0.000005	0.15	0.017	-10	-0.000002	-0.0002	-0.0005	0.000005	0.00069	0.00195	-0.0001

HC 5

CONFIDENTIAL *DRAFT*

Sample =
09SWC506 30-33

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L
27-Jul-12	71	500	450	7.02	12																												
3-Aug-12	72	500	450	6.98	8	#N/A	3.2	6.3	2	-0.5	0.016	4.1	0.0585	-0.00002	0.00026	0.00219	-0.00001	-0.000005	-0.05	0.000007	1.54	-0.0001	-0.000005	0.00058	0.003	0.000064	-0.0005	0.065	0.00026	-0.01	0.000229	0.000048	-0.002
10-Aug-12	73	500	450	7.55	10																												
17-Aug-12	74	500	435	7.12	10	#N/A	3.9	7.2	2	-0.5	0.012	4.47	0.0783	0.000031	0.00036	0.00257	-0.00001	-0.000005	-0.05	-0.000005	1.65	0.0001	0.000008	0.00047	0.0111	0.000066	-0.0005	0.087	0.00067	-0.01	-0.00005	0.000048	-0.002
24-Aug-12	75	500	435	7.15	7																												
31-Aug-12	76	500	445	7.81	22	#N/A	2.5	9.3	2	-0.5	-0.01	3.3	0.0508	-0.00002	0.00038	0.0022	-0.00001	-0.000005	-0.05	-0.000005	1.23	-0.0001	0.000007	0.00034	0.0066	0.000027	-0.0005	0.056	0.00055	-0.01	0.000073	0.000177	-0.002
7-Sep-12	77	500	450	7.38	5																												
14-Sep-12	78	500	480	6.95	6	#N/A	3.3	6.3	2	-0.5	-0.01	3.84	0.0395	-0.00002	0.00024	0.00224	-0.00001	-0.000005	-0.05	-0.000005	1.43	-0.0001	-0.000005	0.0024	0.0019	0.000034	-0.0005	0.064	0.00023	-0.01	-0.00005	0.000044	-0.002
21-Sep-12	79	500	465	7.52	10																												
28-Sep-12	80	500	450	7.44	8	#N/A	2.5	7.3	2	-0.5	0.014	3.29	0.0529	-0.00002	0.00025	0.00211	-0.00001	-0.000005	-0.05	-0.000005	1.23	-0.0001	-0.000005	0.0013	0.003	0.000022	-0.0005	0.054	0.00022	-0.01	-0.00005	0.000103	-0.002
5-Oct-12	81	500	435	7.80	6																												
12-Oct-12	82	500	505	7.30	14	#N/A	4.5	11.1	2	-0.5	0.016	6.49	0.0702	-0.00002	0.00031	0.00333	-0.00001	-0.000005	-0.05	-0.000005	2.41	-0.0001	-0.000005	0.00075	0.0033	0.000058	-0.0005	0.113	0.00018	-0.01	0.000052	-0.00002	-0.002
19-Oct-12	83	500	505	6.91	12																												
26-Oct-12	84	500	495	7.38	12	#N/A	3.0	8.4	2	-0.5	0.012	5.05	0.0628	-0.00002	0.00026	0.00271	-0.00001	-0.000005	-0.05	-0.000005	1.89	-0.0001	-0.000005	0.00045	0.0043	0.000057	-0.0005	0.078	0.00046	-0.01	0.000088	0.000055	-0.002
2-Nov-12	85	500	485	7.52	10																												
9-Nov-12	86	500	490	6.65	11	#N/A	4.9	8.2	3	-0.5	0.019	5.87	0.0836	-0.00002	0.00038	0.0034	-0.00001	-0.000005	-0.05	-0.000005	2.2	-0.0001	-0.000005	0.00052	0.0034	0.000203	-0.0005	0.09	0.0002	-0.01	0.000052	0.000542	-0.002
16-Nov-12	87	500	495	7.25	10																												
23-Nov-12	88	500	490	7.80	21	#N/A	2.9	12.0	2	-0.5	0.016	5.41	0.0553	-0.00002	0.00031	0.00264	-0.00001	-0.000005	-0.05	-0.000005	2.03	-0.0001	-0.000005	0.00028	0.0018	0.000016	-0.0005	0.082	0.00014	-0.01	-0.00005	0.000054	-0.002
30-Nov-12	89	500	490	7.24	10																												
7-Dec-12	90	500	475	7.01	6	#N/A	5.8	7.2	-2	-0.5	0.015	4.24	0.0725	-0.00002	0.0003	0.0029	-0.00001	-0.000005	-0.05	-0.000005	1.59	-0.0001	-0.000005	0.00039	0.003	0.000019	-0.0005	0.065	0.00018	-0.01	0.000061	#N/A	-0.002
14-Dec-12	91	500	465	7.81	10																												
21-Dec-12	92	500	465	7.21	8	#N/A	3.3	6.3	-2	-0.5	0.016	3.76	0.0494	-0.00002	0.00036	0.00231	-0.00001	-0.000005	-0.05	-0.000005	1.42	-0.0001	0.00001	0.00016	0.0029	0.000026	-0.0005	0.051	0.00042	-0.01	-0.00005	0.000129	-0.002
28-Dec-12	93	500	440	7.22	8																												
4-Jan-13	94	500	450	6.83	4	#N/A	4.2	5.3	-2	0.88	0.015	2.96	0.0458	-0.00002	0.00029	0.00222	-0.00001	-0.000005	-0.05	-0.000005	1.1	-0.0001	0.000005	0.0001	-0.001	0.00003	-0.0005	0.051	0.00025	-0.01	-0.00005	0.000074	-0.002
11-Jan-13	95	500	475	7.75	9																												
18-Jan-13	96	500	460	6.88	7	#N/A	2.4	6.2	2	-0.5	0.015	3.68	0.048	-0.00002	0.00032	0.00313	-0.00001	-0.000005	-0.05	-0.000005	1.38	-0.0001	-0.000005	0.00014	0.0013	0.000021	-0.0005	0.058	0.00016	-0.01	-0.00005	0.000024	-0.002
25-Jan-13	97	500	450	6.91	9																												
1-Feb-13	98	500	445	6.65	8	#N/A	3.2	6.2	2	-0.5	0.023	3.94	0.0763	-0.00002	0.00055	0.00223	-0.00001	-0.000005	-0.05	0.000012	1.47	-0.0001	0.000044	0.0002	0.0062	0.000026	-0.0005	0.066	0.00054	-0.01	0.000063	0.000023	-0.002
8-Feb-13	99	500	445	7.71	4																												
15-Feb-13	100	500	445	6.85	9	#N/A	2.73	5.11	2	-0.5	0.013	3.63	0.056	-0.00002	0.00038	0.00232	-0.00001	-0.000005	-0.05	-0.000005	1.35	-0.0001	-0.000005	0.00022	0.0017	0.000019	-0.0005	0.061	0.00011	-0.01	-0.00005	0.000024	-0.002
22-Feb-13	101	500	435	7.82	6																												
1-Mar-13	102	500	435	6.71	5	#N/A	4.4	4.9	3	-0.5	0.011	2.58	0.0521	-0.00002	0.00042	0.00198	-0.00001	-0.000005	-0.05	-0.000005	1.03	-0.0001	-0.000005	0.00012	0.0111	0.000017	-0.0005	-0.05	0.00022	-0.01	0.000108	-0.00002	-0.002
8-Mar-13	103	500	460	6.81	5																												
15-Mar-13	104	500	440	7.35	8	#N/A	4.2	5.5	2	0.59	0.017	3.14	0.0626	-0.00002	0.00046	0.00195	-0.00001	-0.000005	-0.05	0.000019	1.26	-0.0001	-0.000005	0.00021	0.0019	0.000014	-0.0005	-0.05	0.00016	-0.01	0.000054	-0.00002	-0.002
22-Mar-13	105	500	440	7.71	4																												
29-Mar-13	106	500	430	7.24	9	#N/A	2.7	5.3	3	-0.5	0.01	3.84	0.082	-0.00002	0.00044	0.0023	-0.00001	-0.000005	-0.05	-0.000005	1.44	-0.0001	0.000006	0.00013	0.002	0.00003	-0.0005	0.06	0.00012	-0.01	-0.00005	0.000057	-0.002
5-Apr-13	107	500	430	7.61	3																												
12-Apr-13	108	500	450	6.89	4	#N/A	3.8	4.6	2	0.69	-0.01	2.08	0.0456	-0.00002	0.00039	0.00198	-0.00001	-0.000005	-0.05	-0.000005	0.831	-0.0001	-0.000005	8.9E-05	0.0026	0.000017	-0.0005	-0.05	0.00017	-0.01	-0.00005	0.00005	-0.002
19-Apr-13	109	500	450	7.31	6																												
26-Apr-13	110	500	425	7.31	4	#N/A	2.9	3.8	3	-0.5	0.01	1.75	0.0641	-0.00002	0.00033	0.00249	-0.00001	-0.000005	-0.05	-0.000005	0.7	-0.0001	-0.000005	0.00019	0.0037	0.000033	-0.0005	-0.05	0.00037	-0.01	-0.00005	0.000025	-0.002
3-May-13	111	500	425	7.97	3																												
10-May-13	112	500	410	7.33	4	#N/A	3.1	4.3	2	-0.5	-0.01	1.98	0.109	-0.00002	0.00036	0.00384	-0.00001	-0.000005	-0.05	-0.000005	0.791	-0.0001	-0.000005	0.00019	0.0065	0.000059	-0.0005	-0.05	0.00041	-0.01	-0.00005	-0.00002	-0.002
17-May-13	113	500	435	7.63	4																												
24-May-13	114	500	445	7.10	3	#N/A	3.8	3.7	2																								

April 15/11 As 0.00339 and U 0.00136. Repeat As= 0.00309, U= 0.00132. data confirmed, suspect contamination
Aug 5/11 Cl 2.8. Repeat = -0.5, data accepted.
Aug 19/11 Cr 0.0018. Repeat = 0.0001, data accepted.
Jul 22/11 Ni=0.00025, repeat=0.00025. Data confirmed, suspect contamination
Aug 19/11 Ni=0.00024, repeat=0.00024. Data removed, suspect contamination
Nov 11/11 Cd=0.000021, Pb=0.00049. Repeat = 0.000021, 0.000479 respectively. Data confirmed suspect contamination
Dec 23/11 Cr=0.0009, repeat=0.001. data confirmed, suspect contamination
Mar 2/12 Cl=2.4, Cd=0.000074, Cu=0.011, Pb=0.00265, P=0.237, K=2.93, Ag=0.000523, Tl=0.000066, Zn=0.0072. Repeat Cl=-0.5, Data accepted.
Mar 2/12 Repeat Cd=0.000072, Cu=0.0111, Pb=0.00265, P=0.241,K=2.93, Ag=0.00055, Tl=0.000061, Zn=0.0077. Data confirmed, suspect contamination
Jan 20/12 Pb=0.000086, repeat=0.00005. Repeat accepted, fits within 4X Stdev
Apr 13/12 Cd=0.000011, Repeat=0.0000147. Data confirmed, suspect contamination
Apr 27/12 Ni=0.000118, repeat=.000121. Data confirmed, suspect contamination
May 25/12 Tl=0.0000058, repeat=0.000002. Data accepted
May 11/12 Ni=0.000496. Repeat=0.000502. Data confirmed, suspect contamination or analytical error
Jul 20/12 Al=0.112, repeat=0.136. Data confirmed, suspect contamination
Aug 3/12 Sb=0.00018, repeat -0.00002. Data accepted
Dec 7/12 Ni=0.00033, repeat=0.00033. Data confirmed, suspect contamination
Feb 1/13 Zn=0.0036, repeat confirms original result, suspect contamination

HC 5

Sample =
09SWC506 30-33

Date	Cycle No.	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
27-Jul-12	71														
3-Aug-12	72	0.668	-0.00004	0.576	0.00001	0.135	0.0116	-10	0.000002	0.0003	-0.0005	0.000004	0.00025	0.00101	-0.0001
10-Aug-12	73														
17-Aug-12	74	0.8	-0.00004	0.696	-0.000005	0.167	0.0134	-10	0.000002	-0.0002	-0.0005	0.000002	0.00043	0.00184	-0.0001
24-Aug-12	75														
31-Aug-12	76	0.541	-0.00004	0.489	-0.000005	0.18	0.00859	-10	-0.000002	0.00027	-0.0005	0.000005	0.00021	0.00058	-0.0001
7-Sep-12	77														
14-Sep-12	78	0.653	-0.00004	0.486	-0.000005	0.106	0.0109	-10	0.000003	-0.0002	-0.0005	0.000002	0.00026	0.00013	-0.0001
21-Sep-12	79														
28-Sep-12	80	0.597	-0.00004	0.576	-0.000005	0.135	0.00895	-10	0.000002	0.00024	-0.0005	0.000002	0.00029	0.00045	-0.0001
5-Oct-12	81														
12-Oct-12	82	0.919	-0.00004	0.878	-0.000005	0.146	0.019	-10	-0.000002	-0.0002	-0.0005	0.000004	0.00022	0.00016	-0.0001
19-Oct-12	83														
26-Oct-12	84	0.672	-0.00004	0.673	-0.000005	0.103	0.0131	-10	0.000002	0.0003	-0.0005	0.000005	0.00024	0.00082	-0.0001
2-Nov-12	85														
9-Nov-12	86	0.845	-0.00004	0.854	-0.000005	0.143	0.0159	-3	0.000003	0.00024	-0.0005	0.000005	0.00022	0.00085	-0.0001
16-Nov-12	87														
23-Nov-12	88	0.759	-0.00004	0.73	-0.000005	0.111	0.0139	-3	0.000002	0.00036	-0.0005	-0.000002	0.00025	0.00039	-0.0001
30-Nov-12	89														
7-Dec-12	90	0.702	-0.00004	0.609	-0.000005	0.108	0.0117	-3	0.000002	-0.0002	-0.0005	0.000003	0.00036	0.00193	-0.0001
14-Dec-12	91														
21-Dec-12	92	0.616	-0.00004	0.538	-0.000005	0.112	0.00933	-3	0.000002	-0.0002	-0.0005	0.000003	0.00029	0.00026	-0.0001
28-Dec-12	93														
4-Jan-13	94	0.66	-0.00004	0.449	-0.000005	0.123	0.0087	-3	-0.000002	-0.0002	-0.0005	0.000002	0.00024	0.00018	-0.0001
11-Jan-13	95														
18-Jan-13	96	0.728	-0.00004	0.541	-0.000005	0.104	0.00996	-3	-0.000002	-0.0002	-0.0005	0.000002	0.00029	0.00027	-0.0001
25-Jan-13	97														
1-Feb-13	98	0.837	-0.00004	0.688	-0.000005	0.134	0.0109	-3	0.000002	-0.0002	-0.0005	0.000003	0.00079	0.0036	-0.0001
8-Feb-13	99														
15-Feb-13	100	0.82	-0.00004	0.589	-0.000005	0.124	0.0101	-3	0.000002	-0.0002	-0.0005	0.000002	0.00029	0.00036	-0.0001
22-Feb-13	101														
1-Mar-13	102	0.653	-0.00004	0.545	-0.000005	0.109	0.00743	-3	-0.000002	-0.0002	-0.0005	0.000002	0.00027	0.00014	-0.0001
8-Mar-13	103														
15-Mar-13	104	0.683	-0.00004	0.654	-0.000005	0.106	0.00875	-3	-0.000002	-0.0002	-0.0005	0.000003	0.00037	0.00025	-0.0001
22-Mar-13	105														
29-Mar-13	106	0.879	-0.00004	0.705	0.000044	0.122	0.0106	-3	-0.000002	-0.0002	-0.0005	0.000003	0.0004	0.00015	-0.0001
5-Apr-13	107														
12-Apr-13	108	0.534	-0.00004	0.417	-0.000005	0.085	0.00588	-3	-0.000002	-0.0002	0.00316	-0.000002	0.00058	0.00021	-0.0001
19-Apr-13	109														
26-Apr-13	110	0.646	-0.00004	0.45	0.000736	0.1	0.00537	-3	-0.000002	-0.0002	-0.0005	0.000002	-0.0002	0.00014	-0.0001
3-May-13	111														
10-May-13	112	0.603	-0.00004	0.679	0.000006	0.132	0.00621	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00022	0.00015	-0.0001
17-May-13	113														
24-May-13	114														

HC 6
Sample =
09SWC506 30-33
DUP

CONFIDENTIAL *DRAFT*

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L
18-Mar-11	0	500	340	7.49	88	#N/A	3.2	26.3	5	3.7	0.16	26.7	0.209	0.00005	0.00161	0.00463	-0.00001	-0.000005	-0.05	0.000008	9.45	-0.0001	0.000023	0.0015	0.003	0.000036	-0.0005	0.76	0.00308	-0.01	0.00517	0.00016
25-Mar-11	1	500	525	7.83	97																											
1-Apr-11	2	500	505	7.71	69	#N/A	5.5	35.6	4	1.3	0.33	21.1	0.143	0.00005	0.0012	0.00389	-0.00001	-0.000005	-0.05	-0.000005	7.22	-0.0001	0.000007	0.00088	0.005	0.000049	-0.0005	0.76	0.00385	-0.01	0.00479	0.0003
8-Apr-11	3	500	495	7.64	50																											
15-Apr-11	4	500	455	7.58	48	#N/A	2.3	29.9	2	-0.5	0.22	17.9	0.116	0.00004	0.00102	0.00392	-0.00001	-0.000005	-0.05	-0.000005	6.18	-0.0001	0.000005	0.00063	0.008	0.000053	-0.0005	0.61	0.00192	-0.01	0.00075	0.00007
22-Apr-11	5	500	460	7.67	49																											
29-Apr-11	6	500	475	7.49	44	#N/A	3.8	28.3	4	-0.5	0.12	18.9	0.122	0.00003	0.00123	0.0035	-0.00001	-0.000005	-0.05	-0.000005	6.47	-0.0001	-0.000005	0.00061	0.003	0.000026	-0.0005	0.67	0.00212	-0.01	0.00039	0.00008
6-May-11	7	500	460	7.41	38																											
13-May-11	8	500	465	7.39	34	#N/A	3.4	24.2	3	-0.5	0.07	15.5	0.0939	0.00003	0.00088	0.00314	-0.00001	-0.000005	-0.05	-0.000005	5.29	-0.0001	-0.000005	0.00075	0.002	0.000021	-0.0005	0.54	0.00164	-0.01	0.00023	0.00005
20-May-11	9	500	455	7.61	40																											
27-May-11	10	500	460	7.60	40	#N/A	5.4	23.2	4	-0.5	0.09	17.2	0.103	-0.00002	0.00108	0.00318	-0.00001	-0.000005	-0.05	-0.000005	5.91	-0.0001	-0.000005	0.00037	0.002	0.000015	-0.0005	0.58	0.00165	-0.01	0.00023	0.00002
3-Jun-11	11	500	450	7.33	36																											
10-Jun-11	12	500	500	7.46	35	#N/A	2.2	22.7	2	-0.5	0.07	14.9	0.0968	0.00003	0.001	0.00308	-0.00001	-0.000005	-0.05	0.000011	5.22	-0.0001	-0.000005	0.00053	0.003	0.00002	-0.0005	0.45	0.0014	-0.01	0.00018	0.00004
17-Jun-11	13	500	480	7.29	38																											
24-Jun-11	14	500	500	7.60	32	#N/A	2.3	22.3	2	-0.5	-0.01	15.9	0.101	0.00002	0.00083	0.00375	-0.00001	-0.000005	-0.05	-0.000005	5.57	-0.0001	-0.000005	0.00056	0.002	0.00003	-0.0005	0.47	0.00106	-0.01	0.00017	-0.00002
1-Jul-11	15	500	485	7.68	35																											
8-Jul-11	16	500	475	7.39	36	#N/A	3.1	22.9	2	0.7	0.05	14.5	0.124	-0.00002	0.0009	0.00381	-0.00001	-0.000005	-0.05	-0.000005	5.15	-0.0001	-0.000005	0.00051	0.006	0.000038	-0.0005	0.41	0.00095	-0.02	0.00012	0.0002
15-Jul-11	17	500	465	7.59	44																											
22-Jul-11	18	500	485	7.51	35	#N/A	3.6	21.3	-2	0.8	0.04	14.9	0.106	-0.00002	0.00057	0.00891	-0.00001	-0.000005	-0.05	-0.000005	5.26	-0.0001	0.000009	0.00428	0.006	0.000035	-0.0005	0.43	0.00091	-0.01	0.00016	#N/A
29-Jul-11	19	500	475	7.62	40																											
5-Aug-11	20	500	465	7.40	38	#N/A	3.8	22.9	-2	0.5	0.04	15.3	0.141	-0.00002	0.00077	0.00476	-0.00001	-0.000005	-0.05	-0.000005	5.44	-0.0001	0.000005	0.00287	0.007	#N/A	-0.0005	0.42	0.00081	-0.01	0.00012	0.00004
12-Aug-11	21	500	470	7.65	37																											
19-Aug-11	22	500	475	7.46	38	#N/A	3.7	23.3	-2	0.9	0.04	16.9	0.144	-0.00002	0.0007	0.00476	-0.00001	-0.000005	-0.05	-0.000005	6.12	0.0001	0.000006	0.00057	0.007	0.000036	-0.0005	0.39	0.00074	-0.01	0.00012	#N/A
26-Aug-11	23	500	480	7.40	35																											
2-Sep-11	24	500	470	7.62	37	#N/A	3.9	23.9	2	0.8	0.04	15	0.152	-0.00002	0.00072	0.00615	-0.00001	-0.000005	-0.05	-0.000005	5.59	0.0002	0.000006	0.00032	0.006	0.000039	-0.0005	0.37	0.00107	-0.01	0.00015	0.00007
9-Sep-11	25	500	470	7.59	29																											
16-Sep-11	26	500	460	7.34	34	#N/A	4.1	21.9	-2	0.9	0.03	14	0.122	-0.00002	0.00051	0.00459	-0.00001	-0.000005	-0.05	-0.000005	5.09	-0.0001	0.000009	0.00016	0.006	0.000028	-0.0005	0.3	0.00068	-0.01	0.0001	0.00006
23-Sep-11	27	500	505	7.40	38																											
30-Sep-11	28	500	470	7.29	29	#N/A	4.1	21.9	2	0.7	0.03	13.2	0.0994	-0.00002	0.00039	0.00439	-0.00001	-0.000005	-0.05	0.000005	4.87	0.0001	-0.000005	0.00013	0.006	0.000025	-0.0005	0.26	0.00048	-0.01	-0.00005	-0.00002
7-Oct-11	29	500	450	7.47	30																											
14-Oct-11	30	500	455	7.30	29	#N/A	3.3	16.8	2	-0.5	0.03	12.7	0.119	-0.00002	0.0005	0.00394	-0.00001	-0.000005	-0.05	-0.000005	4.65	-0.0001	-0.000005	0.00019	0.002	0.000017	-0.0005	0.26	0.00057	-0.01	0.00008	-0.00002
21-Oct-11	31	500	465	7.62	31																											
28-Oct-11	32	500	460	7.41	30	#N/A	3.6	17.3	-2	-0.5	0.02	14	0.106	-0.00002	0.00048	0.00391	-0.00001	-0.000005	-0.05	-0.000005	5.17	0.0001	-0.000005	0.00027	0.004	0.00002	-0.0005	0.26	0.00029	-0.01	0.00012	0.00011
4-Nov-11	33	500	455	7.53	27																											
11-Nov-11	34	500	470	7.70	28	#N/A	5.0	21.5	2	-0.5	0.02	12.3	0.135	0.00002	0.00055	0.0042	-0.00001	-0.000005	-0.05	#N/A	4.54	0.0003	-0.000005	0.00037	0.005	0.000093	-0.0005	0.24	0.00042	-0.01	0.00012	0.00005
18-Nov-11	35	500	455	7.46	29																											
25-Nov-11	36	500	480	7.62	30	#N/A	3.2	20.3	2	-0.5	0.023	12.7	0.117	0.00002	0.00054	0.00699	-0.00001	-0.000005	-0.05	-0.000005	4.67	-0.0001	0.000006	0.00253	0.007	0.000056	-0.0005	0.24	0.00034	-0.01	0.00012	0.00016
2-Dec-11	37	500	470	7.56	30																											
9-Dec-11	38	500	460	7.38	26	#N/A	4.8	16.3	-2	-0.5	0.014	10.8	0.102	-0.00002	0.00029	0.00375	-0.00001	-0.000005	-0.05	#N/A	3.97	-0.0001	0.000012	0.00059	0.004	#N/A	-0.0005	0.21	0.00195	-0.01	0.00009	0.00028
16-Dec-11	39	500	455	7.59	28																											
23-Dec-11	40	500	460	7.57	28	#N/A	4.1	20.3	3	-0.5	0.021	12.7	0.114	-0.00002	0.00043	0.00467	-0.00001	-0.000005	-0.05	-0.000005	4.68	-0.0001	0.000009	0.00023	0.005	0.000027	-0.0005	0.24	0.0004	-0.01	0.00009	0.00015
30-Dec-11	41	500	465	7.62	24																											
6-Jan-12	42	500	465	7.17	20	#N/A	3.5	13.5	2	-0.5	0.017	8.7	0.0752	-0.00002	0.00035	0.00362	-0.00001	-0.000005	-0.05	-0.000005	3.22	-0.0001	-0.000005	0.00055	0.003	0.000028	-0.0005	0.17	0.00023	-0.01	0.00008	0.00003
13-Jan-12	43	500	465	7.48	22																											
20-Jan-12	44	500	485	7.47	23	#N/A	2.9	15.6	2	-0.5	0.021	9.3	0.0569	-0.00002	0.00034	0.00486	-0.00001	-0.000005	-0.05	-0.000005	3.43	0.0001	0.000007	0.00025	0.003	0.000039	-0.0005	0.16	0.00029	-0.01	0.00008	0.00018
27-Jan-12	45	500	460	7.37	19																											
3-Feb-12	46	500	475	7.29	20	#N/A	5.3	15.0	2	-0.5	0.022	9.7	0.0631	-0.00002	0.00032	0.00313	-0.00001	-0.000005	-0.05	0.000015	3.62	0.0002	0.000006	0.00034	0.003	0.000018	-0.0005	0.16	0.0002	-0.01	0.00007	0.00006
10-Feb-12	47	500	465	7.48	24																											
17-Feb-12	48	500	455	7.32	22	#N/A	2.6	13.2	-2	-0.5	0.018	10.3	0.0812	-0.00002	0.00036	0.00371	-0.00001	-0.000005	-0.05	-0.000005	3.88	-0.0001	0.000006	0.00045	0.003	0.000015	-0.0005	0.16	0.00044	-0.01	0.00007	-0.00002
24-Feb-12	49	500	465	7.29	23																											
2-Mar-12	50	500	460	7.48	22	#N/A	6.6	16.4	-2	-0.5	0.018	9.8	0.0742	-0.00002	0.00034	0.00394	-0.00001	-0.000005	-0.05	0.000006	3.65	-0.0001	0.000006	0.00023	0.007	0.000023	-0.0005	0.16	0.00023	-0.01	0.0001	-0.00002
9-Mar-12	51	500	485	7.41	20																											
16-Mar-12	52	500	460	7.35	22	#N/A	2.9	12.8	-2	-0.5	0.02	9.3	0.0785	-0.00002	0.00034	0.0036	-0.00001	-0.000005	-0.05	-0.000005	3.48	-0.0001	0.000009	0.00033	0.004	0.000044	-0.0005	0.15	0.00029	-0.01	0.00011	#N/A
23-Mar-12	53	500	430	7.47	20																											
30-Mar-12	54	500	485	7.19	22	#N/A	4.0	13.5	2	-0.5	0.022	10.4	0.118	-0.00002	0.00041	0.00486	-0.00001	-0.000005	-0.05	-0.000005	3.92	-0.0001	-0.000005	0.0002	0.008	0.00004	-0.0005	0.15	0.00026	-0.01	0.00009	0.00002
6-Apr-12	55	500	475	7.34	23																											
13-Apr-12	56	500	450	7.36	24	#N/A	2.3	13.9	2	-0.5	0.019	10.2	0.107	-0.00002	0.00045	0.00441	-0.00001	-0.000005	-0.05	#N/A	3.83	0.0001	-0.000005	0.00051	0.005	#N/A	-0.0005	0.15	0.00027	-0.01	0.00011	0.00005
20-Apr-12	57	500	470	7.31	21																											
27-Apr-12	58	500	475	7.46	21	#N/A	4.4	13.5	2	-0.5	0.018	8.83	0.0954	-0.00002	0.000484	0.0037	-0.00001	-0.000005	-0.05	-0.000005	3.32	-0.0001	0.000006	0.00115	0.0042	0.00004	-0.0005	0.132	0.000247	-0.01	0.00007	#N/A
4-May-12	59	500	470	7.56	21																											
11-May-12	60	500	480	7.33	18	#N/A	3.4	10.7	3	-0.5	0.021	8.12	0.107	-0.00002	0.000474	0.00335	-0.00001	-0.000005	-0.05	0.000038	3.09	0.00013	0.000011	0.000942	0.0054	0.00011	-0.0005	0.099	0.000337	-0.01	0.000079	0.000197
18-May-12	61	500	480	7.27	18																											
25-May-12	62	500	470	7.16	17	#N/A	4.1	11.2	2	-0.5	0.016	7.69	0.101	-0.00002	0.000374	0.00353	-0.00001	-0.000005	-0.05	-0.000005	2.9	-0.0001	0.0000104	0.000172	0.0044	0.0000383	-0.0005	0.108	0.000285	-0.01	0.000059	-0.00002
1-Jun-12	63	500	495	7.36	16																											
8-Jun-12	64	500	460	7.27	18	#N/A	3.5	11.7	2	0.64	0.015	8.08	0.0893	-0.00002	0.000575	0.00466	-0.00001	-0.000005	-0.05	-0.000005	3.04	-0.0001	0.0000117	0.000442	0.0041	0.0000224	-0.0005	0.121	0.000375	-0.01	0.000113	0.000249
15-Jun-12	65	500	475	7.24	19																											
22-Jun-12	66	500	440	7.13	13	#N/A	4.3	9.2	3	-0.5	0.024	6.1	0.085	0.000021	0.000467	0.00314	-0.00001	-0.000005	-0.05	-0.000005	2.31	-0.0001	-0.000005	0.000229	0.0035	0.0000264	-0.0005	0.081	0.000229	-0.01	0.000109	0.000026
29-Jun-12	67	500	450	7.21	14																											

HC 6
Sample =
09SWC506 30-33
DUP

Date	Cycle No.	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	0.031	2.45	-0.00004	1.37	-0.000005	5.14	0.0786	-10	0.000002	0.00006	-0.0005	0.000016	0.0006	0.0002	-0.0001
25-Mar-11	1															
1-Apr-11	2	-0.002	2.15	-0.00004	2.04	-0.000005	4.15	0.0704	-10	-0.000002	0.00006	-0.0005	0.000085	0.0012	0.0002	-0.0001
8-Apr-11	3															
15-Apr-11	4	-0.002	1.53	-0.00004	1.69	-0.000005	1.63	0.0675	-10	-0.000002	0.00003	0.0006	0.000143	0.001	0.0007	-0.0001
22-Apr-11	5															
29-Apr-11	6	-0.002	1.69	-0.00004	1.98	-0.000005	0.9	0.0619	-10	-0.000002	0.00003	-0.0005	0.000117	0.0012	0.0002	-0.0001
6-May-11	7															
13-May-11	8	-0.002	1.17	-0.00004	1.42	-0.000005	0.56	0.0493	-10	0.000003	0.00003	-0.0005	0.000156	0.0009	0.0002	-0.0001
20-May-11	9															
27-May-11	10	-0.002	1.22	-0.00004	1.65	-0.000005	0.46	0.056	-10	-0.000002	0.00002	-0.0005	0.000072	0.001	0.0003	-0.0001
3-Jun-11	11															
10-Jun-11	12	-0.002	1.08	-0.00004	1.41	-0.000005	0.32	0.0534	-10	-0.000002	0.00032	-0.0005	0.000049	0.0009	0.0003	-0.0001
17-Jun-11	13															
24-Jun-11	14	-0.002	1.45	-0.00004	1.62	-0.000005	0.35	0.0493	-10	-0.000002	0.00031	-0.0005	0.000043	0.0009	0.0002	-0.0001
1-Jul-11	15															
8-Jul-11	16	-0.002	1.33	-0.00004	1.48	-0.000005	0.35	0.0473	-10	0.000002	0.00004	-0.0005	0.000036	0.0009	0.0005	-0.0001
15-Jul-11	17															
22-Jul-11	18	-0.002	1.45	-0.00004	1.19	-0.000005	0.28	0.0476	-10	-0.000002	0.00005	-0.0005	0.000027	0.0007	0.0006	-0.0001
29-Jul-11	19															
5-Aug-11	20	-0.002	1.64	-0.00004	1.25	0.000011	0.27	0.0527	-10	-0.000002	0.00004	-0.0005	0.000113	0.001	0.0005	-0.0001
12-Aug-11	21															
19-Aug-11	22	-0.002	1.68	-0.00004	1.32	-0.000005	0.26	0.0513	-10	0.000002	-0.00001	-0.0005	0.000029	0.001	0.0004	-0.0001
26-Aug-11	23															
2-Sep-11	24	-0.002	1.62	-0.00004	1.3	-0.000005	0.28	0.0488	-10	-0.000002	0.00022	-0.0005	0.000027	0.001	0.0003	-0.0001
9-Sep-11	25															
16-Sep-11	26	-0.002	1.52	-0.00004	1.08	-0.000005	0.17	0.0431	-10	-0.000002	0.00003	-0.0005	0.000019	0.0009	0.0006	-0.0001
23-Sep-11	27															
30-Sep-11	28	-0.002	1.33	-0.00004	0.968	-0.000005	0.17	0.0386	-10	-0.000002	0.00011	-0.0005	0.000016	0.0003	0.0001	-0.0001
7-Oct-11	29															
14-Oct-11	30	-0.002	1.48	-0.00004	1.08	-0.000005	0.21	0.0358	-10	-0.000002	0.00001	-0.0005	0.000016	0.0008	0.0002	-0.0001
21-Oct-11	31															
28-Oct-11	32	-0.002	1.49	-0.00004	1.13	-0.000005	0.22	0.04	-10	0.000003	0.00024	-0.0005	0.000015	0.0007	0.0002	-0.0001
4-Nov-11	33															
11-Nov-11	34	-0.002	1.42	-0.00004	1.16	0.000005	0.23	0.0363	-10	0.000018	0.00017	-0.0005	0.000021	0.0007	0.0015	-0.0001
18-Nov-11	35															
25-Nov-11	36	-0.002	1.4	-0.00004	1.11	-0.000005	0.22	0.0369	-10	0.000002	0.0004	-0.0005	0.000013	0.0008	0.0009	-0.0001
2-Dec-11	37															
9-Dec-11	38	-0.002	1.24	-0.00004	0.735	-0.000005	0.17	0.032	-10	#N/A	0.00022	-0.0005	0.000011	0.0004	#N/A	-0.0001
16-Dec-11	39															
23-Dec-11	40	-0.002	1.47	-0.00004	1.03	-0.000005	0.25	0.0372	-10	0.000003	-0.00001	0.0005	0.000014	0.0006	0.0004	-0.0001
30-Dec-11	41															
6-Jan-12	42	-0.002	1.08	-0.00004	0.789	-0.000005	0.15	0.0258	-10	-0.000002	0.00059	-0.0005	0.000005	0.0005	0.0004	-0.0001
13-Jan-12	43															
20-Jan-12	44	-0.002	0.97	-0.00004	0.711	-0.000005	0.19	0.0278	-10	0.000002	-0.0002	-0.0005	0.000009	0.0007	0.0006	-0.0001
27-Jan-12	45															
3-Feb-12	46	-0.002	1.01	-0.00004	0.854	-0.000005	0.18	0.0247	-10	-0.000002	-0.0002	-0.0005	0.000008	0.0003	0.0001	-0.0001
10-Feb-12	47															
17-Feb-12	48	-0.002	1.17	-0.00004	0.918	0.000005	0.18	0.0256	-10	-0.000002	-0.0002	-0.0005	0.000022	0.0007	-0.0001	-0.0001
24-Feb-12	49															
2-Mar-12	50	-0.002	1.06	-0.00004	0.839	-0.000005	0.16	0.0269	-10	-0.000002	0.0003	-0.0005	0.000012	0.0004	0.0003	-0.0001
9-Mar-12	51															
16-Mar-12	52	-0.002	1.06	-0.00004	0.891	-0.000005	0.2	0.0248	-10	0.000003	-0.0002	-0.0005	0.000005	0.0004	0.0009	-0.0001
23-Mar-12	53															
30-Mar-12	54	-0.002	1.15	-0.00004	1.16	-0.000005	0.19	0.0279	-10	-0.000002	-0.0002	-0.0005	0.000009	0.0005	0.0001	-0.0001
6-Apr-12	55															
13-Apr-12	56	-0.002	1.24	-0.00004	1.11	-0.000005	0.18	0.0281	-10	0.000004	0.0006	-0.0005	0.000009	0.0006	#N/A	-0.0001
20-Apr-12	57															
27-Apr-12	58	-0.002	1.13	-0.00004	0.985	-0.000005	0.194	0.0232	-10	0.000002	0.00045	-0.0005	0.000007	0.00174	0.00054	-0.0001
4-May-12	59															
11-May-12	60	-0.002	1.08	-0.00004	1.06	-0.000005	0.18	0.0185	-10	0.000003	0.00022	-0.0005	0.000004	0.00056	0.00156	-0.0001
18-May-12	61															
25-May-12	62	-0.002	0.97	-0.00004	0.924	-0.000005	0.151	0.0199	-10	0.0000044	-0.0002	-0.0005	0.0000057	0.00051	0.00059	-0.0001
1-Jun-12	63															
8-Jun-12	64	0.0031	0.946	-0.00004	0.949	-0.000005	0.249	0.0199	-10	0.0000023	-0.0002	-0.0005	0.0000055	0.00056	0.00031	-0.0001
15-Jun-12	65															
22-Jun-12	66	-0.002	0.823	-0.00004	0.828	-0.000005	0.138	0.0155	-10	0.0000026	-0.0002	-0.0005	0.0000035	0.00058	0.00015	-0.0001
29-Jun-12	67															

HC 6
Sample =
09SWC506 30-33
DUP

CONFIDENTIAL *DRAFT*

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L
6-Jul-12	68	500	455	7.19	13	#N/A	4.1	8.4	2	-0.5	0.014	5.85	0.0904	-0.00002	0.000385	0.00288	-0.00001	-0.000005	-0.05	-0.000005	2.22	-0.0001	-0.000005	0.000277	0.0031	0.0000262	-0.0005	0.073	0.000251	-0.01	0.000078	-0.00002
13-Jul-12	69	500	470	7.38	13																											
20-Jul-12	70	500	475	7.30	14	#N/A	3.8	9.0	2	0.63	0.014	6.02	0.104	-0.00002	0.000458	0.00261	-0.00001	-0.000005	-0.05	-0.000005	2.28	-0.0001	-0.000005	0.0003	0.0025	0.0000289	-0.0005	0.08	0.000325	-0.01	0.000055	0.000068
27-Jul-12	71	500	435	7.62	14																											
3-Aug-12	72	500	465	7.29	13	#N/A	3.5	9.3	2	-0.5	0.016	6.29	0.129	-0.00002	0.000378	0.00519	-0.00001	-0.000005	-0.05	#N/A	2.38	0.00014	0.00001	0.0013	0.0097	0.000174	-0.0005	0.082	0.000486	-0.01	0.000069	0.000092
10-Aug-12	73	500	450	7.31	10																											
17-Aug-12	74	500	450	7.13	12	#N/A	4.1	7.8	2	-0.5	0.013	5.03	0.078	0.000032	0.000341	0.00335	-0.00001	-0.000005	-0.05	0.000016	1.89	0.00012	0.000005	0.00116	0.0065	#N/A	-0.0005	0.078	0.00062	-0.01	0.00005	0.000093
24-Aug-12	75	500	465	7.32	11																											
31-Aug-12	76	500	460	7.44	13	#N/A	3.0	8.8	2	-0.5	0.018	5.34	0.0909	-0.00002	0.000307	0.00358	-0.00001	-0.000005	-0.05	-0.000005	2.02	-0.0001	0.000008	0.00036	0.0036	0.000028	-0.0005	0.071	0.000338	-0.01	0.000062	0.000125
7-Sep-12	77	500	455	7.06	9																											
14-Sep-12	78	500	490	6.95	12	#N/A	3.1	8.7	3	-0.5	0.015	5.62	0.0907	0.000021	#N/A	0.00401	-0.00001	-0.000005	-0.05	-0.000005	2.11	0.00016	0.000033	0.00183	0.007	0.000172	-0.0005	0.084	0.000419	-0.01	-0.00005	#N/A
21-Sep-12	79	500	470	7.23	16																											
28-Sep-12	80	500	435	7.06	10	#N/A	2.6	7.6	2	-0.5	0.014	4.68	0.113	-0.00002	0.00034	0.00413	-0.00001	-0.000005	-0.05	-0.000005	1.77	0.00024	0.000005	0.000744	0.0081	0.000044	-0.0005	0.063	0.00039	-0.01	0.00005	0.00008
5-Oct-12	81	500	430	7.41	7																											
12-Oct-12	82	500	485	7.28	12	#N/A	5.1	8.6	2	-0.5	0.014	5.39	0.0875	0.000132	0.000367	0.00357	-0.00001	-0.000005	-0.05	0.00003	2.04	-0.0001	-0.000005	0.000362	0.0045	0.000361	-0.0005	0.072	0.000266	-0.01	0.000071	0.000033
19-Oct-12	83	500	505	7.43	14																											
26-Oct-12	84	500	485	7.16	12	#N/A	2.9	8.8	2	-0.5	0.014	5.31	0.0926	-0.00002	0.000435	0.00362	-0.00001	-0.000005	-0.05	-0.000005	2.02	-0.0001	-0.000005	0.000529	0.0062	0.000041	-0.0005	0.066	0.000338	-0.01	0.000095	0.000054
2-Nov-12	85	500	480	7.20	11																											
9-Nov-12	86	500	495	7.35	11	#N/A	4.8	9.2	3	-0.5	0.02	6.07	0.0996	-0.00002	0.000648	0.00362	-0.00001	0.000007	-0.05	0.000019	2.3	-0.0001	0.000009	0.00228	0.0051	0.00056	-0.0005	0.08	0.000309	-0.01	0.00135	0.000311
16-Nov-12	87	500	475	7.31	11																											
23-Nov-12	88	500	490	7.48	14	#N/A	3.0	8.4	3	-0.5	0.017	6.57	0.085	-0.00002	#N/A	0.00307	-0.00001	-0.000005	-0.05	-0.000005	2.49	-0.0001	0.000029	0.000273	0.0092	0.000021	-0.0005	0.083	0.00015	-0.01	0.000065	0.000497
30-Nov-12	89	500	495	7.10	11																											
7-Dec-12	90	500	475	7.45	8	#N/A	5.2	8.7	-2	-0.5	0.016	4.95	0.0796	-0.00002	0.000418	0.00271	-0.00001	-0.000005	-0.05	-0.000005	1.87	-0.0001	-0.000005	0.000465	0.0023	0.000019	-0.0005	0.065	0.000168	-0.01	0.000053	0.00011
14-Dec-12	91	500	480	7.67	7																											
21-Dec-12	92	500	455	7.29	9	#N/A	3.5	7.4	-2	-0.5	0.015	4.22	0.0677	-0.00002	0.000401	0.0025	-0.00001	-0.000005	-0.05	-0.000005	1.6	-0.0001	-0.000005	0.000117	0.0029	0.000032	-0.0005	0.052	0.000172	-0.01	0.000052	0.000039
28-Dec-12	93	500	450	7.31	12																											
4-Jan-13	94	500	440	7.39	6	#N/A	4.2	7.4	-2	-0.5	0.016	4	0.0514	-0.00002	0.000376	0.00279	-0.00001	-0.000005	-0.05	-0.000005	1.51	-0.0001	0.000007	0.000343	0.0033	0.000289	-0.0005	0.059	0.000424	-0.01	0.00006	0.000117
11-Jan-13	95	500	475	7.34	7																											
18-Jan-13	96	500	460	7.30	9	#N/A	2.4	6.5	2	-0.5	0.017	3.79	0.0464	-0.00002	0.000327	0.00266	-0.00001	-0.000005	-0.05	-0.000005	1.42	-0.0001	-0.000005	0.00119	0.0017	0.000049	-0.0005	0.056	0.000318	-0.01	-0.00005	0.000123
25-Jan-13	97	500	455	7.28	13																											
1-Feb-13	98	500	440	7.44	5	#N/A	3.5	5.6	3	-0.5	0.018	2.96	0.0611	-0.00002	0.000333	0.00243	-0.00001	-0.000005	-0.05	-0.000005	1.18	-0.0001	-0.000005	0.000125	0.0032	0.000046	-0.0005	-0.05	0.000273	-0.01	0.000059	-0.00002
8-Feb-13	99	500	445	7.51	6																											
15-Feb-13	100	500	445	7.06	7	#N/A	2.6	5.0	2	-0.5	0.012	2.7	0.0453	-0.00002	0.000293	0.00241	-0.00001	-0.000005	-0.05	-0.000005	1.08	-0.0001	-0.000005	0.0001	0.0017	0.000017	-0.0005	-0.05	0.000199	-0.01	-0.00005	-0.00002
22-Feb-13	101	500	455	7.64	6																											
1-Mar-13	102	500	440	7.12	5	#N/A	4.4	5.6	3	-0.5	0.012	2.75	0.0561	-0.00002	0.000375	0.00245	-0.00001	-0.000005	-0.05	-0.000005	1.1	-0.0001	-0.000005	0.000217	0.004	0.000026	-0.0005	-0.05	0.000227	-0.01	0.000079	-0.00002
8-Mar-13	103	500	490	7.21	11																											
15-Mar-13	104	500	460	7.27	6	#N/A	4.6	5.6	3	0.65	0.017	3.05	0.048	-0.00002	0.000357	0.00235	-0.00001	-0.000005	-0.05	-0.000005	1.22	0.00071	-0.000005	0.000166	0.0013	0.000017	-0.0005	-0.05	0.000308	-0.01	0.000072	0.000027
22-Mar-13	105	500	445	7.40	4																											
29-Mar-13	106	500	435	7.12	4	#N/A	2.9	4.0	2	-0.5	0.012	2.43	0.0512	-0.00002	0.000404	0.00215	-0.00001	-0.000005	-0.05	-0.000005	0.974	-0.0001	-0.000005	0.000298	0.0021	0.000034	-0.0005	-0.05	0.000289	-0.01	-0.00005	0.000027
5-Apr-13	107	500	435	7.26	3																											
12-Apr-13	108	500	460	7.33	5	#N/A	4.1	5.4	3	0.56	0.011	2.4	0.0555	-0.00002	0.000411	0.00241	-0.00001	-0.000005	-0.05	-0.000005	0.961	-0.0001	-0.000005	0.00011	0.0015	0.000014	-0.0005	-0.05	0.000284	-0.01	0.000063	0.000027
19-Apr-13	109	500	450	7.50	5																											
26-Apr-13	110	500	430	6.98	5	#N/A	3.2	4.4	3	-0.5	0.013	2.5	0.0803	-0.00002	0.000472	0.00332	-0.00001	-0.000005	-0.05	-0.000005	1	-0.0001	-0.000005	0.000199	0.0037	0.000021	-0.0005	-0.05	0.000297	-0.01	0.000058	0.000115
3-May-13	111	500	485	7.22	8																											
10-May-13	112	500	410	6.94	4	#N/A	3.3	3.8	2	1	-0.01	1.95	0.0642	-0.00002	0.000302	0.00265	-0.00001	-0.000005	-0.05	-0.000005	0.783	-0.0001	0.000006	0.000183	0.0021	0.000023	-0.0005	-0.05	0.000353	-0.01	-0.00005	0.000086
17-May-13	113	500	435	7.42	4																											
24-May-13	114	500	435	6.98	4	#N/A	3.8	3.6	2																							

Aug 5/11 Zn 0.0031. Repeat =0.0005, data accepted.
Aug 5/11 Pb=0.000149, repeat= 0.000149. Data confirmed, suspect contamination
Jul 22/11 Ni=0.00069, repeat=0.00069. Data confirmed, suspect contamination
Aug 19/11 Ni=0.0002, repeat=0.0002. Data confirmed, suspect contamination
Dec 9/11 Cl=2.6, Cd=0.000048, Pb=0.000984, Tl=0.000031, Zn=0.0055, repeat= Cl=0.5. data accepted. Cd= 0.000047, Pb= 0.00105, Tl= 0.00003, Zn= 0.0056. data confirmed suspect contamination
Nov 11/11 Cd=0.000052 repeat=0.000049. Data confirmed, suspect contamination
Mar 16/12 Ni=0.00027, repeat=0.00027. Data confirmed, suspect contamination
Apr 13/12 Pb=0.000268, Cd=0.000174, Zn=0.0026. Repeat Cd=0.000162, Pb=0.000296, Zn=0.00279. Data confirmed, suspect contamination
Apr 27,12 Ni=0.000133, repeat=0.000154. Data confirmed, suspect contamination
Sept 14/12 As=0.00166, Ni=0.000621. repeat As=0.000177, Ni=0.00066. Data confirmed suspect contamination
Aug 3/12 Sb=0.000096, Cd=0.000066, repeat Sb=-0.00002, Data accepted. Cd=0.000058, Data confirmed suspect contamination
Aug 17/12 Pb=0.00238, repeat =0.00235
Nov 23/12 As=0.00173, Ni=0.000688, repeat As=0.00173, Data confirmed, suspect contamination Ni=0.000497. Data accepted within 4X stdev

HC 6
Sample =
09SWC506 30-33
DUP

Date	Cycle No.	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
6-Jul-12	68	-0.002	0.866	-0.00004	0.863	-0.000005	0.157	0.014	-10	-0.000002	-0.0002	-0.0005	0.0000036	0.00047	-0.0001	-0.0001
13-Jul-12	69															
20-Jul-12	70	-0.002	0.856	-0.00004	1.02	-0.000005	0.165	0.0143	-10	0.0000022	-0.0002	-0.0005	0.0000028	0.00068	0.00165	-0.0001
27-Jul-12	71															
3-Aug-12	72	-0.002	0.897	-0.00004	1.03	-0.000005	0.213	0.0152	-10	0.000003	0.00029	-0.0005	0.000006	0.00039	0.00336	-0.0001
10-Aug-12	73															
17-Aug-12	74	-0.002	0.886	-0.00004	0.69	-0.000005	0.221	0.0128	-10	0.000002	0.00036	-0.0005	0.000004	0.00034	0.00395	-0.0001
24-Aug-12	75															
31-Aug-12	76	-0.002	0.767	-0.00004	0.79	-0.000005	0.199	0.0126	-10	0.000002	-0.0002	-0.0005	0.000003	0.00025	0.0004	-0.0001
7-Sep-12	77															
14-Sep-12	78	-0.002	0.816	-0.00004	0.824	-0.000005	0.247	0.0157	-10	0.000003	-0.0002	-0.0005	0.000011	0.0004	0.00092	-0.0001
21-Sep-12	79															
28-Sep-12	80	-0.002	0.74	-0.00004	0.868	-0.000005	0.177	0.0112	-10	0.000002	-0.0002	-0.0005	0.000002	0.00026	0.00031	-0.0001
5-Oct-12	81															
12-Oct-12	82	0.0076	0.836	-0.00004	0.88	-0.000005	0.16	0.0126	-10	-0.000002	-0.0002	-0.0005	0.000008	0.00024	0.00218	-0.0001
19-Oct-12	83															
26-Oct-12	84	0.0099	0.753	-0.00004	0.938	-0.000005	0.139	0.0129	-10	0.000002	0.00023	-0.0005	0.000003	0.00038	0.00031	-0.0001
2-Nov-12	85															
9-Nov-12	86	-0.002	0.947	-0.00004	1.16	-0.000005	0.212	0.0142	-3	0.000003	0.00035	-0.0005	0.000006	0.00078	0.00197	-0.0001
16-Nov-12	87															
23-Nov-12	88	-0.002	0.935	-0.00004	1.01	-0.000005	0.148	0.0154	-3	0.000003	0.00046	-0.0005	0.000002	0.00036	0.00069	-0.0001
30-Nov-12	89															
7-Dec-12	90	-0.002	0.788	-0.00004	0.728	-0.000005	0.12	0.0115	-3	0.000002	-0.0002	-0.0005	0.000002	0.00048	0.0009	-0.0001
14-Dec-12	91															
21-Dec-12	92	-0.002	0.708	-0.00004	0.687	-0.000005	0.132	0.00969	-3	0.000002	-0.0002	-0.0005	-0.000002	0.00036	0.00017	-0.0001
28-Dec-12	93															
4-Jan-13	94	-0.002	0.736	-0.00004	0.592	-0.000005	0.144	0.00985	-3	0.000002	0.00023	-0.0005	-0.000002	0.00024	0.00067	-0.0001
11-Jan-13	95															
18-Jan-13	96	0.0027	0.659	-0.00004	0.631	-0.000005	0.113	0.00917	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00076	-0.0001
25-Jan-13	97															
1-Feb-13	98	0.0021	0.667	-0.00004	0.649	-0.000005	0.13	0.00751	-3	0.000002	-0.0002	-0.0005	-0.000002	0.0006	0.00026	-0.0001
8-Feb-13	99															
15-Feb-13	100	-0.002	0.627	-0.00004	0.557	-0.000005	0.111	0.00706	-3	0.000002	-0.0002	-0.0005	-0.000002	-0.0002	-0.0001	-0.0001
22-Feb-13	101															
1-Mar-13	102	-0.002	0.683	-0.00004	0.647	-0.000005	0.138	0.00714	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00026	0.00024	-0.0001
8-Mar-13	103															
15-Mar-13	104	-0.002	0.621	-0.00004	0.681	-0.000005	0.121	0.00733	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00029	0.00011	-0.0001
22-Mar-13	105															
29-Mar-13	106	-0.002	0.611	-0.00004	0.57	-0.000005	0.115	0.00627	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00029	0.00015	-0.0001
5-Apr-13	107															
12-Apr-13	108	-0.002	0.617	-0.00004	0.562	-0.000005	0.115	0.0068	-3	-0.000002	-0.0002	0.00083	-0.000002	0.00043	-0.0001	-0.0001
19-Apr-13	109															
26-Apr-13	110	-0.002	0.649	-0.00004	0.621	0.000045	0.157	0.00684	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00101	-0.0001
3-May-13	111															
10-May-13	112	-0.002	0.5	-0.00004	0.528	-0.000005	0.111	0.00525	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00025	0.00016	-0.0001
17-May-13	113															
24-May-13	114															

HC 7

CONFIDENTIAL *DRAFT*

Sample =
09SWC484 40-43

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L
18-Mar-11	0	500	325	7.71	172	#N/A	3.7	69.5	5	2.2	0.99	42	0.0795	-0.00002	0.00017	0.0155	-0.00001	-0.000005	-0.05	0.000006	11.2	-0.0001	0.000062	0.00614	0.003	-0.000005	0.0058	3.44	0.0282	-0.01	0.00406	0.00011
25-Mar-11	1	500	515	8.00	130																											
1-Apr-11	2	500	525	7.90	119	#N/A	5.3	68.8	4	0.8	0.95	30.2	0.0629	0.00002	0.00038	0.00947	-0.00001	-0.000005	-0.05	0.000008	7.94	0.0009	0.000033	0.00203	0.008	0.000017	0.005	2.53	0.0221	-0.01	0.00491	0.00012
8-Apr-11	3	500	465	7.75	91																											
15-Apr-11	4	500	455	7.90	105	#N/A	2.6	59.8	2	-0.5	0.66	26.4	0.0533	-0.00002	0.00008	0.00799	-0.00001	-0.000005	-0.05	-0.000005	6.84	-0.0001	0.00002	0.00119	0.008	0.000023	0.0042	2.25	0.0191	-0.01	0.00212	0.0001
22-Apr-11	5	500	470	7.79	95																											
29-Apr-11	6	500	465	7.79	91	#N/A	3.8	58.4	4	-0.5	0.55	30.9	0.0643	-0.00002	0.00008	0.00972	-0.00001	-0.000005	-0.05	-0.000005	7.83	-0.0001	0.000019	0.0014	0.007	0.00001	0.0044	2.75	0.0213	-0.01	0.00111	0.00008
6-May-11	7	500	450	7.74	112																											
13-May-11	8	500	460	7.79	100	#N/A	3.8	50.0	4	0.5	0.41	40.3	0.0498	-0.00002	0.00017	0.0107	-0.00001	-0.000005	-0.05	-0.000005	10.4	-0.0001	0.00002	0.00072	0.004	0.000011	0.0043	3.49	0.0256	-0.01	0.00057	0.00009
20-May-11	9	500	460	7.89	88																											
27-May-11	10	500	460	7.80	84	#N/A	5.2	47.8	3	-0.5	0.3	36	0.0451	-0.00002	0.00012	0.00945	-0.00001	-0.000005	-0.05	-0.000005	9.21	-0.0001	0.00002	0.00055	0.002	0.000017	0.0034	3.16	0.0301	-0.01	0.00042	0.00003
3-Jun-11	11	500	455	7.72	90																											
10-Jun-11	12	500	475	7.84	91	#N/A	2.4	56.7	2	0.9	0.24	38.7	0.0506	-0.00002	0.00075	0.0104	-0.00001	-0.000005	-0.05	0.000006	9.95	-0.0001	0.000038	0.00061	0.004	0.00001	0.0035	3.36	0.0327	-0.01	0.0003	#N/A
17-Jun-11	13	500	435	7.69	91																											
24-Jun-11	14	500	465	8.01	97	#N/A	2.0	60.5	2	-0.5	0.21	49.7	0.0412	-0.00002	0.00065	0.012	-0.00001	-0.000005	-0.05	-0.000005	12.7	-0.0001	0.000026	0.00035	0.003	0.000009	0.0034	4.4	0.0435	-0.01	0.00024	-0.00002
1-Jul-11	15	500	470	7.91	109																											
8-Jul-11	16	500	465	7.83	114	#N/A	3.6	64.7	2	-0.5	0.21	46.1	0.0519	-0.00002	0.00004	0.0119	-0.00001	-0.000005	-0.05	-0.000005	12.1	-0.0001	0.00004	0.00078	0.005	0.000031	0.0032	3.87	0.0398	-0.01	0.00014	0.00018
15-Jul-11	17	500	460	7.72	113																											
22-Jul-11	18	500	485	7.78	106	#N/A	3.8	55.5	-2	0.8	0.2	48.5	0.0603	-0.00002	0.00005	0.0133	-0.00001	0.00001	-0.05	0.000006	12.4	-0.0001	0.000065	0.00112	0.017	#N/A	0.0034	4.26	0.0422	-0.01	0.0001	0.0002
29-Jul-11	19	500	450	7.90	114																											
5-Aug-11	20	500	480	7.74	115	#N/A	4.2	65.7	-2	0.8	0.21	50.2	0.0373	-0.00002	0.00003	0.0139	-0.00001	-0.000005	-0.05	-0.000005	12.3	-0.0001	0.000063	0.00025	0.002	-0.000005	0.0035	4.73	0.0514	-0.01	0.0001	0.00002
12-Aug-11	21	500	460	7.80	102																											
19-Aug-11	22	500	465	7.76	106	#N/A	4.4	63.2	-2	0.8	0.23	49.3	0.0409	-0.00002	0.00006	0.0131	-0.00001	-0.000005	-0.05	-0.000005	12.9	-0.0001	0.000057	0.00069	0.003	0.000017	0.0035	4.17	0.0412	-0.01	0.00009	#N/A
26-Aug-11	23	500	460	7.65	103																											
2-Sep-11	24	500	465	7.81	103	#N/A	4.8	64.1	2	0.6	0.22	48	0.0358	-0.00002	0.00013	0.0123	-0.00001	-0.000005	-0.05	0.000012	12.4	-0.0001	0.000059	0.00037	0.003	0.000008	0.0034	4.14	0.0429	-0.01	0.00007	0.00004
9-Sep-11	25	500	470	7.82	105																											
16-Sep-11	26	500	465	7.65	109	#N/A	5.2	64.6	-2	0.9	0.23	50.7	0.0311	-0.00002	0.00012	0.0128	-0.00001	0.000006	-0.05	0.000007	13.4	-0.0001	0.000061	0.00035	0.003	0.000012	0.0034	4.18	0.0411	-0.01	0.00006	0.00004
23-Sep-11	27	500	450	7.71	106																											
30-Sep-11	28	500	475	7.76	108	#N/A	3.4	66.5	-2	0.6	0.24	50.8	0.0224	-0.00002	0.00005	0.0122	-0.00001	-0.000005	-0.05	0.000008	13	-0.0001	0.000045	0.00017	0.004	-0.000005	0.0039	4.46	0.0343	-0.01	-0.00005	-0.00002
7-Oct-11	29	500	455	7.73	107																											
14-Oct-11	30	500	445	7.68	89	#N/A	3.5	51.9	-2	-0.5	0.21	44.3	0.0283	-0.00002	0.0001	0.00956	-0.00001	-0.000005	-0.05	-0.000005	11.4	-0.0001	0.000025	0.00016	0.001	-0.000005	0.0033	3.87	0.0292	-0.01	-0.00005	0.00008
21-Oct-11	31	500	455	7.77	89																											
28-Oct-11	32	500	460	7.86	124	#N/A	3.6	73.8	-2	-0.5	0.25	59.4	0.0322	-0.00002	0.00005	0.0146	-0.00001	-0.000005	-0.05	-0.000005	15.2	-0.0001	0.000039	0.00041	0.008	0.000017	0.0038	5.2	0.0353	-0.01	-0.00005	0.00005
4-Nov-11	33	500	460	7.84	110																											
11-Nov-11	34	500	460	7.81	116	#N/A	6.1	70.6	-2	-0.5	0.26	58.1	0.0214	-0.00002	0.00007	0.0139	-0.00001	-0.000005	-0.05	#N/A	14.8	-0.0001	0.000042	0.00027	0.002	0.000037	0.0047	5.15	0.0306	-0.02	-0.00005	0.00017
18-Nov-11	35	500	455	7.83	125																											
25-Nov-11	36	500	465	7.87	128	#N/A	4.0	78.3	2	-0.5	0.28	61.5	0.0242	-0.00002	0.00004	0.0148	-0.00001	-0.000005	-0.05	0.000013	15.5	-0.0001	0.000041	0.0018	0.003	0.000018	0.0049	5.51	0.0318	-0.01	-0.00005	0.00018
2-Dec-11	37	500	455	7.76	129																											
9-Dec-11	38	500	470	7.70	116	#N/A	5.3	71.5	2	-0.5	0.24	57.6	0.029	-0.00002	0.00005	0.0132	-0.00001	-0.000005	-0.05	-0.000005	14.2	-0.0001	0.000037	0.00093	0.003	0.000007	0.004	5.4	0.0275	-0.01	-0.00005	0.00022
16-Dec-11	39	500	455	7.74	124																											
23-Dec-11	40	500	455	7.76	119	#N/A	4.9	76.7	3	-0.5	0.27	59.8	0.0288	-0.00002	-0.00002	0.0149	-0.00001	-0.000005	-0.05	-0.000005	14.7	#N/A	0.000047	0.0006	0.003	0.000021	0.004	5.6	0.0241	-0.01	-0.00005	0.00031
30-Dec-11	41	500	470	7.73	119																											
6-Jan-12	42	500	465	7.69	114	#N/A	3.7	82.1	2	-0.5	0.24	57.6	0.0149	-0.00002	0.00004	0.0131	-0.00001	-0.000005	-0.05	-0.000005	14.1	-0.0001	0.000027	0.0003	0.001	0.000007	0.0041	5.46	0.022	-0.01	-0.00005	-0.00002
13-Jan-12	43	500	460	7.68	113																											
20-Jan-12	44	500	465	7.80	125	#N/A	3.1	89.6	2	-0.5	0.26	56.6	0.0218	-0.00002	0.00008	0.0171	-0.00001	0.000005	-0.05	#N/A	14.1	0.0002	0.000049	#N/A	0.014	#N/A	0.004	5.18	0.0203	-0.01	-0.00005	#N/A
27-Jan-12	45	500	460	7.68	120																											
3-Feb-12	46	500	465	7.63	121	#N/A	7.4	82.8	2	-0.5	0.25	62.4	0.0186	-0.00002	0.00005	0.0122	-0.00001	-0.000005	-0.05	-0.000005	15.8	-0.0001	0.000016	0.00011	0.002	-0.000005	0.0038	5.58	0.0179	-0.01	0.00011	0.00003
10-Feb-12	47	500	465	7.61	119																											
17-Feb-12	48	500	465	7.77	122	#N/A	3.5	76.3	-2	-0.5	0.26	64.7	0.0231	-0.00002	0.00008	0.0139	-0.00001	-0.000005	-0.05	-0.000005	16.7	-0.0001	0.000018	0.00093	0.009	0.000019	0.0041	5.58	0.0132	-0.01	-0.00005	-0.00002
24-Feb-12	49	500	450	7.62	115																											
2-Mar-12	50	500	455	7.56	114	#N/A	8.9	71.8	-2	-0.5	0.24	54.8	0.0169	-0.00002	0.00004	0.0123	-0.00001	-0.000005	-0.05	0.000012	13.8	-0.0001	0.000017	0.0003	0.002	#N/A	0.0033	4.94	0.00858	-0.01	-0.00005	0.00005
9-Mar-12	51	500	465	7.66	127																											
16-Mar-12	52	500	460	7.83	134	#N/A	3.6	78.6	-2	-0.5	0.24	64.2	0.0159	-0.00002	-0.00002	0.0142	-0.00001	-0.000005	-0.05	0.000006	16.1	-0.0001	0.000018	0.00041	0.004	0.000006	0.0037	5.8	0.0032	-0.01	-0.00005	0.00019
23-Mar-12	53	500	455	7.62	131																											
30-Mar-12	54	500	465	7.64	125	#N/A	4.6	73.5	3	-0.5	0.21	60.4	0.02	-0.00002	0.00007	0.0133	-0.00001	-0.000005	-0.05	-0.000005	15.7	-0.0001	0.000008	0.00016	0.005	0.000009	0.0033	5.17	0.00089	-0.01	-0.00005	0.00004
6-Apr-12	55	500	455	7.77	125																											
13-Apr-12	56	500	455	7.89	121	#N/A	2.6	72.3	2	-0.5	0.19	59.7	0.023	-0.00002	-0.00002	0.0139	-0.00001	-0.000005	-0.05	-0.000005	15.3	-0.0001	-0.000005	0.00038	0.004	0.000067	0.0032	5.23	0.00048	-0.01	-0.00005	0.00004
20-Apr-12	57	500	465	7.73	127																											
27-Apr-12	58	500	465	7.71	117	#N/A	5.5	70.6	2	-0.5	0.19	54	0.016	-0.00002	0.000073	0.0142	-0.00001	-0.000005	-0.05	0.000011	13.8	0.00021	0.000014	0.000815	0.005	0.000008	0.00272	4.71	0.000627	-0.01	0.000084	#N/A
4-May-12	59	500	465	7.60	115																											
11-May-12	60	500	480	7.78	107	#N/A	3.5	63.9	3	-0.5	0.17	54	0.0159	-0.00002	0.000074	0.0124	-0.00001	-0.000005	-0.05	0.000005	14.2	-0.0001	0.000008	0.000632	0.0036	0.000016	0.00241	4.51	0.000662	-0.01	-0.00005	0.000128
18-May-12	61	500	460	7.71	119																											
25-May-12	62	500	470	7.69	117	#N/A	4.8	68.3	2	0.51	0.2	55.7	0.024	-0.00002	0.000181	0.0126	-0.00001	-0.000005	-0.05	-0.000005	14.4	-0.0001	0.0000095	0.000182	0.005	0.0000448	0.00299	4.79	0.000547	-0.01	-0.00005	0.000022
1-Jun-12	63	500	500	7.60	118																											
8-Jun-12	64	500	440	7.75	93	#N/A	3.6	55.6	3	0.77	0.16	43.5	0.0175	-0.00002	0.000025	0.0101	-0.00001	-0.000005	-0.05	0.0000109	11.2	-0.0001	0.0000084	0.00339	0.0042	0.0000513	0.00221	3.8	0.000497	-0.01	-0.00005	0.000236
15-Jun-12	65	500	470	7.62	101																											
22-Jun-12	66	500	440	7.65	96	#N/A	5.1	59.5	3	-0.5	0.2	46.2	0.0253	-0.00002	0.00011	0.0114	-0.00001	-0.000005	-0.05	-0.000005	11.9	-0.0001	0.0000104	0.000188	0.0028	0.000267	0.00249	4	0.00156	-0.01	0.00008	0.000065
29-Jun-12	67	500	455	7.52	91																											
6-Jul-12	68	500	445	7.66	94	#N/A	5.1	57.0	2	-0.5	0.19	42.5	0.0207	-0.00002	0.000147	0.0107	-0.00001	-0.000005	-0.05	-0.000005	10.7	-0.0001	0.0000053	0.000238	0.0038	0.0000106	0.00265	3.84	0.00107	-0.01	-0.00005	0.000041
13-Jul-12	69	500	445	7.64	87																											

HC 7

Sample =
09SWC484 40-43

Date	Cycle No.	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	0.038	4.91	0.0002	1.27	-0.000005	16.7	0.301	-10	-0.000002	0.00003	-0.0005	0.000334	0.0014	0.0004	0.0002
25-Mar-11	1															
1-Apr-11	2	-0.002	3.49	0.00012	1.53	-0.000005	10.1	0.217	-10	-0.000002	0.00024	0.0006	0.000765	0.0015	0.0004	-0.0001
8-Apr-11	3															
15-Apr-11	4	-0.002	3.1	0.00005	1.11	-0.000005	6.11	0.218	-10	-0.000002	0.00017	0.0005	0.000571	0.0013	0.0007	-0.0001
22-Apr-11	5															
29-Apr-11	6	-0.002	3.49	-0.00004	1.3	-0.000005	4.25	0.243	-10	-0.000002	0.00013	-0.0005	0.000533	0.0012	0.0002	-0.0001
6-May-11	7															
13-May-11	8	-0.002	3.51	-0.00004	1.27	-0.000005	2.41	0.292	-10	0.000004	0.00006	-0.0005	0.000464	0.0008	0.0002	-0.0001
20-May-11	9															
27-May-11	10	-0.002	2.66	0.00005	0.915	-0.000005	1.36	0.264	-10	-0.000002	0.00008	-0.0005	0.000337	0.0006	0.0002	-0.0001
3-Jun-11	11															
10-Jun-11	12	-0.002	2.46	-0.00004	0.751	-0.000005	0.81	0.31	-10	0.000003	0.00025	-0.0005	0.000293	0.0004	0.0008	-0.0001
17-Jun-11	13															
24-Jun-11	14	-0.002	2.75	-0.00004	0.913	-0.000005	0.89	0.335	-10	0.000005	0.00003	-0.0005	0.000434	0.0004	0.0002	-0.0001
1-Jul-11	15															
8-Jul-11	16	-0.002	2.27	-0.00004	0.766	-0.000005	0.63	0.35	-10	-0.000002	0.00004	-0.0005	0.000259	0.0003	0.0002	-0.0001
15-Jul-11	17															
22-Jul-11	18	#N/A	2.99	0.00009	0.693	0.00004	0.64	0.347	-10	0.000004	0.00002	-0.0005	0.000201	0.0002	0.0011	-0.0001
29-Jul-11	19															
5-Aug-11	20	-0.002	3.14	-0.00004	0.556	0.000007	0.58	0.387	-10	0.000002	0.00004	-0.0005	0.000225	0.0002	0.0004	-0.0001
12-Aug-11	21															
19-Aug-11	22	-0.002	3.12	-0.00004	0.582	-0.000005	0.52	0.348	-10	0.000003	0.00002	-0.0005	0.000184	-0.0002	0.0002	-0.0001
26-Aug-11	23															
2-Sep-11	24	-0.002	2.96	-0.00004	0.491	-0.000005	0.52	0.336	-10	0.000003	0.00031	-0.0005	0.00017	0.0002	0.0005	-0.0001
9-Sep-11	25															
16-Sep-11	26	-0.002	2.98	-0.00004	0.468	-0.000005	0.43	0.353	-10	0.000003	0.00002	-0.0005	0.00015	-0.0002	0.0004	-0.0001
23-Sep-11	27															
30-Sep-11	28	-0.002	3.04	-0.00004	0.423	-0.000005	0.5	0.361	-10	0.000002	0.00012	-0.0005	0.00013	-0.0002	-0.0001	-0.0001
7-Oct-11	29															
14-Oct-11	30	-0.002	2.66	-0.00004	0.363	-0.000005	0.46	0.285	-10	0.000004	0.00003	-0.0005	0.000088	-0.0002	0.0003	-0.0001
21-Oct-11	31															
28-Oct-11	32	-0.002	3.42	-0.00004	0.405	-0.000005	0.6	0.423	-10	0.000006	0.00031	-0.0005	0.000112	-0.0002	0.0003	-0.0001
4-Nov-11	33															
11-Nov-11	34	-0.002	3.44	-0.00004	0.411	-0.000005	0.63	0.376	-10	0.000018	0.0001	-0.0005	0.000094	-0.0002	#N/A	-0.0001
18-Nov-11	35															
25-Nov-11	36	-0.002	3.34	-0.00004	0.386	-0.000005	0.59	0.397	-10	0.000005	0.00022	-0.0005	0.000077	-0.0002	0.0005	-0.0001
2-Dec-11	37															
9-Dec-11	38	-0.002	3.17	-0.00004	0.329	-0.000005	0.57	0.372	-10	0.000004	0.00017	-0.0005	0.000085	-0.0002	0.0004	-0.0001
16-Dec-11	39															
23-Dec-11	40	-0.002	3.38	-0.00004	0.326	-0.000005	0.65	0.378	-10	0.000006	-0.00001	-0.0005	0.000074	-0.0002	0.0005	-0.0001
30-Dec-11	41															
6-Jan-12	42	-0.002	3.08	-0.00004	0.305	-0.000005	0.48	0.364	-10	0.000005	0.00006	-0.0005	0.000065	-0.0002	0.0002	-0.0001
13-Jan-12	43															
20-Jan-12	44	#N/A	4.57	-0.00004	0.299	#N/A	0.76	0.359	-10	#N/A	-0.0002	-0.0005	0.000062	-0.0002	#N/A	-0.0001
27-Jan-12	45															
3-Feb-12	46	-0.002	2.95	-0.00004	0.323	-0.000005	0.46	0.343	-10	0.000003	-0.0002	-0.0005	0.000062	-0.0002	0.0001	-0.0001
10-Feb-12	47															
17-Feb-12	48	-0.002	3.13	-0.00004	0.364	-0.000005	0.46	0.357	-10	0.000004	-0.0002	-0.0005	0.000056	-0.0002	0.0003	-0.0001
24-Feb-12	49															
2-Mar-12	50	-0.002	2.74	-0.00004	0.272	-0.000005	0.4	0.315	-10	0.000005	-0.0002	-0.0005	0.000056	-0.0002	0.0002	-0.0001
9-Mar-12	51															
16-Mar-12	52	-0.002	2.98	-0.00004	0.327	0.000008	0.46	0.355	-10	0.000007	-0.0002	-0.0005	0.000049	-0.0002	0.0001	-0.0001
23-Mar-12	53															
30-Mar-12	54	-0.002	2.64	-0.00004	0.321	-0.000005	0.37	0.32	-10	0.000005	-0.0002	-0.0005	0.000045	-0.0002	0.0002	-0.0001
6-Apr-12	55															
13-Apr-12	56	-0.002	2.73	-0.00004	0.345	-0.000005	0.36	0.318	-10	0.000006	0.0007	-0.0005	0.00004	-0.0002	0.0017	-0.0001
20-Apr-12	57															
27-Apr-12	58	-0.002	2.63	-0.00004	0.288	-0.000005	0.345	0.308	-10	0.000005	0.00098	-0.0005	0.000044	0.00059	0.0019	-0.0001
4-May-12	59															
11-May-12	60	-0.002	2.62	-0.00004	0.323	-0.000005	0.317	0.291	-10	0.000006	-0.0002	-0.0005	0.000037	-0.0002	0.00022	-0.0001
18-May-12	61															
25-May-12	62	-0.002	2.51	-0.00004	0.353	-0.000005	0.333	0.296	-10	0.0000067	0.0003	-0.0005	0.0000425	-0.0002	0.00071	-0.0001
1-Jun-12	63															
8-Jun-12	64	0.0029	2.12	-0.00004	0.238	-0.000005	0.363	0.211	-10	0.0000046	0.00031	-0.0005	0.0000297	-0.0002	0.00084	-0.0001
15-Jun-12	65															
22-Jun-12	66	-0.002	2.35	-0.00004	0.29	-0.000005	0.33	0.239	-10	0.0000044	-0.0002	-0.0005	0.0000306	-0.0002	0.00016	-0.0001
29-Jun-12	67															
6-Jul-12	68	-0.002	2.54	-0.00004	0.285	-0.000005	0.326	0.224	-10	0.0000051	-0.0002	-0.0005	0.0000286	-0.0002	0.00012	-0.0001
13-Jul-12	69															

HC 7

CONFIDENTIAL *DRAFT*

Sample =
09SWC484 40-43

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L
20-Jul-12	70	500	460	7.61	95	#N/A	5.0	58.1	2	-0.5	0.17	49.2	0.0462	-0.00002	0.000101	0.0102	-0.00001	-0.000005	-0.05	-0.000005	13.2	-0.0001	0.0000088	0.000228	0.0027	0.0000101	0.00269	3.93	0.000371	-0.01	0.000052	0.000039
27-Jul-12	71	500	440	7.57	83																											
3-Aug-12	72	500	470	7.70	85	#N/A	3.7	53.0	2	-0.5	0.16	40	0.0303	-0.00002	-0.00002	0.0102	-0.00001	-0.000005	-0.05	-0.000005	10.2	-0.0001	0.000008	0.00056	0.0084	0.000007	0.00226	3.56	0.000832	-0.01	-0.00005	0.000073
10-Aug-12	73	500	440	7.64	73																											
17-Aug-12	74	500	430	7.57	82	#N/A	4.3	50.0	2	-0.5	0.15	38.7	0.0367	0.00003	0.000043	0.0105	-0.00001	-0.000005	-0.05	#N/A	10.1	-0.0001	0.000015	0.000731	0.0096	0.000118	0.00226	3.27	0.00161	-0.01	-0.00005	#N/A
24-Aug-12	75	500	450	7.55	76																											
31-Aug-12	76	500	460	7.78	86	#N/A	3.5	53.4	2	-0.5	0.14	41.8	0.0133	-0.00002	0.000032	0.0101	-0.00001	-0.000005	-0.05	-0.000005	11.4	-0.0001	0.000011	0.000523	0.0026	0.000095	0.00201	3.28	0.00124	-0.01	-0.00005	0.000041
7-Sep-12	77	500	455	7.52	76																											
14-Sep-12	78	500	460	7.52	81	#N/A	4.1	49.7	2	-0.5	0.12	37.2	0.0243	-0.00002	0.000092	0.00917	-0.00001	-0.000005	-0.05	-0.000005	9.56	0.00014	0.000006	0.000568	0.0055	0.000024	0.00191	3.24	0.000242	-0.01	-0.00005	0.000092
21-Sep-12	79	500	485	7.53	94																											
28-Sep-12	80	500	440	7.65	85	#N/A	3.0	55.1	2	-0.5	0.13	38.5	0.0327	-0.00002	0.000047	0.00995	-0.00001	-0.000005	-0.05	-0.000005	10.3	0.00047	0.000011	0.00166	0.0094	0.000253	0.00193	3.1	0.00133	-0.01	-0.00005	0.000193
5-Oct-12	81	500	430	7.46	#N/A																											
12-Oct-12	82	500	495	7.46	85	#N/A	6.6	55.5	2	-0.5	0.13	44.1	0.0136	-0.00002	0.000122	0.0104	-0.00001	-0.000005	-0.05	-0.000005	12	-0.0001	-0.000005	0.00125	0.0031	0.00001	0.00215	3.41	0.000235	-0.01	-0.00005	-0.00002
19-Oct-12	83	500	480	7.55	88																											
26-Oct-12	84	500	475	7.66	84	#N/A	2.8	53.1	3	-0.5	0.1	40.4	0.024	-0.00002	-0.00002	0.0097	-0.00001	-0.000005	-0.05	-0.000005	11	-0.0001	-0.000005	0.000822	0.0082	0.000018	0.0017	3.15	0.00029	-0.01	0.00008	0.000051
2-Nov-12	85	500	475	7.53	87																											
9-Nov-12	86	500	480	7.55	82	#N/A	5.9	57.5	3	-0.5	0.1	43.5	0.0155	-0.00002	-0.00002	0.011	-0.00001	-0.000005	-0.05	-0.000005	11.9	-0.0001	0.000005	0.000228	0.0041	0.000034	0.00191	3.34	0.000388	-0.01	0.000072	0.000066
16-Nov-12	87	500	480	7.55	87																											
23-Nov-12	88	500	485	7.72	89	#N/A	4.1	54.9	3	-0.5	0.1	44.1	0.0156	-0.00002	#N/A	0.00998	-0.00001	-0.000005	-0.05	-0.000005	11.8	-0.0001	0.000022	0.00018	0.003	0.000027	0.00211	3.55	0.000281	-0.01	-0.00005	#N/A
30-Nov-12	89	500	500	7.58	87																											
7-Dec-12	90	500	480	7.53	80	#N/A	7.2	52.2	2	-0.5	0.093	40.1	0.0233	-0.00002	0.000067	0.0088	-0.00001	-0.000005	-0.05	-0.000005	11.3	-0.0001	-0.000005	0.000965	0.0056	0.000031	0.00157	2.91	0.00103	-0.01	0.000058	0.000029
14-Dec-12	91	500	475	7.57	70																											
21-Dec-12	92	500	460	7.53	64	#N/A	3.8	41.0	-2	-0.5	0.082	29.6	0.0199	-0.00002	0.000047	0.00723	-0.00001	-0.000005	-0.05	-0.000005	8.28	-0.0001	0.000005	0.000096	0.005	0.000009	0.00123	2.17	0.00114	-0.01	-0.00005	0.000044
28-Dec-12	93	500	450	7.61	65																											
4-Jan-13	94	500	490	7.57	59	#N/A	5.8	40.9	-2	0.9	0.082	29.6	0.0158	-0.00002	-0.00002	0.0081	-0.00001	-0.000005	-0.05	0.000005	8.18	0.0008	0.000021	0.000176	0.0042	0.000149	0.00107	2.22	0.000944	-0.01	-0.00005	0.000095
11-Jan-13	95	500	465	7.59	77																											
18-Jan-13	96	500	460	7.56	68	#N/A	2.5	44.6	2	0.6	0.062	33.7	0.0161	-0.00002	0.000021	0.00867	-0.00001	-0.000005	-0.05	-0.000005	9.34	-0.0001	-0.000005	0.000094	0.0029	0.000021	0.00135	2.52	0.000394	-0.01	-0.00005	0.000074
25-Jan-13	97	500	460	7.53	60																											
1-Feb-13	98	500	440	7.54	72	#N/A	4.2	43.9	3	-0.5	0.068	35	0.0168	-0.00002	0.000034	0.00926	-0.00001	-0.000005	-0.05	-0.000005	9.9	-0.0001	0.000005	-0.00005	0.0036	0.000006	0.0014	2.49	0.00077	-0.01	0.000053	0.000049
8-Feb-13	99	500	510	7.50	79																											
15-Feb-13	100	500	460	7.59	74	#N/A	3.5	41.1	2	0.56	0.073	33.8	0.0236	-0.00002	0.000024	0.00863	-0.00001	-0.000005	-0.05	-0.000005	9.64	-0.0001	0.000006	0.000076	0.0063	0.000008	0.00121	2.37	0.0005	-0.01	0.000051	0.000029
22-Feb-13	101	500	440	7.55	69																											
1-Mar-13	102	500	450	7.41	67	#N/A	5.7	43.8	3	-0.5	0.055	31.3	0.0277	-0.00002	-0.00002	0.00822	-0.00001	-0.000005	-0.05	-0.000005	9.11	-0.0001	0.000005	0.000145	0.0069	0.000013	0.00132	2.08	0.000942	-0.01	0.000195	-0.00002
8-Mar-13	103	500	470	7.53	59																											
15-Mar-13	104	500	465	7.52	69	#N/A	5.6	38.4	3	0.65	0.061	32.1	0.0134	-0.00002	0.000037	0.00834	-0.00001	-0.000005	-0.05	-0.000005	9.35	-0.0001	-0.000005	0.000098	0.0035	-0.000005	0.00128	2.13	0.000625	-0.01	0.000058	0.000049
22-Mar-13	105	500	440	7.44	63																											
29-Mar-13	106	500	440	7.53	61	#N/A	4.3	34.7	3	-0.5	0.054	29.6	0.0201	-0.00002	0.00002	0.00776	-0.00001	-0.000005	-0.05	-0.000005	8.66	-0.0001	0.000005	0.000075	0.0047	0.000018	0.00127	1.95	0.000773	-0.01	0.000062	0.000044
5-Apr-13	107	500	445	7.40	57																											
12-Apr-13	108	500	470	7.50	63	#N/A	6.8	37.4	2	0.54	0.051	28.8	0.0264	-0.00002	-0.00002	0.00841	-0.00001	-0.000005	-0.05	-0.000005	8.41	-0.0001	-0.000005	0.000209	0.0069	0.000007	0.00112	1.89	0.000654	-0.01	-0.00005	-0.00002
19-Apr-13	109	500	460	7.46	57																											
26-Apr-13	110	500	445	7.50	57	#N/A	4.1	32.6	3	0.6	0.048	25.3	0.0268	-0.00002	0.000029	0.00795	-0.00001	-0.000005	-0.05	-0.000005	7.52	-0.0001	0.000006	0.00014	0.0071	-0.000005	0.00105	1.59	0.000689	-0.01	0.000071	0.000036
3-May-13	111	500	440	7.42	62																											
10-May-13	112	500	420	7.41	57	#N/A	4.3	31.2	2	-0.5	0.044	25.9	0.0307	-0.00002	0.000024	0.00709	-0.00001	-0.000005	-0.05	-0.000005	7.61	-0.0001	-0.000005	0.000108	0.0095	0.000038	0.00101	1.66	0.000928	-0.01	0.00005	0.000066
17-May-13	113	500	445	7.35	57																											
24-May-13	114	500	450	7.41	50	#N/A	4.2	30.6	2																							

April 1 Alkalinity 70.2. Repeat = 68.8.
June 10/11 Ni 0.00298. Repeat =0.0031, data confirmed suspect contamination
July 22/11 Pb 0.000776 and P 0.137. Repeat P=0.122. Data confirmed, suspect contamination.
Aug 19/11 Ni=0.00026, repeat=0.00026. Data confirmed, suspect contamination
Nov 11/11 Cd=0.000065, Zn=0.0021, repeat=0.000066, Zn= 0.0026. Data confirmed, suspect contamination
Dec 23/11 Cr=0.001, repeat=0.0011. Data confirmed, susepct contamination
Jan 20/12 P=0.186, Ag=0.00131, Pb=0.00281. repeat Pb=0.0029, P= 0.221, Ag=0.00135. Data onfirmed, suspect contamination
Jan 20/12 Cd=0.000075, Cu=0.00902, Ni=0.00049, Tl=0.000028, Zn=0.0077. Repeat Cd=0.000075, Cu=0.00878, Zn=0.0078, Tl=0.000028, Ni=0.00047. Data confirmed, suspect contamination.
Mar 2/12 Pb=0.000234, repeat=0.000228. Data confirmed, suspect contamination
Apr 27/12 Ni=0.000162, repeat=0.000187. Data confirmed, suspect contamination
Aug 17/12 Ni=0.0979, Cd=0.000178, Zn=0.00344. repeat Ni=0.102, Cd=0.000177, Zn=0.00299. Data confirmed, suspect contamination
Jun 22/12 Fe=0.108, repeat=0.0028. Data accepted
Aug 3/12 Sb=0.000048, repeat= -0.00002. Data accepted
Oct 5/12 Conductivity= 5. Cannot repeat suspect titrator malfunction
Nov 23/12 As=0.000812, Ni=0.000451. repeat As=0.000812, Ni=0.000197. Data confirmed, suspect contamination
Dec 7/12 Ni=0.000227, repeat= 0.000029. data accepted

HC 7

Sample =
09SWC484 40-43

Date	Cycle No.	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
20-Jul-12	70	-0.002	2.43	-0.00004	0.343	-0.000005	0.311	0.238	-10	0.0000043	-0.0002	-0.0005	0.0000378	0.00032	0.00098	-0.0001
27-Jul-12	71															
3-Aug-12	72	-0.002	2.32	-0.00004	0.294	-0.000005	0.325	0.204	-10	0.000006	-0.0002	-0.0005	0.000027	-0.0002	0.00025	-0.0001
10-Aug-12	73															
17-Aug-12	74	0.0075	2.31	-0.00004	0.292	-0.000005	0.315	0.198	-10	0.000005	0.00039	-0.0005	0.000027	-0.0002	#N/A	-0.0001
24-Aug-12	75															
31-Aug-12	76	-0.002	2.21	-0.00004	0.279	-0.000005	0.283	0.204	-10	0.000005	-0.0002	-0.0005	0.000025	-0.0002	0.00028	-0.0001
7-Sep-12	77															
14-Sep-12	78	-0.002	2.06	-0.00004	0.272	-0.000005	0.277	0.188	-10	0.000004	-0.0002	-0.0005	0.000022	-0.0002	0.00053	-0.0001
21-Sep-12	79															
28-Sep-12	80	-0.002	2.12	-0.00004	0.324	-0.000005	0.301	0.185	-10	0.000005	-0.0002	-0.0005	0.000031	-0.0002	0.00047	-0.0001
5-Oct-12	81															
12-Oct-12	82	-0.002	2.23	-0.00004	0.328	-0.000005	0.241	0.207	-10	0.000004	-0.0002	-0.0005	0.000026	-0.0002	0.00034	-0.0001
19-Oct-12	83															
26-Oct-12	84	0.0093	1.9	-0.00004	0.327	-0.000005	0.184	0.196	-10	0.000005	-0.0002	-0.0005	0.000024	-0.0002	0.00027	-0.0001
2-Nov-12	85															
9-Nov-12	86	-0.002	2.15	-0.00004	0.353	-0.000005	0.216	0.204	-3	0.000005	-0.0002	-0.0005	0.000024	-0.0002	0.00036	-0.0001
16-Nov-12	87															
23-Nov-12	88	-0.002	2.19	-0.00004	0.371	-0.000005	0.197	0.191	-3	0.000004	0.00043	-0.0005	0.000027	-0.0002	0.0005	-0.0001
30-Nov-12	89															
7-Dec-12	90	-0.002	2.01	-0.00004	0.339	-0.000005	0.169	0.175	-3	0.000004	0.00028	-0.0005	0.000026	-0.0002	0.00112	-0.0001
14-Dec-12	91															
21-Dec-12	92	-0.002	1.54	-0.00004	0.275	-0.000005	0.148	0.135	-3	0.000003	-0.0002	-0.0005	0.000016	-0.0002	0.00017	-0.0001
28-Dec-12	93															
4-Jan-13	94	-0.002	1.71	-0.00004	0.254	-0.000005	0.189	0.13	-3	0.000004	-0.0002	-0.0005	0.000012	-0.0002	0.00042	-0.0001
11-Jan-13	95															
18-Jan-13	96	-0.002	1.77	-0.00004	0.314	-0.000005	0.147	0.145	-3	0.000003	-0.0002	-0.0005	0.000019	-0.0002	0.00023	-0.0001
25-Jan-13	97															
1-Feb-13	98	-0.002	2	-0.00004	0.353	-0.000005	0.172	0.15	-3	0.000004	-0.0002	-0.0005	0.000017	-0.0002	-0.0001	-0.0001
8-Feb-13	99															
15-Feb-13	100	-0.002	2	-0.00004	0.341	-0.000005	0.164	0.149	-3	0.000004	-0.0002	-0.0005	0.000022	-0.0002	0.00013	-0.0001
22-Feb-13	101															
1-Mar-13	102	-0.002	1.79	-0.00004	0.351	-0.000005	0.165	0.133	-3	0.000003	-0.0002	-0.0005	0.000013	-0.0002	0.00048	-0.0001
8-Mar-13	103															
15-Mar-13	104	-0.002	1.91	-0.00004	0.361	-0.000005	0.153	0.138	-3	0.000003	-0.0002	-0.0005	0.000017	-0.0002	-0.0001	-0.0001
22-Mar-13	105															
29-Mar-13	106	-0.002	1.81	-0.00004	0.333	-0.000005	0.145	0.128	-3	-0.000002	-0.0002	-0.0005	0.000019	-0.0002	0.0001	-0.0001
5-Apr-13	107															
12-Apr-13	108	-0.002	1.74	-0.00004	0.324	-0.000005	0.137	0.125	-3	0.000002	-0.0002	0.00066	0.000014	-0.0002	0.00029	-0.0001
19-Apr-13	109															
26-Apr-13	110	-0.002	1.58	-0.00004	0.275	0.000008	0.133	0.11	-3	-0.000002	-0.0002	-0.0005	0.000014	-0.0002	0.00022	-0.0001
3-May-13	111															
10-May-13	112	-0.002	1.61	-0.00004	0.338	-0.000005	0.161	0.105	-3	-0.000002	-0.0002	-0.0005	0.000012	-0.0002	0.00056	-0.0001
17-May-13	113															
24-May-13	114															

HC 8

CONFIDENTIAL *DRAFT*

Sample =
09SWC498 54-57

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L
18-Mar-11	0	500	350	7.56	259	#N/A	3.9	79.1	5	2.1	0.64	101	0.0727	-0.00002	0.00021	0.0112	-0.00001	-0.000005	-0.05	0.000005	32.5	-0.0001	0.000061	0.00504	0.002	0.000015	0.0016	4.74	0.0251	-0.01	0.00106
25-Mar-11	1	500	465	8.00	141																										
1-Apr-11	2	500	455	7.96	99	#N/A	5.0	50.8	5	0.7	0.91	27.6	0.0902	0.00003	0.00032	0.00259	-0.00001	-0.000005	-0.05	-0.000005	8.85	-0.0001	0.000041	0.00232	0.007	0.000009	0.0007	1.34	0.0125	-0.01	0.002
8-Apr-11	3	500	440	7.84	82																										
15-Apr-11	4	500	460	7.87	77	#N/A	2.3	43.7	3	-0.5	0.75	24	0.0729	-0.00002	0.00011	0.00264	-0.00001	-0.000005	-0.05	-0.000005	7.77	0.0002	0.000014	0.00115	0.008	0.000015	-0.0005	1.11	0.0144	-0.01	0.00062
22-Apr-11	5	500	445	7.78	77																										
29-Apr-11	6	500	470	7.81	77	#N/A	3.8	44.4	5	-0.5	0.74	29.8	0.0847	0.00002	0.0001	0.00265	-0.00001	-0.000005	-0.05	-0.000005	9.81	-0.0001	0.000009	0.00211	0.009	0.00001	0.0008	1.3	0.018	-0.01	0.00029
6-May-11	7	500	455	7.71	67																										
13-May-11	8	500	475	7.77	69	#N/A	3.4	33.3	5	-0.5	0.68	24.8	0.076	-0.00002	0.00012	0.00229	-0.00001	-0.000005	-0.05	-0.000005	7.96	-0.0001	-0.000005	0.00109	0.006	0.000009	-0.0005	1.2	0.0142	-0.01	0.00019
20-May-11	9	500	455	7.90	67																										
27-May-11	10	500	460	7.85	65	#N/A	5.2	33.9	3	-0.5	0.59	25.8	0.0586	0.00004	0.00043	0.00202	-0.00001	-0.000005	-0.05	-0.000005	8.36	-0.0001	-0.000005	0.00103	0.003	0.000007	-0.0005	1.19	0.014	-0.01	0.00017
3-Jun-11	11	500	465	7.69	68																										
10-Jun-11	12	500	490	7.69	69	#N/A	2.5	36.6	3	0.5	0.58	27.5	0.0711	-0.00002	0.00012	0.00238	-0.00001	-0.000005	-0.05	0.000005	9	-0.0001	-0.000005	0.00092	0.009	0.000021	0.0007	1.22	0.0154	-0.01	0.00013
17-Jun-11	13	500	470	7.71	52																										
24-Jun-11	14	500	485	7.94	67	#N/A	1.7	36.8	2	0.8	0.52	38.7	0.0812	-0.00002	0.00012	0.00262	-0.00001	-0.000005	-0.05	-0.000005	13.2	-0.0001	0.000008	0.00095	#N/A	0.000008	0.0005	1.42	0.0174	-0.01	0.00011
1-Jul-11	15	500	475	7.92	64																										
8-Jul-11	16	500	485	7.68	67	#N/A	3.1	36.0	5	-0.5	0.56	27.5	0.0568	-0.00002	0.00044	0.0021	-0.00001	-0.000005	-0.05	0.000005	8.99	-0.0001	-0.000005	0.00077	0.004	0.000009	0.0006	1.22	0.0133	-0.02	0.00006
15-Jul-11	17	500	480	7.77	75																										
22-Jul-11	18	500	500	7.81	68	#N/A	3.2	36.0	-2	0.7	0.58	28.5	0.0698	-0.00002	0.0001	0.00309	-0.00001	-0.000005	-0.05	-0.000005	9.19	-0.0001	0.000018	0.00102	0.008	0.000014	0.0007	1.35	0.014	-0.01	-0.00005
29-Jul-11	19	500	460	7.91	72																										
5-Aug-11	20	500	460	7.69	68	#N/A	3.2	36.0	-2	-0.5	0.59	30.6	0.0615	-0.00002	0.0002	0.00229	-0.00001	-0.000005	-0.05	-0.000005	9.88	0.0001	0.000007	0.0009	0.007	0.000008	-0.0005	1.44	0.0161	-0.01	0.00007
12-Aug-11	21	500	495	7.87	74																										
19-Aug-11	22	500	465	7.72	73	#N/A	4.2	38.9	2	-0.5	0.72	32.9	0.0707	-0.00002	0.00012	0.00294	-0.00001	-0.000005	-0.05	-0.000005	10.9	-0.0001	0.00001	0.00119	0.01	0.000026	0.0006	1.41	0.0128	-0.01	0.00006
26-Aug-11	23	500	475	7.70	65																										
2-Sep-11	24	500	440	7.80	60	#N/A	4.0	34.4	3	0.7	0.6	27	0.0532	-0.00002	0.00008	0.00204	-0.00001	-0.000005	-0.05	-0.000005	8.78	-0.0001	0.000006	0.00086	0.004	0.000009	0.0005	1.15	0.0127	-0.01	-0.00005
9-Sep-11	25	500	435	7.83	64																										
16-Sep-11	26	500	470	7.59	68	#N/A	4.7	38.0	-2	0.9	0.71	31.1	0.0583	-0.00002	0.00011	0.0026	-0.00001	-0.000005	-0.05	0.000006	10.2	-0.0001	0.000009	0.00083	0.007	0.000008	0.0006	1.39	0.0107	-0.01	-0.00005
23-Sep-11	27	500	460	7.61	61																										
30-Sep-11	28	500	465	7.60	59	#N/A	3.0	32.4	-2	-0.5	0.54	27.7	0.0482	0.00003	0.0002	0.00229	-0.00001	-0.000005	-0.05	-0.000005	9.08	-0.0001	0.00001	0.00077	0.005	0.000015	0.0006	1.21	0.0138	-0.01	-0.00005
7-Oct-11	29	500	465	7.68	53																										
14-Oct-11	30	500	475	7.52	55	#N/A	3.3	30.8	2	-0.5	0.64	26.6	0.0557	-0.00002	0.00008	0.00228	-0.00001	-0.000005	-0.05	-0.000005	8.72	-0.0001	-0.000005	0.00067	0.003	0.000006	-0.0005	1.17	0.0153	-0.01	-0.00005
21-Oct-11	31	500	465	7.77	55																										
28-Oct-11	32	500	470	7.67	60	#N/A	3.8	32.5	3	-0.5	0.55	28.3	0.0565	-0.00002	0.00006	0.0023	-0.00001	-0.000005	-0.05	-0.000005	9.3	-0.0001	-0.000005	0.00083	0.005	0.00001	-0.0005	1.23	0.0151	-0.01	-0.00005
4-Nov-11	33	500	465	7.75	55																										
11-Nov-11	34	500	465	7.93	59	#N/A	5.1	35.6	2	-0.5	0.6	28.6	0.0656	-0.00002	0.00008	0.00284	-0.00001	-0.000005	-0.05	0.000007	9.36	-0.0001	0.000007	0.00106	0.008	0.000015	0.0006	1.27	0.0158	-0.01	-0.00005
18-Nov-11	35	500	460	7.70	60																										
25-Nov-11	36	500	475	7.71	58	#N/A	3.8	32.9	-2	-0.5	0.46	27.8	0.0651	-0.00002	0.0001	0.00373	-0.00001	-0.000005	-0.05	0.000006	9.15	-0.0001	0.000017	0.00214	0.01	0.000124	0.0006	1.2	0.0143	-0.01	-0.00005
2-Dec-11	37	500	460	7.77	58																										
9-Dec-11	38	500	460	7.65	58	#N/A	4.4	34.4	2	-0.5	0.57	28.4	0.0658	-0.00002	0.00005	0.00249	-0.00001	-0.000005	-0.05	-0.000005	9.39	0.0003	0.000008	0.00124	0.009	0.000015	0.0005	1.2	0.0164	-0.01	-0.00005
16-Dec-11	39	500	465	7.81	58																										
23-Dec-11	40	500	455	7.77	52	#N/A	3.8	31.4	4	-0.5	0.56	24.2	0.0625	-0.00002	0.00003	0.00287	-0.00001	-0.000005	-0.05	-0.000005	7.88	-0.0001	0.00001	0.0007	0.006	0.000014	-0.0005	1.1	0.0117	-0.01	-0.00005
30-Dec-11	41	500	485	7.83	52																										
6-Jan-12	42	500	475	7.51	50	#N/A	3.6	31.6	2	-0.5	0.53	24.4	0.0545	-0.00002	0.00005	0.00256	-0.00001	-0.000005	-0.05	-0.000005	8.03	-0.0001	0.000006	0.00067	0.005	0.000014	0.0005	1.05	0.0146	-0.01	-0.00005
13-Jan-12	43	500	470	7.73	48																										
20-Jan-12	44	500	465	7.68	53	#N/A	2.9	35.4	2	-0.5	0.56	23.3	0.0599	#N/A	0.00035	0.00275	-0.00001	-0.000005	-0.05	-0.000005	7.68	-0.0001	0.000006	0.00131	0.01	0.000027	0.0005	0.99	0.0137	-0.01	-0.00005
27-Jan-12	45	500	475	7.64	49																										
3-Feb-12	46	500	480	7.74	53	#N/A	5.9	35.3	2	-0.5	0.56	25	0.0565	-0.00002	0.00006	0.00258	-0.00001	-0.000005	-0.05	-0.000005	8.3	-0.0001	0.000008	0.00066	0.008	0.000014	0.0005	1.02	0.0161	0.01	-0.00005
10-Feb-12	47	500	465	7.78	60																										
17-Feb-12	48	500	465	7.62	55	#N/A	3.0	31.2	3	-0.5	0.56	26.2	0.0614	-0.00002	0.00013	0.00298	-0.00001	-0.000005	-0.05	-0.000005	8.68	0.0002	0.000007	0.00081	0.007	0.000005	0.0007	1.09	0.0145	-0.01	-0.00005
24-Feb-12	49	500	460	7.56	53																										
2-Mar-12	50	500	455	7.72	53	#N/A	7.6	34.9	3	-0.5	0.51	23.2	0.0505	-0.00002	0.00008	0.00285	-0.00001	-0.000005	-0.05	-0.000005	7.59	-0.0001	-0.000005	0.00065	0.005	0.000008	0.0006	1.03	0.0152	-0.01	-0.00005
9-Mar-12	51	500	485	7.74	55																										
16-Mar-12	52	500	465	7.65	52	#N/A	2.8	29.2	3	-0.5	0.54	23.9	0.0495	-0.00002	-0.00002	0.00281	-0.00001	-0.000005	-0.05	0.000012	7.96	-0.0001	0.000007	0.00128	0.006	0.000069	-0.0005	0.97	0.0128	-0.01	-0.00005
23-Mar-12	53	500	460	7.71	60																										
30-Mar-12	54	500	480	7.48	60	#N/A	4.1	32.4	2	-0.5	0.65	26.8	0.0458	0.00003	0.00004	0.0037	-0.00001	-0.000005	-0.05	-0.000005	8.99	-0.0001	-0.000005	0.00091	0.005	0.000008	0.0006	1.05	0.0143	-0.01	-0.00005
6-Apr-12	55	500	480	7.72	61																										
13-Apr-12	56	500	445	7.71	60	#N/A	2.3	33.0	3	-0.5	0.6	27.4	0.0643	-0.00002	0.00002	0.00363	-0.00001	-0.000005	-0.05	#N/A	9.18	-0.0001	-0.000005	0.00104	0.012	#N/A	0.0007	1.09	0.0148	-0.01	-0.00005
20-Apr-12	57	500	465	7.69	63																										
27-Apr-12	58	500	460	7.71	57	#N/A	4.4	32.0	3	-0.5	0.62	24.9	0.0483	0.000034	0.000131	0.00317	-0.00001	-0.000005	-0.05	0.000006	8.29	0.00013	0.000011	0.0011	0.011	0.000043	-0.0005	1.02	0.0132	-0.01	-0.00005
4-May-12	59	500	470	7.80	57																										
11-May-12	60	500	475	7.69	62	#N/A	3.3	32.8	4	0.51	0.67	28.2	0.0539	-0.00002	0.000108	0.00376	-0.00001	-0.000005	-0.05	-0.000005	9.49	0.0001	0.000009	0.00187	0.0064	0.000016	0.00051	1.08	0.015	-0.01	0.000054
18-May-12	61	500	465	7.65	57																										
25-May-12	62	500	475	7.53	60	#N/A	4.2	33.6	2	-0.5	0.66	26.2	0.0697	-0.00002	0.000058	0.00407	-0.00001	-0.000005	-0.05	-0.000005	8.84	0.00043	0.0000081	0.000812	0.0113	0.000142	0.00064	1.01	0.0168	-0.01	-0.00005
1-Jun-12	63	500	495	7.66	63																										
8-Jun-12	64	500	460	7.64	62	#N/A	3.3	34.5	3	-0.5	0.66	26.5	0.0585	-0.00002	0.000041	0.00399	-0.00001	-0.000005	-0.05	0.0000123	8.86	-0.0001	0.0000102	0.000943	0.0078	0.0000204	0.00064	1.05	0.0159	-0.01	-0.00005
15-Jun-12	65	500	475	7.61	61																										
22-Jun-12	66	500	445	7.54	48	#N/A	4.3	26.6	2	-0.5	0.57	21.5	0.056	-0.00002	0.000354	0.00328	-0.00001	-0.000005	-0.05	-0.000005	7.32	-0.0001	0.0000061	0.000632	0.0075	0.0000103	-0.0005	0.781	0.0148	-0.01	-0.00005

HC 8

Sample =
09SWC498 54-57

Date	Cycle No.	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	0.00011	-0.002	5.81	0.00104	1.18	-0.000005	11.6	0.858	-10	0.000006	0.00003	-0.0005	0.000277	0.0007	0.0001	0.0001
25-Mar-11	1																
1-Apr-11	2	0.00011	0.002	2.58	0.00065	1.39	-0.000005	5.47	0.221	-10	0.000004	0.00026	0.0006	0.000549	0.0024	0.0002	-0.0001
8-Apr-11	3																
15-Apr-11	4	0.0001	-0.002	2.15	0.0003	1.14	-0.000005	3.56	0.211	-10	0.000003	0.00019	0.0007	0.00035	0.0023	0.0006	-0.0001
22-Apr-11	5																
29-Apr-11	6	0.00008	-0.002	2.4	0.00029	1.57	-0.000005	2.64	0.219	-10	-0.000002	0.00012	0.0008	0.000307	0.0024	0.0004	-0.0001
6-May-11	7																
13-May-11	8	0.0001	-0.002	1.97	0.00025	1.15	-0.000005	1.94	0.197	-10	0.000004	0.00007	0.001	0.000274	0.0019	0.0001	-0.0001
20-May-11	9																
27-May-11	10	-0.00002	-0.002	1.68	0.00037	1.08	-0.000005	1.28	0.204	-10	0.000003	0.00006	-0.0005	0.00018	0.0018	0.0001	-0.0001
3-Jun-11	11																
10-Jun-11	12	0.00004	-0.002	1.68	0.00044	1.12	-0.000005	0.87	0.229	-10	0.000002	0.00006	-0.0005	0.00017	0.0017	-0.0001	-0.0001
17-Jun-11	13																
24-Jun-11	14	-0.00002	-0.002	1.71	0.00064	1.62	-0.000005	0.8	0.229	-10	0.000002	0.00003	0.0012	0.000152	0.0016	0.0017	-0.0001
1-Jul-11	15																
8-Jul-11	16	0.00004	-0.002	1.39	0.00048	1.07	-0.000005	0.61	0.216	-10	-0.000002	0.00006	-0.0005	0.00014	0.0014	0.0017	-0.0001
15-Jul-11	17																
22-Jul-11	18	#N/A	-0.002	1.49	0.00059	1.13	-0.000005	0.53	0.221	-10	-0.000002	0.00012	0.0007	0.000131	0.0016	0.0007	-0.0001
29-Jul-11	19																
5-Aug-11	20	0.00003	0.003	1.43	0.00058	1.09	-0.000005	0.49	0.229	-10	0.000002	0.00004	-0.0005	0.000137	0.0015	0.0003	-0.0001
12-Aug-11	21																
19-Aug-11	22	#N/A	-0.002	1.49	0.00065	1.3	-0.000005	0.45	0.255	-10	0.000003	-0.00001	0.0009	0.000154	0.0017	0.0002	-0.0001
26-Aug-11	23																
2-Sep-11	24	0.00002	-0.002	1.1	0.00057	0.876	-0.000005	0.3	0.208	-10	0.000002	0.00003	0.0005	0.000098	0.0011	0.0003	-0.0001
9-Sep-11	25																
16-Sep-11	26	0.00004	-0.002	1.28	0.00061	0.995	-0.000005	0.29	0.247	-10	0.000002	0.00002	-0.0005	0.00014	0.0014	0.0003	-0.0001
23-Sep-11	27																
30-Sep-11	28	-0.00002	-0.002	1.1	0.0005	0.852	-0.000005	0.3	0.209	-10	0.000005	0.00014	0.0006	0.000103	0.0009	-0.0001	-0.0001
7-Oct-11	29																
14-Oct-11	30	-0.00002	-0.002	1.11	0.00056	0.854	-0.000005	0.29	0.192	-10	-0.000002	0.00002	-0.0005	0.000135	0.0012	0.0004	-0.0001
21-Oct-11	31																
28-Oct-11	32	0.00004	-0.002	1.1	0.00058	0.828	-0.000005	0.25	0.212	-10	0.000003	0.00028	-0.0005	0.000093	0.0011	0.0002	-0.0001
4-Nov-11	33																
11-Nov-11	34	0.00018	-0.002	1.15	0.00063	0.895	-0.000005	0.31	0.211	-10	0.000009	0.00013	0.0007	0.000094	0.001	0.0004	-0.0001
18-Nov-11	35																
25-Nov-11	36	0.00019	-0.002	1.12	0.00054	0.812	-0.000005	0.26	0.197	-10	0.000002	0.00033	0.0006	0.000078	0.001	0.001	-0.0001
2-Dec-11	37																
9-Dec-11	38	0.00012	-0.002	1.11	0.00059	0.741	-0.000005	0.26	0.201	-10	0.000002	0.00015	0.0007	0.000091	0.0008	0.0003	-0.0001
16-Dec-11	39																
23-Dec-11	40	0.00028	-0.002	1.13	0.00054	0.673	-0.000005	0.23	0.18	-10	0.000002	-0.00001	-0.0005	0.000073	0.0007	0.0003	-0.0001
30-Dec-11	41																
6-Jan-12	42	0.00004	-0.002	1.13	0.00049	0.694	-0.000005	0.22	0.178	-10	-0.000002	0.00008	-0.0005	0.000065	0.0008	0.0003	-0.0001
13-Jan-12	43																
20-Jan-12	44	0.00013	-0.002	1.02	0.00048	0.635	0.000006	0.44	0.182	-10	0.000002	-0.0002	0.0005	0.000067	0.0009	0.0003	-0.0001
27-Jan-12	45																
3-Feb-12	46	0.00002	-0.002	1.31	0.00049	0.677	-0.000005	0.2	0.163	-10	0.000002	-0.0002	-0.0005	0.000059	0.0007	-0.0001	-0.0001
10-Feb-12	47																
17-Feb-12	48	-0.00002	-0.002	1.57	0.00051	0.688	-0.000005	0.23	0.179	-10	0.000003	-0.0002	-0.0005	0.0001	0.001	-0.0001	-0.0001
24-Feb-12	49																
2-Mar-12	50	0.00004	-0.002	1.41	0.00041	0.53	-0.000005	0.19	0.166	-10	0.000003	-0.0002	-0.0005	0.000059	0.0005	0.0002	-0.0001
9-Mar-12	51																
16-Mar-12	52	0.00011	-0.002	1.38	0.00046	0.645	-0.000005	0.22	0.157	-10	0.000004	-0.0002	-0.0005	0.000057	0.0005	0.0003	-0.0001
23-Mar-12	53																
30-Mar-12	54	0.00003	-0.002	1.55	0.00053	0.658	-0.000005	0.2	0.185	-10	0.000004	-0.0002	0.0005	0.00006	0.0006	-0.0001	-0.0001
6-Apr-12	55																
13-Apr-12	56	0.00002	-0.002	1.72	0.00059	0.739	-0.000005	0.19	0.187	-10	0.000006	0.0002	0.0013	0.000064	0.0007	0.0005	-0.0001
20-Apr-12	57																
27-Apr-12	58	#N/A	-0.002	1.7	0.00054	0.633	-0.000005	0.225	0.177	-10	0.000015	0.00085	0.00058	0.000057	0.00138	0.00174	-0.0001
4-May-12	59																
11-May-12	60	0.000097	-0.002	1.96	0.000558	0.764	-0.000005	0.227	0.193	-10	0.000004	-0.0002	0.00062	0.000048	0.00071	0.00031	-0.0001
18-May-12	61																
25-May-12	62	0.000076	-0.002	1.72	0.000527	0.772	-0.000005	0.243	0.177	-10	0.0000052	-0.0002	0.00126	0.000052	0.00074	0.00135	-0.0001
1-Jun-12	63																
8-Jun-12	64	0.000173	0.0043	1.79	0.000486	0.645	-0.000005	0.253	0.173	-10	0.0000087	0.0005	0.00058	0.0000537	0.00069	0.00076	-0.0001
15-Jun-12	65																
22-Jun-12	66	0.000031	0.002	1.48	0.00044	0.555	-0.000005	0.151	0.141	-10	0.0000043	-0.0002	0.00075	0.0000363	0.0006	0.00016	-0.0001

HC 8

CONFIDENTIAL *DRAFT*

Sample =
09SWC498 54-57

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L
29-Jun-12	67	500	455	7.63	55																										
6-Jul-12	68	500	465	7.63	55	#N/A	4.4	30.4	2	-0.5	0.59	24.2	0.06	-0.00002	0.000098	0.00381	-0.00001	-0.000005	-0.05	-0.000005	8.31	-0.0001	0.0000074	0.000784	0.0085	0.0000161	0.00069	0.835	0.0148	-0.01	-0.00005
13-Jul-12	69	500	465	7.63	52																										
20-Jul-12	70	500	465	7.60	50	#N/A	4.1	29.9	2	0.65	0.56	24.9	0.0734	-0.00002	0.000174	0.00317	-0.00001	-0.000005	-0.05	-0.000005	8.51	-0.0001	0.000005	0.000839	0.0031	0.0000156	0.00054	0.881	0.0149	-0.01	-0.00005
27-Jul-12	71	500	450	7.83	52																										
3-Aug-12	72	500	460	7.64	54	#N/A	3.5	29.6	2	-0.5	0.65	23.9	0.0596	0.000028	-0.00002	0.00377	-0.00001	-0.000005	-0.05	-0.000005	8.11	-0.0001	0.00001	0.000926	0.0106	0.000012	0.0006	0.875	0.0166	-0.01	-0.00005
10-Aug-12	73	500	475	7.64	47																										
17-Aug-12	74	500	460	7.56	50	#N/A	4.0	29.8	2	-0.5	0.6	24	0.0613	0.000026	0.000058	0.00392	-0.00001	-0.000005	-0.05	0.000017	8.15	-0.0001	0.000017	0.00117	0.0127	#N/A	0.00065	0.877	0.0168	-0.01	-0.00005
24-Aug-12	75	500	455	7.66	52																										
31-Aug-12	76	500	475	7.70	54	#N/A	3.6	31.5	2	-0.5	0.62	24.8	0.0565	-0.00002	0.000089	0.00371	-0.00001	-0.000005	-0.05	-0.000005	8.51	-0.0001	0.000008	0.000716	0.008	0.000028	0.00053	0.873	0.0179	0.01	-0.00005
7-Sep-12	77	500	445	7.56	48																										
14-Sep-12	78	500	450	7.44	51	#N/A	3.7	28.7	2	0.5	0.59	22	0.0468	-0.00002	0.000443	0.00329	-0.00001	-0.000005	-0.05	-0.000005	7.41	#N/A	0.000018	0.00147	#N/A	0.000077	0.00057	0.843	0.0152	-0.01	-0.00005
21-Sep-12	79	500	480	7.58	53																										
28-Sep-12	80	500	450	7.53	50	#N/A	2.8	30.0	2	-0.5	0.58	23	0.0551	-0.00002	0.000081	0.00923	-0.00001	-0.000005	-0.05	-0.000005	7.88	-0.0001	0.000006	0.00152	0.0156	0.000094	0.0006	0.809	0.0147	-0.01	-0.00005
5-Oct-12	81	500	460	7.39	50																										
12-Oct-12	82	500	495	7.57	53	#N/A	6.2	33.3	3	-0.5	0.73	24.5	0.0489	-0.00002	0.000074	0.00369	-0.00001	-0.000005	-0.05	-0.000005	8.35	-0.0001	-0.000005	0.00235	0.0042	0.000013	0.00063	0.884	0.0159	-0.01	-0.00005
19-Oct-12	83	500	480	7.67	58																										
26-Oct-12	84	500	480	7.61	57	#N/A	3.0	33.2	2	-0.5	0.65	25.7	0.0562	-0.00002	0.000079	0.00365	-0.00001	-0.000005	-0.05	-0.000005	8.81	-0.0001	0.000007	0.00119	0.0105	0.000016	0.00056	0.889	0.0137	-0.01	0.000109
2-Nov-12	85	500	475	7.59	55																										
9-Nov-12	86	500	480	7.62	53	#N/A	5.0	33.7	3	-0.5	0.65	26.3	0.0589	-0.00002	0.000037	0.00429	-0.00001	0.000014	-0.05	0.000055	8.92	-0.0001	0.000016	0.00387	0.0089	0.000495	0.0007	0.982	0.0186	-0.01	-0.00005
16-Nov-12	87	500	480	7.49	49																										
23-Nov-12	88	500	485	7.74	62	#N/A	3.8	34.7	3	-0.5	0.71	29.3	0.0509	-0.00002	0.000167	0.00405	-0.00001	-0.000005	-0.05	-0.000005	9.95	-0.0001	0.000007	0.000717	0.0075	0.000015	0.00089	1.07	0.0136	-0.01	0.00007
30-Nov-12	89	500	500	7.62	57																										
7-Dec-12	90	500	495	7.81	56	#N/A	6.6	37.5	2	-0.5	0.63	26.3	0.0512	-0.00002	0.000051	0.00397	-0.00001	-0.000005	-0.05	-0.000005	9.04	-0.0001	0.000006	0.000692	0.004	0.000008	0.00065	0.9	0.0154	-0.01	-0.00005
14-Dec-12	91	500	505	7.83	53																										
21-Dec-12	92	500	470	7.68	52	#N/A	3.6	31.3	-2	-0.5	0.56	23.4	0.0543	-0.00002	0.00004	0.0034	-0.00001	-0.000005	-0.05	-0.000005	8.13	-0.0001	-0.000005	0.000512	0.008	0.000027	0.00058	0.746	0.0133	-0.01	-0.00005
28-Dec-12	93	500	455	7.75	55																										
4-Jan-13	94	500	445	7.72	47	#N/A	5.0	32.6	-2	0.86	0.53	29.3	0.0462	-0.00002	0.000032	0.00374	-0.00001	-0.000005	-0.05	0.000013	10.4	0.00037	0.000014	0.000712	0.0053	0.000048	-0.0005	0.806	0.0127	-0.01	-0.00005
11-Jan-13	95	500	465	7.70	47																										
18-Jan-13	96	500	460	7.67	49	#N/A	2.4	30.2	-2	0.56	0.5	21.3	0.0489	-0.00002	0.000034	0.00318	-0.00001	-0.000005	-0.05	-0.000005	7.25	-0.0001	0.000005	0.000472	0.0033	0.000008	0.00079	0.772	0.0138	-0.01	-0.00005
25-Jan-13	97	500	440	7.61	50																										
1-Feb-13	98	500	450	7.74	46	#N/A	3.9	26.6	2	-0.5	0.54	21.2	0.0492	-0.00002	0.000127	0.0032	-0.00001	-0.000005	-0.05	0.000006	7.26	-0.0001	0.000008	0.000543	0.0051	0.000007	-0.0005	0.745	0.0116	-0.01	-0.00005
8-Feb-13	99	500	440	7.96	45																										
15-Feb-13	100	500	445	7.57	48	#N/A	3.3	25.1	3	-0.5	0.56	21.2	0.0589	-0.00002	0.00002	0.00353	-0.00001	-0.000005	-0.05	-0.000005	7.29	-0.0001	0.000007	0.000462	0.0095	0.00001	0.0005	0.737	0.0147	-0.01	-0.00005
22-Feb-13	101	500	440	7.96	46																										
1-Mar-13	102	500	450	7.64	49	#N/A	5.2	31.5	3	0.53	0.54	22	0.0582	-0.00002	-0.00002	0.00498	-0.00001	-0.000005	-0.05	-0.000005	7.58	-0.0001	-0.000005	0.00291	0.0112	0.000017	0.00057	0.739	0.014	-0.01	-0.00005
8-Mar-13	103	500	455	7.63	53																										
15-Mar-13	104	500	445	7.64	50	#N/A	5.2	26.7	3	0.63	0.56	22	0.0464	0.000087	0.000031	0.0033	-0.00001	-0.000005	-0.05	-0.000005	7.6	-0.0001	-0.000005	0.000452	0.0062	0.000008	0.00054	0.741	0.013	-0.01	0.000081
22-Mar-13	105	500	435	7.77	45																										
29-Mar-13	106	500	445	7.63	48	#N/A	3.7	25.8	3	-0.5	0.56	21.5	0.0534	-0.00002	0.000049	0.00378	-0.00001	-0.000005	-0.05	-0.000005	7.42	-0.0001	-0.000005	0.000579	0.0048	0.000018	0.00066	0.723	0.0127	-0.01	-0.00005
5-Apr-13	107	500	455	7.71	49																										
12-Apr-13	108	500	460	7.77	49	#N/A	6.3	28.0	3	0.55	0.56	21.1	0.0644	-0.00002	0.000045	0.00378	-0.00001	-0.000005	-0.05	-0.000005	7.24	-0.0001	0.000008	0.00102	0.009	0.000012	-0.0005	0.726	0.0123	-0.01	-0.00005
19-Apr-13	109	500	450	7.83	44																										
26-Apr-13	110	500	445	7.45	44	#N/A	3.8	23.6	2	-0.5	0.5	18.8	0.0537	-0.00002	0.000039	0.00359	-0.00001	-0.000005	-0.05	-0.000005	6.39	-0.0001	-0.000005	0.000603	0.0077	-0.000005	-0.0005	0.689	0.0129	-0.01	-0.00005
3-May-13	111	500	425	7.69	48																										
10-May-13	112	500	405	7.52	49	#N/A	4.5	25.9	2	0.61	0.56	21.1	0.0643	-0.00002	0.000035	0.00357	-0.00001	-0.000005	-0.05	-0.000005	7.27	-0.0001	-0.000005	0.000583	0.0101	-0.000005	-0.0005	0.724	0.0134	-0.01	-0.00005
17-May-13	113	500	440	7.86	49																										
24-May-13	114	500	440	7.52	40	#N/A	3.9	23.7	2																						

April 1/11 Alkalinity 55.2. Repeat = 50.8.
June 24/11 Fe 0.03. Repeat =0.021, data confirmed, suspect contamination
Jul 22/11 Ni=0.00018, repeat=0.00018. Data confirmed, suspect contamination
Aug 19/11 Ni=0.00035, repeat=0.00035. Data confirmed, suspect contamination
Jan 20/12 Sb=0.0001, repeat=0.0001. Data confirmed, suspect contamination
Apr 13/12 Pb=0.00022, Cd=0.000052. Repeat Cd=0.0000549, pb=0.000239. Data confirmed, suspect contamination
Apr 27/12 Ni=0.00019, repeat=0.000203. Data confirmed, suspect contamination
Sept 14/12 Fe=0.0859, Ni=0.000253, Cr=0.00134. Repeat Ni=0.000199, Fe=0.0881, Cr=0.00124. Data confirmed suspect contamination
Aug 31/12 Ni=0.000433, repeat=0.000053. Data accepted
Aug 17/12 Pb=0.0001, Cannot repeat suspect contamination or analytical error

HC 8

Sample =
09SWC498 54-57

Date	Cycle No.	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Jun-12	67																
6-Jul-12	68	0.000022	-0.002	1.63	0.000479	0.626	-0.000005	0.166	0.152	-10	0.0000035	-0.0002	0.00099	0.0000427	0.00078	0.00024	-0.0001
13-Jul-12	69																
20-Jul-12	70	0.000024	-0.002	1.66	0.000431	0.618	-0.000005	0.156	0.156	-10	0.0000045	-0.0002	-0.0005	0.0000454	0.00081	0.00149	-0.0001
27-Jul-12	71																
3-Aug-12	72	0.000066	-0.002	1.78	0.000727	0.586	-0.000005	0.188	0.158	-10	0.000004	-0.0002	0.00065	0.000039	0.00054	0.0003	-0.0001
10-Aug-12	73																
17-Aug-12	74	0.000123	-0.002	1.78	0.000468	0.571	-0.000005	0.182	0.154	-10	0.000005	0.00089	0.00063	0.000037	0.00055	0.00165	-0.0001
24-Aug-12	75																
31-Aug-12	76	0.000053	-0.002	1.74	0.000378	0.577	-0.000005	0.158	0.163	-10	0.000006	-0.0002	-0.0005	0.000046	0.00044	-0.0001	-0.0001
7-Sep-12	77																
14-Sep-12	78	#N/A	-0.002	1.62	0.000406	0.506	-0.000005	0.225	0.152	-10	0.000004	-0.0002	0.00074	0.000049	0.00056	0.00057	-0.0001
21-Sep-12	79																
28-Sep-12	80	0.000107	0.0024	1.62	0.000345	0.568	-0.000005	0.139	0.148	-10	0.000006	0.00023	0.00092	0.000036	0.00047	0.00043	-0.0001
5-Oct-12	81																
12-Oct-12	82	0.000023	-0.002	1.75	0.000349	0.577	-0.000005	0.143	0.158	-10	0.000005	-0.0002	0.00054	0.00004	0.00029	0.00015	-0.0001
19-Oct-12	83																
26-Oct-12	84	0.000069	0.0094	1.68	0.00042	0.592	-0.000005	0.12	0.173	-10	0.000006	-0.0002	0.00052	0.000041	0.00055	0.00026	-0.0001
2-Nov-12	85																
9-Nov-12	86	0.000179	-0.002	1.94	0.000444	0.606	-0.000005	0.164	0.168	-3	0.000006	-0.0002	0.00073	0.000044	0.00038	0.00183	-0.0001
16-Nov-12	87																
23-Nov-12	88	0.000122	-0.002	2	0.000447	0.738	-0.000005	0.172	0.183	-3	0.000004	0.00057	-0.0005	0.000043	0.00051	0.00055	-0.0001
30-Nov-12	89																
7-Dec-12	90	0.00015	-0.002	1.71	0.000347	0.585	-0.000005	0.105	0.163	-3	0.000005	-0.0002	-0.0005	0.000041	0.00058	0.00072	-0.0001
14-Dec-12	91																
21-Dec-12	92	-0.00002	-0.002	1.6	0.000367	0.54	-0.000005	0.101	0.148	-3	0.000004	-0.0002	-0.0005	0.000034	0.00058	0.0005	-0.0001
28-Dec-12	93																
4-Jan-13	94	0.000095	-0.002	1.69	0.000323	0.625	-0.000005	0.147	0.146	-3	0.000004	-0.0002	-0.0005	0.000028	0.00053	0.00115	-0.0001
11-Jan-13	95																
18-Jan-13	96	0.000091	0.0029	1.56	0.000279	0.46	-0.000005	0.093	0.131	-3	0.000004	-0.0002	-0.0005	0.000029	0.00029	0.00015	-0.0001
25-Jan-13	97																
1-Feb-13	98	0.000045	-0.002	1.61	0.000244	0.483	-0.000005	0.115	0.129	-3	0.000004	-0.0002	-0.0005	0.000031	0.00062	0.00081	-0.0001
8-Feb-13	99																
15-Feb-13	100	-0.00002	-0.002	1.63	0.000266	0.515	-0.000005	0.116	0.13	-3	0.000006	-0.0002	0.0008	0.000033	0.00038	0.00046	-0.0001
22-Feb-13	101																
1-Mar-13	102	0.000138	-0.002	1.64	0.000308	0.526	-0.000005	0.117	0.139	-3	0.000005	-0.0002	0.00061	0.000027	0.00043	0.00052	-0.0001
8-Mar-13	103																
15-Mar-13	104	0.000054	-0.002	1.69	0.000408	0.527	-0.000005	0.106	0.136	-3	0.000005	-0.0002	-0.0005	0.000029	0.00042	0.00019	-0.0001
22-Mar-13	105																
29-Mar-13	106	-0.00002	-0.002	1.71	0.000184	0.493	-0.000005	0.104	0.149	-3	0.000004	-0.0002	-0.0005	0.000031	0.00042	-0.0001	-0.0001
5-Apr-13	107																
12-Apr-13	108	0.000024	-0.002	1.64	0.000242	0.491	-0.000005	0.096	0.138	-3	0.000003	-0.0002	0.00216	0.000028	0.00062	0.00023	-0.0001
19-Apr-13	109																
26-Apr-13	110	0.000062	-0.002	1.61	0.000212	0.384	-0.000005	0.1	0.119	-3	0.000002	-0.0002	0.00089	0.000024	0.00021	0.00024	-0.0001
3-May-13	111																
10-May-13	112	0.000051	-0.002	1.67	0.000223	0.5	-0.000005	0.103	0.126	-3	0.000003	-0.0002	0.0011	0.000025	0.0005	0.00014	-0.0001
17-May-13	113																
24-May-13	114																

HC 9

CONFIDENTIAL *DRAFT*

Sample =
07SWC258 20-23

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L
18-Mar-11	0	500	335	7.69	77	#N/A	2.7	34.2	5	2.2	0.19	16.9	0.279	-0.00002	0.00782	0.0193	-0.00001	-0.000005	-0.05	0.000019	5.6	-0.0001	0.000022	0.00408	0.011	0.000101	0.0017	0.7	0.00499	-0.01	0.0253
25-Mar-11	1	500	490	7.98	129																										
1-Apr-11	2	500	465	7.85	80	#N/A	5.0	47.9	4	0.8	0.27	19.4	0.0985	0.00003	0.0072	0.029	-0.00001	-0.000005	-0.05	0.00001	5.76	-0.0001	0.000013	0.00405	0.005	0.000091	0.0018	1.22	0.0119	-0.01	0.0284
8-Apr-11	3	500	445	7.72	69																										
15-Apr-11	4	500	450	7.74	60	#N/A	2.2	36.5	3	-0.5	0.13	20.2	0.0774	0.00002	0.0059	0.0385	-0.00001	-0.000005	-0.05	-0.000005	6.07	0.0006	0.000007	0.00215	0.006	0.000062	0.0012	1.22	0.0127	-0.01	0.00564
22-Apr-11	5	500	455	7.74	57																										
29-Apr-11	6	500	455	7.70	59	#N/A	3.1	35.8	5	0.9	0.09	23.8	0.0944	0.00002	0.00662	0.0508	-0.00001	-0.000005	-0.05	-0.000005	7.25	-0.0001	0.000012	0.00222	0.007	0.000023	0.001	1.38	0.0112	-0.01	0.00271
6-May-11	7	500	455	7.53	50																										
13-May-11	8	500	460	7.57	50	#N/A	3.4	28.3	5	1.7	0.08	20.9	0.0973	-0.00002	0.00509	0.0456	-0.00001	-0.000005	-0.05	-0.000005	6.48	-0.0001	-0.000005	0.00155	0.005	0.000025	0.0007	1.15	0.0106	-0.01	0.00179
20-May-11	9	500	460	7.77	56																										
27-May-11	10	500	465	7.74	50	#N/A	5.3	26.6	3	1.2	0.05	20.9	0.088	0.00008	0.00429	0.0484	-0.00001	-0.000005	-0.05	-0.000005	6.63	-0.0001	0.000013	0.00147	0.003	0.000012	0.0006	1.05	0.0102	-0.01	0.00133
3-Jun-11	11	500	470	7.55	50																										
10-Jun-11	12	500	485	7.60	47	#N/A	2.2	28.5	2	1.4	0.06	19.7	0.0945	-0.00002	0.00422	0.0548	-0.00001	-0.000005	-0.05	0.000012	6.47	-0.0001	0.000008	0.00137	0.009	#N/A	0.0006	0.86	0.00964	-0.01	0.00097
17-Jun-11	13	500	485	7.51	54																										
24-Jun-11	14	500	475	7.75	45	#N/A	2.0	27.5	2	0.9	0.04	21.1	0.0989	-0.00002	0.00396	0.0569	-0.00001	-0.000005	-0.05	0.000008	6.92	-0.0001	0.000007	0.00126	0.004	0.000011	-0.0005	0.94	0.0104	-0.01	0.00072
1-Jul-11	15	500	465	7.82	44																										
8-Jul-11	16	500	465	7.51	46	#N/A	2.9	27.0	3	0.8	0.04	19.4	0.0975	-0.00002	0.00399	0.0549	-0.00001	-0.000005	-0.05	0.000007	6.54	-0.0001	0.000005	0.00092	0.005	0.000023	-0.0005	0.76	0.00835	-0.02	0.00053
15-Jul-11	17	500	460	7.68	49																										
22-Jul-11	18	500	480	7.63	43	#N/A	3.4	25.1	-2	1	0.03	18.8	0.104	-0.00002	0.00341	0.0582	-0.00001	-0.000005	-0.05	-0.000005	6.29	0.0001	0.000012	0.00119	0.008	0.000022	-0.0005	0.75	0.00888	-0.01	0.00043
29-Jul-11	19	500	465	7.76	46																										
5-Aug-11	20	500	470	7.53	48	#N/A	3.6	28.3	-2	-0.5	0.03	21.8	0.113	-0.00002	0.00412	0.0658	-0.00001	-0.000005	-0.05	-0.000005	7.49	-0.0001	0.000008	0.0013	0.008	0.000021	-0.0005	0.75	0.00861	-0.01	0.00046
12-Aug-11	21	500	470	7.81	44																										
19-Aug-11	22	500	470	7.59	43	#N/A	4.1	27.0	2	1	0.03	19.8	0.101	-0.00002	0.00313	0.0663	-0.00001	-0.000005	-0.05	0.000006	6.96	0.0002	0.000008	0.00141	0.007	0.000014	-0.0005	0.59	0.00865	-0.01	0.00037
26-Aug-11	23	500	470	7.62	46																										
2-Sep-11	24	500	465	7.72	43	#N/A	4.2	29.4	2	0.6	0.03	20	0.106	-0.00002	0.00318	0.0719	-0.00001	-0.000005	-0.05	-0.000005	7.03	-0.0001	0.000013	0.00108	0.005	0.000012	-0.0005	0.61	0.00984	-0.01	0.00046
9-Sep-11	25	500	460	7.77	43																										
16-Sep-11	26	500	465	7.49	45	#N/A	4.1	27.4	-2	0.9	0.03	20.4	0.1	-0.00002	0.00297	0.0735	-0.00001	-0.000005	-0.05	0.000005	7.26	-0.0001	0.000007	0.00077	0.006	0.000012	-0.0005	0.54	0.00848	-0.01	0.00036
23-Sep-11	27	500	450	7.48	40																										
30-Sep-11	28	500	470	7.51	44	#N/A	3.1	27.6	-2	0.6	0.03	19.2	0.0865	-0.00002	0.00271	0.0757	-0.00001	-0.000005	-0.05	0.000008	6.86	-0.0001	0.000008	0.00065	0.004	0.000012	-0.0005	0.49	0.00839	-0.01	0.00029
7-Oct-11	29	500	455	7.57	37																										
14-Oct-11	30	500	445	7.38	36	#N/A	3.1	22.9	-2	-0.5	0.03	16.5	0.12	-0.00002	0.00288	0.0623	-0.00001	-0.000005	-0.05	-0.000005	5.92	-0.0001	-0.000005	0.00083	0.005	0.000023	-0.0005	0.42	0.00638	-0.01	0.00028
21-Oct-11	31	500	465	7.69	38																										
28-Oct-11	32	500	455	7.61	44	#N/A	3.5	27.2	-2	-0.5	0.03	21.8	0.116	-0.00002	0.00295	0.0835	-0.00001	-0.000005	-0.05	-0.000005	7.91	0.0001	-0.000005	0.00094	0.007	0.000038	-0.0005	0.5	0.0079	-0.01	0.0003
4-Nov-11	33	500	455	7.58	35																										
11-Nov-11	34	500	470	7.82	37	#N/A	5.1	26.5	-2	0.5	0.029	18	0.0967	-0.00002	0.00253	0.0724	-0.00001	-0.000005	-0.05	#N/A	6.54	-0.0001	0.000008	0.00115	0.006	0.000038	-0.0005	0.41	0.00708	-0.01	0.00028
18-Nov-11	35	500	455	7.59	38																										
25-Nov-11	36	500	470	7.71	38	#N/A	3.1	25.4	2	-0.5	0.022	17.6	0.0903	-0.00002	0.00237	0.0734	-0.00001	-0.000005	-0.05	0.000006	6.35	-0.0001	0.00001	0.00192	0.006	0.000016	-0.0005	0.41	0.00775	-0.01	0.00023
2-Dec-11	37	500	470	7.62	35																										
9-Dec-11	38	500	475	7.48	37	#N/A	4.6	23.0	2	-0.5	0.025	15.9	0.097	-0.00002	0.00214	0.0718	-0.00001	-0.000005	-0.05	0.000011	5.73	0.0003	-0.000005	0.00139	0.006	#N/A	-0.0005	0.38	0.00749	-0.01	0.00021
16-Dec-11	39	500	455	7.76	37																										
23-Dec-11	40	500	450	7.70	35	#N/A	4.1	23.8	2	-0.5	0.021	15.8	0.0927	-0.00002	0.00194	0.077	-0.00001	-0.000005	-0.05	-0.000005	5.79	-0.0001	0.000009	0.00085	0.005	0.000026	-0.0005	0.33	0.00684	-0.01	0.00017
30-Dec-11	41	500	470	7.74	37																										
6-Jan-12	42	500	450	7.39	36	#N/A	3.7	26.4	2	-0.5	0.019	17	0.0975	-0.00002	0.00223	0.0794	-0.00001	-0.000005	-0.05	-0.000005	6.26	-0.0001	-0.000005	0.00076	0.004	0.000014	-0.0005	0.34	0.0066	-0.01	0.00018
13-Jan-12	43	500	470	7.66	37																										
20-Jan-12	44	500	455	7.61	36	#N/A	2.7	26.8	-2	-0.5	0.023	15.5	0.0837	-0.00002	0.00202	0.0757	-0.00001	-0.000005	-0.05	-0.000005	5.7	0.0007	0.000008	0.0017	0.006	#N/A	-0.0005	0.3	0.00625	-0.01	0.00018
27-Jan-12	45	500	460	7.52	35																										
3-Feb-12	46	500	465	7.67	38	#N/A	5.6	28.6	2	-0.5	0.025	17.9	0.0965	-0.00002	0.00216	0.0695	-0.00001	-0.000005	-0.05	-0.000005	6.61	-0.0001	-0.000005	0.00115	0.003	0.000013	-0.0005	0.33	0.00665	0.01	0.00017
10-Feb-12	47	500	465	7.71	36																										
17-Feb-12	48	500	455	7.51	35	#N/A	2.9	22.8	2	-0.5	0.02	16.6	0.11	-0.00002	0.00218	0.0721	-0.00001	-0.000005	-0.05	-0.000005	6.16	-0.0001	-0.000005	0.0008	0.005	0.000012	-0.0005	0.29	0.00573	-0.01	0.00019
24-Feb-12	49	500	455	7.50	37																										
2-Mar-12	50	500	460	7.65	35	#N/A	6.8	25.9	2	-0.5	0.018	15.7	0.0908	-0.00002	0.002	0.075	-0.00001	-0.000005	-0.05	-0.000005	5.83	-0.0001	-0.000005	0.00073	0.005	0.000013	-0.0005	0.28	0.00579	-0.01	0.00015
9-Mar-12	51	500	475	7.59	39																										
16-Mar-12	52	500	460	7.57	41	#N/A	2.8	25.6	2	-0.5	0.021	17.6	0.117	-0.00002	0.00264	0.0853	-0.00001	-0.000005	-0.05	0.000009	6.52	-0.0001	0.000009	0.00092	0.006	0.000049	-0.0005	0.31	0.00566	-0.01	0.00021
23-Mar-12	53	500	465	7.61	37																										
30-Mar-12	54	500	465	7.31	36	#N/A	4.1	23.8	2	-0.5	0.019	16.6	0.116	-0.00002	0.00185	0.0794	-0.00001	-0.000005	-0.05	-0.000005	6.22	-0.0001	-0.000005	0.00088	0.007	0.000015	-0.0005	0.26	0.00595	-0.01	0.00015
6-Apr-12	55	500	460	7.57	37																										
13-Apr-12	56	500	450	7.57	36	#N/A	2.2	22.6	3	-0.5	0.017	16.7	0.112	-0.00002	0.00216	0.0809	-0.00001	-0.000005	-0.05	0.000014	6.25	-0.0001	-0.000005	0.00078	0.007	0.000019	-0.0005	0.27	0.00523	-0.01	0.00016
20-Apr-12	57	500	460	7.56	35																										
27-Apr-12	58	500	475	7.60	33	#N/A	4.5	23.0	2	-0.5	0.015	15.1	0.0837	-0.00002	0.00142	0.0773	-0.00001	-0.000005	-0.05	0.000009	5.65	0.00011	0.000006	0.00129	0.0057	0.00002	-0.0005	0.231	0.00539	-0.01	0.000136
4-May-12	59	500	470	7.79	34																										
11-May-12	60	500	470	7.56	35	#N/A	3.1	21.3	3	-0.5	0.019	16.7	0.09	-0.00002	0.0018	0.079	-0.00001	-0.000005	-0.05	-0.000005	6.3	0.00013	-0.000005	0.00111	0.0042	0.00002	-0.0005	0.229	0.00596	-0.01	0.000131
18-May-12	61	500	455	7.58	35																										
25-May-12	62	500	480	7.45	34	#N/A	4.0	21.7	2	-0.5	0.017	15.2	0.121	-0.00002	0.00172	0.0756	-0.00001	-0.000005	-0.05	0.0000063	5.7	-0.0001	0.000006	0.000723	0.0087	0.0000282	-0.0005	0.22	0.00587	-0.01	0.000112
1-Jun-12	63	500	495	7.54	33																										
8-Jun-12	64	500	450	7.50	32	#N/A	3.1	20.4	2	0.67	0.015	13.9	0.0782	-0.00002	0.00141	0.0714	-0.00001	-0.000005	-0.05	0.0000086	5.21	0.0007	0.0000056	0.00198	0.0059	0.000975	-0.0005	0.216	0.00499	-0.01	0.000143
15-Jun-12	65	500	485	7.48	35																										
22-Jun-12	66	500	455	7.41	30	#N/A	4.4	21.0	2	-0.5	0.018	13.9	0.118	-0.00002	0.00184	0.0743	-0.00001	-0.000005	-0.05	-0.000005	5.22	-0.0001	-0.000005	0.000681	0.0056	0.0000149	-0.0005	0.212	0.00434	-0.01	0.000169
29-Jun-12	67	500	455	7.53	30																										

HC 9

Sample =
07SWC258 20-23

Date	Cycle No.	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	0.00003	0.016	4.2	0.00027	1.77	-0.000005	8.52	0.0352	-10	0.000002	0.00003	0.0005	0.000048	0.003	0.0002	-0.0001
25-Mar-11	1																
1-Apr-11	2	0.00009	0.002	4.55	0.00021	2.29	-0.000005	6.62	0.0415	-10	0.000002	0.00042	-0.0005	0.000187	0.0028	0.0002	-0.0001
8-Apr-11	3																
15-Apr-11	4	0.00007	-0.002	3.55	0.00013	1.74	-0.000005	1.77	0.0499	-10	-0.000002	0.00019	-0.0005	0.000094	0.0025	0.0012	-0.0001
22-Apr-11	5																
29-Apr-11	6	0.00009	-0.002	3.49	0.00019	2.24	-0.000005	0.87	0.0564	-10	-0.000002	0.00015	-0.0005	0.00009	0.0028	0.0003	-0.0001
6-May-11	7																
13-May-11	8	0.0001	-0.002	2.49	0.00013	1.75	-0.000005	0.53	0.0466	-10	0.000004	0.0001	-0.0005	0.000054	0.0022	0.0005	-0.0001
20-May-11	9																
27-May-11	10	0.00004	-0.002	1.95	0.00016	1.65	-0.000005	0.44	0.0488	-10	-0.000002	0.00006	-0.0005	0.000045	0.0019	0.0003	-0.0001
3-Jun-11	11																
10-Jun-11	12	#N/A	-0.002	1.77	0.00016	1.51	-0.000005	0.32	0.052	-10	-0.000002	0.00012	-0.0005	0.000042	0.0019	0.0009	-0.0001
17-Jun-11	13																
24-Jun-11	14	-0.00002	-0.002	1.76	0.00017	1.6	-0.000005	0.36	0.0482	-10	-0.000002	0.00005	-0.0005	0.000039	0.0019	-0.0001	-0.0001
1-Jul-11	15																
8-Jul-11	16	0.00002	-0.002	1.47	0.00016	1.47	-0.000005	0.26	0.0469	-10	-0.000002	0.00004	-0.0005	0.000034	0.002	0.0002	-0.0001
15-Jul-11	17																
22-Jul-11	18	#N/A	-0.002	1.39	0.00015	1.33	-0.000005	0.3	0.0442	-10	-0.000002	0.00003	-0.0005	0.000028	0.0017	0.0005	-0.0001
29-Jul-11	19																
5-Aug-11	20	0.00004	-0.002	1.46	0.00018	1.49	-0.000005	0.26	0.0491	-10	-0.000002	0.00003	-0.0005	0.000071	0.002	0.0005	-0.0001
12-Aug-11	21																
19-Aug-11	22	#N/A	-0.002	1.33	0.00015	1.29	-0.000005	0.33	0.0452	-10	-0.000002	-0.00001	0.0005	0.000026	0.0019	0.0002	-0.0001
26-Aug-11	23																
2-Sep-11	24	0.00003	-0.002	1.32	0.00012	1.26	-0.000005	0.26	0.0476	-10	-0.000002	0.00016	-0.0005	0.000035	0.002	0.0006	-0.0001
9-Sep-11	25																
16-Sep-11	26	-0.00002	-0.002	1.27	0.00014	1.21	-0.000005	0.18	0.0465	-10	0.000002	0.00002	-0.0005	0.000032	0.0017	0.0003	-0.0001
23-Sep-11	27																
30-Sep-11	28	-0.00002	-0.002	1.18	0.00013	1.14	-0.000005	0.22	0.0449	-10	0.000004	0.00012	-0.0005	0.000025	0.0012	0.0001	-0.0001
7-Oct-11	29																
14-Oct-11	30	#N/A	-0.002	1.11	0.00012	1.14	-0.000005	0.22	0.0377	-10	-0.000002	0.00018	-0.0005	0.000024	0.0017	0.0012	-0.0001
21-Oct-11	31																
28-Oct-11	32	0.00005	-0.002	1.31	0.00014	1.32	-0.000005	0.24	0.0504	-10	0.000003	0.00023	-0.0005	0.000023	0.0018	0.0003	-0.0001
4-Nov-11	33																
11-Nov-11	34	0.00019	-0.002	1.14	0.00012	1.15	-0.000005	0.29	0.0396	-10	0.000007	0.00012	-0.0005	0.000019	0.0014	0.0016	-0.0001
18-Nov-11	35																
25-Nov-11	36	0.00014	-0.002	1.12	0.0001	1.03	-0.000005	0.25	0.0382	-10	-0.000002	0.00016	-0.0005	0.000014	0.0014	0.0006	-0.0001
2-Dec-11	37																
9-Dec-11	38	0.00014	-0.002	1.09	0.0001	0.85	-0.000005	0.23	0.0379	-10	0.000006	0.00011	-0.0005	0.000018	0.0012	0.0009	-0.0001
16-Dec-11	39																
23-Dec-11	40	0.00022	-0.002	1	0.00011	0.877	-0.000005	0.24	0.0367	-10	0.000002	-0.00001	-0.0005	0.000021	0.001	0.0009	-0.0001
30-Dec-11	41																
6-Jan-12	42	-0.00002	-0.002	1.06	0.00009	0.993	-0.000005	0.19	0.0377	-10	-0.000002	0.00014	-0.0005	0.000013	0.0014	0.0003	-0.0001
13-Jan-12	43																
20-Jan-12	44	#N/A	-0.002	0.96	0.00009	0.861	-0.000005	0.28	0.0359	-10	0.000003	-0.0002	-0.0005	0.000016	0.0014	0.0012	-0.0001
27-Jan-12	45																
3-Feb-12	46	0.00013	-0.002	1.1	0.00008	1	-0.000005	0.23	0.0354	-10	0.000002	-0.0002	-0.0005	0.000012	0.0012	0.0002	-0.0001
10-Feb-12	47																
17-Feb-12	48	-0.00002	-0.002	1.04	0.00011	1.01	-0.000005	0.2	0.0337	-10	-0.000002	-0.0002	-0.0005	0.000017	0.0015	-0.0001	-0.0001
24-Feb-12	49																
2-Mar-12	50	0.00003	-0.002	0.94	0.00008	0.827	-0.000005	0.17	0.0317	-10	0.000002	-0.0002	-0.0005	0.00001	0.0011	0.0002	-0.0001
9-Mar-12	51																
16-Mar-12	52	0.00006	-0.002	1.02	0.0001	1.06	-0.000005	0.32	0.0375	-10	0.000007	-0.0002	0.0005	0.000014	0.0014	0.0002	-0.0001
23-Mar-12	53																
30-Mar-12	54	0.00004	-0.002	0.92	0.00009	0.936	-0.000005	0.18	0.0353	-10	-0.000002	-0.0002	0.0006	0.000014	0.001	0.0003	-0.0001
6-Apr-12	55																
13-Apr-12	56	0.00005	-0.002	1	0.0001	1.06	-0.000005	0.18	0.0342	-10	0.000003	-0.0002	0.0006	0.000014	0.0012	0.0005	-0.0001
20-Apr-12	57																
27-Apr-12	58	#N/A	-0.002	0.894	0.00009	0.754	-0.000005	0.191	0.0297	-10	0.000002	0.00022	-0.0005	0.000014	0.00155	0.00024	-0.0001
4-May-12	59																
11-May-12	60	0.000142	-0.002	0.97	0.00008	0.955	-0.000005	0.205	0.0302	-10	0.000003	-0.0002	-0.0005	0.000011	0.00108	0.00023	-0.0001
18-May-12	61																
25-May-12	62	0.000083	-0.002	0.865	0.00009	0.966	-0.000005	0.199	0.0309	-10	0.0000035	-0.0002	-0.0005	0.000011	0.001	0.0002	-0.0001
1-Jun-12	63																
8-Jun-12	64	0.000163	0.0025	0.784	0.000072	0.728	-0.000005	0.291	0.0274	-10	0.0000024	-0.0002	-0.0005	0.0000121	0.00091	0.00049	-0.0001
15-Jun-12	65																
22-Jun-12	66	0.000055	0.0027	0.802	0.000091	0.871	-0.000005	0.181	0.0277	-10	-0.000002	-0.0002	-0.0005	0.0000105	0.00111	0.00021	-0.0001
29-Jun-12	67																

HC 9

CONFIDENTIAL *DRAFT*

Sample =
07SWC258 20-23

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L
6-Jul-12	68	500	450	7.48	30	#N/A	3.9	20.9	2	-0.5	0.015	13.6	0.0832	-0.00002	0.0016	0.0727	-0.00001	-0.000005	-0.05	-0.000005	5.13	-0.0001	-0.000005	0.000613	0.0032	0.0000122	-0.0005	0.2	0.00455	-0.01	0.000147
13-Jul-12	69	500	465	7.58	30																										
20-Jul-12	70	500	465	7.49	30	#N/A	4.2	20.0	2	-0.5	0.013	14.5	0.119	-0.00002	0.00134	0.0712	-0.00001	-0.000005	-0.05	-0.000005	5.46	-0.0001	0.0000056	0.000569	0.0047	0.0000167	-0.0005	0.212	0.00482	-0.01	0.000126
27-Jul-12	71	500	455	7.78	29																										
3-Aug-12	72	500	445	7.55	28	#N/A	3.5	16.6	2	-0.5	0.017	13.6	0.0991	0.00002	0.00159	0.0694	-0.00001	-0.000005	-0.05	-0.000005	5.12	-0.0001	0.000006	0.000821	0.0043	0.000014	-0.0005	0.2	0.00417	-0.01	0.000107
10-Aug-12	73	500	460	7.56	26																										
17-Aug-12	74	500	450	7.45	32	#N/A	4.5	21.0	2	-0.5	0.016	14.8	0.106	-0.00002	0.00154	0.08	-0.00001	-0.000005	-0.05	0.000008	5.53	0.00102	0.000011	0.00112	0.0238	0.000065	-0.0005	0.239	0.00502	-0.01	0.000111
24-Aug-12	75	500	475	7.62	34																										
31-Aug-12	76	500	460	7.60	32	#N/A	3.3	21.8	2	-0.5	0.019	15.3	0.117	-0.00002	0.00157	0.078	-0.00001	-0.000005	-0.05	0.000008	5.76	0.00153	0.00001	0.00181	0.0127	0.000079	-0.0005	0.221	0.00503	-0.01	0.000111
7-Sep-12	77	500	445	7.45	26																										
14-Sep-12	78	500	460	7.27	27	#N/A	3.4	17.0	2	-0.5	0.012	12.6	0.0894	-0.00002	0.00143	0.0738	-0.00001	-0.000005	-0.05	-0.000005	4.72	-0.0001	-0.000005	0.00333	0.0076	0.000033	-0.0005	0.199	0.00493	-0.01	0.000108
21-Sep-12	79	500	475	7.48	33																										
28-Sep-12	80	500	455	7.37	31	#N/A	2.8	22.0	2	-0.5	0.015	14.4	0.112	-0.00002	0.00111	0.0774	-0.00001	-0.000005	-0.05	0.000005	5.39	-0.0001	0.000005	0.00118	0.0078	0.000028	-0.0005	0.23	0.00502	-0.01	0.000105
5-Oct-12	81	500	320	7.73	30																										
12-Oct-12	82	500	495	7.47	33	#N/A	5.8	23.0	2	-0.5	0.016	15.5	0.0903	-0.00002	0.00135	0.0862	-0.00001	-0.000005	-0.05	-0.000005	5.81	-0.0001	-0.000005	0.002	0.0045	0.000022	-0.0005	0.245	0.00469	-0.01	0.000111
19-Oct-12	83	500	495	7.58	31																										
26-Oct-12	84	500	495	7.48	33	#N/A	2.8	22.6	2	-0.5	0.016	15.4	0.0913	-0.00002	0.00133	0.0816	-0.00001	-0.000005	-0.05	0.000007	5.82	-0.0001	0.000005	0.00137	0.0086	0.000134	-0.0005	0.223	0.00426	-0.01	0.000119
2-Nov-12	85	500	485	7.54	34																										
9-Nov-12	86	500	495	7.57	30	#N/A	5.1	23.1	3	-0.5	0.019	15.6	0.0807	-0.00002	0.00126	0.0843	-0.00001	-0.000005	-0.05	0.000016	5.84	0.00058	0.000048	0.00101	0.0051	0.000023	-0.0005	0.25	#N/A	-0.01	0.000106
16-Nov-12	87	500	490	7.65	28																										
23-Nov-12	88	500	480	7.60	34	#N/A	3.8	22.4	3	-0.5	0.018	16.4	0.0984	-0.00002	#N/A	0.0861	-0.00001	-0.000005	-0.05	-0.000005	6.16	-0.0001	0.000017	0.000878	0.0066	0.000027	-0.0005	0.252	0.00401	-0.01	0.000094
30-Nov-12	89	500	505	7.48	34																										
7-Dec-12	90	500	425	7.81	25	#N/A	5.6	21.5	2	-0.5	0.017	13	0.121	-0.00002	0.00118	0.0704	-0.00001	-0.000005	-0.05	-0.000005	4.87	-0.0001	0.000005	0.000938	0.0068	0.000022	-0.0005	0.199	0.00331	-0.01	0.000085
14-Dec-12	91	500	485	7.87	23																										
21-Dec-12	92	500	480	7.66	30	#N/A	3.5	21.6	-2	0.56	0.019	13.9	0.0932	-0.00002	0.00107	0.0787	-0.00001	-0.000005	-0.05	-0.000005	5.22	-0.0001	0.000005	0.000566	0.0059	0.000015	-0.0005	0.201	0.00361	-0.01	0.000088
28-Dec-12	93	500	465	7.61	35																										
4-Jan-13	94	500	460	7.74	27	#N/A	4.5	21.5	-2	0.87	0.024	13.9	0.0784	-0.00002	0.00086	0.0831	-0.00001	-0.000005	-0.05	-0.000005	5.17	-0.0001	0.000011	0.000589	0.0036	0.000019	-0.0005	0.238	0.00405	-0.01	0.00007
11-Jan-13	95	500	465	7.58	27																										
18-Jan-13	96	500	460	7.62	29	#N/A	2.6	20.8	2	0.66	0.016	13.9	0.0869	-0.00002	0.000928	0.0806	-0.00001	-0.000005	-0.05	-0.000005	5.18	-0.0001	0.000006	0.000469	0.0048	0.000017	-0.0005	0.225	0.00389	-0.01	0.000065
25-Jan-13	97	500	460	7.54	40																										
1-Feb-13	98	500	435	7.64	24	#N/A	4.0	15.7	2	0.54	0.023	11.5	0.0918	-0.00002	0.00106	0.0643	-0.00001	-0.000005	-0.05	-0.000005	4.29	-0.0001	0.000005	0.000511	0.0044	0.000009	-0.0005	0.192	0.00301	-0.01	0.000079
8-Feb-13	99	500	445	7.92	21																										
15-Feb-13	100	500	440	7.43	22	#N/A	3.0	11.2	2	-0.5	0.012	10.1	0.088	-0.00002	0.000786	0.058	-0.00001	-0.000005	-0.05	-0.000005	3.74	-0.0001	-0.000005	0.000403	0.0041	0.000011	-0.0005	0.178	0.00298	-0.01	0.000069
22-Feb-13	101	500	425	7.86	22																										
1-Mar-13	102	500	445	7.58	22	#N/A	5.1	15.5	3	-0.5	0.02	10.2	0.0924	-0.00002	0.000845	0.0612	-0.00001	-0.000005	-0.05	-0.000005	3.76	-0.0001	-0.000005	0.000504	0.0059	0.000018	-0.0005	0.187	0.00297	-0.01	0.00008
8-Mar-13	103	500	445	7.71	31																										
15-Mar-13	104	500	440	7.55	21	#N/A	4.5	12.7	2	0.66	0.016	9.68	0.081	-0.00002	0.000769	0.0547	-0.00001	-0.000005	-0.05	0.000017	3.59	-0.0001	-0.000005	0.000578	0.0055	0.000012	-0.0005	0.17	0.00272	-0.01	0.000059
22-Mar-13	105	500	455	7.84	20																										
29-Mar-13	106	500	435	7.44	20	#N/A	3.1	11.2	3	0.97	0.012	9.27	0.0738	-0.00002	0.000704	0.0535	-0.00001	-0.000005	-0.05	-0.000005	3.44	-0.0001	-0.000005	0.000408	0.0034	0.000022	-0.0005	0.163	0.00266	-0.01	0.00007
5-Apr-13	107	500	430	7.70	21																										
12-Apr-13	108	500	450	7.71	24	#N/A	5.2	15.3	3	-0.5	0.011	10.3	0.0719	-0.00002	0.000812	0.0631	-0.00001	-0.000005	-0.05	-0.000005	3.8	-0.0001	0.000005	0.0005	0.0035	0.000011	-0.0005	0.19	0.00275	-0.01	0.000066
19-Apr-13	109	500	440	7.80	21																										
26-Apr-13	110	500	440	7.42	22	#N/A	3.8	12.0	2	-0.5	0.013	9.25	0.0766	-0.00002	0.00071	0.0573	-0.00001	-0.000005	-0.05	-0.000005	3.42	-0.0001	0.000005	0.000606	0.0093	0.00004	-0.0005	0.174	0.00274	-0.01	0.000062
3-May-13	111	500	430	7.74	22																										
10-May-13	112	500	425	7.38	20	#N/A	3.8	11.5	2	-0.5	-0.01	8.83	0.0756	-0.00002	0.000657	0.0504	-0.00001	-0.000005	-0.05	-0.000005	3.26	-0.0001	-0.000005	0.000521	0.0058	0.000009	-0.0005	0.171	0.00247	-0.01	0.000053
17-May-13	113	500	440	7.89	23																										
24-May-13	114	500	440	7.41	20	#N/A	3.7	11.8	2																						

June 10/11 Pb 0.000042 and Ni . Repeat Pb=0.000045, Ni= 0.00398 data confirmed suspect contamination
June 24/11 Cl 3.1. Repeat = 0.9, data accepted.
Jul 22/11 Ni=0.00023, repeat=0.00023. data confirmed, suspect contamination
Aug 19/11 Ni= 0.00021, repeat=0.00021. Data confirmed, suspect contamination
Nov 11/11 Cd=0.000057, repeat=0.000054. data confirmed, suspect contamination
Dec 9/11 Pb=0.000631, repeat=0.000634. data confirmed, suspect contamination.
Oct 14/11 Ni=0.00034, repeat=0.00041. Data confirmed, suspect contamination.
Jan 20/12 Pb=0.000271, Ni=0.00025. Repeat Pb=0.000254, Ni=0.00023. Data confirmed, suspect contamination
Apr 27/12 Ni=0.000109, repeat=0.000132. Data confirmed, suspect contamination
Nov 23/12 As=0.00212, repeat=0.00212. Data confirmed, suspect contamination
Nov 9/12 Mn=0.00876, repeat confirms original result, suspect contamination

HC 9

Sample =
07SWC258 20-23

Date	Cycle No.	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
6-Jul-12	68	0.000022	-0.002	0.839	0.000078	0.81	-0.000005	0.17	0.0253	-10	-0.000002	-0.0002	-0.0005	0.0000111	0.00114	0.00014	-0.0001
13-Jul-12	69																
20-Jul-12	70	-0.00002	-0.002	0.793	0.000064	0.873	-0.000005	0.17	0.0261	-10	0.000002	-0.0002	0.00056	0.0000095	0.00103	0.00115	-0.0001
27-Jul-12	71																
3-Aug-12	72	0.000095	-0.002	0.845	0.000063	0.799	-0.000005	0.19	0.0246	-10	0.000002	-0.0002	-0.0005	0.000011	0.00102	0.00031	-0.0001
10-Aug-12	73																
17-Aug-12	74	0.00015	-0.002	0.939	0.000096	0.775	-0.000005	0.244	0.0281	-10	0.000003	0.00074	-0.0005	0.00001	0.00095	0.00109	-0.0001
24-Aug-12	75																
31-Aug-12	76	0.000175	-0.002	0.837	0.000079	0.858	-0.000005	0.315	0.0286	-10	0.000003	0.0003	-0.0005	0.000013	0.00094	0.00086	-0.0001
7-Sep-12	77																
14-Sep-12	78	0.000068	-0.002	0.718	0.000093	0.648	-0.000005	0.142	0.0254	-10	0.000005	-0.0002	0.00064	0.000008	0.00072	0.00027	-0.0001
21-Sep-12	79																
28-Sep-12	80	0.000173	-0.002	0.838	0.000058	0.851	-0.000005	0.198	0.029	-10	0.000002	0.00023	-0.0005	0.00001	0.00089	0.0002	-0.0001
5-Oct-12	81																
12-Oct-12	82	0.000038	-0.002	0.883	0.000068	0.772	-0.000005	0.149	0.0282	-10	0.000002	-0.0002	-0.0005	0.000011	0.0007	0.00031	-0.0001
19-Oct-12	83																
26-Oct-12	84	0.000072	0.0083	0.797	0.00009	0.754	-0.000005	0.137	0.0282	-10	0.000003	0.00036	-0.0005	0.000018	0.0009	0.00109	-0.0001
2-Nov-12	85																
9-Nov-12	86	0.00023	-0.002	0.859	0.000075	0.742	-0.000005	0.208	0.0271	-3	0.000003	0.00026	-0.0005	0.000015	0.00094	0.00304	-0.0001
16-Nov-12	87																
23-Nov-12	88	0.000384	-0.002	0.879	0.000046	0.867	-0.000005	0.164	0.0315	-3	0.000003	0.00036	-0.0005	0.000011	0.00078	0.00075	-0.0001
30-Nov-12	89																
7-Dec-12	90	0.000293	-0.002	0.786	-0.00004	0.722	-0.000005	0.132	0.0246	-3	0.000002	-0.0002	-0.0005	0.00001	0.00101	0.00142	-0.0001
14-Dec-12	91																
21-Dec-12	92	0.000046	-0.002	0.799	0.000067	0.643	-0.000005	0.116	0.0224	-3	0.000002	-0.0002	-0.0005	0.000009	0.00075	0.00017	-0.0001
28-Dec-12	93																
4-Jan-13	94	0.000165	-0.002	0.833	0.000041	0.549	-0.000005	0.159	0.0232	-3	0.000003	-0.0002	-0.0005	0.000006	0.00067	0.00032	-0.0001
11-Jan-13	95																
18-Jan-13	96	-0.00002	0.0037	0.851	0.000052	0.636	-0.000005	0.126	0.0232	-3	0.000002	-0.0002	-0.0005	0.000007	0.00063	0.00047	-0.0001
25-Jan-13	97																
1-Feb-13	98	0.000116	-0.002	0.778	0.000047	0.606	-0.000005	0.124	0.0189	-3	0.000002	-0.0002	-0.0005	0.000025	0.00074	0.00017	-0.0001
8-Feb-13	99																
15-Feb-13	100	-0.00002	-0.002	0.788	0.000059	0.516	-0.000005	0.121	0.0168	-3	0.000002	-0.0002	-0.0005	0.000006	0.00058	-0.0001	-0.0001
22-Feb-13	101																
1-Mar-13	102	-0.00002	-0.002	0.783	0.000088	0.562	-0.000005	0.131	0.0177	-3	-0.000002	-0.0002	-0.0005	0.000006	0.00053	0.00033	-0.0001
8-Mar-13	103																
15-Mar-13	104	0.000104	-0.002	0.707	-0.00004	0.566	-0.000005	0.137	0.0159	-3	0.000002	-0.0002	-0.0005	0.000004	0.00049	0.00053	-0.0001
22-Mar-13	105																
29-Mar-13	106	0.000029	-0.002	0.767	-0.00004	0.473	-0.000005	0.113	0.0154	-3	-0.000002	-0.0002	-0.0005	0.000005	0.00049	0.00016	-0.0001
5-Apr-13	107																
12-Apr-13	108	0.000026	-0.002	0.761	0.000098	0.463	-0.000005	0.11	0.0182	-3	-0.000002	-0.0002	0.00095	0.000006	0.00071	0.00401	-0.0001
19-Apr-13	109																
26-Apr-13	110	0.000076	0.014	0.742	0.000057	0.438	0.000414	0.133	0.0163	-3	-0.000002	0.00025	0.00095	0.000006	0.0003	0.00067	-0.0001
3-May-13	111																
10-May-13	112	0.00003	-0.002	0.71	0.000057	0.482	-0.000005	0.117	0.0145	-3	-0.000002	-0.0002	0.00063	0.000004	0.0005	0.00021	-0.0001
17-May-13	113																
24-May-13	114																

HC 10

CONFIDENTIAL *DRAFT*

Sample =
08SWC337 10-13

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L
18-Mar-11	0	500	345	7.68	105	#N/A	2.8	50.2	5	2.8	0.29	27.8	0.0568	-0.00002	0.00072	0.0195	-0.00001	-0.000005	-0.05	0.000014	7.75	0.0001	0.000181	0.0046	0.013	0.000024	0.0008	2.05	0.0123	-0.01	0.0122	0.00018
25-Mar-11	1	500	470	7.91	121																											
1-Apr-11	2	500	525	7.91	96	#N/A	5.1	56.3	4	0.6	0.33	29.8	0.0351	0.00003	0.00086	0.017	-0.00001	-0.000005	-0.05	-0.000005	8.06	0.0003	0.000112	0.00334	0.009	0.000022	0.0007	2.35	0.0068	-0.01	0.0133	0.00016
8-Apr-11	3	500	520	7.82	78																											
15-Apr-11	4	500	490	7.78	61	#N/A	2.1	37.6	3	-0.5	0.2	22.9	0.0243	0.00002	0.00173	0.0128	-0.00001	-0.000005	-0.05	-0.000005	6.33	0.0003	0.000056	0.0016	0.007	0.00002	-0.0005	1.73	0.00646	-0.01	0.00829	0.00015
22-Apr-11	5	500	490	7.73	65																											
29-Apr-11	6	500	480	7.72	59	#N/A	3.1	39.1	4	-0.5	0.15	26.2	0.0293	-0.00002	0.00052	0.0151	-0.00001	-0.000005	-0.05	-0.000005	7.61	0.0002	0.000034	0.00141	0.008	0.000008	-0.0005	1.74	0.00381	-0.01	0.00631	0.00009
6-May-11	7	500	470	7.61	59																											
13-May-11	8	500	490	7.67	75	#N/A	3.1	33.2	4	-0.5	0.16	26.4	0.0305	0.00002	0.00065	0.0159	-0.00001	-0.000005	-0.05	-0.000005	7.28	0.0003	0.000028	0.00117	0.007	0.000011	-0.0005	2	0.0049	-0.01	0.0058	0.00013
20-May-11	9	500	450	7.78	55																											
27-May-11	10	500	410	7.81	52	#N/A	4.9	31.4	4	-0.5	0.15	23.1	0.0203	0.00003	0.00077	0.0145	-0.00001	-0.000005	-0.05	-0.000005	6.55	0.0001	0.000016	0.00124	0.003	0.000016	-0.0005	1.64	0.00068	-0.01	0.0063	0.00019
3-Jun-11	11	500	400	7.61	50																											
10-Jun-11	12	500	425	7.72	53	#N/A	2.0	33.6	2	0.7	0.12	21.5	0.0309	0.00002	0.00194	0.014	-0.00001	-0.000005	-0.05	0.000011	6.16	-0.0001	0.000016	0.00131	0.009	0.000009	-0.0005	1.49	0.00117	-0.01	0.00498	0.00005
17-Jun-11	13	500	450	7.63	53																											
24-Jun-11	14	500	520	7.90	52	#N/A	1.6	34.3	2	-0.5	0.08	26.2	0.0193	0.00003	0.00053	0.0175	-0.00001	-0.000005	-0.05	-0.000005	7.48	0.0001	0.000011	0.00131	0.003	-0.000005	-0.0005	1.83	0.00044	-0.01	0.00379	-0.00002
1-Jul-11	15	500	520	7.89	48																											
8-Jul-11	16	500	505	7.50	47	#N/A	2.8	29.4	2	-0.5	0.07	20	0.0161	-0.00002	0.00023	0.0133	-0.00001	-0.000005	-0.05	-0.000005	5.81	0.0002	0.000012	0.00092	0.003	0.000009	-0.0005	1.34	0.00036	-0.01	0.00259	0.00005
15-Jul-11	17	500	505	7.71	64																											
22-Jul-11	18	500	515	7.77	51	#N/A	3.1	31.0	-2	0.5	0.08	23.3	0.0226	-0.00002	0.00021	0.0173	-0.00001	-0.000005	-0.05	-0.000005	6.41	0.0002	0.000013	0.00148	0.007	0.000017	-0.0005	1.76	0.00099	-0.01	0.00313	#N/A
29-Jul-11	19	500	490	7.77	52																											
5-Aug-11	20	500	515	7.70	59	#N/A	3.4	35.3	-2	-0.5	0.07	26.8	0.0177	-0.00002	0.00022	0.0193	-0.00001	-0.000005	-0.05	-0.000005	7.6	0.0002	0.000008	0.00078	0.004	0.000007	-0.0005	1.9	0.00042	-0.01	0.00312	0.00003
12-Aug-11	21	500	500	7.80	53																											
19-Aug-11	22	500	490	7.68	58	#N/A	3.8	35.4	-2	-0.5	0.08	26.9	0.0263	-0.00002	0.00029	0.0206	-0.00001	-0.000005	-0.05	-0.000005	7.81	0.0002	0.000011	0.00136	0.009	0.000011	-0.0005	1.79	0.0011	-0.01	0.00308	#N/A
26-Aug-11	23	500	515	7.63	59																											
2-Sep-11	24	500	475	7.76	48	#N/A	3.9	32.7	2	-0.5	0.06	23	0.0332	-0.00002	0.00033	0.0154	-0.00001	-0.000005	-0.05	-0.000005	6.71	#N/A	0.000011	0.00168	0.011	0.000013	-0.0005	1.46	0.0012	-0.01	0.00254	#N/A
9-Sep-11	25	500	510	7.81	51																											
16-Sep-11	26	500	520	7.55	48	#N/A	3.9	31.1	-2	0.7	0.05	23.2	0.0179	-0.00002	0.00025	0.0173	-0.00001	-0.000005	-0.05	-0.000005	6.85	0.0002	0.00001	0.00069	0.004	-0.000005	-0.0005	1.49	0.00085	-0.01	0.00201	-0.00002
23-Sep-11	27	500	510	7.55	47																											
30-Sep-11	28	500	495	7.53	48	#N/A	3.1	30.1	-2	-0.5	0.05	21.8	0.0125	-0.00002	0.00021	0.016	-0.00001	-0.000005	-0.05	0.000006	6.55	0.0001	0.000009	0.00052	0.003	0.000038	-0.0005	1.32	0.00032	-0.01	0.00177	-0.00002
7-Oct-11	29	500	495	7.55	46																											
14-Oct-11	30	500	495	7.50	48	#N/A	3.4	30.3	-2	-0.5	0.06	25.4	0.0232	-0.00002	0.00025	0.0182	-0.00001	-0.000005	-0.05	-0.000005	7.37	0.0001	-0.000005	0.0007	0.004	0.000009	-0.0005	1.69	0.00068	-0.01	0.00226	-0.00002
21-Oct-11	31	500	505	7.69	46																											
28-Oct-11	32	500	510	7.60	57	#N/A	3.5	36.3	-2	-0.5	0.05	29.8	0.0195	-0.00002	0.00016	0.0226	-0.00001	-0.000005	-0.05	-0.000005	8.57	0.0002	-0.000005	0.00181	0.002	0.000006	-0.0005	2.04	0.00027	-0.01	0.00207	0.00005
4-Nov-11	33	500	505	7.68	53																											
11-Nov-11	34	500	410	7.84	52	#N/A	5.2	35.7	2	-0.5	0.054	25.5	#N/A	0.00002	0.00031	0.0209	-0.00001	-0.000005	-0.05	#N/A	7.47	0.0001	0.000026	0.00158	#N/A	0.000054	-0.0005	1.67	0.00582	-0.01	0.00231	0.0002
18-Nov-11	35	500	420	7.64	53																											
25-Nov-11	36	500	490	7.73	56	#N/A	3.3	36.3	2	-0.5	0.043	27.4	0.0235	0.00002	0.00022	0.0257	-0.00001	-0.000005	-0.05	-0.000005	7.84	0.0002	0.00001	0.00209	0.008	0.000023	-0.0005	1.9	0.00174	-0.01	0.00187	0.00016
2-Dec-11	37	500	485	7.61	53																											
9-Dec-11	38	500	495	7.58	57	#N/A	4.1	36.2	2	0.9	0.036	27.5	0.0233	-0.00002	0.00017	0.0222	-0.00001	-0.000005	-0.05	-0.000005	7.85	0.0002	0.000011	0.00118	0.006	0.000013	-0.0005	1.91	0.00134	-0.01	0.00145	0.00012
16-Dec-11	39	500	485	7.68	60																											
23-Dec-11	40	500	475	7.64	58	#N/A	4.8	38.3	2	-0.5	0.038	28.5	0.0243	-0.00002	0.00015	0.0266	-0.00001	-0.000005	-0.05	-0.000005	7.97	0.0003	0.000009	0.00101	0.006	0.000028	-0.0005	2.09	0.00115	-0.01	0.00133	0.00023
30-Dec-11	41	500	485	7.70	49																											
6-Jan-12	42	500	475	7.42	41	#N/A	3.5	31.0	2	-0.5	0.03	20.7	0.0408	-0.00002	0.00012	0.0168	-0.00001	-0.000005	-0.05	-0.000005	6.08	0.0001	0.000015	0.00065	0.017	0.000013	-0.0005	1.35	0.00262	-0.01	0.00111	-0.00002
13-Jan-12	43	500	480	7.62	46																											
20-Jan-12	44	500	480	7.73	55	#N/A	3.0	41.7	2	-0.5	0.036	25	0.0358	-0.00002	0.0002	0.0216	-0.00001	-0.000005	-0.05	-0.000005	7.45	0.0003	0.000011	0.00178	0.017	#N/A	-0.0005	1.55	0.00179	-0.01	0.00118	#N/A
27-Jan-12	45	500	485	7.56	49																											
3-Feb-12	46	500	480	7.64	52	#N/A	5.8	36.3	2	-0.5	0.033	24.6	0.0208	-0.00002	0.00011	0.0179	-0.00001	-0.000005	-0.05	-0.000005	7.32	0.0001	0.000014	0.00073	0.005	0.000009	-0.0005	1.55	0.00154	-0.01	0.00114	0.00014
10-Feb-12	47	500	465	7.63	52																											
17-Feb-12	48	500	480	7.58	51	#N/A	3.0	33.6	2	-0.5	0.031	25.4	0.0196	0.00002	0.00025	0.0212	-0.00001	-0.000005	-0.05	-0.000005	7.59	0.0002	0.00001	0.00064	0.005	0.000008	-0.0005	1.56	0.0012	-0.01	0.00118	-0.00002
24-Feb-12	49	500	485	7.46	52																											
2-Mar-12	50	500	470	7.53	52	#N/A	7.3	35.4	2	-0.5	0.026	25	0.0156	-0.00002	0.00015	0.021	-0.00001	-0.000005	-0.05	-0.000005	7.43	-0.0001	-0.000005	0.00052	0.003	0.000009	-0.0005	1.56	0.00055	-0.01	0.00086	0.00004
9-Mar-12	51	500	465	7.59	47																											
16-Mar-12	52	500	475	7.57	48	#N/A	2.9	29.9	2	-0.5	0.026	23	0.0189	-0.00002	0.00009	0.0173	-0.00001	-0.000005	-0.05	-0.000005	6.99	0.0001	0.000009	0.00069	0.006	0.000007	-0.0005	1.36	0.0014	-0.01	0.00087	0.00015
23-Mar-12	53	500	465	7.55	53																											
30-Mar-12	54	500	495	7.50	63	#N/A	4.2	38.2	2	-0.5	0.033	29.2	0.0186	0.00002	0.0001	0.0247	-0.00001	-0.000005	-0.05	-0.000005	8.73	0.0001	-0.000005	0.00052	0.005	0.000008	-0.0005	1.79	0.00051	-0.01	0.00123	0.00004
6-Apr-12	55	500	465	7.66	56																											
13-Apr-12	56	500	465	7.69	57	#N/A	2.2	36.2	2	-0.5	0.029	29.2	0.0281	-0.00002	0.00015	0.0247	-0.00001	-0.000005	-0.05	0.000006	8.84	0.0001	-0.000005	0.00069	0.009	0.000041	-0.0005	1.74	0.00129	-0.01	0.00141	-0.00002
20-Apr-12	57	500	480	7.63	57																											
27-Apr-12	58	500	495	7.70	59	#N/A	4.8	37.9	-2	-0.5	0.029	27	0.0223	-0.00002	0.000225	0.0227	-0.00001	-0.000005	-0.05	#N/A	8.23	0.00024	0.000011	0.00071	0.0077	0.000025	-0.0005	1.57	0.00134	-0.01	0.00113	#N/A
4-May-12	59	500	495	7.61	51																											
11-May-12	60	500	505	7.60	51	#N/A	3.4	32.0	3	-0.5	0.033	26.2	0.0128	-0.00002	0.000227	0.0214	-0.00001	-0.000005	-0.05	0.000005	8.13	0.00019	0.000015	0.00075	0.004	0.000017	-0.0005	1.43	0.00137	-0.01	0.00097	0.000177
18-May-12	61	500	520	7.61	52																											
25-May-12	62	500	515	7.59	51	#N/A	3.9	31.9	2	-0.5	0.027	24.2	0.0203	0.00009	0.000239	0.0209	-0.00001	-0.000005	-0.05	0.000101	7.43	0.00027	0.0000096	0.00186	0.0138	0.0000258	-0.0005	1.38	0.00159	-0.01	0.00092	0.000066
1-Jun-12	63	500	520	7.55	51																											
8-Jun-12	64	500	475	7.63	55	#N/A	3.2	34.4	2	0.61	0.026	25.4	0.0242	-0.00002	0.000217	0.0219	-0.00001	-0.000005	-0.05	0.0000067	7.75	0.00015	0.0000276	0.00125	0.011	0.0000282	-0.0005	1.47	0.00149	-0.01	0.00104	0.000234
15-Jun-12	65	500	490	7.51	49																											
22-Jun-12	66	500	470	7.45	42	#N/A	4.2	29.2	2	-0.5	0.03	21	0.0206	-0.00002	0.000356	0.0185	-0.00001	-0.000005	-0.05	-0.000005	6.43	0.00012	-0.000005	0.00049	0.0043	0.0000065	-0.0005	1.19	0.00053	-0.01	0.00092	0.000029
29-Jun-12	67	500	470	7.52	44																											
6-Jul-12	68	500	465	7.54	47	#N/A	4.4	30.1	2	-0.5	0.026	21.9	0.02	-0.00002	0.000301	0.0196	-0.00001	-0.000005	-0.05	-0.000005	6.73	0.00014	0.0000053	0.00062	0.0049	0.0000072	-0.0005	1.23	0.00076	-0.01	0.00091	0.000033

HC 10

Sample =
08SWC337_10-13

Date	Cycle No.	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	-0.002	3.27	0.00015	1.54	0.000009	11.4	0.0369	-10	-0.000002	0.00022	-0.0005	0.00034	0.0008	0.0002	-0.0001
25-Mar-11	1															
1-Apr-11	2	-0.002	2.6	0.0001	2.38	0.000005	7.17	0.0436	-10	-0.000002	0.00047	0.0005	0.000137	0.0011	0.0002	-0.0001
8-Apr-11	3															
15-Apr-11	4	-0.002	1.92	-0.00004	1.58	0.000007	3.38	0.0371	-10	-0.000002	0.00058	-0.0005	#N/A	0.0009	0.0007	-0.0001
22-Apr-11	5															
29-Apr-11	6	-0.002	1.91	-0.00004	1.72	-0.000005	2.3	0.0345	-10	-0.000002	0.00019	-0.0005	0.000067	0.0008	0.0002	-0.0001
6-May-11	7															
13-May-11	8	-0.002	1.75	-0.00004	1.7	0.000006	1.62	0.0384	-10	-0.000002	0.00013	-0.0005	0.000072	0.0009	0.0002	-0.0001
20-May-11	9															
27-May-11	10	-0.002	1.77	0.00011	1.6	0.000005	1.2	0.0316	-10	-0.000002	0.00019	-0.0005	0.000045	0.0009	0.0004	-0.0001
3-Jun-11	11															
10-Jun-11	12	-0.002	1.58	-0.00004	1.41	-0.000005	0.87	0.0341	-10	-0.000002	0.00033	-0.0005	0.000052	0.0008	0.0002	-0.0001
17-Jun-11	13															
24-Jun-11	14	-0.002	1.64	-0.00004	1.6	0.000006	0.74	0.0341	-10	-0.000002	0.00015	-0.0005	0.000056	0.0007	-0.0001	-0.0001
1-Jul-11	15															
8-Jul-11	16	-0.002	1.09	-0.00004	1.2	-0.000005	0.43	0.0299	-10	-0.000002	0.00007	-0.0005	0.000048	0.0005	0.0004	-0.0001
15-Jul-11	17															
22-Jul-11	18	-0.002	1.39	-0.00004	1.37	0.000006	0.5	0.0332	-10	-0.000002	0.00006	-0.0005	0.000044	0.0006	0.0005	-0.0001
29-Jul-11	19															
5-Aug-11	20	-0.002	1.38	-0.00004	1.46	0.000008	0.43	0.0365	-10	-0.000002	0.00006	-0.0005	0.00018	0.0007	0.0002	-0.0001
12-Aug-11	21															
19-Aug-11	22	-0.002	1.45	-0.00004	1.49	0.000006	0.46	0.039	-10	-0.000002	0.00004	-0.0005	0.000051	0.0009	0.0002	-0.0001
26-Aug-11	23															
2-Sep-11	24	-0.002	1.11	-0.00004	1.18	0.000009	0.37	0.0319	-10	-0.000002	0.0001	0.0005	0.00004	0.0007	0.0005	-0.0001
9-Sep-11	25															
16-Sep-11	26	-0.002	1.04	-0.00004	1.12	0.000007	0.2	0.0318	-10	-0.000002	0.00005	-0.0005	0.000048	0.0007	0.0002	-0.0001
23-Sep-11	27															
30-Sep-11	28	-0.002	0.94	-0.00004	0.985	0.000006	0.21	0.0303	-10	-0.000002	0.00013	-0.0005	0.000037	-0.0002	-0.0001	-0.0001
7-Oct-11	29															
14-Oct-11	30	-0.002	1.09	-0.00004	1.32	0.000006	0.27	0.0346	-10	-0.000002	0.00003	-0.0005	0.000044	0.0006	0.0007	-0.0001
21-Oct-11	31															
28-Oct-11	32	-0.002	1.28	-0.00004	1.4	0.000009	0.26	0.0431	-10	-0.000002	0.00063	-0.0005	0.000054	0.0007	-0.0001	-0.0001
4-Nov-11	33															
11-Nov-11	34	-0.002	1.45	-0.00004	1.49	0.000014	0.28	0.0351	-10	0.000004	0.00023	0.0014	0.000046	0.0008	0.001	-0.0001
18-Nov-11	35															
25-Nov-11	36	-0.002	1.55	-0.00004	1.39	0.000008	0.27	0.0397	-10	-0.000002	0.00032	-0.0005	0.00006	0.0007	0.0004	-0.0001
2-Dec-11	37															
9-Dec-11	38	-0.002	1.32	-0.00004	1.11	0.000008	0.21	0.0403	-10	-0.000002	0.00013	-0.0005	0.000058	0.0005	0.0002	-0.0001
16-Dec-11	39															
23-Dec-11	40	-0.002	1.45	-0.00004	1.21	0.000011	0.26	0.0427	-10	-0.000002	0.00002	-0.0005	0.000058	0.0005	0.0012	-0.0001
30-Dec-11	41															
6-Jan-12	42	-0.002	0.94	-0.00004	0.895	0.000008	0.14	0.0287	-10	-0.000002	0.00008	0.0008	0.000026	0.0005	0.0001	-0.0001
13-Jan-12	43															
20-Jan-12	44	-0.002	1.01	-0.00004	0.992	0.000008	0.24	0.0378	-10	-0.000002	-0.0002	0.0005	0.000054	0.0007	0.0009	-0.0001
27-Jan-12	45															
3-Feb-12	46	-0.002	0.97	-0.00004	0.989	0.000006	0.18	0.0311	-10	-0.000002	-0.0002	-0.0005	0.000035	0.0005	-0.0001	-0.0001
10-Feb-12	47															
17-Feb-12	48	-0.002	1.05	-0.00004	1.08	0.000007	0.16	0.036	-10	-0.000002	-0.0002	-0.0005	0.000046	0.0007	0.0003	-0.0001
24-Feb-12	49															
2-Mar-12	50	-0.002	0.9	-0.00004	0.9	0.000009	0.13	0.0322	-10	-0.000002	-0.0002	-0.0005	0.000041	0.0004	0.0001	-0.0001
9-Mar-12	51															
16-Mar-12	52	-0.002	0.82	-0.00004	0.894	-0.000005	0.16	0.0302	-10	-0.000002	-0.0002	-0.0005	0.000027	0.0003	0.0003	-0.0001
23-Mar-12	53															
30-Mar-12	54	-0.002	0.96	-0.00004	1.12	0.000006	0.16	0.0419	-10	-0.000002	-0.0002	-0.0005	0.000042	0.0004	0.0003	-0.0001
6-Apr-12	55															
13-Apr-12	56	-0.002	1.02	-0.00004	1.29	0.000009	0.14	0.04	-10	-0.000002	-0.0002	-0.0005	0.000044	0.0005	0.0002	-0.0001
20-Apr-12	57															
27-Apr-12	58	-0.002	0.949	-0.00004	1.07	0.000008	0.176	0.0369	-10	-0.000002	0.00031	-0.0005	0.000043	0.001	#N/A	-0.0001
4-May-12	59															
11-May-12	60	-0.002	0.896	-0.00004	1.06	0.000011	0.15	0.0326	-10	-0.000002	0.00023	-0.0005	0.000031	0.00047	0.00091	-0.0001
18-May-12	61															
25-May-12	62	-0.002	0.794	-0.00004	1.06	0.0000059	0.151	0.033	-10	#N/A	-0.0002	-0.0005	0.0000321	0.00045	#N/A	-0.0001
1-Jun-12	63															
8-Jun-12	64	0.0035	0.753	-0.00004	0.94	0.0000064	0.241	0.0331	-10	-0.000002	0.00033	-0.0005	0.0000366	0.00046	0.00109	-0.0001
15-Jun-12	65															
22-Jun-12	66	-0.002	0.625	-0.00004	0.831	-0.000005	0.126	0.0284	-10	-0.000002	-0.0002	-0.0005	0.000025	0.00046	0.00011	-0.0001
29-Jun-12	67															
6-Jul-12	68	-0.002	0.75	-0.00004	0.926	-0.000005	0.124	0.0285	-10	-0.000002	-0.0002	-0.0005	0.0000273	0.00064	0.00014	-0.0001

HC 10

CONFIDENTIAL *DRAFT*

Sample =
08SWC337 10-13

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L
13-Jul-12	69	500	510	7.55	47																											
20-Jul-12	70	500	490	7.48	45	#N/A	4.0	28.8	2	0.5	0.023	23.5	#N/A	-0.00002	0.000093	0.0197	-0.00001	-0.000005	-0.05	-0.000005	7.29	0.00013	0.0000099	0.00067	0.0053	0.0000131	-0.0005	1.29	0.00067	-0.01	0.00084	0.000064
27-Jul-12	71	500	475	7.68	44																											
3-Aug-12	72	500	485	7.60	49	#N/A	3.6	31.6	2	-0.5	0.024	25.4	0.0168	0.000023	0.000084	0.022	-0.00001	-0.000005	-0.05	-0.000005	7.94	0.00014	0.00001	0.00091	0.0049	0.000025	-0.0005	1.36	0.0011	-0.01	0.00092	0.000158
10-Aug-12	73	500	480	7.62	44																											
17-Aug-12	74	500	475	7.50	52	#N/A	4.5	32.3	2	-0.5	0.026	25.3	0.0211	0.00002	0.000123	0.0246	-0.00001	-0.000005	-0.05	-0.000005	7.59	0.00017	0.000008	0.00113	0.0071	#N/A	-0.0005	1.54	0.00122	-0.01	0.00104	0.000126
24-Aug-12	75	500	460	7.57	45																											
31-Aug-12	76	500	500	7.59	48	#N/A	3.6	31.9	2	-0.5	0.02	24.2	0.0204	-0.00002	0.000212	0.0206	-0.00001	-0.000005	-0.05	0.000011	7.6	-0.0001	0.000014	0.00076	0.0051	0.000022	-0.0005	1.27	0.00118	-0.01	0.00076	0.000104
7-Sep-12	77	500	465	7.47	47																											
14-Sep-12	78	500	470	7.45	53	#N/A	4.0	34.3	3	-0.5	0.021	25.2	0.0216	-0.00002	0.000486	0.0252	-0.00001	-0.000005	-0.05	-0.000005	7.65	#N/A	0.000009	0.00151	0.0103	0.000072	-0.0005	1.48	0.00116	-0.01	0.00082	0.000182
21-Sep-12	79	500	510	7.51	53																											
28-Sep-12	80	500	460	7.50	49	#N/A	2.9	33.2	2	-0.5	0.024	24.8	0.0259	-0.00002	0.000134	0.0243	-0.00001	-0.000005	-0.05	-0.000005	7.72	-0.0001	0.000008	0.0005	0.0066	0.000009	-0.0005	1.34	0.00093	-0.01	0.00076	0.000066
5-Oct-12	81	500	465	7.65	47																											
12-Oct-12	82	500	515	7.47	47	#N/A	5.9	31.4	2	0.53	0.022	23.8	0.0157	-0.00002	0.00009	0.0211	-0.00001	-0.000005	-0.05	-0.000005	7.47	-0.0001	-0.000005	0.00117	0.0043	0.000021	-0.0005	1.25	0.0004	-0.01	0.00065	-0.00002
19-Oct-12	83	500	505	7.57	48																											
26-Oct-12	84	500	490	7.52	47	#N/A	2.9	30.7	2	-0.5	0.024	22.9	0.0205	-0.00002	0.000088	0.0217	-0.00001	-0.000005	-0.05	-0.000005	7.21	0.00011	0.000009	0.00084	0.0076	0.000064	-0.0005	1.2	0.00113	-0.01	0.00074	0.000094
2-Nov-12	85	500	495	7.53	53																											
9-Nov-12	86	500	505	7.58	48	#N/A	5.2	36.3	3	-0.5	0.022	26.2	0.0189	-0.00002	0.000097	0.0264	-0.00001	-0.000005	-0.05	0.00001	8.18	0.0001	0.000009	0.00121	0.0045	0.000034	-0.0005	1.39	0.00074	-0.01	0.00062	0.000118
16-Nov-12	87	500	495	7.59	45																											
23-Nov-12	88	500	490	7.63	52	#N/A	3.7	34.3	2	-0.5	0.019	27.7	0.0164	-0.00002	0.000132	0.0252	-0.00001	-0.000005	-0.05	-0.000005	8.71	-0.0001	-0.000005	0.00051	0.0047	0.00009	-0.0005	1.44	0.00025	-0.01	0.00058	0.000147
30-Nov-12	89	500	500	7.51	49																											
7-Dec-12	90	500	440	7.70	47	#N/A	6.8	33.5	2	-0.5	0.022	24	0.0214	-0.00002	0.000111	0.0219	-0.00001	-0.000005	-0.05	-0.000005	7.36	-0.0001	0.000006	0.00178	0.005	0.000149	-0.0005	1.37	0.00042	-0.01	0.00064	0.000144
14-Dec-12	91	500	495	7.79	43																											
21-Dec-12	92	500	460	7.64	71	#N/A	3.7	46.5	-2	-0.5	0.026	34.6	0.0159	-0.00002	0.000176	0.0329	-0.00001	-0.000005	-0.05	-0.000005	11.1	-0.0001	0.000006	0.0004	0.005	0.000013	-0.0005	1.7	0.00048	-0.01	0.00092	0.000054
28-Dec-12	93	500	475	7.68	75																											
4-Jan-13	94	500	490	7.72	46	#N/A	4.9	33.1	-2	0.76	0.022	24	0.0226	-0.00002	0.000077	0.0236	-0.00001	-0.000005	-0.05	-0.000005	7.48	-0.0001	0.000013	0.00036	0.0067	0.00003	-0.0005	1.29	0.00088	-0.01	0.00049	0.000152
11-Jan-13	95	500	455	7.60	45																											
18-Jan-13	96	500	450	7.66	51	#N/A	2.9	34.1	-2	0.54	0.018	25.2	0.0274	-0.00002	0.000194	0.0219	-0.00001	-0.000005	-0.05	0.000011	7.99	-0.0001	-0.000005	0.0004	0.0071	0.00018	-0.0005	1.27	0.00147	-0.01	0.00055	0.000022
25-Jan-13	97	500	455	7.53	60																											
1-Feb-13	98	500	435	7.72	47	#N/A	3.7	30.1	2	-0.5	0.025	24.3	0.0169	-0.00002	0.00019	0.0208	-0.00001	-0.000005	-0.05	-0.000005	7.56	-0.0001	-0.000005	0.00035	0.004	0.000021	-0.0005	1.33	0.00042	-0.01	0.00067	0.000022
8-Feb-13	99	500	450	7.69	47																											
15-Feb-13	100	500	445	7.59	50	#N/A	3.1	28.8	3	0.63	0.02	22.9	0.0149	-0.00002	0.00015	0.0209	-0.00001	-0.000005	-0.05	-0.000005	6.95	-0.0001	-0.000005	0.00026	0.0025	0.000007	-0.0005	1.34	0.00042	-0.01	0.0006	-0.00002
22-Feb-13	101	500	425	7.72	45																											
1-Mar-13	102	500	445	7.63	45	#N/A	5.5	31.1	3	0.61	0.017	21.9	0.0303	-0.00002	0.000121	0.0183	-0.00001	-0.000005	-0.05	-0.000005	6.91	-0.0001	0.000008	0.00048	0.0082	0.000011	-0.0005	1.12	0.00124	-0.01	0.00051	-0.00002
8-Mar-13	103	500	450	7.69	69																											
15-Mar-13	104	500	435	7.59	49	#N/A	5.0	29.2	2	0.58	0.021	22.5	0.026	-0.00002	0.000089	0.0192	-0.00001	-0.000005	-0.05	-0.000005	7.14	-0.0001	0.000006	0.00033	0.007	0.000006	-0.0005	1.13	0.00103	-0.01	0.00049	-0.00002
22-Mar-13	105	500	450	7.61	43																											
29-Mar-13	106	500	435	7.64	50	#N/A	3.4	28.2	2	0.58	0.018	24.8	0.015	-0.00002	0.00013	0.0239	-0.00001	-0.000005	-0.05	-0.000005	7.58	0.00012	0.000023	0.00055	0.0028	0.000017	-0.0005	1.43	0.00035	-0.01	0.00063	0.00002
5-Apr-13	107	500	445	7.62	46																											
12-Apr-13	108	500	440	7.64	48	#N/A	5.8	29.5	2	0.53	0.019	22.4	0.0316	-0.00002	0.000094	0.0264	-0.00001	-0.000005	-0.05	-0.000005	6.9	-0.0001	0.000009	0.00056	0.0096	0.000017	-0.0005	1.26	0.00108	-0.01	0.00058	0.00002
19-Apr-13	109	500	435	7.74	47																											
26-Apr-13	110	500	440	7.58	47	#N/A	4.0	26.7	3	-0.5	0.019	21.9	0.0336	-0.00002	0.000107	0.0257	-0.00001	-0.000005	-0.05	-0.000005	6.71	-0.0001	0.000008	0.00047	0.0117	-0.000005	-0.0005	1.25	0.00128	-0.01	0.00055	0.000032
3-May-13	111	500	430	7.59	45																											
10-May-13	112	500	420	7.47	48	#N/A	4.2	27.1	2	0.74	0.017	23	0.0513	-0.00002	0.000141	0.0237	-0.00001	-0.000005	-0.05	-0.000005	7.1	-0.0001	0.000009	0.00047	0.016	0.000018	-0.0005	1.29	0.00159	-0.01	0.00054	0.000048
17-May-13	113	500	445	7.72	50																											
24-May-13	114	500	465	7.51	43	#N/A	4.1	27.7	2																							

April 15/11 U 0.00196. Repeat = 0.00185. Data confirmed, suspect contamination
Sept 2/11 Cr=0.0016, repeat= 0.0012. data confirmed, suspect contamination
Jul 22/11 Ni=0.00025, repeat=0.00025. Data confirmed, suspect contamination
Aug 19/11 Ni=0.00022, repeat=0.00022. Data confirmed, suspect contamination
Sept 2/11 Ni=0.00027, repeat=0.00011. Data confirmed, suspect contamination
Nov 11/11 Al=0.0722, Cd=0.000025, Fe=0.033. Repeat= Al= 0.047, Cd=0.000024, Fe= 0.021. Data rejected, suspect contmaination
Jan 20/12 Pb=0.000498, Ni=0.00034. Repeat Pb=0.000466, Ni=0.00029. Data confirmed, suspect contamination
Apr 27/12 Cd=0.000103, Ni=0.000155, Zn=0.00425. Cannot repeat suspect contamination or analytical error
May 25/12 Tl=0.0000208, Zn=0.00664. repeat Tl=0.000019, Zn=0.00686. Data confirmed, suspect contamination or analytical error
Aug 31/12 Ni=0.000888, repeat=0.000104. Data accepted
Sept 14/12 Ni=0.000216, Cr=0.00346, repeat Ni=0.000182, data accepted within 4X stdev. Cr=0.00321. Data confirmed suspect contamination
Jul 20/12 Al=0.0484, repeat=0.0527. Data confirmed, suspect contamination or analytical error
Dec 21/12 Si=1.18, repeat confirms original result, suspect contamination
Aug 17/12 Pb=0.000136, Cannot repeat suspect contamination or analytical error

HC 10

Sample =
08SWC337 10-13

Date	Cycle No.	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
13-Jul-12	69															
20-Jul-12	70	-0.002	0.7	-0.00004	0.999	0.0000051	0.115	0.0298	-10	-0.000002	-0.0002	-0.0005	0.0000323	0.0007	0.00167	-0.0001
27-Jul-12	71															
3-Aug-12	72	-0.002	0.78	-0.00004	0.992	0.000007	0.173	0.0325	-10	-0.000002	0.0003	-0.0005	0.000031	0.00042	0.00034	-0.0001
10-Aug-12	73															
17-Aug-12	74	-0.002	0.854	-0.00004	0.926	-0.000005	0.191	0.0353	-10	-0.000002	0.00078	-0.0005	0.000033	0.00046	0.00118	-0.0001
24-Aug-12	75															
31-Aug-12	76	-0.002	0.697	-0.00004	0.834	0.000005	0.125	0.031	-10	-0.000002	-0.0002	-0.0005	0.000028	0.00035	0.00073	-0.0001
7-Sep-12	77															
14-Sep-12	78	-0.002	0.733	-0.00004	0.833	0.000006	0.308	0.036	-10	0.000002	-0.0002	-0.0005	0.000043	0.0004	0.00044	-0.0001
21-Sep-12	79															
28-Sep-12	80	-0.002	0.746	-0.00004	0.986	-0.000005	0.103	0.032	-10	-0.000002	-0.0002	-0.0005	0.00003	0.00041	0.00016	-0.0001
5-Oct-12	81															
12-Oct-12	82	-0.002	0.639	-0.00004	0.848	-0.000005	0.096	0.0299	-10	-0.000002	-0.0002	-0.0005	0.00003	-0.0002	-0.0001	-0.0001
19-Oct-12	83															
26-Oct-12	84	0.0119	0.67	-0.00004	0.845	0.000007	0.083	0.0316	-10	-0.000002	0.00022	-0.0005	0.000026	0.00038	0.0004	-0.0001
2-Nov-12	85															
9-Nov-12	86	-0.002	0.715	-0.00004	0.881	-0.000005	0.12	0.0337	-3	-0.000002	0.00021	-0.0005	0.000032	0.00028	0.00057	-0.0001
16-Nov-12	87															
23-Nov-12	88	-0.002	0.694	0.000041	0.933	-0.000005	0.106	0.0324	-3	-0.000002	0.0006	-0.0005	0.000052	0.0003	0.00035	-0.0001
30-Nov-12	89															
7-Dec-12	90	-0.002	0.666	0.000048	0.787	-0.000005	0.14	0.0304	-3	-0.000002	0.00039	-0.0005	0.00003	0.00058	0.00154	-0.0001
14-Dec-12	91															
21-Dec-12	92	-0.002	0.825	-0.00004	#N/A	-0.000005	0.105	0.0446	-3	-0.000002	-0.0002	-0.0005	0.000045	0.00048	0.00025	-0.0001
28-Dec-12	93															
4-Jan-13	94	-0.002	0.663	-0.00004	0.67	-0.000005	0.12	0.0307	-3	-0.000002	-0.0002	-0.0005	0.000023	0.00045	0.00023	-0.0001
11-Jan-13	95															
18-Jan-13	96	0.0028	0.649	-0.00004	0.789	-0.000005	0.092	0.03	-3	-0.000002	-0.0002	-0.0005	0.000038	0.00037	0.00089	-0.0001
25-Jan-13	97															
1-Feb-13	98	0.0032	0.652	0.000044	0.841	-0.000005	0.108	0.0295	-3	-0.000002	-0.0002	-0.0005	0.000026	0.00049	0.00018	-0.0001
8-Feb-13	99															
15-Feb-13	100	-0.002	0.687	-0.00004	0.727	-0.000005	0.099	0.0293	-3	-0.000002	-0.0002	-0.0005	0.00003	0.00038	0.00011	-0.0001
22-Feb-13	101															
1-Mar-13	102	-0.002	0.613	-0.00004	0.7	-0.000005	0.087	0.0265	-3	-0.000002	-0.0002	-0.0005	0.000023	0.00037	0.00013	-0.0001
8-Mar-13	103															
15-Mar-13	104	-0.002	0.641	-0.00004	0.762	-0.000005	0.084	0.0273	-3	-0.000002	-0.0002	0.00051	0.000024	0.00036	0.00022	-0.0001
22-Mar-13	105															
29-Mar-13	106	-0.002	0.745	-0.00004	0.814	-0.000005	0.116	0.0308	-3	-0.000002	-0.0002	-0.0005	0.000027	0.00042	0.00013	-0.0001
5-Apr-13	107															
12-Apr-13	108	-0.002	0.702	0.00004	0.767	-0.000005	0.082	0.0323	-3	-0.000002	-0.0002	-0.0005	0.000028	0.00051	0.00021	-0.0001
19-Apr-13	109															
26-Apr-13	110	-0.002	0.681	-0.00004	0.678	0.000053	0.087	0.0307	-3	-0.000002	-0.0002	0.00056	0.000027	0.00028	0.00014	-0.0001
3-May-13	111															
10-May-13	112	-0.002	0.688	-0.00004	0.817	-0.000005	0.1	0.0293	-3	-0.000002	-0.0002	-0.0005	0.000024	0.00049	0.00016	-0.0001
17-May-13	113															
24-May-13	114															

HC 11

CONFIDENTIAL *DRAFT*

Sample =
08SWC348 12-15

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L
18-Mar-11	0	500	310	7.36	120	#N/A	3.5	36.6	10	4.2	0.25	11.3	0.0462	0.00011	0.0023	0.11	-0.00001	-0.000005	-0.05	0.000026	3.42	0.0001	0.000503	0.016	0.051	0.000087	0.0028	0.66	0.035	-0.01	0.0768
25-Mar-11	1	500	525	7.81	110																										
1-Apr-11	2	500	505	7.72	108	#N/A	5.2	34.1	8	1.5	0.33	6.7	0.0379	0.00006	0.00168	0.0775	-0.00001	-0.000005	-0.05	0.000033	2.03	0.0003	0.000202	0.00636	0.025	0.000033	0.0017	0.4	0.00754	-0.01	0.137
8-Apr-11	3	500	485	7.78	76																										
15-Apr-11	4	500	450	7.45	56	#N/A	2.2	22.0	5	0.6	0.24	2.9	0.0495	0.00004	0.002	0.0574	-0.00001	-0.000005	-0.05	0.000015	0.85	0.0002	0.000111	0.00417	0.049	0.000048	0.0009	0.19	0.00355	-0.01	0.0849
22-Apr-11	5	500	475	7.78	61																										
29-Apr-11	6	500	480	7.57	52	#N/A	3.5	17.4	6	0.9	0.17	3.3	0.0443	0.00006	0.00107	0.0849	-0.00001	-0.000005	-0.05	0.000017	0.96	0.0002	0.000054	0.00406	0.041	0.000054	0.0011	0.22	0.00242	-0.01	0.0512
6-May-11	7	500	455	7.41	39																										
13-May-11	8	500	460	7.38	46	#N/A	3.0	12.5	6	2.1	0.13	2.7	0.0507	0.00003	0.001	0.0585	-0.00001	-0.000005	-0.05	-0.000005	0.81	0.0002	0.000037	0.00222	0.044	0.000042	0.0008	0.16	0.00254	-0.01	0.0309
20-May-11	9	500	450	7.48	30																										
27-May-11	10	500	495	7.71	31	#N/A	4.6	12.9	4	0.9	0.12	3.7	0.0282	0.00002	0.00086	0.0592	-0.00001	-0.000005	-0.05	0.000012	1.11	0.0002	0.000025	0.00246	0.021	0.000074	0.001	0.23	0.0015	-0.01	0.0217
3-Jun-11	11	500	470	7.21	44																										
10-Jun-11	12	500	490	7.15	41	#N/A	2.4	9.3	4	1	0.09	3.9	0.0146	0.00003	0.00089	0.0649	-0.00001	-0.000005	-0.05	0.00001	1.18	0.0002	0.000015	0.00137	0.012	0.000014	0.0013	0.23	0.00048	-0.01	0.0109
17-Jun-11	13	500	475	7.11	49																										
24-Jun-11	14	500	480	7.32	25	#N/A	2.3	8.2	3	0.8	0.06	4.7	0.0396	0.00002	0.00055	0.0792	-0.00001	-0.000005	-0.05	0.000015	1.41	0.0002	0.000038	0.00158	0.042	0.000091	0.0011	0.28	0.00315	-0.01	0.007
1-Jul-11	15	500	480	7.66	21																										
8-Jul-11	16	500	470	7.40	28	#N/A	2.6	12.2	4	0.8	0.05	3.1	0.0093	0.00002	0.00046	0.0602	-0.00001	-0.000005	-0.05	-0.000005	0.95	0.0002	0.000008	0.00125	0.006	0.000026	0.0009	0.18	0.0006	-0.01	0.00554
15-Jul-11	17	500	480	7.65	30																										
22-Jul-11	18	500	485	7.42	32	#N/A	3.5	7.9	2	0.8	0.08	4.3	0.0333	0.00002	0.00066	0.058	-0.00001	-0.000005	-0.05	-0.000005	1.28	0.0002	0.00002	0.00111	0.028	0.000029	0.0011	0.27	0.00099	-0.01	0.00768
29-Jul-11	19	500	470	7.44	27																										
5-Aug-11	20	500	460	7.25	23	#N/A	3.6	8.1	-2	0.5	0.08	5.3	0.0288	0.00003	0.00063	0.0722	-0.00001	-0.000005	-0.05	-0.000005	1.59	0.0003	0.000022	0.00129	0.029	0.00003	0.0011	0.32	0.0009	-0.01	0.00808
12-Aug-11	21	500	470	7.77	16																										
19-Aug-11	22	500	475	7.37	16	#N/A	4.0	6.2	3	0.9	0.05	3.7	0.027	-0.00002	0.00047	0.0623	-0.00001	-0.000005	-0.05	0.000011	1.13	0.0003	0.000013	0.00166	0.022	0.000029	0.0009	0.23	0.0011	-0.01	0.00431
26-Aug-11	23	500	455	7.47	18																										
2-Sep-11	24	500	465	7.60	23	#N/A	3.6	6.3	2	0.7	0.04	-10	0.0355	-0.00002	0.00039	0.0602	-0.00001	-0.000005	-0.05	0.000006	0.97	0.0002	0.000016	0.00083	0.031	0.00004	0.0007	0.2	0.00143	-0.01	0.00347
9-Sep-11	25	500	475	7.57	24																										
16-Sep-11	26	500	485	7.14	14	#N/A	4.0	6.4	-2	0.9	0.04	4	0.0291	-0.00002	0.00032	0.0734	-0.00001	0.000022	-0.05	0.000009	1.2	0.0002	0.000015	0.00061	0.027	0.000027	0.0008	0.24	0.00113	-0.01	0.00305
23-Sep-11	27	500	460	7.10	11																										
30-Sep-11	28	500	460	6.93	15	#N/A	3.0	3.1	2	0.6	0.04	3.1	0.0066	0.00002	0.00035	0.0705	-0.00001	-0.000005	-0.05	0.000011	0.91	0.0003	0.000007	0.00064	0.004	0.000008	0.0007	0.19	0.00091	-0.01	0.00253
7-Oct-11	29	500	450	7.14	16																										
14-Oct-11	30	500	455	6.72	16	#N/A	4.2	3.4	3	-0.5	0.04	3.5	0.012	-0.00002	0.00036	0.0737	-0.00001	-0.000005	-0.05	0.000009	1.06	-0.0001	0.000006	0.00073	0.007	0.000025	0.0006	0.21	0.00157	-0.01	0.00333
21-Oct-11	31	500	475	7.58	11																										
28-Oct-11	32	500	480	7.22	14	#N/A	3.8	5.5	2	-0.5	0.04	4.6	0.0164	0.00002	0.0003	0.0806	-0.00001	-0.000005	-0.05	0.000014	1.38	0.0002	0.000007	0.00125	0.013	0.000074	0.0007	0.28	0.00201	-0.01	0.00323
4-Nov-11	33	500	475	7.47	17																										
11-Nov-11	34	500	475	7.71	9	#N/A	4.3	5.6	4	-0.5	0.026	3.2	0.0222	0.00002	0.00027	0.0642	-0.00001	-0.000005	-0.05	0.000015	0.95	0.0001	0.000014	0.0012	0.015	#N/A	0.0007	0.2	0.00187	-0.01	0.0022
18-Nov-11	35	500	470	7.21	22																										
25-Nov-11	36	500	505	7.44	13	#N/A	3.6	5.8	3	-0.5	0.034	4.1	0.0248	-0.00002	0.0003	0.0701	-0.00001	-0.000005	-0.05	0.000007	1.24	-0.0001	0.000012	0.0012	0.017	0.000035	0.0008	0.24	0.00116	-0.01	0.00252
2-Dec-11	37	500	465	7.46	14																										
9-Dec-11	38	500	475	7.03	11	#N/A	4.2	4.0	3	-0.5	0.021	3	0.027	-0.00002	0.00021	0.0608	-0.00001	-0.000005	-0.05	0.000008	0.88	-0.0001	0.000007	0.00102	0.019	0.000026	0.0006	0.18	0.00145	-0.01	0.00175
16-Dec-11	39	500	465	7.68	10																										
23-Dec-11	40	500	460	7.53	9	#N/A	4.0	4.5	4	-0.5	0.025	2.9	0.0324	-0.00002	0.00021	0.0631	-0.00001	-0.000005	-0.05	-0.000005	0.84	-0.0001	0.000014	0.00045	0.012	0.000033	-0.0005	0.19	0.00133	-0.01	0.00177
30-Dec-11	41	500	455	7.72	8																										
6-Jan-12	42	500	460	6.79	9	#N/A	3.2	3.8	3	-0.5	0.021	2.8	0.0569	-0.00002	0.0002	0.0678	-0.00001	-0.000005	-0.05	0.000011	0.82	-0.0001	0.000019	0.00114	0.047	0.000063	0.0005	0.18	0.00293	-0.01	0.0014
13-Jan-12	43	500	465	7.54	9																										
20-Jan-12	44	500	475	7.44	9	#N/A	3.1	4.6	3	#N/A	0.025	2.7	0.0095	-0.00002	0.00031	0.0733	-0.00001	-0.000005	-0.05	0.000019	0.78	-0.0001	-0.000005	0.0005	0.007	0.000023	-0.0005	0.17	0.0012	-0.01	0.00144
27-Jan-12	45	500	470	7.31	8																										
3-Feb-12	46	500	475	7.63	8	#N/A	4.7	5.0	2	-0.5	0.025	2.9	0.025	-0.00002	0.00022	0.0594	-0.00001	-0.000005	-0.05	0.000008	0.85	0.0001	0.000011	0.00046	0.015	0.000021	0.0005	0.18	0.00178	-0.01	0.00146
10-Feb-12	47	500	465	7.72	7																										
17-Feb-12	48	500	460	7.05	6	#N/A	2.6	3.5	3	-0.5	0.02	2.5	0.0228	0.00003	0.00028	0.056	-0.00001	-0.000005	-0.05	0.000012	0.75	-0.0001	0.000012	0.00195	0.015	0.000052	0.0005	0.16	0.00154	-0.01	0.00121
24-Feb-12	49	500	460	7.22	6																										
2-Mar-12	50	500	455	7.57	6	#N/A	6.6	4.6	2	-0.5	0.017	2.5	0.0391	-0.00002	0.0002	0.0601	-0.00001	-0.000005	-0.05	0.000011	0.74	-0.0001	0.000012	0.00115	0.024	0.000028	-0.0005	0.16	0.00167	-0.01	0.00128
9-Mar-12	51	500	465	7.47	6																										
16-Mar-12	52	500	475	7.15	6	#N/A	2.9	3.3	2	-0.5	0.021	2.3	0.0299	-0.00002	0.00012	0.0526	-0.00001	-0.000005	-0.05	0.000006	0.67	-0.0001	-0.000005	0.00363	0.018	#N/A	-0.0005	0.14	0.00129	-0.01	0.00116
23-Mar-12	53	500	465	7.49	9																										
30-Mar-12	54	500	485	6.91	7	#N/A	4.0	4.0	3	-0.5	0.023	3.3	0.0428	-0.00002	0.00015	0.0708	-0.00001	-0.000005	-0.05	0.000006	0.99	0.0001	0.000016	0.00109	0.029	0.000033	-0.0005	0.19	0.00175	-0.01	0.00133
6-Apr-12	55	500	465	7.18	8																										
13-Apr-12	56	500	465	7.09	8	#N/A	2.4	3.8	3	-0.5	0.017	3.2	0.0543	-0.00002	0.00021	0.0656	-0.00001	-0.000005	-0.05	0.000084	0.96	0.0001	0.00001	0.00092	0.024	#N/A	0.0005	0.19	0.00175	-0.01	0.00146
20-Apr-12	57	500	485	7.26	8																										
27-Apr-12	58	500	495	7.23	7	#N/A	4.0	4.1	2	-0.5	0.018	2.57	0.0334	-0.00002	0.000233	0.0705	-0.00001	-0.000005	-0.05	0.000138	0.761	0.00012	0.00001	0.00156	0.0212	#N/A	-0.0005	0.163	0.00141	-0.01	0.00133
4-May-12	59	500	490	7.82	7																										
11-May-12	60	500	500	7.19	8	#N/A	3.4	3.8	3	-0.5	0.023	2.76	0.0483	-0.00002	0.000212	0.0699	-0.00001	-0.000005	-0.05	0.000013	0.844	0.00013	0.000014	0.0015	0.0313	0.00004	-0.0005	0.159	0.00199	-0.01	0.00142
18-May-12	61	500	505	7.12	7																										
25-May-12	62	500	505	7.01	4	#N/A	3.4	3.6	2	-0.5	0.017	2.25	0.0543	-0.00002	0.000202	0.0624	-0.00001	-0.000005	-0.05	0.0000093	0.675	-0.0001	0.0000107	0.000628	0.0341	0.000057	-0.0005	0.137	0.00208	-0.01	0.00124
1-Jun-12	63	500	500	7.28	3																										
8-Jun-12	64	500	475	7.21	5	#N/A	3.1	3.9	3	-0.5	0.017	2.4	0.0349	-0.00002	0.000168	0.0634	-0.00001	-0.000005	-0.05	0.0000117	0.718	0.00014	0.0000171	0.00138	0.0206	0.000036	-0.0005	0.147	0.00169	-0.01	0.00113
15-Jun-12	65	500	490	7.19	5																										
22-Jun-12	66	500	490	7.03	6	#N/A	3.8	3.7	2	-0.5	0.019	2.57	0.0274	-0.00002	0.000223	0.0728	-0.00001	-0.000005	-0.05	0.0000069	0.766	-0.0001	-0.000005	0.000894	0.0128	0.0000187	-0.0005	0.159	0.00202	-0.01	0.00128

HC 11

Sample =
08SWC348 12-15

Date	Cycle No.	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	0.00053	0.004	2.42	0.00014	2.67	0.000103	18.5	0.0173	-10	-0.000002	0.00004	0.0039	0.000015	0.0016	0.0014	0.0001
25-Mar-11	1																
1-Apr-11	2	0.00036	0.012	1.45	0.00011	3.22	0.000026	12.8	0.00985	-10	-0.000002	0.00053	0.0016	0.000021	0.0039	0.0009	-0.0001
8-Apr-11	3																
15-Apr-11	4	0.00024	0.017	1.08	0.00006	2.69	0.000042	8.78	0.00489	-10	-0.000002	0.00028	0.003	0.000056	0.0047	0.0009	-0.0001
22-Apr-11	5																
29-Apr-11	6	0.00018	0.012	1.1	-0.00004	2.86	0.000041	6.76	0.00591	-10	-0.000002	0.00022	0.0028	0.000004	0.0034	0.0007	-0.0001
6-May-11	7																
13-May-11	8	0.00015	0.006	0.86	-0.00004	2.51	0.000024	4.9	0.00464	-10	-0.000002	0.00013	0.0029	0.000017	0.003	0.0006	-0.0001
20-May-11	9																
27-May-11	10	0.00014	0.005	0.97	-0.00004	2.66	0.000018	4.33	0.00589	-10	-0.000002	0.00012	0.0009	0.000003	0.0028	0.0007	-0.0001
3-Jun-11	11																
10-Jun-11	12	0.00005	0.005	1.1	-0.00004	2.75	0.000006	3.41	0.00664	-10	-0.000002	0.00016	-0.0005	-0.000002	0.0022	0.0009	-0.0001
17-Jun-11	13																
24-Jun-11	14	-0.00002	-0.002	1.15	-0.00004	3.09	0.000034	2.94	0.00735	-10	-0.000002	0.00007	0.002	-0.000002	0.0021	0.0009	-0.0001
1-Jul-11	15																
8-Jul-11	16	0.00004	-0.002	0.82	-0.00004	2.34	0.000008	1.83	0.00538	-10	-0.000002	0.00004	0.0005	-0.000002	0.0016	0.0007	-0.0001
15-Jul-11	17																
22-Jul-11	18	0.00017	0.005	1.12	-0.00004	3.32	0.000021	2.11	0.00686	-10	-0.000002	0.00007	0.002	-0.000002	0.0023	0.0011	-0.0001
29-Jul-11	19																
5-Aug-11	20	0.00013	0.005	1.27	-0.00004	3.85	0.00002	2	0.00813	-10	-0.000002	0.00007	0.0016	-0.000002	0.0022	0.001	-0.0001
12-Aug-11	21																
19-Aug-11	22	#N/A	0.003	1.02	-0.00004	2.47	0.000021	1.09	0.00603	-10	-0.000002	-0.00001	0.001	-0.000002	0.0027	0.001	-0.0001
26-Aug-11	23																
2-Sep-11	24	0.00004	-0.002	0.82	-0.00004	1.96	0.000014	0.74	0.00532	-10	-0.000002	0.00004	0.0015	-0.000002	0.0016	0.0011	-0.0001
9-Sep-11	25																
16-Sep-11	26	0.00009	-0.002	0.87	-0.00004	2.27	0.000012	0.61	0.00645	-10	-0.000002	0.00004	0.0009	-0.000002	0.0015	0.0014	-0.0001
23-Sep-11	27																
30-Sep-11	28	0.00003	-0.002	0.74	-0.00004	1.68	0.000006	0.58	0.00521	-10	-0.000002	0.00007	-0.0005	-0.000002	0.0009	0.0008	-0.0001
7-Oct-11	29																
14-Oct-11	30	0.00007	-0.002	0.89	-0.00004	2.19	-0.000005	0.55	0.00585	-10	-0.000002	0.00003	-0.0005	-0.000002	0.0015	0.0013	-0.0001
21-Oct-11	31																
28-Oct-11	32	0.00005	-0.002	1.05	-0.00004	2.52	0.000013	0.55	0.00773	-10	-0.000002	0.00073	0.0008	-0.000002	0.0014	0.0011	-0.0001
4-Nov-11	33																
11-Nov-11	34	0.00018	-0.002	0.82	-0.00004	1.87	0.000017	0.37	0.00527	-10	0.000004	0.00018	0.0005	0.000014	0.0012	0.0016	-0.0001
18-Nov-11	35																
25-Nov-11	36	0.00014	-0.002	0.95	-0.00004	2.39	0.000017	0.39	0.00663	-10	-0.000002	0.00016	0.0006	-0.000002	0.0014	0.0009	-0.0001
2-Dec-11	37																
9-Dec-11	38	0.00013	-0.002	0.74	-0.00004	1.47	0.000013	0.27	0.00525	-10	-0.000002	0.0001	0.0013	-0.000002	0.0011	0.0012	-0.0001
16-Dec-11	39																
23-Dec-11	40	0.00006	-0.002	0.74	-0.00004	1.54	0.000014	0.22	0.00521	-10	-0.000002	0.00002	0.0006	0.000002	0.001	0.0013	-0.0001
30-Dec-11	41																
6-Jan-12	42	0.00004	-0.002	0.69	-0.00004	1.56	0.000027	0.2	0.00486	-10	-0.000002	0.00019	0.0031	-0.000002	0.0011	0.0014	-0.0001
13-Jan-12	43																
20-Jan-12	44	0.00012	-0.002	0.63	-0.00004	1.37	0.000005	0.22	0.00494	-10	-0.000002	-0.0002	-0.0005	-0.000002	0.0012	0.0011	-0.0001
27-Jan-12	45																
3-Feb-12	46	0.00013	0.004	0.71	-0.00004	1.56	0.000008	0.23	0.00476	-10	-0.000002	-0.0002	0.0006	-0.000002	0.0009	0.0009	-0.0001
10-Feb-12	47																
17-Feb-12	48	-0.00002	-0.002	0.64	-0.00004	1.42	0.000012	0.17	0.00412	-10	-0.000002	-0.0002	0.0007	-0.000002	0.0014	#N/A	-0.0001
24-Feb-12	49																
2-Mar-12	50	0.00013	-0.002	0.6	-0.00004	1.3	0.000013	0.2	0.00438	-10	-0.000002	-0.0002	0.0013	-0.000002	0.0008	0.0008	-0.0001
9-Mar-12	51																
16-Mar-12	52	0.00013	-0.002	0.56	-0.00004	1.35	0.000013	0.18	0.00383	-10	-0.000002	-0.0002	0.0011	0.000002	0.0007	0.001	-0.0001
23-Mar-12	53																
30-Mar-12	54	0.0002	-0.002	0.68	-0.00004	1.79	0.00002	0.23	0.00589	-10	-0.000002	-0.0002	0.0016	-0.000002	0.0008	0.0015	-0.0001
6-Apr-12	55																
13-Apr-12	56	0.00007	-0.002	0.71	-0.00004	1.93	0.000023	0.17	0.00531	-10	-0.000002	0.0004	0.0016	0.000002	0.001	0.0019	-0.0001
20-Apr-12	57																
27-Apr-12	58	#N/A	-0.002	0.639	-0.00004	1.54	0.000027	0.18	0.00456	-10	0.000002	0.00032	0.00132	-0.000002	0.00166	0.00149	-0.0001
4-May-12	59																
11-May-12	60	0.000126	-0.002	0.686	-0.00004	1.89	0.000038	0.179	0.00458	-10	-0.000002	0.00032	0.00159	-0.000002	0.00105	0.00101	-0.0001
18-May-12	61																
25-May-12	62	0.000068	-0.002	0.525	-0.00004	1.65	0.0000276	0.169	0.00413	-10	-0.000002	-0.0002	0.00189	-0.000002	0.00095	0.00156	-0.0001
1-Jun-12	63																
8-Jun-12	64	0.000215	0.0024	0.543	-0.00004	1.53	0.0000332	0.193	0.0041	-10	-0.000002	-0.0002	0.00121	-0.000002	0.00087	0.00143	-0.0001
15-Jun-12	65																
22-Jun-12	66	0.000053	-0.002	0.557	-0.00004	1.72	0.0000166	0.16	0.00453	-10	-0.000002	-0.0002	0.00056	-0.000002	0.00091	0.00095	-0.0001

HC 11

CONFIDENTIAL *DRAFT*

Sample =
08SWC348 12-15

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L
29-Jun-12	67	500	475	7.28	5																										
6-Jul-12	68	500	470	7.16	7	#N/A	4.0	3.6	2	-0.5	0.019	2.45	0.0203	-0.00002	0.000222	0.0758	-0.00001	-0.000005	-0.05	0.0000099	0.736	-0.0001	0.0000079	0.00111	0.0125	0.0000141	-0.0005	0.148	0.00249	-0.01	0.00137
13-Jul-12	69	500	515	7.39	4																										
20-Jul-12	70	500	480	7.27	5	#N/A	3.7	3.2	3	-0.5	0.014	2.16	0.0383	-0.00002	0.000193	0.0648	-0.00001	-0.000005	-0.05	0.0000082	0.652	-0.0001	0.0000066	0.000379	0.0047	-0.000005	-0.0005	0.13	0.00228	-0.01	0.0011
27-Jul-12	71	500	475	7.48	4																										
3-Aug-12	72	500	480	7.30	4	#N/A	3.2	3.5	2	-0.5	0.016	2.22	0.0408	-0.00002	0.00014	0.0636	-0.00001	-0.000005	-0.05	0.000033	0.664	-0.0001	0.000024	0.00339	0.0342	#N/A	-0.0005	0.135	0.00222	-0.01	0.00104
10-Aug-12	73	500	485	7.31	3																										
17-Aug-12	74	500	470	7.00	5	#N/A	4.4	3.2	2	-0.5	0.014	2.02	0.0492	0.000022	0.000189	0.069	-0.00001	-0.000005	-0.05	0.000008	0.582	-0.0001	0.000018	0.000847	0.0265	0.000062	-0.0005	0.137	0.00166	-0.01	0.00104
24-Aug-12	75	500	470	7.48	3																										
31-Aug-12	76	500	490	7.33	4	#N/A	3.6	3.4	2	-0.5	0.014	2.02	0.0424	-0.00002	0.000158	0.0602	-0.00001	-0.000005	-0.05	0.000012	0.611	-0.0001	0.000019	0.000645	0.0229	0.000079	-0.0005	0.119	0.00233	-0.01	0.000909
7-Sep-12	77	500	480	7.14	2																										
14-Sep-12	78	500	475	7.01	2	#N/A	3.4	3.1	3	-0.5	0.013	1.87	0.0449	-0.00002	0.000168	0.0606	-0.00001	-0.000005	-0.05	0.000005	0.541	0.00019	0.000014	0.00117	0.0243	0.000226	-0.0005	0.126	0.00168	-0.01	0.00079
21-Sep-12	79	500	500	7.32	8																										
28-Sep-12	80	500	470	6.89	3	#N/A	2.9	3.2	2	-0.5	0.013	1.93	0.0339	-0.00002	0.000127	0.0586	-0.00001	-0.000005	-0.05	0.000009	0.574	-0.0001	0.000011	0.00302	0.0221	0.000329	-0.0005	0.121	0.00244	-0.01	0.00084
5-Oct-12	81	500	475	7.41	4																										
12-Oct-12	82	500	500	7.29	5	#N/A	4.8	4.0	2	-0.5	0.014	2.28	0.0119	-0.00002	0.000195	0.0672	-0.00001	-0.000005	-0.05	0.000011	0.68	-0.0001	0.00001	0.000731	0.0061	0.000008	-0.0005	0.141	0.00226	-0.01	0.000816
19-Oct-12	83	500	490	7.52	5																										
26-Oct-12	84	500	485	7.01	5	#N/A	2.8	3.3	2	-0.5	0.014	2.18	0.0393	-0.00002	0.000167	0.0609	-0.00001	-0.000005	-0.05	0.000011	0.665	-0.0001	0.000013	0.000746	0.0232	0.000067	-0.0005	0.126	0.00281	-0.01	0.000852
2-Nov-12	85	500	485	7.53	14																										
9-Nov-12	86	500	485	7.43	4	#N/A	4.4	3.7	3	0.75	0.017	2.58	0.0108	-0.00002	0.000189	0.0723	-0.00001	-0.000005	-0.05	0.000009	0.765	-0.0001	0.000006	0.000325	0.0062	0.000011	-0.0005	0.162	0.00231	-0.01	0.00104
16-Nov-12	87	500	495	7.35	4																										
23-Nov-12	88	500	485	7.43	4	#N/A	3.5	3.4	3	-0.5	0.014	2.41	0.0116	-0.00002	0.000881	0.0677	-0.00001	-0.000005	-0.05	0.000008	0.715	-0.0001	0.000024	0.00121	0.0077	0.000076	0.00052	0.151	0.00123	-0.01	0.000642
30-Nov-12	89	500	500	7.09	4																										
7-Dec-12	90	500	445	7.39	-1	#N/A	4.9	4.4	-2	-0.5	0.016	1.91	0.0178	-0.00002	0.000153	0.0634	-0.00001	-0.000005	-0.05	0.000013	0.568	-0.0001	0.00001	0.00222	0.0085	0.000046	-0.0005	0.121	0.00317	-0.01	0.000627
14-Dec-12	91	500	490	7.51	7																										
21-Dec-12	92	500	480	7.64	4	#N/A	3.3	3.8	-2	0.54	0.016	2.17	0.0168	-0.00002	0.000163	0.0711	-0.00001	-0.000005	-0.05	0.000012	0.655	-0.0001	0.000011	0.000302	0.0107	0.000017	-0.0005	0.129	0.00336	-0.01	0.000794
28-Dec-12	93	500	480	7.41	5																										
4-Jan-13	94	500	480	7.73	2	#N/A	3.7	4.3	-2	0.75	0.017	2.12	#N/A	-0.00002	0.000132	0.0729	-0.00001	-0.000005	-0.05	0.00001	0.628	0.00012	0.000014	0.000626	0.0283	0.000025	-0.0005	0.133	0.00317	-0.01	0.000629
11-Jan-13	95	500	465	7.39	3																										
18-Jan-13	96	500	455	7.44	4	#N/A	2.6	3.4	-2	0.52	0.012	2.03	0.0254	-0.00002	0.000142	0.0682	-0.00001	-0.000005	-0.05	0.000014	0.589	-0.0001	0.000008	0.00033	0.0119	0.000019	0.00053	0.137	0.00443	-0.01	0.000597
25-Jan-13	97	500	470	7.38	6																										
1-Feb-13	98	500	440	7.59	3	#N/A	3.7	3.4	2	-0.5	0.018	1.99	0.0156	-0.00002	0.000163	0.0628	-0.00001	-0.000005	-0.05	0.000011	0.583	-0.0001	0.000012	0.00025	0.008	0.000012	-0.0005	0.131	0.00509	-0.01	0.000678
8-Feb-13	99	500	450	7.89	4																										
15-Feb-13	100	500	445	7.23	4	#N/A	3.1	3.5	3	-0.5	0.013	1.98	0.0127	-0.00002	0.000148	0.0689	-0.00001	-0.000005	-0.05	0.000015	0.578	-0.0001	0.000008	0.000629	0.0077	0.000019	-0.0005	0.131	0.00506	-0.01	0.000724
22-Feb-13	101	500	430	7.92	4																										
1-Mar-13	102	500	445	7.59	3	#N/A	4.5	4.0	4	-0.5	0.013	1.89	0.0362	-0.00002	0.000198	0.0631	-0.00001	-0.000005	-0.05	0.00001	0.561	-0.0001	0.000008	0.000318	0.0177	0.000034	-0.0005	0.12	0.00523	-0.01	0.000636
8-Mar-13	103	500	440	7.43	4																										
15-Mar-13	104	500	445	7.47	3	#N/A	4.1	3.2	3	0.59	0.016	1.73	0.0226	-0.00002	0.000166	0.0616	-0.00001	-0.000005	-0.05	0.000023	0.518	-0.0001	0.000008	0.000399	0.0118	0.000013	-0.0005	0.107	0.0049	-0.01	0.000552
22-Mar-13	105	500	445	7.76	2																										
29-Mar-13	106	500	460	7.41	5	#N/A	2.9	3.3	3	-0.5	0.018	2.49	0.00792	-0.00002	0.000162	0.0877	-0.00001	-0.000005	-0.05	0.000015	0.746	-0.0001	0.000006	0.000354	0.0044	0.000018	0.00051	0.152	0.00543	-0.01	0.000741
5-Apr-13	107	500	445	7.67	2																										
12-Apr-13	108	500	450	7.79	4	#N/A	4.2	4.2	2	0.51	0.012	2.05	0.0428	-0.00002	0.000194	0.0773	-0.00001	-0.000005	-0.05	0.000014	0.606	-0.0001	0.000013	0.000482	0.0259	0.000024	-0.0005	0.129	0.00521	-0.01	0.000671
19-Apr-13	109	500	455	7.83	3																										
26-Apr-13	110	500	450	7.08	4	#N/A	3.4	2.9	2	-0.5	0.012	1.92	0.0586	-0.00002	0.000172	0.0824	-0.00001	-0.000005	-0.05	0.000014	0.558	-0.0001	0.000014	0.000483	0.035	0.000039	-0.0005	0.127	0.00615	-0.01	0.000607
3-May-13	111	500	450	7.66	3																										
10-May-13	112	500	430	7.12	4	#N/A	3.5	3.1	2	-0.5	0.01	1.87	0.00979	-0.00002	0.00026	0.0656	-0.00001	-0.000005	-0.05	0.000011	0.56	-0.0001	0.000007	0.000273	0.0056	-0.000005	-0.0005	0.115	0.00421	-0.01	0.000618
17-May-13	113	500	455	8.00	4																										
24-May-13	114	500	440	7.18	3	#N/A	3.8	2.8	2																						

June 10/11 Pb 0.000014. Repeat =0.000014. Accepted.
June 24/11 Fe 0.042. Repeat = 0.058, data confirmed, accept original result.
Aug 19/11 Ni=0.0002, repeat=0.0002. Data confirmed, suspect contamination
Nov 11/11 Pb=0.00111, repeat=0.00111. data confirmed, suspect contamination
Jan 20 11 Cl 5.5. Repeat =
Mar 16/12 Pb=0.0023, repeat=0.00228. Data confirmed, suspect contamination
Feb 17/12 Zn=0.0033, repeat=0.0029. Data confirmed, suspect contamination
Apr 13/12 Pb=0.000426, repeat=0.000424. Data confirmed, suspect contamination
Apr 27/12 Pb=0.00345, Ni=0.000132, Repeat Ni=0.000168, Pb=0.00346. Data confirmed, suspect contamination
Aug 3/12 P=0.0782, Ag=0.000197, Pb=0.000711, Zn=0.00335. Repeat P=0.0741, Ag=0.000212, Pb=0.000719, Zn=0.00316. Data confirmed, suspect contamination
Jan 4/12 Al=0.16, repeat=0.402. Data confirmed, suspect contamination

HC 11

Sample =
08SWC348 12-15

Date	Cycle No.	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Jun-12	67																
6-Jul-12	68	0.000047	-0.002	0.566	-0.00004	1.65	0.0000133	0.156	0.00425	-10	-0.000002	-0.0002	0.00076	-0.000002	0.00114	0.0011	-0.0001
13-Jul-12	69																
20-Jul-12	70	0.000111	-0.002	0.432	-0.00004	1.59	0.0000068	0.158	0.00356	-10	-0.000002	-0.0002	-0.0005	-0.000002	0.00095	0.00168	-0.0001
27-Jul-12	71																
3-Aug-12	72	0.000222	#N/A	0.93	-0.00004	1.45	#N/A	0.267	0.00399	-10	0.000002	-0.0002	0.00117	0.00001	0.0008	#N/A	-0.0001
10-Aug-12	73																
17-Aug-12	74	0.000126	-0.002	0.557	-0.00004	1.25	0.000027	0.178	0.00398	-10	-0.000002	0.00058	0.00172	-0.000002	0.00095	0.00119	-0.0001
24-Aug-12	75																
31-Aug-12	76	0.000137	-0.002	0.475	-0.00004	1.25	0.000026	0.145	0.00346	-10	-0.000002	0.00026	0.00091	0.000003	0.00073	0.00125	-0.0001
7-Sep-12	77																
14-Sep-12	78	0.000087	-0.002	0.472	-0.00004	1.1	0.000028	0.163	0.00375	-10	-0.000002	-0.0002	0.00159	0.000002	0.00081	0.00084	-0.0001
21-Sep-12	79																
28-Sep-12	80	0.000125	-0.002	0.473	-0.00004	1.29	0.000015	0.117	0.00436	-10	-0.000002	0.00034	0.00094	0.000004	0.00072	0.00155	-0.0001
5-Oct-12	81																
12-Oct-12	82	0.000041	-0.002	0.523	-0.00004	1.33	0.000006	0.129	0.00399	-10	-0.000002	-0.0002	-0.0005	-0.000002	0.00044	0.00081	-0.0001
19-Oct-12	83																
26-Oct-12	84	0.000062	0.0094	0.488	-0.00004	1.36	0.000035	0.094	0.00378	-10	-0.000002	-0.0002	0.00063	0.000004	0.0008	0.00084	-0.0001
2-Nov-12	85																
9-Nov-12	86	0.000078	-0.002	0.568	-0.00004	1.54	0.000008	0.131	0.00447	-3	-0.000002	0.00027	-0.0005	-0.000002	0.00082	0.00073	-0.0001
16-Nov-12	87																
23-Nov-12	88	0.000271	-0.002	0.54	-0.00004	1.44	0.000006	0.117	0.00426	-3	-0.000002	0.00041	-0.0005	-0.000002	0.00055	0.00242	-0.0001
30-Nov-12	89																
7-Dec-12	90	0.000099	-0.002	0.42	-0.00004	1.03	0.000007	0.109	0.00356	-3	-0.000002	0.00037	-0.0005	-0.000002	0.00075	0.00245	-0.0001
14-Dec-12	91																
21-Dec-12	92	0.000046	-0.002	0.49	-0.00004	1.3	0.000009	0.102	0.00377	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00072	0.00096	-0.0001
28-Dec-12	93																
4-Jan-13	94	0.000098	-0.002	0.473	-0.00004	1.12	0.000015	0.141	0.00406	-3	-0.000002	-0.0002	0.00131	-0.000002	0.00071	0.00117	-0.0001
11-Jan-13	95																
18-Jan-13	96	0.000048	-0.002	0.463	-0.00004	1.11	0.000008	0.087	0.0038	-3	-0.000002	-0.0002	0.00055	-0.000002	0.00057	0.00104	-0.0001
25-Jan-13	97																
1-Feb-13	98	0.000038	-0.002	0.46	-0.00004	1.12	0.000008	0.118	0.00371	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00085	0.001	-0.0001
8-Feb-13	99																
15-Feb-13	100	0.000041	-0.002	0.471	-0.00004	1.13	-0.000005	0.125	0.00366	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00058	0.00091	-0.0001
22-Feb-13	101																
1-Mar-13	102	0.000033	-0.002	0.466	-0.00004	1.06	0.000006	0.098	0.00372	-3	-0.000002	-0.0002	0.00099	-0.000002	0.00058	0.00084	-0.0001
8-Mar-13	103																
15-Mar-13	104	0.000029	-0.002	0.411	-0.00004	1.07	0.000009	0.084	0.00321	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00065	0.00089	-0.0001
22-Mar-13	105																
29-Mar-13	106	0.000062	-0.002	0.534	-0.00004	1.43	-0.000005	0.142	0.00461	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.00063	0.00089	-0.0001
5-Apr-13	107																
12-Apr-13	108	0.000067	-0.002	0.477	-0.00004	1.12	0.000007	0.087	0.00401	-3	-0.000002	-0.0002	0.00207	-0.000002	0.00132	0.00104	-0.0001
19-Apr-13	109																
26-Apr-13	110	0.000039	-0.002	0.477	-0.00004	0.981	0.000025	0.089	0.00402	-3	-0.000002	-0.0002	0.00231	-0.000002	0.00047	0.00098	-0.0001
3-May-13	111																
10-May-13	112	0.000073	-0.002	0.411	-0.00004	1.03	-0.000005	0.109	0.00347	-3	-0.000002	-0.0002	-0.0005	-0.000002	0.0006	0.00076	-0.0001
17-May-13	113																
24-May-13	114																

HC 12

CONFIDENTIAL *DRAFT*

Sample =
08SWC370 10-13

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L
18-Mar-11	0	500	330	7.51	252	#N/A	4.1	80.4	8	3	0.34	76.6	0.0342	0.00003	0.00052	0.12	-0.00001	-0.000005	-0.05	-0.000005	23.9	0.0002	0.000132	0.00553	0.005	0.000013	0.0045	4.08	0.0112	-0.02	0.0123	0.00029
25-Mar-11	1	500	500	7.67	139																											
1-Apr-11	2	500	455	7.71	115	#N/A	5.3	54.5	6	1	0.44	27.2	0.0337	0.00003	0.00102	0.0374	-0.00001	-0.000005	-0.05	-0.000005	8.48	0.0003	0.000052	0.0045	0.011	0.000009	0.0021	1.46	0.00379	-0.01	0.0183	0.00018
8-Apr-11	3	500	445	7.52	95																											
15-Apr-11	4	500	450	7.61	79	#N/A	2.5	37.1	4	-0.5	0.29	20.9	0.0336	-0.00002	0.00071	0.0337	-0.00001	-0.000005	-0.05	-0.000005	6.57	0.0001	0.00003	0.00282	0.019	0.000011	0.0015	1.09	0.00441	-0.01	0.0132	0.00017
22-Apr-11	5	500	440	7.53	70																											
29-Apr-11	6	500	465	7.61	65	#N/A	3.5	39.5	4	-0.5	0.2	25.1	0.05	-0.00002	0.0006	0.0469	-0.00001	-0.000005	-0.05	-0.000005	8.05	0.0001	0.000027	0.00259	0.027	0.000011	0.0015	1.21	0.00399	-0.01	0.00949	0.00023
6-May-11	7	500	450	7.49	60																											
13-May-11	8	500	450	7.47	67	#N/A	3.0	26.1	5	-0.5	0.14	21.1	0.0385	-0.00002	0.00054	0.0372	-0.00001	-0.000005	-0.05	-0.000005	6.84	-0.0001	0.000018	0.00151	0.017	0.000017	0.001	0.98	0.0028	-0.01	0.00615	0.00013
20-May-11	9	500	455	7.66	49																											
27-May-11	10	500	470	7.59	52	#N/A	4.5	28.8	3	-0.5	0.13	20.5	0.0199	-0.00002	0.00055	0.046	-0.00001	-0.000005	-0.05	-0.000005	6.54	-0.0001	0.00001	0.00128	0.003	0.000015	0.0011	1.02	0.0029	-0.01	0.00515	0.00006
3-Jun-11	11	500	480	7.39	95																											
10-Jun-11	12	500	505	7.58	71	#N/A	2.2	33.4	3	0.6	0.12	23	0.0581	-0.00002	0.00054	0.0574	-0.00001	-0.000005	-0.05	0.000016	7.33	-0.0001	0.000036	0.00224	0.038	0.000019	0.0013	1.14	0.00356	-0.01	0.00407	0.00039
17-Jun-11	13	500	460	7.31	101																											
24-Jun-11	14	500	460	7.78	51	#N/A	1.8	30.3	2	-0.5	0.08	23.9	0.026	0.00002	0.00051	0.0548	-0.00001	-0.000005	-0.05	-0.000005	7.59	0.0004	0.000009	0.00152	0.012	0.000011	0.001	1.21	0.00341	-0.01	0.0034	0.0002
1-Jul-11	15	500	460	7.75	50																											
8-Jul-11	16	500	470	7.53	49	#N/A	3.0	29.5	3	-0.5	0.07	20.9	0.0177	-0.00002	0.00049	0.0472	-0.00001	-0.000005	-0.05	-0.000005	6.69	-0.0001	0.000015	0.00085	0.005	0.000008	0.0009	1.01	0.00293	-0.01	0.00259	0.00005
15-Jul-11	17	500	480	7.44	58																											
22-Jul-11	18	500	465	7.53	44	#N/A	3.4	25.7	-2	0.7	0.06	18.9	0.0351	-0.00002	0.00028	0.0502	-0.00001	-0.000005	-0.05	-0.000005	5.89	0.0003	0.000023	0.00141	0.017	0.000009	0.0008	1.03	0.00253	-0.01	0.00208	0.00015
29-Jul-11	19	500	455	7.53	52																											
5-Aug-11	20	500	450	7.48	56	#N/A	3.3	32.2	-2	-0.5	0.07	25.5	0.0384	-0.00002	0.00047	0.0617	-0.00001	-0.000005	-0.05	-0.000005	8.18	0.0003	0.000015	0.00132	0.016	#N/A	0.001	1.23	0.0029	-0.01	0.00215	0.00017
12-Aug-11	21	500	440	7.65	55																											
19-Aug-11	22	500	460	7.51	52	#N/A	3.7	30.0	2	1.4	0.06	24.3	0.0449	-0.00002	0.00044	0.0662	-0.00001	-0.000005	-0.05	-0.000005	7.97	0.0006	0.000015	0.0018	0.026	0.000014	0.0009	1.07	0.00266	-0.01	0.00161	0.0002
26-Aug-11	23	500	465	7.45	49																											
2-Sep-11	24	500	455	7.44	55	#N/A	4.1	29.1	2	0.7	0.05	22	0.0214	-0.00002	0.00051	0.0625	-0.00001	-0.000005	-0.05	-0.000005	7	0.0001	0.000014	0.00073	0.006	-0.000005	0.0008	1.03	0.00274	-0.01	0.00142	0.00005
9-Sep-11	25	500	455	7.53	54																											
16-Sep-11	26	500	465	7.40	54	#N/A	4.2	31.1	-2	0.7	0.05	24.4	0.0241	-0.00002	0.0004	0.0717	-0.00001	-0.000005	-0.05	-0.000005	7.8	0.0001	0.000013	0.00082	0.01	0.000018	0.001	1.2	0.0024	-0.01	0.00133	0.00005
23-Sep-11	27	500	445	7.41	54																											
30-Sep-11	28	500	465	7.30	55	#N/A	3.7	28.6	2	-0.5	0.05	25.2	0.0133	-0.00002	0.00093	0.0796	-0.00001	-0.000005	-0.05	-0.000005	8.07	-0.0001	0.000013	0.00091	0.003	0.000007	0.0011	1.22	0.00204	-0.01	0.00118	0.00016
7-Oct-11	29	500	450	7.29	57																											
14-Oct-11	30	500	455	7.21	48	#N/A	4.4	25.4	3	-0.5	0.05	23.9	0.0275	-0.00002	0.00055	0.0737	-0.00001	-0.000005	-0.05	-0.000005	7.71	0.0003	0.000009	0.00107	0.009	0.000008	0.0009	1.12	0.00116	-0.01	0.00122	0.00002
21-Oct-11	31	500	470	7.48	49																											
28-Oct-11	32	500	460	7.50	52	#N/A	3.6	30.7	-2	-0.5	0.04	26.7	0.0239	-0.00002	0.00032	0.0856	-0.00001	-0.000005	-0.05	-0.000005	8.6	0.0001	-0.000005	0.00228	0.01	0.00007	0.0008	1.28	0.00054	-0.01	0.00104	0.00004
4-Nov-11	33	500	445	7.53	44																											
11-Nov-11	34	500	460	7.54	50	#N/A	5.5	31.1	3	-0.5	0.036	24	0.0187	-0.00002	0.00037	0.0806	-0.00001	-0.000005	-0.05	#N/A	7.74	-0.0001	0.000008	0.0009	0.005	0.000051	0.0009	1.13	0.00054	-0.01	0.00088	0.00003
18-Nov-11	35	500	465	7.42	52																											
25-Nov-11	36	500	460	7.62	61	#N/A	3.7	37.7	2	-0.5	0.037	29.7	0.022	-0.00002	0.00064	0.105	-0.00001	-0.000005	-0.05	-0.000005	9.52	-0.0001	0.000009	0.00096	0.007	0.000013	0.0012	1.44	0.00109	-0.01	0.00085	0.00009
2-Dec-11	37	500	460	7.47	53																											
9-Dec-11	38	500	510	7.43	56	#N/A	4.5	34.6	2	-0.5	0.032	26.4	0.0419	-0.00002	0.00033	0.0942	-0.00001	-0.000005	-0.05	-0.000005	8.4	0.0006	0.000017	0.0021	0.023	#N/A	0.001	1.33	0.00077	-0.01	0.0007	0.00019
16-Dec-11	39	500	455	7.51	61																											
23-Dec-11	40	500	455	7.43	56	#N/A	4.9	36.0	3	-0.5	0.033	27.4	0.0396	-0.00002	0.00038	0.112	-0.00001	-0.000005	-0.05	-0.000005	8.71	0.0001	0.000012	0.00092	0.012	0.000017	0.0009	1.38	0.00044	-0.01	0.00067	0.00005
30-Dec-11	41	500	465	7.51	55																											
6-Jan-12	42	500	470	7.27	41	#N/A	3.6	28.5	2	-0.5	0.022	19.4	0.0159	-0.00002	0.00026	0.0816	-0.00001	-0.000005	-0.05	-0.000005	6.13	-0.0001	-0.000005	0.00068	0.004	-0.000005	0.0008	0.98	0.00022	-0.01	0.00042	-0.00002
13-Jan-12	43	500	460	7.42	45																											
20-Jan-12	44	500	460	7.52	51	#N/A	3.1	37.0	2	-0.5	0.025	23.3	0.0389	-0.00002	0.00029	0.11	-0.00001	-0.000005	-0.05	-0.000005	7.53	-0.0001	0.000011	0.00108	0.02	0.000022	0.0008	1.08	0.00037	-0.01	0.00043	0.00004
27-Jan-12	45	500	465	7.35	43																											
3-Feb-12	46	500	490	7.34	42	#N/A	5.2	30.2	2	-0.5	0.023	20	0.0259	-0.00002	0.00018	0.0741	-0.00001	-0.000005	-0.05	-0.000005	6.52	-0.0001	0.000007	0.00107	0.011	0.000008	0.0006	0.89	0.00027	-0.01	0.00051	0.00012
10-Feb-12	47	500	455	7.34	42																											
17-Feb-12	48	500	455	7.70	54	#N/A	2.6	32.6	3	-0.5	0.022	20.7	0.0308	-0.00002	0.00028	0.0847	-0.00001	-0.000005	-0.05	-0.000005	6.7	0.0002	0.000011	0.00133	0.013	0.000005	0.0007	0.96	0.00064	-0.01	0.00037	-0.00002
24-Feb-12	49	500	450	7.30	44																											
2-Mar-12	50	500	460	7.30	49	#N/A	7.3	32.7	3	-0.5	0.018	23.8	0.0366	-0.00002	0.00021	0.101	-0.00001	-0.000005	-0.05	-0.000005	7.75	-0.0001	0.000009	0.00123	0.017	0.00002	0.0008	1.09	0.00045	-0.01	0.00033	0.00012
9-Mar-12	51	500	460	7.38	45																											
16-Mar-12	52	500	465	7.46	51	#N/A	3.1	30.5	3	-0.5	0.021	24	0.0278	-0.00002	0.00024	0.108	-0.00001	-0.000005	-0.05	0.000006	7.82	0.0002	0.000013	0.00086	0.011	0.000015	0.0007	1.08	0.00036	-0.01	0.00039	0.00015
23-Mar-12	53	500	460	7.39	53																											
30-Mar-12	54	500	465	7.38	62	#N/A	4.3	35.7	3	-0.5	0.025	29.3	0.0418	-0.00002	0.00022	0.132	-0.00001	-0.000005	-0.05	-0.000005	9.78	0.0002	0.000013	#N/A	0.035	0.000055	0.0008	1.18	0.00065	-0.01	0.00043	#N/A
6-Apr-12	55	500	460	7.52	54																											
13-Apr-12	56	500	455	7.63	62	#N/A	2.5	36.6	3	-0.5	0.02	31.5	0.0336	-0.00002	0.00022	0.145	-0.00001	-0.000005	-0.05	-0.000005	10.5	-0.0001	-0.000005	0.00111	0.015	0.000035	0.001	1.27	0.00023	-0.01	0.00051	0.00005
20-Apr-12	57	500	460	7.48	59																											
27-Apr-12	58	500	455	7.45	57	#N/A	4.6	33.4	2	-0.5	0.019	27.4	0.0294	-0.00002	0.00031	0.129	-0.00001	-0.000005	-0.05	0.000005	9.1	0.00014	0.000009	0.00109	0.0133	0.000015	0.00064	1.13	0.000313	-0.01	0.000379	0.000138
4-May-12	59	500	465	7.34	52																											
11-May-12	60	500	470	7.44	49	#N/A	3.7	29.2	3	-0.5	0.02	24.8	0.0301	-0.00002	0.000277	0.118	-0.00001	-0.000005	-0.05	-0.000005	8.38	0.00011	0.00001	0.00173	0.0169	0.000012	0.00053	0.937	0.000917	-0.01	0.000344	0.000089
18-May-12	61	500	460	7.43	54																											
25-May-12	62	500	470	7.38	48	#N/A	4.0	28.0	2	-0.5	0.015	21.7	0.0446	-0.00002	0.000205	0.107	-0.00001	-0.000005	-0.05	0.0000083	7.29	-0.0001	0.0000169	0.00112	0.0253	0.0000675	0.00058	0.85	0.000481	-0.01	0.00023	0.000091
1-Jun-12	63	500	490	7.39	54																											
8-Jun-12	64	500	465	7.49	53	#N/A	3.6	32.8	2	-0.5	0.016	24.3	0.024	-0.00002	0.000183	0.124	-0.00001	-0.000005	-0.05	-0.000005	8.04	0.00011	0.0000143	0.0011	0.0112	0.0000097	0.00073	1.02	0.000857	-0.01	0.00028	0.000229
15-Jun-12	65	500	495	7.38	55																											
22-Jun-12	66	500	470	7.35	48	#N/A	4.6	29.4	2	-0.5	0.017	23.5	0.0313	-0.00002	0.000443	0.125	-0.00001	-0.000005	-0.05	-0.000005	7.89	-0.0001	0.0000099	0.000773	0.0116	0.0000065	0.00063	0.929	0.000511	-0.01	0.000326	0.000051
29-Jun-12	67	500	475	7.28	51																											

HC 12

Sample =
08SWC370 10-13

Date	Cycle No.	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	0.013	5.57	0.00051	3.11	-0.000005	23.1	0.0881	-10	-0.000002	0.00003	-0.0005	0.000083	0.0018	0.0013	-0.0001
25-Mar-11	1															
1-Apr-11	2	0.007	2.53	0.0003	3.53	-0.000005	10.9	0.0331	-10	-0.000002	0.00045	0.0005	0.000067	0.0043	0.0003	-0.0001
8-Apr-11	3															
15-Apr-11	4	0.005	2	0.00012	2.7	-0.000005	5.19	0.028	-10	-0.000002	0.0003	0.0012	0.000031	0.004	0.0004	-0.0001
22-Apr-11	5															
29-Apr-11	6	0.004	2.05	0.00006	2.86	-0.000005	3.26	0.0302	-10	-0.000002	0.00022	0.0012	0.000028	0.0035	0.0004	-0.0001
6-May-11	7															
13-May-11	8	0.002	1.54	-0.00004	2.16	-0.000005	1.96	0.023	-10	-0.000002	0.0001	0.0011	0.00001	0.003	0.0003	-0.0001
20-May-11	9															
27-May-11	10	0.002	1.52	0.00005	2.03	-0.000005	1.38	0.0262	-10	-0.000002	0.00008	-0.0005	0.000018	0.0031	0.0003	-0.0001
3-Jun-11	11															
10-Jun-11	12	0.003	1.71	0.00004	2.29	-0.000005	1.01	0.0311	-10	-0.000002	0.00005	0.0022	0.000017	0.0032	0.0005	-0.0001
17-Jun-11	13															
24-Jun-11	14	-0.002	1.56	0.00004	2.16	-0.000005	0.88	0.0281	-10	-0.000002	0.00006	-0.0005	0.000011	0.0028	0.0002	-0.0001
1-Jul-11	15															
8-Jul-11	16	0.003	1.26	-0.00004	1.9	-0.000005	0.65	0.0271	-10	-0.000002	0.00006	-0.0005	0.000011	0.0022	0.0003	-0.0001
15-Jul-11	17															
22-Jul-11	18	-0.002	1.22	-0.00004	1.6	-0.000005	0.52	0.0253	-10	-0.000002	0.00003	0.0008	0.000009	0.0023	0.0005	-0.0001
29-Jul-11	19															
5-Aug-11	20	0.004	1.39	0.00007	2.08	-0.000005	0.52	0.031	-10	-0.000002	0.00004	0.0011	0.000122	0.0027	0.0008	-0.0001
12-Aug-11	21															
19-Aug-11	22	0.003	1.32	-0.00004	1.89	-0.000005	0.5	0.0295	-10	-0.000002	-0.00001	0.0017	0.000012	0.003	0.0004	-0.0001
26-Aug-11	23															
2-Sep-11	24	0.002	1.1	-0.00004	1.56	-0.000005	0.38	0.028	-10	-0.000002	0.00011	0.0007	0.000022	0.0025	0.0004	-0.0001
9-Sep-11	25															
16-Sep-11	26	0.002	1.3	-0.00004	1.77	-0.000005	0.35	0.0316	-10	-0.000002	0.00003	-0.0005	0.000011	0.0024	0.0006	-0.0001
23-Sep-11	27															
30-Sep-11	28	-0.002	1.18	0.00005	1.78	-0.000005	0.41	0.0327	-10	0.000002	0.00007	-0.0005	0.000014	0.0018	0.0002	-0.0001
7-Oct-11	29															
14-Oct-11	30	-0.002	1.29	-0.00004	1.91	-0.000005	0.34	0.0289	-10	-0.000002	0.00002	-0.0005	0.00001	0.0027	0.0005	-0.0001
21-Oct-11	31															
28-Oct-11	32	-0.002	1.38	-0.00004	1.92	-0.000005	0.3	0.0352	-10	-0.000002	0.00043	-0.0005	0.000012	0.0023	#N/A	-0.0001
4-Nov-11	33															
11-Nov-11	34	-0.002	1.17	0.00006	1.75	-0.000005	0.29	0.0314	-10	0.000003	0.00016	-0.0005	0.000012	0.002	0.0007	-0.0001
18-Nov-11	35															
25-Nov-11	36	0.003	1.37	0.00009	2.03	-0.000005	0.31	0.0388	-10	-0.000002	0.00022	-0.0005	0.000017	0.0022	0.0006	-0.0001
2-Dec-11	37															
9-Dec-11	38	0.003	1.38	-0.00004	1.67	0.000006	0.29	0.0359	-10	0.000003	0.00019	0.0009	0.000017	0.0024	0.0008	-0.0001
16-Dec-11	39															
23-Dec-11	40	0.002	1.45	-0.00004	1.81	-0.000005	0.23	0.0371	-10	-0.000002	0.00003	0.0009	0.000016	0.0024	0.0006	-0.0001
30-Dec-11	41															
6-Jan-12	42	-0.002	1	-0.00004	1.18	-0.000005	0.19	0.027	-10	-0.000002	0.00006	-0.0005	0.000006	0.0017	0.0003	-0.0001
13-Jan-12	43															
20-Jan-12	44	-0.002	1.03	-0.00004	1.43	-0.000005	0.18	0.0333	-10	-0.000002	-0.0002	0.0011	0.000015	0.0018	0.0007	-0.0001
27-Jan-12	45															
3-Feb-12	46	0.004	0.93	-0.00004	1.18	-0.000005	0.17	0.0254	-10	-0.000002	-0.0002	-0.0005	0.000006	0.0016	0.0004	-0.0001
10-Feb-12	47															
17-Feb-12	48	0.002	1.02	-0.00004	1.29	0.000005	0.17	0.0268	-10	-0.000002	-0.0002	-0.0005	0.000009	0.0021	0.0002	-0.0001
24-Feb-12	49															
2-Mar-12	50	-0.002	1	-0.00004	1.36	-0.000005	0.18	0.0297	-10	-0.000002	-0.0002	0.0009	0.00001	0.0015	0.0004	-0.0001
9-Mar-12	51															
16-Mar-12	52	-0.002	1.05	-0.00004	1.44	-0.000005	0.2	0.0314	-10	0.000002	-0.0002	0.0005	0.000009	0.0015	0.0004	-0.0001
23-Mar-12	53															
30-Mar-12	54	-0.002	1.09	-0.00004	1.78	0.000006	0.21	0.0371	-10	-0.000002	-0.0002	0.0014	0.000014	0.0016	#N/A	-0.0001
6-Apr-12	55															
13-Apr-12	56	-0.002	1.23	0.00005	1.97	0.000007	0.17	0.0386	-10	-0.000002	0.0005	0.0009	0.000013	0.0019	0.0013	-0.0001
20-Apr-12	57															
27-Apr-12	58	0.0028	1.21	-0.00004	1.76	-0.000005	0.175	0.0346	-10	-0.000002	-0.0002	0.00056	0.000013	0.00246	0.00053	-0.0001
4-May-12	59															
11-May-12	60	-0.002	1.04	0.000044	1.45	-0.000005	0.148	0.0296	-10	-0.000002	-0.0002	0.00086	0.000009	0.00161	0.00047	-0.0001
18-May-12	61															
25-May-12	62	-0.002	0.901	-0.00004	1.31	-0.000005	0.163	0.0284	-10	-0.000002	-0.0002	0.00136	0.0000082	0.0015	0.0015	-0.0001
1-Jun-12	63															
8-Jun-12	64	0.0033	0.984	-0.00004	1.32	-0.000005	0.213	0.0322	-10	-0.000002	-0.0002	0.00053	0.0000135	0.00157	0.00047	-0.0001
15-Jun-12	65															
22-Jun-12	66	0.0034	0.926	-0.00004	1.35	-0.000005	0.129	0.0306	-10	-0.000002	-0.0002	0.00058	0.0000073	0.00178	0.00032	-0.0001
29-Jun-12	67															

HC 12

CONFIDENTIAL *DRAFT*

Sample =
08SWC370 10-13

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L
6-Jul-12	68	500	470	7.42	52	#N/A	4.3	31.0	2	-0.5	0.018	26	0.0303	-0.00002	0.000323	0.139	-0.00001	-0.000005	-0.05	-0.000005	8.8	-0.0001	0.0000089	0.00104	0.0129	0.0000146	0.00075	0.975	0.000243	-0.01	0.00034	-0.00002
13-Jul-12	69	500	480	7.40	44																											
20-Jul-12	70	500	470	7.33	51	#N/A	4.1	32.1	2	-0.5	0.015	24.8	0.044	-0.00002	0.000356	0.136	-0.00001	-0.000005	-0.05	-0.000005	8.41	-0.0001	-0.000005	0.00053	0.0033	0.0000053	0.00065	0.916	0.000085	-0.01	0.000258	0.000031
27-Jul-12	71	500	470	7.31	55																											
3-Aug-12	72	500	465	7.51	57	#N/A	3.6	35.1	2	-0.5	0.018	28.1	0.0312	-0.00002	0.000273	0.16	-0.00001	-0.000005	-0.05	-0.000005	9.47	-0.0001	0.000013	0.00118	0.0181	0.000031	0.00081	1.07	0.000418	-0.01	0.000313	0.000122
10-Aug-12	73	500	475	7.43	45																											
17-Aug-12	74	500	450	7.41	57	#N/A	4.0	35.3	2	-0.5	0.014	26.5	0.0355	-0.00002	0.00022	0.166	-0.00001	-0.000005	-0.05	-0.000005	8.87	0.00013	0.00001	0.00136	0.0175	0.000044	0.0008	1.04	0.000719	-0.01	0.000262	0.000098
24-Aug-12	75	500	480	7.37	55																											
31-Aug-12	76	500	465	7.45	48	#N/A	4.1	30.3	2	-0.5	0.013	24	0.0345	-0.00002	0.000238	0.14	-0.00001	-0.000005	-0.05	0.000006	8.27	-0.0001	0.000013	0.0015	0.018	0.000049	0.00062	0.822	0.000389	-0.01	0.000223	0.000104
7-Sep-12	77	500	470	7.32	48																											
14-Sep-12	78	500	480	7.30	47	#N/A	3.6	28.5	2	-0.5	0.012	22.8	0.0292	-0.00002	0.000341	0.136	-0.00001	-0.000005	-0.05	-0.000005	7.84	0.00044	0.000008	0.00105	0.0198	0.000017	0.00065	0.792	0.000526	-0.01	0.0002	0.000036
21-Sep-12	79	500	500	7.34	54																											
28-Sep-12	80	500	475	7.45	55	#N/A	3.4	35.5	2	-0.5	0.015	27.1	0.0253	-0.00002	0.000268	0.168	-0.00001	-0.000005	-0.05	-0.000005	9.28	0.00019	0.000006	0.000775	0.0112	0.000018	0.0007	0.962	0.000255	-0.01	0.000245	0.000035
5-Oct-12	81	500	465	7.31	53																											
12-Oct-12	82	500	495	7.27	62	#N/A	5.8	40.1	2	-0.5	0.017	31.6	0.019	-0.00002	0.000343	0.195	-0.00001	-0.000005	-0.05	-0.000005	10.8	-0.0001	0.000005	0.000744	0.0057	0.000007	0.00087	1.1	0.000145	-0.01	0.000286	0.000062
19-Oct-12	83	500	475	7.35	55																											
26-Oct-12	84	500	480	7.40	45	#N/A	2.9	28.8	2	-0.5	0.013	21.8	0.0263	-0.00002	0.000175	0.138	-0.00001	-0.000005	-0.05	-0.000005	7.55	-0.0001	0.00001	0.00123	0.0145	0.000056	0.00055	0.711	0.000437	-0.01	0.000172	0.000073
2-Nov-12	85	500	475	7.44	52																											
9-Nov-12	86	500	480	7.37	49	#N/A	5.3	32.9	3	-0.5	0.015	25.3	0.0189	-0.00002	0.000375	0.167	-0.00001	-0.000005	-0.05	-0.000005	8.72	-0.0001	0.000006	0.00102	0.0074	0.000069	0.00063	0.852	0.000302	-0.01	0.000203	0.000133
16-Nov-12	87	500	485	7.39	60																											
23-Nov-12	88	500	490	7.43	44	#N/A	3.6	26.7	3	-0.5	0.014	23.2	0.0178	-0.00002	#N/A	0.135	-0.00001	-0.000005	-0.05	-0.000005	8.05	-0.0001	0.000013	0.000701	0.007	0.000008	0.00062	0.747	0.000156	-0.01	0.000169	0.00022
30-Nov-12	89	500	505	7.37	45																											
7-Dec-12	90	500	460	7.32	51	#N/A	6.4	35.2	2	-0.5	0.018	26.6	0.0279	-0.00002	0.000256	0.17	-0.00001	-0.000005	-0.05	-0.000005	9.18	-0.0001	-0.000005	0.000751	0.0088	0.000018	0.00072	0.896	0.000137	-0.01	0.000247	0.000059
14-Dec-12	91	500	490	7.39	38																											
21-Dec-12	92	500	460	7.38	48	#N/A	4.0	30.9	-2	-0.5	0.015	22.5	0.0213	-0.00002	0.000228	0.158	-0.00001	-0.000005	-0.05	-0.000005	7.91	-0.0001	0.000006	0.000627	0.0159	0.000012	0.00061	0.678	0.00023	-0.01	0.000168	0.000041
28-Dec-12	93	500	475	7.65	45																											
4-Jan-13	94	500	465	7.41	52	#N/A	5.3	36.1	-2	0.86	0.019	27.2	0.0281	-0.00002	0.00023	0.193	-0.00001	-0.000005	-0.05	-0.000005	9.3	0.0003	0.000016	0.000936	0.0139	0.000021	0.00069	0.969	0.00065	-0.01	0.000201	0.00011
11-Jan-13	95	500	450	7.43	53																											
18-Jan-13	96	500	455	7.48	52	#N/A	3.0	34.7	2	0.63	0.013	25	0.0253	-0.00002	0.000178	0.176	-0.00001	-0.000005	-0.05	-0.000005	8.67	-0.0001	-0.000005	0.000682	0.0103	0.000013	0.00083	0.811	0.000189	-0.01	0.000187	0.000117
25-Jan-13	97	500	450	7.61	39																											
1-Feb-13	98	500	440	7.47	45	#N/A	3.8	27.8	3	0.56	0.028	21.4	0.0215	#N/A	0.000376	0.148	-0.00001	-0.000005	-0.05	-0.000005	7.38	-0.0001	0.000006	0.000533	0.0075	0.000005	0.0005	0.71	0.000615	-0.01	0.00016	0.00002
8-Feb-13	99	500	450	7.37	48																											
15-Feb-13	100	500	430	7.42	48	#N/A	3.2	27.4	2	0.57	0.012	22.6	0.0193	-0.00002	0.000253	0.167	-0.00001	-0.000005	-0.05	-0.000005	7.84	-0.0001	0.000005	0.000487	0.0067	0.000006	0.00056	0.726	0.000169	-0.01	0.000166	-0.00002
22-Feb-13	101	500	430	7.44	54																											
1-Mar-13	102	500	440	7.44	48	#N/A	5.8	32.1	3	-0.5	0.013	22.5	0.0381	-0.00002	0.000242	0.164	-0.00001	-0.000005	-0.05	-0.000005	7.8	-0.0001	0.000009	0.000847	0.0158	0.000032	0.00061	0.73	0.000298	-0.01	0.000166	-0.00002
8-Mar-13	103	500	440	7.59	35																											
15-Mar-13	104	500	455	7.32	46	#N/A	5.2	26.7	2	-0.5	0.012	22.2	0.0331	-0.00002	0.00026	0.159	-0.00001	-0.000005	-0.05	-0.000005	7.76	-0.0001	0.000009	0.000817	0.0146	0.000006	0.00057	0.678	0.000545	-0.01	0.000135	0.00006
22-Mar-13	105	500	440	7.30	47																											
29-Mar-13	106	500	440	7.44	46	#N/A	3.6	27.0	2	-0.5	0.012	22.5	0.0181	-0.00002	0.000354	0.166	-0.00001	-0.000005	-0.05	-0.000005	7.91	-0.0001	0.000012	0.000642	0.0056	0.000021	0.00054	0.665	0.000148	-0.01	0.000147	0.000071
5-Apr-13	107	500	435	7.33	48																											
12-Apr-13	108	500	440	7.41	43	#N/A	5.5	27.1	2	-0.5	0.011	20.5	0.0394	-0.00002	0.00021	0.158	-0.00001	-0.000005	-0.05	-0.000005	7.18	-0.0001	0.00001	0.00101	0.0209	0.000011	-0.0005	0.624	0.000532	-0.01	0.00012	0.000062
19-Apr-13	109	500	435	7.34	46																											
26-Apr-13	110	500	445	7.34	47	#N/A	4.0	27.0	3	-0.5	0.012	20.7	0.0203	-0.00002	0.000212	0.174	-0.00001	-0.000005	-0.05	-0.000005	7.26	-0.0001	0.000006	0.000477	0.0074	-0.000005	0.00051	0.636	0.00015	-0.01	0.000133	0.000051
3-May-13	111	500	435	7.27	46																											
10-May-13	112	500	425	7.37	48	#N/A	4.1	26.8	2	0.5	0.01	22.5	0.025	-0.00002	0.000331	0.174	-0.00001	-0.000005	-0.05	-0.000005	7.88	-0.0001	-0.000005	0.00053	0.0083	0.000025	0.00057	0.674	0.000153	-0.01	0.000159	0.000046
17-May-13	113	500	440	7.35	54																											
24-May-13	114	500	450	7.37	45	#N/A	4.7	26.8	2																							

May 13/11 Cl 4.8. Repeat=-0.5, data confirmed
June 10/11 Fe 0.038 and Cu 0.00224 . Repeat Cu= 0.0026, Fe= 0.042. data confirmed, keep original result.
Aug 5/11 Pb 0.000451. Repeat =.000515, data confirmed, suspect contamination
Nov 11/11 Cd=0.000032, repeat=0.000029. data confirmed, suspect contamination
Dec 9/11 Pb=0.000519, repeat=0.000497. data confirmed, suspect contamination
Oct 28/11 Zn=0.0035, repeat=0.0065. Data rejected, suspect contamination
March 30/12 Cu=0.00425, Ni=0.00041, Zn=0.02 repeat Cu=0.00438, Ni=0.000378, Zn=0.0205. Data confirmed, suspect contamination
Apr 27/12 Ni=0.000183, repeat=0.000138, Data accepted
Nov 23/12 As=0.00059,repeat= 0.00059. Data confirmed suspect contamination
Feb 1/13 Sb=0.000041, repeat confirms original result, suspect contamination
Dec 7/12 Ni=0.000773, repeat=0.000059. Data accepted

HC 12

Sample =
08SWC370 10-13

Date	Cycle No.	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
6-Jul-12	68	0.002	0.974	-0.00004	1.59	-0.000005	0.142	0.0308	-10	-0.000002	-0.0002	-0.0005	0.0000096	0.00193	0.0003	-0.0001
13-Jul-12	69															
20-Jul-12	70	-0.002	0.907	-0.00004	1.37	-0.000005	0.135	0.031	-10	-0.000002	-0.0002	-0.0005	0.0000113	0.00192	0.00138	-0.0001
27-Jul-12	71															
3-Aug-12	72	0.0031	1.16	-0.00004	1.58	0.000005	0.178	0.0369	-10	-0.000002	0.00026	-0.0005	0.000013	0.00191	0.00078	-0.0001
10-Aug-12	73															
17-Aug-12	74	-0.002	1.08	-0.00004	1.32	-0.000005	0.17	0.0353	-10	-0.000002	0.0005	-0.0005	0.000008	0.00159	0.00098	-0.0001
24-Aug-12	75															
31-Aug-12	76	-0.002	0.871	-0.00004	1.16	-0.000005	0.127	0.0301	-10	-0.000002	-0.0002	0.00079	0.000011	0.00128	0.00081	-0.0001
7-Sep-12	77															
14-Sep-12	78	-0.002	0.843	-0.00004	1.11	-0.000005	0.123	0.0295	-10	-0.000002	-0.0002	0.00089	0.000009	0.00133	0.00042	-0.0001
21-Sep-12	79															
28-Sep-12	80	-0.002	0.993	-0.00004	1.46	-0.000005	0.121	0.0335	-10	-0.000002	-0.0002	0.00081	0.000009	0.00148	0.00038	-0.0001
5-Oct-12	81															
12-Oct-12	82	0.0022	1.12	0.000043	1.62	-0.000005	0.137	0.0389	-10	-0.000002	-0.0002	-0.0005	0.000012	0.00121	0.00036	-0.0001
19-Oct-12	83															
26-Oct-12	84	0.0087	0.799	-0.00004	1.06	-0.000005	0.08	0.0277	-10	-0.000002	-0.0002	0.00052	0.000009	0.00136	0.00052	-0.0001
2-Nov-12	85															
9-Nov-12	86	-0.002	0.933	0.00004	1.2	-0.000005	0.104	0.0316	-3	-0.000002	0.00041	-0.0005	0.000008	0.00143	0.00224	-0.0001
16-Nov-12	87															
23-Nov-12	88	0.0036	0.838	-0.00004	1.24	-0.000005	0.091	0.0262	-3	-0.000002	0.0003	-0.0005	0.000008	0.00114	0.00044	-0.0001
30-Nov-12	89															
7-Dec-12	90	-0.002	0.958	-0.00004	1.39	-0.000005	0.117	0.0328	-3	0.000002	0.00037	-0.0005	0.000013	0.0016	0.00136	-0.0001
14-Dec-12	91															
21-Dec-12	92	-0.002	0.846	-0.00004	1.07	-0.000005	0.089	0.0268	-3	-0.000002	-0.0002	-0.0005	0.000007	0.00143	0.00039	-0.0001
28-Dec-12	93															
4-Jan-13	94	-0.002	1.06	-0.00004	1.25	-0.000005	0.158	0.0331	-3	-0.000002	-0.0002	0.00056	0.000008	0.00158	0.00109	-0.0001
11-Jan-13	95															
18-Jan-13	96	0.0028	0.903	-0.00004	1.18	-0.000005	0.101	0.0293	-3	-0.000002	-0.0002	-0.0005	0.000008	0.00132	0.00051	-0.0001
25-Jan-13	97															
1-Feb-13	98	0.0026	0.89	-0.00004	0.961	-0.000005	0.109	0.0256	-3	-0.000002	-0.0002	-0.0005	0.000008	0.00154	0.00043	-0.0001
8-Feb-13	99															
15-Feb-13	100	-0.002	0.911	-0.00004	1.04	-0.000005	0.129	0.0269	-3	-0.000002	-0.0002	-0.0005	0.000006	0.00128	0.00023	-0.0001
22-Feb-13	101															
1-Mar-13	102	-0.002	0.918	-0.00004	1.12	-0.000005	0.107	0.0274	-3	-0.000002	0.00078	0.00073	0.000006	0.00136	0.00044	-0.0001
8-Mar-13	103															
15-Mar-13	104	0.0031	0.934	0.000044	1.09	-0.000005	0.101	0.0265	-3	-0.000002	-0.0002	0.00094	0.000006	0.00144	0.00042	-0.0001
22-Mar-13	105															
29-Mar-13	106	-0.002	0.923	-0.00004	1.01	-0.000005	0.137	0.027	-3	-0.000002	-0.0002	-0.0005	0.000006	0.0014	0.00042	-0.0001
5-Apr-13	107															
12-Apr-13	108	-0.002	0.87	-0.00004	0.897	-0.000005	0.077	0.0257	-3	-0.000002	-0.0002	0.00139	0.000006	0.00166	0.00057	-0.0001
19-Apr-13	109															
26-Apr-13	110	-0.002	0.863	-0.00004	0.824	0.000005	0.096	0.0264	-3	-0.000002	-0.0002	0.00059	0.000007	0.00104	0.00024	-0.0001
3-May-13	111															
10-May-13	112	-0.002	0.895	-0.00004	1.01	-0.000005	0.108	0.0269	-3	-0.000002	-0.0002	-0.0005	0.000006	0.00142	0.00034	-0.0001
17-May-13	113															
24-May-13	114															

HC 13

CONFIDENTIAL *DRAFT*

Sample =
09SWC419 15-18

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L
18-Mar-11	0	500	360	7.69	201	#N/A	3.2	68.2	3	1.8	0.2	88.7	0.0356	-0.00002	0.00022	0.152	-0.00001	-0.000005	-0.05	0.00001	25.4	-0.0001	0.000035	0.00078	0.002	0.000014	0.0018	6.11	0.00947	-0.01
25-Mar-11	1	500	525	7.78	111																									
1-Apr-11	2	500	525	7.81	74	#N/A	4.8	45.2	4	0.8	0.28	31.7	0.0336	-0.00002	0.0003	0.0486	-0.00001	-0.000005	-0.05	-0.000005	9.39	0.0001	0.000015	0.0006	0.007	-0.000005	0.0008	2.01	0.00733	-0.01
8-Apr-11	3	500	43	7.75	60																									
15-Apr-11	4	500	440	7.74	61	#N/A	2.1	36.4	3	-0.5	0.23	26.5	0.0264	-0.00002	0.00018	0.0398	-0.00001	-0.000005	-0.05	-0.000005	7.76	-0.0001	0.000013	0.00064	0.011	-0.000005	0.0006	1.74	0.00654	-0.01
22-Apr-11	5	500	420	7.73	65																									
29-Apr-11	6	500	430	7.67	59	#N/A	3.0	38.1	5	-0.5	0.17	27.4	0.031	-0.00002	0.00026	0.0355	-0.00001	-0.000005	-0.05	-0.000005	8.04	-0.0001	0.000012	0.00018	0.011	0.000006	0.0006	1.79	0.00667	-0.01
6-May-11	7	500	430	7.59	58																									
13-May-11	8	500	430	7.52	74	#N/A	3.1	30.2	4	-0.5	0.13	25.1	0.0401	-0.00002	0.00023	0.0282	-0.00001	-0.000005	-0.05	-0.000005	7.44	-0.0001	0.000009	0.00038	0.012	0.000009	-0.0005	1.58	0.00621	-0.01
20-May-11	9	500	450	7.76	51																									
27-May-11	10	500	450	7.76	54	#N/A	4.8	31.7	-2	-0.5	0.12	24.6	0.025	-0.00002	0.00023	0.0322	-0.00001	-0.000005	-0.05	-0.000005	7.19	-0.0001	0.000007	0.0003	0.006	-0.000005	-0.0005	1.62	0.00681	-0.01
3-Jun-11	11	500	465	7.53	55																									
10-Jun-11	12	500	465	7.71	59	#N/A	2.0	36.6	3	0.6	0.1	26.1	0.0275	-0.00002	0.00035	0.0351	-0.00001	-0.000005	-0.05	0.000009	7.82	0.0001	0.000007	0.00037	0.006	-0.000005	-0.0005	1.6	0.00622	-0.01
17-Jun-11	13	500	475	7.49	56																									
24-Jun-11	14	500	455	7.88	56	#N/A	1.8	35.4	-2	-0.5	0.09	27.9	0.0314	-0.00002	0.00017	0.0334	-0.00001	-0.000005	-0.05	0.000005	8.03	-0.0001	-0.000005	0.0004	0.009	-0.000005	-0.0005	1.9	0.00527	-0.01
1-Jul-11	15	500	455	7.90	59																									
8-Jul-11	16	500	460	7.61	57	#N/A	2.6	34.1	-2	0.6	0.07	25	0.0252	-0.00002	0.0002	0.032	-0.00001	-0.000005	-0.05	-0.000005	7.24	-0.0001	0.000009	0.00018	0.005	0.000006	0.0005	1.67	0.0054	-0.01
15-Jul-11	17	500	445	7.67	55																									
22-Jul-11	18	500	475	7.74	53	#N/A	3.3	31.1	-2	0.7	0.07	24.5	0.0329	-0.00002	0.00014	0.0343	-0.00001	-0.000005	-0.05	-0.000005	6.93	0.0005	0.000009	0.00075	0.009	0.000017	-0.0005	1.75	0.00475	-0.01
29-Jul-11	19	500	455	7.76	53																									
5-Aug-11	20	500	460	7.67	64	#N/A	3.5	37.8	-2	-0.5	0.07	30.4	0.029	-0.00002	0.00019	0.0347	-0.00001	-0.000005	-0.05	-0.000005	8.81	0.0001	0.00001	0.00023	0.009	-0.000005	-0.0005	2.04	0.00598	-0.01
12-Aug-11	21	500	450	7.85	59																									
19-Aug-11	22	500	465	7.65	61	#N/A	3.6	38.3	2	0.6	0.06	27.8	0.0308	-0.00002	0.00017	0.0346	-0.00001	-0.000005	-0.05	-0.000005	8.15	0.0001	0.000007	0.00039	0.01	0.000028	-0.0005	1.82	0.00619	-0.01
26-Aug-11	23	500	460	7.64	59																									
2-Sep-11	24	500	450	7.80	60	#N/A	4.0	38.8	-2	0.6	0.06	27	0.0295	-0.00002	0.00017	0.035	-0.00001	-0.000005	-0.05	-0.000005	7.9	0.0001	0.00001	0.00027	0.008	0.000005	-0.0005	1.78	0.00589	-0.01
9-Sep-11	25	500	465	7.76	59																									
16-Sep-11	26	500	445	7.59	61	#N/A	4.1	37.3	-2	0.9	0.05	29	0.0303	0.00002	#N/A	0.034	-0.00001	-0.000005	-0.05	0.000008	8.6	-0.0001	0.000007	0.00012	0.007	0.000036	-0.0005	1.84	0.00563	-0.01
23-Sep-11	27	500	450	7.60	53																									
30-Sep-11	28	500	455	7.66	58	#N/A	3.0	36.9	-2	-0.5	0.05	27.8	0.0241	-0.00002	0.00014	0.0347	-0.00001	-0.000005	-0.05	-0.000005	8.26	-0.0001	0.00001	0.00019	0.005	0.00001	-0.0005	1.74	0.00702	-0.01
7-Oct-11	29	500	455	7.65	57																									
14-Oct-11	30	500	450	7.54	51	#N/A	3.3	32.0	-2	-0.5	0.04	25.2	0.028	-0.00002	0.0001	0.0297	-0.00001	-0.000005	-0.05	-0.000005	7.36	-0.0001	-0.000005	0.00013	0.004	-0.000005	-0.0005	1.65	0.00734	-0.01
21-Oct-11	31	500	460	7.73	58																									
28-Oct-11	32	500	455	7.67	59	#N/A	3.3	36.9	-2	-0.5	0.03	31.1	0.0312	-0.00002	0.00011	0.0349	-0.00001	-0.000005	-0.05	-0.000005	9.36	-0.0001	0.000008	0.00016	0.005	0.000022	-0.0005	1.88	0.009	-0.01
4-Nov-11	33	500	455	7.69	56																									
11-Nov-11	34	500	465	7.84	56	#N/A	4.9	36.4	2	-0.5	0.033	27.9	0.0197	-0.00002	0.00011	0.0326	-0.00001	-0.000005	-0.05	0.000007	8.19	-0.0001	0.000008	0.00047	0.003	0.000019	-0.0005	1.81	0.00639	-0.01
18-Nov-11	35	500	465	7.67	56																									
25-Nov-11	36	500	480	7.76	56	#N/A	3.3	36.6	-2	-0.5	0.029	28.2	0.024	-0.00002	0.00009	0.0317	-0.00001	-0.000005	-0.05	-0.000005	8.45	-0.0001	0.000011	0.00037	0.005	0.000005	-0.0005	1.74	0.00556	-0.01
2-Dec-11	37	500	465	7.68	59																									
9-Dec-11	38	500	440	7.63	55	#N/A	3.9	34.4	-2	-0.5	0.027	26.6	0.0292	-0.00002	0.00008	0.0304	-0.00001	-0.000005	-0.05	-0.000005	7.8	-0.0001	-0.000005	0.00076	0.007	0.000011	-0.0005	1.73	0.00636	-0.01
16-Dec-11	39	500	465	7.77	58																									
23-Dec-11	40	500	450	7.73	54	#N/A	4.2	36.7	2	-0.5	0.03	26.6	0.0393	-0.00002	0.00006	0.033	-0.00001	-0.000005	-0.05	-0.000005	7.78	-0.0001	0.000011	0.00013	0.006	0.00002	-0.0005	1.74	0.00585	-0.01
30-Dec-11	41	500	460	7.78	56																									
6-Jan-12	42	500	480	7.53	58	#N/A	3.3	42.3	2	-0.5	0.033	28.8	0.0271	-0.00002	0.00008	0.0363	-0.00001	-0.000005	-0.05	-0.000005	8.33	-0.0001	-0.000005	0.00017	0.004	0.000006	-0.0005	1.94	0.00612	-0.01
13-Jan-12	43	500	465	7.64	52																									
20-Jan-12	44	500	465	7.71	58	#N/A	2.7	43.0	-2	-0.5	0.029	25.2	0.0192	-0.00002	0.00006	0.0324	-0.00001	-0.000005	-0.05	-0.000005	7.47	-0.0001	0.000005	0.00025	0.004	0.000011	-0.0005	1.59	0.00466	-0.01
27-Jan-12	45	500	465	7.55	50																									
3-Feb-12	46	500	465	7.65	53	#N/A	5.1	38.3	2	-0.5	0.029	26	0.0219	-0.00002	0.00008	0.0278	-0.00001	-0.000005	-0.05	-0.000005	7.63	-0.0001	-0.000005	0.0002	0.004	-0.000005	-0.0005	1.68	0.00476	-0.01
10-Feb-12	47	500	445	7.67	55																									
17-Feb-12	48	500	455	7.63	54	#N/A	2.7	34.3	2	-0.5	0.027	26.2	0.0206	-0.00002	0.00012	0.0296	-0.00001	-0.000005	-0.05	-0.000005	7.81	-0.0001	0.000006	0.00027	0.003	-0.000005	-0.0005	1.62	0.00509	-0.01
24-Feb-12	49	500	450	7.57	56																									
2-Mar-12	50	500	455	7.62	55	#N/A	7.1	36.5	2	-0.5	0.024	26.4	0.0206	-0.00002	0.00012	0.0307	-0.00001	-0.000005	-0.05	0.000011	7.83	-0.0001	0.000009	0.00128	0.004	#N/A	-0.0005	1.65	0.00478	-0.01
9-Mar-12	51	500	470	7.67	55																									
16-Mar-12	52	500	465	7.66	58	#N/A	2.8	35.8	2	-0.5	0.026	26.5	0.0217	-0.00002	0.00004	0.0286	-0.00001	-0.000005	-0.05	-0.000005	7.97	#N/A	0.000007	0.00045	0.004	0.000015	-0.0005	1.6	0.00392	-0.01
23-Mar-12	53	500	460	7.61	59																									
30-Mar-12	54	500	490	7.49	59	#N/A	3.9	37.3	3	-0.5	0.028	28.1	0.0161	-0.00002	-0.00002	0.0317	-0.00001	-0.000005	-0.05	-0.000005	8.39	-0.0001	0.000007	0.00024	0.003	0.000027	-0.0005	1.74	0.00355	-0.01
6-Apr-12	55	500	450	7.69	59																									
13-Apr-12	56	500	460	7.72	56	#N/A	2.5	35.2	2	-0.5	0.022	27.2	0.0228	-0.00002	0.00005	0.0307	-0.00001	-0.000005	-0.05	-0.000005	8.24	-0.0001	0.000006	0.00022	0.004	-0.000005	-0.0005	1.62	0.00439	-0.01
20-Apr-12	57	500	445	7.70	54																									
27-Apr-12	58	500	460	7.71	55	#N/A	3.8	35.7	2	-0.5	0.024	23.8	0.0246	-0.00002	0.000093	0.0284	-0.00001	-0.000005	-0.05	0.000006	7.16	-0.0001	-0.000005	0.00046	0.0047	0.000011	-0.0005	1.44	0.00384	-0.01
4-May-12	59	500	450	7.75	52																									
11-May-12	60	500	470	7.68	54	#N/A	3.1	33.5	3	-0.5	0.031	27.6	0.0312	-0.00002	0.000197	0.029	-0.00001	-0.000005	-0.05	-0.000005	8.55	0.00012	0.000012	0.000241	0.0078	0.000011	-0.0005	1.51	0.00666	-0.01
18-May-12	61	500	455	7.61	53																									
25-May-12	62	500	470	7.55	53	#N/A	3.6	32.3	2	-0.5	0.022	24.5	0.0358	-0.00002	0.000081	0.0282	-0.00001	-0.000005	-0.05	-0.000005	7.38	0.00055	-0.000005	0.000287	0.0089	0.0000616	-0.0005	1.48	0.00438	-0.01
1-Jun-12	63	500	515	7.59	53																									
8-Jun-12	64	500	465	7.62	51	#N/A	3.2	31.8	2	0.69	0.018	23.5	0.0221	-0.00002	0.000036	0.0252	-0.00001	-0.000005	-0.05	-0.000005	7.13	0.00016	0.0000085	0.000979	0.0127	0.0000169	-0.0005	1.39	0.00456	-0.01
15-Jun-12	65	500	480	7.59	52																									

HC 13

Sample =
09SWC419 15-18

Date	Cycle No.	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	0.00088	0.0002	-0.002	6.25	0.0001	1.47	-0.000005	3.46	0.149	-10	0.000003	0.00004	-0.0005	0.000049	-0.0002	0.0018	-0.0001
25-Mar-11	1																	
1-Apr-11	2	0.00083	0.0001	-0.002	2.41	0.00007	1.89	-0.000005	1.61	0.0554	-10	-0.000002	0.00049	-0.0005	0.000054	0.001	0.0002	-0.0001
8-Apr-11	3																	
15-Apr-11	4	0.00108	0.0001	-0.002	2.14	0.00004	1.7	-0.000005	1.22	0.0519	-10	-0.000002	0.00033	-0.0005	0.000053	0.0011	0.0004	-0.0001
22-Apr-11	5																	
29-Apr-11	6	0.00084	0.00009	-0.002	2.12	-0.00004	1.72	-0.000005	0.88	0.0492	-10	-0.000002	0.00021	-0.0005	0.000055	0.001	0.0001	-0.0001
6-May-11	7																	
13-May-11	8	0.00057	0.0001	-0.002	1.64	-0.00004	1.39	-0.000005	0.58	0.0423	-10	-0.000002	0.00013	-0.0005	0.000046	0.0011	0.0001	-0.0001
20-May-11	9																	
27-May-11	10	0.00057	0.00002	-0.002	1.53	-0.00004	1.51	-0.000005	0.49	0.0456	-10	-0.000002	0.00012	-0.0005	0.000047	0.001	-0.0001	-0.0001
3-Jun-11	11																	
10-Jun-11	12	0.00066	0.00003	-0.002	1.47	-0.00004	1.47	-0.000005	0.37	0.0524	-10	-0.000002	0.00013	-0.0005	0.000051	0.001	0.0002	-0.0001
17-Jun-11	13																	
24-Jun-11	14	0.00048	-0.00002	-0.002	1.71	-0.00004	1.57	-0.000005	0.35	0.0483	-10	-0.000002	0.00005	0.0007	0.000046	0.0011	0.0001	-0.0001
1-Jul-11	15																	
8-Jul-11	16	0.00043	0.00007	-0.002	1.35	-0.00004	1.38	-0.000005	0.29	0.0466	-10	-0.000002	0.00004	-0.0005	0.00005	0.0009	0.0004	-0.0001
15-Jul-11	17																	
22-Jul-11	18	0.00038	#N/A	-0.002	1.38	-0.00004	1.28	-0.000005	0.33	0.0451	-10	-0.000002	0.00003	-0.0005	0.000036	0.0009	0.0009	-0.0001
29-Jul-11	19																	
5-Aug-11	20	0.00034	0.00012	-0.002	1.53	-0.00004	1.41	-0.000005	0.28	0.0533	-10	-0.000002	0.00004	-0.0005	0.000055	0.001	0.0003	-0.0001
12-Aug-11	21																	
19-Aug-11	22	0.00032	0.00015	-0.002	1.48	-0.00004	1.3	-0.000005	0.35	0.0515	-10	-0.000002	0.00001	-0.0005	0.000055	0.0012	0.0001	-0.0001
26-Aug-11	23																	
2-Sep-11	24	0.00031	0.00003	-0.002	1.43	-0.00004	1.28	-0.000005	0.22	0.052	-10	-0.000002	0.00004	-0.0005	0.000048	0.0009	0.0002	-0.0001
9-Sep-11	25																	
16-Sep-11	26	0.00029	0.00004	-0.002	1.43	0.00005	1.27	-0.000005	0.23	0.0522	-10	0.000006	0.00003	-0.0005	0.000065	0.0011	0.001	-0.0001
23-Sep-11	27																	
30-Sep-11	28	0.00019	-0.00002	-0.002	1.39	-0.00004	1.13	-0.000005	0.18	0.0508	-10	-0.000002	0.00008	-0.0005	0.00005	0.0006	-0.0001	-0.0001
7-Oct-11	29																	
14-Oct-11	30	0.00021	-0.00002	-0.002	1.31	-0.00004	1.01	-0.000005	0.17	0.0445	-10	-0.000002	0.00001	-0.0005	0.000049	0.0009	0.0003	-0.0001
21-Oct-11	31																	
28-Oct-11	32	0.00015	0.00002	-0.002	1.41	-0.00004	1.15	-0.000005	0.18	0.0544	-10	-0.000002	0.00028	-0.0005	0.000045	0.0008	0.0003	-0.0001
4-Nov-11	33																	
11-Nov-11	34	0.00017	0.00019	-0.002	1.33	-0.00004	1.08	-0.000005	0.21	0.05	-10	0.000003	0.00014	-0.0005	0.000039	0.0007	0.0005	-0.0001
18-Nov-11	35																	
25-Nov-11	36	0.00016	0.00014	-0.002	1.28	-0.00004	0.972	-0.000005	0.19	0.0474	-10	-0.000002	0.00013	-0.0005	0.00004	0.0008	0.0002	-0.0001
2-Dec-11	37																	
9-Dec-11	38	0.00015	0.00017	-0.002	1.26	-0.00004	0.849	-0.000005	0.16	0.0468	-10	-0.000002	0.00013	-0.0005	0.000043	0.0007	0.0003	-0.0001
16-Dec-11	39																	
23-Dec-11	40	0.0001	0.00005	-0.002	1.35	-0.00004	0.907	-0.000005	0.14	0.0459	-10	-0.000002	-0.00001	-0.0005	0.000041	0.0006	0.0003	-0.0001
30-Dec-11	41																	
6-Jan-12	42	0.00014	-0.00002	-0.002	1.42	-0.00004	0.966	-0.000005	0.15	0.0539	-10	-0.000002	0.00008	-0.0005	0.00004	0.0008	0.0002	-0.0001
13-Jan-12	43																	
20-Jan-12	44	0.00013	0.00017	-0.002	1.17	-0.00004	0.827	-0.000005	0.16	0.048	-10	-0.000002	-0.0002	-0.0005	0.000036	0.0006	0.0005	-0.0001
27-Jan-12	45																	
3-Feb-12	46	0.00026	0.00002	-0.002	1.18	-0.00004	0.875	-0.000005	0.13	0.0437	-10	-0.000002	-0.0002	-0.0005	0.000035	0.0006	-0.0001	-0.0001
10-Feb-12	47																	
17-Feb-12	48	0.00011	-0.00002	-0.002	1.25	-0.00004	0.861	-0.000005	0.14	0.045	-10	-0.000002	-0.0002	-0.0005	0.000052	0.001	0.0002	-0.0001
24-Feb-12	49																	
2-Mar-12	50	0.00009	0.00013	-0.002	1.19	-0.00004	0.825	-0.000005	0.15	0.0447	-10	-0.000002	0.0002	-0.0005	0.000038	0.0006	0.0005	-0.0001
9-Mar-12	51																	
16-Mar-12	52	0.00011	0.00011	-0.002	1.18	-0.00004	0.865	-0.000005	0.23	0.0449	-10	-0.000002	0.0002	-0.0005	0.00004	0.0006	0.0011	-0.0001
23-Mar-12	53																	
30-Mar-12	54	0.00009	0.00015	-0.002	1.2	-0.00004	0.886	-0.000005	0.15	0.0477	-10	-0.000002	-0.0002	-0.0005	0.000038	0.0005	0.0029	-0.0001
6-Apr-12	55																	
13-Apr-12	56	0.00011	-0.00002	-0.002	1.2	-0.00004	0.857	-0.000005	0.1	0.0452	-10	-0.000002	0.0005	-0.0005	0.000036	0.0005	0.0013	-0.0001
20-Apr-12	57																	
27-Apr-12	58	0.000081	0.000114	-0.002	1.14	-0.00004	0.745	-0.000005	0.139	0.0429	-10	0.000002	0.00055	-0.0005	0.000035	0.00111	0.00301	-0.0001
4-May-12	59																	
11-May-12	60	0.000101	0.000118	-0.002	1.19	-0.00004	0.866	-0.000005	0.131	0.0466	-10	-0.000002	0.00049	-0.0005	0.000031	0.00067	0.00097	-0.0001
18-May-12	61																	
25-May-12	62	0.000066	0.000065	-0.002	1.12	-0.00004	0.837	-0.000005	0.177	0.043	-10	0.0000021	-0.0002	0.00057	0.000033	0.00065	0.00041	-0.0001
1-Jun-12	63																	
8-Jun-12	64	0.000073	0.000151	0.0034	0.962	-0.00004	0.687	-0.000005	0.144	0.0397	-10	-0.000002	0.00028	-0.0005	0.0000296	0.00054	0.00049	-0.0001
15-Jun-12	65																	

HC 13

CONFIDENTIAL *DRAFT*

Sample =
09SWC419 15-18

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L
22-Jun-12	66	500	465	7.54	48	#N/A	4.3	32.1	3	-0.5	0.02	23.6	0.0334	-0.00002	0.00012	0.0275	-0.00001	-0.000005	-0.05	-0.000005	7.18	-0.0001	0.0000087	0.000194	0.007	-0.000005	-0.0005	1.38	0.00382	-0.01
29-Jun-12	67	500	465	7.56	47																									
6-Jul-12	68	500	465	7.61	50	#N/A	4.2	33.0	2	-0.5	0.023	23.5	0.0201	-0.00002	0.000071	0.0261	-0.00001	-0.000005	-0.05	-0.000005	7.25	-0.0001	0.0000076	0.000293	0.0038	0.0000411	-0.0005	1.32	0.00398	-0.01
13-Jul-12	69	500	450	7.60	44																									
20-Jul-12	70	500	475	7.57	50	#N/A	3.7	31.6	2	0.6	0.02	24.9	#N/A	-0.00002	0.000105	0.026	-0.00001	-0.000005	-0.05	-0.000005	7.64	-0.0001	-0.000005	0.000215	0.0041	-0.000005	-0.0005	1.42	0.004	-0.01
27-Jul-12	71	500	465	7.74	47																									
3-Aug-12	72	500	465	7.67	49	#N/A	3.1	31.6	2	-0.5	0.02	24.2	0.0166	-0.00002	0.000133	0.0266	-0.00001	-0.000005	-0.05	-0.000005	7.38	-0.0001	0.000009	0.000406	0.0032	0.000158	-0.0005	1.41	0.00346	-0.01
10-Aug-12	73	500	470	7.66	44																									
17-Aug-12	74	500	460	7.57	52	#N/A	3.8	32.2	2	-0.5	0.02	25.7	0.025	-0.00002	0.000065	0.028	-0.00001	-0.000005	-0.05	-0.000005	7.79	-0.0001	0.000006	0.000367	0.0069	0.000099	-0.0005	1.51	0.00398	-0.01
24-Aug-12	75	500	465	7.66	53																									
31-Aug-12	76	500	485	7.63	53	#N/A	3.7	34.3	2	-0.5	0.019	26	0.0295	-0.00002	0.000053	0.0279	-0.00001	-0.000005	-0.05	-0.000005	7.89	-0.0001	0.00001	0.000517	0.0067	0.000013	-0.0005	1.53	0.00369	-0.01
7-Sep-12	77	500	480	7.57	50																									
14-Sep-12	78	500	490	7.46	52	#N/A	3.4	32.6	2	-0.5	0.019	26.1	0.0179	-0.00002	0.000265	0.0277	-0.00001	-0.000005	-0.05	-0.000005	7.87	0.00013	0.000006	0.000269	0.0055	0.000032	-0.0005	1.56	0.00293	-0.01
21-Sep-12	79	500	510	7.59	58																									
28-Sep-12	80	500	470	7.53	50	#N/A	2.9	34.4	2	-0.5	0.02	24	0.0181	-0.00002	0.000053	0.0277	-0.00001	-0.000005	-0.05	-0.000005	7.28	0.00023	0.000007	0.00318	0.0039	0.00004	-0.0005	1.4	0.00279	-0.01
5-Oct-12	81	500	460	7.77	50																									
12-Oct-12	82	500	470	7.56	53	#N/A	5.3	35.0	2	-0.5	0.023	27	0.021	-0.00002	0.000064	0.0288	-0.00001	-0.000005	-0.05	-0.000005	8.24	-0.0001	-0.000005	0.00046	0.0046	0.000005	-0.0005	1.55	0.0032	-0.01
19-Oct-12	83	500	480	7.65	51																									
26-Oct-12	84	500	475	7.57	50	#N/A	3.0	33.2	2	-0.5	0.02	24.1	0.0165	-0.00002	0.000042	0.0258	-0.00001	-0.000005	-0.05	-0.000005	7.41	-0.0001	0.000005	0.000295	0.0038	0.000023	-0.0005	1.36	0.00249	-0.01
2-Nov-12	85	500	480	7.61	51																									
9-Nov-12	86	500	490	7.58	50	#N/A	4.9	36.5	3	-0.5	0.021	25.8	0.0124	-0.00002	0.000079	0.0279	-0.00001	-0.000005	-0.05	-0.000005	7.83	-0.0001	0.000008	0.000347	0.0022	0.000014	-0.0005	1.53	0.00301	-0.01
16-Nov-12	87	500	500	7.64	52																									
23-Nov-12	88	500	485	7.66	52	#N/A	3.7	32.9	3	-0.5	0.019	26.6	0.0184	-0.00002	0.000134	0.0253	-0.00001	-0.000005	-0.05	-0.000005	8.09	-0.0001	-0.000005	0.000341	0.005	0.000011	-0.0005	1.56	0.00265	-0.01
30-Nov-12	89	500	505	7.60	53																									
7-Dec-12	90	500	465	7.78	51	#N/A	6.0	36.6	2	-0.5	0.022	26.2	0.0334	-0.00002	0.000169	0.0274	-0.00001	-0.000005	-0.05	-0.000005	8.05	-0.0001	-0.000005	0.00041	0.0052	0.000005	-0.0005	1.49	0.00312	-0.01
14-Dec-12	91	500	485	7.83	46																									
21-Dec-12	92	500	470	7.64	58	#N/A	3.7	37.9	-2	-0.5	0.022	27	0.0248	-0.00002	0.000096	0.0284	-0.00001	-0.000005	-0.05	0.000008	8.45	-0.0001	0.000008	0.000105	0.0067	0.000381	-0.0005	1.43	0.00362	-0.01
28-Dec-12	93	500	465	7.61	60																									
4-Jan-13	94	500	485	7.76	51	#N/A	4.8	36.3	-2	0.69	0.023	26.1	0.0353	-0.00002	0.000108	0.0294	-0.00001	-0.000005	-0.05	-0.000005	8	#N/A	0.000009	0.000244	0.0042	0.000044	-0.0005	1.49	0.00318	-0.01
11-Jan-13	95	500	485	7.62	49																									
18-Jan-13	96	500	455	7.65	52	#N/A	2.7	35.6	-2	-0.5	0.018	25.5	0.0233	-0.00002	0.000063	0.0267	-0.00001	-0.000005	-0.05	-0.000005	7.67	-0.0001	0.000007	0.000137	0.0071	0.000016	-0.0005	1.54	0.00338	-0.01
25-Jan-13	97	500	470	7.52	55																									
1-Feb-13	98	500	435	7.80	50	#N/A	3.3	32.3	2	0.52	0.026	23.8	0.0226	-0.00002	0.000172	0.0238	-0.00001	-0.000005	-0.05	0.000005	7.18	-0.0001	-0.000005	0.000154	0.0046	0.000013	-0.0005	1.41	0.00258	-0.01
8-Feb-13	99	500	455	7.86	49																									
15-Feb-13	100	500	455	7.60	51	#N/A	3.0	30.3	2	-0.5	0.02	23.5	0.0206	-0.00002	0.000096	0.0243	-0.00001	-0.000005	-0.05	-0.000005	7.05	-0.0001	0.000006	0.000076	0.0036	-0.000005	-0.0005	1.43	0.00315	-0.01
22-Feb-13	101	500	440	7.88	50																									
1-Mar-13	102	500	450	7.73	49	#N/A	5.4	33.4	3	0.59	0.016	23	0.0258	-0.00002	0.000057	0.0239	-0.00001	-0.000005	-0.05	-0.000005	6.92	-0.0001	-0.000005	-0.00005	0.0054	-0.000005	-0.0005	1.38	0.00294	-0.01
8-Mar-13	103	500	450	7.58	39																									
15-Mar-13	104	500	445	7.64	48	#N/A	5.4	30.0	2	-0.5	0.015	23.1	0.021	-0.00002	0.000097	0.0246	-0.00001	-0.000005	-0.05	0.000009	7.01	-0.0001	0.000005	0.000202	0.0034	0.00002	-0.0005	1.37	0.00319	-0.01
22-Mar-13	105	500	455	7.78	45																									
29-Mar-13	106	500	450	7.66	49	#N/A	3.5	28.9	2	0.69	0.017	24.9	0.0191	-0.00002	0.000053	0.0256	-0.00001	-0.000005	-0.05	-0.000005	7.69	0.00011	0.000005	0.00138	0.0047	0.000076	-0.0005	1.37	0.00355	-0.01
5-Apr-13	107	500	440	7.73	47																									
12-Apr-13	108	500	450	7.75	50	#N/A	6.0	31.2	2	-0.5	0.017	21.8	0.0221	-0.00002	0.000073	0.0242	-0.00001	-0.000005	-0.05	-0.000005	6.57	-0.0001	0.000005	0.00141	0.005	0.000018	-0.0005	1.3	0.00297	-0.01
19-Apr-13	109	500	450	7.80	51																									
26-Apr-13	110	500	445	7.62	49	#N/A	3.5	28.0	2	-0.5	0.018	22.6	0.0293	-0.00002	0.000073	0.0262	-0.00001	-0.000005	-0.05	-0.000005	6.88	-0.0001	-0.000005	0.000111	0.0074	-0.000005	-0.0005	1.31	0.00375	-0.01
3-May-13	111	500	435	7.68	50																									
10-May-13	112	500	420	7.36	54	#N/A	4.3	30.5	2	-0.5	0.017	23.8	0.0231	-0.00002	0.000258	0.0225	-0.00001	-0.000005	-0.05	-0.000005	7.26	-0.0001	-0.000005	0.000106	0.0043	-0.000005	-0.0005	1.36	0.00395	-0.01
17-May-13	113	500	450	7.89	54																									
24-May-13	114	500	430	7.66	50	#N/A	4.4	30.5	2																					

Sept 16/11 As=0.00146, repeat=0.00166. Data confirmed, suspect contamination
Jul 22/11 Ni=0.00028, repeat=0.00028. data confirmed, suspect contamination
Mar 16/12 Cr=0.0009, repeat=0.0009. Data confirmed, suspect contamination
Mar 2/12 Pb=0.000266, repeat=0.00026. Data confirmed, suspect contamination
Apr 27/12 Ni=0.000144, repeat=0.000114. Data accepted
Jul 20/12 Al=0.0577, Zn=0.00254. Repeat Al=0.0606, Zn=0.00221. Data confirmed, suspect contamination or analytical error
Jan 4/13 Cr=0.00139, repeat=0.00139. Data confirmed, suspect contamination
Sept 28/12 Ni=0.000571, repeat confirms original result, suspect contamination
Dec 7/12 Zn=0.00462, repeat=0.00089, Data accepted

HC 13

Sample =
09SWC419 15-18

Date	Cycle No.	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
22-Jun-12	66	0.000095	0.000035	-0.002	1	-0.00004	0.764	-0.000005	0.095	0.0409	-10	-0.000002	-0.0002	-0.0005	0.0000281	0.00063	0.00029	-0.0001
29-Jun-12	67																	
6-Jul-12	68	0.000071	-0.00002	-0.002	0.99	-0.00004	0.752	-0.000005	0.118	0.0383	-10	-0.000002	0.00027	-0.0005	0.0000265	0.00071	0.00115	-0.0001
13-Jul-12	69																	
20-Jul-12	70	0.000065	0.000074	-0.002	0.975	-0.00004	0.801	-0.000005	0.105	0.0422	-10	-0.000002	-0.0002	-0.0005	0.0000305	0.00077	#N/A	-0.0001
27-Jul-12	71																	
3-Aug-12	72	-0.00005	0.000099	-0.002	1.09	-0.00004	0.699	-0.000005	0.125	0.0412	-10	0.000002	-0.0002	-0.0005	0.000027	0.00054	0.00042	-0.0001
10-Aug-12	73																	
17-Aug-12	74	0.000078	0.000072	-0.002	1.16	-0.00004	0.673	-0.000005	0.129	0.0435	-10	0.000002	0.00074	-0.0005	0.000027	0.00058	0.001	-0.0001
24-Aug-12	75																	
31-Aug-12	76	0.000061	0.000079	-0.002	1.14	-0.00004	0.711	-0.000005	0.135	0.0446	-10	-0.000002	-0.0002	-0.0005	0.000031	0.00046	0.00027	-0.0001
7-Sep-12	77																	
14-Sep-12	78	0.000076	0.000084	-0.002	1.06	-0.00004	0.747	-0.000005	0.112	0.0425	-10	0.000002	-0.0002	-0.0005	0.000031	0.00049	0.00061	-0.0001
21-Sep-12	79																	
28-Sep-12	80	0.000056	#N/A	0.0026	0.992	-0.00004	0.671	-0.000005	0.126	0.0395	-10	0.000002	0.00047	-0.0005	0.000027	0.00051	0.00043	-0.0001
5-Oct-12	81																	
12-Oct-12	82	0.000058	-0.00002	-0.002	1.17	-0.00004	0.75	-0.000005	0.099	0.0441	-10	-0.000002	-0.0002	-0.0005	0.000029	0.00021	0.00018	-0.0001
19-Oct-12	83																	
26-Oct-12	84	-0.00005	0.000048	0.0056	1.02	-0.00004	0.663	-0.000005	0.077	0.0423	-10	-0.000002	-0.0002	-0.0005	0.000026	0.00045	0.00025	-0.0001
2-Nov-12	85																	
9-Nov-12	86	0.000085	0.00012	-0.002	1.1	-0.00004	0.703	-0.000005	0.151	0.042	-3	0.000002	0.00039	-0.0005	0.000028	0.00054	0.00051	-0.0001
16-Nov-12	87																	
23-Nov-12	88	0.000054	0.000109	-0.002	1.07	-0.00004	0.755	-0.000005	0.094	0.0401	-3	-0.000002	0.0004	-0.0005	0.000026	0.00045	0.00066	-0.0001
30-Nov-12	89																	
7-Dec-12	90	0.000077	0.000128	-0.002	1.07	-0.00004	0.662	-0.000005	0.097	0.0417	-3	-0.000002	-0.0002	-0.0005	0.000029	0.00073	0.00089	-0.0001
14-Dec-12	91																	
21-Dec-12	92	0.000058	0.000056	-0.002	1.06	-0.00004	0.676	-0.000005	0.086	0.0455	-3	0.000003	-0.0002	-0.0005	0.000029	0.00057	0.00089	-0.0001
28-Dec-12	93																	
4-Jan-13	94	0.00005	0.000107	-0.002	1.08	-0.00004	0.646	-0.000005	0.189	0.0432	-3	-0.000002	-0.0002	-0.0005	0.000022	0.00049	0.00073	-0.0001
11-Jan-13	95																	
18-Jan-13	96	0.000056	0.000082	-0.002	1.09	-0.00004	0.714	-0.000005	0.085	0.0407	-3	-0.000002	-0.0002	-0.0005	0.000033	0.00045	0.00018	-0.0001
25-Jan-13	97																	
1-Feb-13	98	0.000062	0.000027	-0.002	1.06	-0.00004	0.672	-0.000005	0.098	0.0389	-3	-0.000002	-0.0002	-0.0005	0.000026	0.00065	0.00055	-0.0001
8-Feb-13	99																	
15-Feb-13	100	0.000061	-0.00002	0.0021	1.12	-0.00004	0.607	-0.000005	0.096	0.0381	-3	-0.000002	-0.0002	-0.0005	0.000025	0.00055	0.00015	-0.0001
22-Feb-13	101																	
1-Mar-13	102	-0.00005	-0.00002	-0.002	1.07	-0.00004	0.657	-0.000005	0.083	0.0376	-3	-0.000002	-0.0002	-0.0005	0.000022	0.00055	0.00012	-0.0001
8-Mar-13	103																	
15-Mar-13	104	-0.00005	0.000022	-0.002	1.07	-0.00004	0.596	-0.000005	0.081	0.0375	-3	-0.000002	0.00022	-0.0005	0.000023	0.0004	0.00025	-0.0001
22-Mar-13	105																	
29-Mar-13	106	-0.00005	0.000024	-0.002	1.15	-0.00004	0.658	-0.000005	0.102	0.0398	-3	-0.000002	0.00096	-0.0005	0.000022	0.00049	0.00078	-0.0001
5-Apr-13	107																	
12-Apr-13	108	-0.00005	-0.00002	-0.002	1.04	-0.00004	0.544	-0.000005	0.075	0.0377	-3	-0.000002	-0.0002	0.00091	0.000023	0.00084	0.00095	-0.0001
19-Apr-13	109																	
26-Apr-13	110	-0.00005	-0.00002	-0.002	1.06	-0.00004	0.519	0.000008	0.093	0.0374	-3	-0.000002	-0.0002	-0.0005	0.000022	0.00033	0.0001	-0.0001
3-May-13	111																	
10-May-13	112	-0.00005	-0.00002	-0.002	1.07	-0.00004	0.552	-0.000005	0.104	0.0373	-3	0.000005	-0.0002	-0.0005	0.000021	0.00058	0.00015	-0.0001
17-May-13	113																	
24-May-13	114																	

HC 14

CONFIDENTIAL *DRAFT*

Sample = Blank

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L
18-Mar-11	0	500	480	7.23	-1	#N/A	2.0	1.9	3	-0.5	-0.01	-0.5	0.0014	-0.00002	-0.00002	0.00041	-0.00001	-0.000005	-0.05	-0.000005	0.1	-0.0001	-0.000005	0.00027	-0.001	0.000019	-0.0005	-0.05	0.00024	-0.01
25-Mar-11	1	500	525	7.95	2																									
1-Apr-11	2	500	475	7.92	-1	#N/A	3.1	2.6	-2	-0.5	0.02	-0.5	0.0015	-0.00002	-0.00002	0.00011	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.00071	-0.001	0.000036	-0.0005	-0.05	0.00013	-0.01
8-Apr-11	3	500	480	7.83	-1																									
15-Apr-11	4	500	475	6.49	-1	#N/A	1.9	1.7	-2	-0.5	0.01	-0.5	0.0019	-0.00002	-0.00002	0.00046	-0.00001	-0.000005	-0.05	-0.000005	0.06	-0.0001	0.000006	0.00206	-0.001	0.000011	-0.0005	-0.05	0.00025	-0.01
22-Apr-11	5	500	485	7.65	1																									
29-Apr-11	6	500	490	6.96	-1	#N/A	3.3	1.4	-2	-0.5	-0.01	-0.5	0.001	-0.00002	-0.00002	0.00015	-0.00001	-0.000005	-0.05	-0.000005	0.05	-0.0001	-0.000005	0.00108	-0.001	0.000013	-0.0005	-0.05	0.00017	-0.01
6-May-11	7	500	475	6.81	-1																									
13-May-11	8	500	465	6.61	-1	#N/A	2.4	1.6	-2	-0.5	0.01	-0.5	0.0012	-0.00002	0.00002	0.00006	-0.00001	-0.000005	-0.05	-0.000005	0.06	-0.0001	-0.000005	0.00031	-0.001	0.000006	-0.0005	-0.05	0.00009	-0.01
20-May-11	9	500	500	7.01	-1																									
27-May-11	10	500	505	7.64	-1	#N/A	3.8	2.4	-2	-0.5	-0.01	-0.5	0.0012	-0.00002	-0.00002	0.0042	-0.00001	-0.000005	-0.05	-0.000005	0.06	-0.0001	0.000009	0.00134	0.002	0.000027	-0.0005	-0.05	0.00019	-0.01
3-Jun-11	11	500	490	6.16	-1																									
10-Jun-11	12	500	510	6.00	1	#N/A	1.8	1.0	-2	0.6	-0.01	-0.5	0.0034	-0.00002	-0.00002	0.0003	-0.00001	-0.000005	-0.05	0.000009	-0.05	-0.0001	0.000021	0.00222	0.001	0.000028	-0.0005	-0.05	0.00023	-0.01
17-Jun-11	13	500	495	6.19	2																									
24-Jun-11	14	500	475	6.50	-1	#N/A	2.2	1.3	-2	-0.5	-0.01	-0.5	0.0007	-0.00002	-0.00002	0.00005	-0.00001	-0.000005	-0.05	-0.000005	0.05	-0.0001	-0.000005	0.00049	#N/A	-0.000005	-0.0005	-0.05	0.00015	-0.01
1-Jul-11	15	500	500	7.39	-1																									
8-Jul-11	16	500	480	6.47	-1	#N/A	2.1	1.0	-2	-0.5	0.02	-0.5	0.0014	-0.00002	-0.00002	0.00008	-0.00001	-0.000005	-0.05	-0.000005	0.05	-0.0001	-0.000005	0.00022	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.02
15-Jul-11	17	500	525	7.59	-1																									
22-Jul-11	18	500	525	7.06	-1	#N/A	2.6	1.0	-2	-0.5	-0.01	-0.5	0.0019	-0.00002	-0.00002	0.00036	-0.00001	-0.000005	-0.05	-0.000005	0.05	-0.0001	0.000012	0.0011	-0.001	0.000011	-0.0005	-0.05	0.0002	-0.01
29-Jul-11	19	500	525	7.04	-1																									
5-Aug-11	20	500	525	6.66	-1	#N/A	2.5	1.2	-2	-0.5	-0.01	-0.5	0.0012	-0.00002	-0.00002	0.00046	-0.00001	-0.000005	-0.05	-0.000005	0.07	0.0002	0.00002	0.00234	-0.001	0.000006	-0.0005	-0.05	0.00024	-0.01
12-Aug-11	21	500	495	7.87	-1																									
19-Aug-11	22	500	525	7.03	-1	#N/A	2.7	1.5	-2	0.8	-0.01	-0.5	0.0011	-0.00002	-0.00002	0.00018	-0.00001	-0.000005	-0.05	0.000005	-0.05	-0.0001	0.000011	0.00114	-0.001	-0.000005	-0.0005	-0.05	0.00007	-0.01
26-Aug-11	23	500	520	7.36	-1																									
2-Sep-11	24	500	490	7.54	-1	#N/A	2.6	2.9	-2	-0.5	-0.01	-0.5	0.0006	-0.00002	-0.00002	0.0001	-0.00001	-0.000005	-0.05	0.000008	-0.05	-0.0001	-0.000005	0.0005	-0.001	-0.000005	-0.0005	-0.05	0.00007	-0.01
9-Sep-11	25	500	525	7.40	-1																									
16-Sep-11	26	500	505	6.76	-1	#N/A	2.9	2.0	-2	0.8	-0.01	-0.5	0.0009	-0.00002	-0.00002	0.00007	-0.00001	-0.000005	-0.05	#N/A	-0.05	-0.0001	0.000007	0.0002	-0.001	-0.000005	-0.0005	-0.05	0.00009	-0.01
23-Sep-11	27	500	515	6.60	-1																									
30-Sep-11	28	500	505	6.27	-1	#N/A	2.3	1.5	-2	-0.5	-0.01	-0.5	0.0015	-0.00002	-0.00002	0.00003	-0.00001	-0.000005	-0.05	0.000014	-0.05	-0.0001	-0.000005	0.00019	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
7-Oct-11	29	500	505	7.16	-1																									
14-Oct-11	30	500	515	6.27	-1	#N/A	2.3	1.5	-2	-0.5	-0.01	-0.5	0.0006	-0.00002	-0.00002	0.00011	-0.00001	-0.000005	-0.05	0.000013	-0.05	-0.0001	-0.000005	0.00042	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
21-Oct-11	31	500	515	7.51	-1																									
28-Oct-11	32	500	480	6.58	-1	#N/A	3.0	1.7	-2	-0.5	-0.01	-0.5	0.0031	-0.00002	-0.00002	0.0001	-0.00001	-0.000005	-0.05	0.000006	-0.05	0.0002	-0.000005	0.00049	0.008	0.000013	-0.0005	-0.05	0.00007	-0.01
4-Nov-11	33	500	505	6.69	-1																									
11-Nov-11	34	500	520	7.90	-1	#N/A	3.2	3.1	-2	-0.5	0.01	-0.5	0.001	-0.00002	-0.00002	0.00011	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.00056	-0.001	0.000012	-0.0005	-0.05	0.00006	-0.01
18-Nov-11	35	500	510	6.88	-1																									
25-Nov-11	36	500	495	7.20	-1	#N/A	2.6	2.4	-2	-0.5	-0.01	-0.5	0.0019	-0.00002	-0.00002	0.00007	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.00035	0.004	0.000015	-0.0005	-0.05	0.00013	-0.01
2-Dec-11	37	500	505	7.13	-1																									
9-Dec-11	38	500	490	6.76	-1	#N/A	2.9	1.8	-2	-0.5	-0.01	-0.5	0.0014	-0.00002	-0.00002	0.0001	-0.00001	-0.000005	-0.05	-0.000005	-0.05	0.0005	-0.000005	0.00061	0.001	0.000026	-0.0005	-0.05	0.00008	-0.01
16-Dec-11	39	500	500	7.66	-1																									
23-Dec-11	40	500	495	7.10	-1	#N/A	3.3	2.3	-2	-0.5	-0.01	-0.5	0.0187	-0.00002	-0.00002	0.00118	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.0001	0.002	0.000024	-0.0005	-0.05	0.00007	-0.01
30-Dec-11	41	500	485	7.63	-1																									
6-Jan-12	42	500	495	6.10	-1	#N/A	2.8	1.3	-2	-0.5	-0.01	-0.5	0.0004	-0.00002	-0.00002	0.00007	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.00037	-0.001	0.000006	-0.0005	-0.05	-0.00005	-0.01
13-Jan-12	43	500	490	7.33	-1																									
20-Jan-12	44	500	505	6.64	1	#N/A	2.5	2.0	-2	-0.5	-0.01	-0.5	0.0009	-0.00002	-0.00002	0.0002	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.00029	0.001	0.000013	-0.0005	-0.05	-0.00005	-0.01
27-Jan-12	45	500	500	6.81	-1																									
3-Feb-12	46	500	510	7.48	-1	#N/A	3.9	2.4	-2	-0.5	-0.01	-0.5	0.0013	-0.00002	-0.00002	0.00004	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.00021	-0.001	0.000007	-0.0005	-0.05	-0.00005	-0.01
10-Feb-12	47	500	500	7.63	-1																									
17-Feb-12	48	500	495	6.54	-1	#N/A	2.2	1.6	-2	-0.5	-0.01	-0.5	0.0015	-0.00002	0.00003	0.00007	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.00042	0.001	0.000006	-0.0005	-0.05	0.00008	-0.01
24-Feb-12	49	500	480	6.68	-1																									
2-Mar-12	50	500	495	7.40	-1	#N/A	5.1	2.6	-2	-0.5	-0.01	-0.5	0.0023	-0.00002	-0.00002	0.00011	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.00024	-0.001	0.000005	-0.0005	-0.05	0.00006	-0.01
9-Mar-12	51	500	500	7.24	-1																									
16-Mar-12	52	500	500	6.51	-1	#N/A	2.7	1.4	-2	-0.5	-0.01	-0.5	0.001	-0.00002	-0.00002	0.00009	-0.00001	-0.000005	-0.05	-0.000005	-0.05	0.0004	-0.000005	0.0008	0.001	0.000011	-0.0005	-0.05	0.0004	-0.01
23-Mar-12	53	500	495	7.39	-1																									
30-Mar-12	54	500	500	6.03	-1	#N/A	2.8	1.4	-2	-0.5	-0.01	-0.5	0.001	-0.00002	-0.00002	0.00006	-0.00001	-0.000005	-0.05	-0.000005	-0.05	0.0001	-0.000005	0.00019	0.001	0.000006	-0.0005	-0.05	0.00007	-0.01
6-Apr-12	55	500	490	6.73	-1																									
13-Apr-12	56	500	500	6.52	-1	#N/A	2.3	1.7	-2	-0.5	-0.01	-0.5	0.0006	-0.00002	-0.00002	0.00008	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.0001	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
20-Apr-12	57	500	495	6.88	-1																									
27-Apr-12	58	500	500	5.89	-1	#N/A	3.2	2.4	-2	-0.5	-0.01	-0.5	0.00112	-0.00002	0.000024	0.000076	-0.00001	-0.000005	-0.05	-0.000005	-0.05	0.00014	0.000006	0.000609	-0.001	0.000021	-0.0005	-0.05	0.000075	-0.01
4-May-12	59	500	495	7.67	-1																									
11-May-12	60	500	500	6.81	-1	#N/A	3.0	1.9	-2	-0.5	-0.01	-0.5	0.00047	-0.00002	-0.00002	0.000056	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000133	-0.001	0.000014	-0.0005	-0.05	0.000111	-0.01
18-May-12	61	500	490	6.78	-1																									
25-May-12	62	500	510	6.38	-1	#N/A	2.5	1.6	-2	-0.5	-0.01	-0.5	0.00066	-0.00002	-0.00002	0.000068	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000435	0.0011	-0.000005	-0.0005	-0.05	0.000054	-0.01
1-Jun-12	63	500	525	6.84	-1																									
8-Jun-12	64	500	495	6.65	-1	#N/A	3.0	2.0	-2	-0.5	-0.01	-0.5	-0.0002	-0.00002	0.000024	0.00004	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	-0.00005	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
15-Jun-12	65	500	500	6.86	-1																									
22-Jun-12	66	500	485	6.61	-1	#N/A	3.5	2.1	-2	-0.5	-0.01	-0.5	0.00062	-0.00002	-0.00002	0.000085	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000146	-0.001	0.0000059	-0.0005	-0.05	0.000059	-0.01

HC 14

Sample = Blank

Date	Cycle No.	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Mar-11	0	0.00011	0.00014	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.06	0.00021	-10	-0.000002	0.00003	-0.0005	-0.000002	-0.0002	0.0018	-0.0001
25-Mar-11	1																	
1-Apr-11	2	-0.00005	0.0001	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	0.00009	-0.0005	-0.000002	-0.0002	0.0005	-0.0001
8-Apr-11	3																	
15-Apr-11	4	-0.00005	0.00011	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	0.00011	-10	-0.000002	0.00012	-0.0005	-0.000002	-0.0002	0.001	-0.0001
22-Apr-11	5																	
29-Apr-11	6	-0.00005	0.00008	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	0.0001	-10	-0.000002	0.00007	-0.0005	-0.000002	-0.0002	0.0006	-0.0001
6-May-11	7																	
13-May-11	8	-0.00005	0.00009	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	0.00009	-10	-0.000002	0.00005	-0.0005	-0.000002	-0.0002	0.0003	-0.0001
20-May-11	9																	
27-May-11	10	-0.00005	0.00021	-0.002	0.07	-0.00004	-0.1	-0.000005	0.08	0.00013	-10	-0.000002	0.00008	-0.0005	-0.000002	-0.0002	0.0012	-0.0001
3-Jun-11	11																	
10-Jun-11	12	0.0001	0.00006	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	0.00013	-10	-0.000002	0.00003	-0.0005	-0.000002	-0.0002	0.0013	-0.0001
17-Jun-11	13																	
24-Jun-11	14	-0.00005	0.00013	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.08	0.0001	-10	-0.000002	0.00001	-0.0005	-0.000002	-0.0002	-0.0001	-0.0001
1-Jul-11	15																	
8-Jul-11	16	-0.00005	0.00005	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	0.00006	-10	-0.000002	-0.00001	-0.0005	-0.000002	-0.0002	0.0002	-0.0001
15-Jul-11	17																	
22-Jul-11	18	-0.00005	0.00016	-0.002	-0.05	-0.00004	-0.1	0.000007	0.07	0.00015	-10	-0.000002	0.00002	-0.0005	-0.000002	-0.0002	0.0013	-0.0001
29-Jul-11	19																	
5-Aug-11	20	-0.00005	0.00015	-0.002	-0.05	-0.00004	-0.1	0.000008	0.06	0.00026	-10	-0.000002	0.00004	-0.0005	-0.000002	-0.0002	#N/A	-0.0001
12-Aug-11	21																	
19-Aug-11	22	-0.00005	0.00004	-0.002	-0.05	-0.00004	-0.1	0.000007	-0.05	0.0001	-10	-0.000002	-0.00001	-0.0005	-0.000002	0.0004	0.0009	-0.0001
26-Aug-11	23																	
2-Sep-11	24	-0.00005	0.00003	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	0.00002	-0.0005	-0.000002	-0.0002	0.0004	-0.0001
9-Sep-11	25																	
16-Sep-11	26	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	0.00001	-0.0005	-0.000002	-0.0002	0.0004	-0.0001
23-Sep-11	27																	
30-Sep-11	28	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	#N/A	-0.0005	-0.000002	-0.0002	0.0002	-0.0001
7-Oct-11	29																	
14-Oct-11	30	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	0.000006	0.05	-0.00005	-10	-0.000002	0.00001	-0.0005	-0.000002	-0.0002	0.0008	-0.0001
21-Oct-11	31																	
28-Oct-11	32	-0.00005	0.00005	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	0.00031	-0.0005	-0.000002	-0.0002	0.0003	-0.0001
4-Nov-11	33																	
11-Nov-11	34	-0.00005	0.0001	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.06	0.00008	-10	-0.000002	0.00012	-0.0005	-0.000002	-0.0002	0.0003	-0.0001
18-Nov-11	35																	
25-Nov-11	36	-0.00005	0.00012	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.06	0.00008	-10	-0.000002	0.00015	-0.0005	-0.000002	-0.0002	0.0004	-0.0001
2-Dec-11	37																	
9-Dec-11	38	-0.00005	0.00011	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.06	0.00009	-10	-0.000002	0.00012	-0.0005	-0.000002	-0.0002	0.0002	-0.0001
16-Dec-11	39																	
23-Dec-11	40	-0.00005	0.00005	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	0.00047	-10	-0.000002	-0.00001	-0.0005	-0.000002	-0.0002	0.0004	-0.0001
30-Dec-11	41																	
6-Jan-12	42	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	0.00014	-0.0005	-0.000002	-0.0002	0.0003	-0.0001
13-Jan-12	43																	
20-Jan-12	44	-0.00005	0.00016	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.08	0.00007	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.0006	-0.0001
27-Jan-12	45																	
3-Feb-12	46	-0.00005	0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.0002	-0.0001
10-Feb-12	47																	
17-Feb-12	48	-0.00005	0.00007	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	0.0003	0.0001	-0.0001
24-Feb-12	49																	
2-Mar-12	50	-0.00005	0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.0001	-0.0001
9-Mar-12	51																	
16-Mar-12	52	-0.00005	0.00017	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.14	0.00024	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.0006	-0.0001
23-Mar-12	53																	
30-Mar-12	54	-0.00005	0.00017	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.09	0.00007	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.0006	-0.0001
6-Apr-12	55																	
13-Apr-12	56	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.0001	-0.0001
20-Apr-12	57																	
27-Apr-12	58	-0.00005	#N/A	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.065	0.000069	-10	-0.000002	0.0003	-0.0005	-0.000002	0.00062	0.00094	-0.0001
4-May-12	59																	
11-May-12	60	-0.00005	0.00011	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	0.000087	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.0003	-0.0001
18-May-12	61																	
25-May-12	62	-0.00005	0.000122	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.072	0.000052	-10	-0.000002	0.00025	-0.0005	-0.000002	-0.0002	0.00043	-0.0001
1-Jun-12	63																	
8-Jun-12	64	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00012	-0.0001
15-Jun-12	65																	
22-Jun-12	66	-0.00005	0.000029	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00057	-0.0001

HC 14

CONFIDENTIAL *DRAFT*

Sample = Blank

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L
29-Jun-12	67	500	495	7.12	-1																									
6-Jul-12	68	500	490	6.71	-1	#N/A	3.8	2.2	-2	-0.5	-0.01	-0.5	0.00058	-0.00002	-0.00002	0.000046	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000289	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
13-Jul-12	69	500	500	6.98	-1																									
20-Jul-12	70	500	495	6.76	-1	#N/A	3.3	1.5	-2	-0.5	-0.01	-0.5	#N/A	-0.00002	-0.00002	0.000046	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000163	0.0011	-0.000005	-0.0005	-0.05	-0.00005	-0.01
27-Jul-12	71	500	490	7.79	-1																									
3-Aug-12	72	500	490	7.00	-1	#N/A	2.9	1.7	-2	-0.5	-0.01	-0.5	0.00096	-0.00002	-0.00002	0.00011	-0.00001	0.000007	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000832	0.0022	0.000059	-0.0005	-0.05	0.000133	-0.01
10-Aug-12	73	500	500	7.00	-1																									
17-Aug-12	74	500	500	6.54	-1	#N/A	3.5	2.3	-2	-0.5	-0.01	-0.5	0.0019	-0.00002	-0.00002	0.000139	-0.00001	-0.000005	-0.05	0.000006	-0.05	-0.0001	-0.000005	0.00197	0.0081	0.0034	-0.0005	-0.05	0.000118	-0.01
24-Aug-12	75	500	485	7.31	-1																									
31-Aug-12	76	500	500	6.95	-1	#N/A	3.3	2.4	-2	-0.5	-0.01	-0.5	0.00061	-0.00002	-0.00002	0.000047	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000575	0.0022	0.000006	-0.0005	-0.05	-0.00005	-0.01
7-Sep-12	77	500	470	6.67	-1																									
14-Sep-12	78	500	495	6.01	-1	#N/A	2.5	1.4	-2	-0.5	-0.01	-0.5	0.00044	-0.00002	-0.00002	0.000116	-0.00001	-0.000005	-0.05	-0.000005	-0.05	0.00069	-0.000005	0.000553	-0.001	0.000008	-0.0005	-0.05	-0.00005	-0.01
21-Sep-12	79	500	500	6.99	-1																									
28-Sep-12	80	500	490	6.13	-1	#N/A	1.8	1.7	-2	-0.5	-0.01	-0.5	0.00074	-0.00002	-0.00002	0.000529	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000442	0.0013	0.000008	-0.0005	-0.05	0.000053	-0.01
5-Oct-12	81	500	490	7.81	-1																									
12-Oct-12	82	500	515	6.82	-1	#N/A	3.5	1.7	-2	-0.5	-0.01	-0.5	0.00039	-0.00002	-0.00002	0.000078	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000542	-0.001	0.000005	-0.0005	-0.05	-0.00005	-0.01
19-Oct-12	83	500	505	7.23	-1																									
26-Oct-12	84	500	500	6.40	-1	#N/A	2.8	1.8	-2	-0.5	-0.01	-0.5	0.00044	-0.00002	-0.00002	0.000057	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000138	-0.001	0.000007	-0.0005	-0.05	-0.00005	-0.01
2-Nov-12	85	500	505	6.99	-1																									
9-Nov-12	86	500	510	7.17	-1	#N/A	3.9	2.4	-2	-0.5	-0.01	-0.5	0.00022	-0.00002	-0.00002	0.000088	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000063	-0.001	0.000006	-0.0005	-0.05	-0.00005	-0.01
16-Nov-12	87	500	495	6.72	-1																									
23-Nov-12	88	500	495	7.05	-1	#N/A	3.1	2.5	-2	-0.5	0.01	-0.5	0.00024	-0.00002	-0.00002	0.00107	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000346	-0.001	0.000012	-0.0005	-0.05	0.000097	-0.01
30-Nov-12	89	500	510	6.61	-1																									
7-Dec-12	90	500	490	7.77	-1	#N/A	3.9	3.2	-2	-0.5	-0.01	-0.5	-0.0002	-0.00002	-0.00002	0.000214	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000593	0.0024	0.000009	-0.0005	-0.05	0.000068	-0.01
14-Dec-12	91	500	500	8.06	-1																									
21-Dec-12	92	500	490	7.07	-1	#N/A	3.2	1.7	-2	-0.5	-0.01	-0.5	0.00249	-0.00002	-0.00002	0.000086	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	0.000011	0.000138	0.0022	0.000013	-0.0005	-0.05	0.000055	-0.01
28-Dec-12	93	500	485	7.12	-1																									
4-Jan-13	94	500	505	7.65	-1	#N/A	3.2	3.0	-2	0.6	0.019	-0.5	0.00038	-0.00002	-0.00002	0.000081	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000116	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
11-Jan-13	95	500	510	7.22	-1																									
18-Jan-13	96	500	485	7.04	-1	#N/A	2.0	1.7	-2	-0.5	-0.01	-0.5	0.00045	-0.00002	-0.00002	0.000039	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000091	-0.001	0.000007	-0.0005	-0.05	-0.00005	-0.01
25-Jan-13	97	500	490	7.13	-1																									
1-Feb-13	98	500	490	7.59	-1	#N/A	3.0	1.9	-2	-0.5	0.011	-0.5	0.0005	-0.00002	0.000024	0.000068	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000168	-0.001	0.000036	-0.0005	-0.05	-0.00005	-0.01
8-Feb-13	99	500	515	8.08	-1																									
15-Feb-13	100	500	505	6.52	-1	#N/A	2.7	2.0	-2	-0.5	-0.01	-0.5	0.00039	-0.00002	-0.00002	0.000032	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	-0.00005	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
22-Feb-13	101	500	485	7.98	-1																									
1-Mar-13	102	500	495	7.53	-1	#N/A	3.8	3.0	-2	-0.5	-0.01	-0.5	-0.0002	-0.00002	-0.00002	0.00003	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	-0.00005	-0.001	0.000006	-0.0005	-0.05	-0.00005	-0.01
8-Mar-13	103	500	490	7.13	-1																									
15-Mar-13	104	500	490	7.04	-1	#N/A	3.6	2.5	-2	-0.5	-0.01	-0.5	-0.0002	-0.00002	-0.00002	0.000048	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	-0.00005	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
22-Mar-13	105	500	495	7.64	-1																									
29-Mar-13	106	500	495	6.46	-1	#N/A	2.3	1.9	-2	-0.5	-0.01	-0.5	-0.0002	-0.00002	-0.00002	0.000028	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	-0.00005	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
5-Apr-13	107	500	490	7.53	-1																									
12-Apr-13	108	500	485	7.71	-1	#N/A	3.5	3.1	-2	-0.5	-0.01	-0.5	0.00023	-0.00002	0.000021	0.000025	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000162	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
19-Apr-13	109	500	495	7.75	-1																									
26-Apr-13	110	500	485	6.61	-1	#N/A	3.7	1.6	-2	-0.5	-0.01	-0.5	0.00077	-0.00002	-0.00002	0.000144	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	0.000095	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
3-May-13	111	500	500	7.56	-1																									
10-May-13	112	500	485	6.61	-1	#N/A	3.4	1.9	-2	-0.5	-0.01	-0.5	-0.0002	-0.00002	-0.00002	0.000031	-0.00001	-0.000005	-0.05	-0.000005	-0.05	-0.0001	-0.000005	-0.00005	-0.001	-0.000005	-0.0005	-0.05	-0.00005	-0.01
17-May-13	113	500	490	8.02	-1																									
24-May-13	114	500	495	6.76	-1	#N/A	3.6	1.6	-2																					

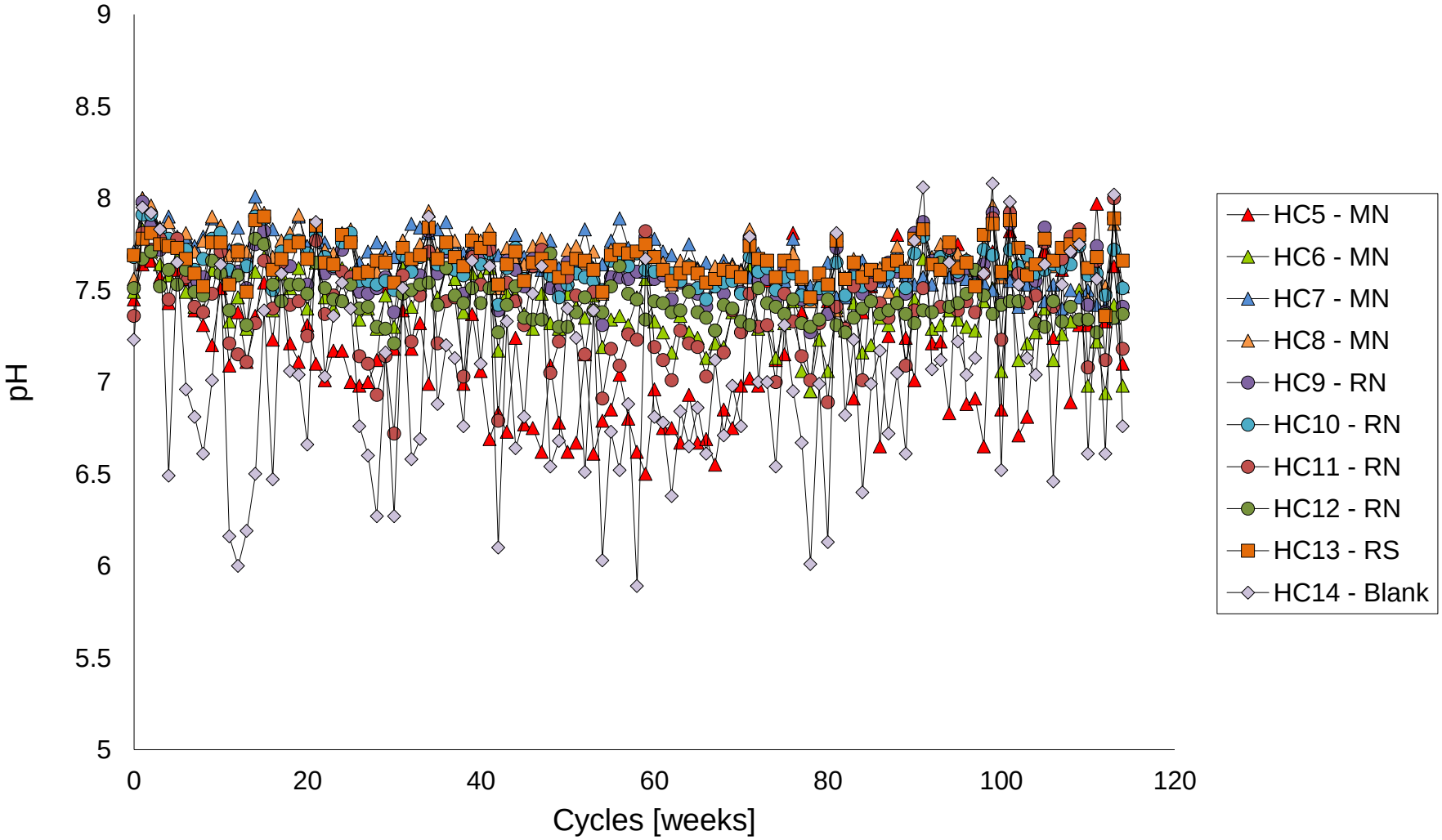
June 24/11 Fe 0.014, repeat =0.009, data confirmed suspect contamination
June 10/11 Cu 0.00222. Repeat =0.00224 data confirmed, keep result.
Sept 30/11 Sn=0.0006, repeat=0.0003. data confirmed, suspect contamination
Aug 5/11 Zn=0.0015, repeat=0.0015. Data confirmed, suspect contamination
Sept 16/11 Cd=0.000021, repeat=0.00002. data confirmed, suspect contamination
Sept 2/11 Hardness=-10, repeat= -0.5. data accepted
Apr 27/12 As=0.000047, Ni=0.000543 repeat Ni=0.000573. Data confirmed, suspect contamination. Repeat As=0.000024. data accepted
Aug 3/12 Cl=25, repeat=<0.5
Jul 20/12 Al=0.0227, repeat=0.0264. Data confirmed, suspect contamination or analytical error
Aug 17/12 Cu=0.00197, Pb=0.0034, Sn=0.00119. repeat Cu=0.00208, Pb=0.00337, Sn=0.00215. Data confirmed suspect contamination
Dec 7/12 Ni=0.00145, repeat= 0.000051, data accepted

HC 14

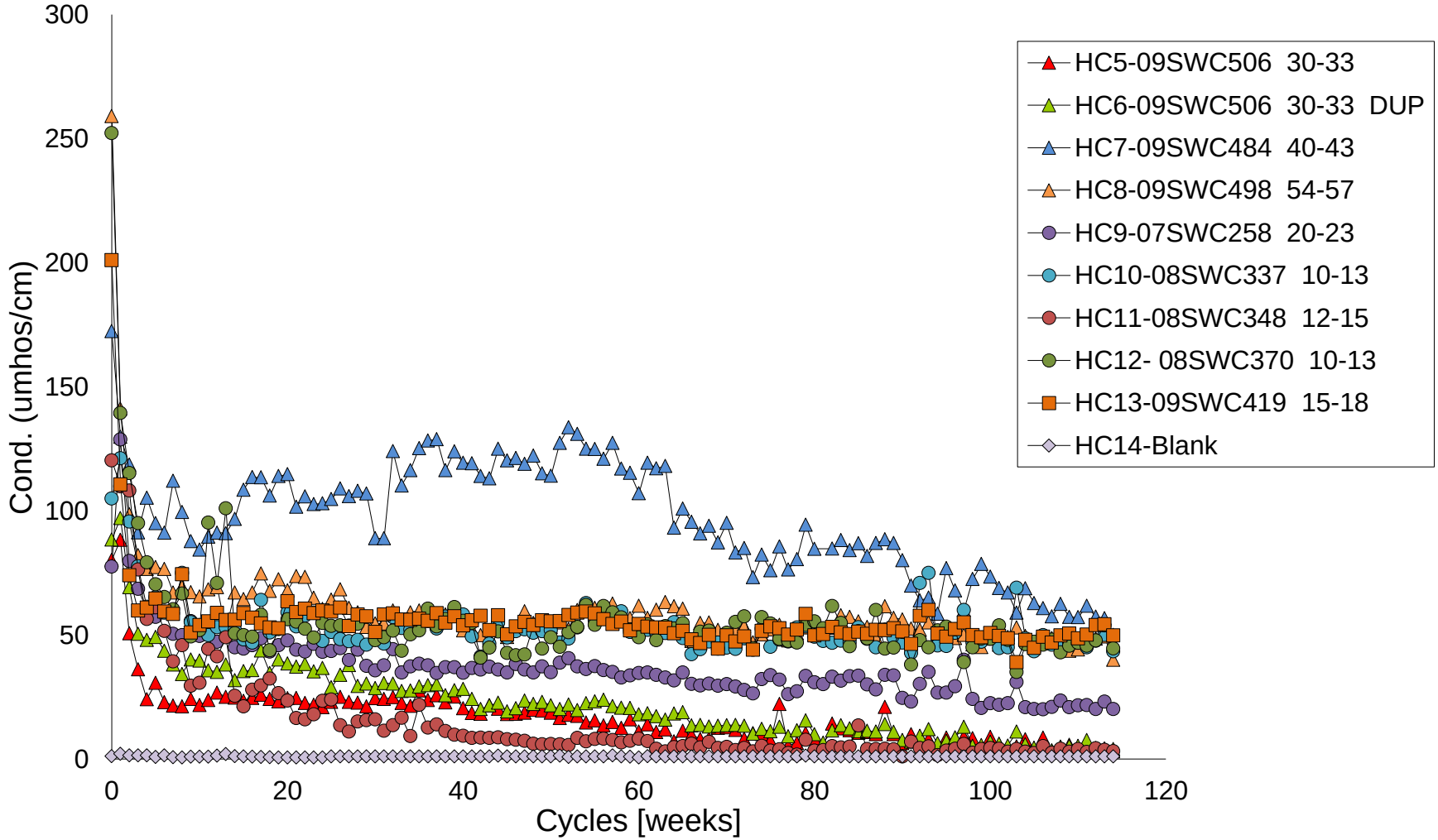
Sample = Blank

Date	Cycle No.	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Jun-12	67																	
6-Jul-12	68	-0.00005	0.000021	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	-0.0001	-0.0001
13-Jul-12	69																	
20-Jul-12	70	-0.00005	0.000133	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	0.00025	0.0011	-0.0001
27-Jul-12	71																	
3-Aug-12	72	-0.00005	0.000066	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.084	0.00013	-10	-0.000002	0.00022	-0.0005	-0.000002	-0.0002	0.0009	-0.0001
10-Aug-12	73																	
17-Aug-12	74	0.000065	0.000062	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.052	-0.00005	-10	-0.000002	0.00119	-0.0005	-0.000002	-0.0002	0.00142	-0.0001
24-Aug-12	75																	
31-Aug-12	76	-0.00005	0.000053	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.051	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00024	-0.0001
7-Sep-12	77																	
14-Sep-12	78	-0.00005	0.000063	0.0021	-0.05	-0.00004	-0.1	0.000005	0.069	0.000062	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00025	-0.0001
21-Sep-12	79																	
28-Sep-12	80	-0.00005	0.00006	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.055	0.000587	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00016	-0.0001
5-Oct-12	81																	
12-Oct-12	82	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00012	-0.0001
19-Oct-12	83																	
26-Oct-12	84	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-10	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00041	-0.0001
2-Nov-12	85																	
9-Nov-12	86	-0.00005	0.00003	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00047	-0.0001
16-Nov-12	87																	
23-Nov-12	88	-0.00005	0.000325	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	0.00006	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00162	-0.0001
30-Nov-12	89																	
7-Dec-12	90	-0.00005	0.000051	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00119	-0.0001
14-Dec-12	91																	
21-Dec-12	92	-0.00005	0.000031	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	0.00033	-0.0005	-0.000002	-0.0002	0.00087	-0.0001
28-Dec-12	93																	
4-Jan-13	94	-0.00005	0.000063	-0.002	-0.05	-0.00004	-0.1	-0.000005	0.062	0.000096	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00021	-0.0001
11-Jan-13	95																	
18-Jan-13	96	-0.00005	0.000076	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00052	-0.0001
25-Jan-13	97																	
1-Feb-13	98	-0.00005	0.000047	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00034	-0.0001
8-Feb-13	99																	
15-Feb-13	100	-0.00005	0.000063	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00033	-0.0001
22-Feb-13	101																	
1-Mar-13	102	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00022	-0.0001
8-Mar-13	103																	
15-Mar-13	104	-0.00005	0.000024	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00049	-0.0001
22-Mar-13	105																	
29-Mar-13	106	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00019	-0.0001
5-Apr-13	107																	
12-Apr-13	108	-0.00005	-0.00002	-0.002	-0.05	-0.00004	-0.1	0.000006	-0.05	-0.00005	-3	-0.000002	-0.0002	0.00064	-0.000002	0.00086	0.00013	-0.0001
19-Apr-13	109																	
26-Apr-13	110	-0.00005	0.000035	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.00039	-0.0001
3-May-13	111																	
10-May-13	112	-0.00005	0.000031	-0.002	-0.05	-0.00004	-0.1	-0.000005	-0.05	-0.00005	-3	-0.000002	-0.0002	-0.0005	-0.000002	-0.0002	0.0002	-0.0001
17-May-13	113																	
24-May-13	114																	

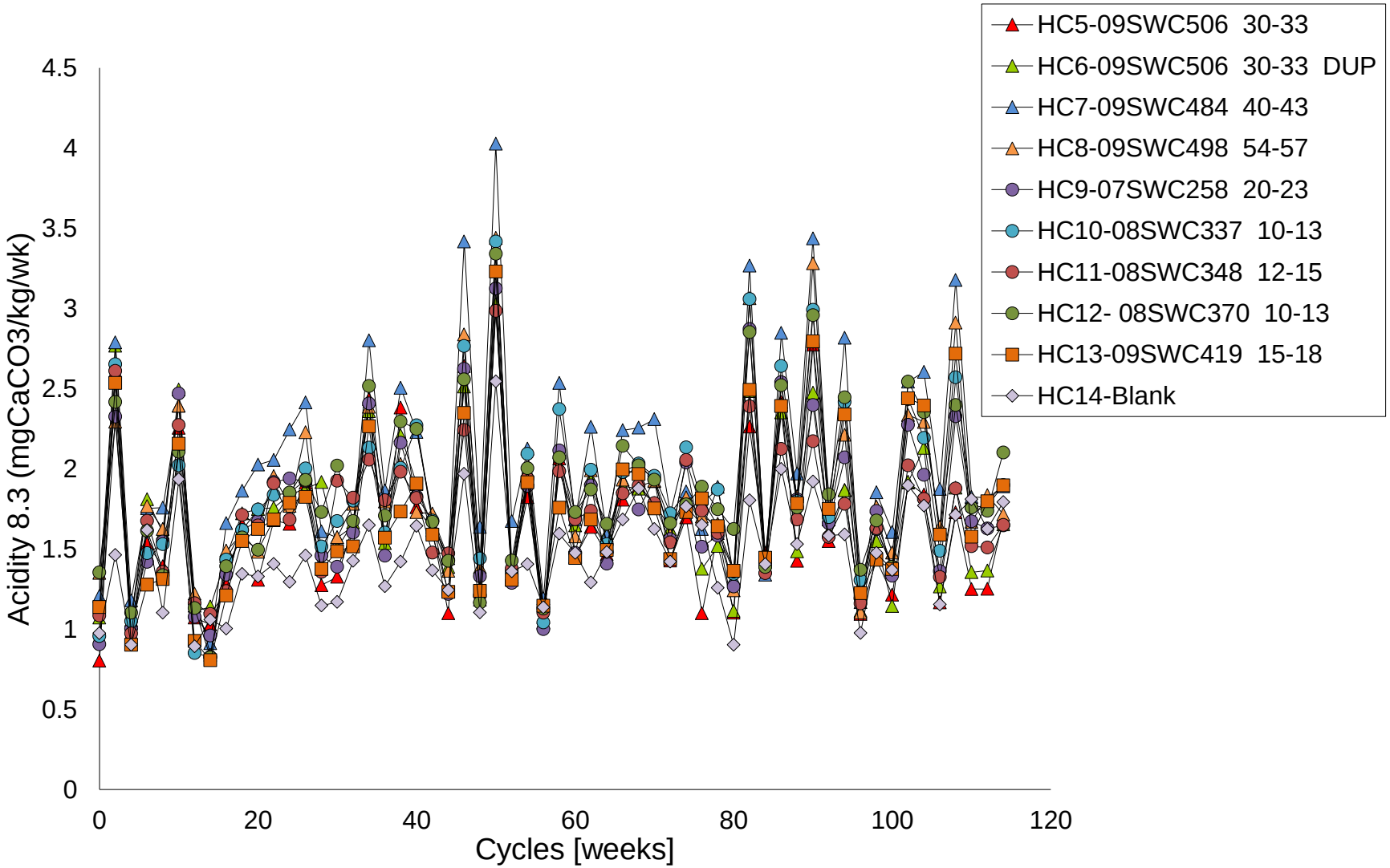
Appendix D5
Phase V/VI HCT Results: Charts- Release Rates



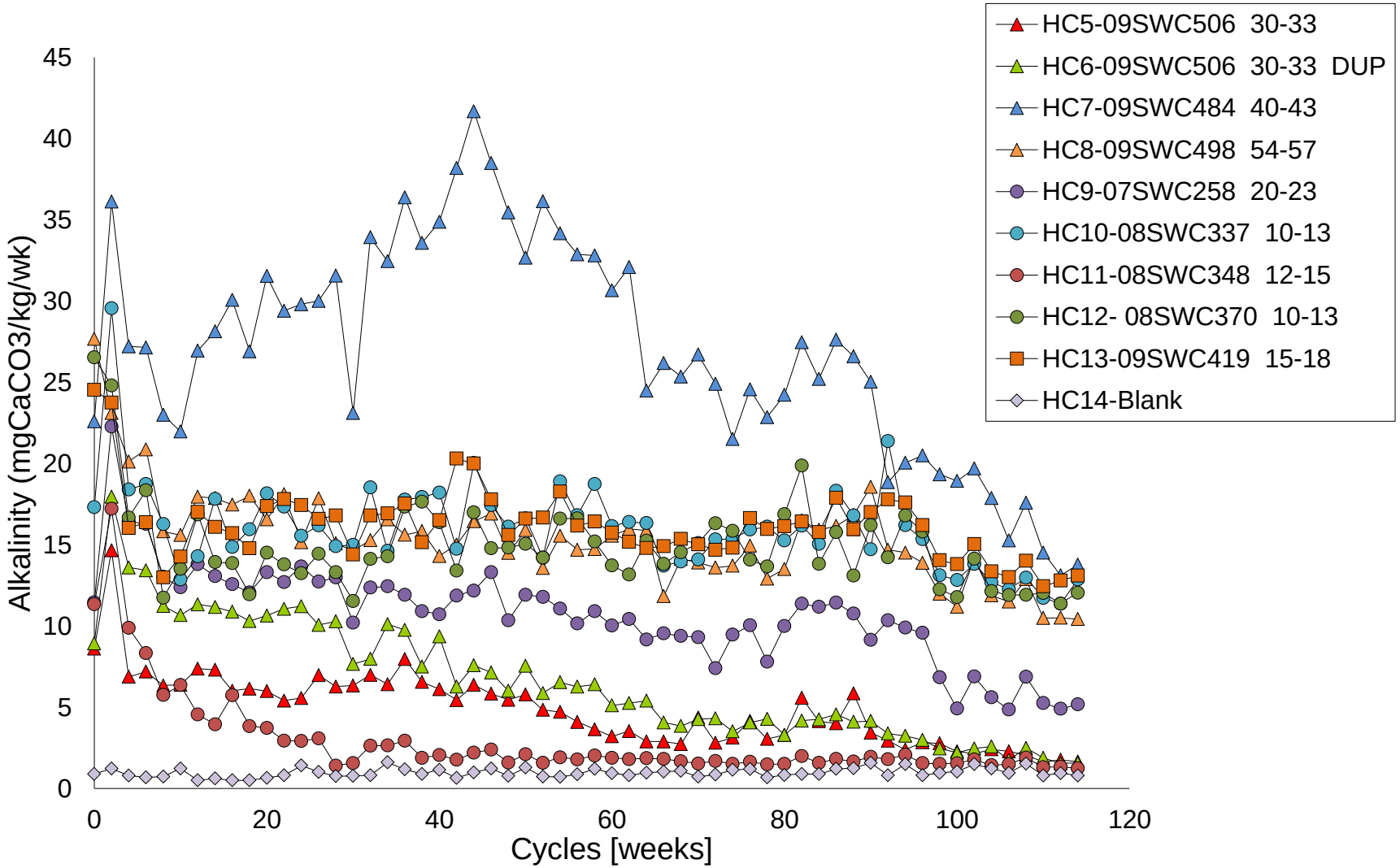
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



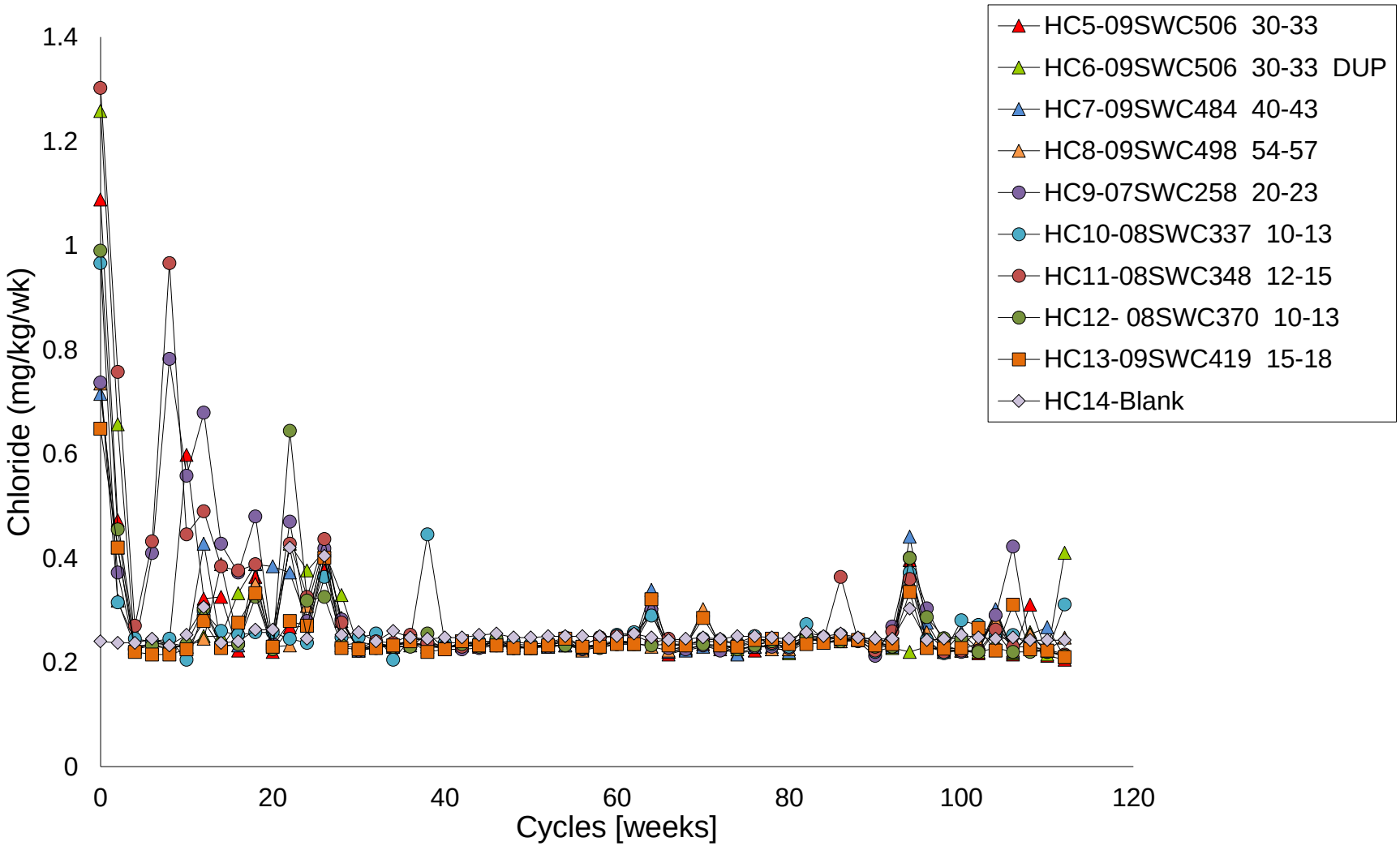
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



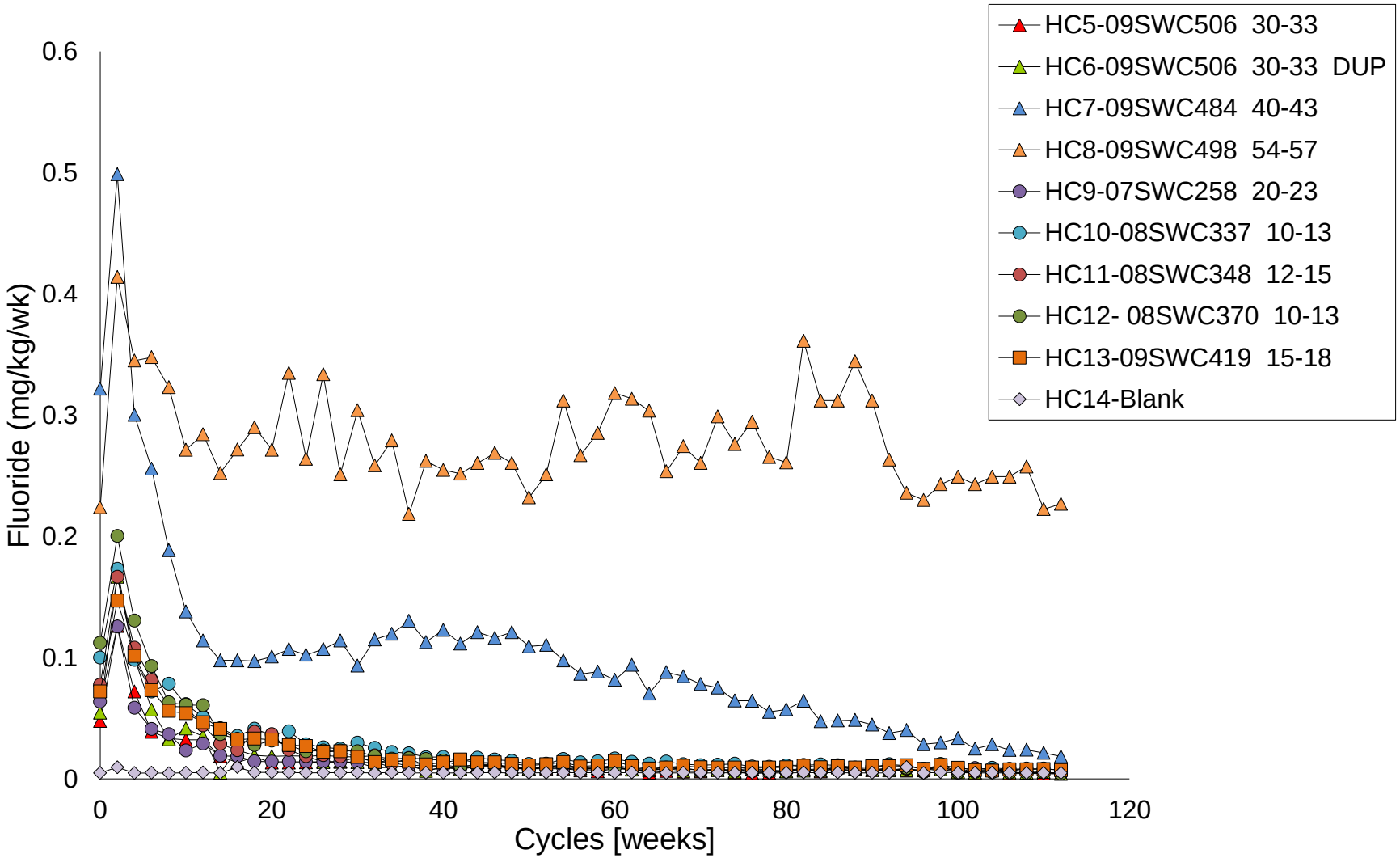
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



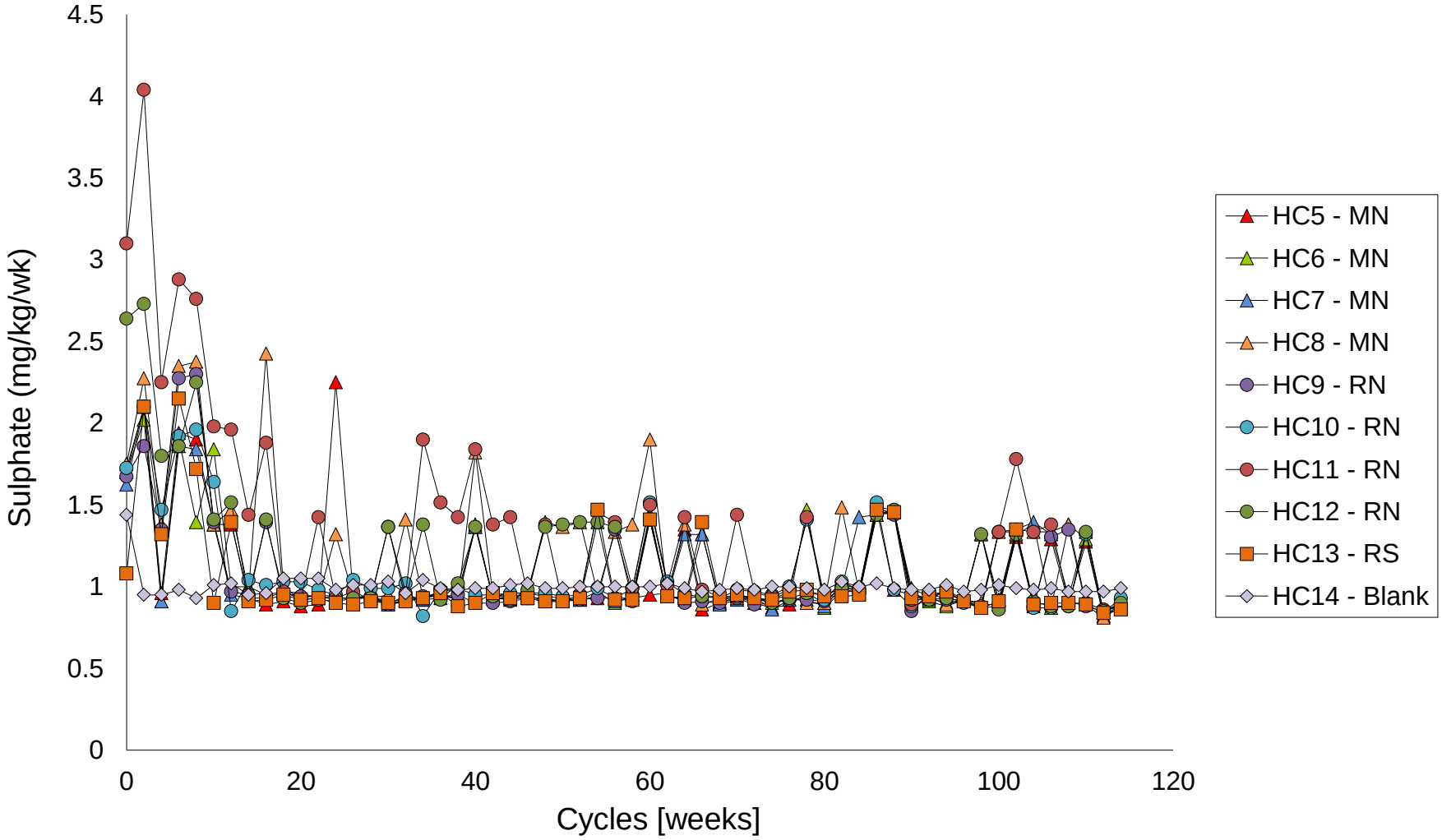
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



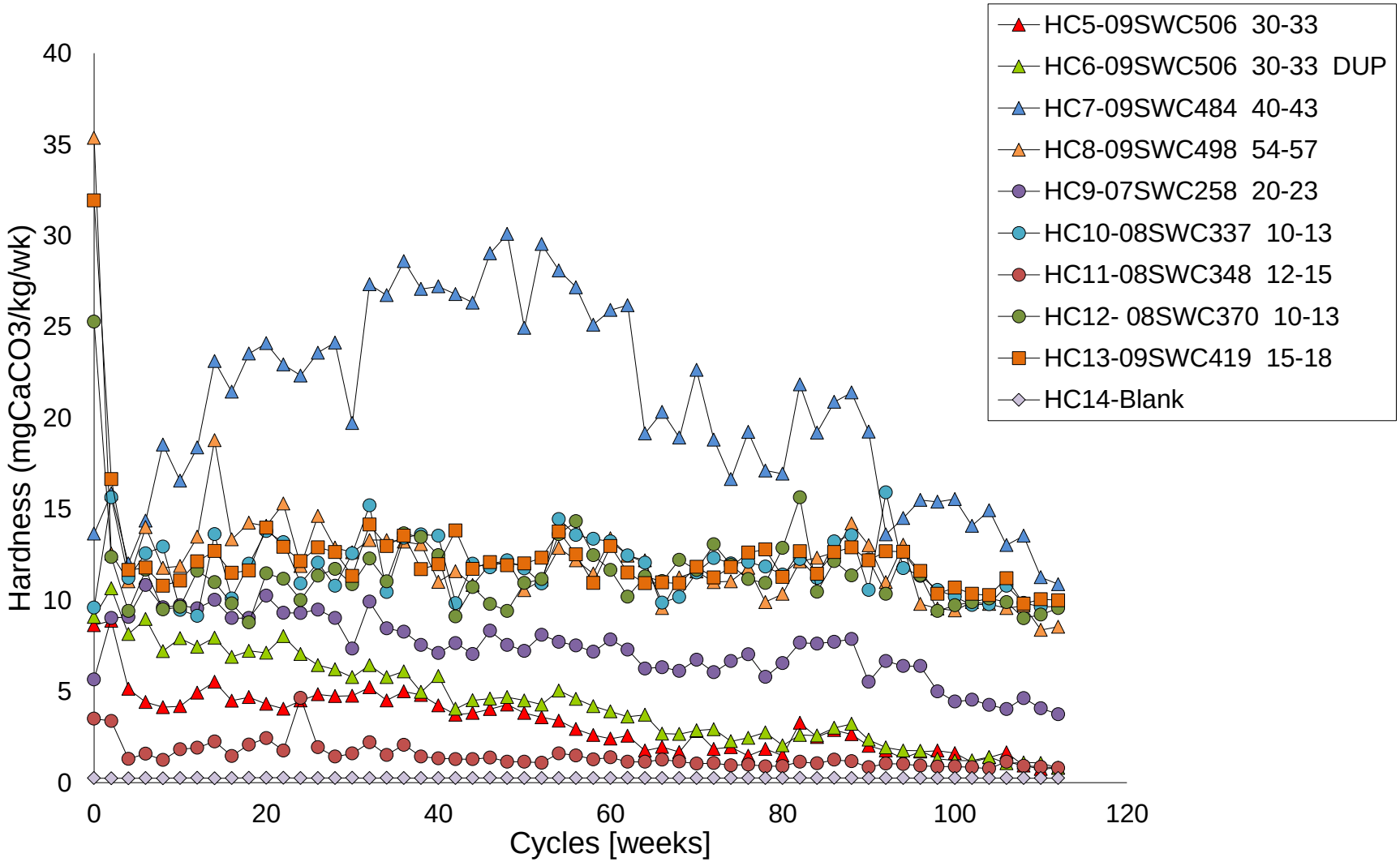
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



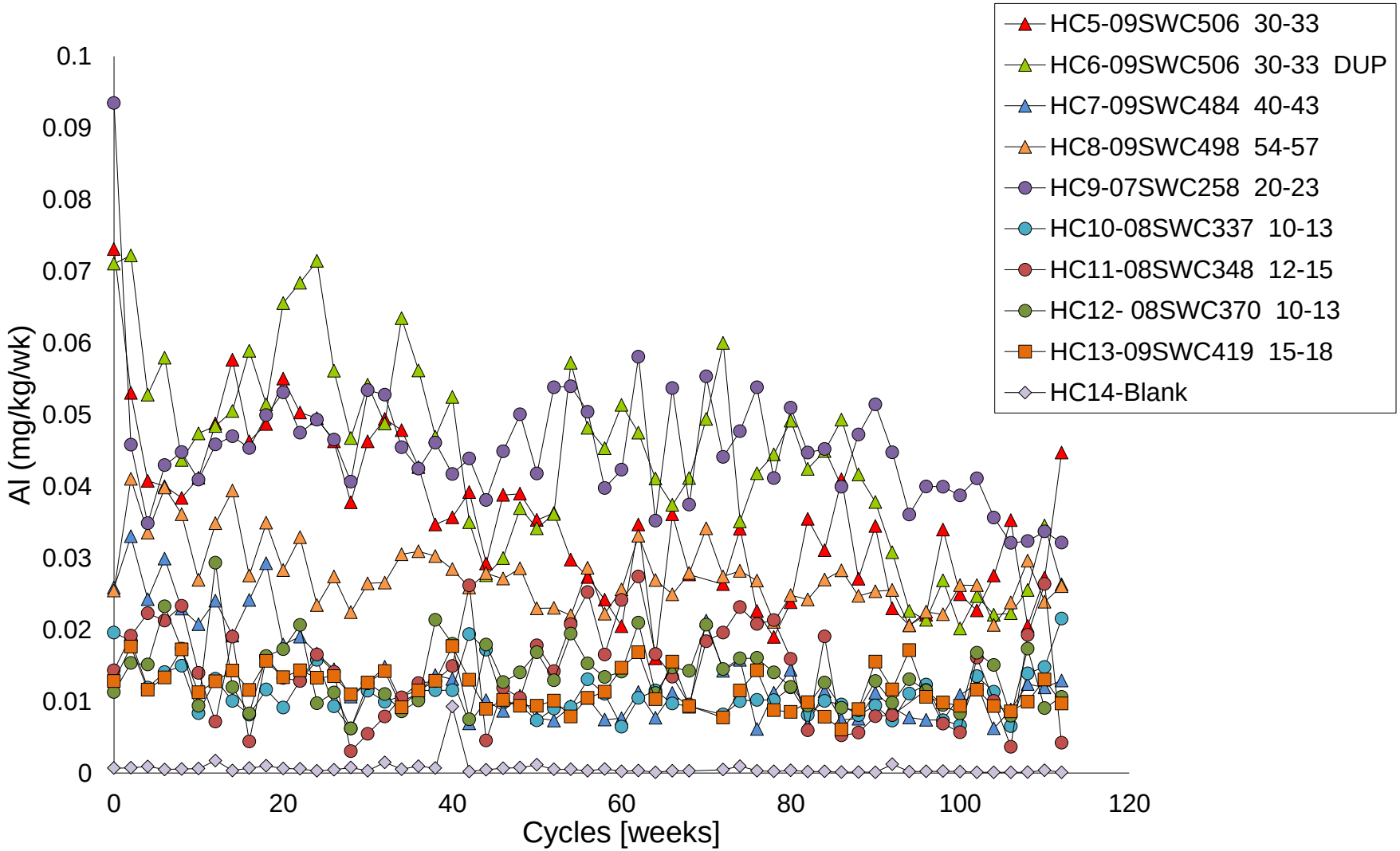
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



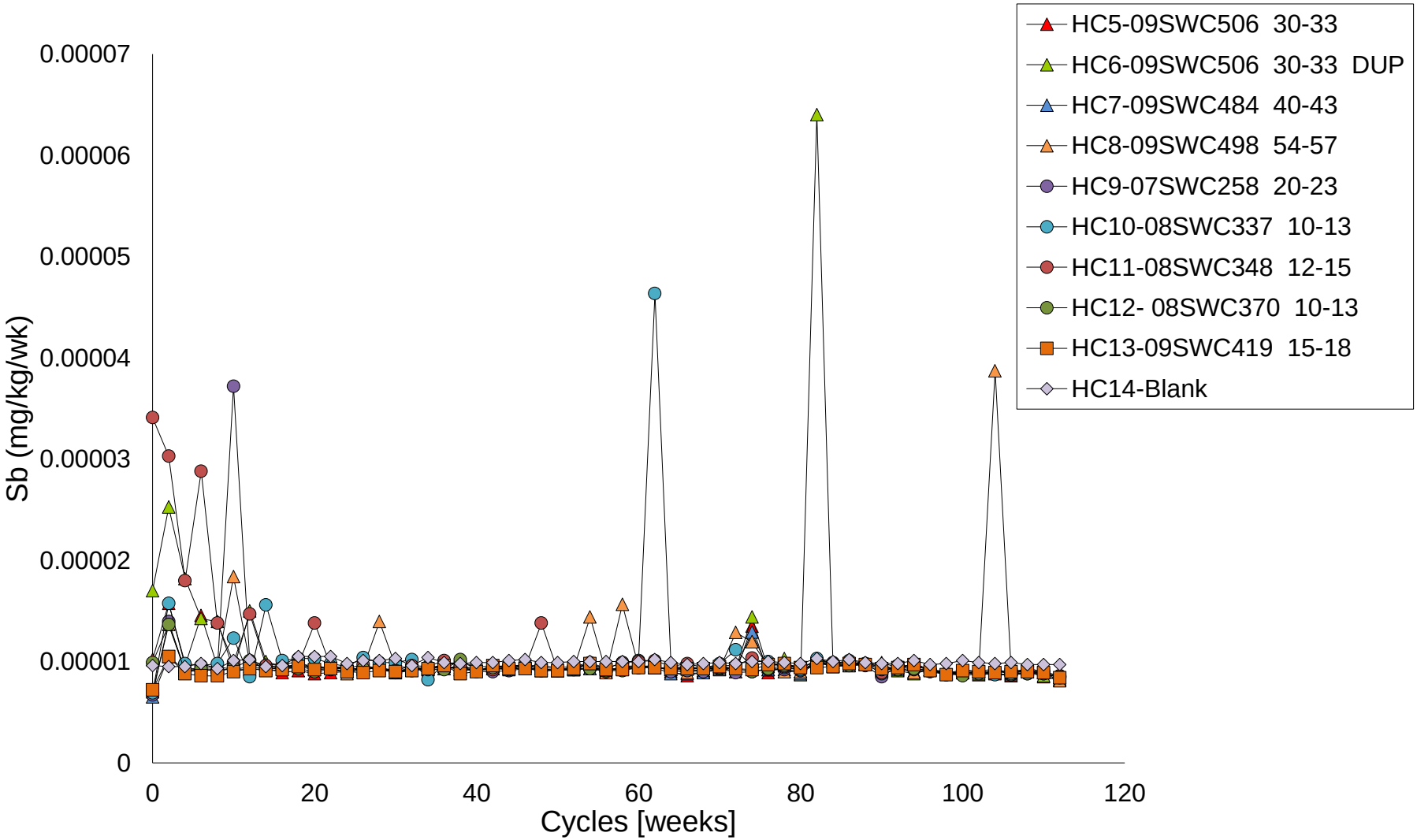
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



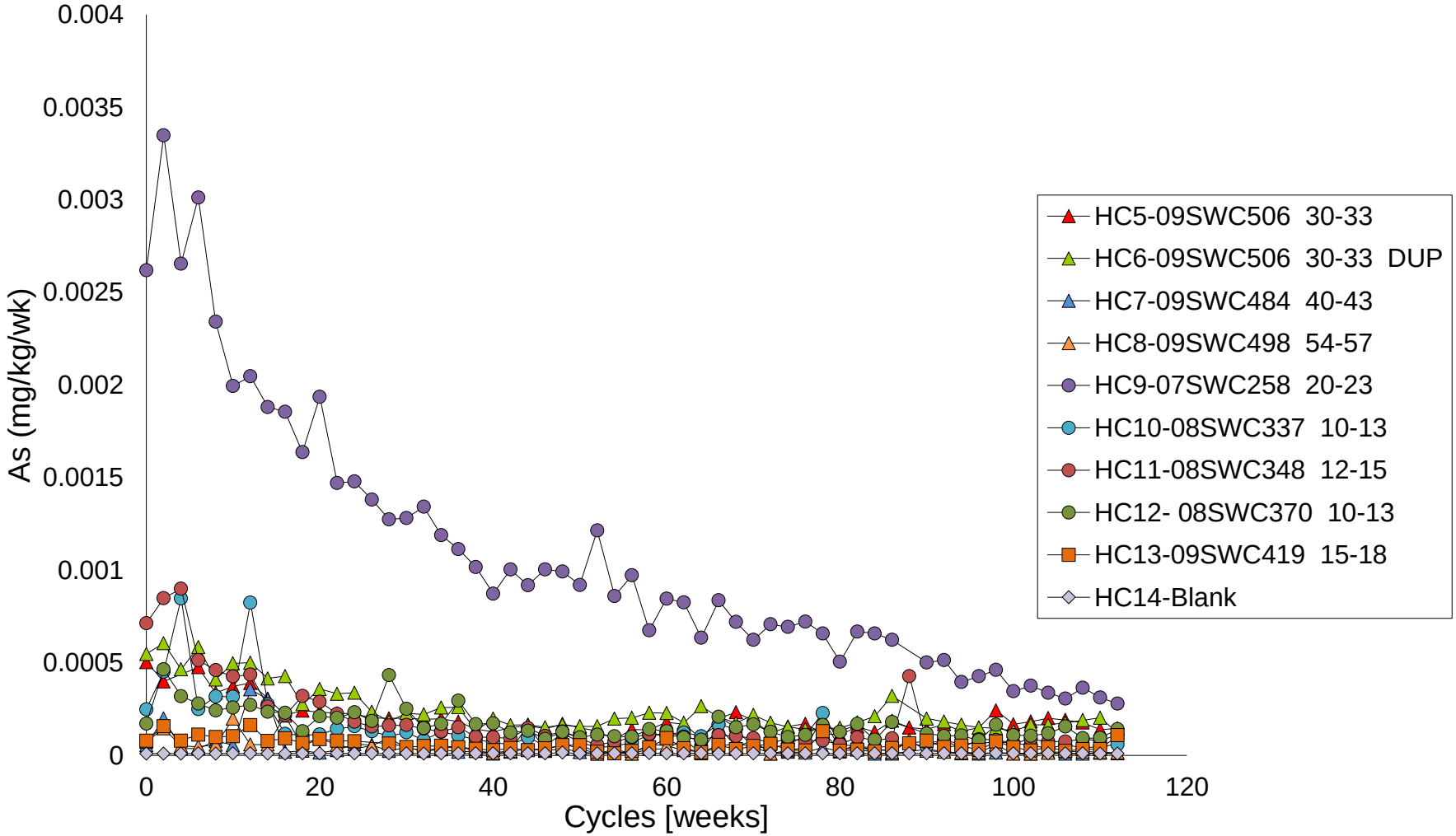
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



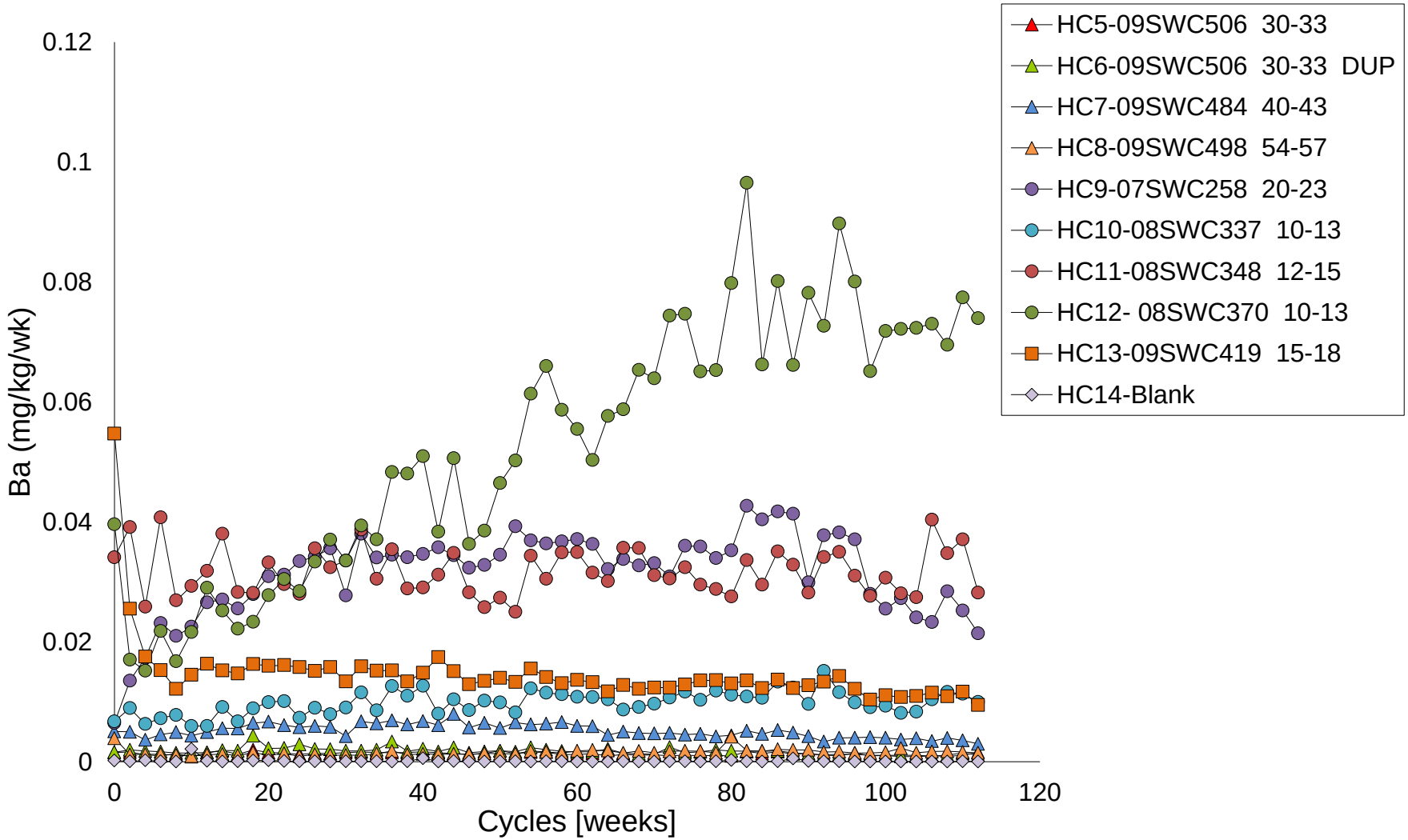
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



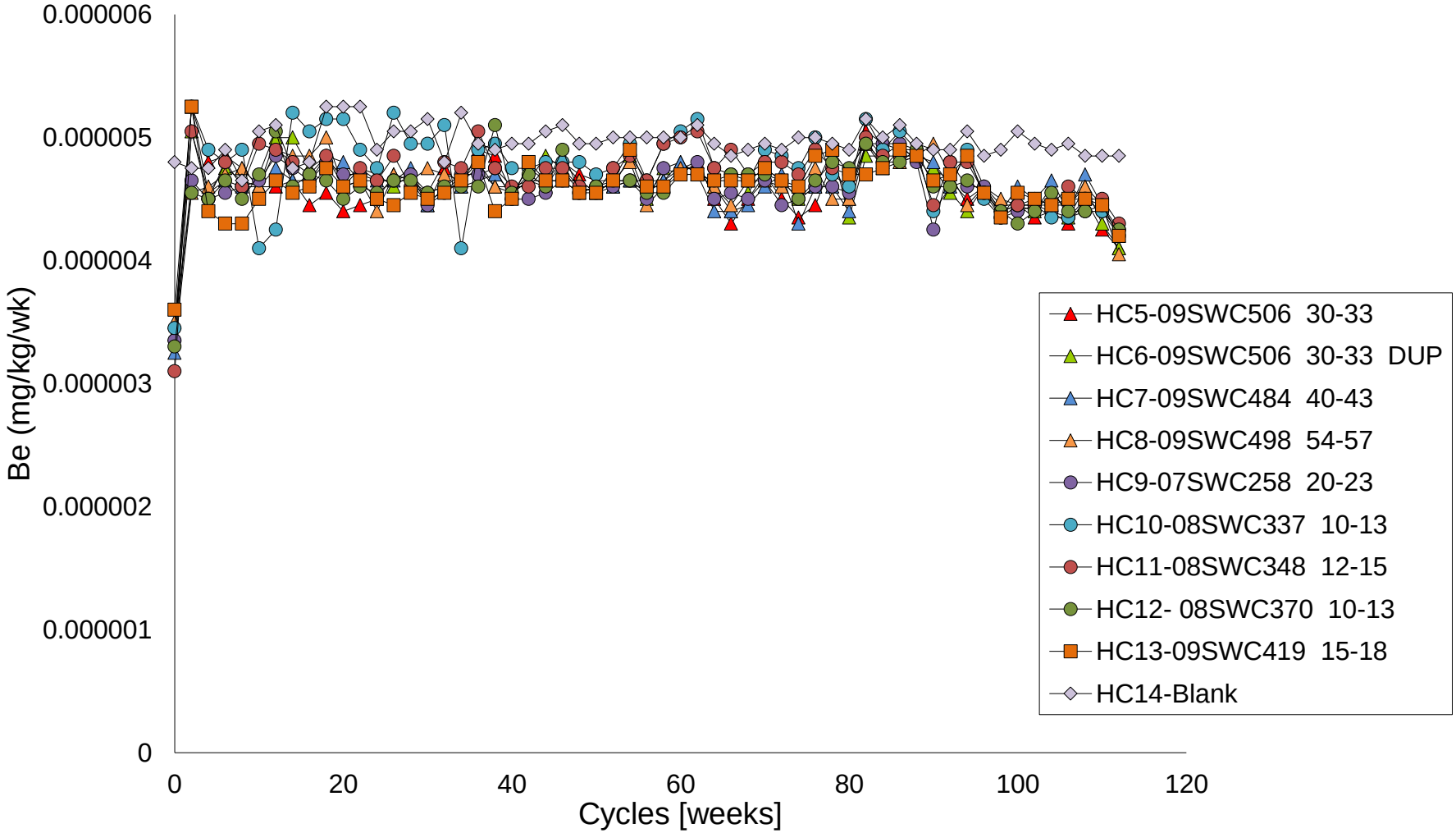
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



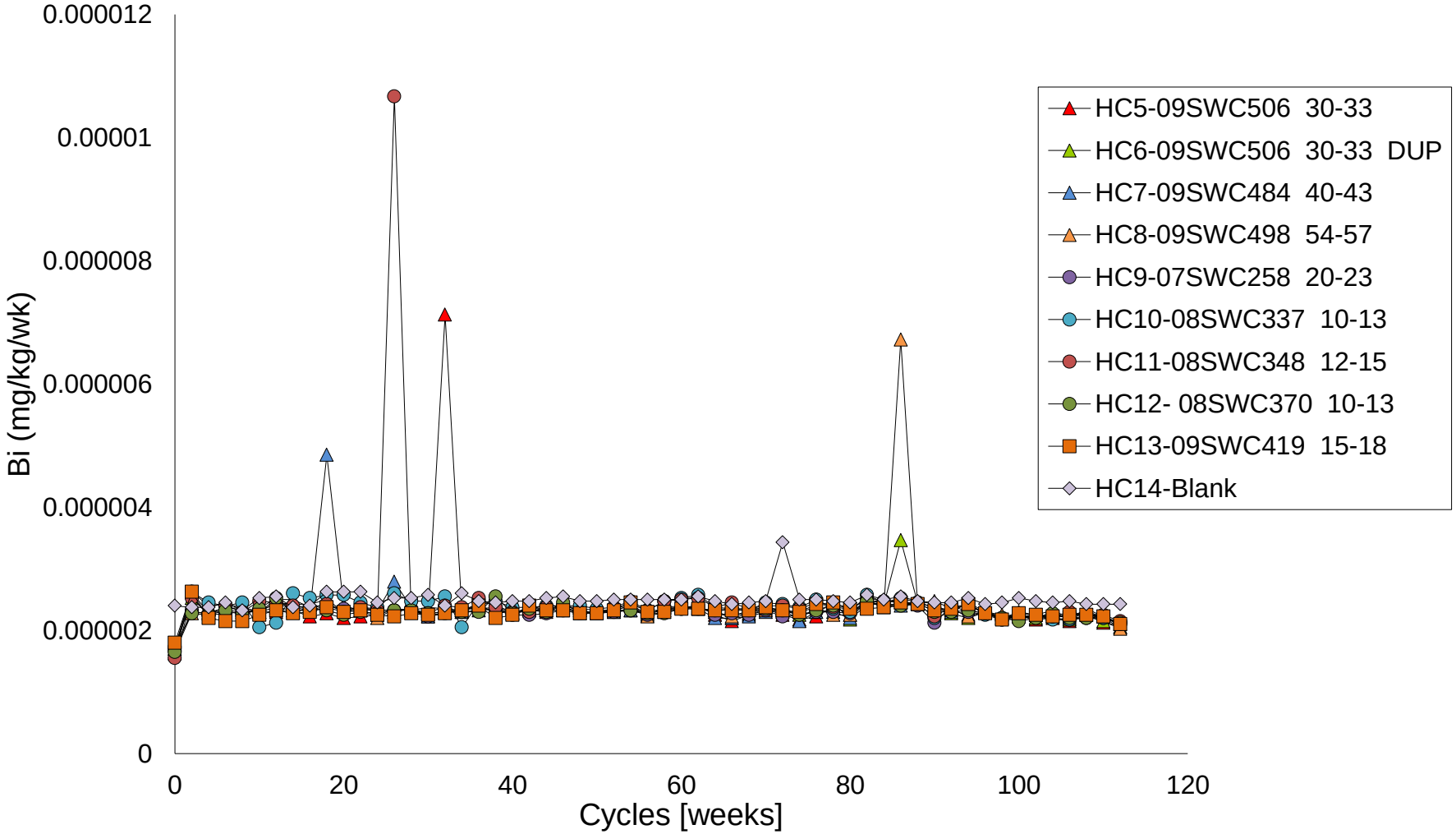
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



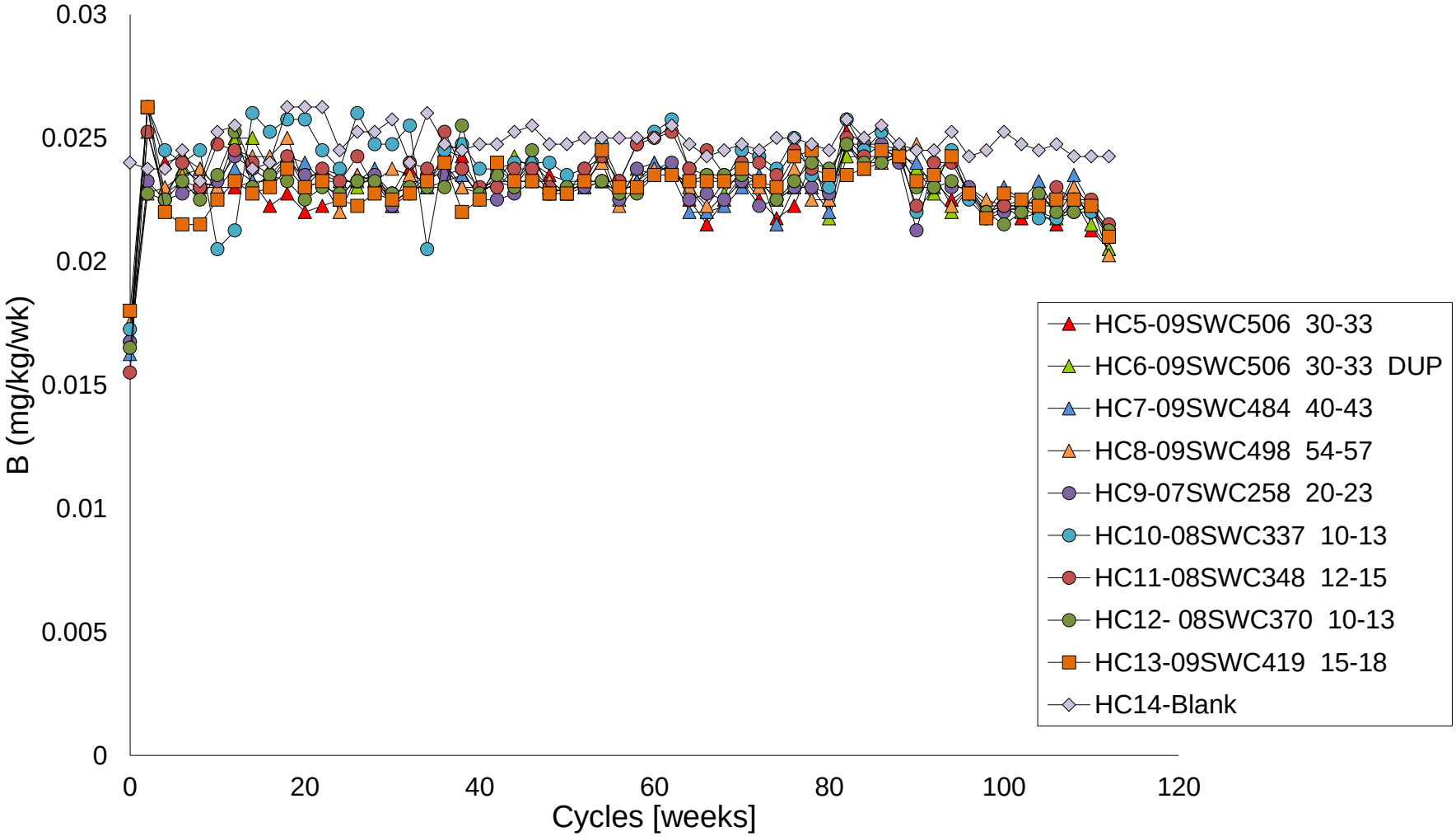
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



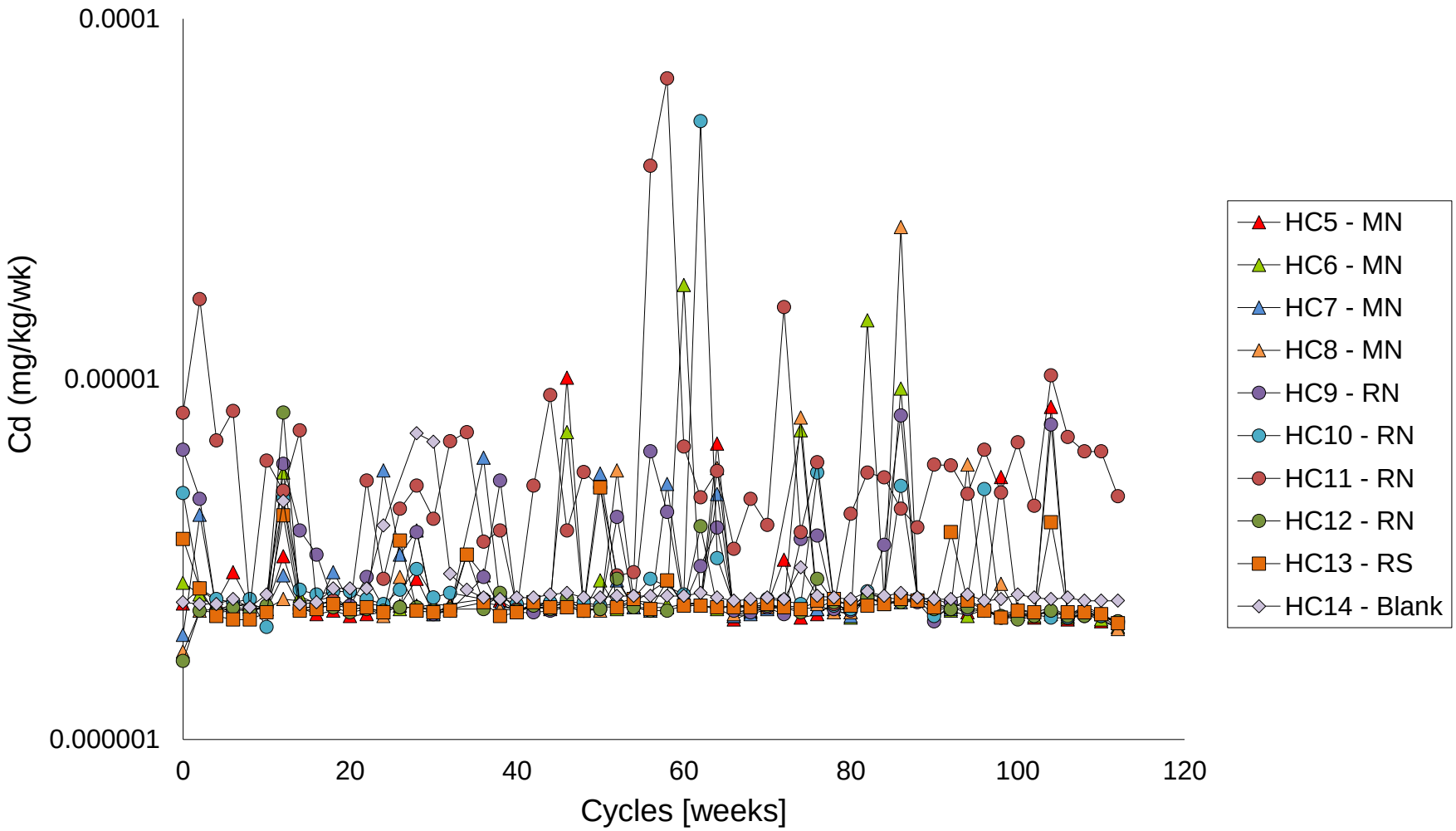
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



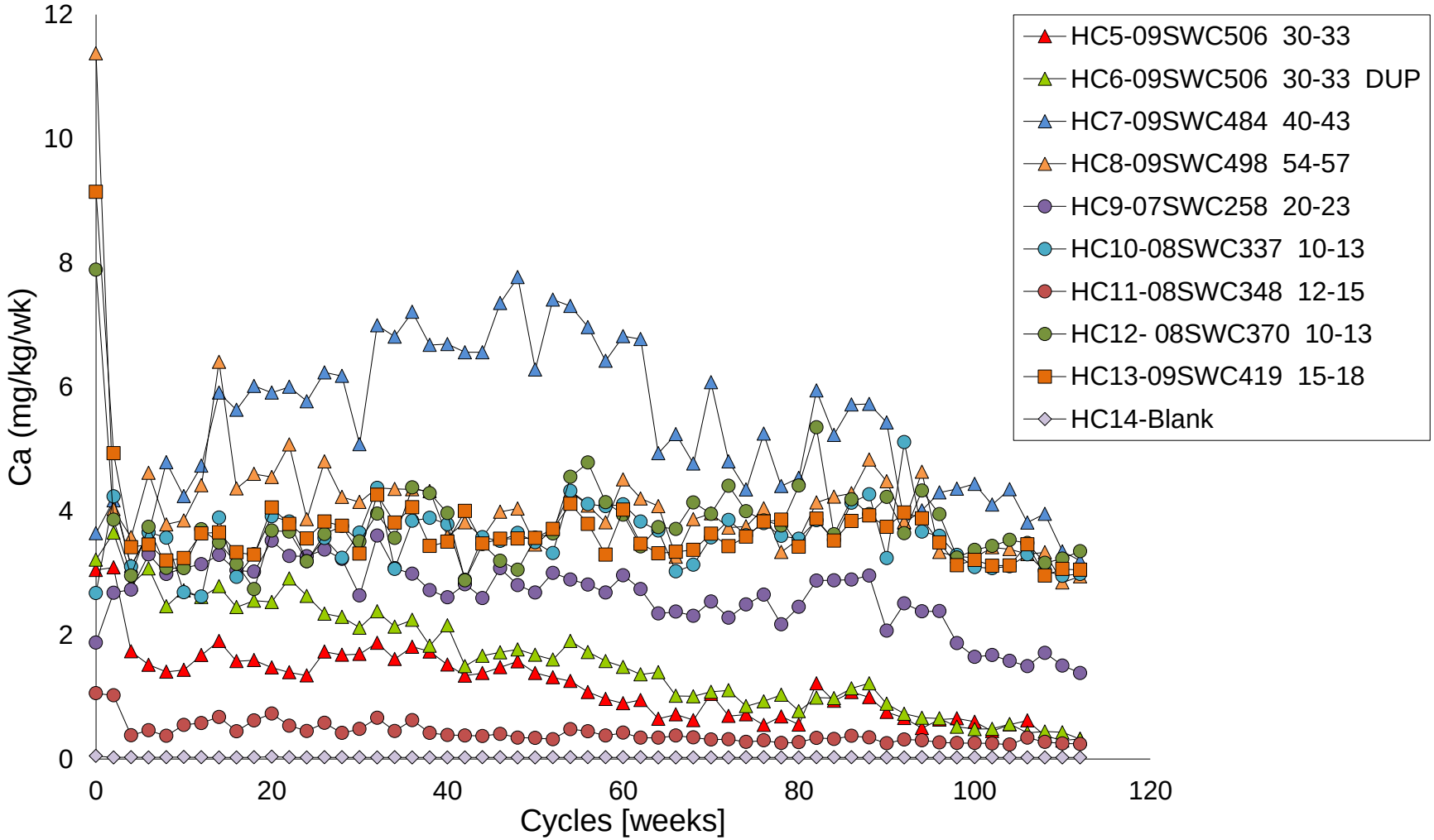
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



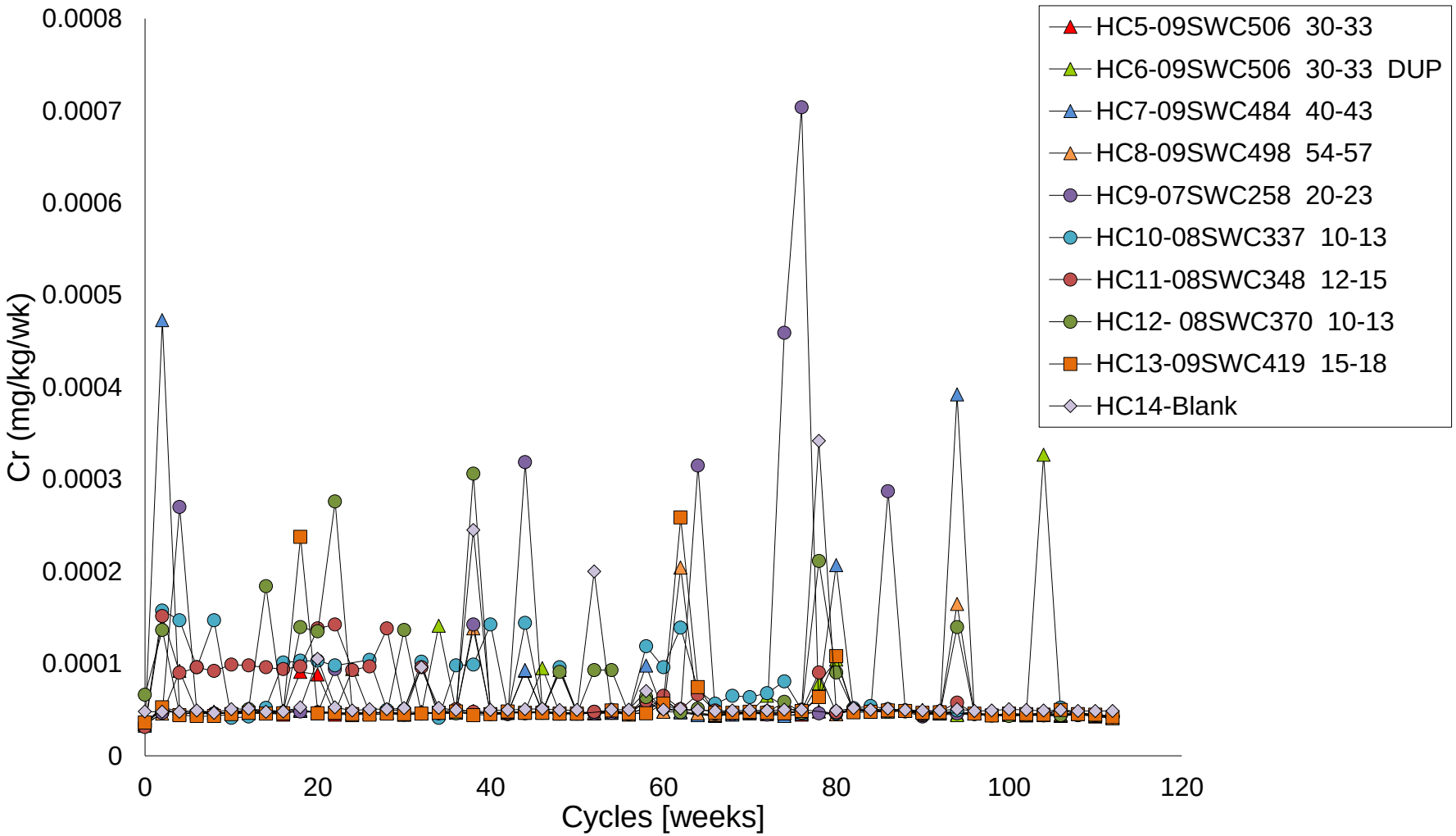
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



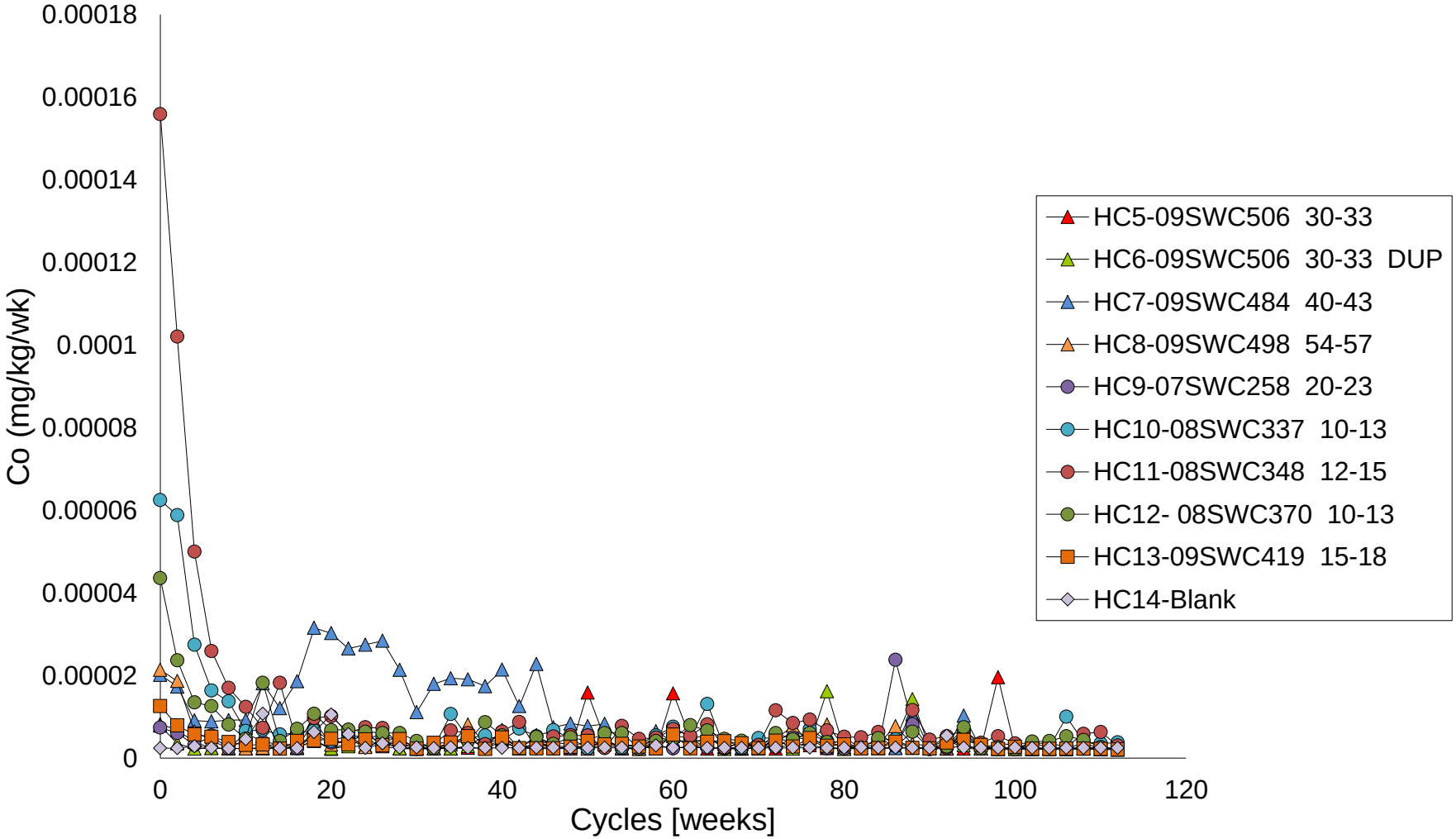
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



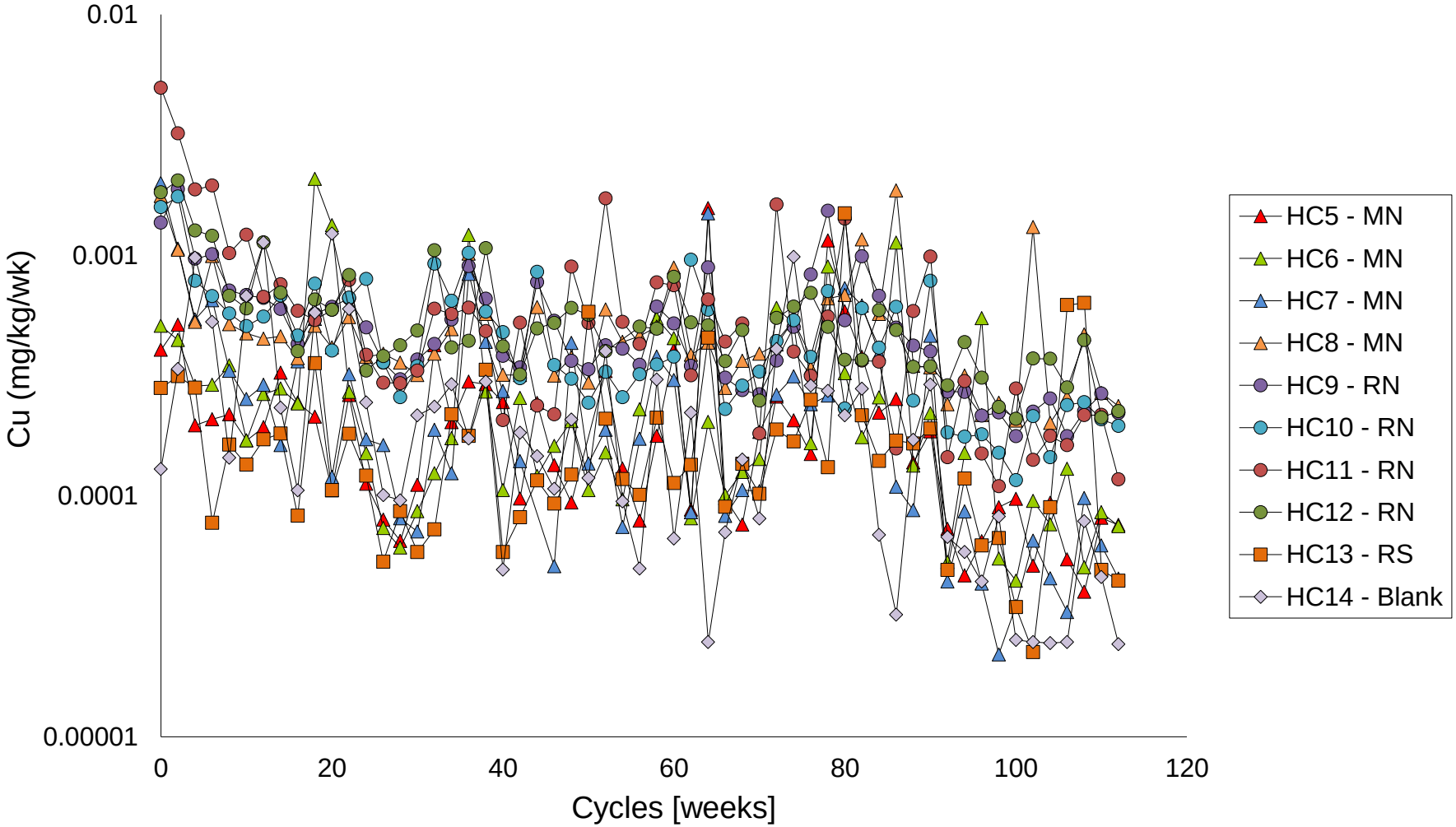
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



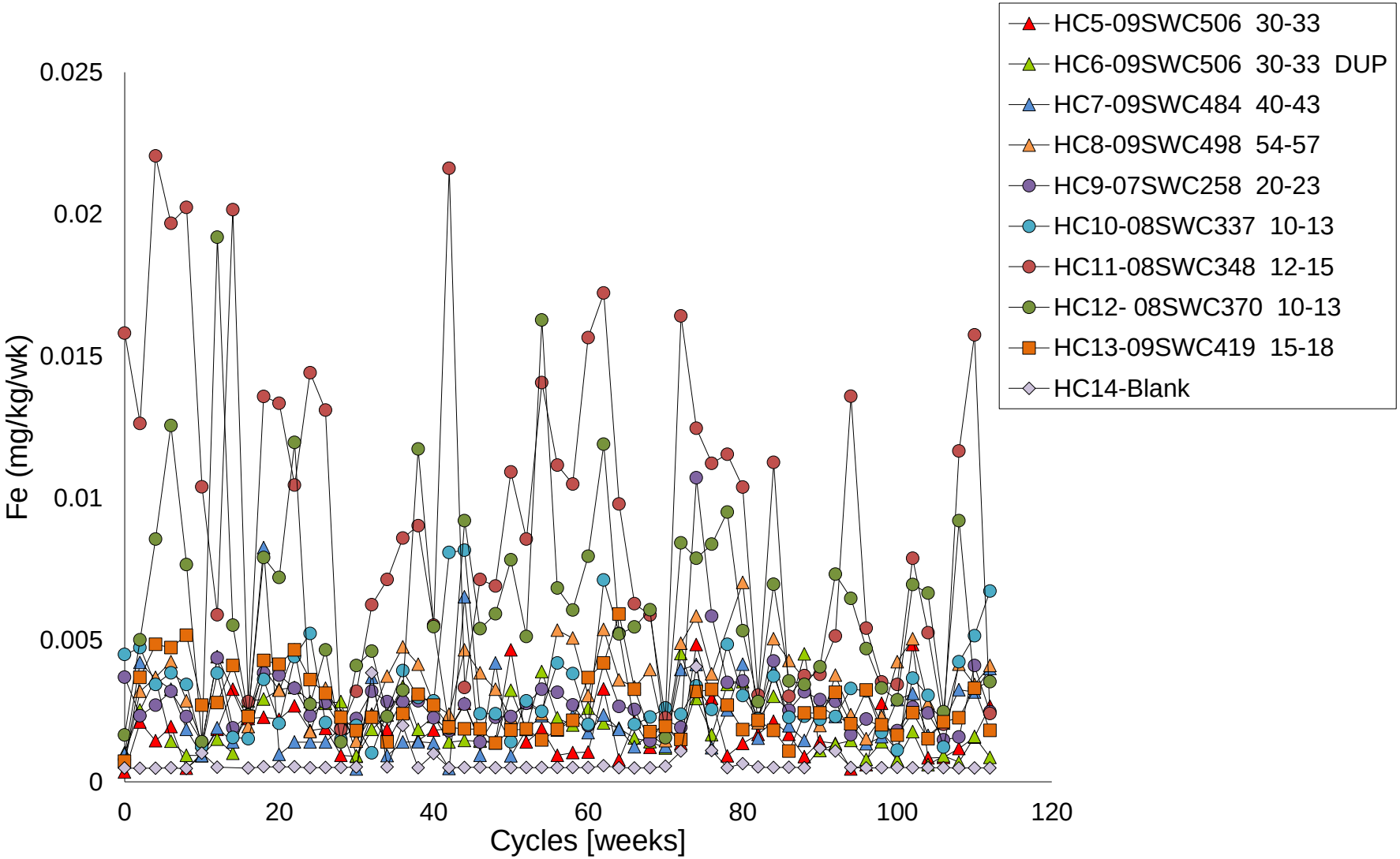
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



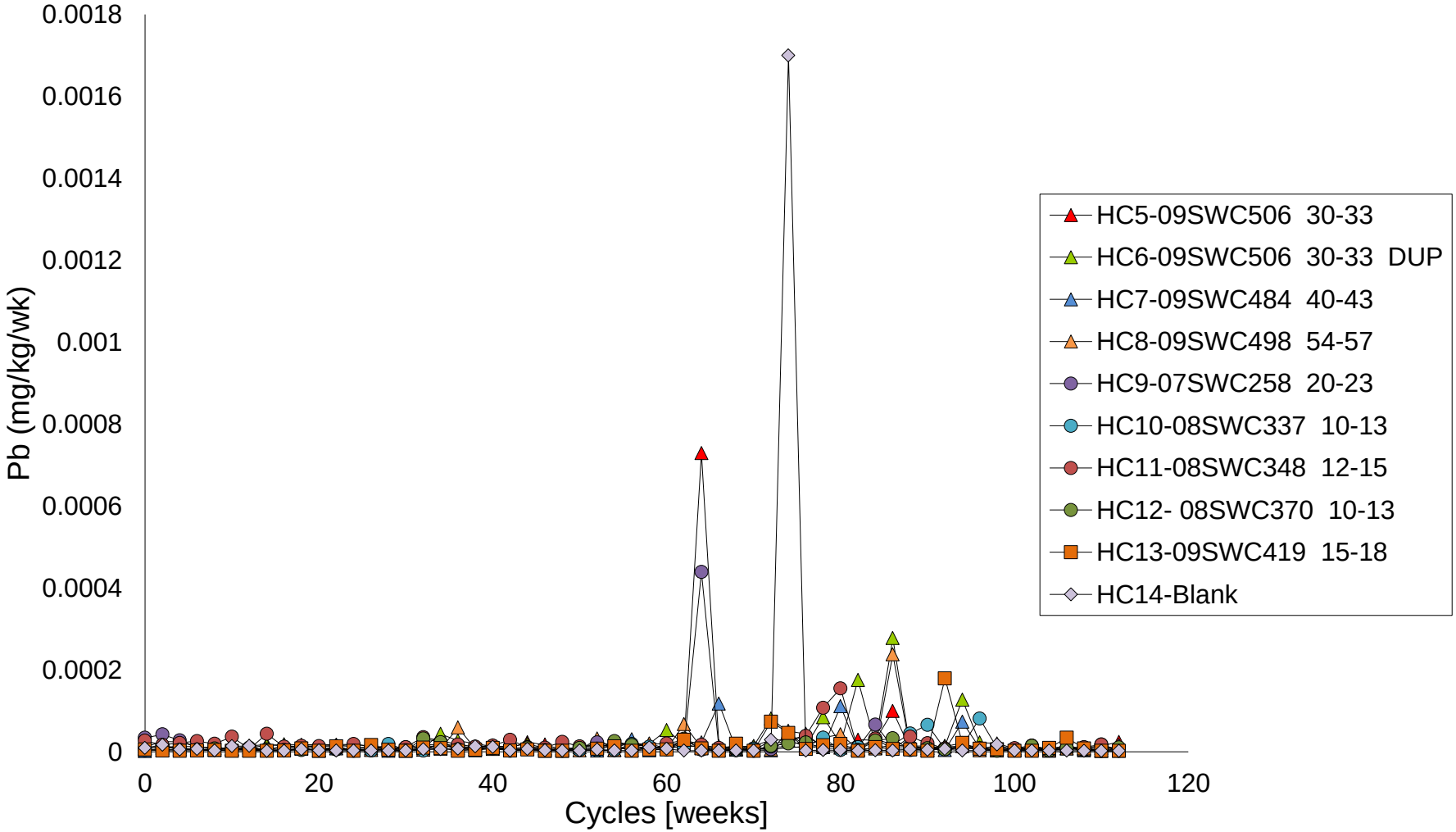
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



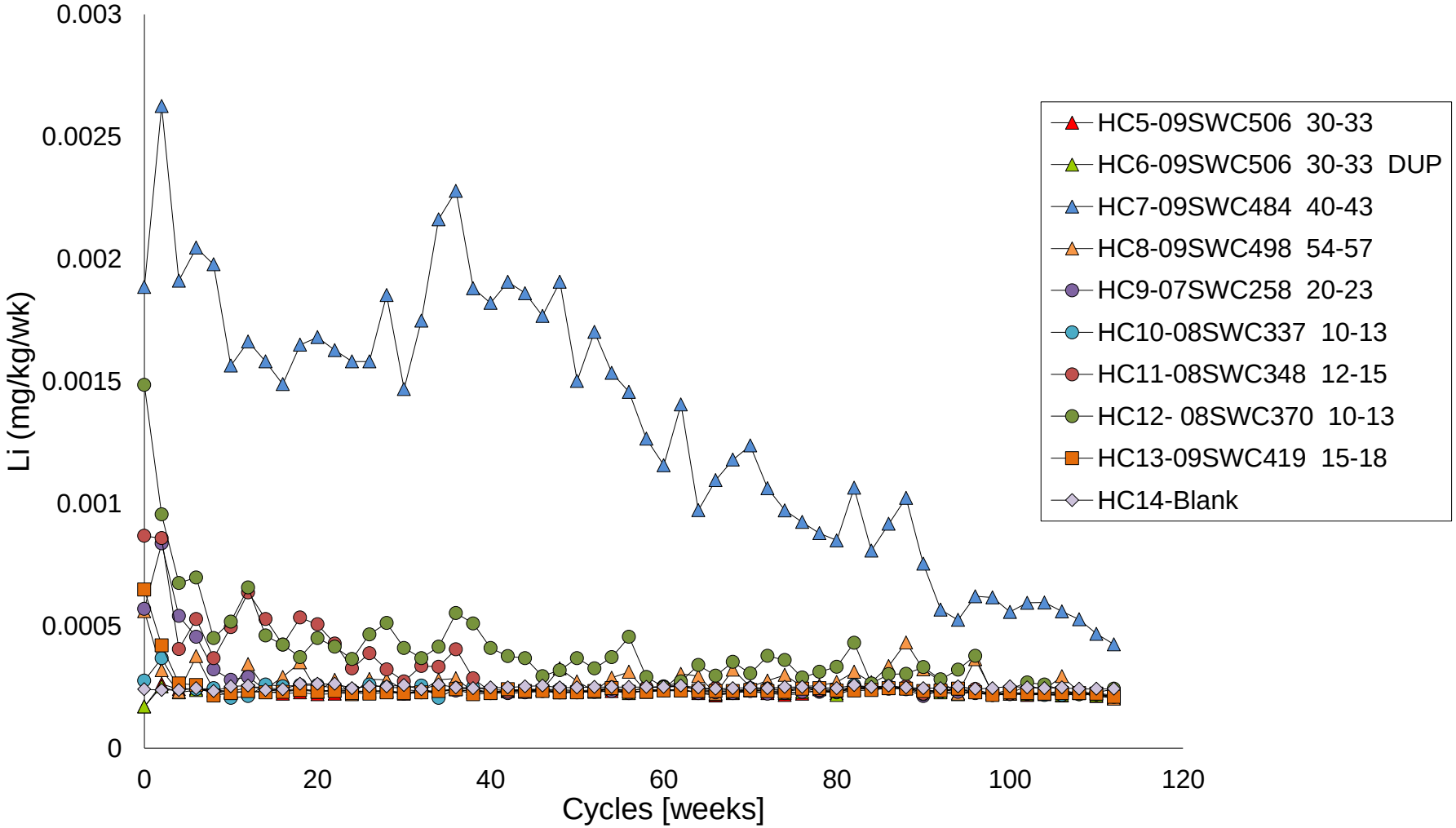
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



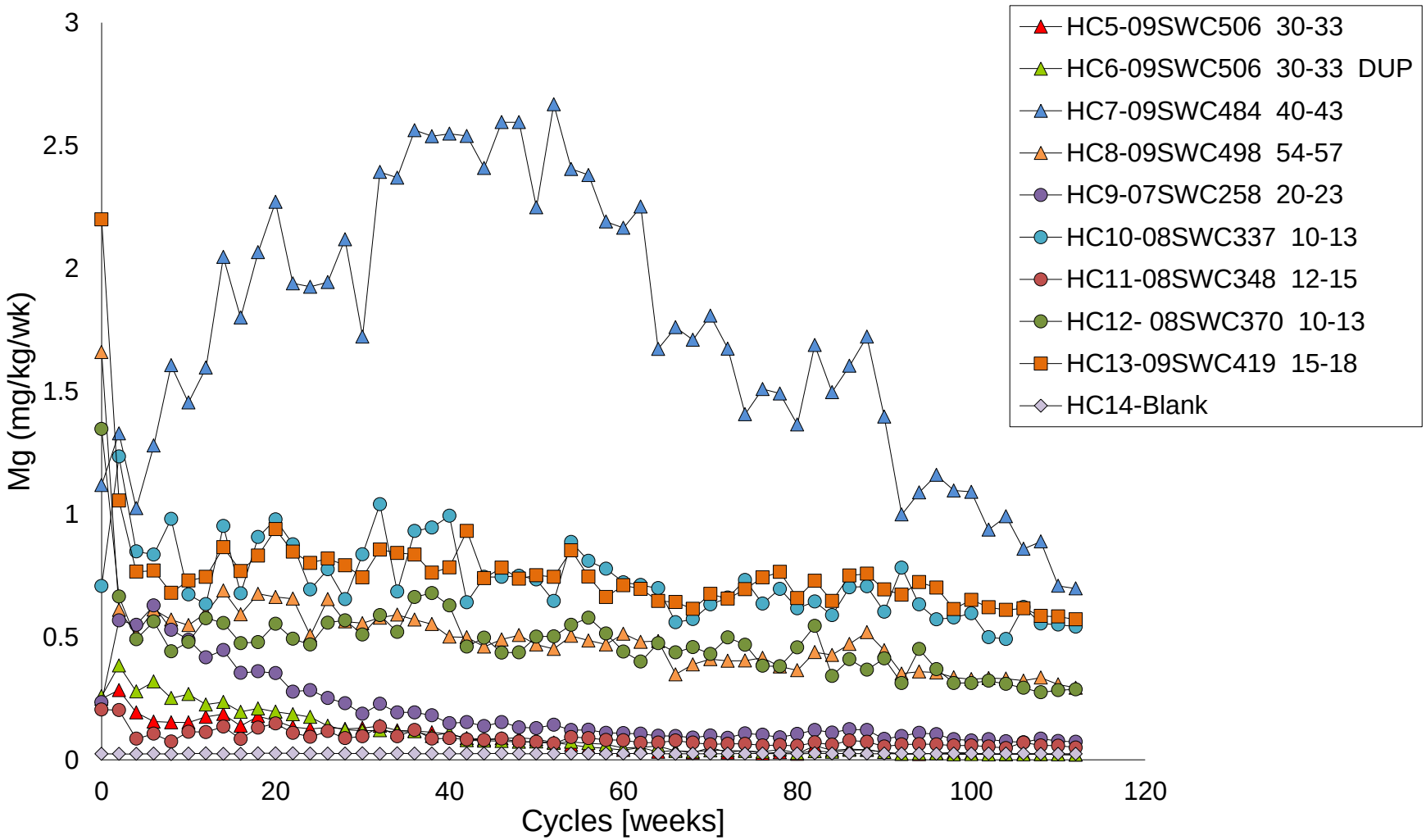
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



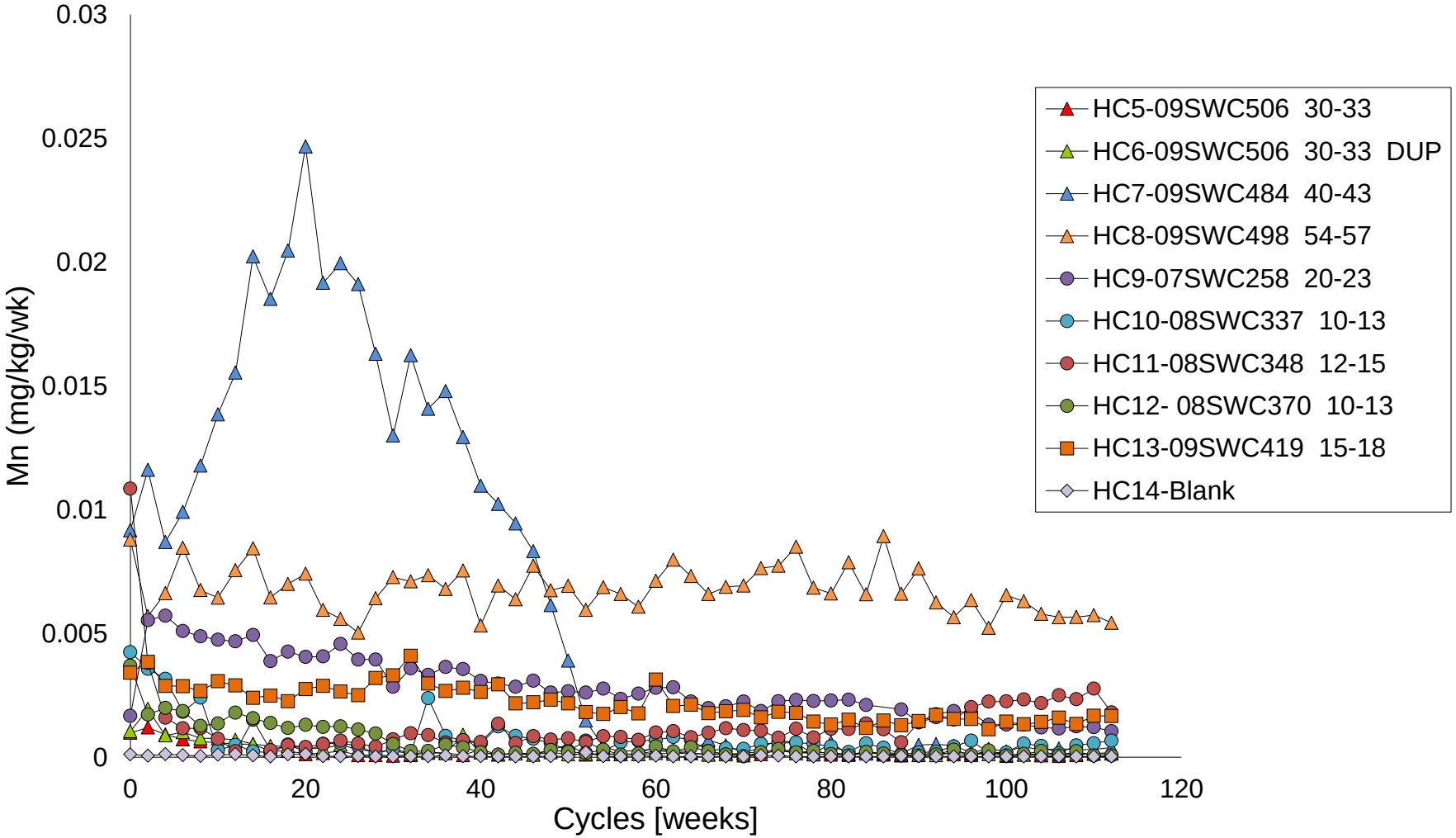
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



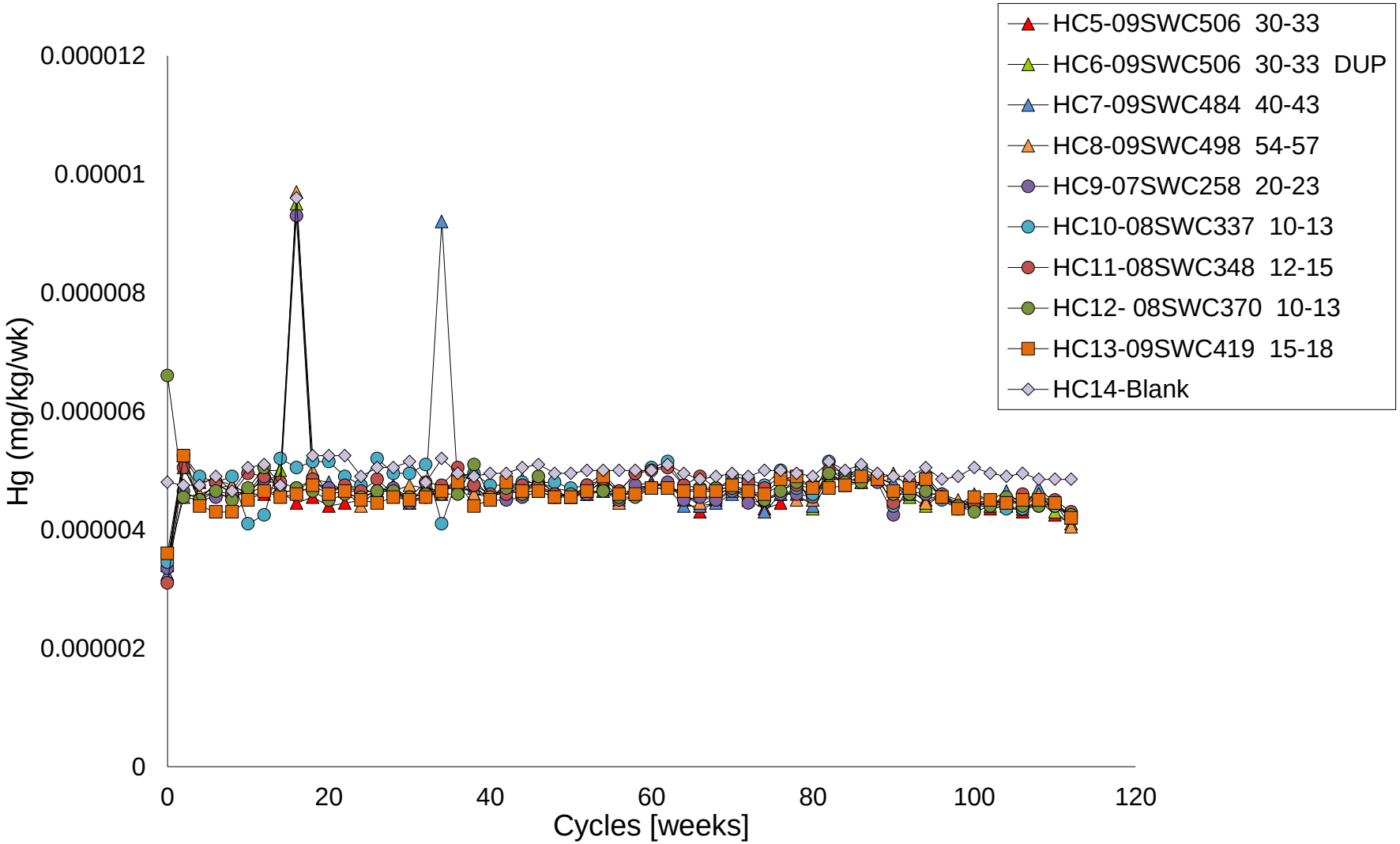
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



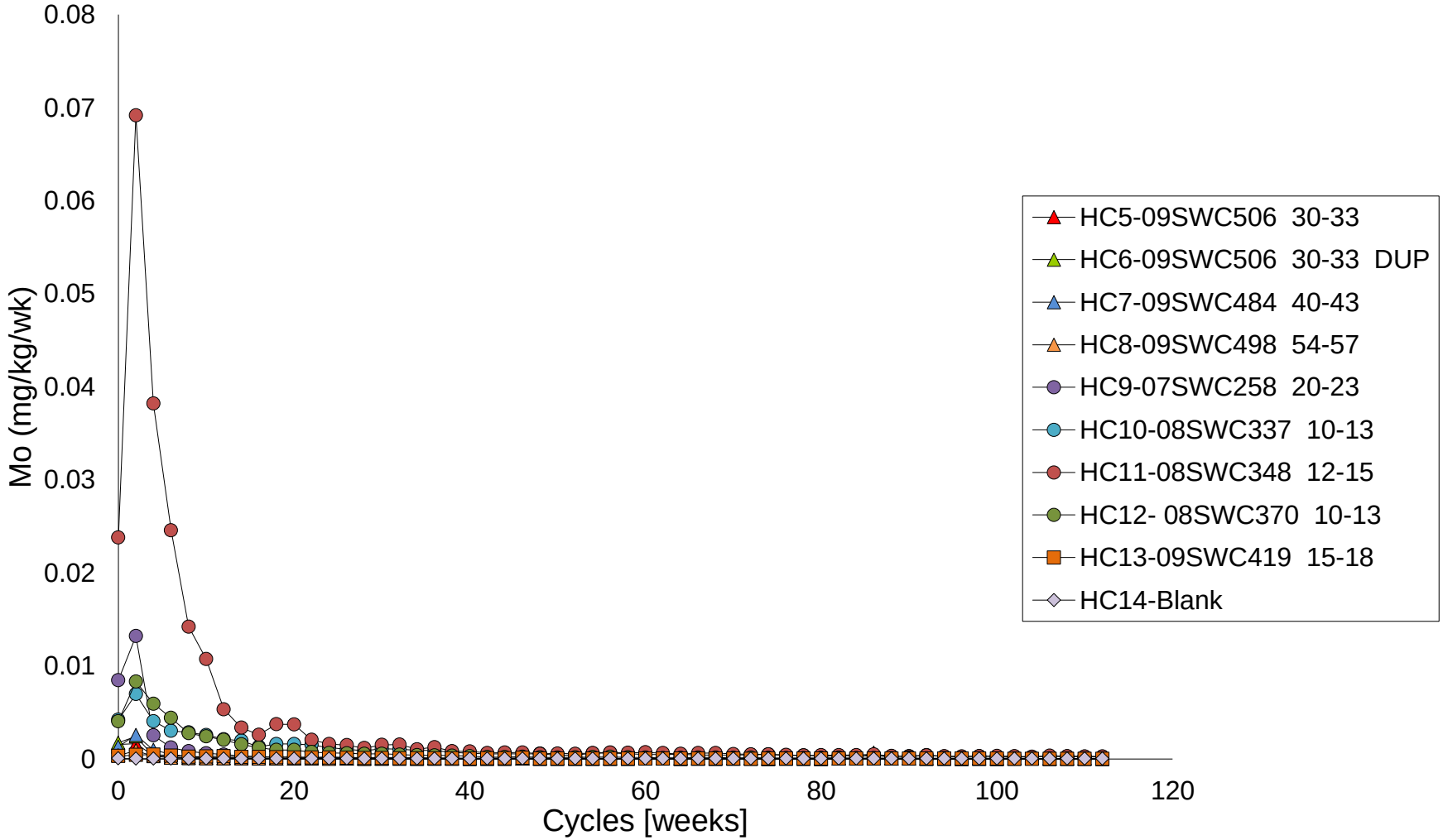
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



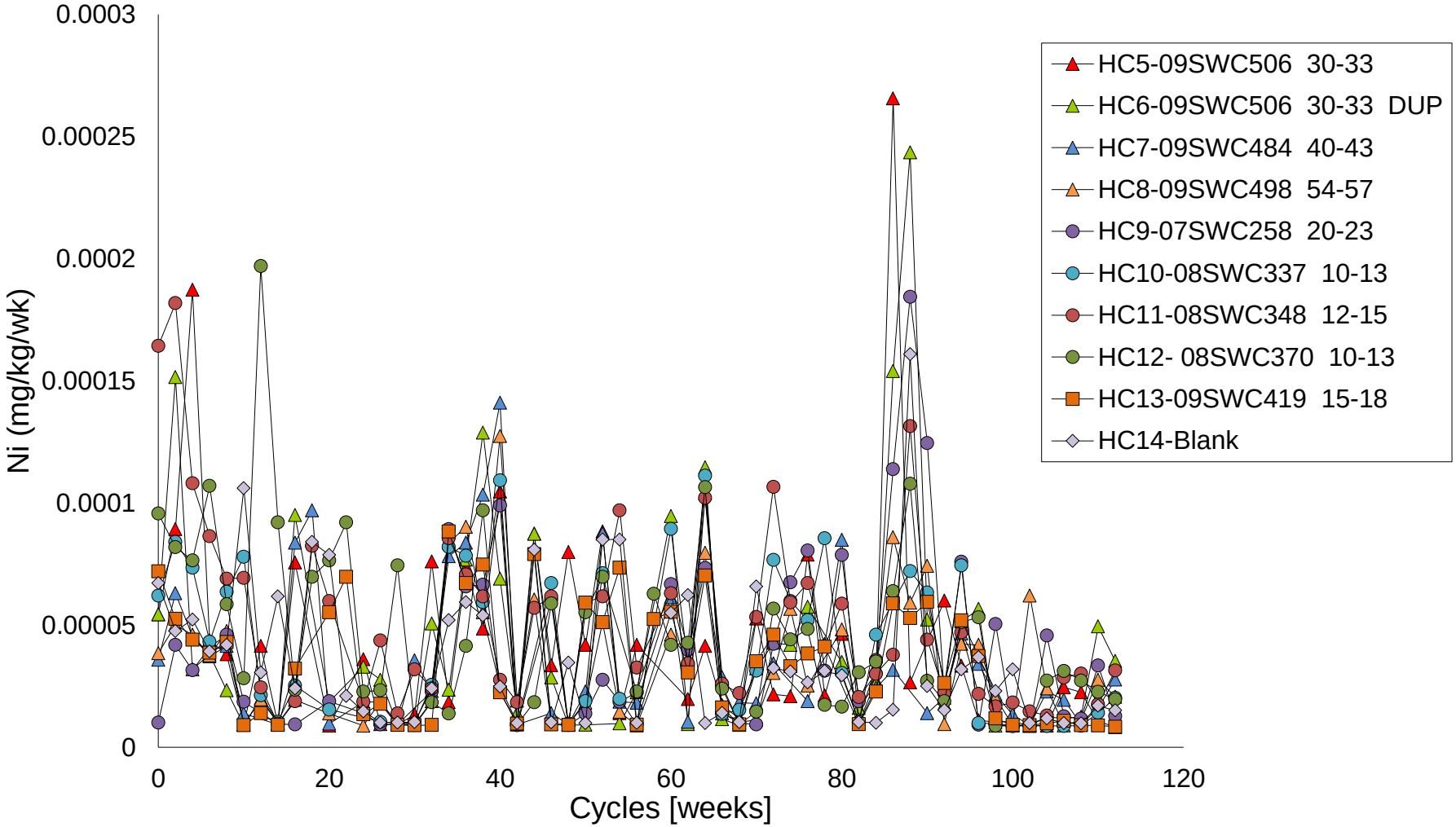
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



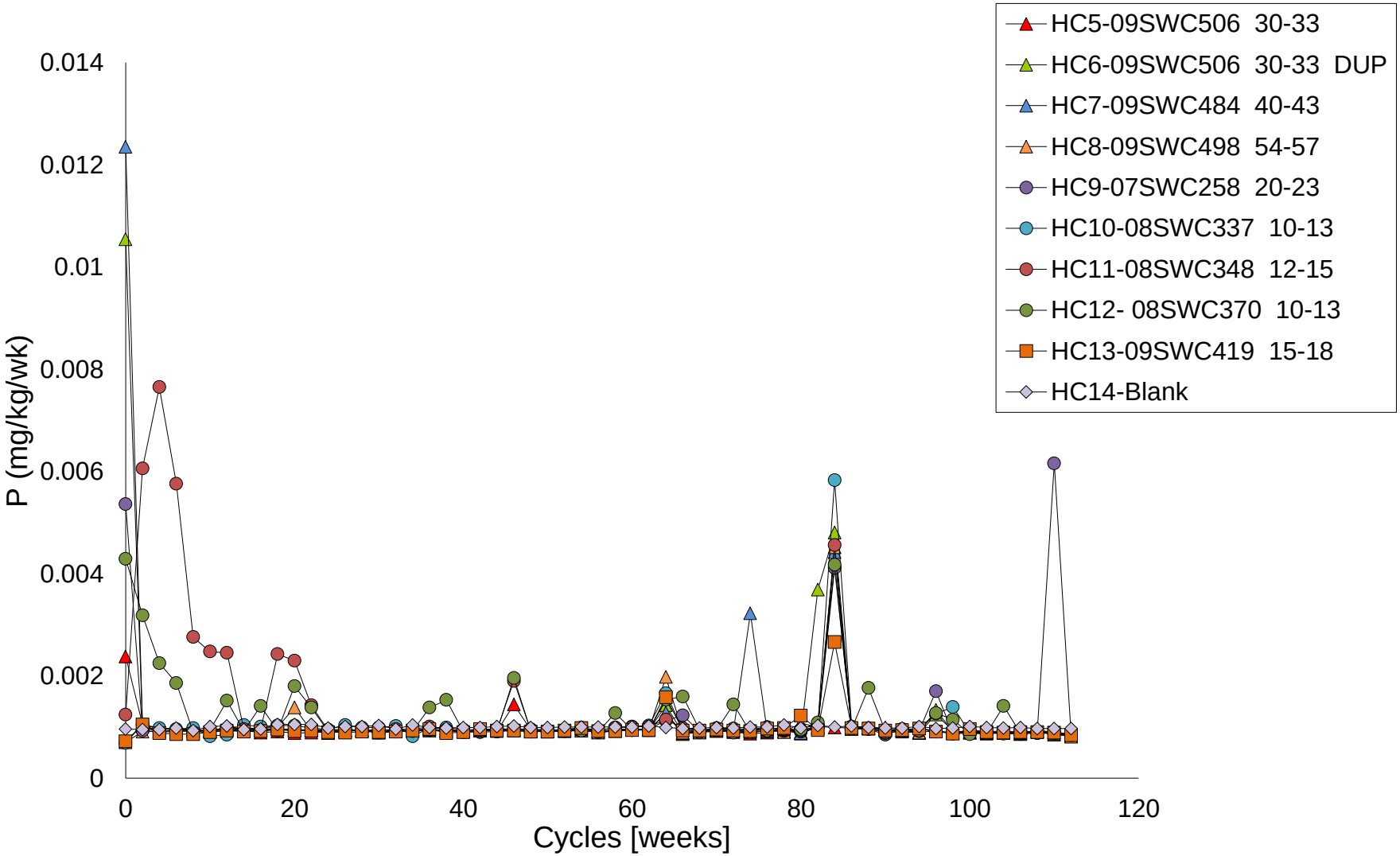
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



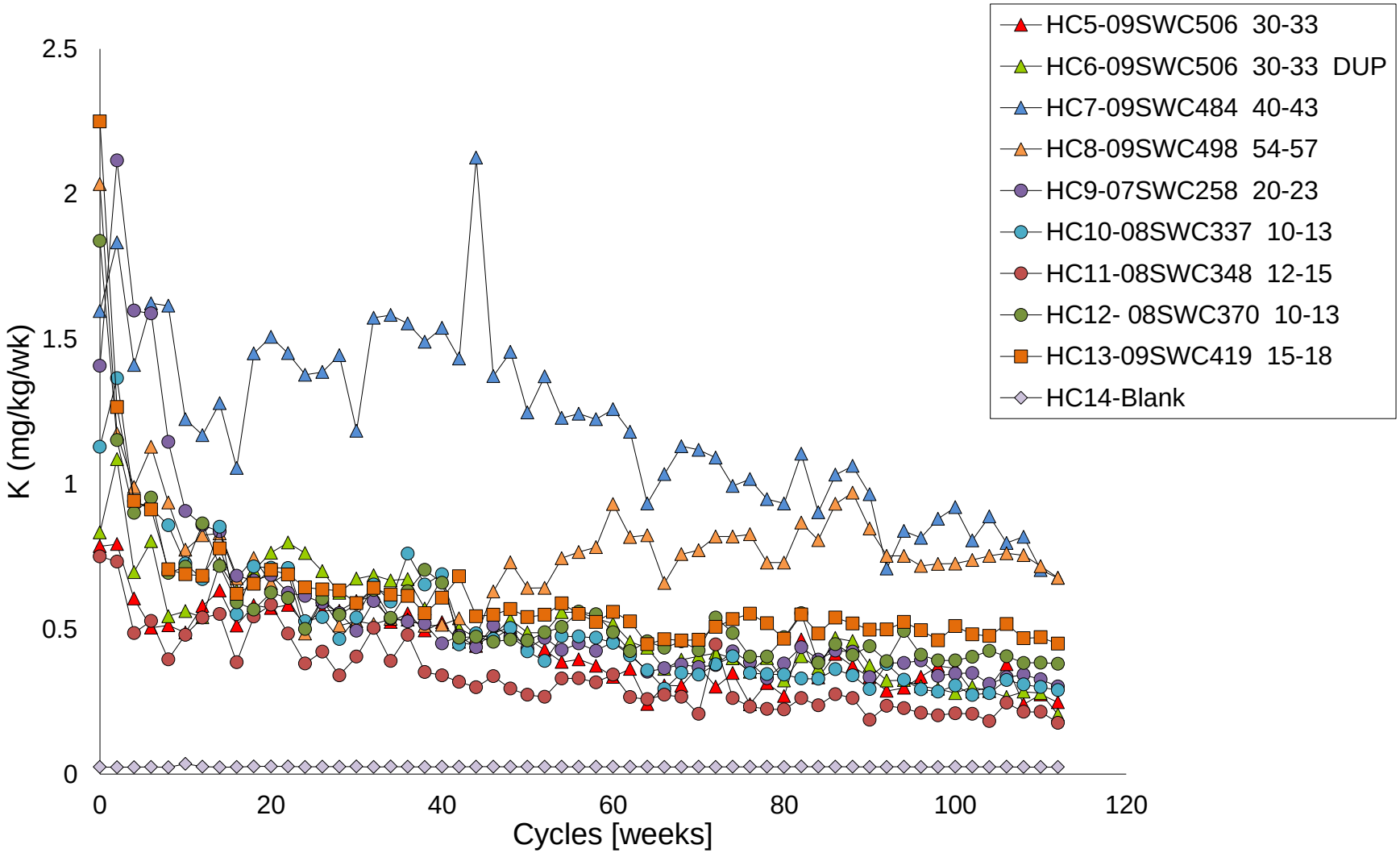
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



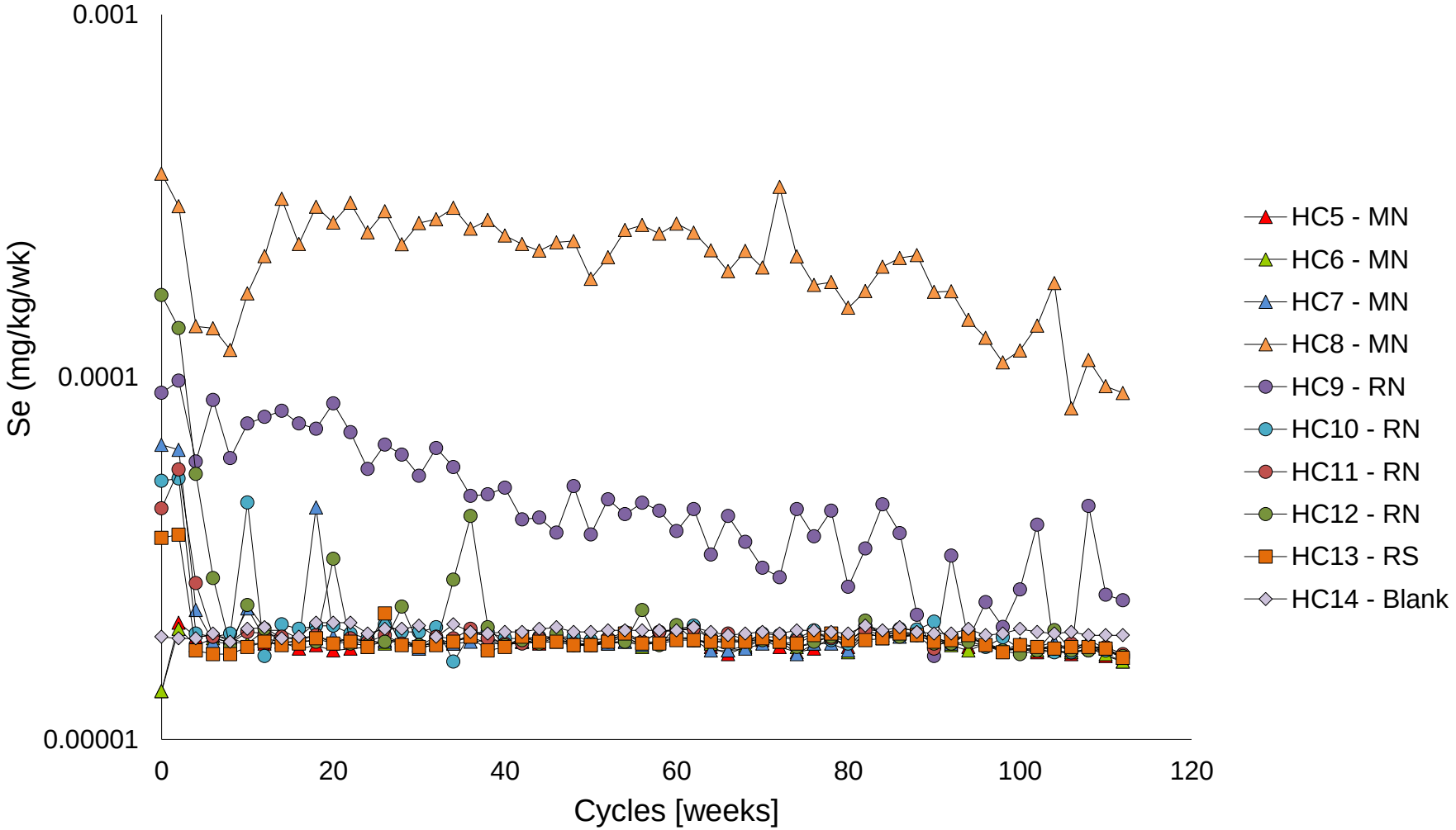
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



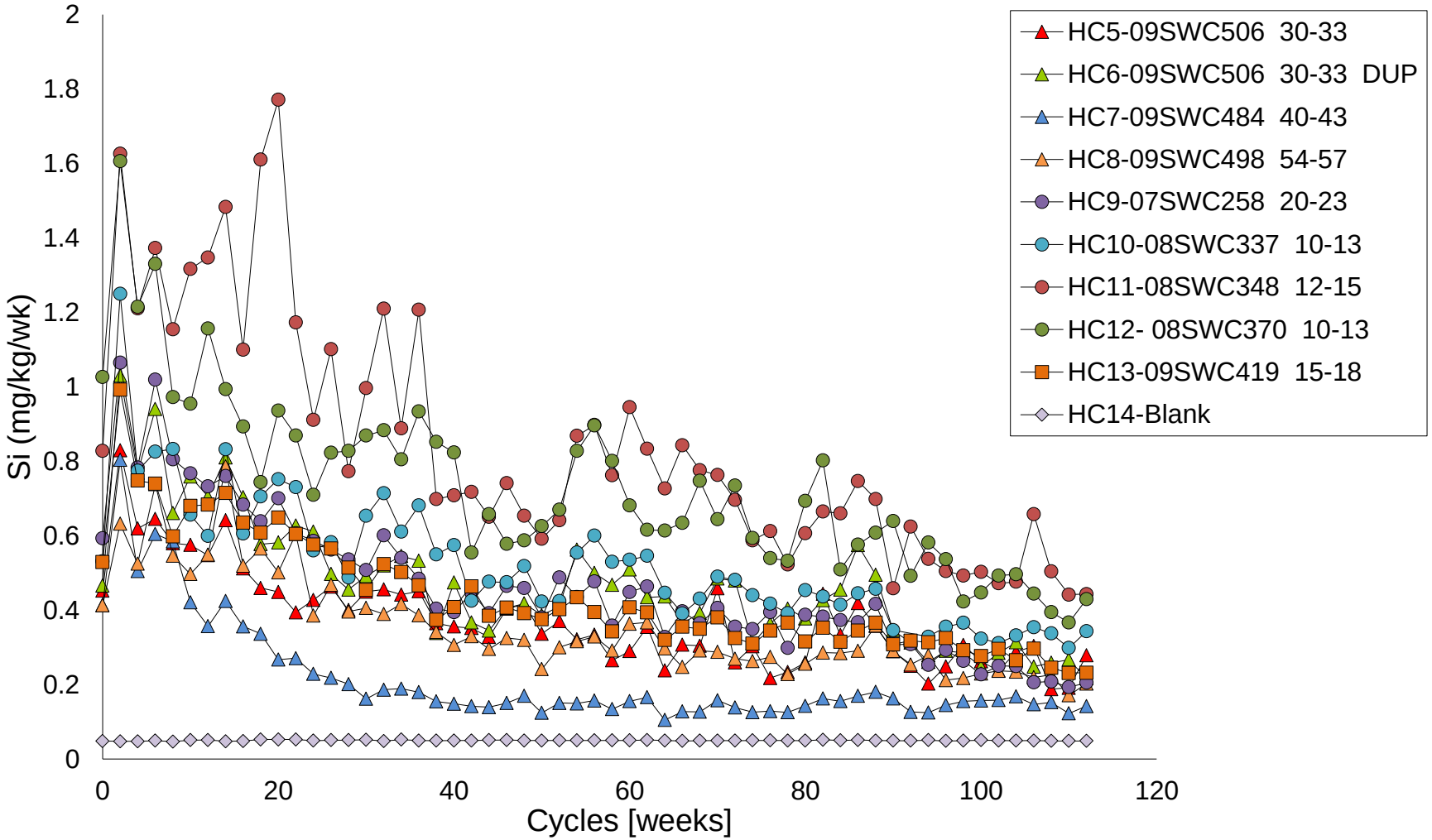
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



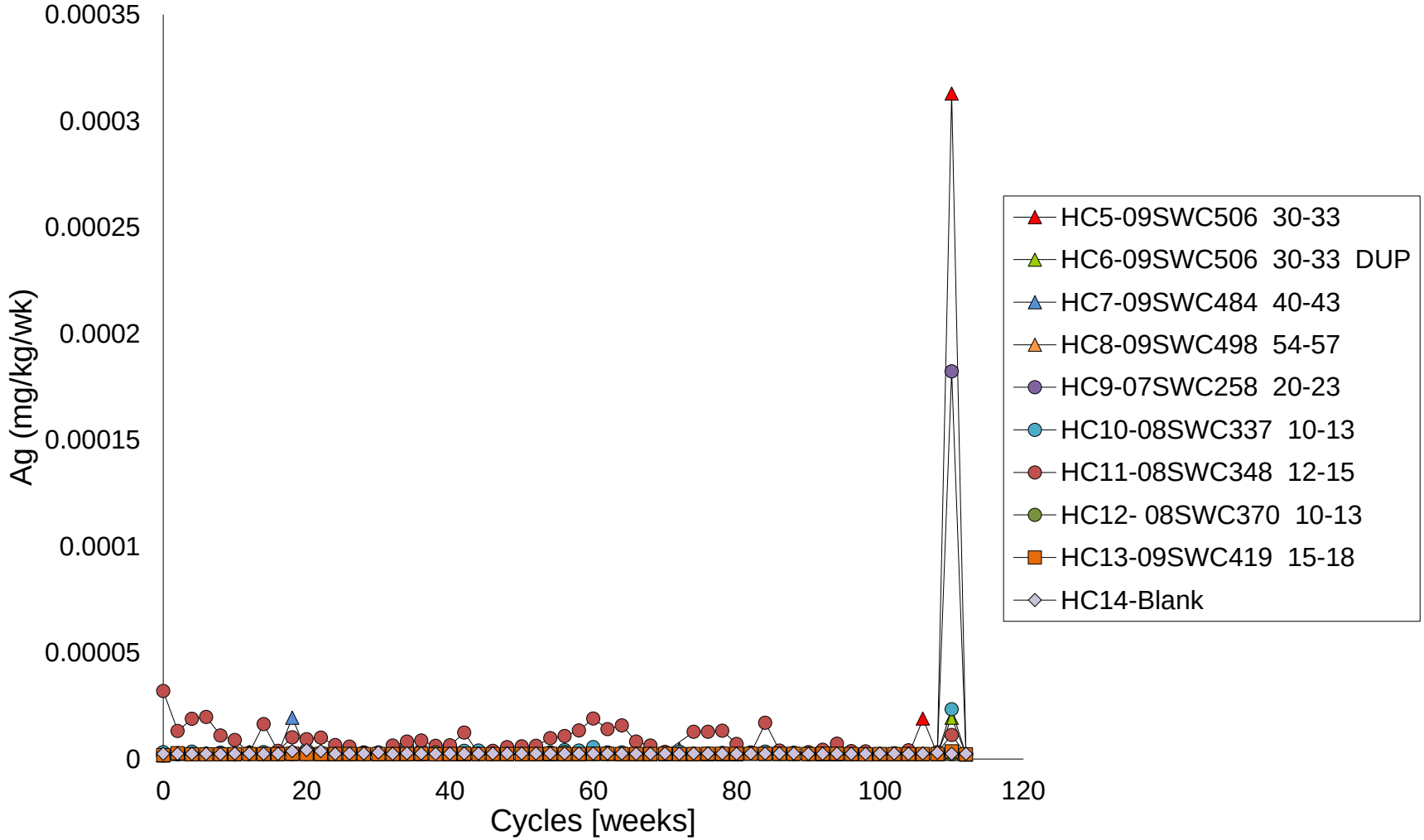
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



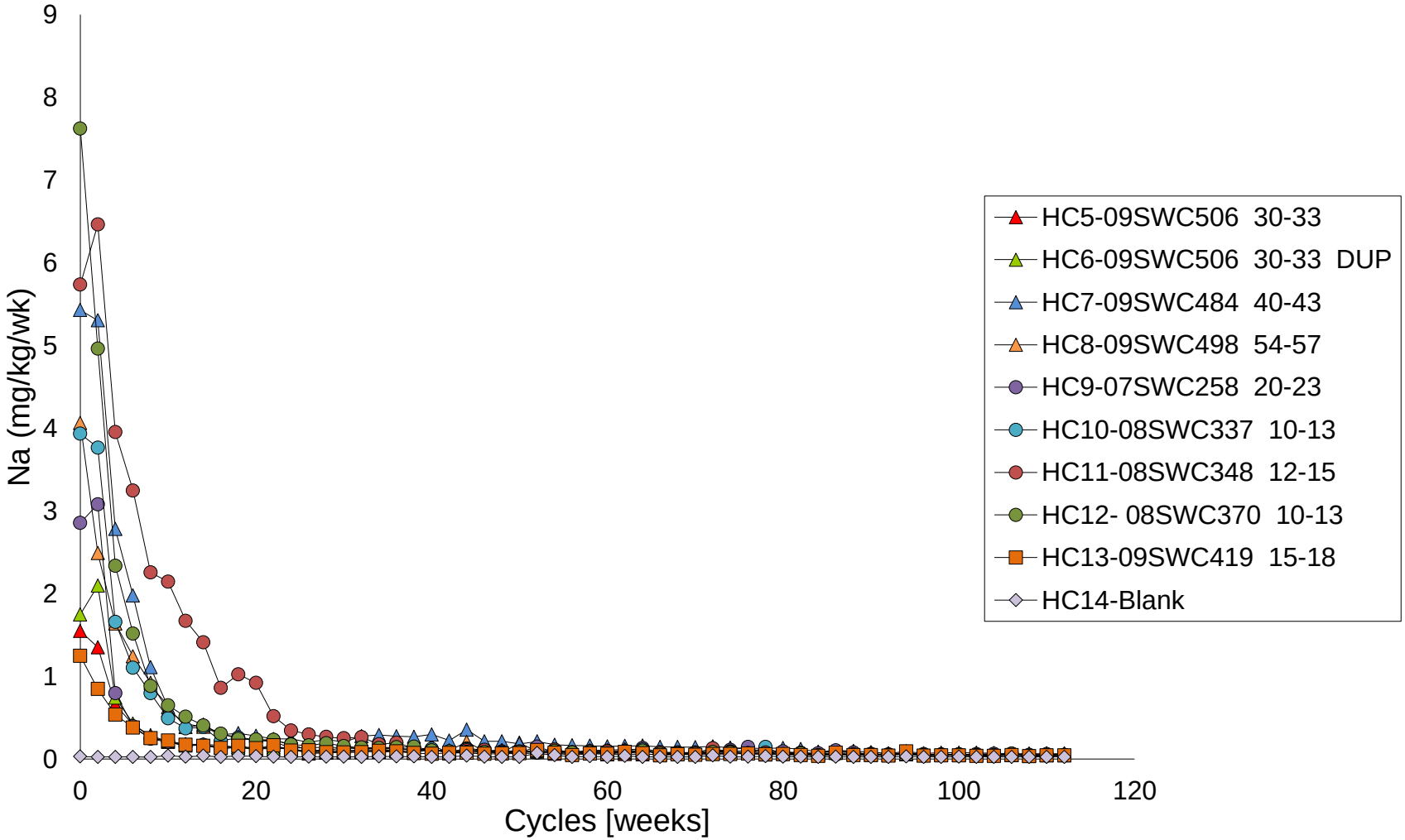
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



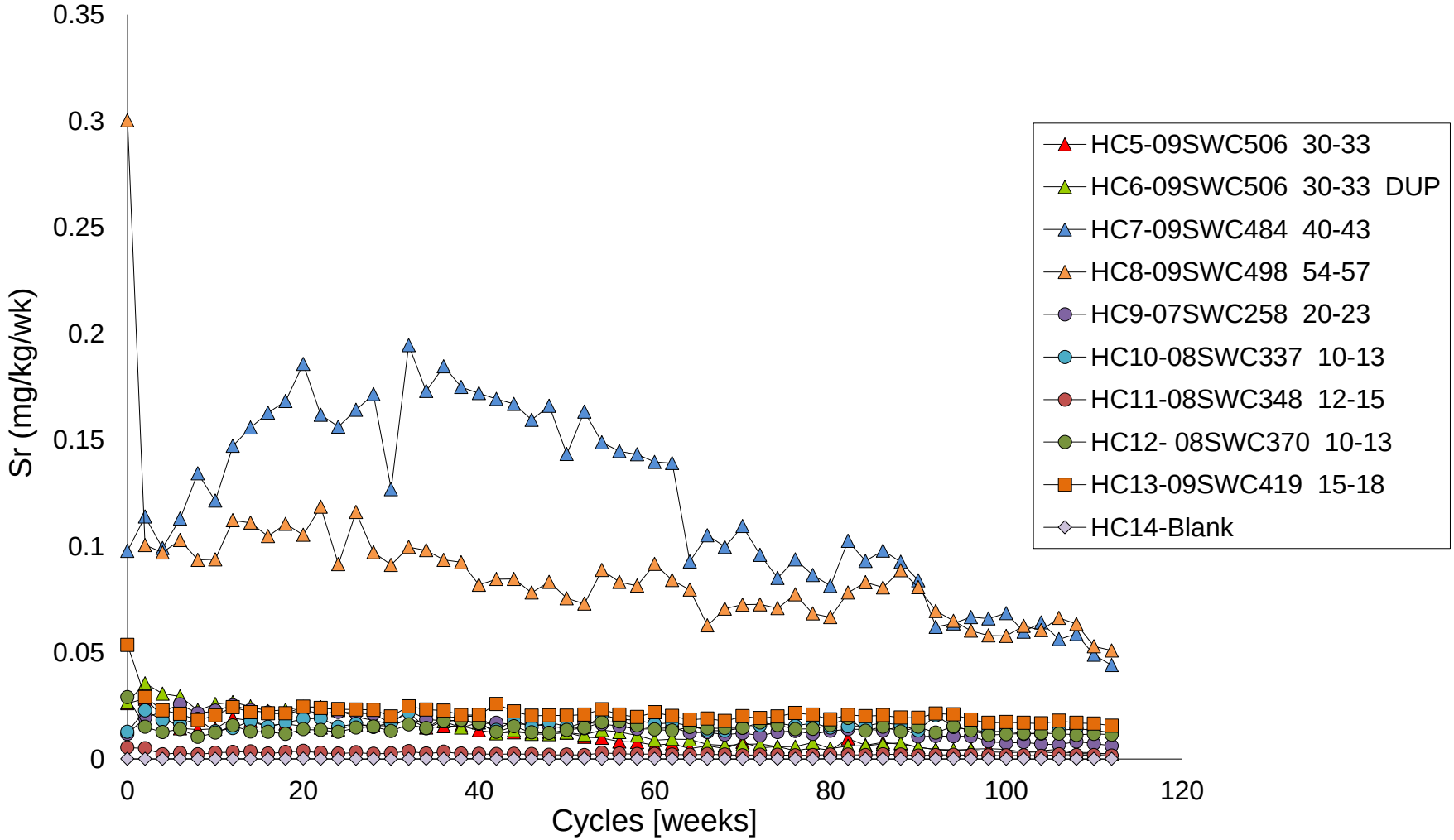
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



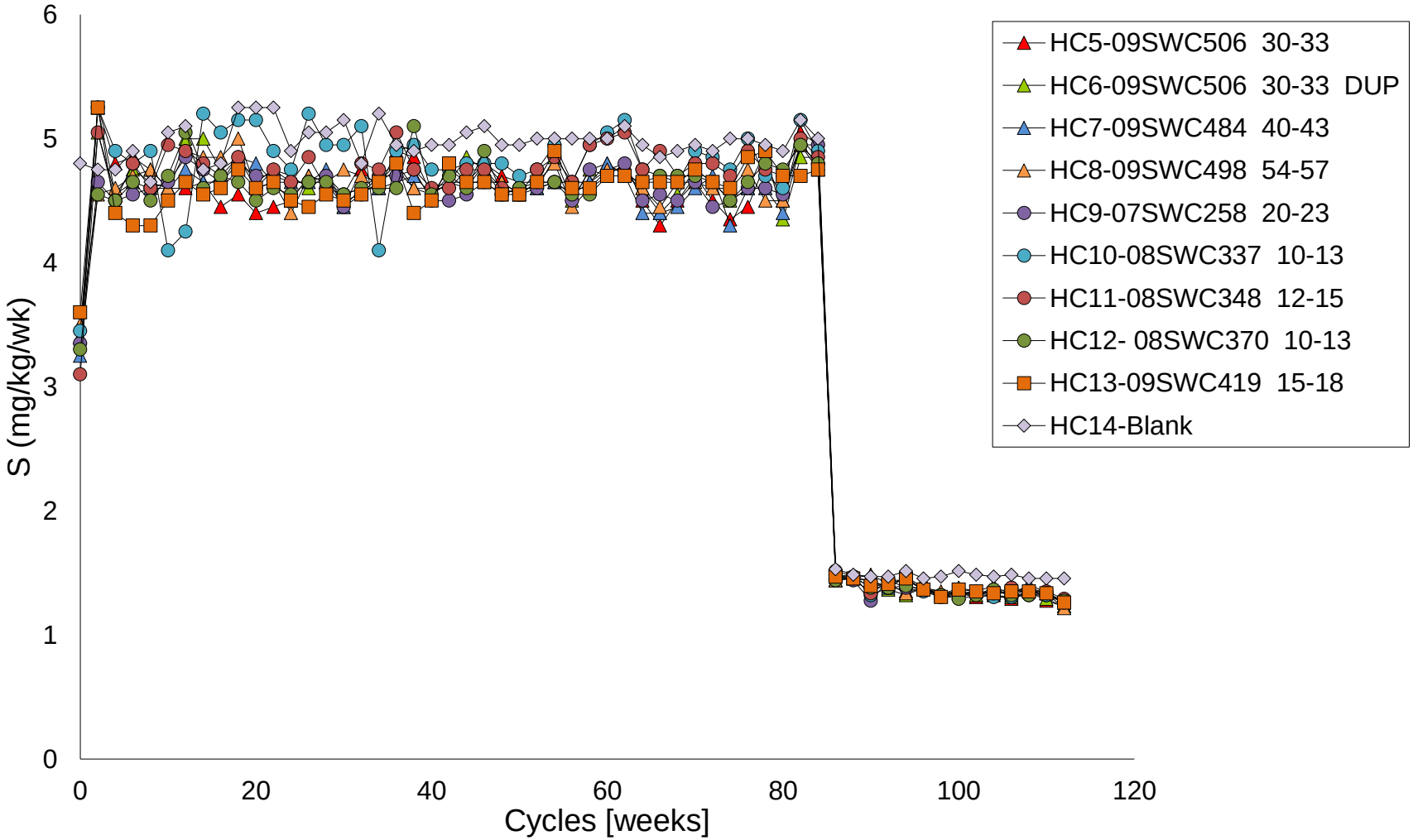
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



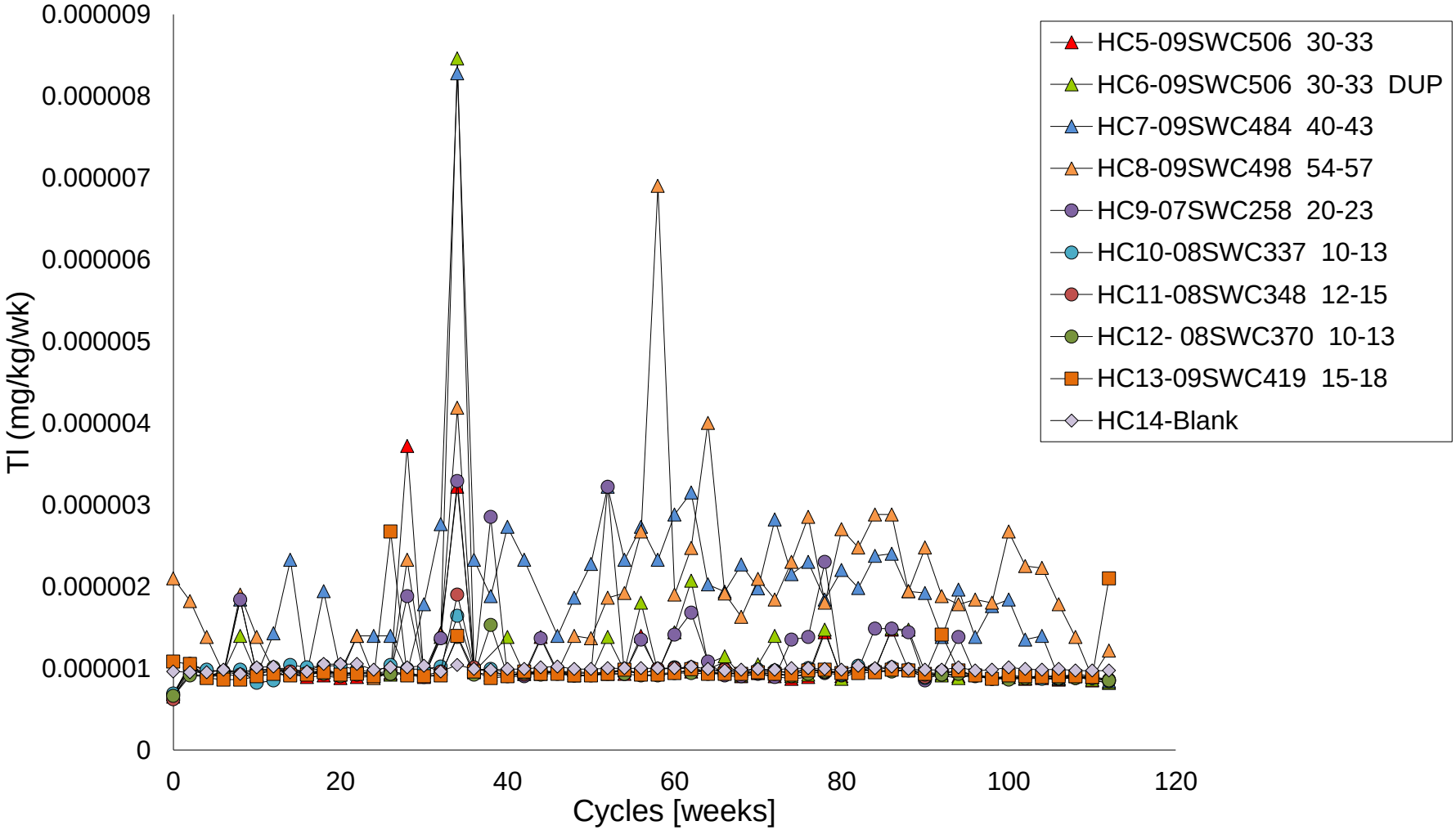
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



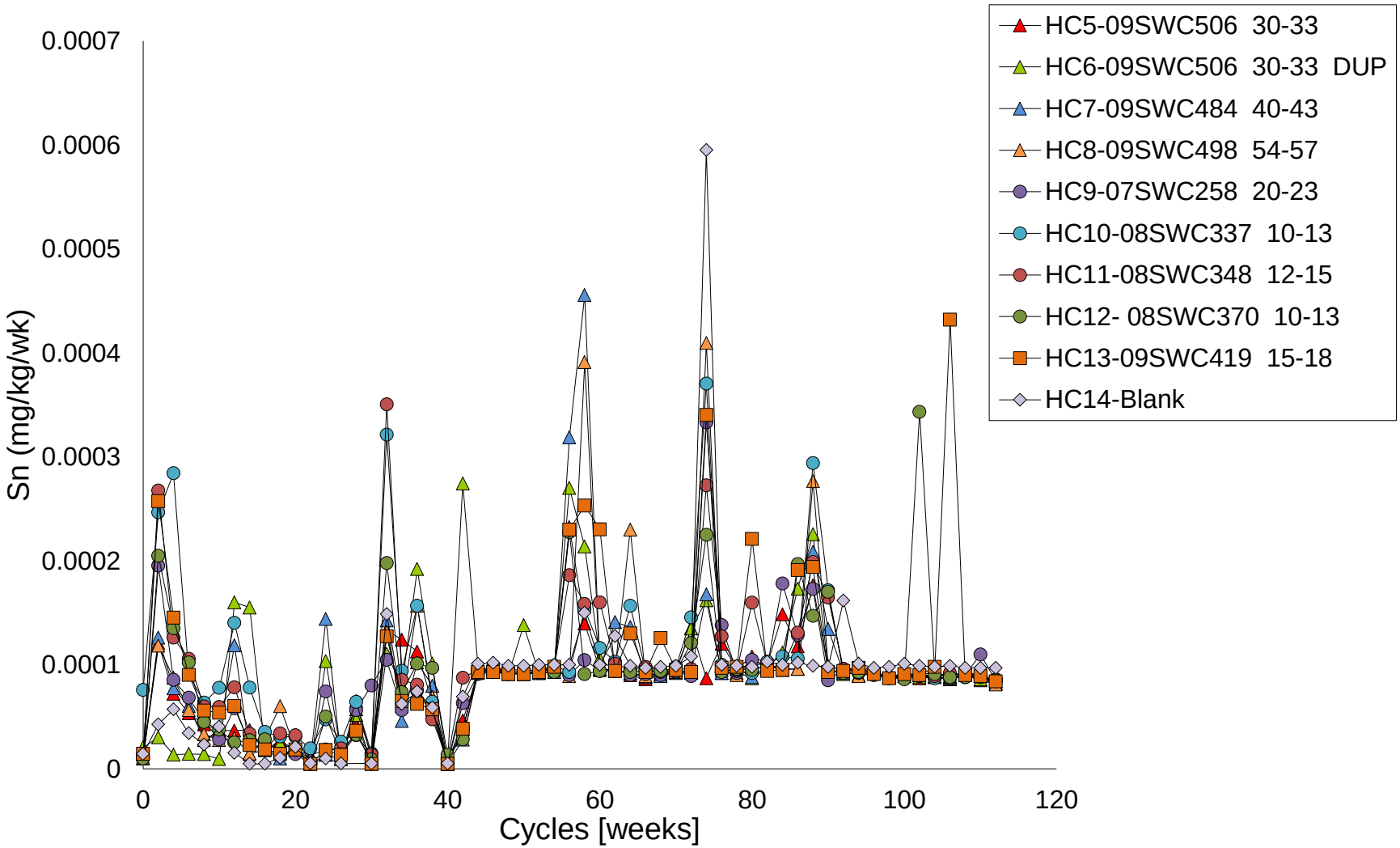
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



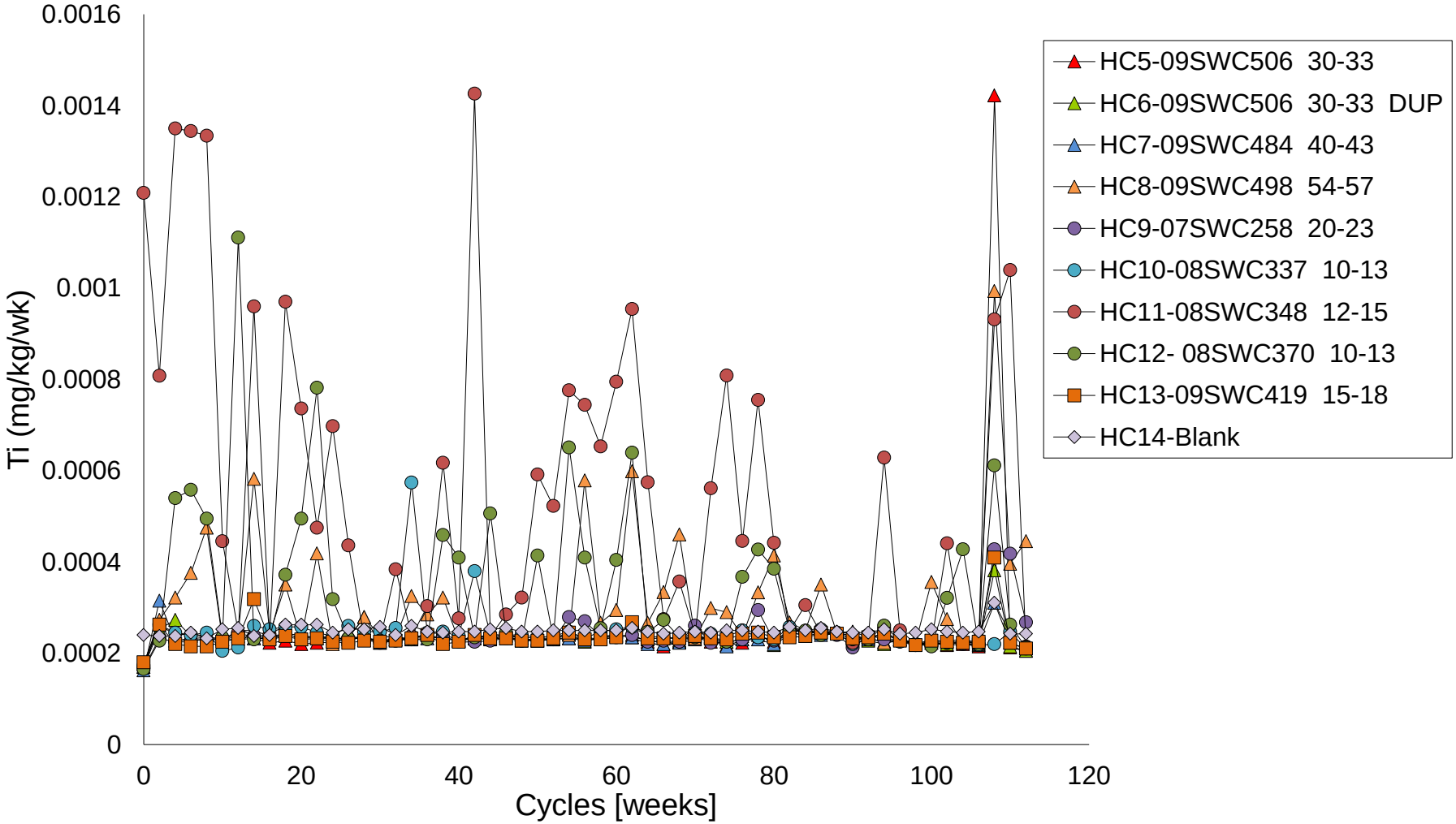
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



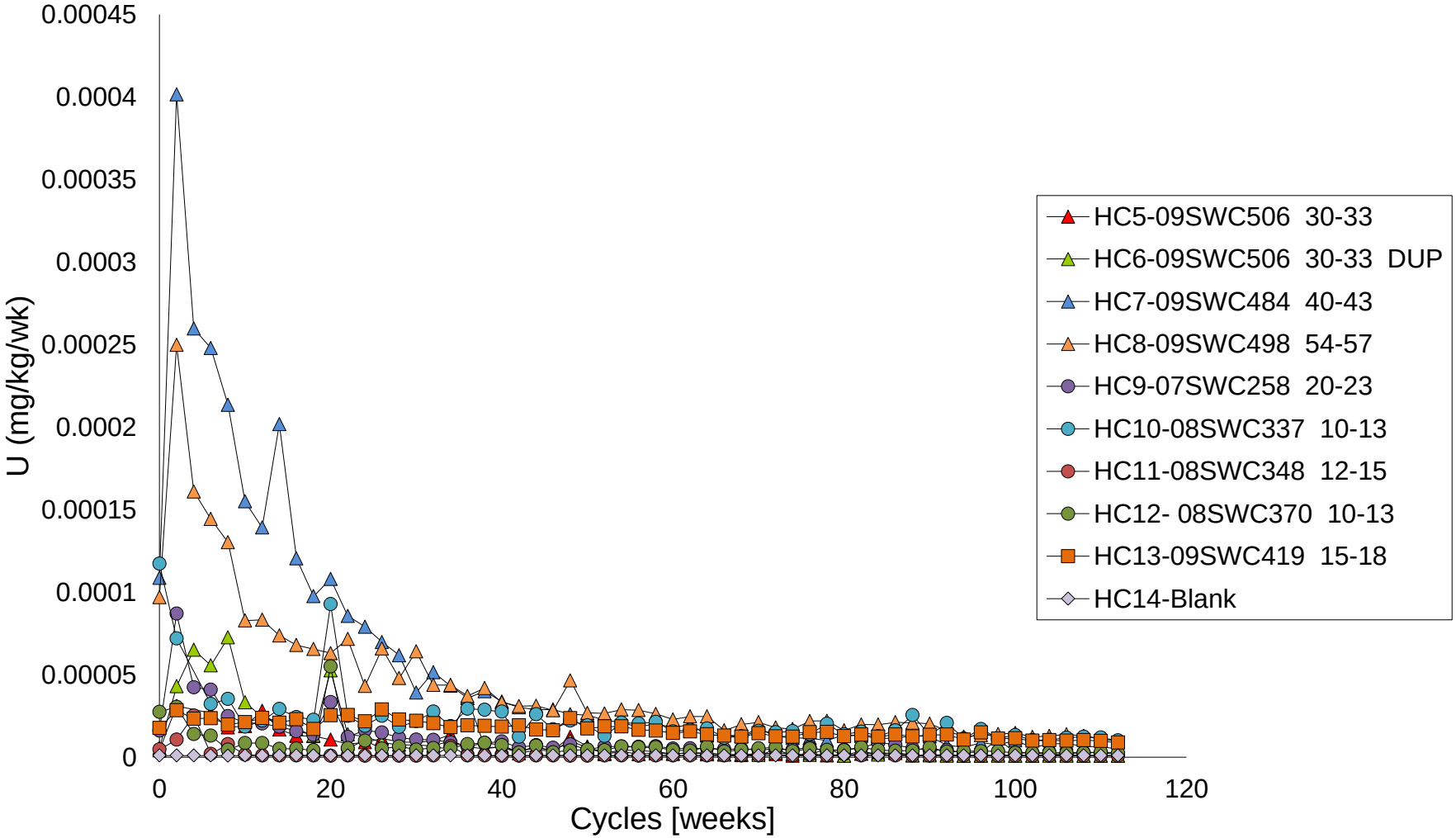
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



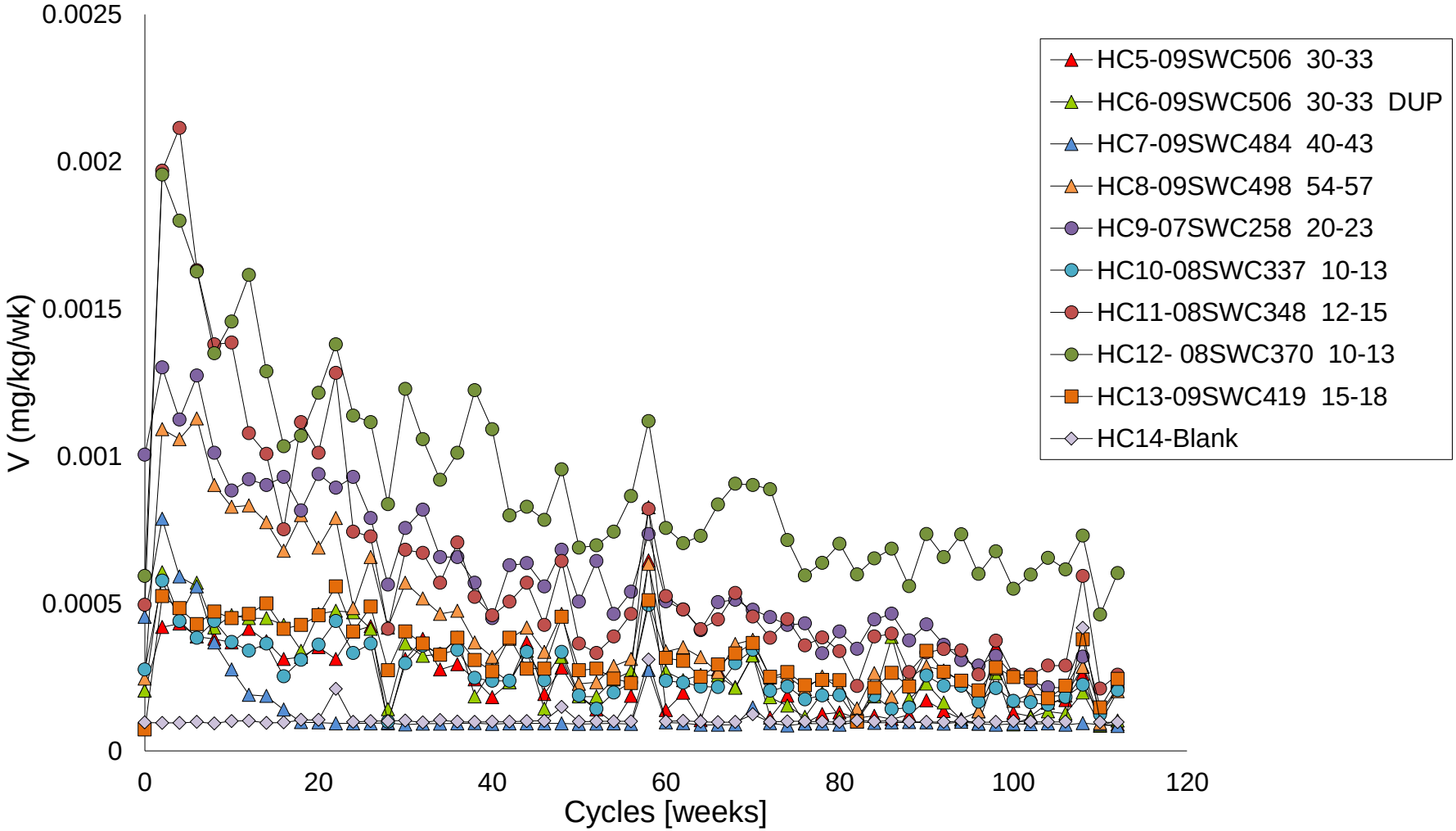
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



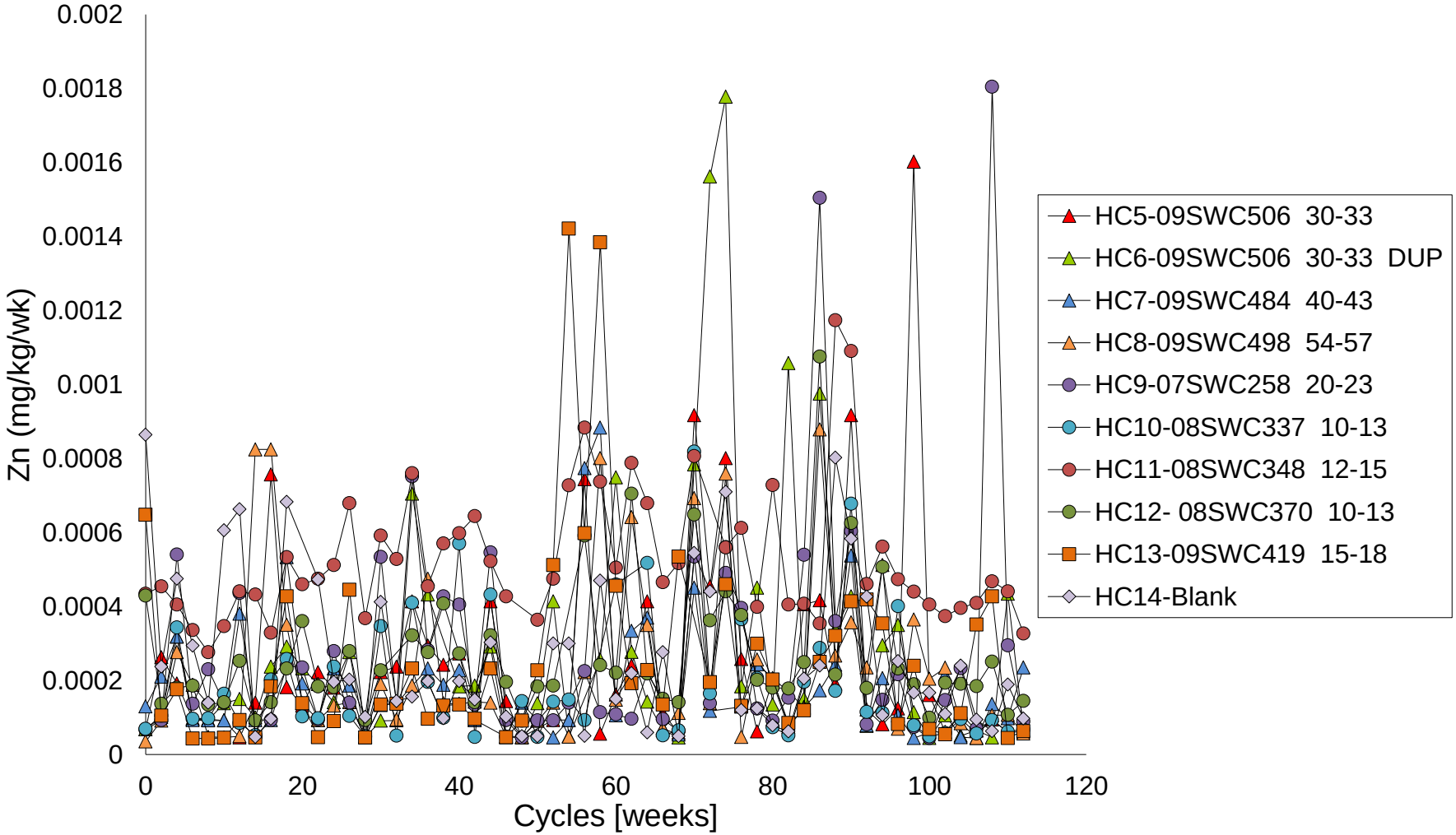
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



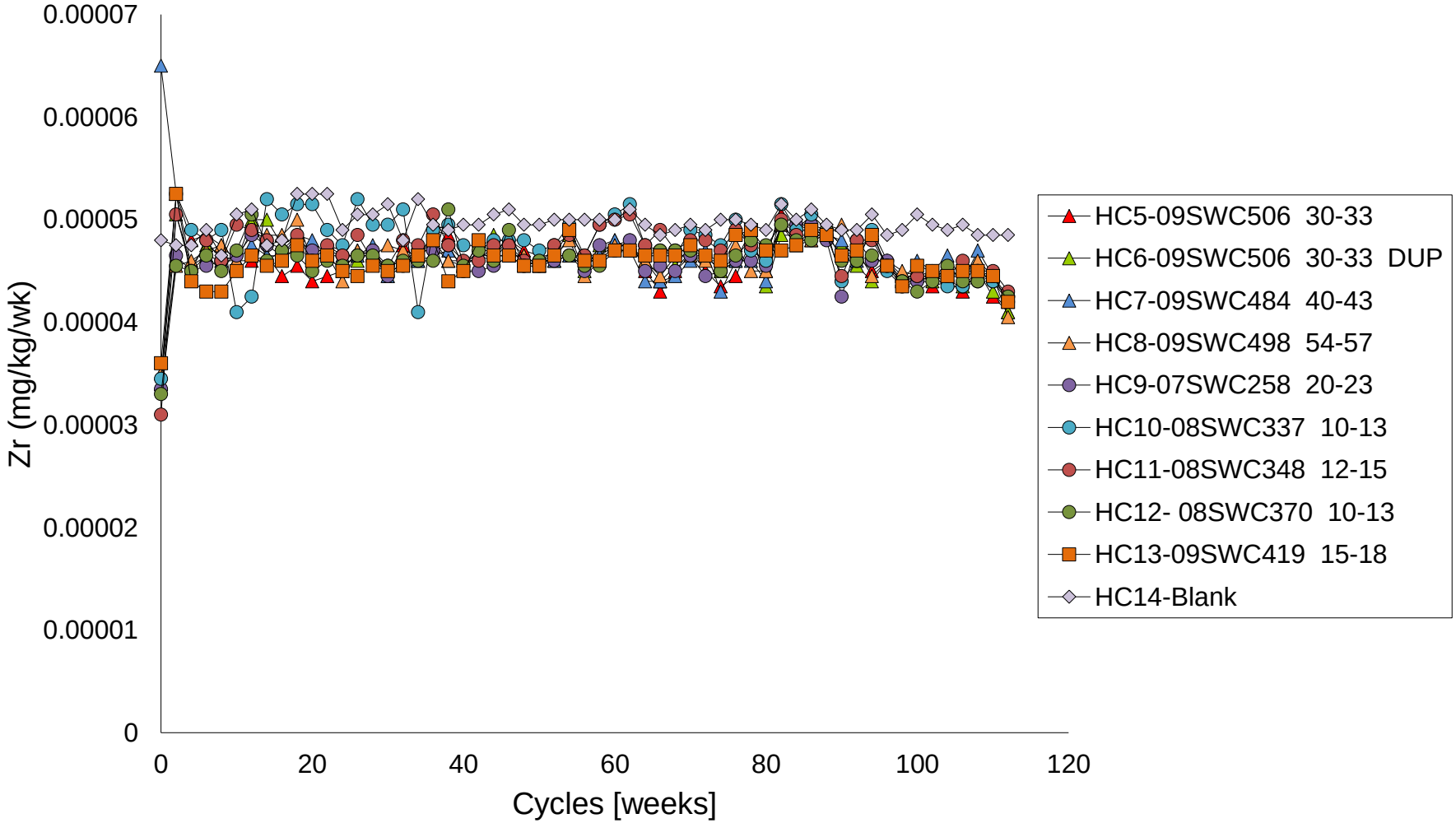
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]



K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

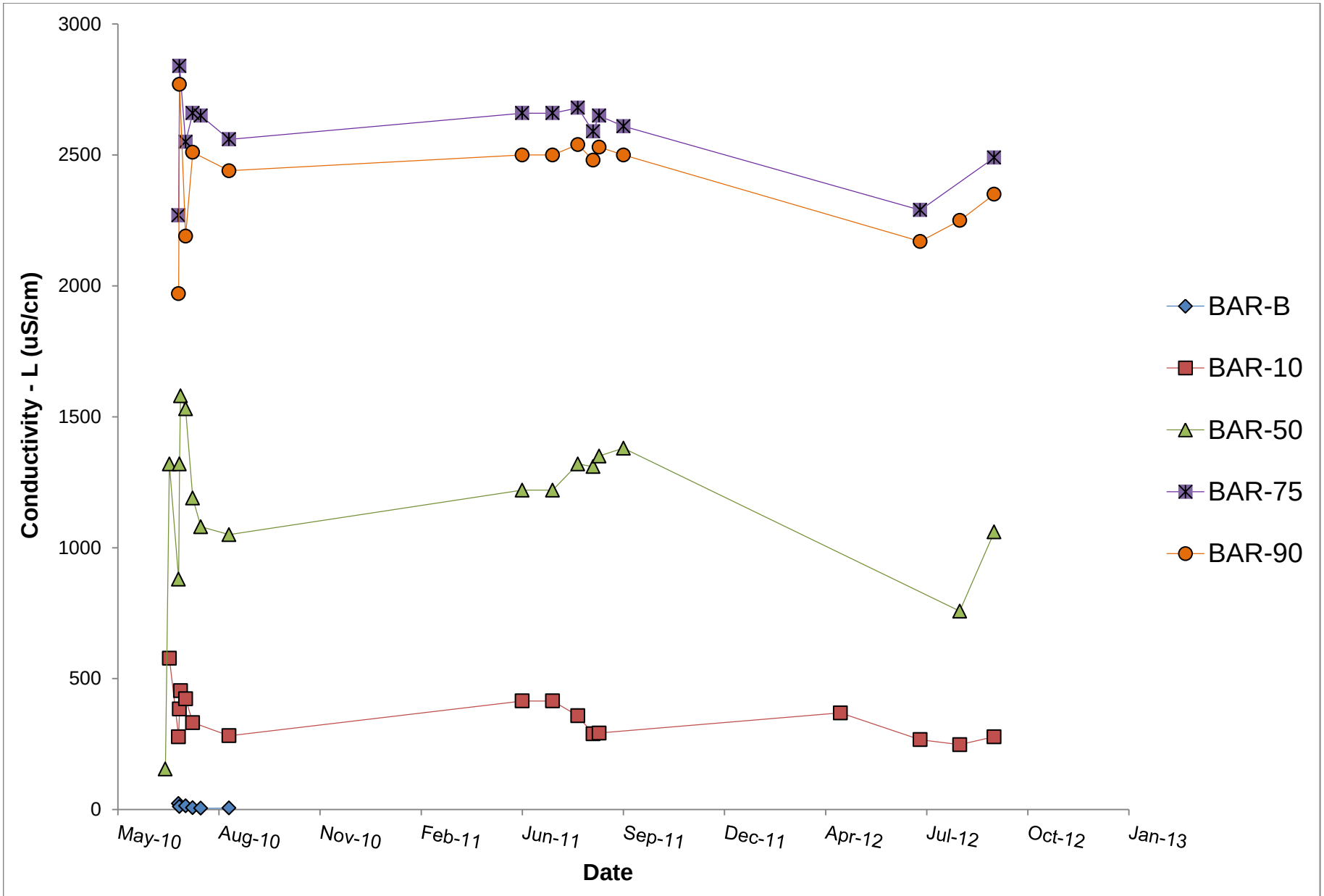


K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

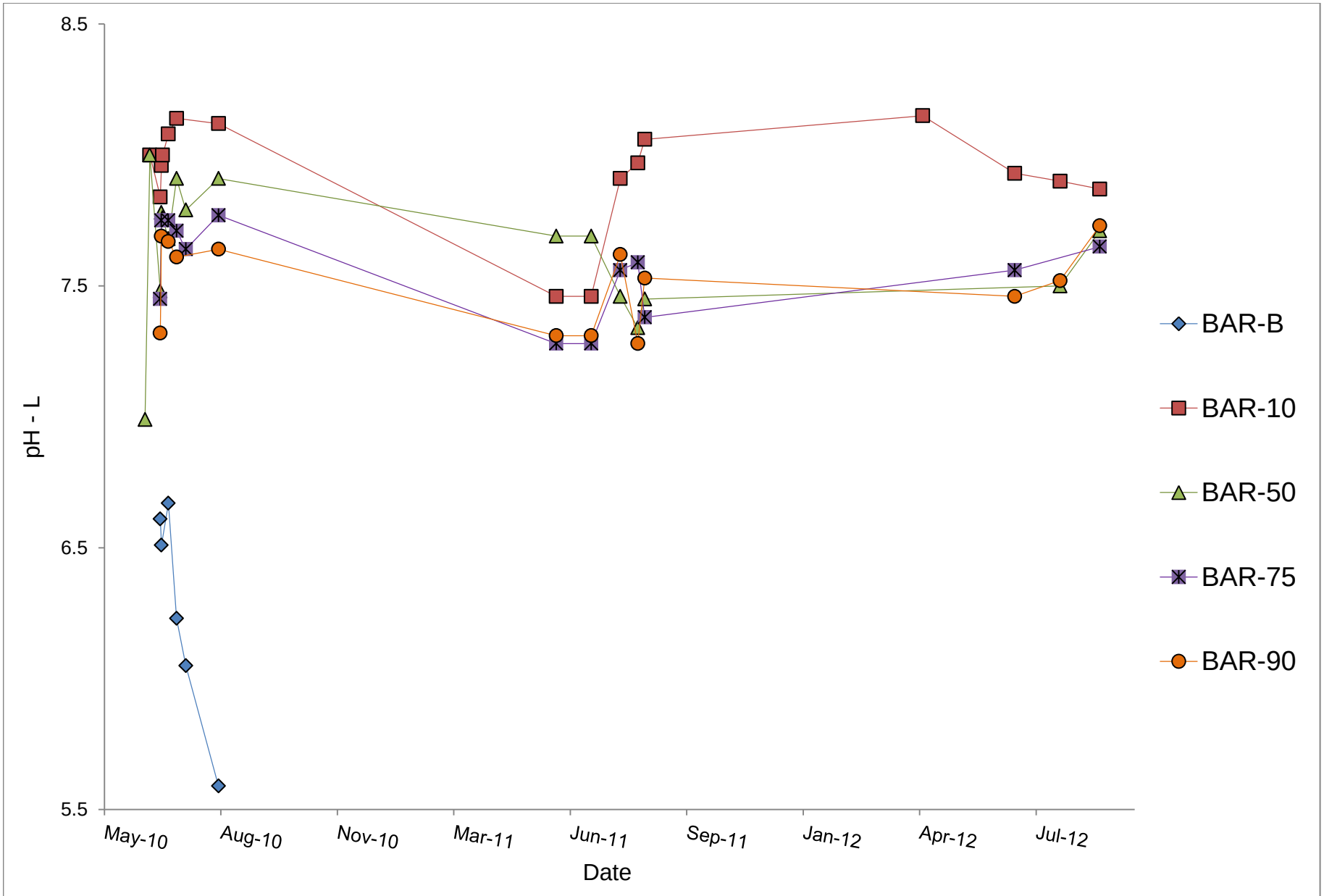


K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\D_PhaseV-VI_WasteRock_HCTs\D5_Results_Charts-ReleaseRates\[Minto_Phase5_loadings_1CM002.003.rtc.rev01.xlsx]

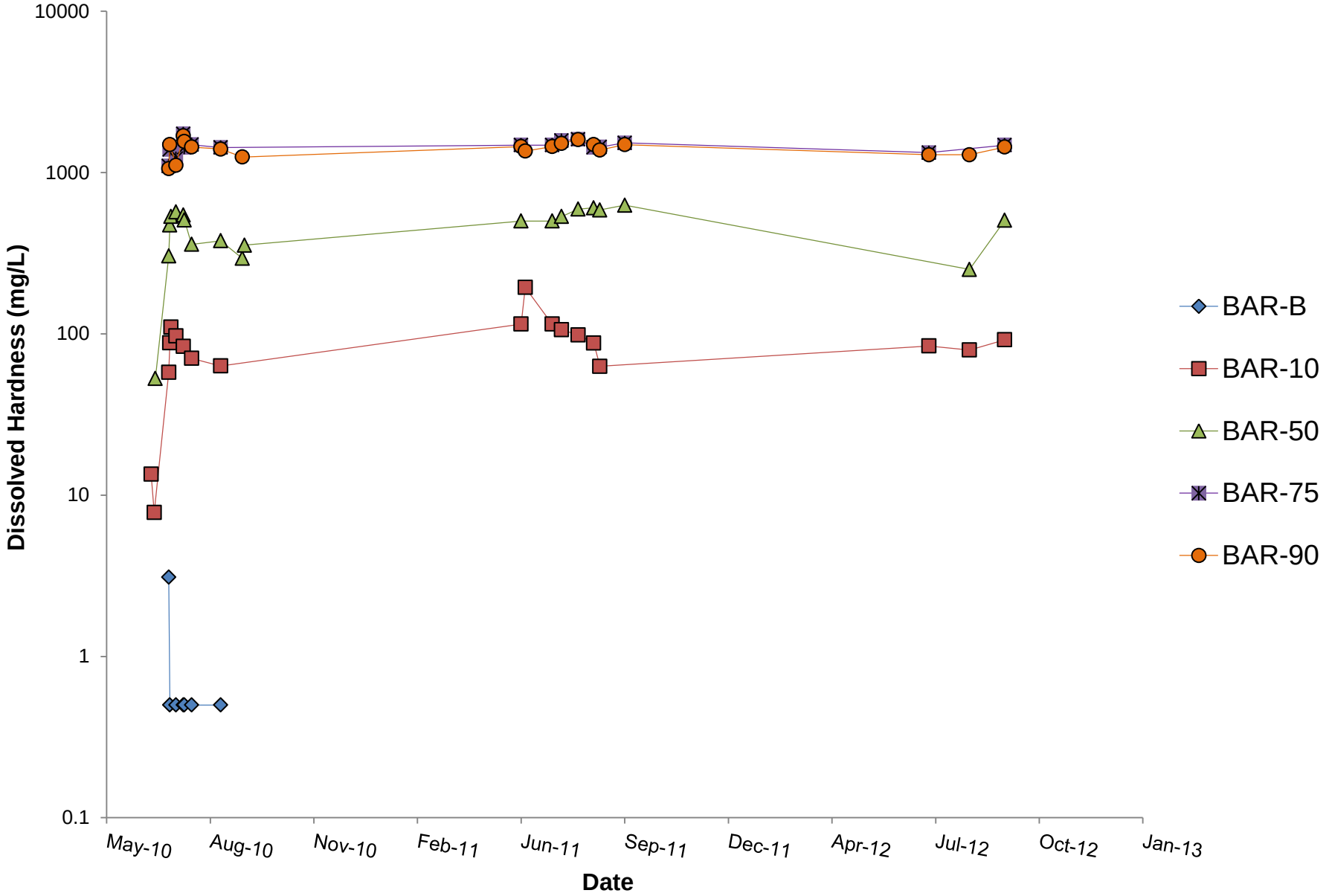
Appendix E
On-Site Waste Rock Barrel Test Results



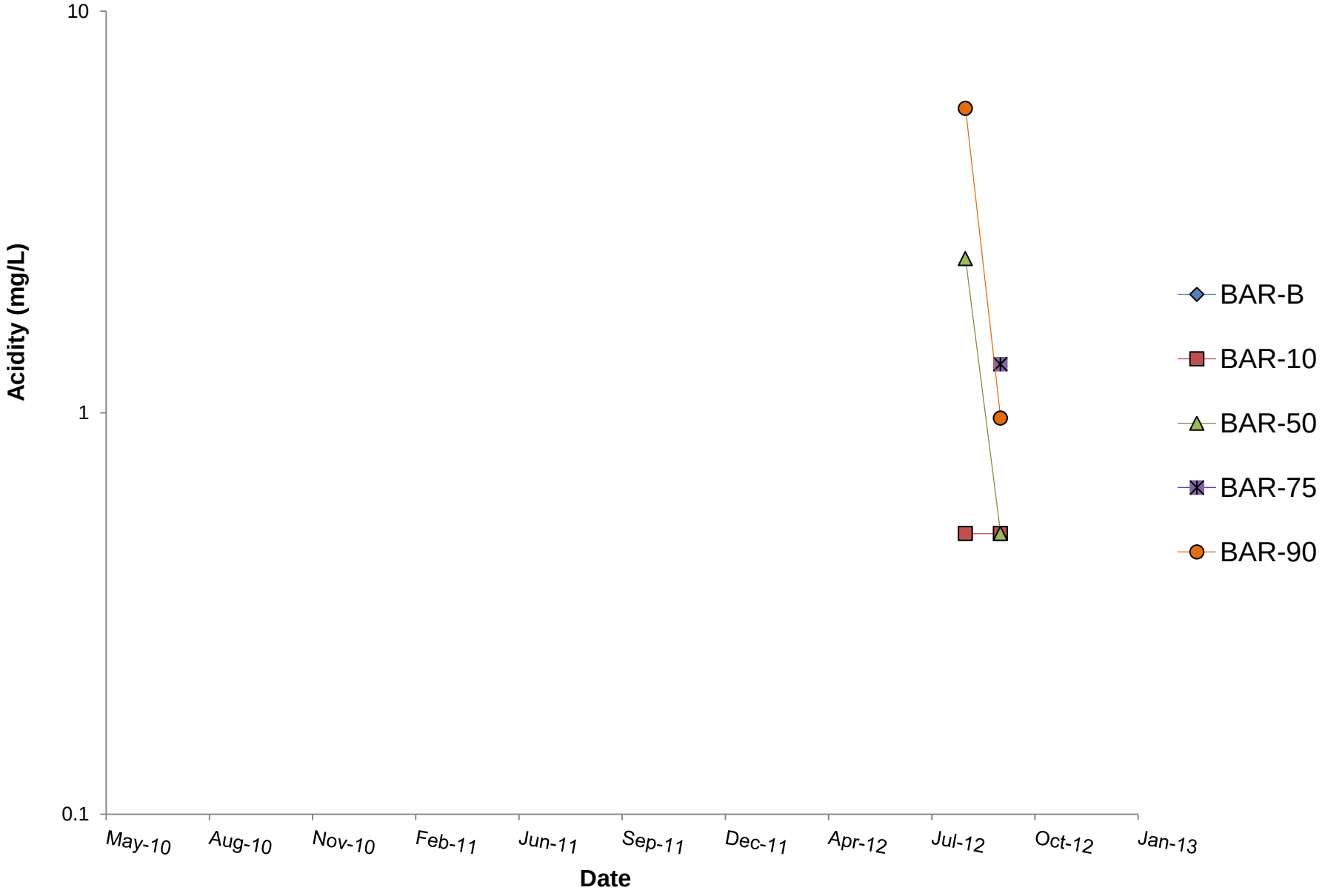
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



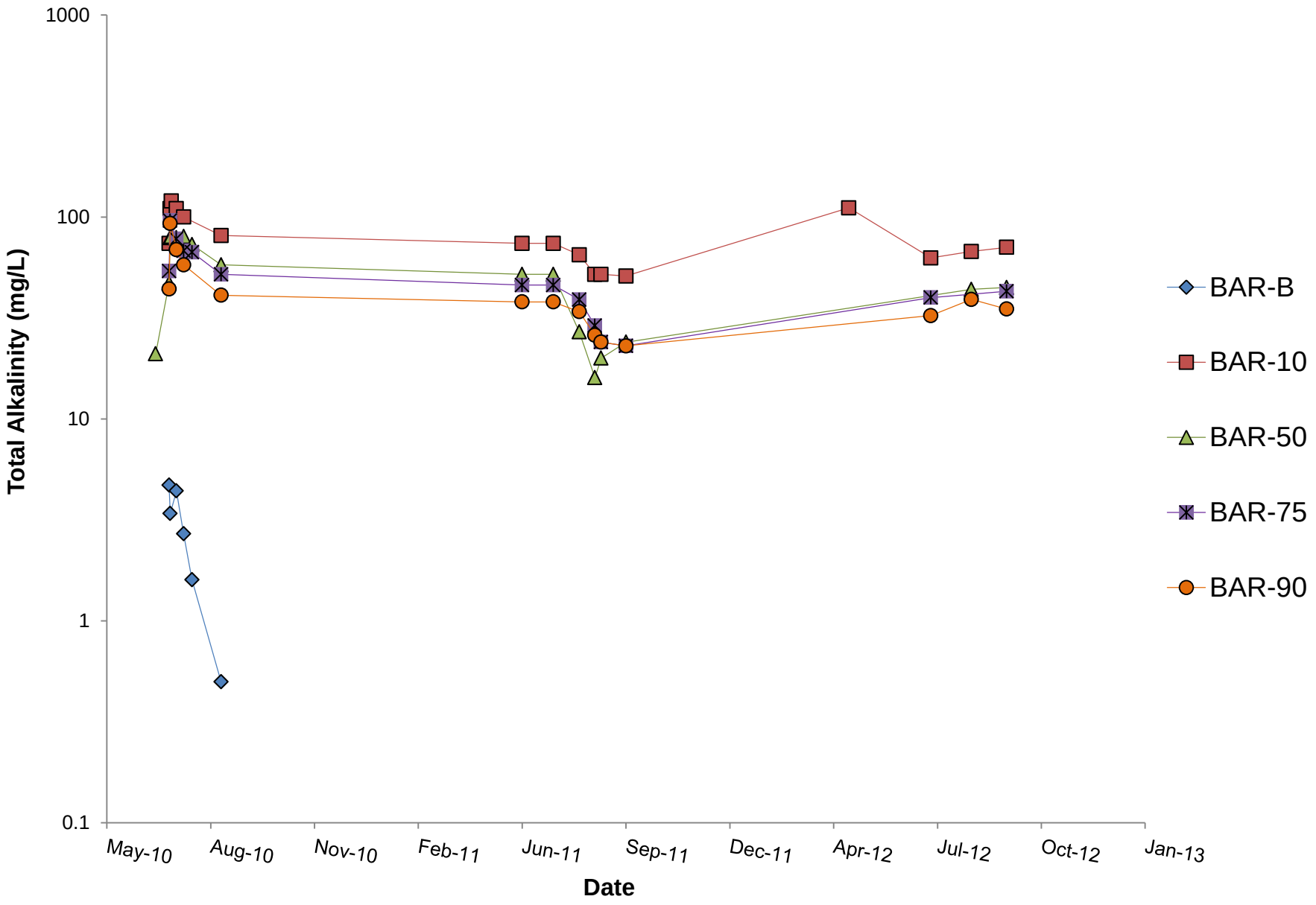
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



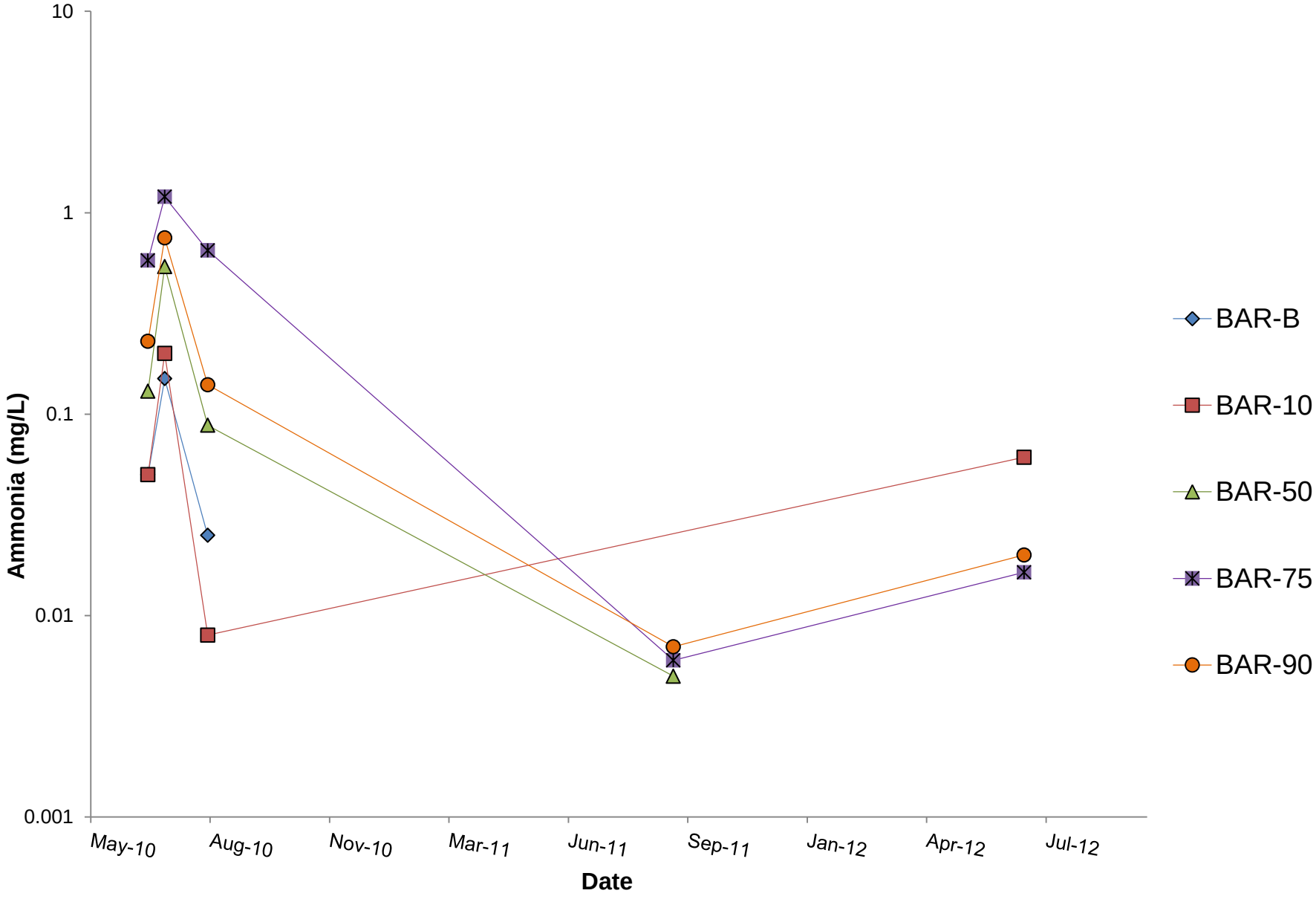
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



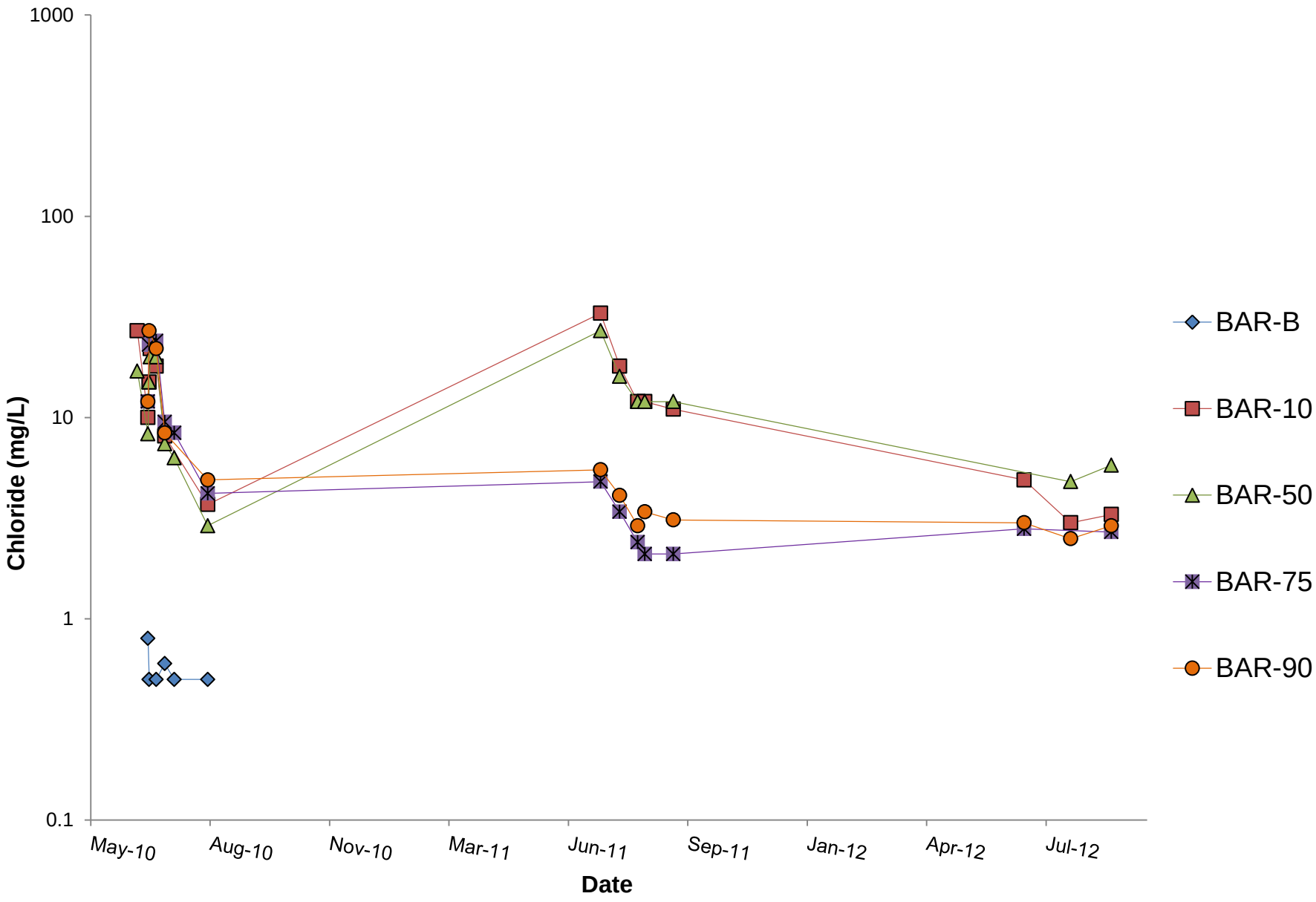
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



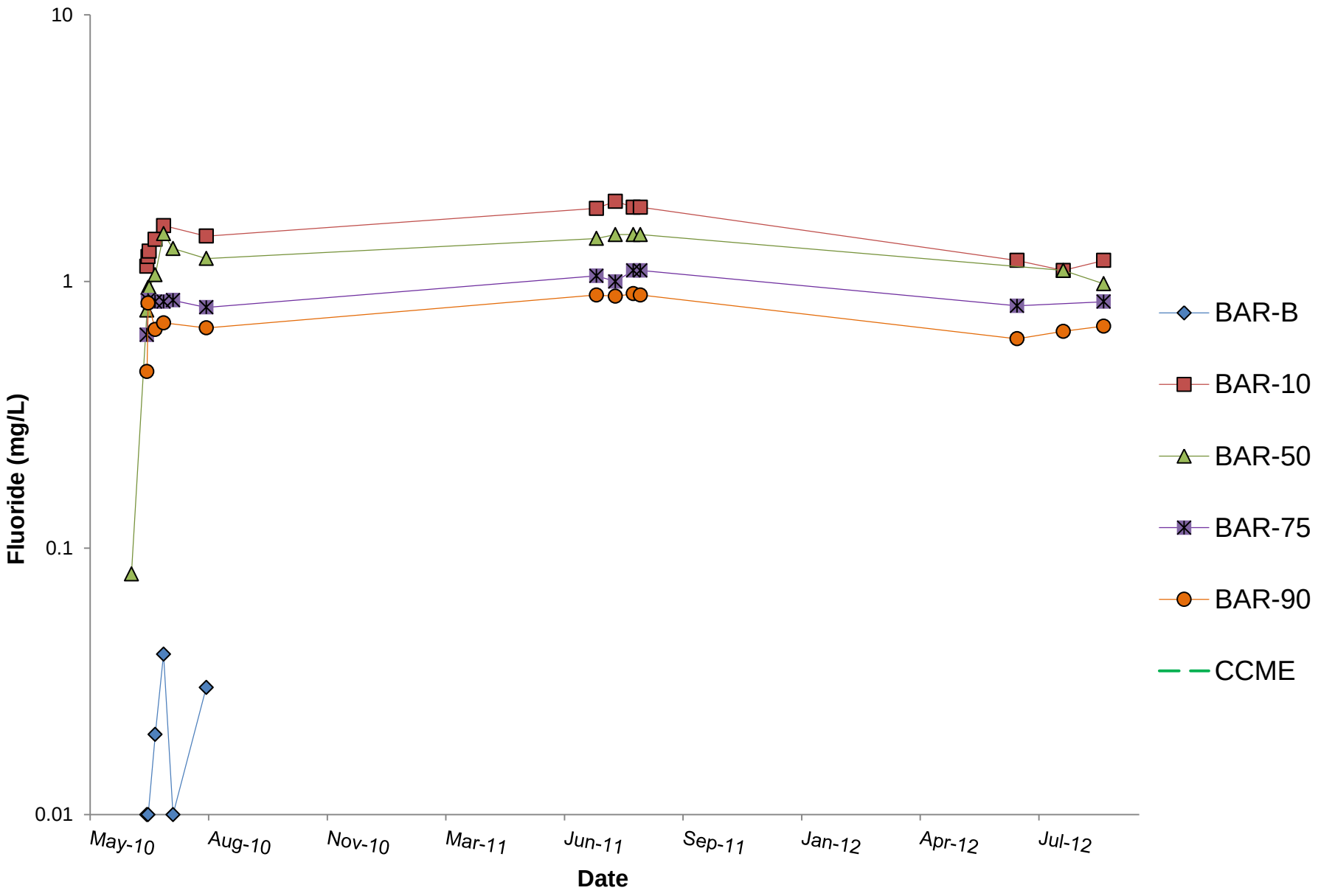
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



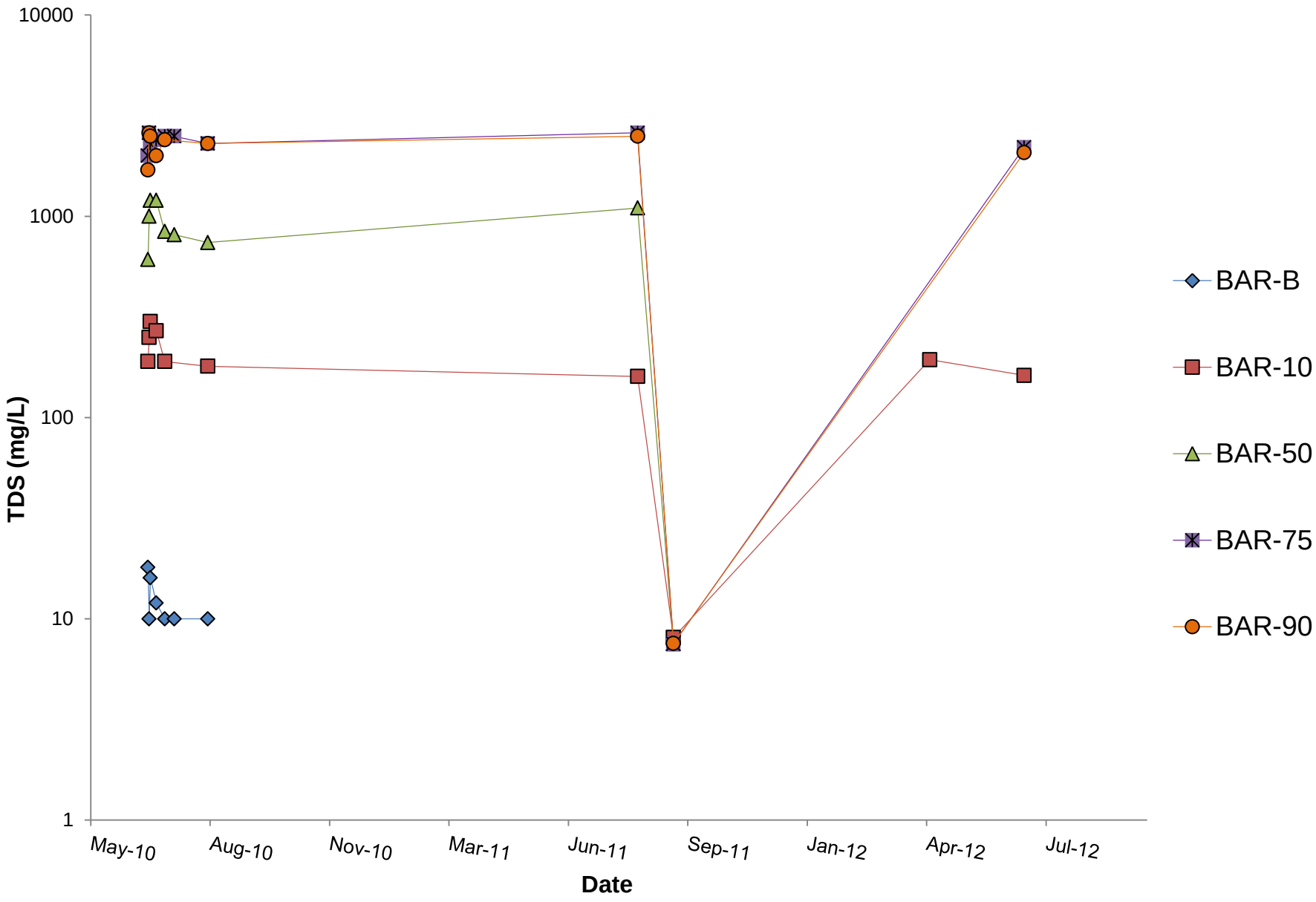
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



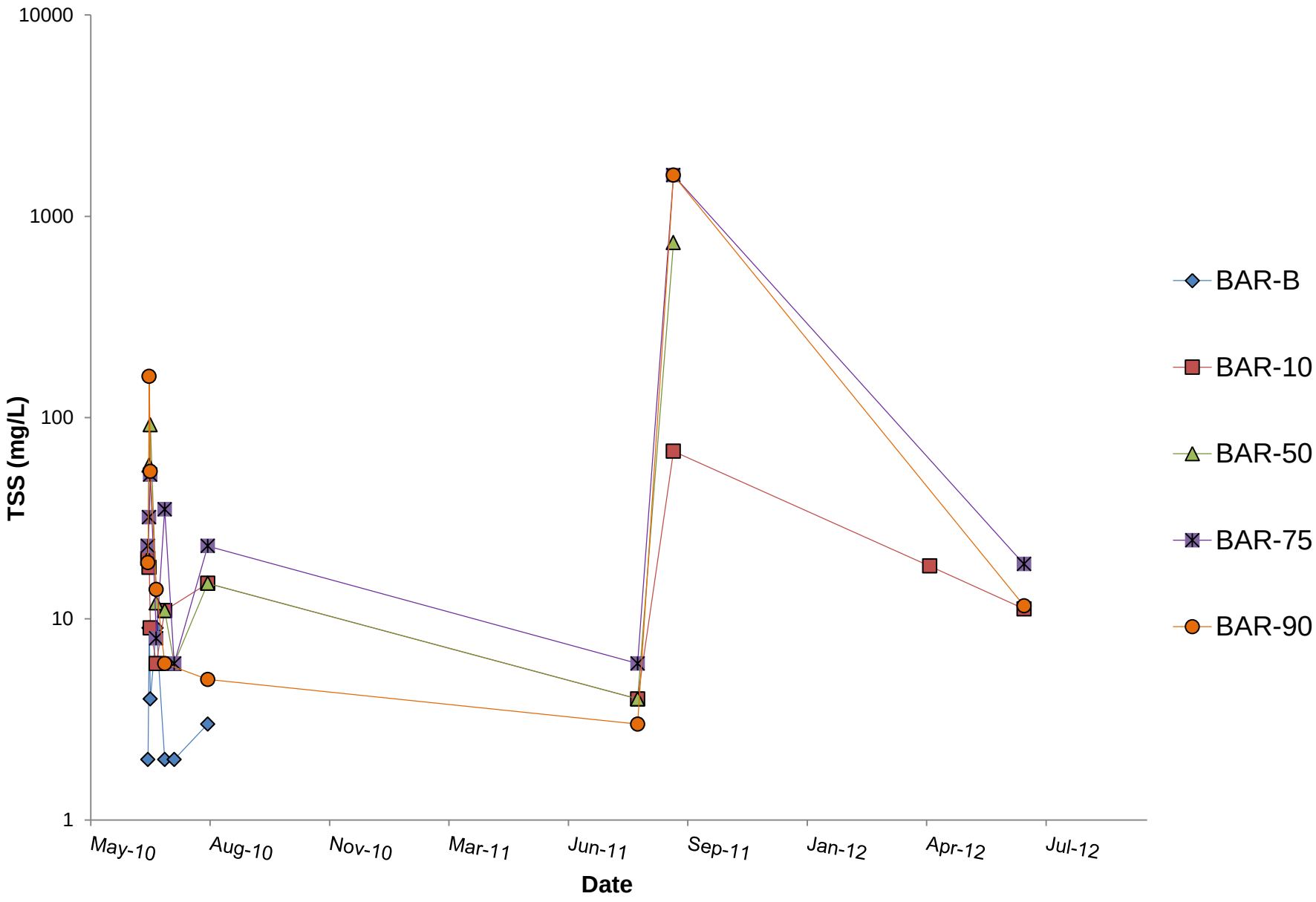
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



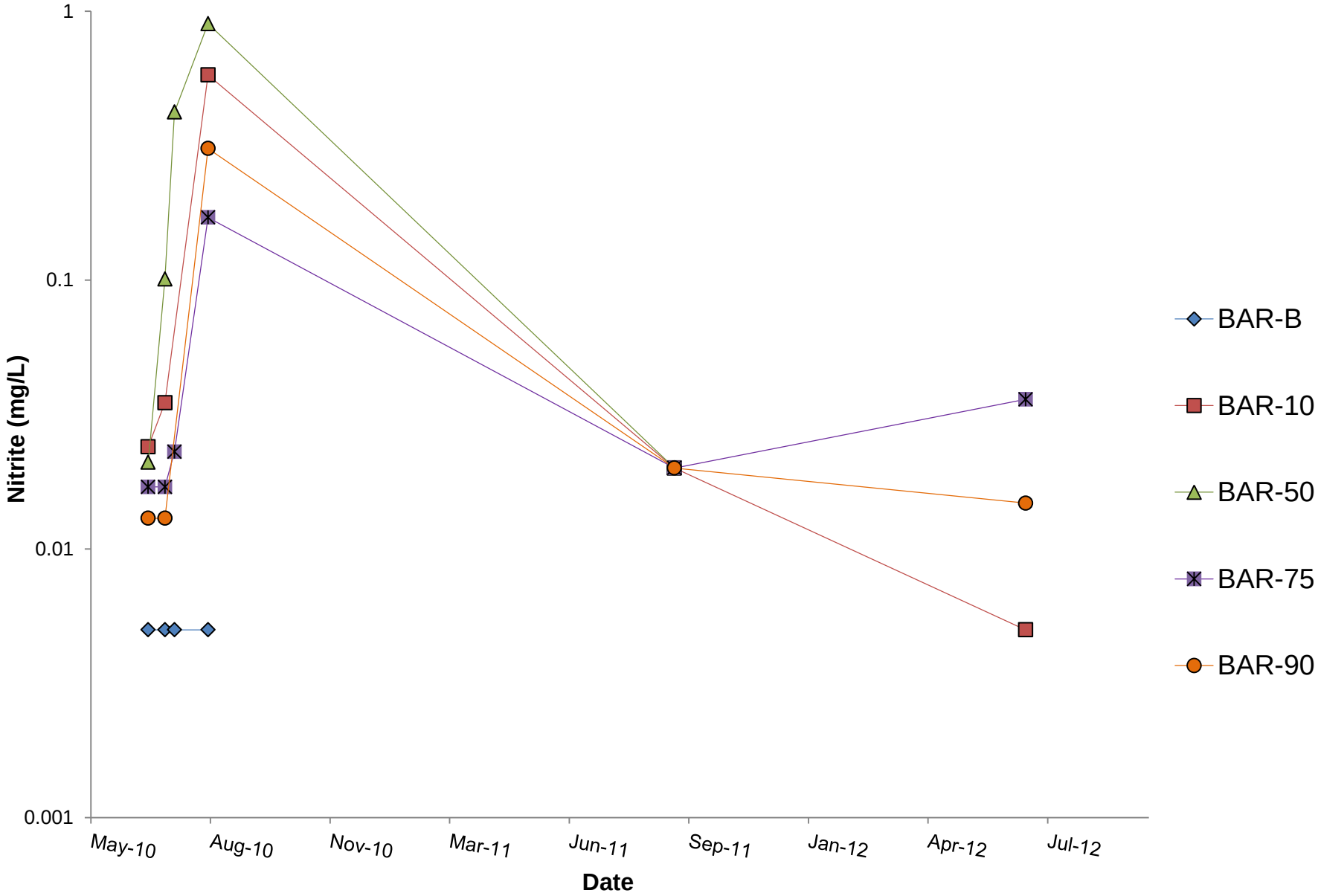
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



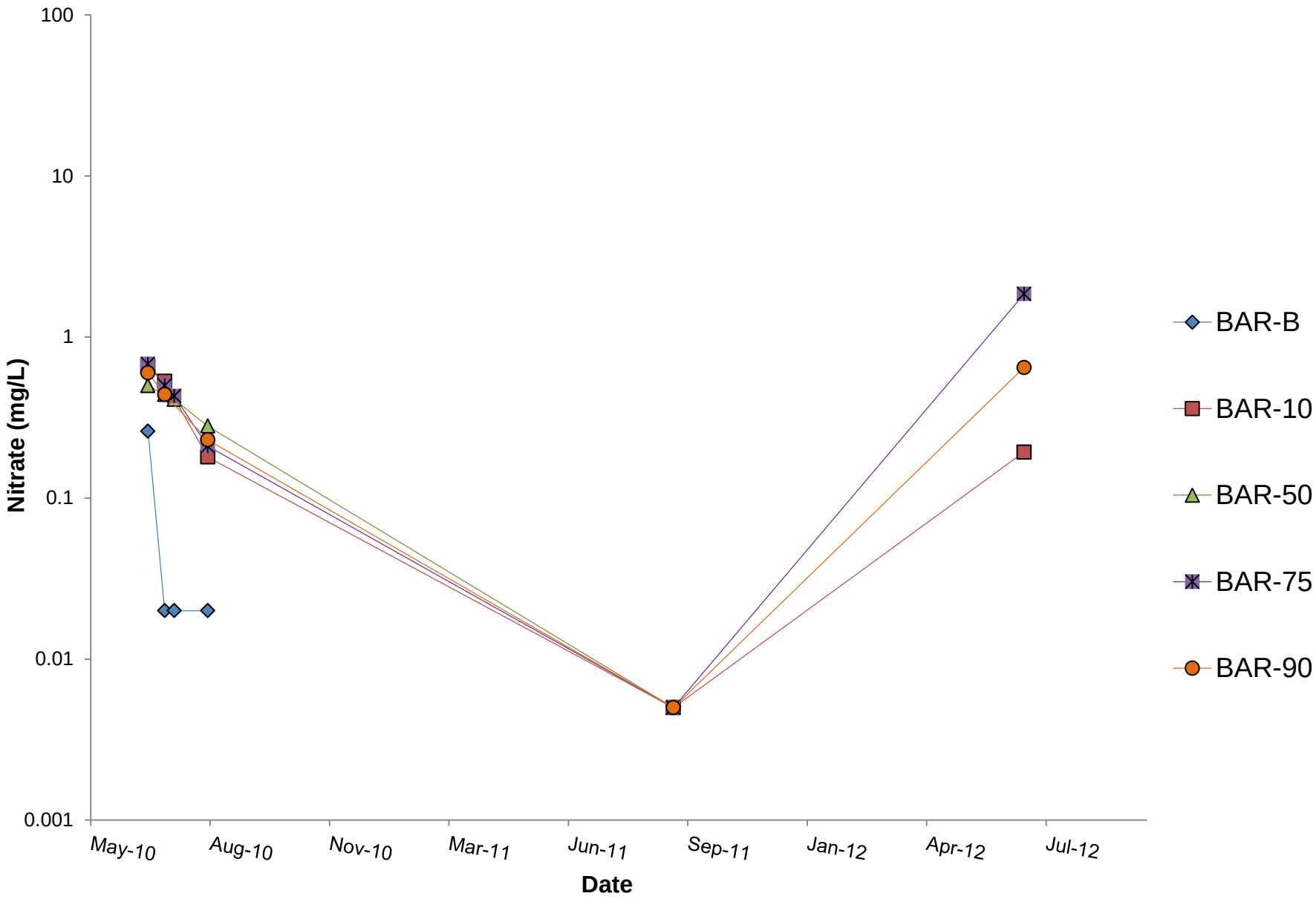
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



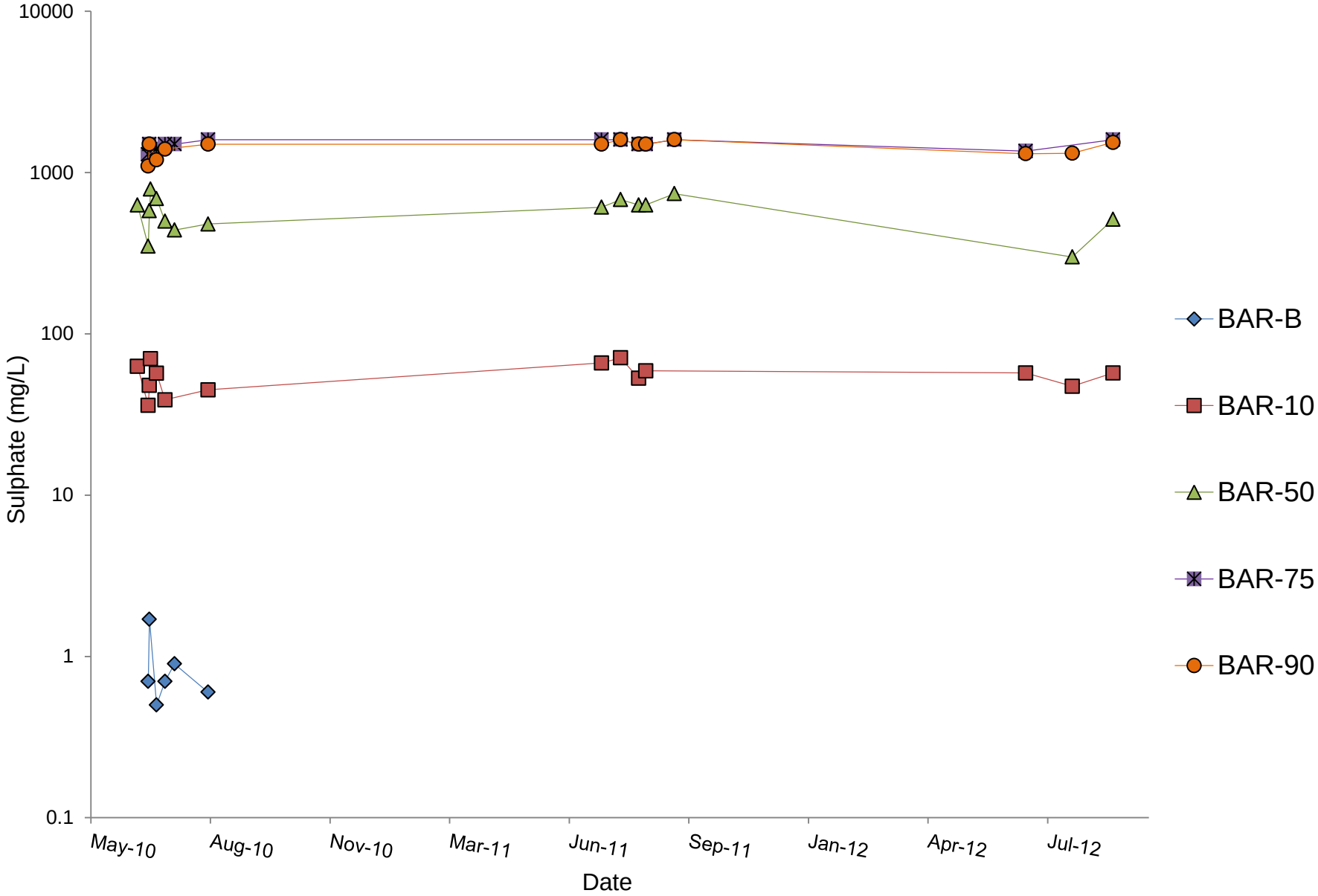
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



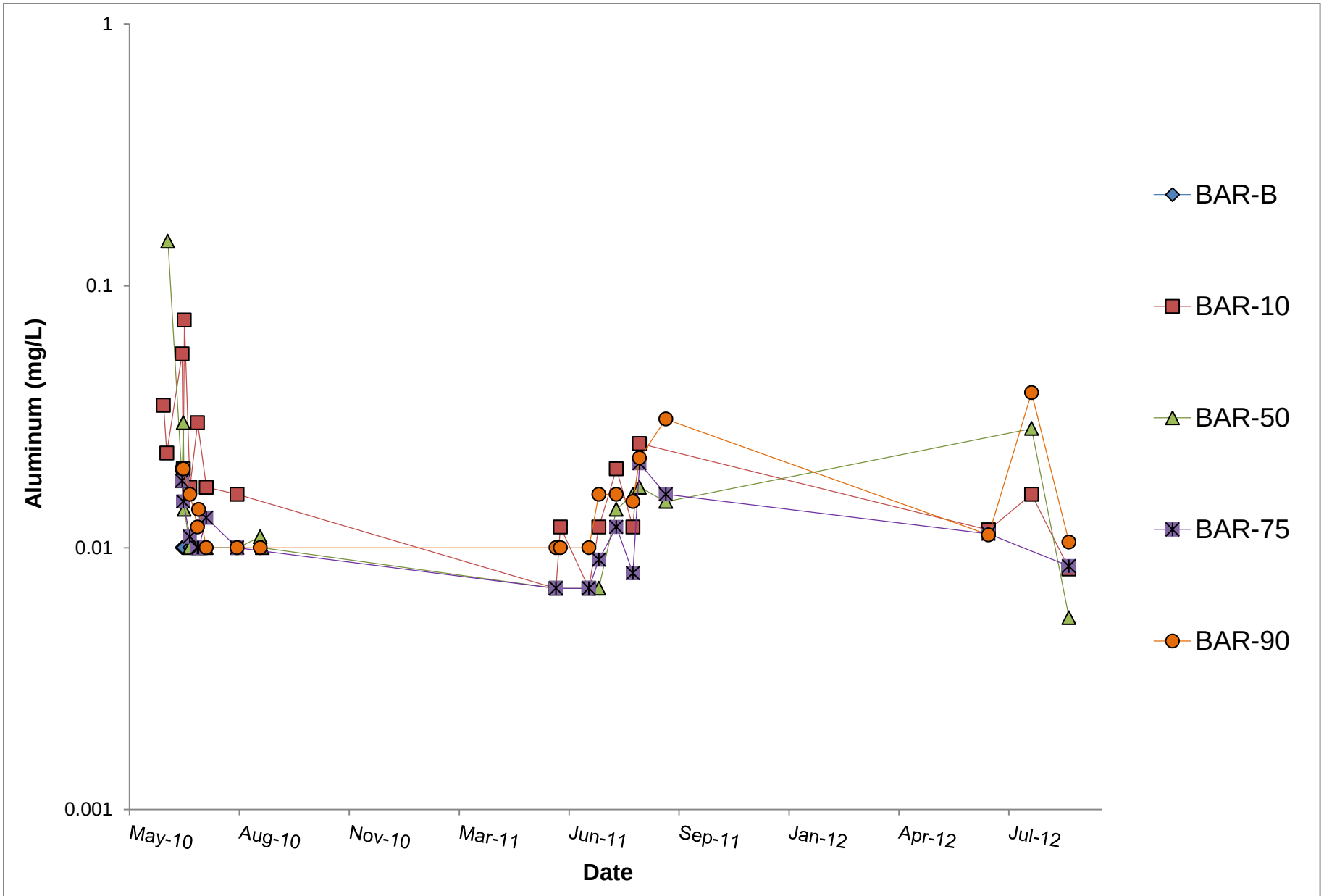
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



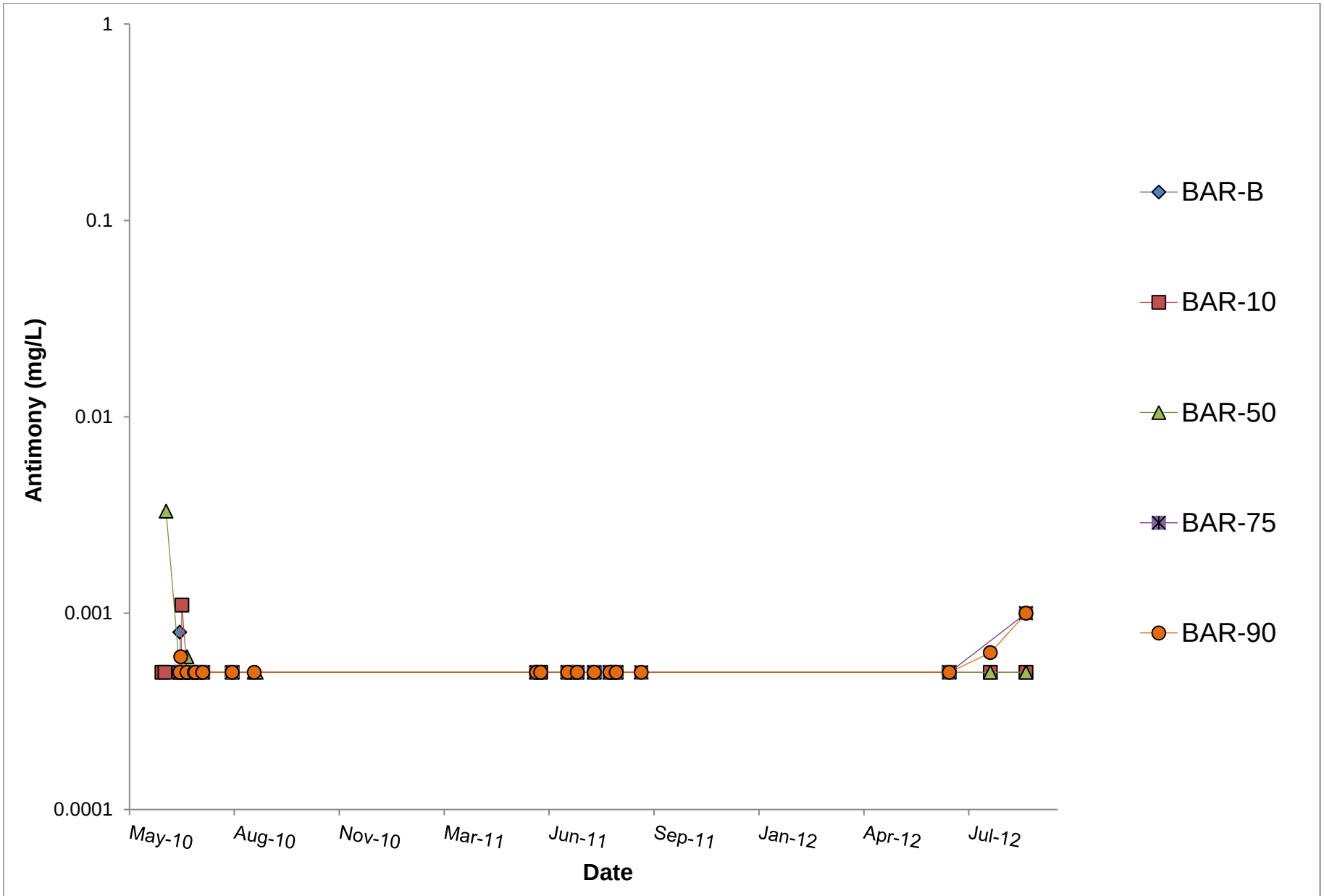
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



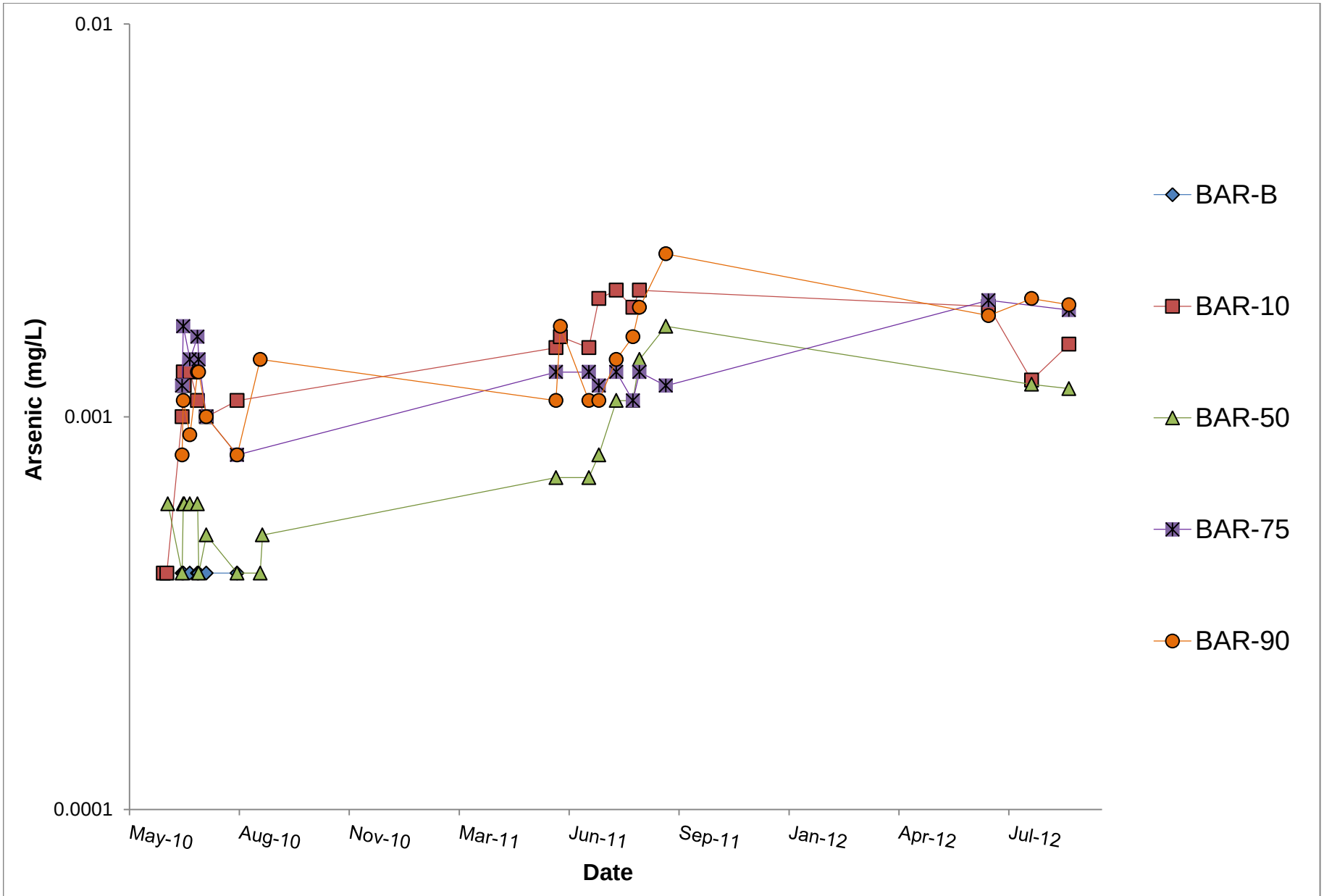
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



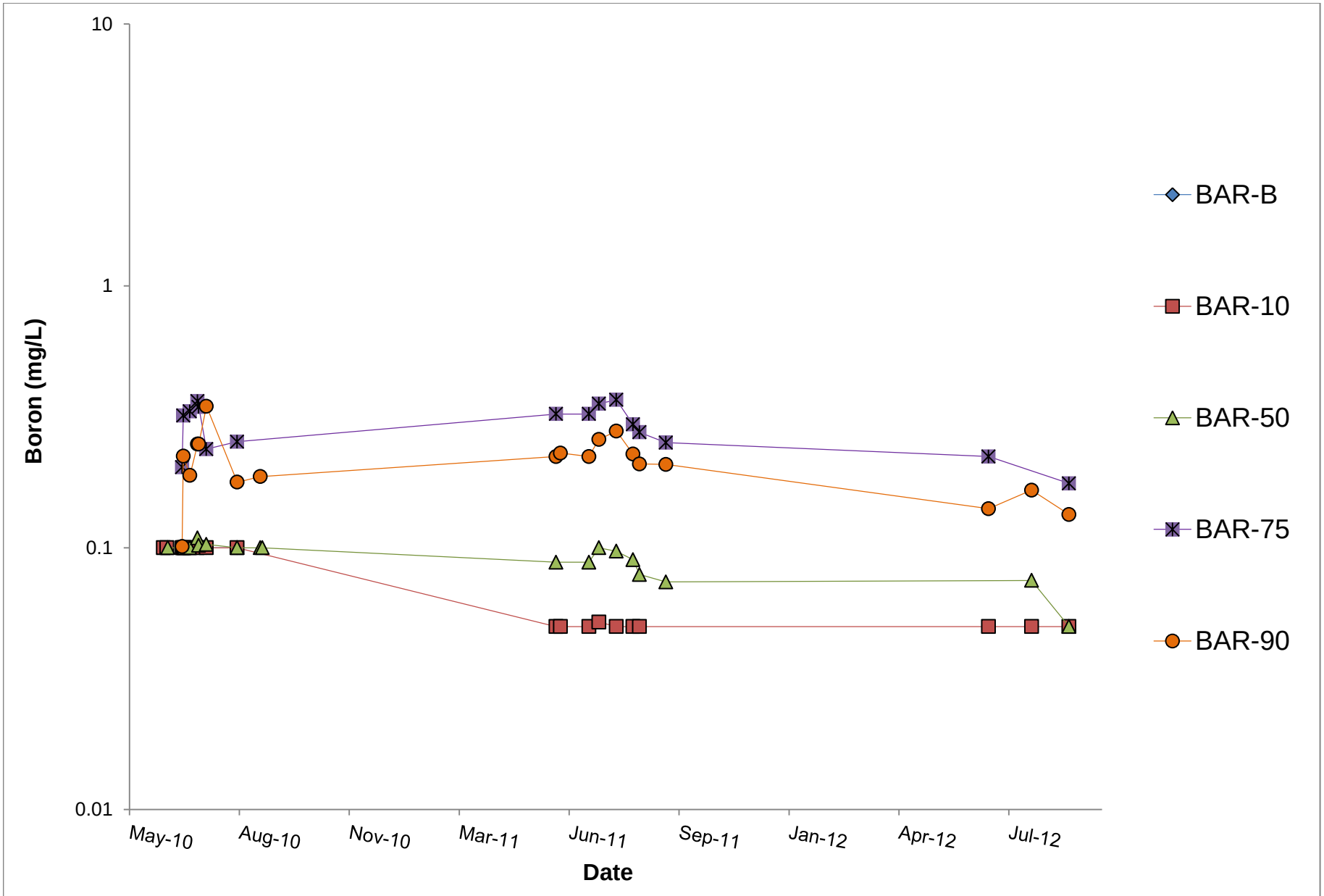
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



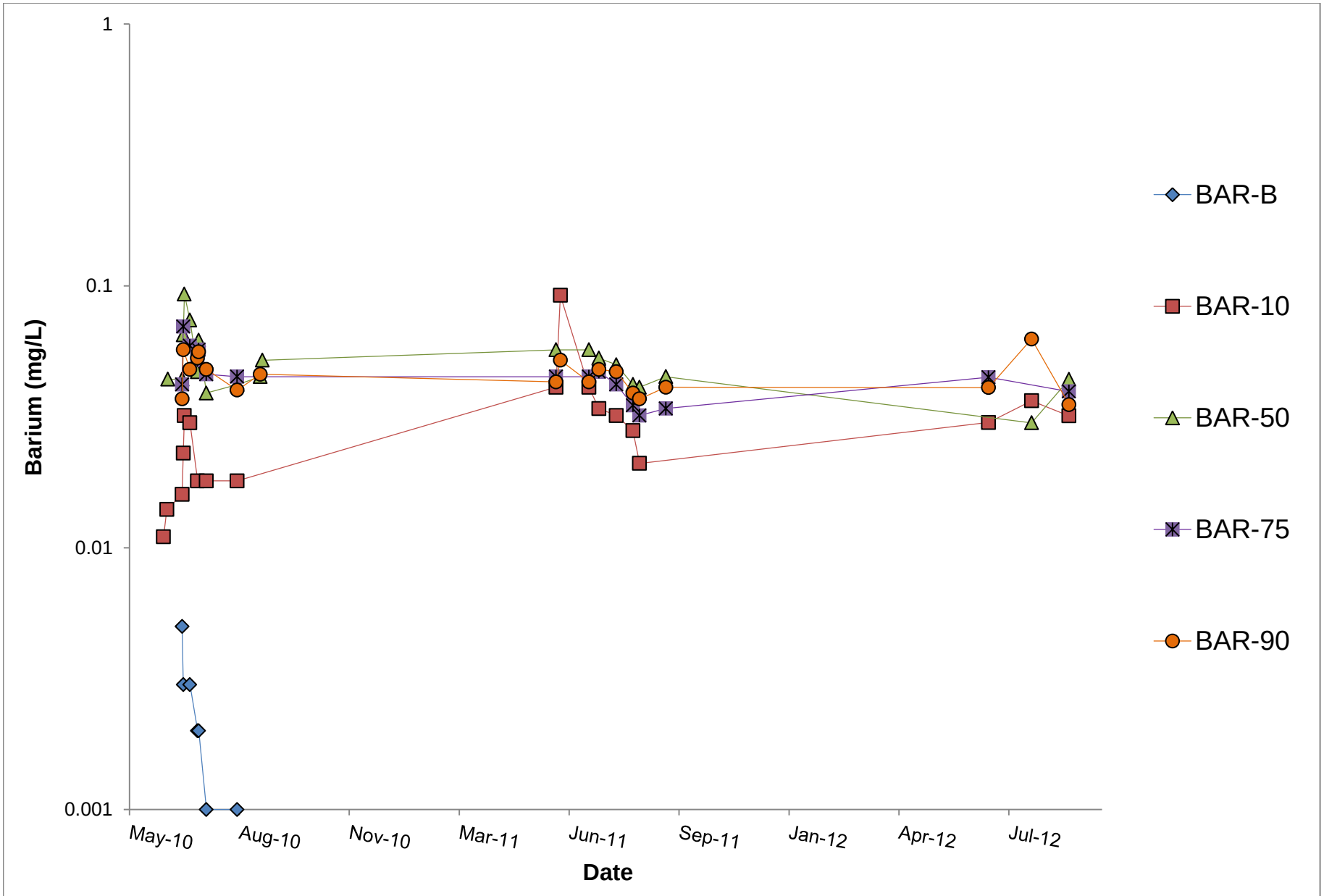
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



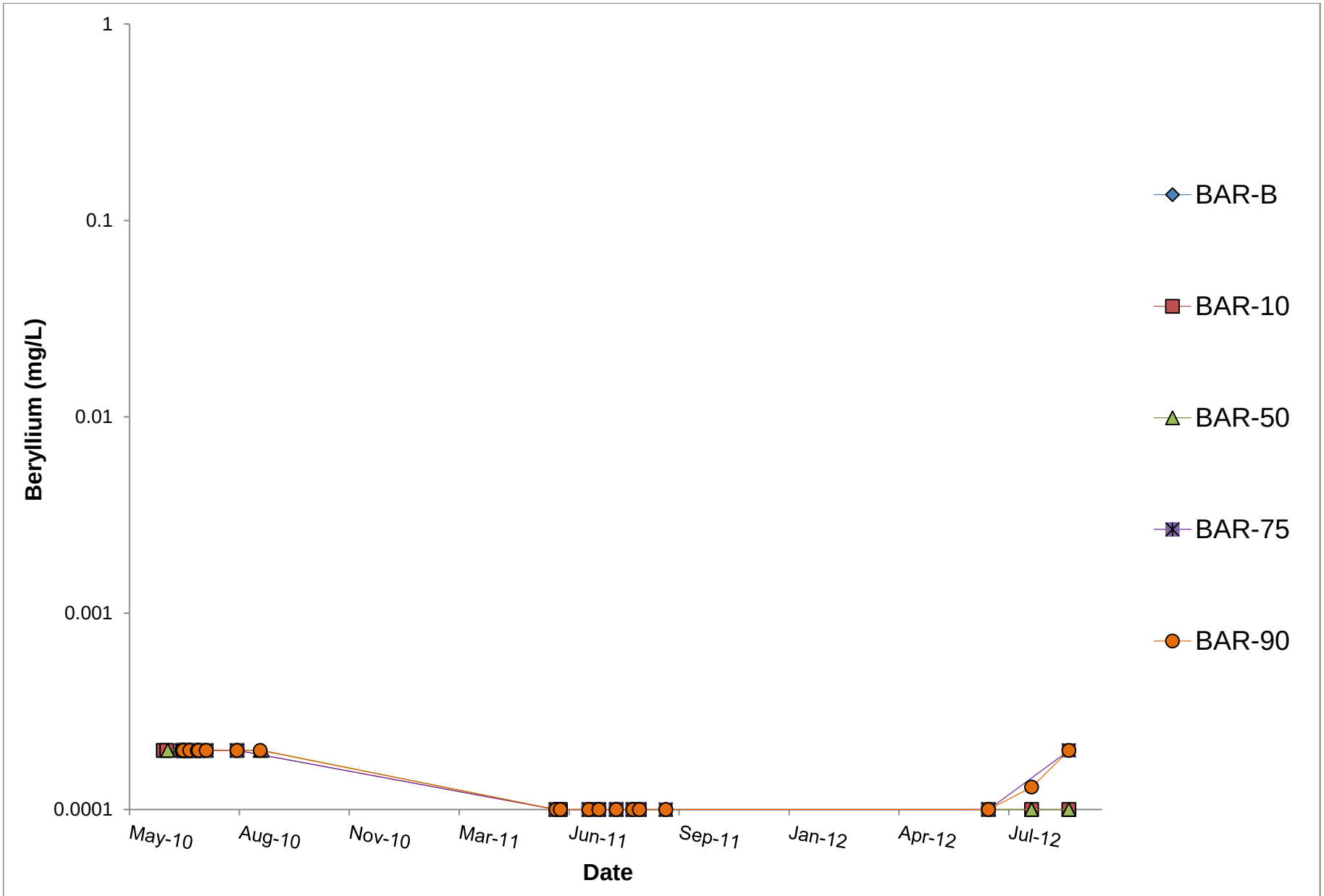
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



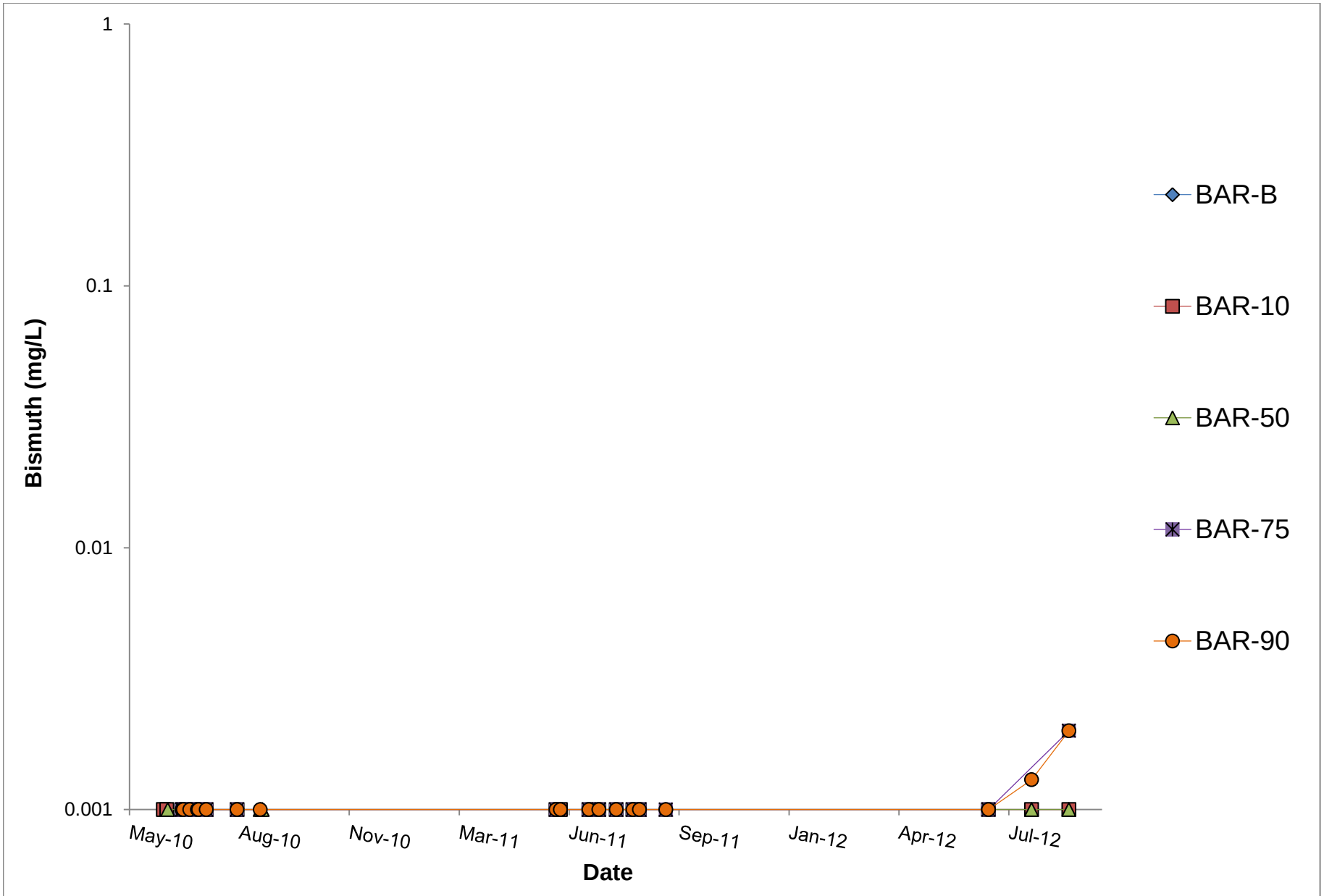
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



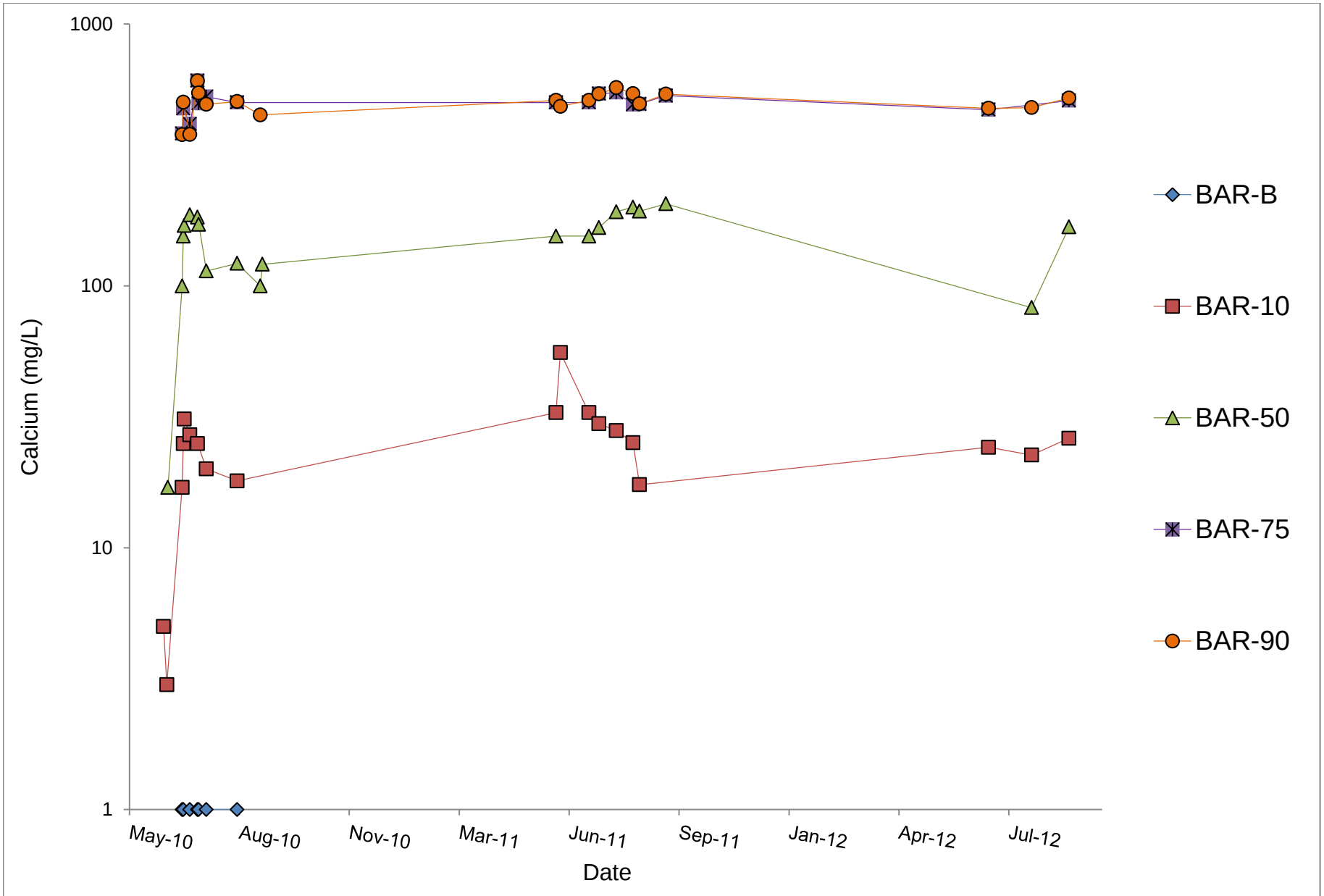
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



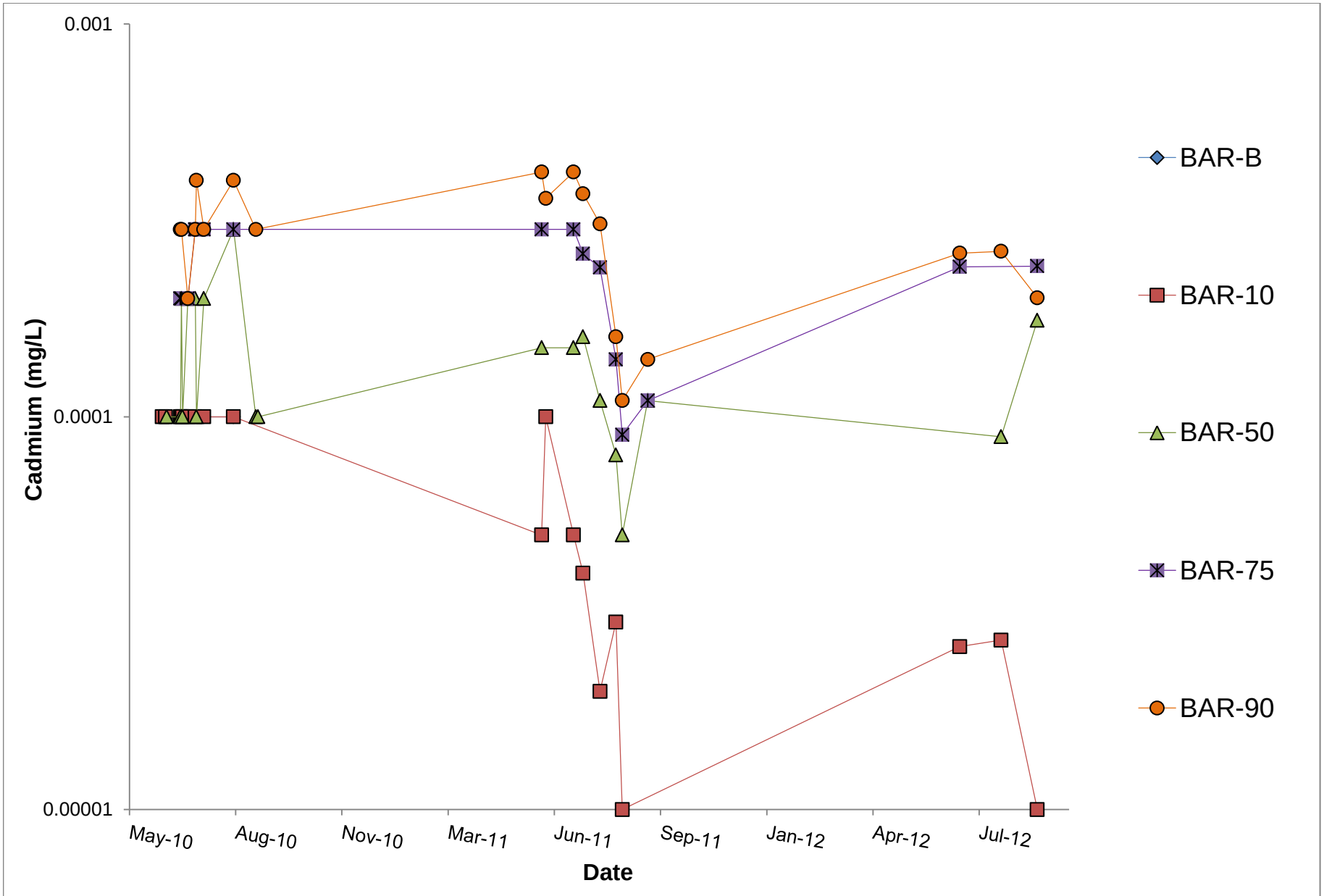
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



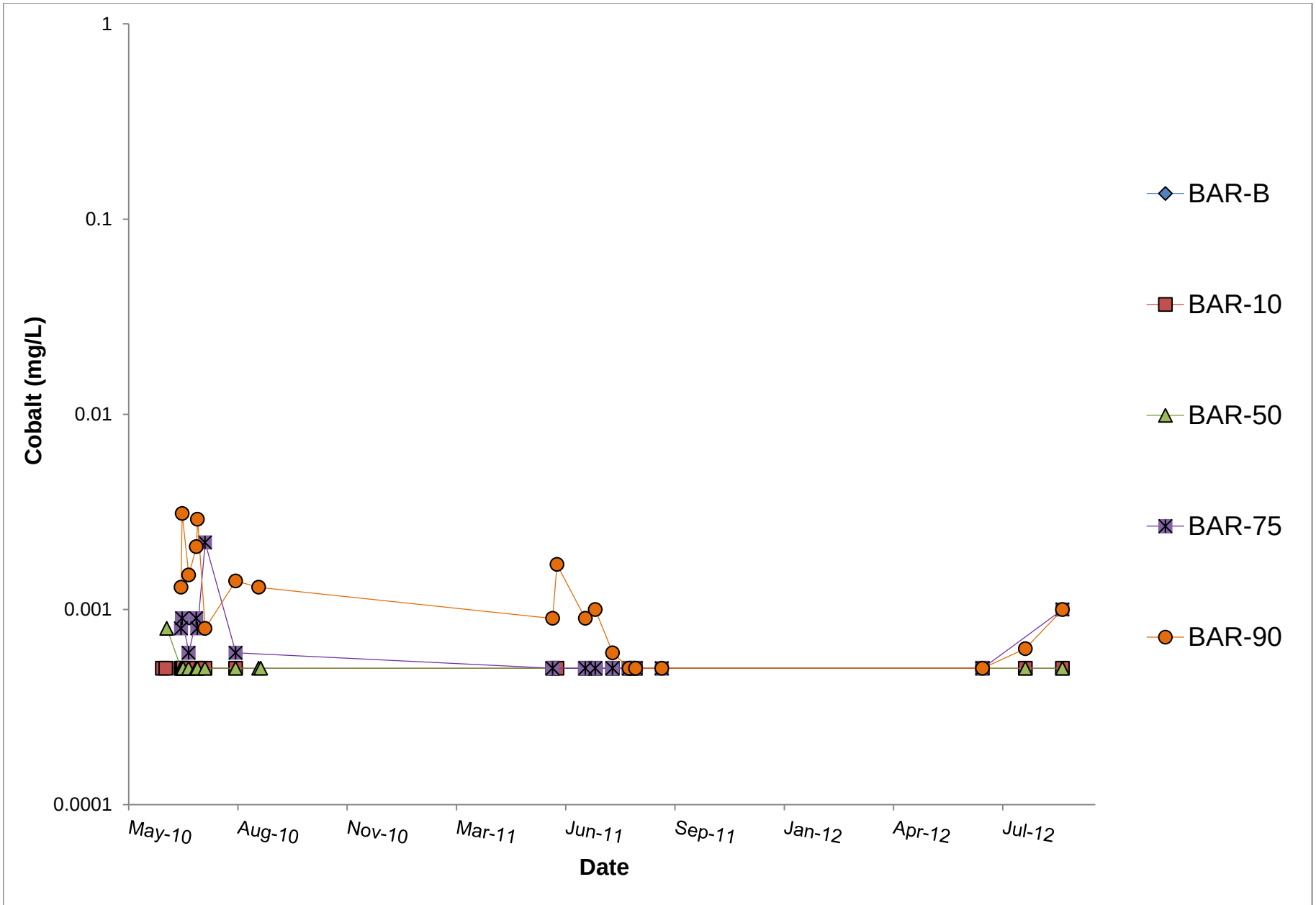
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



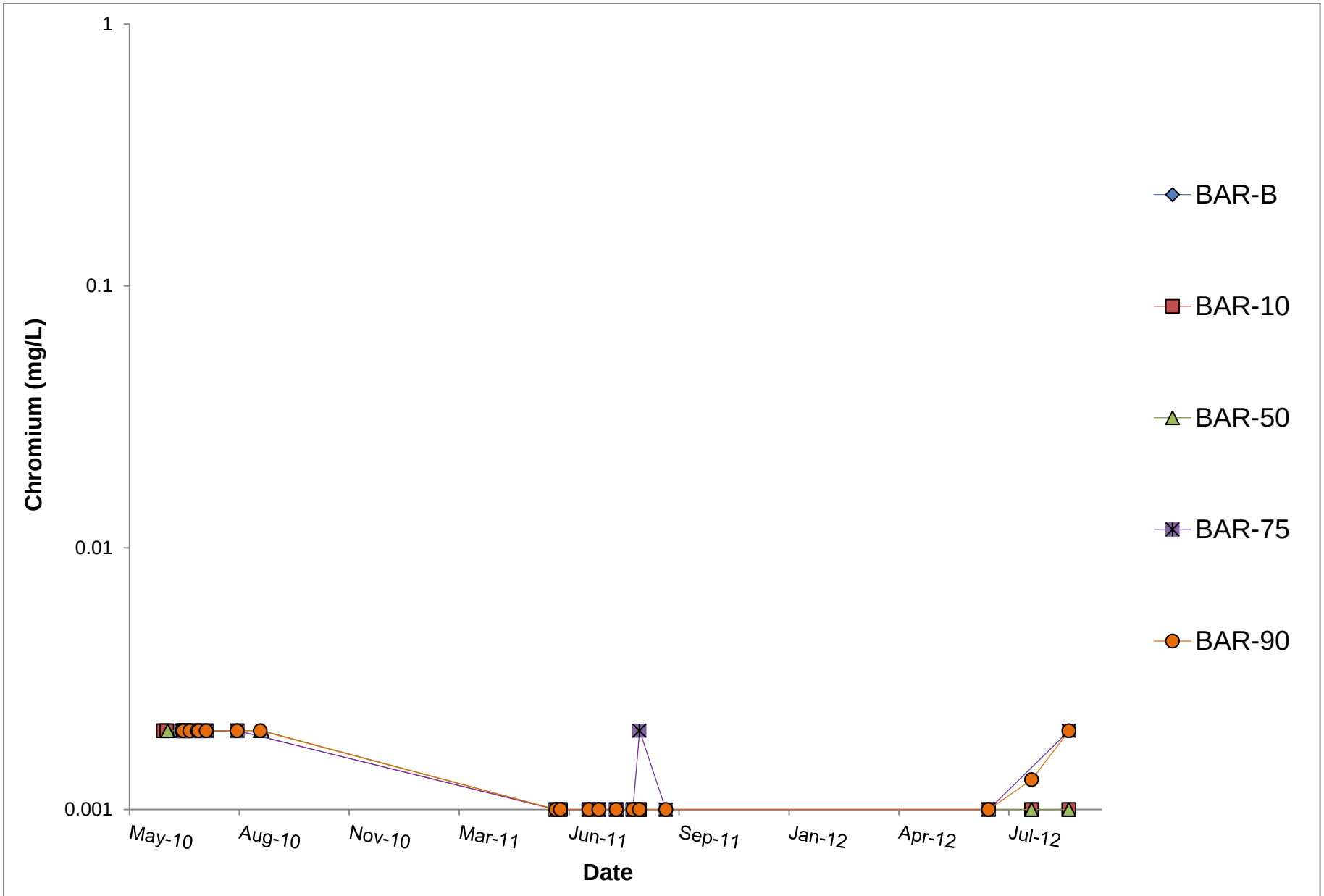
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



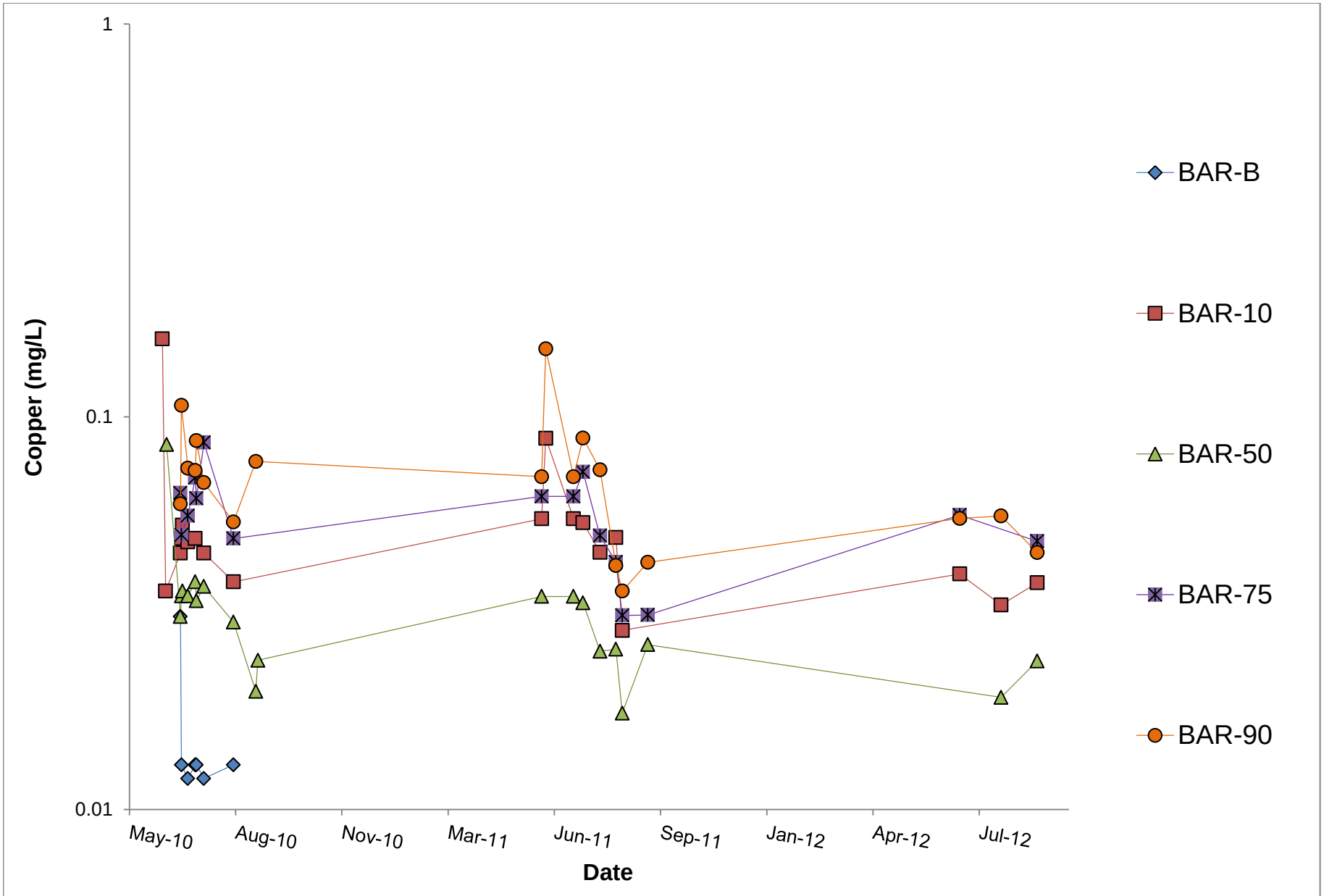
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



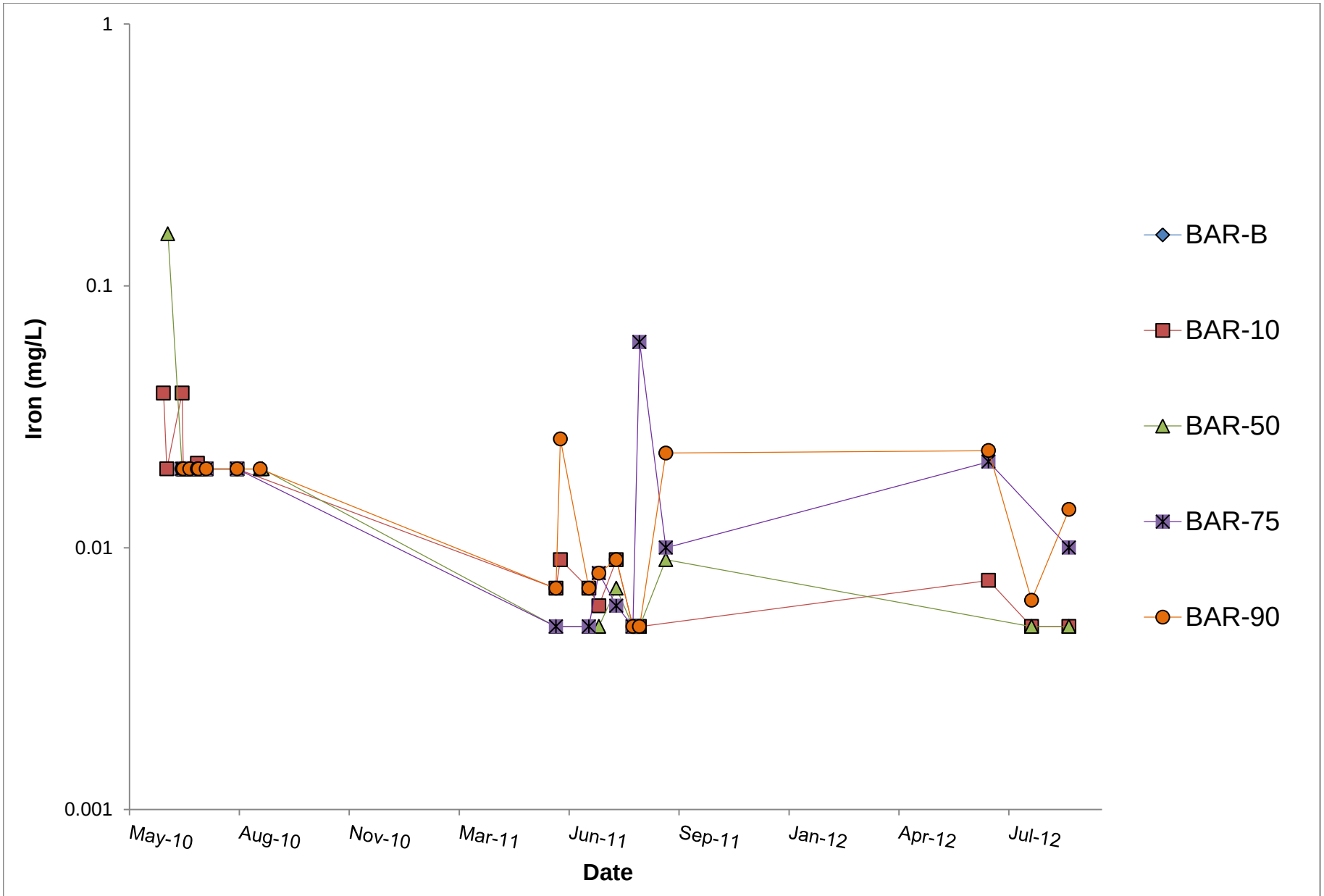
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



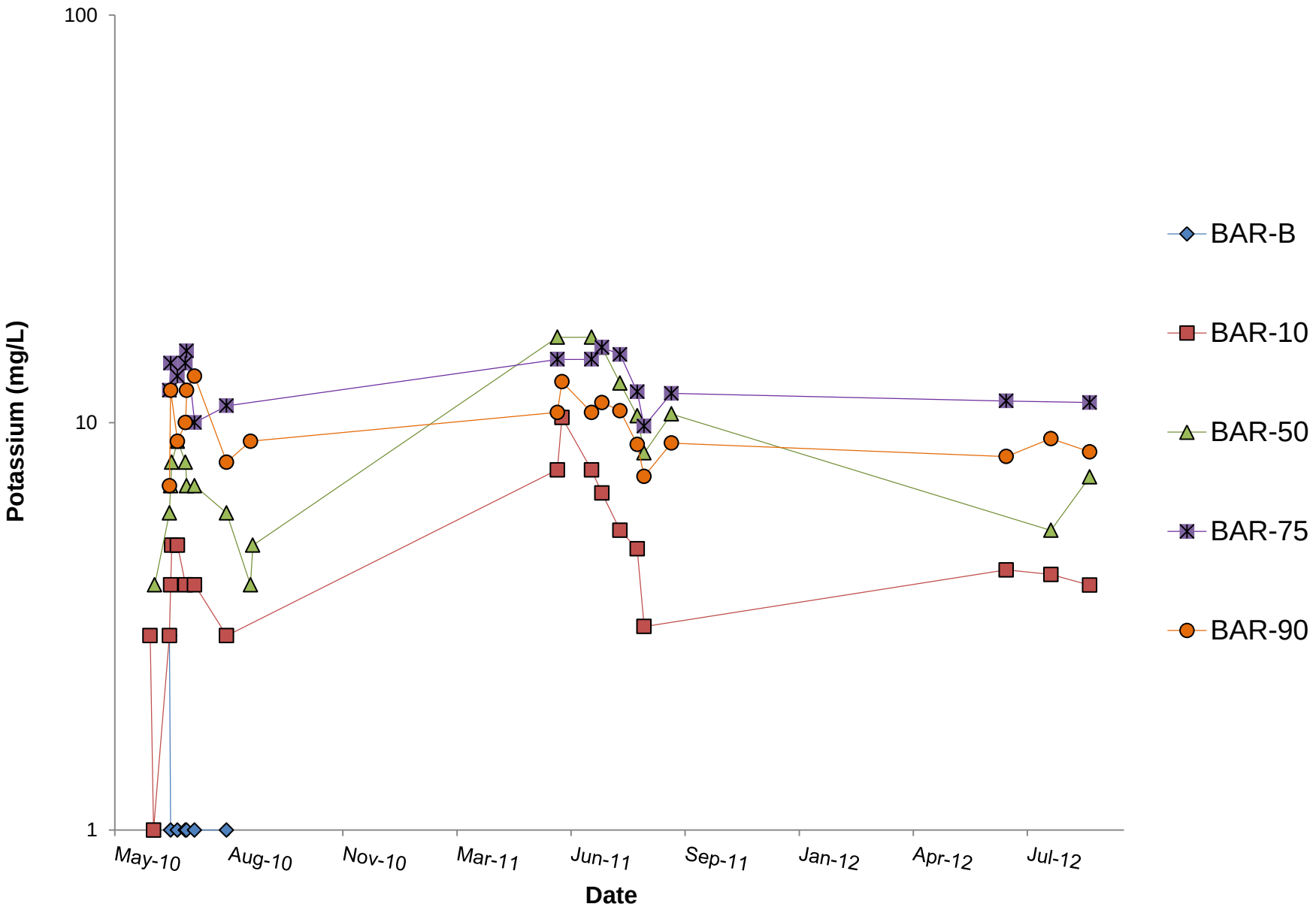
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



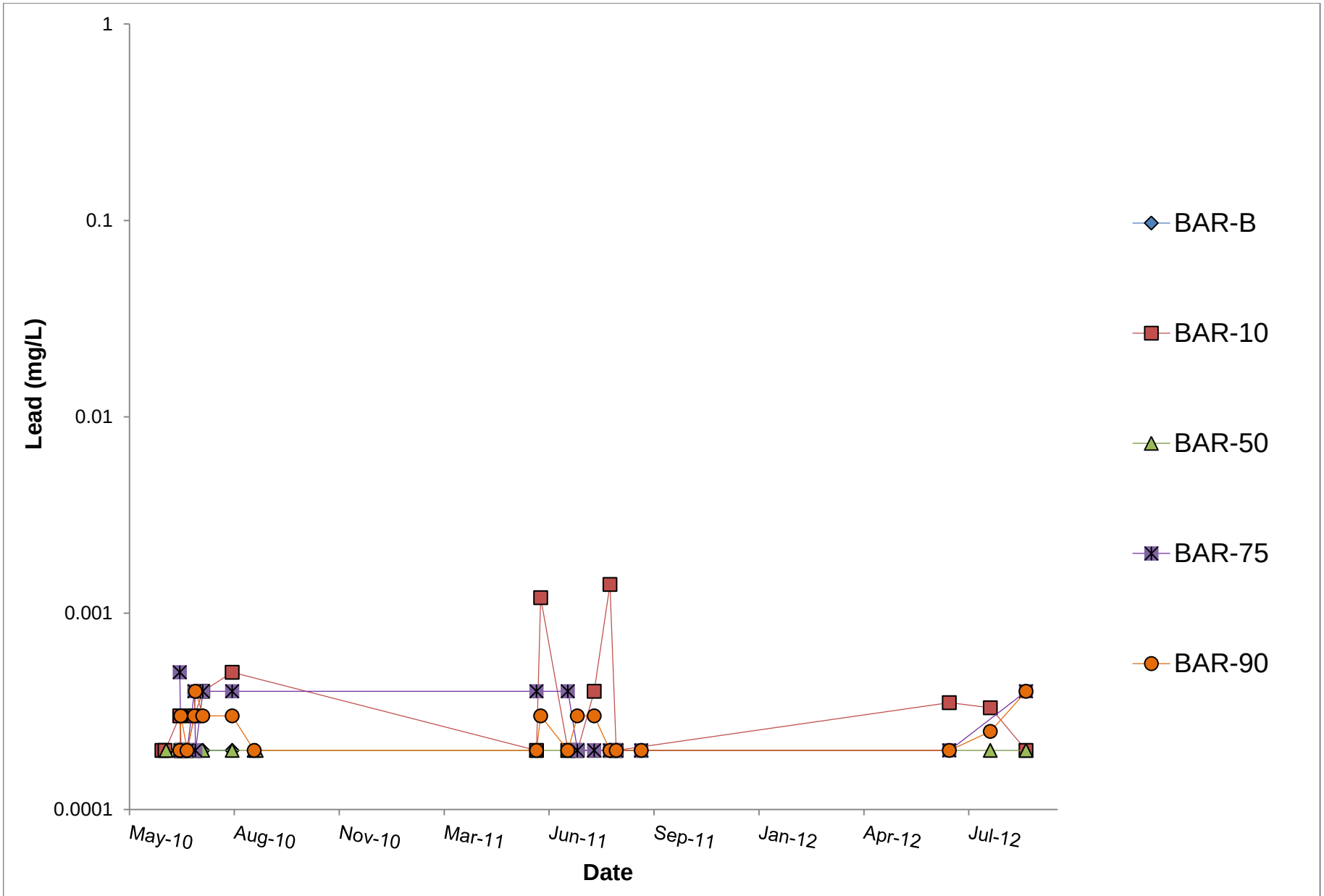
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



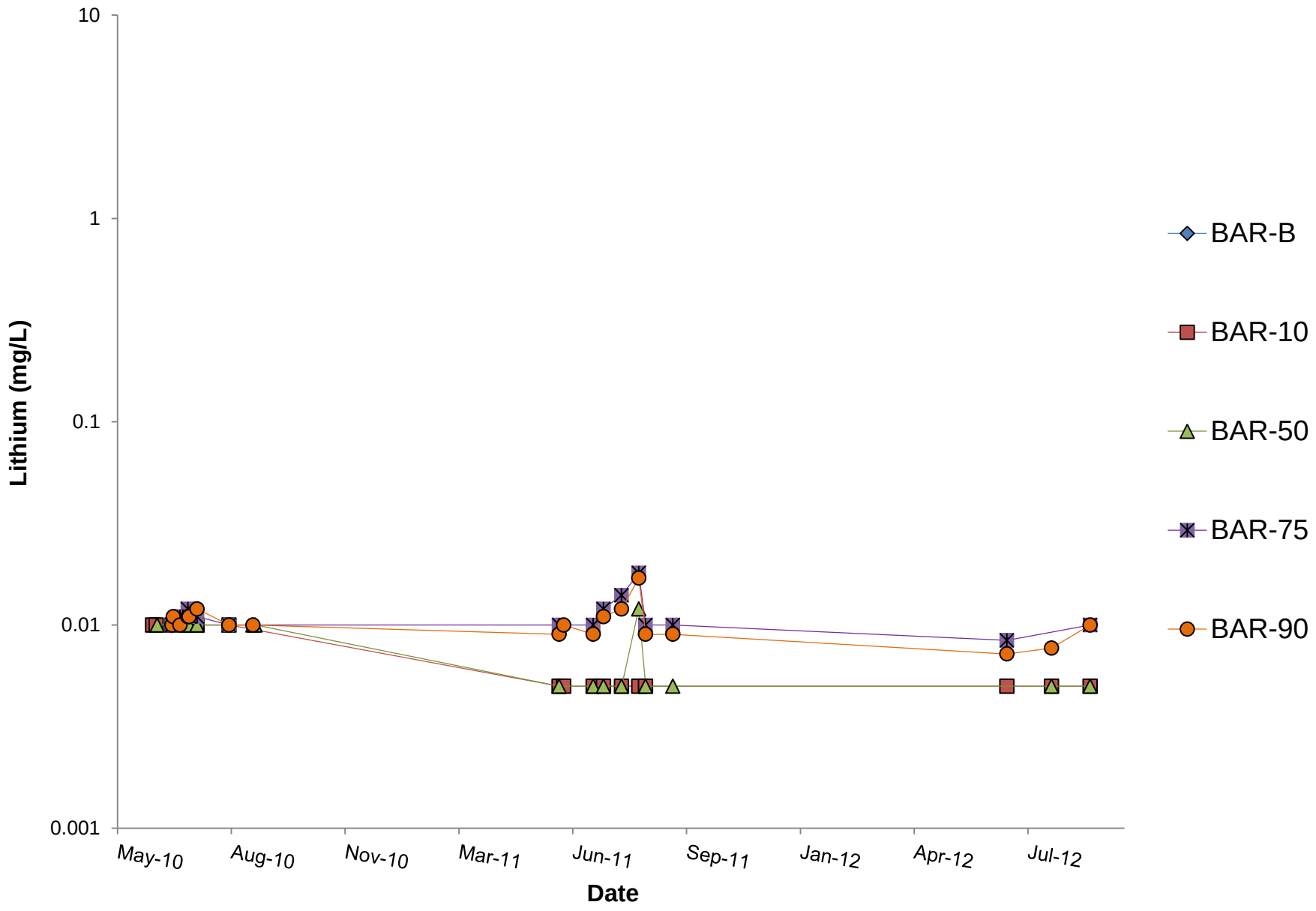
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



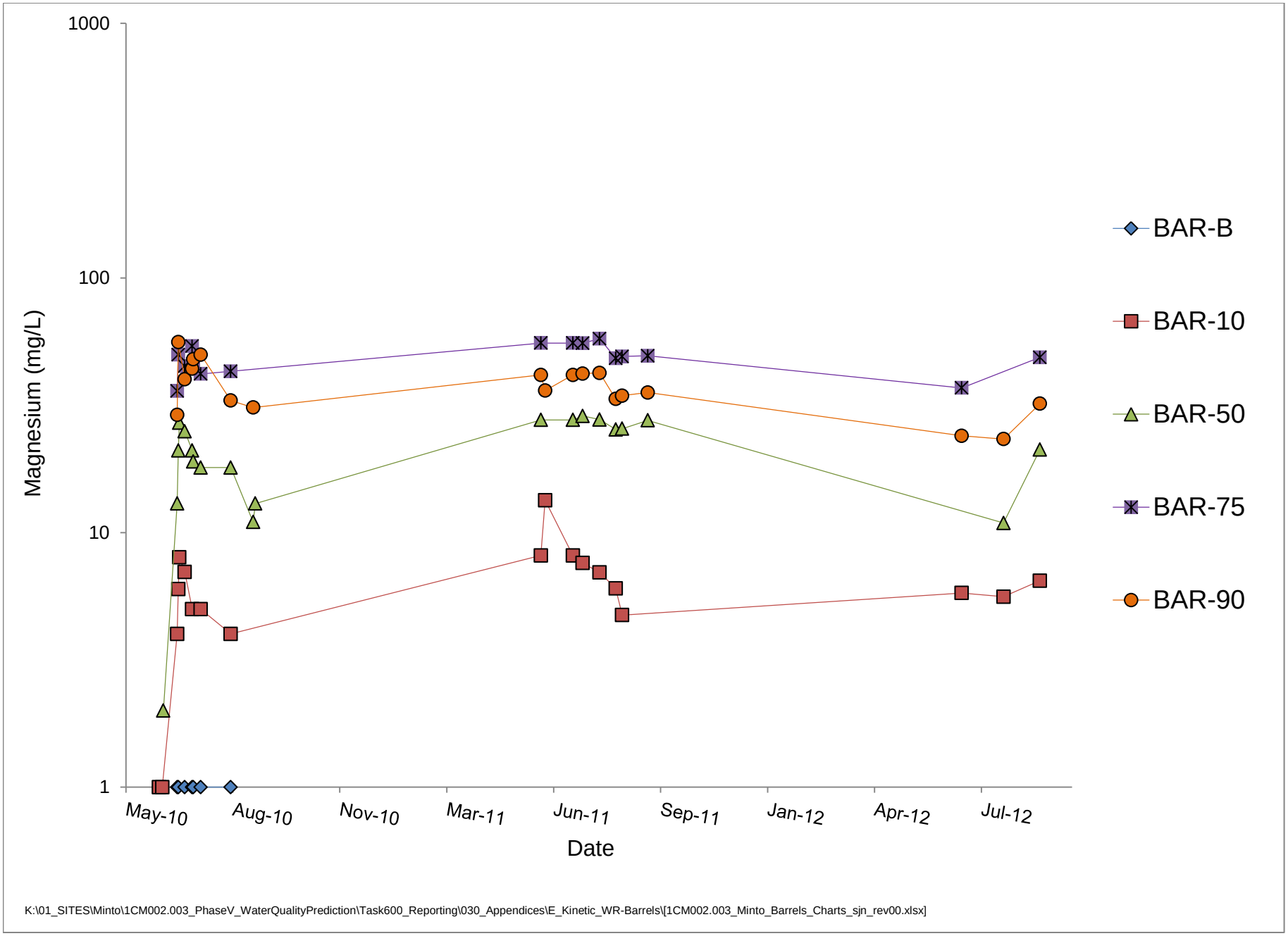
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]

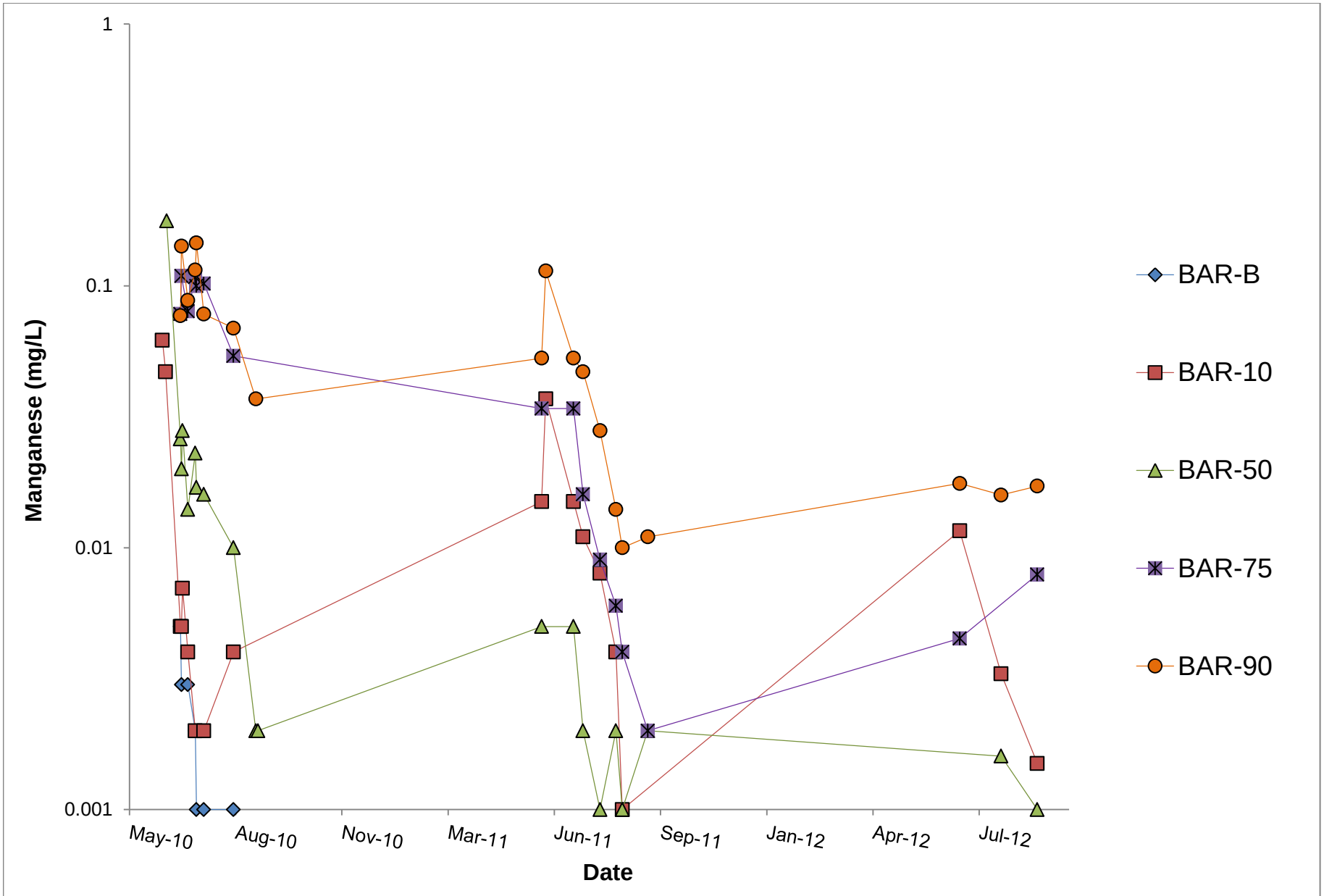


K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]

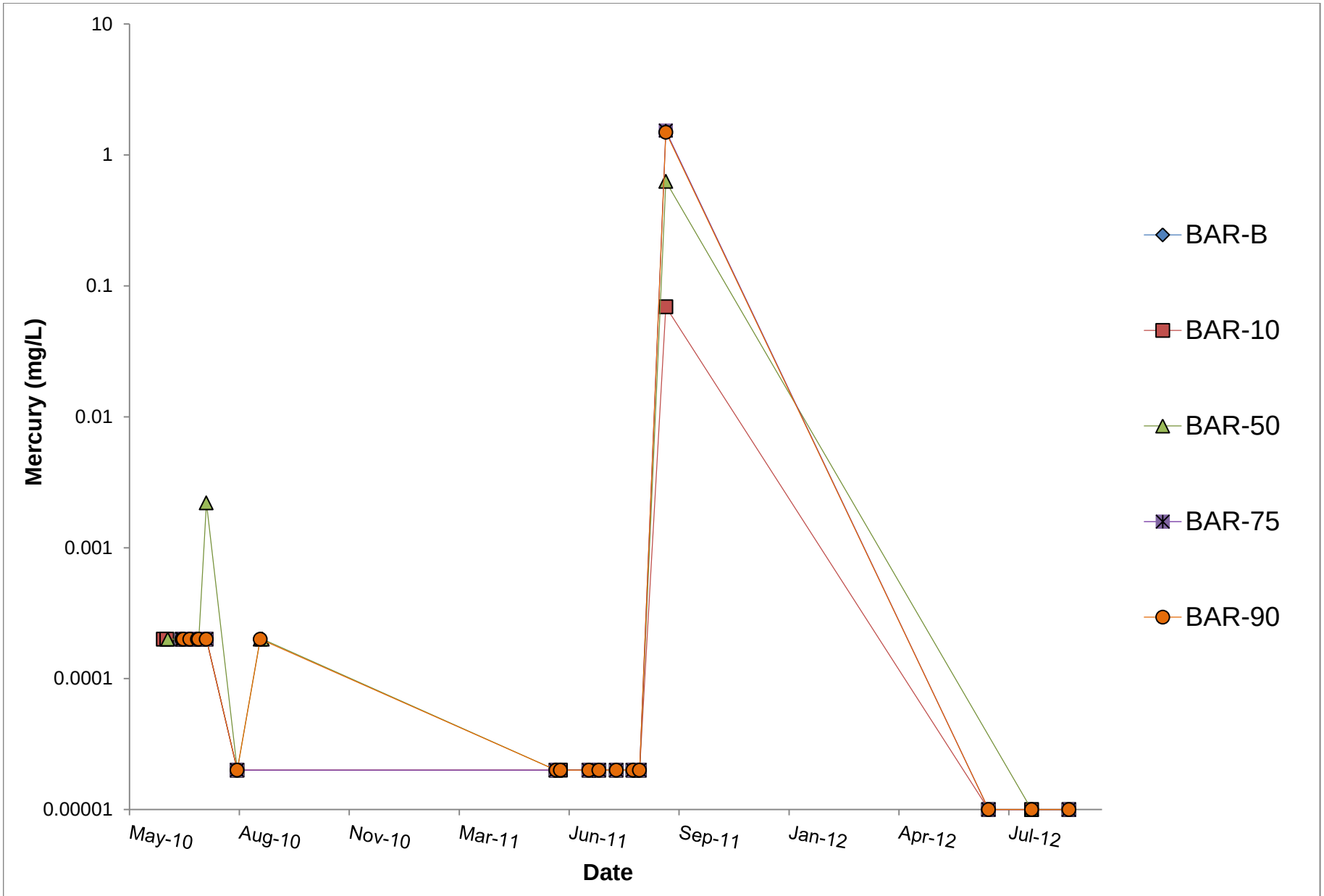


K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]

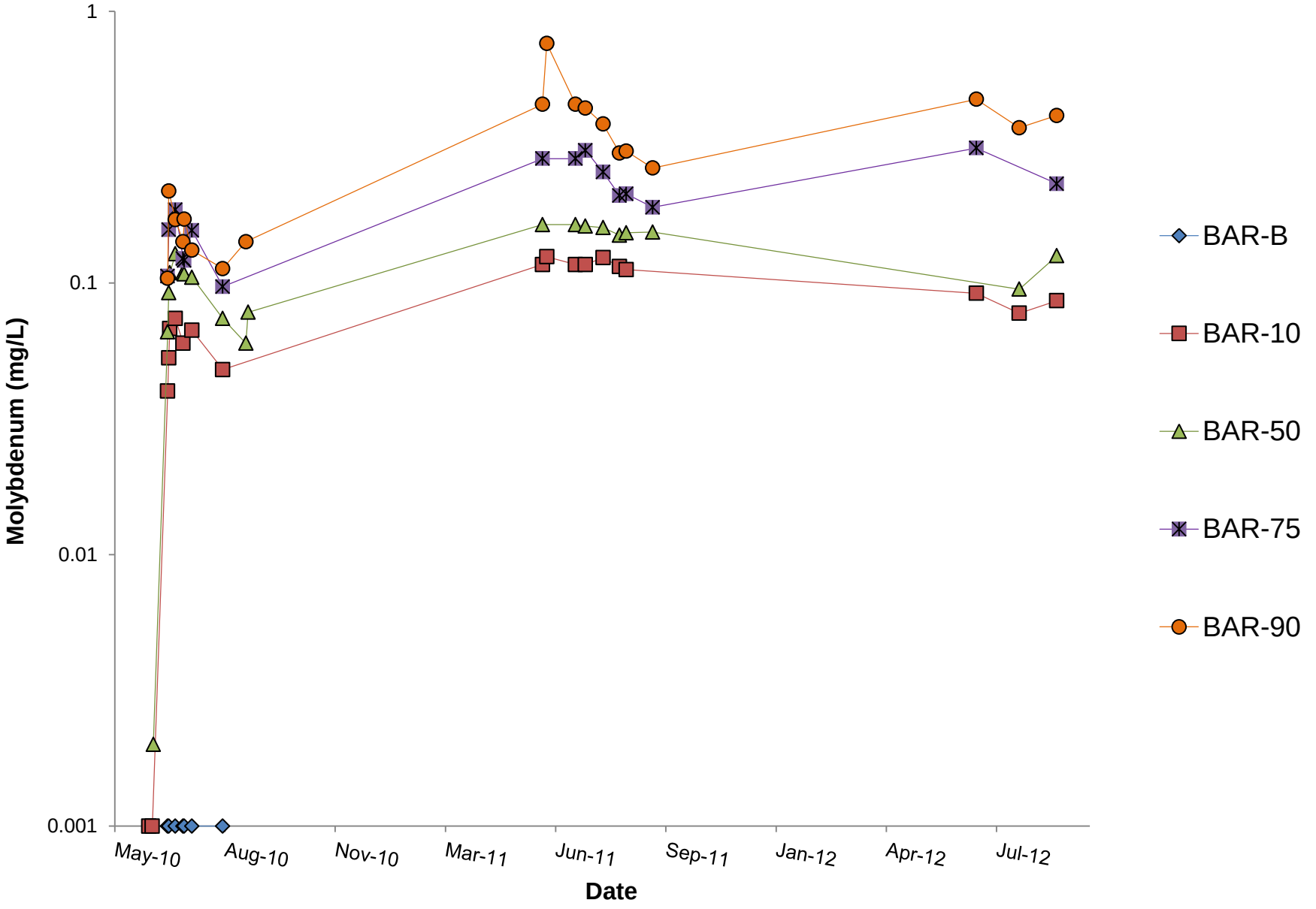

1000
100
10
1
Magnesium (mg/L)
May-10
Aug-10
Nov-10
Mar-11
Jun-11
Sep-11
Jan-12
Apr-12
Jul-12
Date
BAR-B
BAR-10
BAR-50
BAR-75
BAR-90
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



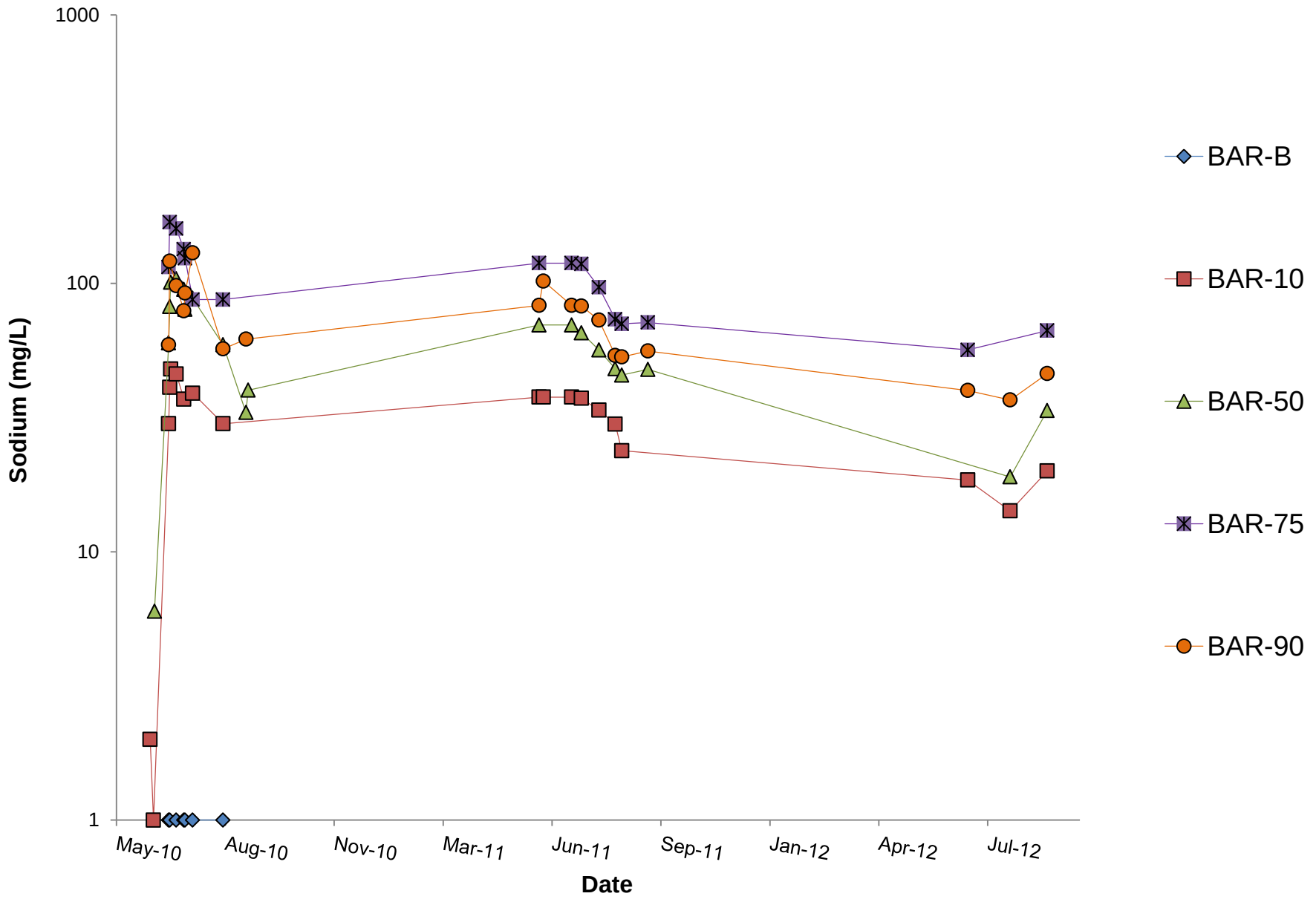
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



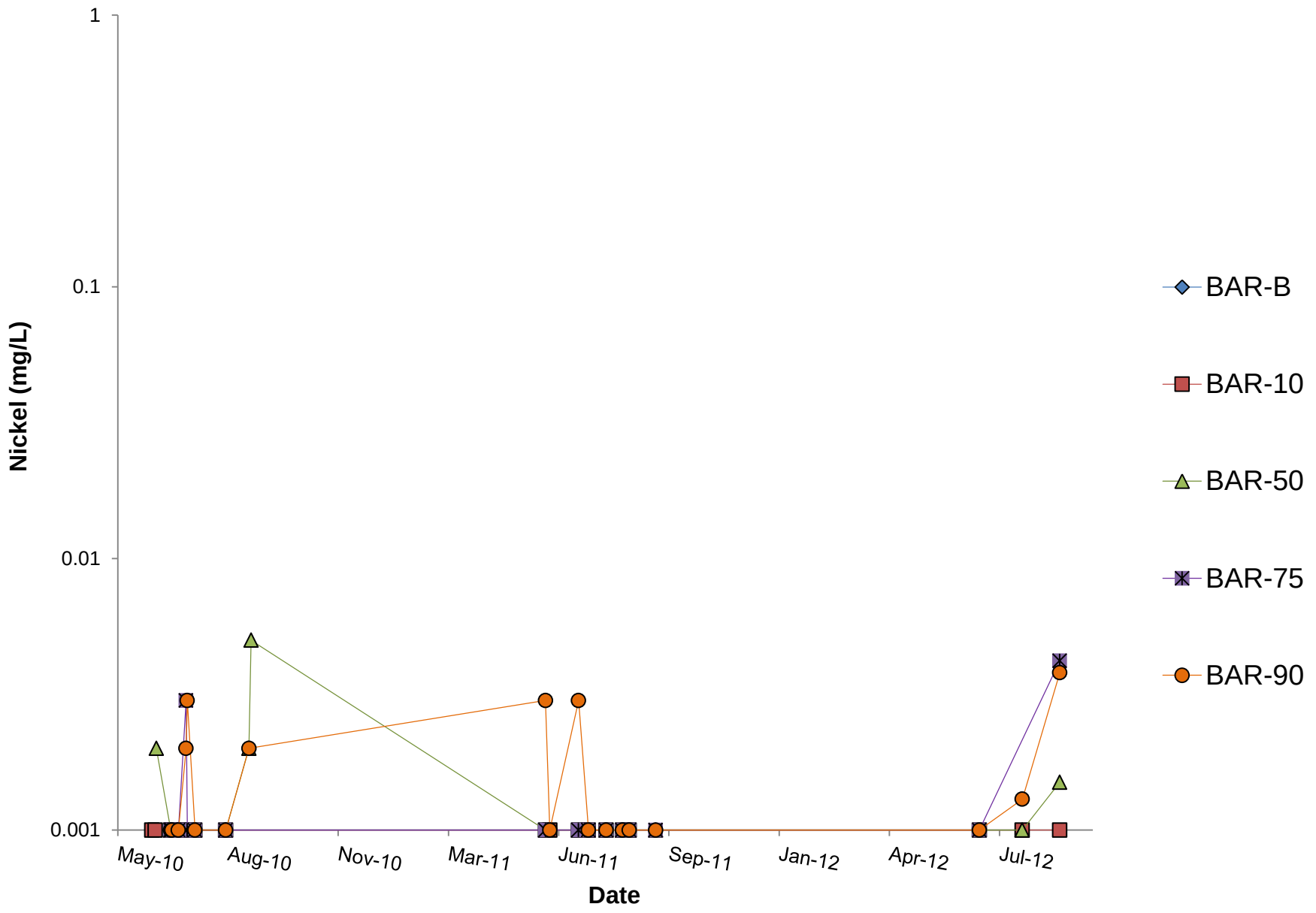
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



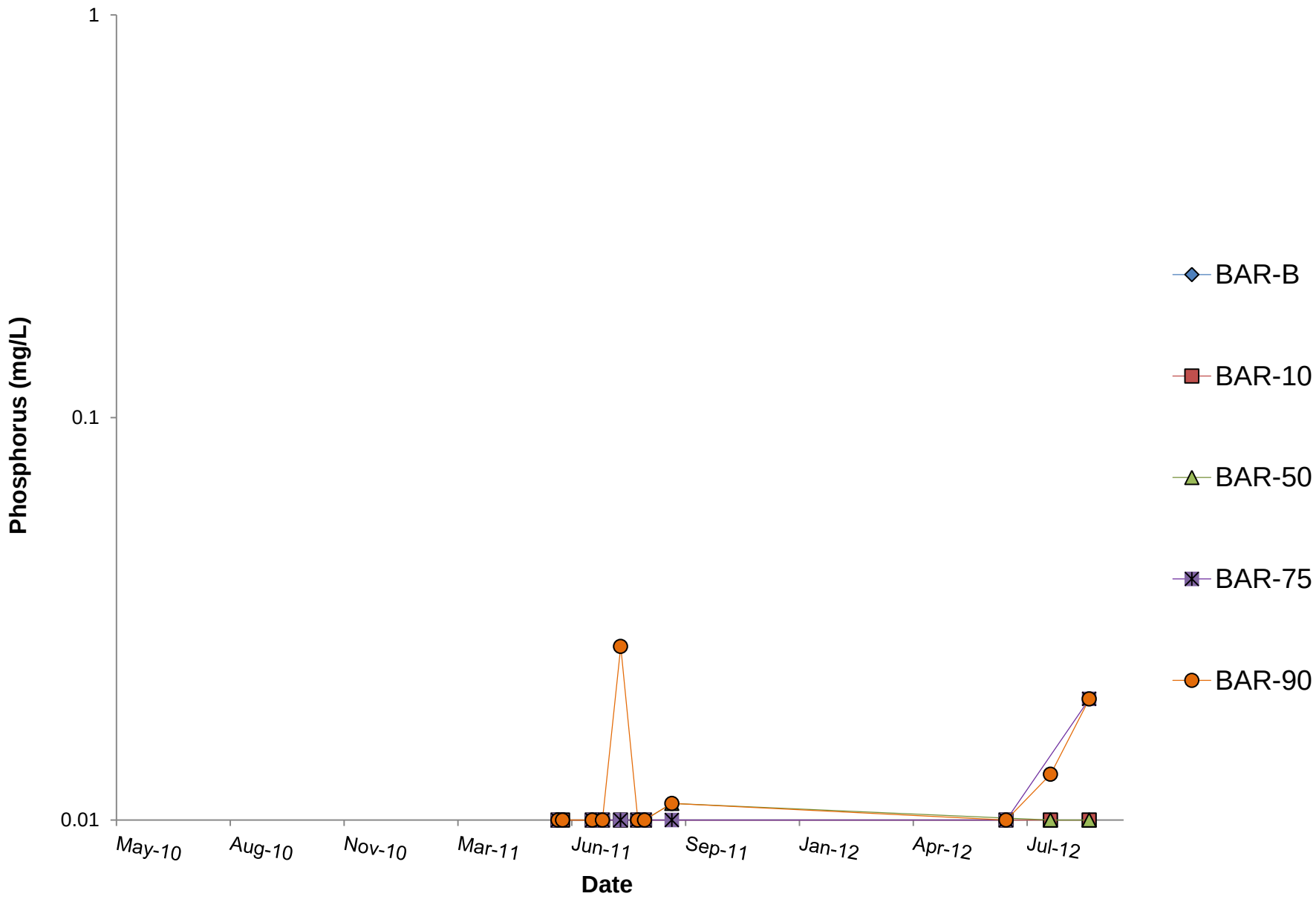
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



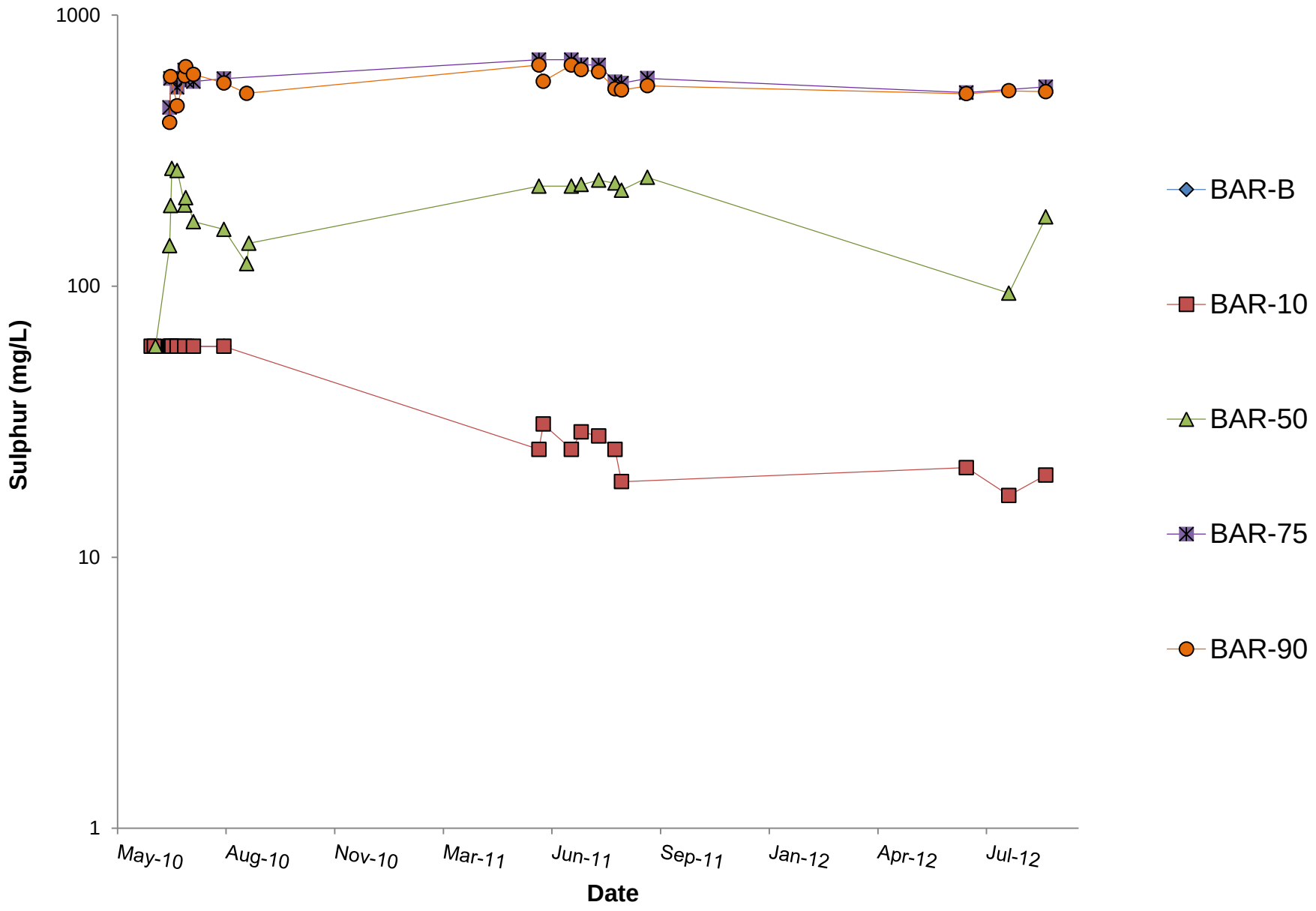
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



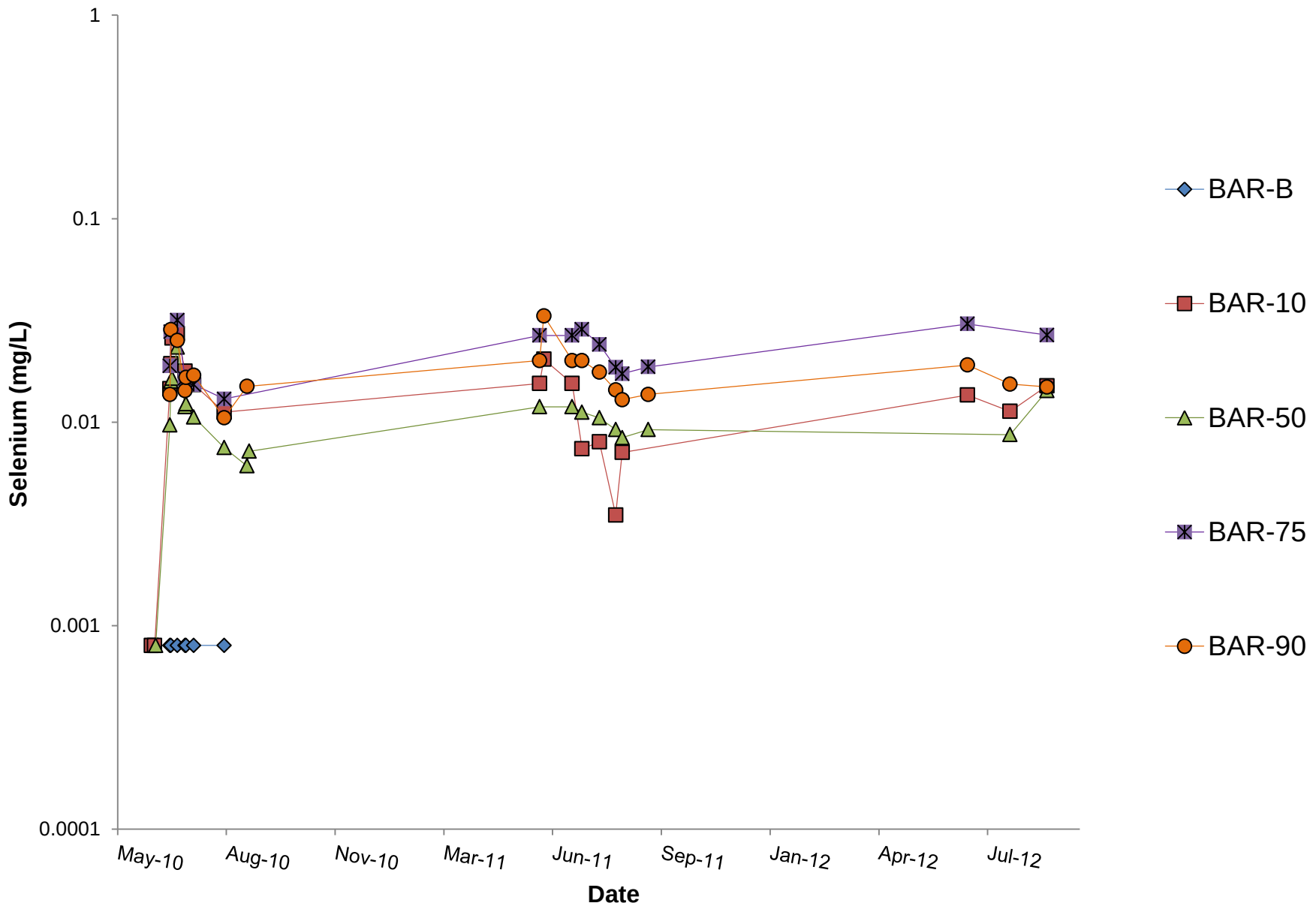
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



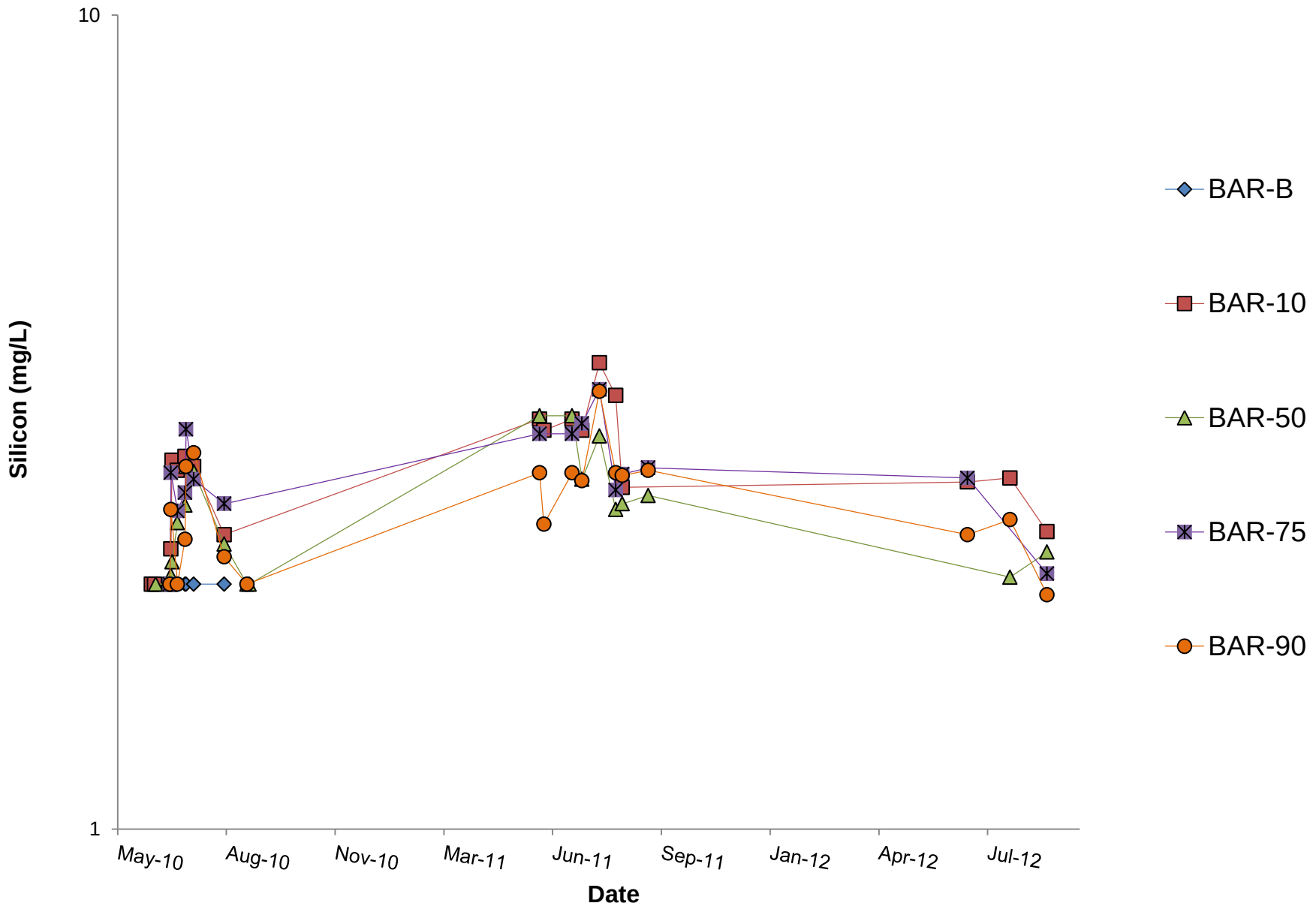
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



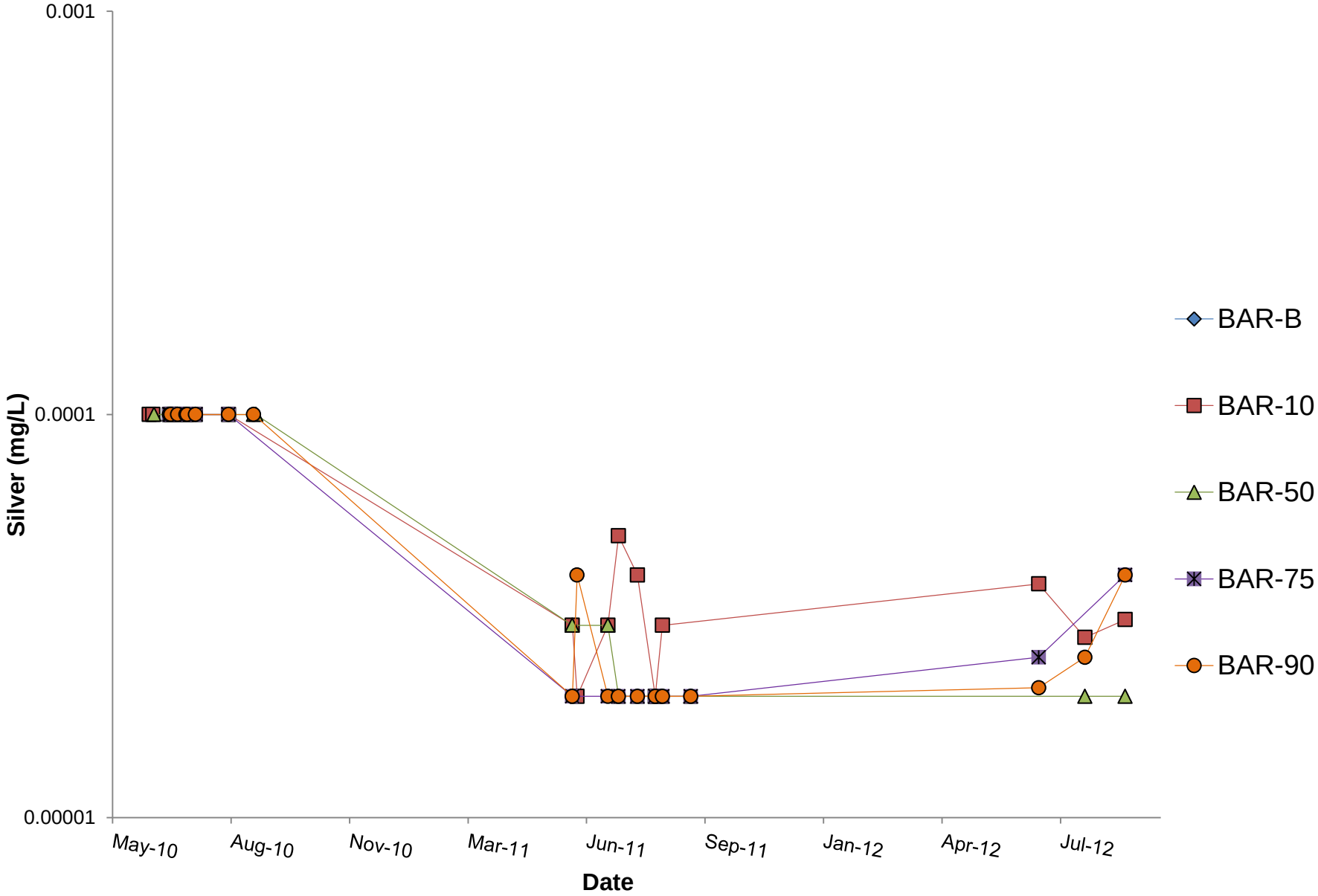
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



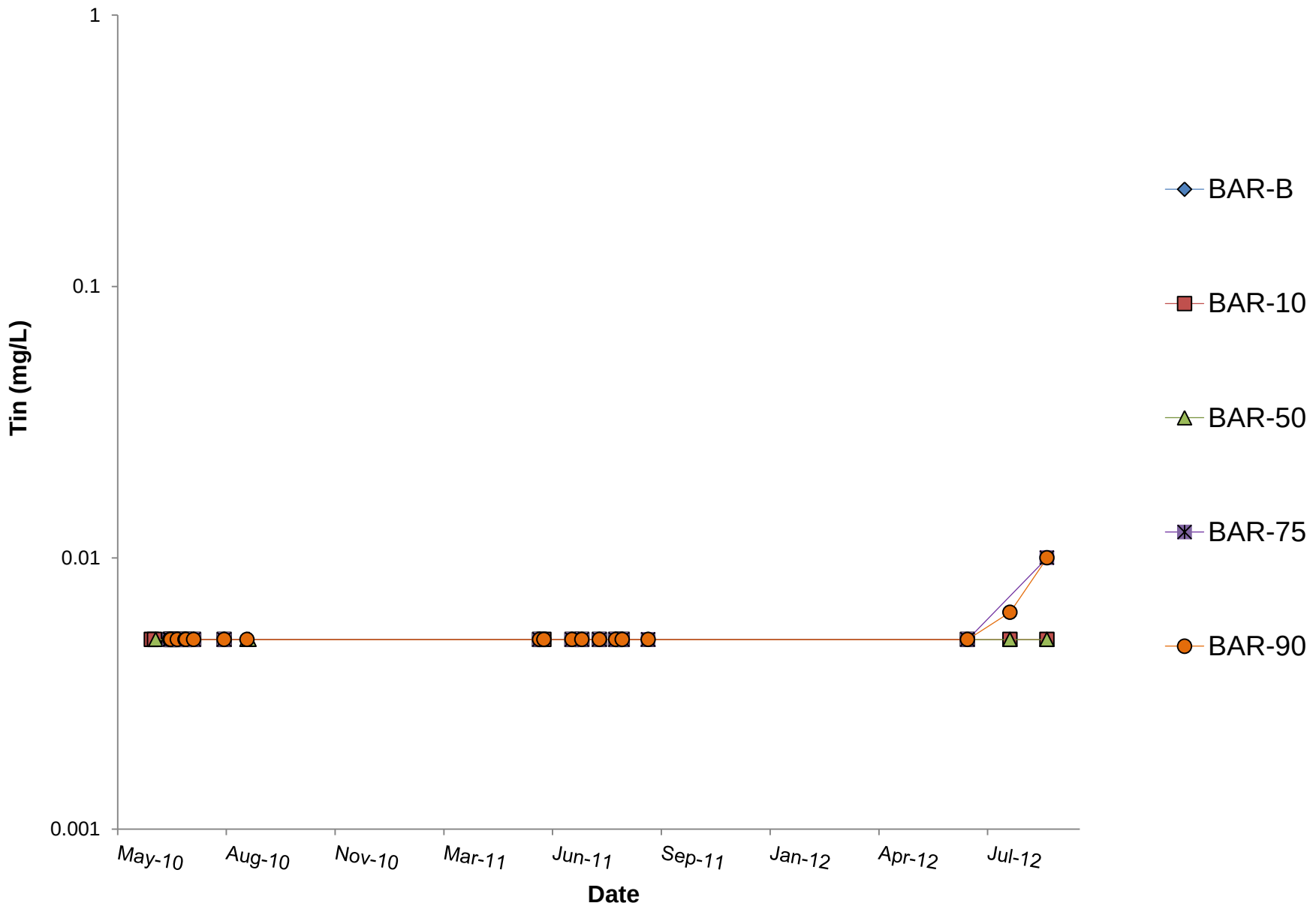
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



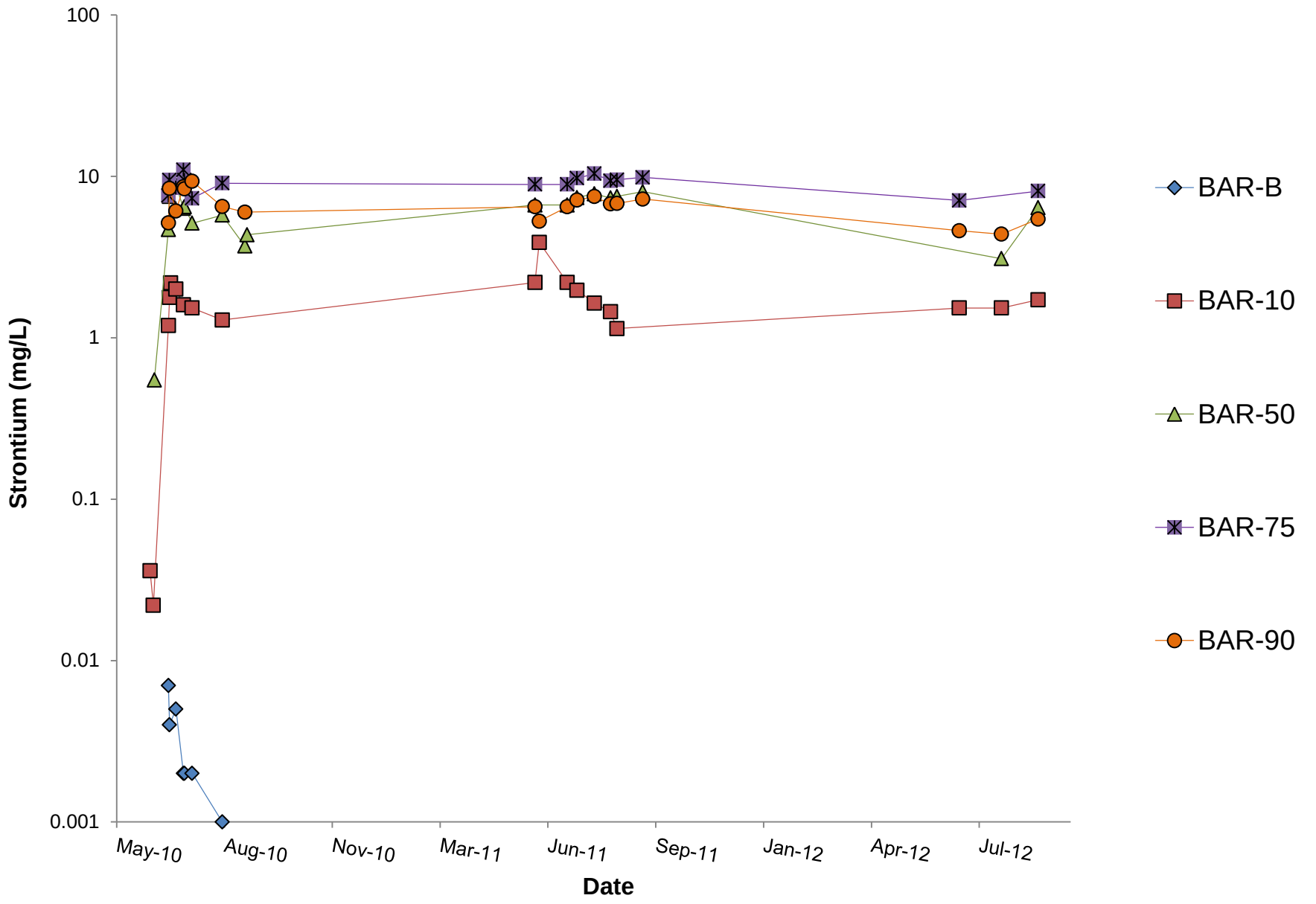
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



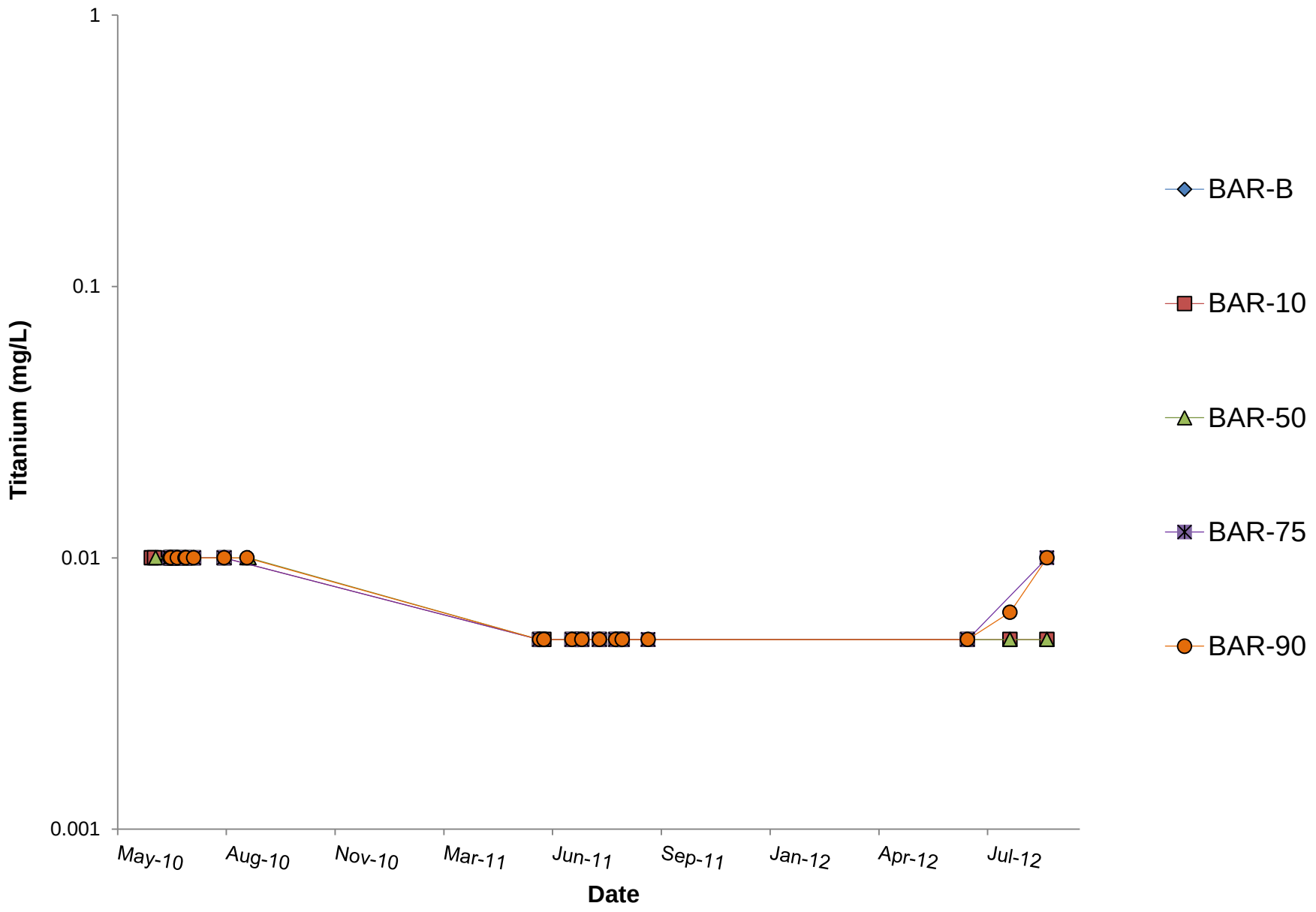
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



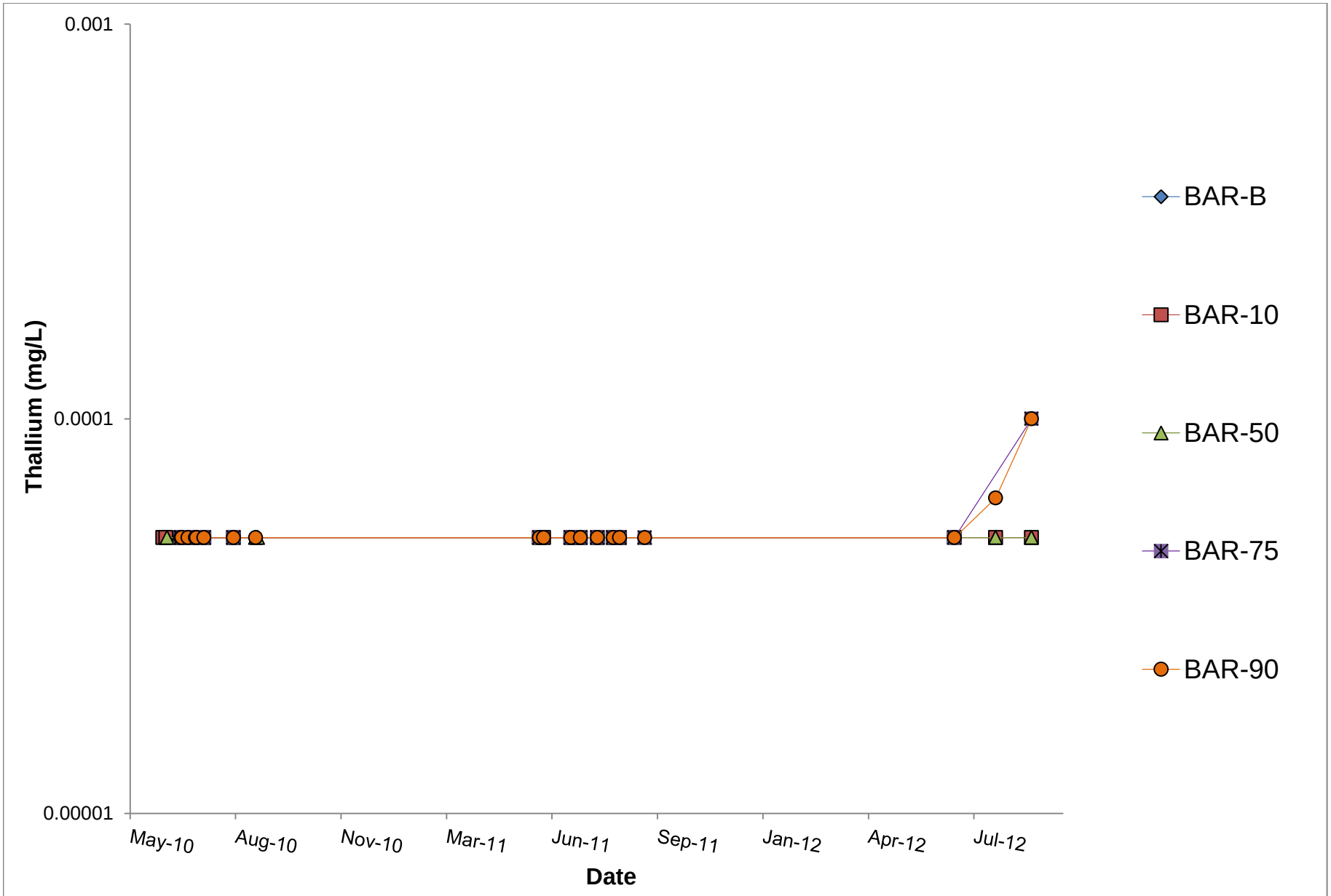
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



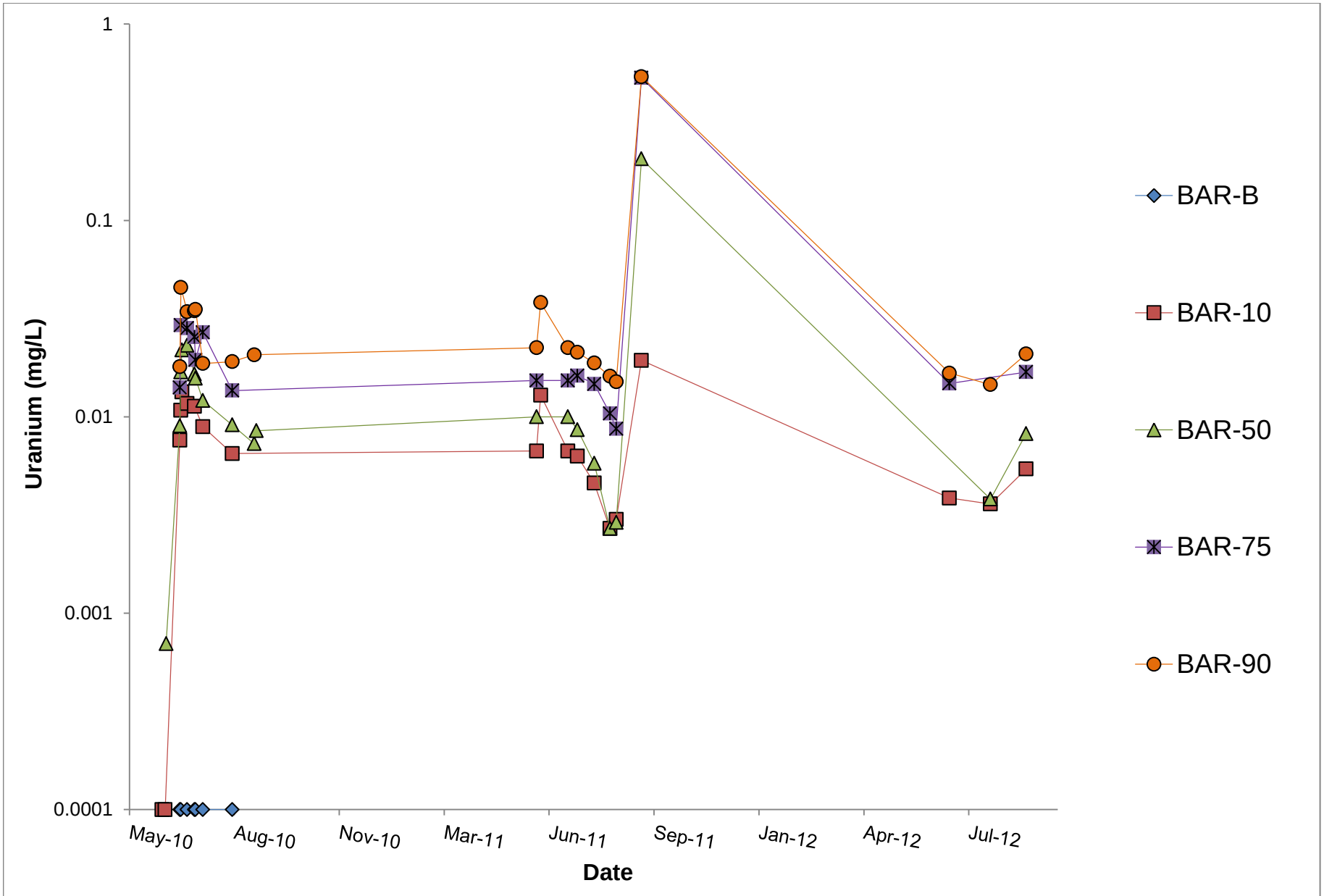
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



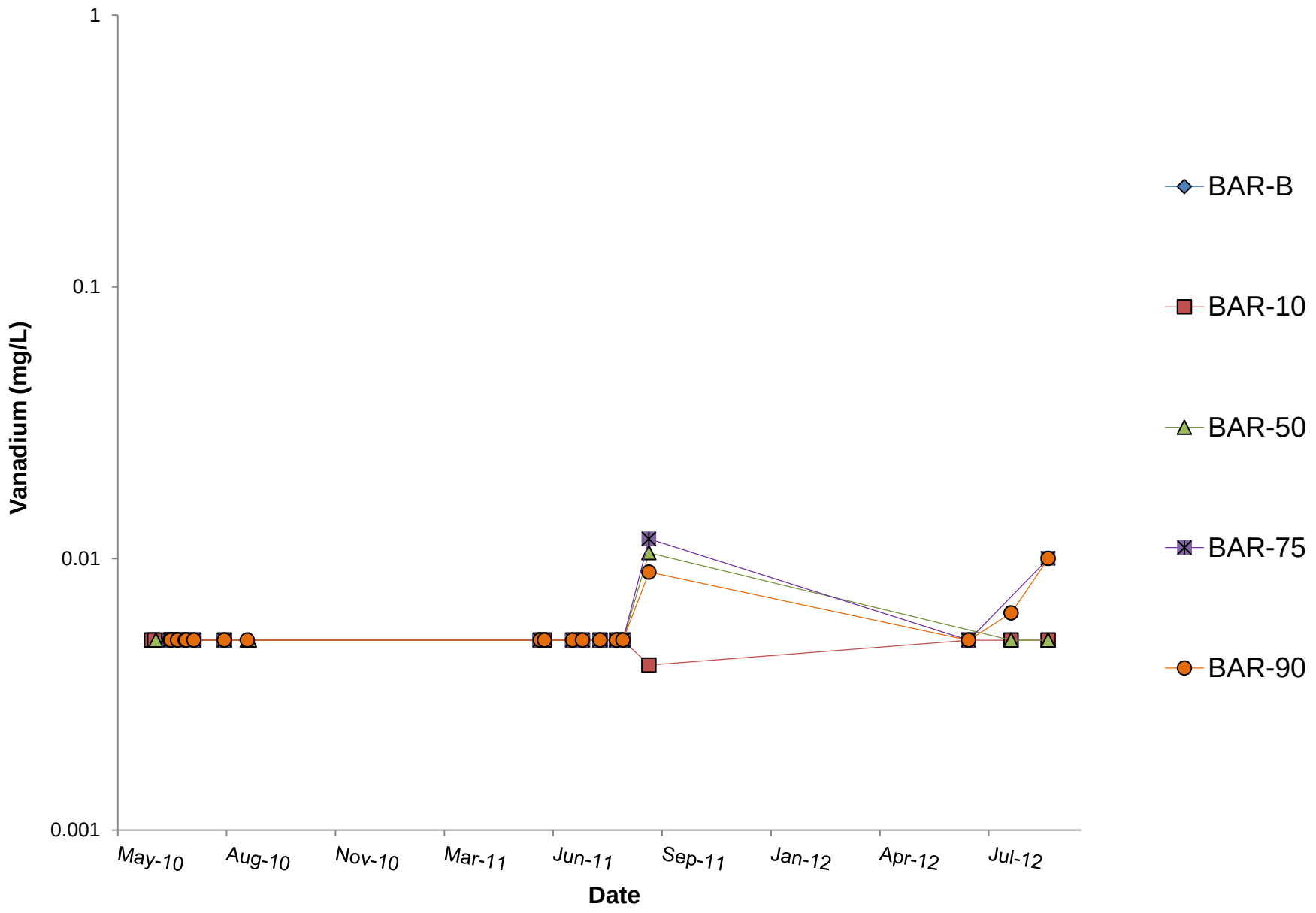
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



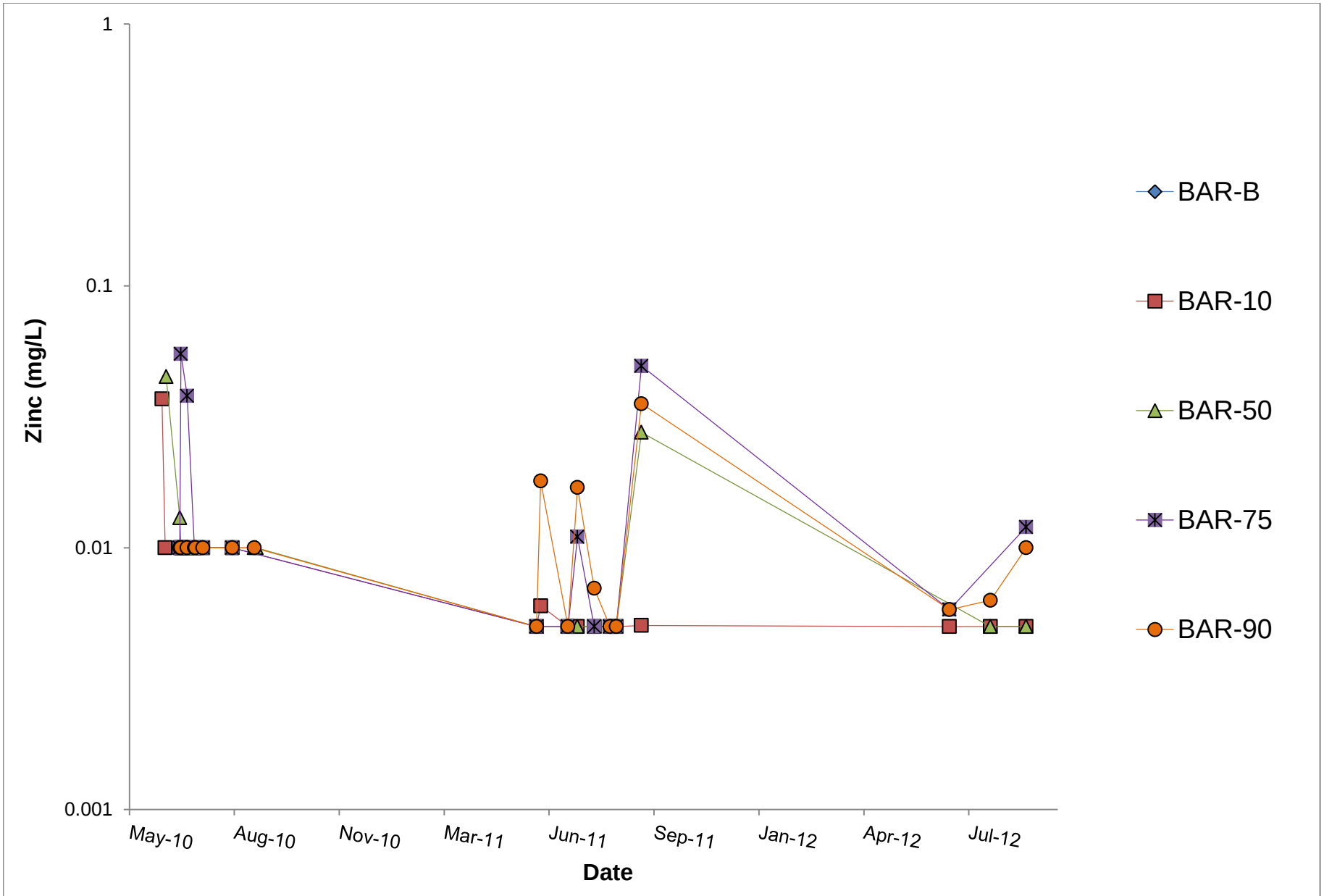
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



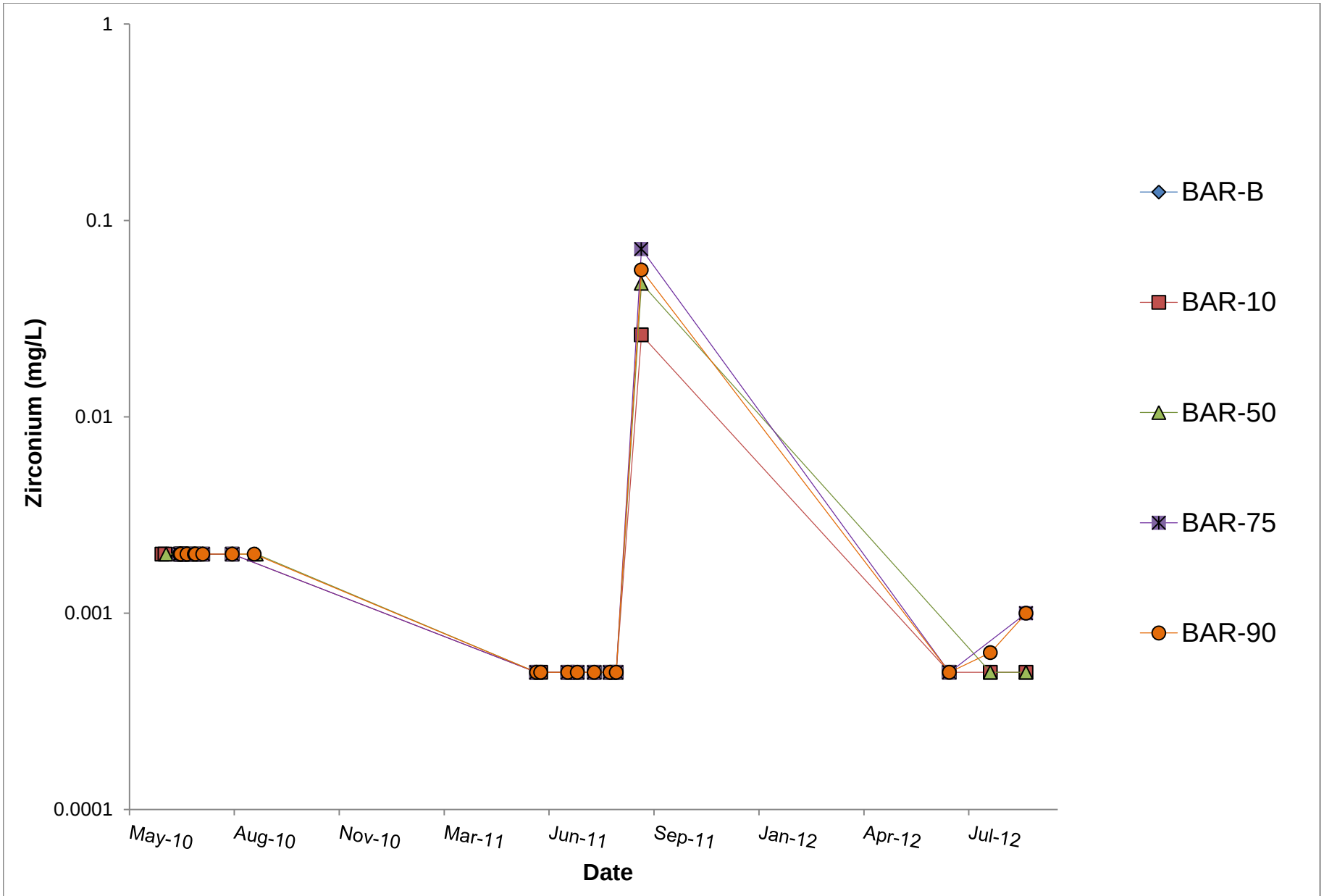
K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]



K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\E_Kinetic_WR-Barrels\[1CM002.003_Minto_Barrels_Charts_sjn_rev00.xlsx]

Appendix F
Phase V/VI Tailings: Static Test Results

Mine Area	Sample ID	Paste pH Std. Units	CO2 % CO2	Equiv. CaCO3 kg CaCO3/t	Total S % S	Sulphate % S	Sulphur Diff. % S	AP kg CaCO3/t	NP kg CaCO3/t	Net NP kg CaCO3/t	NP/AP Ratio	Fizz Test Visual
	LOD Method Code	0.01 Sobek	0.02 HCl Leach	#N/A Calc.	0.02 Leco	0.01 HCl Leach	#N/A Calc.	#N/A Calc.	0.2 Sobek NP	#N/A Calc.	#N/A Calc.	#N/A Sobek
Minto North	2420-10 Cu (Rougher + Cleaner Tails) Composite	8.31	0.64	15	<0.02	<0.01	<0.02	0.6	19.2	19	32	Slight
Area 118- Lower	Composite 2351-33	8.39	1.69	38	0.04	0.01	0.03	0.9	30.1	29	32	Slight
Area 118- Upper	Composite 2351-34	8.62	1.98	45	0.08	<0.01	0.08	2.5	38.2	36	15	Slight
Ridgetop East- Lower	Composite 2351-35	8.58	2.55	58	0.04	<0.01	0.04	1.3	32.9	32	26	Slight
Ridgetop East- Upper	Composite 2351-36	9.01	1.87	43	<0.02	<0.01	<0.02	0.6	37.2	37	62	Slight
Ridgetop East- Upper	Composite 2351-37	9.26	1.9	43	0.04	<0.01	0.04	1.3	35.2	34	28	Slight
Area 2	KM 1966-13,22 MINTO K1	7.9	2	45	0.12	<0.01	0.12	3.8	57.0	53	15	Slight
Area 2	KM 1966-29,30 MINTO L+M ZONE	8.3	0.7	16	0.09	0.01	0.08	2.5	31.0	29	12	Slight
Area 2	KM 1966-28 MINTO N ZONE	8.2	0.2	5	0.08	0.02	0.06	1.9	22.0	20	12	Slight
Area 2	KM 1966-29 MINTO M ZONE	8.4	0.5	11	0.06	0.01	0.05	1.6	27.0	25	17	Slight
Area 2	KM 1966-30 MINTO L ZONE	8.2	0.6	14	0.1	<0.01	0.1	3.1	25.0	22	8.0	Slight
Area 2	KM 1966-40 MINTO O ZONE	8.1	1.4	32	0.1	<0.01	0.1	3.1	43.0	40	14	Slight
Area 2	KM 1966-41 MINTO P ZONE	7.8	<0.2	4.5	0.52	0.37	0.15	4.7	18.0	13	3.8	Slight
Area 2	KM 1966-42 MINTO Q ZONE	7.9	0.2	4.5	0.28	0.13	0.15	4.7	28.0	23	6.0	Slight
Minto East	KM2751-24 RoTL & Cu/CT 3, 4, 5,	7.69	0.82	18.6	0.64	0.57	0.07	2.2	24.9	23	11	slight
Copper Keel	KM2751-25 RoTL & Cu/CT 3, 4, 5,	8.03	1.41	32.0	0.08	0.03	0.05	1.6	23.75621891	22	15.2	slight
Wildfire	KM2751-26 RoTL & Cu/CT 3, 4, 5,	8.52	4.06	92.3	0.04	<0.01	0.04	1.3	21.64179104	20	17.3	slight

Mine Area	Sample ID	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppb	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm
	LOD	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1
	Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Minto North	2420-10 Cu (Rougher + Cleaner Tails) Composite	0.7	453	4	117	0.5	8	7	542	4.6	1.3	0.2	115.2	3.1	28	0.2	<0.1	0.1
Area 118- Lower	Composite 2351-33	0.4	591	2	151	0.5	5	9	794	4.5	<0.5	0.1	88.9	2	34	0.8	<0.1	0.1
Area 118- Upper	Composite 2351-34	2.6	515	3	109	0.3	9	7	651	3.0	0.6	0.7	45	4.7	57	0.4	<0.1	<0.1
Ridgetop East- Lower	Composite 2351-35	0.7	384	3	129	0.3	5	7	582	4.5	1.1	0.2	66.9	2.8	25	0.6	<0.1	<0.1
Ridgetop East- Upper	Composite 2351-36	2.1	1333	3	69	0.2	3	5	396	2.5	1.1	0.3	35.9	3	28	0.2	<0.1	0.2
Ridgetop East- Upper	Composite 2351-37	2.5	1340	4	68	0.2	3	5	379	2.3	0.8	0.3	37.2	2.7	25	0.2	<0.1	0.2
Area 2	KM 1966-13,22 MINTO K1	7.0	249	14	70	0.2	5	7	677	3.3	1.3	1.4	<200	5.7	90	0.2	0.21	0.05
Area 2	KM 1966-29,30 MINTO L+M ZONE	1.1	1330	43	229	2.4	7	10	953	8.1	2.6	0.35	200	3	33	0.7	30.2	0.27
Area 2	KM 1966-28 MINTO N ZONE	1.4	672	25	145	1.1	5	12	591	3.8	4	1.04	200	4.7	75	0.5	0.8	0.08
Area 2	KM 1966-29 MINTO M ZONE	0.7	1005	9	150	0.9	5	10	869	7.1	1.3	0.35	200	2.9	30	0.4	0.13	0.24
Area 2	KM 1966-30 MINTO L ZONE	0.9	1580	42	253	1.3	6	13	1030	8.3	3.2	0.21	200	2.8	31	0.7	1.34	0.28
Area 2	KM 1966-40 MINTO O ZONE	1.1	1570	5	107	1.1	4	9	885	6.1	1.5	0.46	200	2.7	47	0.2	0.14	0.31
Area 2	KM 1966-41 MINTO P ZONE	0.9	1940	5	151	1.0	7	10	749	4.7	1.7	0.27	200	4.4	272	0.5	0.1	0.15
Area 2	KM 1966-42 MINTO Q ZONE	0.8	1990	4	138	1.1	5	10	771	5.9	1.8	0.35	200	3.5	196	0.4	0.16	0.53
Minto East	KM2751-24 RoTL & Cu/CT 3, 4, 5,	2.9	1762	4	157	0.9	11	8	773	4.3	0.6	<0.1	220.5	2.6	112	0.5	<0.1	0.1
Copper Keel	KM2751-25 RoTL & Cu/CT 3, 4, 5,	1.9	1250	6	115	1.3	10	7	668	3.9	<0.5	0.3	215.7	3.1	81	0.5	<0.1	0.3
Wildfire	KM2751-26 RoTL & Cu/CT 3, 4, 5,	2.6	1554	6	158	2.0	7	7	1220	4.9	<0.5	0.4	363.2	2	32	1.1	<0.1	1.4

Mine Area	Sample ID	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Hg ppm	Sc ppm	Tl ppm	S %	Ga ppm	Se ppm
	LOD	2	0.01	0.001	1	1	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5
	Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Minto North	2420-10 Cu (Rougher + Cleaner Tails) Composite	74	0.51	0.047	4	53	0.53	128	0.108	<20	0.92	0.024	0.5	<0.1	<0.01	2.2	0.2	<0.05	8	0.6
Area 118- Lower	Composite 2351-33	72	0.91	0.067	5	9	0.68	238	0.114	<20	0.92	0.01	0.68	<0.1	0.02	2.6	0.3	<0.05	8	0.6
Area 118- Upper	Composite 2351-34	77	1.12	0.114	12	17	0.91	322	0.161	<20	1.08	0.014	0.99	<0.1	<0.01	4.6	0.3	0.06	6	0.6
Ridgetop East- Lower	Composite 2351-35	67	0.87	0.089	8	10	0.82	246	0.143	<20	0.96	0.012	0.84	<0.1	<0.01	3.7	0.3	<0.05	7	0.7
Ridgetop East- Upper	Composite 2351-36	63	0.84	0.065	7	5	0.69	227	0.105	<20	0.75	0.016	0.62	0.2	<0.01	3.5	0.2	<0.05	5	1.2
Ridgetop East- Upper	Composite 2351-37	60	0.8	0.067	6	6	0.68	227	0.106	<20	0.73	0.014	0.62	0.2	<0.01	3.7	0.2	<0.05	5	0.9
Area 2	KM 1966-13,22 MINTO K1	72	2.13	0.101	30	6	0.82	260	0.112	<10	1.27	0.02	0.65	0.1	<0.01	5.9	0.31	0.13	7.07	0.9
Area 2	KM 1966-29,30 MINTO L+M ZONE	105	0.97	0.061	4.2	12	0.76	260	0.154	<10	1.24	0.02	0.71	0.08	0.84	3.5	0.3	0.1	12.4	1.7
Area 2	KM 1966-28 MINTO N ZONE	97	1.24	0.118	14.7	9	1.02	160	0.223	<10	1.62	0.04	0.33	0.08	0.01	3.9	0.1	0.08	9.27	1.2
Area 2	KM 1966-29 MINTO M ZONE	81	0.91	0.051	4.6	9	0.66	170	0.116	<10	1.02	0.02	0.53	0.06	0.01	3	0.22	0.07	11.85	1.3
Area 2	KM 1966-30 MINTO L ZONE	130	0.81	0.072	3.8	9	0.92	390	0.215	<10	1.52	0.02	1.02	0.07	0.02	5.1	0.41	0.11	14.75	2.2
Area 2	KM 1966-40 MINTO O ZONE	72	1.36	0.047	4.7	6	0.54	200	0.017	<10	0.71	0.01	0.12	0.05	0.06	1.9	0.06	0.11	9.45	1.7
Area 2	KM 1966-41 MINTO P ZONE	87	1.43	0.101	8.6	15	0.99	190	0.231	<10	1.45	0.04	0.47	0.08	0.02	3.3	0.13	0.63	8.98	1.7
Area 2	KM 1966-42 MINTO Q ZONE	87	0.99	0.06	7.1	9	0.7	130	0.142	<10	1.12	0.02	0.33	0.06	0.01	2.7	0.11	0.29	10.5	2.3
Minto East	KM2751-24 RoTL & Cu/CT 3, 4, 5,	64	1.34	0.046	5	47	0.66	99	0.096	<20	0.88	0.01	0.34	<0.1	0.07	2	0.1	0.69	8	1.6
Copper Keel	KM2751-25 RoTL & Cu/CT 3, 4, 5,	61	0.97	0.055	7	63	0.57	194	0.081	<20	0.91	0.024	0.46	<0.1	0.12	2.6	0.1	0.09	7	1.2
Wildfire	KM2751-26 RoTL & Cu/CT 3, 4, 5,	54	0.68	0.036	2	35	0.59	136	0.053	<20	0.42	0.014	0.31	<0.1	0.05	3	0.2	<0.05	5	2.4

Appendix G
Phase V/VI Tailings: Saturated Column Test Results

Appendix G1
Sample Origin

Deposit	Column ID	Origin of Tailings Sample	Reference
Area 118	Col 1	Composite 2351-33 and Composite 2351-34	G&T Metallurgical Services Ltd. 2009. Pre-Feasibility Metallurgical Testing On Samples From The Area 118 And Ridgetop East Zones At The Minto Mine, Yukon, Canada. Report KM2351, prepared for SRK Consulting, May 2009.
Ridgetop	Col 2	Composite 2351-35 and Composite 2351-36	

Source: K:\01_SITES\Minto\1CM002.003_PhaseV_WaterQualityPrediction\Task600_Reporting\030_Appendices\G_PhaseV-VI_Taliings_SatColumns\G1_Sample\[SampleOrigins_Tailings_1CM002-003_dbm_rev00.xlsx]

Appendix G2
Saturated Column Operating Parameters

Cell No.	Sample ID	Sample Type	Method Reference	Column Dimensions			Column Packing			Pore Volume	Total Volume of Initial Flushings	Flushing Rate/Weekly Input*	Temp	Sampling Frequency	Start-up Date	Sampling Day	Operation Procedure	Sample Prep for Flushings
				Inner Diameter (cm)	Length (cm)	Distance from Top of Column to Sample (cm)	Dry Wt. of Sample (kg)	Other Materials Used	Column Material	(mL)	(mL)	(mL)	(°C)		**2009**			
Col 1	2351-33&34 Composite	Tailings	MEND	5.10	60.00		2.50	Acrylic perforated disk & nylon mesh	Plexiglas		160	50	20-22 °C	Weekly	9-Sep	Wednesday	Overlying water circulation	None
Col 2	2351-35&36 Composite	Tailings	MEND	5.10	60.00		2.50	Acrylic perforated disk & nylon mesh	Plexiglas		160	50	20-22 °C	Weekly	9-Sep	Wednesday	Overlying water circulation	None

Appendix G3
Phase V/VI Tailings Saturated Column Test Results: Tables

Col 1 Surface
Sample = 2351-33&34 Composite

CONFIDENTIAL *DRAFT*

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L
9-Sep-09	0	160	160	6.95	214	79	#N/A	3.1	24.3	20	7.40	0.8	0.26	34.3	0.0196	0.00021	0.00032	0.0682	-0.00001	-0.000005	-0.05	0.000041	11.1	0.0002	0.000077	0.00409	0.005	0.000015
16-Sep-09	1	50	50	6.78	320	49					7.50																	
23-Sep-09	2	160	160	6.99	281	61	#N/A	4.1	22.1	9	8.40	1.5	0.2	27.9	0.0083	0.00016	0.0003	0.0631	-0.00001	-0.000005	-0.05	0.000038	8.96	-0.0001	0.000076	0.00224	0.003	0.00393
30-Sep-09	3	50	50	6.74	399	51					8.50																	
7-Oct-09	4	160	160	6.78	453	56	#N/A	4.2	21.6	17	7.90	-0.5	0.14	25.2	0.0074	0.00007	0.00013	0.0486	-0.00001	-0.000005	-0.05	0.000015	7.96	-0.0001	0.000075	0.00632	0.002	0.00214
14-Oct-09	5	50	50	6.82	370	45					8.50																	
21-Oct-09	6	160	160	7.27	312	51	#N/A	3.1	22.0	9	8.70	0.8	0.27	24.5	0.0113	0.00021	0.00056	0.0449	-0.00001	-0.000005	-0.05	0.000055	7.56	0.0002	0.000046	0.00357	0.008	0.000146
28-Oct-09	7	50	50	6.85	370	45					8.80																	
4-Nov-09	8	160	160	7.40	352	46	#N/A	4.9	22.6	6	9.00	-0.5	0.13	23.5	0.0107	0.00014	0.00023	0.0419	-0.00001	-0.000005	-0.05	0.000024	7.29	0.0006	0.000022	0.00302	0.003	0.000053
11-Nov-09	9	50	50	7.32	294	39					7.90																	
18-Nov-09	10	160	160	6.89	328	58	#N/A	6.4	26.7	5	7.90	-0.5	0.09	22.4	0.0112	0.00011	0.00015	0.0435	0.00003	-0.000005	-0.05	0.000025	6.98	-0.0001	0.000026	0.00212	0.006	0.000084
25-Nov-09	11	50	50	7.02	315	54					7.20																	
2-Dec-09	12	160	160	6.65	364	57	#N/A	4.7	24.5	6	7.50	-0.5	0.08	23.1	0.0237	0.0001	0.00017	0.0422	-0.00001	-0.000005	-0.05	0.000018	7.23	0.0001	0.000029	0.00217	0.009	0.000182
9-Dec-09	13	50	50	6.70	399	54					8.00																	
16-Dec-09	14	160	160	7.31	376	58	#N/A	3.4	23.3	5	7.80	-0.5	0.06	22.2	0.0091	0.00009	0.00007	0.0394	-0.00001	-0.000005	-0.05	0.000014	7.05	0.0001	0.000008	0.0012	0.002	0.000014
23-Dec-09	15	50	50	7.26	430	46					7.50																	
30-Dec-09	16	160	160	6.91	264	52	#N/A	3.3	20.8	6	6.80	0.7	0.06	20.2	0.0074	0.00004	0.00007	0.0392	-0.00001	-0.000005	-0.05	0.00001	6.39	-0.0001	0.000016	0.00341	0.001	0.000007
6-Jan-10	17	50	50	6.35	178	48					7.60																	
13-Jan-10	18	160	160	6.01	329	49	#N/A	3.8	21.0	5	7.40	-0.5	0.04	20.5	0.011	0.0004	0.0007	0.0417	-0.0002	-0.0001	-1	-0.0001	6.5	-0.002	-0.0001	0.002	-0.02	0.0006
20-Jan-10	19	50	50	5.66	352	45					8.20																	
27-Jan-10	20	160	160	5.91	281	50	#N/A	3.0	21.0	6	7.10	-0.5	0.04	20	0.008	-0.0002	0.0004	0.0394	-0.0001	-0.00005	-0.5	-0.00005	6.31	-0.001	-0.00005	0.0029	-0.01	0.00019
3-Feb-10	21	50	50	6.02	293	44					7.50																	
10-Feb-10	22	160	160	7.19	282	50	#N/A	2.8	20.3	5	7.50	1.4	-0.05	23.1	0.011	-0.0001	0.0007	0.0476	-0.00005	-0.00003	-0.3	-0.00003	7.42	-0.0005	0.00003	0.0032	0.006	0.00008
17-Feb-10	23	50	50	6.82	383	47					8.80																	
24-Feb-10	24	160	160	6.82	338	48	#N/A	2.6	20.0	6	6.40	-0.5	0.03	18.7	0.009	-0.0004	-0.0004	0.0423	-0.0002	-0.0001	-1	-0.0001	6.1	-0.002	-0.0001	0.002	-0.02	-0.0001
3-Mar-10	25	50	50	6.29	363	48					6.30																	
10-Mar-10	26	160	160	6.78	404	47	#N/A	2.3	17.7	7	6.80	-0.5	0.04	19.5	0.007	0.0002	-0.0002	0.0409	-0.0001	-0.00005	-0.5	-0.00005	6.1	-0.001	-0.00005	0.0025	-0.01	0.00006
17-Mar-10	27	50	50	6.25	401	43					6.50																	
24-Mar-10	28	160	160	6.76	311	45	#N/A	2.5	15.5	7	6.70	-0.5	-0.05	17	0.007	0.0003	0.0003	0.0334	-0.00005	-0.00003	-0.3	-0.00003	5.5	-0.0005	0.00006	0.0012	-0.005	0.00004
31-Mar-10	29	50	50	6.54	312	41					9.50																	
7-Apr-10	30	160	160	6.37	419	43	#N/A	2.6	15.0	7	9.10	-0.5	0.03	16.2	0.0074	0.00006	0.00003	0.0426	-0.00001	-0.000005	-0.05	0.000019	5.18	-0.0001	0.00003	0.00237	0.004	0.000023
14-Apr-10	31	50	50	6.26	426	38					6.70																	
21-Apr-10	32	160	160	6.45	467	42	#N/A	2.6	15.3	3	9.80	2.1	-0.05	15.2	0.0091	0.00016	0.00031	0.035	-0.00001	-0.000005	-0.05	0.000064	4.85	0.0002	0.00137	0.0027	0.002	0.000158
28-Apr-10	33	50	50	6.74	420	33					9.60																	
5-May-10	34	160	160	5.96	452	38	#N/A	2.8	14.9	3	9.60	-0.5	0.05	16.6	0.005	0.0001	0.00035	0.0332	-0.00001	-0.000005	-0.05	0.000028	5.31	-0.0001	0.000053	0.00161	0.003	0.000018
12-May-10	35	50	50	6.01	418	20					9.80																	
19-May-10	36	160	160	6.00	373	28	#N/A	2.2	10.6	3	9.70	-0.5	0.01	11.6	0.005	0.00006	0.00062	0.0256	-0.00001	-0.000005	-0.05	0.000015	3.76	-0.0001	0.000047	0.00141	0.004	0.00002
26-May-10	37	50	50	5.76	470	29					9.80																	
2-Jun-10	38	160	160	6.04	495	33	#N/A	2.0	12.6	3	8.06	-0.5	0.01	12	0.0056	0.00006	0.00006	0.027	-0.00001	-0.000005	-0.05	0.000019	3.82	-0.0001	0.000067	#N/A	0.002	0.000054
9-Jun-10	39	50	50	5.52	362	29					8.47																	
16-Jun-10	40	160	160	5.88	481	36	#N/A	2.7	13.8	-2	8.55	-0.5	0.02	13.8	0.0062	0.00005	0.00039	0.0273	-0.00001	-0.000005	-0.05	0.000025	4.47	0.0001	0.000065	0.00184	0.006	0.000058
23-Jun-10	41	50	50	6.00	432	33					8.75																	
30-Jun-10	42	160	160	5.32	369	36	#N/A	2.4	15.1	3	8.70	-0.5	0.02	14.4	0.0095	0.00009	0.00017	0.0309	-0.00001	-0.000005	-0.05	0.000024	4.58	-0.0001	0.000074	0.00318	0.009	0.000126
7-Jul-10	43	50	50	5.99	346	32					8.71																	
14-Jul-10	44	160	160	5.59	380	38	#N/A	3.0	14.9	2	8.70	-0.5	0.02	13.6	0.0051	0.00005	0.00017	0.0306	-0.00001	-0.000005	-0.05	0.000026	4.38	-0.0001	0.000105	0.00291	-0.001	0.00002
21-Jul-10	45	50	50	5.65	408	32					8.77																	
28-Jul-10	46	160	160	5.39	475	37	#N/A	3.8	15.8	4	8.63	-0.5	0.02	14.6	0.0064	0.00003	0.0007	0.03	-0.00001	-0.000005	-0.05	0.000022	4.65	0.0004	0.000109	0.00133	0.006	0.000035
4-Aug-10	47	50	50	5.67	420	38					7.86																	
11-Aug-10	48	160	160	5.77	333	26	#N/A	4.2	12.0	-2	8.62	-0.5	0.01	9.9	0.0053	0.00003	0.00005	0.0246	-0.00001	-0.000005	-0.05	0.000016	3.16	0.0002	0.000078	0.00116	0.002	0.000013
18-Aug-10	49	50	50	5.53	405	26					8.52																	
25-Aug-10	50	160	160	5.30	486	28	#N/A	3.2	12.2	4	8.70	-0.5	0.01	10.2	0.0005	-0.00002	0.0008	0.0193	-0.00001	-0.000005	-0.05	-0.000005	3.23	0.0001	0.000041	0.00072	-0.001	-0.000005
1-Sep-10	51	50	50	6.34	454	26					8.56																	
8-Sep-10	52	160	160	6.06	489	29	#N/A	4.1	13.0	4	8.68	-0.5	0.14	12.8	0.0093	0.00003	0.00079	0.0259	-0.00001	-0.000005	-0.05	0.000024	4.12	-0.0001	0.000094	0.00088	0.002	0.000008
15-Sep-10	53	50	50	6.16	460	27					8.62																	
22-Sep-10	54	160	160	6.91	468	33	#N/A	2.8	13.6	4	7.97	-0.5	0.01	13	0.0135	0.00003	0.00025	0.0317	-0.00001	-0.000005	-0.05	0.000029	4.14	0.0003	0.000106	0.00155	0.003	0.000151
29-Sep-10	55	50	50	6.43	421	28					8.28																	
6-Oct-10	56	160	160	6.01	396	32	#N/A	2.8	14.0	4	8.32	-0.5	0.36	13.5	0.0071	0.00002	0.00007	0.0291	-0.00001	-0.000005	-0.05	0.000024	4.3	0.0003	0.000073	0.00195	0.006	0.000444
13-Oct-10	57	50	50	6.28	358	32					8.23																	
20-Oct-10	58	160	160	5.93	401	33	#N/A	2.9	14.8	5	8.46	-0.5	0.06	12.9	0.0039	0.00002	0.00007	0.0321	-0.00001	-0.000005	-0.05	0.000025	4.19	0.0001	0.000129	0.0016	0.001	0.000106
27-Oct-10	59	50	50	6.88	338	28					8.50																	
3-Nov-10	60	160	160	6.89	329	31	#N/A	2.1	15.4	2	8.40	-0.5	0.09	14.1	0.0042	-0.00002	0.00007	0.033	-0.00001	-0.000005	-0.05	0.000029	4.48	-0.0001	0.000058	0.00166	0.001	0.000358
10-Nov-10	61	50	50	7.09	300	30					8.26																	
17-Nov-10	62	160	160	6.70	313	33	#N/A	2.8	14.9	2	8.00	-0.5	0.06	13.1	0.0043	0.00006	0.00007	0.0274	-0.00001	-0.000005	-0.05	0.000024	4.16	-0.0001	0.000061	0.0046	-0.001	0.000016
24-Nov-10	63	50	50	6.85	442	28					8.62																	
1-Dec-10	64	160	160	7.30	459	32	#N/A	4.0	14.7	-2	8.10	-0.5	-0.05	12.8	0.0044	0.00002	0.00023	0.0285	-0.00001	-0.000005	-0.05	0.000024	4.09	-0.0001	0.000052	0.00168	0.001	0.000013
8-Dec-10	65	50	50	7.27	468	27					8.24																	
15-Dec-10	66	160	160	7.39	473	30	#N/A	3.1	13.9	4	8.86	-0.5	0.02	12.3	0.0046	0.00003	0.00007	0.0249	-0.00001	-0.000005	-0.05	0.000018	3.96	-0.0001	0.000039	0.00264	0.003	0.00002
22-Dec-10	67	50	50	7.40	389	28					8.66																	

Col 1 Surface
Sample = 2351-33&

Date	Cycle No.	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L	Maxxam ID	Maxxam File#	Major Anions	Major Cations	Diff	Diff (%)
9-Sep-09	0	0.0008	1.57	0.0362	-0.01	0.00295	0.00036	0.089	4.32	0.00141	0.701	-0.000005	2.92	0.152	8	0.000041	0.00166	-0.0005	0.000097	0.0006	0.0043	-0.0001			0.94	0.92	-0.02	-1.0%
16-Sep-09	1																											
23-Sep-09	2	0.001	1.35	0.0298	-0.01	0.00289	0.00037	0.141	4.18	0.00111	0.728	-0.000005	2.75	0.13	6	0.000019	0.00569	-0.0005	0.000018	0.0002	0.0044	-0.0001			0.68	0.78	0.10	7.0%
30-Sep-09	3																											
7-Oct-09	4	0.0006	1.29	0.0254	-0.01	0.00242	0.00045	0.036	3.4	0.0009	0.757	-0.000005	2.31	0.118	5	0.000005	0.0108	0.0006	0.00003	0.0004	0.0036	-0.0001			0.81	0.69	-0.12	-7.8%
14-Oct-09	5																											
21-Oct-09	6	0.0006	1.36	0.0239	-0.01	0.00168	0.00048	0.21	2.86	0.00078	0.83	0.000036	1.98	0.114	3	0.00004	0.0197	-0.0005	0.000034	0.0003	0.0074	-0.0001			0.66	0.65	-0.02	-1.2%
28-Oct-09	7																											
4-Nov-09	8	-0.0005	1.28	0.0171	-0.01	0.00111	0.00034	0.105	2.35	0.00061	0.683	-0.000005	1.37	0.098	-3	0.000011	0.0255	-0.0005	0.000031	-0.0002	0.0035	-0.0001			0.60	0.59	-0.01	-0.8%
11-Nov-09	9																											
18-Nov-09	10	-0.0005	1.21	0.0161	-0.01	0.0008	0.00035	0.046	1.81	0.00046	0.721	0.00001	0.9	0.0902	-3	0.000033	0.0287	0.0005	0.00005	-0.0002	0.0031	-0.0001			0.66	0.53	-0.12	-10.4%
25-Nov-09	11																											
2-Dec-09	12	0.0006	1.23	0.0136	-0.01	0.00065	0.00036	0.043	1.67	0.00046	0.856	0.000008	0.85	0.0873	-3	0.000018	0.033	0.0005	0.000039	0.0003	0.0067	-0.0001			0.63	0.54	-0.09	-7.8%
9-Dec-09	13																											
16-Dec-09	14	-0.0005	1.11	0.00843	-0.01	0.00047	0.00029	0.034	1.32	0.00046	0.932	-0.000005	0.57	0.0773	-3	0.000009	0.0357	0.0006	0.000037	-0.0002	0.0017	-0.0001			0.59	0.50	-0.09	-7.8%
23-Dec-09	15																											
30-Dec-09	16	-0.0005	1.03	0.00694	-0.01	0.00039	0.00025	0.03	1.19	0.00033	0.878	-0.000005	0.44	0.0723	-3	0.000005	0.0338	-0.0005	0.000042	-0.0002	0.0019	-0.0001			0.56	0.45	-0.11	-10.8%
6-Jan-10	17																											
13-Jan-10	18	-0.01	1	0.006	-0.2	-0.001	0.0026	-0.04	1.2	-0.0008	-2	0.0001	0.4	0.07	-10	0.0001	0.0356	-0.01	-0.00004	0.01	0.006	-0.002			0.54	0.45	-0.09	-8.7%
20-Jan-10	19																											
27-Jan-10	20	-0.005	1.02	0.0061	-0.1	-0.0005	0.0035	0.059	1.06	0.0005	-1	-0.00005	0.37	0.0655	-6	-0.00002	0.041	0.008	0.00004	0.003	0.005	-0.001			0.56	0.44	-0.12	-11.9%
3-Feb-10	21																											
10-Feb-10	22	-0.003	1.1	0.0087	-0.05	0.0004	0.0011	0.031	1.21	0.0003	1.14	-0.00003	0.48	0.0711	-3	-0.00001	0.0413	-0.003	0.00002	-0.001	0.003	-0.0005			0.55	0.51	-0.04	-3.7%
17-Feb-10	23																											
24-Feb-10	24	-0.01	0.9	0.011	-0.2	-0.001	0.0072	-0.04	0.8	-0.0008	-2	-0.0001	0.3	0.06	14	-0.00004	0.0395	-0.01	-0.00004	-0.004	#N/A	-0.002			0.54	0.41	-0.13	-13.5%
3-Mar-10	25																											
10-Mar-10	26	-0.005	1	0.0172	-0.1	-0.0005	0.0002	-0.02	0.9	-0.0004	1.21	-0.00005	-0.5	0.0584	#N/A	-0.00002	0.033	-0.005	0.00002	-0.002	0.003	-0.001			0.52	0.43	-0.08	-8.9%
17-Mar-10	27																											
24-Mar-10	28	-0.003	0.8	0.0165	-0.05	-0.0003	0.0001	0.02	0.7	0.0003	1.08	-0.00003	-0.3	0.0524	-10	0.00001	0.024	-0.003	0.00001	-0.001	0.0029	-0.0005			0.47	0.37	-0.10	-11.9%
31-Mar-10	29																											
7-Apr-10	30	-0.0005	0.78	0.0198	0.01	0.00015	0.00035	0.025	0.72	0.00025	1.14	-0.000005	0.31	0.0492	-2	0.000006	0.0189	-0.0005	0.000008	-0.0002	0.0027	-0.0001			0.46	0.35	-0.11	-13.2%
14-Apr-10	31																											
21-Apr-10	32	-0.0005	0.76	0.0239	-0.01	0.00013	0.00084	0.027	3.38	0.00027	1.34	0.000082	0.42	0.0439	-10	0.000013	0.0147	-0.0005	0.000021	-0.0002	0.0395	0.0004			0.43	0.41	-0.02	-2.6%
28-Apr-10	33																											
5-May-10	34	-0.0005	0.81	0.0276	-0.01	0.00015	0.00031	0.034	0.78	0.00027	1.54	-0.000005	0.27	0.0433	-10	0.000012	0.0192	-0.0005	0.000006	-0.0002	0.0025	-0.0001			0.38	0.36	-0.01	-1.9%
12-May-10	35																											
19-May-10	36	-0.0005	0.54	0.0228	0.02	0.00007	0.0003	0.021	0.65	0.00018	0.941	-0.000005	0.22	0.0296	-10	0.000004	0.0117	-0.0005	0.000021	-0.0002	0.0018	-0.0001			0.29	0.26	-0.03	-5.6%
26-May-10	37																											
2-Jun-10	38	-0.0005	0.59	0.0257	-0.01	0.00008	0.00031	0.025	0.61	0.00019	1.07	-0.000005	0.24	0.0297	-10	0.000005	0.0122	-0.0005	0.000009	-0.0002	0.0042	-0.0001			0.33	0.27	-0.06	-10.9%
9-Jun-10	39																											
16-Jun-10	40	-0.0005	0.64	0.0283	-0.01	0.00011	0.00022	0.027	0.84	0.00025	1.24	0.000022	0.19	0.0313	-10	0.000021	0.0138	-0.0005	0.000007	-0.0002	0.0015	-0.0001			0.33	0.31	-0.03	-4.3%
23-Jun-10	41																											
30-Jun-10	42	-0.0005	0.73	0.0313	-0.01	0.00011	0.00026	0.03	0.66	0.00022	1.41	-0.000005	0.3	0.0357	-10	0.000005	0.0129	0.0005	0.000009	-0.0002	0.0019	-0.0001			0.38	0.32	-0.06	-8.6%
7-Jul-10	43																											
14-Jul-10	44	-0.0005	0.66	0.0319	-0.01	0.00009	0.00032	0.03	0.72	0.00026	1.4	-0.000005	0.22	0.0357	-10	0.000005	0.0159	-0.0005	0.000016	-0.0002	0.0025	-0.0001			0.35	0.30	-0.05	-8.2%
21-Jul-10	45																											
28-Jul-10	46	-0.0005	0.73	0.0333	-0.01	0.00018	0.00041	0.029	0.63	0.00024	1.52	-0.000005	0.31	0.0346	-10	0.000006	0.0134	-0.0005	0.000014	0.0003	0.0048	-0.0001			0.42	0.32	-0.09	-12.7%
4-Aug-10	47																											
11-Aug-10	48	-0.0005	0.48	0.0232	-0.01	0.0001	0.00032	0.009	0.4	0.00015	0.886	-0.000005	0.25	0.0241	-10	0.000003	0.00817	0.0006	0.000006	-0.0002	0.0013	-0.0001			0.30	0.22	-0.08	-15.3%
18-Aug-10	49																											
25-Aug-10	50	-0.0005	0.51	0.0186	-0.01	0.00049	0.00011	0.029	0.49	0.00021	0.996	-0.000005	0.35	0.0232	-10	0.000002	0.00114	-0.0005	-0.000002	-0.0002	0.0002	-0.0001			0.34	0.23	-0.11	-19.2%
1-Sep-10	51																											
8-Sep-10	52	-0.0005	0.61	0.0276	-0.01	0.00011	0.00029	0.044	0.65	0.00019	1.16	-0.000005	0.22	0.0274	-10	0.000004	0.00965	-0.0005	0.000006	-0.0002	0.0012	-0.0001	W89678	B083997	0.36	0.28	-0.08	-12.8%
15-Sep-10	53																											
22-Sep-10	54	-0.0005	0.64	0.0297	-0.01	0.0001	0.00039	0.035	0.63	0.00021	1.16	-0.000005	0.31	0.0297	-10	0.000007	0.0108	-0.0005	0.000065	-0.0002	0.0037	-0.0001	X21181	B091571	0.37	0.29	-0.08	-12.3%
29-Sep-10	55																											
6-Oct-10	56	-0.0005	0.66	0.0291	-0.01	0.00012	0.00029	0.023	0.88	0.00019	1.26	0.000011	0.27	0.0289	-10	0.000011	0.0104	-0.0005	0.000011	-0.0002	0.0024	-0.0001	X52942	B096727	0.40	0.30	-0.09	-13.4%
13-Oct-10	57																											
20-Oct-10	58	-0.0005	0.6	0.0273	-0.01	0.0001	0.00038	0.017	0.56	0.00017	1.34	-0.000005	0.22	0.0292	-10	0.000009	0.00909	-0.0005	0.000017	-0.0002	0.0038	-0.0001	X99708	B0A4122	0.42	0.28	-0.13	-19.2%
27-Oct-10	59																											
3-Nov-10	60	-0.0005	0.69	0.029	-0.01	0.00022	0.00012	0.011	0.53	0.00018	1.42	-0.000005	0.19	0.0305	-10	0.000002	0.0115	-0.0005	#N/A	-0.0002	0.0038	-0.0001	Y24866	B0A8557	0.37	0.30	-0.07	-9.8%
10-Nov-10	61																											
17-Nov-10	62	-0.0005	0.66	0.0275	-0.01	0.00008	0.00028	0.028	0.71	0.0002	1.45	-0.000005	0.29	0.0281	-10	0.000008	0.00867	-0.0005	#N/A	-0.0002	0.0037	-0.0001	Y62099	B0B4325	0.36	0.29	-0.06	-9.8%
24-Nov-10	63																											
1-Dec-10	64	-0.0005	0.62	0.0278	0.01	0.00017	0.00029	0.069	0.66	0.00019	1.44	-0.000005	0.26	0.0274	-10	0.000005	0.0115	-0.0005	0.000019	-0.0002	0.0015	-0.0001	Y83921	B0B8076	0.35	0.28	-0.07	-10.9%
8-Dec-10	65																											
15-Dec-10	66	-0.0005	0.58	0.0255	-0.01	0.00015	0.00027	0.024	0.49	0.00019	1.32	-0.000005	0.2	0.0243	-10	0.000006	0.00944	-0.0005	0.000008	0.0003	0.0019	-0.0001	Z18060	B0C3703	0.38	0.27	-0.11	-17.1%
22-Dec-10	67																											

Col 1 Surface
Sample = 2351-33&34 Composite

CONFIDENTIAL *DRAFT*

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L
29-Dec-10	68	160	160	7.36	456	31	#N/A	4.1	14.6	4	8.96	-0.5	0.01	10.8	0.004	-0.00002	0.00018	0.0262	-0.00001	-0.000005	-0.05	0.000029	3.34	-0.0001	0.000069	0.0013	-0.001	0.000013
5-Jan-11	69	50	50	7.30	426	25					9.30																	
12-Jan-11	70	160	160	7.36	443	28	#N/A	3.4	12.7	2	9.48	-0.5	0.02	11.8	0.0078	0.00005	0.00023	0.0257	-0.00001	-0.000005	-0.05	0.000038	3.79	-0.0001	0.000047	0.00158	0.002	0.000081
19-Jan-11	71	50	50	7.27	416	24					9.52																	
26-Jan-11	72	160	160	7.13	447	30	#N/A	3.4	13.1	2	9.46	1.4	0.02	12	0.0068	0.00009	0.00019	0.0256	-0.00001	-0.000005	-0.05	0.000033	3.82	0.0001	0.00005	0.00342	0.004	0.000066
2-Feb-11	73	50	50	7.05	460	26					8.30																	
9-Feb-11	74	50	50	6.75	420	27																						
16-Feb-11	75	50	50	6.88	423	30																						
23-Feb-11	76	50	50	6.66	386	31																						
2-Mar-11	77	50	50	6.80	402	34																						
9-Mar-11	78	50	50	6.47	430	34																						
16-Mar-11	79	50	50	6.65	382	34																						
23-Mar-11	80	50	50	5.95	440	37																						
30-Mar-11	81	50	50	#N/A	453	38																						
6-Apr-11	82	50	50	#N/A	407	38																						
13-Apr-11	83	50	50	6.92	392	41																						
20-Apr-11	84	160	160	7.11	400	43	#N/A	5.5	17.5	3	9.20	1.4	0.03	16.8	0.0049	#N/A	0.00017	0.034	-0.00001	-0.000005	-0.05	0.000024	5.29	0.0001	0.000019	0.00251	0.001	#N/A
27-Apr-11	85	50	50	7.18	389	37																						
4-May-11	86	50	50	7.03	361	38																						
11-May-11	87	50	50	7.23	367	40																						
18-May-11	88	50	50	7.52	453	44																						
25-May-11	89	50	50	7.11	459	45																						
1-Jun-11	90	50	50	6.64	384	56																						
8-Jun-11	91	50	50	7.51	210	55																						
15-Jun-11	92	50	50	7.56	321	51																						
22-Jun-11	93	50	50	7.36	359	53																						
29-Jun-11	94	50	50	6.69	353	55																						
6-Jul-11	95	50	50	6.53	350	53																						
13-Jul-11	96	160	160	6.63	337	57	#N/A	4.7	21.0	5	8.73	1.8	0.02	20.2	0.0054	0.00003	0.00025	0.0422	-0.00001	-0.000005	-0.05	0.000028	6.35	0.0003	0.000011	0.002	0.003	0.00005
20-Jul-11	97	50	50	7.37	330	21																						
27-Jul-11	98	50	50	6.60	412	30																						
3-Aug-11	99	50	50	6.91	405	29																						
10-Aug-11	100	160	160	7.02	399	31																						
17-Aug-11	101	50	50	7.30	368	32																						
24-Aug-11	102	160	160	7.04	332	33																						
31-Aug-11	103	50	50	7.23	384	39																						
7-Sep-11	104	160	160	7.61	406	39																						
14-Sep-11	105	50	50	7.05	456	40																						
21-Sep-11	106	160	160	7.15	445	41																						
28-Sep-11	107	50	50	6.59	490	42																						
5-Oct-11	108	160	160	7.20	427	40	#N/A	3.5	16.0	4	9.63	0.9	0.02	17.2	0.005	#N/A	0.00034	0.0347	-0.00001	-0.000005	-0.05	0.000022	5.45	-0.0001	0.000017	0.0021	-0.001	#N/A
12-Oct-11	109	50	50	7.13	443	33																						
19-Oct-11	110	50	50	6.60	446	35																						
26-Oct-11	111	50	50	7.10	452	36																						
2-Nov-11	112	50	50	6.80	451	38																						
9-Nov-11	113	50	50	7.00	470	40																						
16-Nov-11	114	50	50	7.02	467	36																						
23-Nov-11	115	50	50	6.92	265	38																						
30-Nov-11	116	50	50	7.20	439	37																						
7-Dec-11	117	50	50	7.22	439	38																						
14-Dec-11	118	50	50	7.29	462	38																						
21-Dec-11	119	50	50	7.45	492	39																						
28-Dec-11	120	160	160	7.41	513	41	#N/A	3.1	20.8	2	9.51	#N/A	0.022	16.3	0.0086	0.00003	0.00017	0.0322	-0.00001	0.000015	-0.05	#N/A	5.13	0.0002	0.000046	0.0021	#N/A	#N/A
4-Jan-12	121	50	50	7.56	639	34																						
11-Jan-12	122	50	50	7.77	672	33																						
18-Jan-12	123	50	50	7.90	724	34																						
25-Jan-12	124	50	50	6.80	686	32																						
1-Feb-12	125	50	50	7.70	625	35																						
8-Feb-12	126	50	50	7.73	565	21																						
15-Feb-12	127	50	50	7.67	566	22																						
22-Feb-12	128	50	50	7.91	675	24																						
29-Feb-12	129	50	50	7.98	584	24																						
7-Mar-12	130	50	50	7.60	671	24																						
14-Mar-12	131	50	50	7.31	458	26																						
21-Mar-12	132	160	160	6.88	502	30	#N/A	3.4	14.2	4	8.88	0.7	0.019	12.5	0.0045	0.00002	0.00018	0.0264	-0.00001	-0.000005	-0.05	0.000016	3.97	-0.0001	0.00001	0.00164	0.002	0.000126
28-Mar-12	133	50	50	7.17	698	26																						
4-Apr-12	134	50	50	6.87	560	26																						
11-Apr-12	135	50	50	6.68	640	28																						
18-Apr-12	136	50	50	6.92	579	29																						
25-Apr-12	137	50	50	6.91	708	30																						
2-May-12	138	50	50	7.13	683	30																						
9-May-12	139	50	50	6.91	678	24																						
16-May-12	140	50	50	6.94	632	32																						

Col 1 Surface
Sample = 2351-33&

Date	Cycle No.	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L	Maxxam ID	Maxxam File#	Major Anions	Major Cations	Diff	Diff (%)
29-Dec-10	68	-0.0005	0.59	0.025	-0.01	0.00018	0.0003	0.062	0.57	0.00017	1.02	-0.000005	0.25	0.0251	-10	0.000008	0.00681	-0.0005	0.000027	-0.0002	0.0018	-0.0001	Z27191	B0C5481	0.39	0.24	-0.15	-23.5%
5-Jan-11	69																											
12-Jan-11	70	-0.0005	0.57	0.0269	-0.01	0.00007	0.00031	0.043	0.52	0.00016	1.21	0.000009	0.23	0.0241	-10	0.000019	0.00879	-0.0005	0.000018	0.0006	0.0064	-0.0001	Z43444	B103513	0.31	0.26	-0.05	-8.9%
19-Jan-11	71																											
26-Jan-11	72	-0.0005	0.6	0.0264	-0.01	0.00018	0.00038	0.018	0.47	0.00023	1.15	0.000009	0.24	0.0234	-10	0.000009	0.00736	-0.0005	0.000024	0.0002	0.0037	-0.0001	Z63196	B107211	0.34	0.26	-0.08	-13.4%
2-Feb-11	73																											
9-Feb-11	74																											
16-Feb-11	75																											
23-Feb-11	76																											
2-Mar-11	77																											
9-Mar-11	78																											
16-Mar-11	79																											
23-Mar-11	80																											
30-Mar-11	81																											
6-Apr-11	82																											
13-Apr-11	83																											
20-Apr-11	84	-0.0005	0.87	0.0271	-0.01	0.00012	0.00027	0.026	0.7	0.00022	1.33	0.00001	0.24	0.035	-10	0.000009	0.00603	-0.0005	0.000015	-0.0002	0.0043	-0.0001	AJ6920	B132133	0.45	0.36	-0.09	-10.9%
27-Apr-11	85																											
4-May-11	86																											
11-May-11	87																											
18-May-11	88																											
25-May-11	89																											
1-Jun-11	90																											
8-Jun-11	91																											
15-Jun-11	92																											
22-Jun-11	93																											
29-Jun-11	94																											
6-Jul-11	95																											
13-Jul-11	96	-0.0005	1.05	0.0301	-0.01	0.00022	0.0002	0.016	1.69	0.00023	1.6	0.000033	0.3	0.0359	-10	0.00002	0.00438	-0.0005	0.000004	-0.0002	0.0026	-0.0001	AZ8087	B163259	0.58	0.46	-0.12	-11.3%
20-Jul-11	97																											
27-Jul-11	98																											
3-Aug-11	99																											
10-Aug-11	100																											
17-Aug-11	101																											
24-Aug-11	102																											
31-Aug-11	103																											
7-Sep-11	104																											
14-Sep-11	105																											
21-Sep-11	106																											
28-Sep-11	107																											
5-Oct-11	108	-0.0005	0.88	0.0178	-0.01	0.0001	0.00031	0.026	1.17	0.00042	1.14	0.000026	0.2	0.0296	-10	0.000008	0.0042	-0.0005	0.000008	0.0003	0.0077	-0.0001	BU0789	B196969	0.43	0.38	-0.05	-5.8%
12-Oct-11	109																											
19-Oct-11	110																											
26-Oct-11	111																											
2-Nov-11	112																											
9-Nov-11	113																											
16-Nov-11	114																											
23-Nov-11	115																											
30-Nov-11	116																											
7-Dec-11	117																											
14-Dec-11	118																											
21-Dec-11	119																											
28-Dec-11	120	-0.0005	0.85	0.0118	-0.01	0.00012	0.0005	#N/A	#N/A	0.00018	1.18	#N/A	0.33	0.0276	-10	0.000017	0.0046	0.0007	0.000014	0.0002	#N/A	-0.0001	CL2523	B1C4800	#N/A	#N/A	#N/A	#N/A
4-Jan-12	121																											
11-Jan-12	122																											
18-Jan-12	123																											
25-Jan-12	124																											
1-Feb-12	125																											
8-Feb-12	126																											
15-Feb-12	127																											
22-Feb-12	128																											
29-Feb-12	129																											
7-Mar-12	130																											
14-Mar-12	131																											
21-Mar-12	132	-0.0005	0.63	0.0232	-0.01	0.00006	0.0002	#N/A	1.29	0.00011	0.843	#N/A	0.21	0.021	-10	0.000009	0.0029	-0.0005	0.00002	0.0003	0.0017	-0.0001	DA2101	B224526	0.39	0.29	-0.09	-13.8%
28-Mar-12	133																											
4-Apr-12	134																											
11-Apr-12	135																											
18-Apr-12	136																											
25-Apr-12	137																											
2-May-12	138																											
9-May-12	139																											
16-May-12	140																											

Col 1 Surface
Sample = 2351-33&34 Composite

CONFIDENTIAL *DRAFT*

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L
23-May-12	141	50	50	6.73	628	24																						
30-May-12	142	50	50	7.18	632	24																						
6-Jun-12	143	50	50	7.15	550	38																						
13-Jun-12	144	160	160	6.94	578	34	#N/A	5.2	23.1	4	9.86	-0.5	0.02	14.8	0.00257	0.000027	0.000261	0.0301	-0.00001	-0.000005	-0.05	0.0000162	4.65	0.00054	0.0000078	0.00108	0.001	0.000154
20-Jun-12	145	50	50	6.76	584	26																						
27-Jun-12	146	50	50	6.62	558	22																						
4-Jul-12	147	50	50	7.14	557	22																						
11-Jul-12	148	50	50	7.25	566	22																						
18-Jul-12	149	50	50	7.13	608	34																						
25-Jul-12	150	50	50	6.75	580	33																						
1-Aug-12	151	50	50	6.82	592	32																						
8-Aug-12	152	50	50	7.05	582	36																						
15-Aug-12	153	50	50	6.64	555	34																						
22-Aug-12	154	50	50	7.19	594	33																						
29-Aug-12	155	50	50	7.48	690	27																						
5-Sep-12	156	160	160	7.59	622	27	#N/A	3.8	20.9	6	9.38	-0.5	0.019	14.5	0.00581	0.000035	0.000177	0.0292	-0.00001	-0.000005	-0.05	0.000013	4.49	0.0004	0.000027	0.00451	0.0072	0.000151
12-Sep-12	157	50	50	8.03	711	21																						
19-Sep-12	158	50	50	7.32	620	30																						
26-Sep-12	159	50	50	6.82	610	33																						
3-Oct-12	160	50	50	7.33	626	32																						
10-Oct-12	161	50	50	7.31	688	32																						
17-Oct-12	162	50	50	7.51	514	27																						
24-Oct-12	163	50	50	6.88	469	30																						
31-Oct-12	164	50	50	7.47	500	32																						
7-Nov-12	165	50	50	6.95	557	34																						
14-Nov-12	166	50	50	7.40	657	34																						
21-Nov-12	167	50	50	7.17	645	34																						
28-Nov-12	168	160	160	7.08	538	35	#N/A	6.9	21.2	8	9.62	-0.5	0.019	14.4	0.00416	0.000062	0.000129	0.0308	-0.00001	-0.000005	-0.05	#N/A	4.38	0.00028	0.000011	0.00145	0.0045	0.000126
5-Dec-12	169	50	50	7.48	567	28																						
12-Dec-12	170	50	50	7.88	502	30																						
19-Dec-12	171	50	50	7.77	633	28																						
26-Dec-12	172	50	50	7.87	634	27																						
2-Jan-13	173	50	50	7.88	688	24																						
9-Jan-13	174	50	50	7.65	628	25																						
16-Jan-13	175	50	50	7.23	619	22																						
23-Jan-13	176	50	50	6.52	593	25																						
30-Jan-13	177	50	50	7.06	690	28																						
6-Feb-13	178	50	50	6.50	518	31																						
13-Feb-13	179	50	50	6.97	580	31																						
20-Feb-13	180	160	160	7.00	522	30	#N/A	4.5	16.0	6	8.60	0.56	0.017	13.2	0.00413	0.000079	0.000243	0.0262	-0.00001	-0.000005	-0.05	0.000021	4.14	-0.0001	0.000014	0.00129	0.0011	0.000049
27-Feb-13	181	50	50	7.05	547	32																						
6-Mar-13	182	50	50	7.36	666	24																						
13-Mar-13	183	50	50	6.93	568	27																						
20-Mar-13	184	50	50	7.35	614	29																						
27-Mar-13	185	50	50	6.82	548	28																						
3-Apr-13	186	50	50	6.98	487	29																						
10-Apr-13	187	50	50	7.15	633	29																						
17-Apr-13	188	50	50	7.18	596	30																						
24-Apr-13	189	50	50	6.67	468	29																						
1-May-13	190	50	50	6.30	454	30																						
8-May-13	191	50	50	6.08	548	31																						
15-May-13	192	160	160	6.29	536	32	#N/A	5.9	18.1	3	8.78	-0.5	0.015	13.7	0.00491	0.000024	0.000064	0.0272	-0.00001	-0.000005	-0.05	0.000017	4.27	-0.0001	0.000011	0.00154	0.0019	0.000027
22-May-13	193	50	50	7.22	653	26																						
29-May-13	194	50	50	7.52	578	27																						

Col 1 Surface
Sample = 2351-33&

Date	Cycle No.	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L	Maxxam ID	Maxxam File#	Major Anions	Major Cations	Diff	Diff (%)
23-May-12	141																											
30-May-12	142																											
6-Jun-12	143																											
13-Jun-12	144	-0.0005	0.768	0.0162	-0.01	0.00021	0.00012	0.0263	0.555	0.00019	1.01	0.0000295	0.235	0.0245	-10	0.0000116	0.00193	-0.0005	0.0000044	-0.0002	0.00177	-0.0001	DR7382	B251074	0.56	0.32	-0.24	-27.1%
20-Jun-12	145																											
27-Jun-12	146																											
4-Jul-12	147																											
11-Jul-12	148																											
18-Jul-12	149																											
25-Jul-12	150																											
1-Aug-12	151																											
8-Aug-12	152																											
15-Aug-12	153																											
22-Aug-12	154																											
29-Aug-12	155																											
5-Sep-12	156	-0.0005	0.788	0.00547	-0.01	0.00021	0.00035	#N/A	0.741	0.0001	0.948	#N/A	0.252	0.0234	-10	0.000008	0.00235	-0.0005	#N/A	0.00094	0.00179	-0.0001	EK3364	B280253	0.56	0.32	-0.24	-27.2%
12-Sep-12	157																											
19-Sep-12	158																											
26-Sep-12	159																											
3-Oct-12	160																											
10-Oct-12	161																											
17-Oct-12	162																											
24-Oct-12	163																											
31-Oct-12	164																											
7-Nov-12	165																											
14-Nov-12	166																											
21-Nov-12	167																											
28-Nov-12	168	-0.0005	0.842	0.0135	-0.01	0.00026	0.00017	0.0527	0.593	0.00023	0.911	0.000009	0.204	0.0244	-3	0.000016	0.00267	-0.0005	0.000016	-0.0002	#N/A	-0.0001	FD8560	B2A9774	0.60	0.31	-0.29	-31.8%
5-Dec-12	169																											
12-Dec-12	170																											
19-Dec-12	171																											
26-Dec-12	172																											
2-Jan-13	173																											
9-Jan-13	174																											
16-Jan-13	175																											
23-Jan-13	176																											
30-Jan-13	177																											
6-Feb-13	178																											
13-Feb-13	179																											
20-Feb-13	180	-0.0005	0.697	0.016	-0.01	8.8E-05	0.00015	0.048	0.674	0.0001	0.78	0.000227	0.187	0.0206	-3	0.000011	0.00208	-0.0005	0.000008	0.00027	0.00238	-0.0001	FS0799	B314368	0.46	0.29	-0.17	-22.7%
27-Feb-13	181																											
6-Mar-13	182																											
13-Mar-13	183																											
20-Mar-13	184																											
27-Mar-13	185																											
3-Apr-13	186																											
10-Apr-13	187																											
17-Apr-13	188																											
24-Apr-13	189																											
1-May-13	190																											
8-May-13	191																											
15-May-13	192	-0.0005	0.749	0.00862	-0.01	0.00008	0.00021	0.0145	0.479	0.0001	0.833	0.000015	0.172	0.0206	-3	0.000009	0.00123	-0.0005	0.000002	-0.0002	0.00244	-0.0001	GK4528	B339617	0.44	0.30	-0.14	-19.7%
22-May-13	193																											
29-May-13	194																											

Dec 18/09 checked neoprene pump tubing for possible source of Sn contamination. Found that recirculating nanopure water at ~1 mL/min over 18 days increased Sn from <0.00001 ppm to 0.00046 ppm. All neoprene tubing being replaced with Tygon or Silicon.
Feb 24/10 Bi 0.0004, Cu 0.48, Pb 0.0234 and Zn 0.317. Repeat = -0.0001, 0.002, -0.001, and 0.317.
June 2/10 Cu 0.00778. Repeat = 0.00767. Data confirmed.
Nov 3/10 U 0.000746. Cannot repeat. Sample discarded.
Nov 17/10 Cl 1.4. Repeat = -0.5.
Nov 17/10 U 0.000045. Cannot repeat; sample discarded.
Feb 4/11 Change in analytical schedule.
Mar 30/11 pH 5.80. Suspect probe malfunction.
April 6/11 pH 5.60. Suspect probe malfunction.
Jul 13/11 Leak in pump tubing. 550 mL added to maintain correct volume.
April 20/11 Sb 0.00027 and Pb 0.000141. Repeat Sb= 0.00024, Pb=0.000141. Data confirmed, suspect contamination
Oct 5/11 Pb= 0.000629, Mo=0.00054, Repeat= Pb 0.00062. Data confirmed, suspect contamination. Mo= 0.0001, data accepted
Dec 28/11 Cl=5.1, Cd=0.000145, K=5.82, Ag=0.000144, Fe=0.027, Pb=0.000543, P=.073. cannot repeat, suspect contamination or analytical error
Oct 5/11 Sb=0.00026, repeat=0.00022. Data confirmed, suspect contamination
Mar 21/12 P=0.055, Ag=0.000147 repeat P=0.0566, Ag=0.000146. Data confirmed, suspect contamination
Sept 5/12 P=0.0783, Ag=0.000137. repeat P=0.0653, Ag=0.000147. Data confirmed suspect contamination
Nov 28/12 Cd=0.00004, Zn=0.0061, repeat Cd=0.00004, Zn=0.0061. data confirmed, suspect contamination
Sept 5/12 Cu=0.00451, U=0.000135, Cannot repeat suspect contamination or analytical error

Col 1 Bottom

CONFIDENTIAL *DRAFT*

Sample = 2351-33&34 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L
9-Sep-09	0	160	160	7.39	219	147	#N/A	4.2	73.5	27	4.30	0.8	0.93	79.8	0.0488	0.00025	0.00019	0.297	-0.00001	-0.000005	-0.05	0.000076	26.2	-0.0001	0.000164
16-Sep-09	1	50	50	7.53	319	175					5.20														
23-Sep-09	2	160	160	7.35	217	219	#N/A	2.8	130.7	38	6.00	0.6	1.12	135	0.022	0.00032	0.00021	0.37	-0.00001	-0.000005	-0.05	0.000039	42.2	-0.0001	0.000143
30-Sep-09	3	50	50	7.97	340	262					5.50														
7-Oct-09	4	160	160	7.52	340	298	#N/A	8.2	165.5	49	5.40	1	1.17	160	0.0141	0.00022	0.00014	0.261	0.00002	-0.000005	0.057	0.00003	47.6	-0.0001	0.000072
14-Oct-09	5	50	50	7.96	254	148					6.00														
21-Oct-09	6	160	160	7.93	252	415	#N/A	#N/A	#N/A	67	5.60	2.5	1.21	171	0.0128	0.00033	0.00029	0.15	-0.00001	-0.000005	0.071	0.000052	48.7	0.0004	0.000045
28-Oct-09	7	50	50	7.83	221	401					4.50														
4-Nov-09	8	160	160	6.77	310	357	#N/A	6.9	182.4	48	5.60	2.2	1.31	170	0.0085	0.00028	0.00023	0.113	-0.00001	-0.000005	0.068	0.000017	48.6	-0.0001	0.000022
11-Nov-09	9	50	50	7.61	289	360					3.90														
18-Nov-09	10	160	160	7.66	173	334	#N/A	8.8	155.9	37	5.20	1.4	1.62	138	0.0095	0.00029	0.00023	0.0956	0.00001	-0.000005	0.051	0.000017	39.5	-0.0001	0.000035
25-Nov-09	11	50	50	7.26	105	330					4.80														
2-Dec-09	12	160	160	7.46	70	294	#N/A	6.4	133.3	26	4.60	0.8	1.96	110	0.0278	0.00025	0.0003	0.083	-0.00001	-0.000005	-0.05	0.00001	31.4	0.0002	0.000212
9-Dec-09	13	50	50	7.60	381	105					3.50														
16-Dec-09	14	160	160	7.60	25	210	#N/A	4.1	117.6	8	4.50	0.6	2.25	85.8	0.008	0.00025	0.00018	0.0977	-0.00001	-0.000005	-0.05	0.000028	24.3	0.0002	0.000049
23-Dec-09	15	50	50	7.94	113	192					3.50														
30-Dec-09	16	160	160	7.75	121	204	#N/A	4.6	102.8	4	4.50	1	2.03	76.8	0.0085	0.00016	0.00027	0.46	-0.00001	-0.000005	-0.05	0.000022	22.5	-0.0001	0.000029
6-Jan-10	17	50	50	7.31	161	199					5.10														
13-Jan-10	18	160	160	7.00	184	193	#N/A	6.5	101.3	-2	5.40	-0.5	1.97	68.5	0.034	0.0005	0.0005	0.73	-0.0002	-0.0001	-1	-0.0001	19.3	-0.002	-0.0001
20-Jan-10	19	50	50	7.33	291	187					5.40														
27-Jan-10	20	160	160	6.72	187	187	#N/A	3.3	96.1	-2	4.30	-0.5	2.12	60.1	0.01	0.0002	0.0004	0.844	-0.00005	-0.00003	-0.3	-0.00003	17.2	-0.0005	-0.00003
3-Feb-10	21	50	50	6.93	265	180					4.30														
10-Feb-10	22	160	160	7.82	229	183	#N/A	3.3	94.6	-2	3.80	-0.5	1.86	67	0.011	0.0002	0.0007	1.3	-0.00005	-0.00003	-0.3	-0.00003	19.9	-0.0005	-0.00003
17-Feb-10	23	50	50	7.12	219	191					5.30														
24-Feb-10	24	160	160	7.79	316	181	#N/A	3.1	90.9	-2	4.40	-0.5	1.72	54.7	0.01	-0.0004	-0.0004	1.47	-0.0002	-0.0001	-1	-0.0001	16.6	-0.002	-0.0001
3-Mar-10	25	50	50	7.63	317	179					4.40														
10-Mar-10	26	160	160	7.53	307	180	#N/A	3.1	89.6	-2	5.00	-0.5	1.74	58.1	0.0108	0.00014	0.0003	1.62	-0.00001	-0.000005	-0.05	0.000015	17.2	-0.0001	0.000011
17-Mar-10	27	50	50	7.20	310	176					3.40														
24-Mar-10	28	160	160	7.54	260	179	#N/A	3.1	89.1	5	4.16	-0.5	1.66	53.6	0.012	0.0003	0.0004	1.71	-0.00005	-0.00003	-0.3	-0.00003	15.6	-0.0005	0.00004
31-Mar-10	29	50	50	7.41	265	176					3.80														
7-Apr-10	30	160	160	7.59	398	185	#N/A	3.4	88.3	2	4.70	-0.5	1.66	56.8	0.012	0.0002	0.0002	1.82	-0.00005	-0.00003	-0.3	-0.00003	16.5	-0.0005	-0.00003
14-Apr-10	31	50	50	7.75	217	176					4.00														
21-Apr-10	32	160	160	7.50	370	184	#N/A	3.2	89.4	-2	4.20	-0.5	1.55	54.5	0.0116	0.00011	0.00031	1.87	-0.00001	-0.000005	-0.05	0.000015	16	0.0002	0.000012
28-Apr-10	33	50	50	7.62	330	161					4.60														
5-May-10	34	160	160	6.96	400	170	#N/A	3.6	88.9	-2	5.10	-0.5	1.57	62.2	0.0093	0.00011	0.00051	1.96	-0.00001	-0.000005	-0.05	0.000015	19	-0.0001	0.000007
12-May-10	35	50	50	7.35	316	176					3.70														
19-May-10	36	160	160	6.94	260	185	#N/A	2.8	93.6	-2	4.60	-0.5	1.58	66.9	0.0099	0.00011	0.00029	2.29	-0.00001	-0.000005	-0.05	0.000014	20.5	-0.0001	0.000006
26-May-10	37	50	50	7.06	360	187					4.00														
2-Jun-10	38	160	160	6.76	353	190	#N/A	2.4	91.7	2	3.60	-0.5	1.56	58.2	0.0099	0.00009	0.00019	2.1	-0.00001	-0.000005	-0.05	0.000014	17.3	-0.0001	0.000007
9-Jun-10	39	50	50	7.12	316	174					3.20														
16-Jun-10	40	160	160	7.32	418	175	#N/A	2.7	93.6	-2	3.00	-0.5	1.5	53.4	0.0094	0.00009	0.00058	2.31	-0.00001	-0.000005	-0.05	0.000011	15.5	-0.0001	0.000008
23-Jun-10	41	50	50	6.97	337	170					3.60														
30-Jun-10	42	160	160	7.10	288	171	#N/A	3.0	93.4	-2	2.95	-0.5	1.59	52.8	0.0106	0.0001	0.00048	2.3	-0.00001	-0.000005	-0.05	0.000075	15	-0.0001	0.000037
7-Jul-10	43	50	50	6.87	346	168					2.82														
14-Jul-10	44	160	160	6.52	393	177	#N/A	4.2	88.8	-2	0.85	-0.5	1.42	49.1	0.0069	0.00008	0.00026	2.33	-0.00001	-0.000005	-0.05	0.000019	14.3	-0.0001	0.000013
21-Jul-10	45	50	50	6.58	361	163					3.10														
28-Jul-10	46	160	160	6.33	439	169	#N/A	4.9	87.7	-2	3.20	-0.5	1.37	53	0.0111	0.00006	0.00029	2.39	-0.00001	-0.000005	-0.05	0.000019	15.6	0.0002	0.000016
4-Aug-10	47	50	50	6.65	331	165					3.10														
11-Aug-10	48	160	160	6.56	251	179	#N/A	5.9	88.8	-2	0.70	-0.5	1.34	54.2	0.0166	0.0001	0.00021	2.32	-0.00001	-0.000005	-0.05	0.000013	16	0.0002	0.000008
18-Aug-10	49	50	50	6.60	362	177					1.85														
25-Aug-10	50	160	160	6.29	440	165	#N/A	4.5	89.9	3	0.65	-0.5	1.35	55.7	0.0013	0.00006	0.0002	2.36	-0.00001	-0.000005	-0.05	0.000006	16.3	0.0001	0.000011
1-Sep-10	51	50	50	7.50	406	160					0.70														
8-Sep-10	52	160	160	7.03	431	167	#N/A	6.2	90.9	-2	1.25	-0.5	1.24	55.3	0.0108	0.00007	0.00022	2.51	-0.00001	-0.000005	-0.05	0.000018	16.3	0.0002	0.000016
15-Sep-10	53	50	50	7.00	410	158					1.00														
22-Sep-10	54	160	160	7.26	432	169	#N/A	3.7	90.0	2	0.55	-0.5	1.26	56	0.0181	0.00007	#N/A	2.54	-0.00001	-0.000005	-0.05	0.000017	16.5	0.0002	0.000023
29-Sep-10	55	50	50	7.92	343	159					0.95														
6-Oct-10	56	160	160	7.40	343	167	#N/A	4.0	95.8	2	0.90	2.2	1.27	59.2	0.013	0.00006	0.00019	2.67	-0.00001	-0.000005	-0.05	0.000021	17.8	#N/A	0.00002
13-Oct-10	57	50	50	7.13	315	176					0.98														
20-Oct-10	58	160	160	6.69	291	194	#N/A	4.0	95.0	2	0.85	-0.5	1.23	56.2	0.0072	#N/A	0.00018	2.61	-0.00001	-0.000005	-0.05	0.000017	16.8	-0.0001	0.000021
27-Oct-10	59	50	50	6.85	315	157					0.65														
3-Nov-10	60	160	160	6.89	299	163	#N/A	2.4	99.4	2	0.71	-0.5	1.11	61.8	0.0057	0.00003	0.00014	3.22	-0.00001	-0.000005	-0.05	0.000017	18.5	0.0002	0.000007
10-Nov-10	61	50	50	6.88	370	130					0.88														
17-Nov-10	62	160	160	6.84	315	171	#N/A	3.1	98.2	-2	0.50	-0.5	1.15	65.2	0.0099	0.00008	0.0003	2.74	-0.00001	-0.000005	-0.05	0.000023	19.9	-0.0001	0.000015
24-Nov-10	63	50	50	7.12	398	167					0.85														
1-Dec-10	64	160	160	6.90	425	169	#N/A	5.7	97.2	-2	1.80	-0.5	1.01	59	0.0053	0.00006	0.00018	2.71	-0.00001	-0.000005	-0.05	0.000008	17.8	-0.0001	0.00002
8-Dec-10	65	50	50	7.03	410	172					0.90														
15-Dec-10	66	160	160	6.91	420	170	#N/A	5.5	91.9	-2	0.75	-0.5	1.08	60.3	0.0066	0.00007	0.00019	2.7	-0.00001	-0.000005	-0.05	0.000034	18.6	-0.0001	0.000013
22-Dec-10	67	50	50	7.07	400	169					0.68														
29-Dec-10	68	160	160	7.25	406	171	#N/A	7.0	92.2	-2	0.85	-0.5	0.74	57.9	0.0065	0.00005	0.00016	3.05	-0.00001	-0.000005	-0.05	0.000013	17.5	-0.0001	0.000028
5-Jan-11	69	50	50	7.35	385	172					0.90														
12-Jan-11	70	160	160	7.38	408	157	#N/A	5.4	89.8	-2	0.85	-0.5	0.88	59	0.0114	0.00007	0.00025	2.73	-0.00001	-0.000005	-0.05	0.000017	18	0.0001	0.000007
19-Jan-11	71	50	50	7.41	385	156					0.85														

Col 1 Bottom

Sample = 2351-33&34 Composite

Date	Cycle No.	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
9-Sep-09	0	0.0102	0.003	0.00156	0.0022	3.48	0.0324	0.01	0.00861	0.00038	0.011	6.49	0.00129	2.16	0.000011	1.81	0.401	9	0.000032	0.0284	0.001	0.00101	0.0009	0.0042	-0.0001
16-Sep-09	1																								
23-Sep-09	2	0.00765	0.003	0.00172	0.0034	7.29	0.0471	-0.01	0.0156	0.00029	0.1	11	0.00198	3.09	-0.000005	4.91	0.742	13	0.00004	0.0231	-0.0005	0.00269	0.0003	0.0033	-0.0001
30-Sep-09	3																								
7-Oct-09	4	0.0102	0.013	0.000104	0.0036	9.95	0.0587	-0.01	0.0242	0.00065	0.007	14.6	0.0027	3.82	-0.000005	11.5	0.893	17	0.000006	0.0226	0.0005	0.00196	-0.0002	0.0027	-0.0001
14-Oct-09	5																								
21-Oct-09	6	0.00365	0.017	0.000098	0.0033	11.9	0.0644	-0.01	0.0287	0.00043	0.013	16.7	0.0022	3.55	-0.000005	16.1	0.985	22	0.000033	0.0167	0.0009	0.000751	0.0003	0.002	-0.0001
28-Oct-09	7																								
4-Nov-09	8	0.00416	0.006	0.00003	0.0026	11.9	0.0638	-0.01	0.0179	0.0002	0.006	17.4	0.00123	3.43	-0.000005	14.8	0.934	19	0.000019	0.0203	-0.0005	0.000257	-0.0002	0.0009	-0.0001
11-Nov-09	9																								
18-Nov-09	10	0.00189	0.012	0.000054	0.0022	9.69	0.0495	-0.01	0.00627	0.00023	0.008	16.9	0.00019	3.1	0.000008	10.8	0.741	13	0.000049	0.023	-0.0005	0.000197	-0.0002	0.0011	-0.0001
25-Nov-09	11																								
2-Dec-09	12	0.00212	0.034	0.00041	0.002	7.75	0.0482	-0.01	0.00415	0.00052	0.007	15.2	0.00008	3.53	0.000007	8.34	0.634	11	0.000028	0.0312	0.0011	0.000185	-0.0002	0.0046	-0.0001
9-Dec-09	13																								
16-Dec-09	14	0.0023	0.011	0.000045	0.0013	6.1	0.0255	-0.01	0.00288	0.00039	0.007	14.2	0.00006	2.87	-0.000005	6.83	0.52	4	0.000026	0.0249	-0.0005	0.000077	-0.0002	0.0013	-0.0001
23-Dec-09	15																								
30-Dec-09	16	0.00264	0.015	0.000016	0.0013	5.02	0.0209	-0.01	0.00617	0.00034	0.006	14.4	-0.00004	3.31	-0.000005	5.97	0.551	-3	0.000002	0.0252	-0.0005	0.000067	-0.0002	0.0014	-0.0001
6-Jan-10	17																								
13-Jan-10	18	0.002	-0.02	0.002	-0.01	4.9	0.016	-0.2	0.006	0.0053	-0.04	14.4	-0.0008	3.54	-0.0001	5.8	0.556	-10	0.00007	0.0204	0.00007	0.00007	0.007	0.004	-0.002
20-Jan-10	19																								
27-Jan-10	20	0.0034	0.02	0.00031	-0.003	4.19	0.0141	-0.05	0.009	0.0018	0.013	13.1	-0.0002	2.8	-0.00003	5.48	0.499	-3	0.00003	0.0197	0.004	0.00005	-0.001	0.0018	-0.0005
3-Feb-10	21																								
10-Feb-10	22	0.0052	0.034	0.00015	-0.003	4.18	0.0143	-0.05	0.0121	0.0006	0.013	15.8	-0.0002	3.19	-0.00003	6.16	0.545	-3	-0.00001	0.0218	-0.003	0.00003	-0.001	0.0037	-0.0005
17-Feb-10	23																								
24-Feb-10	24	0.003	-0.02	0.0001	-0.01	3.2	0.013	-0.2	0.012	0.0055	-0.04	11.7	-0.0008	2.65	-0.0001	4.9	0.541	-10	-0.00004	0.0226	-0.01	-0.00004	-0.004	0.003	-0.002
3-Mar-10	25																								
10-Mar-10	26	0.00346	0.096	0.00029	0.0016	3.68	0.0136	-0.01	0.0115	0.00018	0.02	12.5	0.00004	3.14	0.000007	5.91	0.574	-10	0.000016	0.0198	-0.0005	0.000044	-0.0002	0.0155	-0.0001
17-Mar-10	27																								
24-Mar-10	28	0.0021	0.015	0.00064	-0.003	3.5	0.0106	-0.05	0.0094	0.0002	-0.01	11.7	-0.0002	3.29	-0.00003	5.7	0.553	-10	0.00007	0.0159	-0.003	0.00005	-0.001	0.0041	-0.0005
31-Mar-10	29																								
7-Apr-10	30	0.004	0.02	0.00024	-0.003	3.78	0.009	-0.05	0.0092	0.0004	0.018	12.2	-0.0002	3.1	-0.00003	6.02	0.601	-10	0.00007	0.0154	-0.003	0.00005	-0.001	0.0081	-0.0005
14-Apr-10	31																								
21-Apr-10	32	0.0025	0.023	0.000389	0.0019	3.54	0.00649	-0.01	0.00958	0.00035	0.019	11.5	0.00005	3.44	0.000031	5.79	0.601	-10	0.000029	0.0165	0.0006	0.000045	-0.0002	0.004	-0.0001
28-Apr-10	33																								
5-May-10	34	0.00212	0.008	0.000021	0.0019	3.6	0.0064	-0.01	0.01	0.00017	0.029	11.5	-0.00004	3.54	-0.000005	5.78	0.626	-10	0.000015	0.0148	-0.0005	0.00004	-0.0002	0.0027	-0.0001
12-May-10	35																								
19-May-10	36	0.00279	0.013	0.000236	0.0022	3.8	0.00395	0.02	0.0109	0.00014	0.025	11.7	-0.00004	4.08	-0.000005	5.86	0.697	-10	0.000072	0.0149	-0.0005	0.000047	-0.0002	0.003	-0.0001
26-May-10	37																								
2-Jun-10	38	#N/A	0.006	0.000105	0.0019	3.63	0.00652	-0.01	0.0102	0.00012	0.023	10.5	-0.00004	3.54	-0.000005	5.44	0.631	-10	0.000008	0.0128	-0.0005	0.000042	-0.0002	0.0029	-0.0001
9-Jun-10	39																								
16-Jun-10	40	0.0023	0.01	0.000054	0.0022	3.6	0.0035	-0.01	0.0114	0.00016	0.03	10.6	-0.00004	3.73	0.000008	5.52	0.655	-10	0.000015	0.0134	-0.0005	0.000043	-0.0002	0.0019	-0.0001
23-Jun-10	41																								
30-Jun-10	42	0.00279	0.013	0.00084	0.0023	3.74	0.018	-0.01	0.0113	0.00023	0.271	10.6	-0.00004	3.67	-0.000005	5.68	0.668	-10	0.000012	0.0123	0.0005	0.000088	-0.0002	0.0036	-0.0001
7-Jul-10	43																								
14-Jul-10	44	0.00272	0.006	0.000029	0.0022	3.24	0.00896	-0.01	0.0113	0.00011	0.041	9.17	-0.00004	3.26	-0.000005	4.46	0.683	-10	0.000004	0.0124	-0.0005	0.000078	-0.0002	0.0032	-0.0001
21-Jul-10	45																								
28-Jul-10	46	0.00249	0.012	0.000047	0.0022	3.45	0.00989	-0.01	0.0113	0.00031	0.021	8.63	-0.00004	3.43	-0.000005	4.61	0.67	-10	0.000009	0.0106	-0.0005	0.000046	-0.0002	0.003	-0.0001
4-Aug-10	47																								
11-Aug-10	48	0.00273	0.015	0.000041	0.0023	3.45	0.00778	-0.01	0.0112	0.00041	0.029	8.69	-0.00004	3.51	-0.000005	4.56	0.681	-10	0.000008	0.00905	0.0013	0.000039	-0.0002	0.0028	-0.0001
18-Aug-10	49																								
25-Aug-10	50	0.00112	0.011	0.00004	0.0024	3.67	0.00533	-0.01	0.0128	0.00014	0.016	8.88	-0.00004	3.87	-0.000005	4.57	0.673	-10	0.000005	0.00188	-0.0005	0.000009	-0.0002	0.0019	-0.0001
1-Sep-10	51																								
8-Sep-10	52	0.00262	0.014	0.000211	0.0023	3.55	0.00865	-0.01	0.0116	0.00126	0.012	8.42	-0.00004	3.7	-0.000005	4.19	0.691	-10	0.000003	0.00766	-0.0005	0.000048	-0.0002	0.0038	-0.0001
15-Sep-10	53																								
22-Sep-10	54	0.00297	0.011	0.00032	0.0025	3.56	0.0102	-0.01	0.0121	0.00041	0.031	8.31	-0.00004	3.78	-0.000005	3.91	0.706	-10	0.000005	0.00754	-0.0005	0.000067	-0.0002	0.0054	-0.0001
29-Sep-10	55																								
6-Oct-10	56	0.00268	0.007	0.000589	0.0026	3.61	0.0121	-0.01	0.0122	0.00039	0.021	8.46	-0.00004	3.91	-0.000005	3.75	0.734	-10	0.00001	0.00766	-0.0005	0.000073	-0.0002	0.0032	-0.0001
13-Oct-10	57																								
20-Oct-10	58	0.00335	0.012	0.000323	0.0027	3.49	0.0246	-0.01	0.0122	0.00038	0.012	7.53	-0.00004	3.37	-0.000005	3.5	0.707	-10	0.000078	0.00828	-0.0005	0.000129	-0.0002	0.0048	-0.0001
27-Oct-10	59																								
3-Nov-10	60	0.00252	0.01	0.000253	0.0029	3.78	0.0122	-0.01	0.0122	0.00012	0.011	8.12	-0.00004	3.85	-0.000005	3.75	0.786	-10	-0.000002	0.0072	-0.0005	#N/A	-0.0002	0.0024	-0.0001
10-Nov-10	61																								
17-Nov-10	62	0.0041	0.009	0.000052	0.0025	3.77	0.0115	-0.01	0.0103	0.00034	0.014	7.57	-0.00004	4.29	-0.000005	3.56	0.748	-10	0.000008	0.00475	-0.0005	#N/A	-0.0002	0.0068	-0.0001
24-Nov-10	63																								
1-Dec-10	64	0.00474	0.007	0.000146	0.0025	3.57	0.0108	-0.01	0.0111	0.00034	0.019	7.16	-0.00004	3.88	-0.000005	3.09	0.732	-10	0.000047	0.00565	-0.0005	0.000071	-0.0002	0.0041	-0.0001
8-Dec-10	65																								
15-Dec-10	66	0.00324	0.01	0.000063	0.0025	3.36	0.01	-0.01	0.011	0.00044	0.01	6.45	-0.00004	3.9	-0.000005	2.7	0.728	-10	0.000045	0.0052	0.0006	0.000067	-0.0002	0.0039	-0.0001
22-Dec-10	67																								
29-Dec-10	68	0.00394	0.008	0.000058	0.0024	3.47	0.0079	-0.01	0.00823	0.00036	0.019	6.67	-0.00004	3.81	-0.000005	2.68	0.722	-10	0.00004	0.00463	-0.0005	0.000138	-0.0002	0.0033	-0.0001
5-Jan-11	69																								
12-Jan-11	70	0.00296	0.018	0.000168	0.0023	3.39	0.00199	-0.01	0.011	0.00036	0.012	5.99	-0.00004	3.92	0.000013	2.49	0.715	-10	0.000036	0.0044	-0.0005	#N/A	-0.0002	0.0035	#N/A
19-Jan-11	71																								

Col 1 Bottom

CONFIDENTIAL *DRAFT*

Sample = 2351-33&34 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L
26-Jan-11	72	160	160	7.16	413	165	#N/A	5.3	88.9	-2	0.80	-0.5	0.79	57.7	0.0136	0.0001	0.00033	2.63	-0.00001	-0.000005	-0.05	0.000028	17.3	-0.0001	0.000009
2-Feb-11	73	50	50	7.13	420	153					0.60														
9-Feb-11	74	50	50	7.68	382	155																			
16-Feb-11	75	50	50	7.46	396	156																			
23-Feb-11	76	50	50	7.73	362	164																			
2-Mar-11	77	50	50	7.43	409	160																			
9-Mar-11	78	50	50	7.08	388	172																			
16-Mar-11	79	50	50	7.63	366	156																			
23-Mar-11	80	50	50	6.83	386	157																			
30-Mar-11	81	50	50	7.02	336	160																			
6-Apr-11	82	50	50	#N/A	355	160																			
13-Apr-11	83	50	50	7.89	391	163																			
20-Apr-11	84	160	160	8.06	357	168	#N/A	7.1	95.6	3	0.90	-0.5	0.95	61	0.012	0.0001	0.0001	2.74	-0.00005	-0.00003	-0.3	0.00003	18.3	-0.0005	0.00004
27-Apr-11	85	50	50	7.92	373	169																			
4-May-11	86	50	50	7.67	372	169																			
11-May-11	87	50	50	7.87	372	172																			
18-May-11	88	50	50	7.83	371	189																			
25-May-11	89	50	50	7.86	378	165																			
1-Jun-11	90	50	50	7.84	371	173																			
8-Jun-11	91	50	50	7.35	303	170																			
15-Jun-11	92	50	50	7.37	290	160																			
22-Jun-11	93	50	50	8.04	345	165																			
29-Jun-11	94	50	50	7.60	342	173																			
6-Jul-11	95	50	50	7.20	364	177																			
13-Jul-11	96	160	160	7.15	347	183	#N/A	7.9	89.2	2	0.95	-0.5	0.77	66.8	0.005	-0.0001	0.0004	2.88	-0.00005	-0.00003	-0.3	-0.00003	20.3	-0.0005	0.00005
20-Jul-11	97	50	50	7.20	346	182																			
27-Jul-11	98	50	50	7.00	345	186																			
3-Aug-11	99	50	50	7.29	358	160																			
10-Aug-11	100	50	50	7.45	355	165																			
17-Aug-11	101	50	50	7.53	351	171																			
24-Aug-11	102	160	160	7.60	328	177																			
31-Aug-11	103	50	50	7.60	348	193																			
7-Sep-11	104	160	160	7.83	380	181																			
14-Sep-11	105	50	50	7.77	413	187																			
21-Sep-11	106	160	160	7.81	435	191																			
28-Sep-11	107	50	50	7.31	456	188																			
5-Oct-11	108	160	160	7.91	385	171	#N/A	4.5	89.3	2	1.08	#N/A	0.68	67.2	0.01	0.0002	0.0003	2.99	-0.00005	-0.00003	-0.3	-0.00003	20.9	-0.0005	-0.00003
12-Oct-11	109	50	50	7.92	406	170																			
19-Oct-11	110	50	50	7.55	394	171																			
26-Oct-11	111	50	50	7.70	410	170																			
2-Nov-11	112	50	50	7.69	387	175																			
9-Nov-11	113	50	50	7.77	391	179																			
16-Nov-11	114	50	50	7.55	407	162																			
23-Nov-11	115	50	50	7.02	202	166																			
30-Nov-11	116	50	50	6.85	417	166																			
7-Dec-11	117	50	50	7.46	446	168																			
14-Dec-11	118	50	50	7.23	464	165																			
21-Dec-11	119	50	50	7.52	469	199																			
28-Dec-11	120	160	160	7.92	558	174	#N/A	4.7	102.2	2	0.96	-0.5	0.62	67.5	0.008	-0.0001	0.0004	2.87	-0.00005	-0.00003	-0.3	-0.00003	20.7	0.001	0.00005
4-Jan-12	121	50	50	7.45	585	175																			
11-Jan-12	122	50	50	7.45	630	168																			
18-Jan-12	123	50	50	7.41	657	165																			
25-Jan-12	124	50	50	7.53	639	189																			
1-Feb-12	125	50	50	7.35	586	176																			
8-Feb-12	126	50	50	7.37	535	165																			
15-Feb-12	127	50	50	7.25	543	168																			
22-Feb-12	128	50	50	7.34	636	174																			
29-Feb-12	129	50	50	7.80	553	163																			
7-Mar-12	130	50	50	7.33	622	172																			
14-Mar-12	131	50	50	7.71	434	191																			
21-Mar-12	132	160	160	7.35	489	163	#N/A	5.0	91.2	5	1.10	0.9	0.52	61.8	0.009	0.0001	0.0003	2.64	-0.00005	-0.00003	-0.3	-0.00003	18.6	-0.0005	0.00017
28-Mar-12	133	50	50	7.73	643	169																			
4-Apr-12	134	50	50	7.41	543	167																			
11-Apr-12	135	50	50	7.26	603	162																			
18-Apr-12	136	50	50	7.59	580	166																			
25-Apr-12	137	50	50	7.73	641	165																			
2-May-12	138	50	50	7.67	640	157																			
9-May-12	139	50	50	7.31	641	130																			
16-May-12	140	50	50	7.47	615	160																			
23-May-12	141	50	50	7.41	598	125																			
30-May-12	142	50	50	7.53	599	125																			
6-Jun-12	143	50	50	7.64	542	174																			

Col 1 Bottom

Sample = 2351-33&34 Composite

Date	Cycle No.	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
26-Jan-11	72	0.00216	0.012	0.000054	0.0022	3.54	0.00911	-0.01	0.0108	0.00014	0.014	6.04	0.00009	3.66	0.000007	2.44	0.701	-10	0.000045	0.004	-0.0005	0.000079	0.0003	0.0052	0.0001
2-Feb-11	73																								
9-Feb-11	74																								
16-Feb-11	75																								
23-Feb-11	76																								
2-Mar-11	77																								
9-Mar-11	78																								
16-Mar-11	79																								
23-Mar-11	80																								
30-Mar-11	81																								
6-Apr-11	82																								
13-Apr-11	83																								
20-Apr-11	84	0.0029	0.014	#N/A	-0.003	3.7	0.0245	-0.05	0.0115	0.0003	-0.01	5.8	-0.0002	3.49	#N/A	2.6	0.767	-50	-0.00001	0.00461	-0.003	0.00017	-0.001	0.0054	-0.0005
27-Apr-11	85																								
4-May-11	86																								
11-May-11	87																								
18-May-11	88																								
25-May-11	89																								
1-Jun-11	90																								
8-Jun-11	91																								
15-Jun-11	92																								
22-Jun-11	93																								
29-Jun-11	94																								
6-Jul-11	95																								
13-Jul-11	96	0.003	0.011	0.00017	-0.003	3.9	0.0129	-0.05	0.0143	0.0003	0.02	5.3	-0.0002	4.15	-0.00003	2.5	0.757	-50	0.00003	0.00226	-0.003	0.00018	-0.001	0.0048	-0.0005
20-Jul-11	97																								
27-Jul-11	98																								
3-Aug-11	99																								
10-Aug-11	100																								
17-Aug-11	101																								
24-Aug-11	102																								
31-Aug-11	103																								
7-Sep-11	104																								
14-Sep-11	105																								
21-Sep-11	106																								
28-Sep-11	107																								
5-Oct-11	108	0.002	0.015	#N/A	-0.003	3.7	0.0172	-0.05	0.0087	0.0003	-0.01	5.2	-0.0002	4.1	-0.00003	2.1	0.755	-50	-0.00001	0.00183	-0.003	0.00033	-0.001	0.0043	-0.0005
12-Oct-11	109																								
19-Oct-11	110																								
26-Oct-11	111																								
2-Nov-11	112																								
9-Nov-11	113																								
16-Nov-11	114																								
23-Nov-11	115																								
30-Nov-11	116																								
7-Dec-11	117																								
14-Dec-11	118																								
21-Dec-11	119																								
28-Dec-11	120	0.003	0.022	0.00035	-0.003	3.8	0.0317	-0.05	0.01	0.0003	0.029	5.2	-0.0002	3.78	0.00003	2.1	0.787	-50	-0.00001	0.00308	-0.003	0.00035	-0.001	0.007	-0.0005
4-Jan-12	121																								
11-Jan-12	122																								
18-Jan-12	123																								
25-Jan-12	124																								
1-Feb-12	125																								
8-Feb-12	126																								
15-Feb-12	127																								
22-Feb-12	128																								
29-Feb-12	129																								
7-Mar-12	130																								
14-Mar-12	131																								
21-Mar-12	132	0.0021	0.015	#N/A	-0.003	3.7	0.0185	-0.05	0.0078	0.0005	-0.01	4.9	-0.0002	3.39	-0.00003	1.8	0.701	-50	0.00001	0.001	-0.003	0.00048	-0.001	0.0078	-0.0005
28-Mar-12	133																								
4-Apr-12	134																								
11-Apr-12	135																								
18-Apr-12	136																								
25-Apr-12	137																								
2-May-12	138																								
9-May-12	139																								
16-May-12	140																								
23-May-12	141																								
30-May-12	142																								
6-Jun-12	143																								

Col 1 Bottom

CONFIDENTIAL *DRAFT*

Sample = 2351-33&34 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L
13-Jun-12	144	160	160	7.51	560	157	#N/A	7.2	91.8	4	1.18	0.65	0.49	64.7	0.0124	-0.0001	0.00043	2.64	-0.00005	-0.000025	-0.25	-0.000025	20.1	-0.0005	0.000063
20-Jun-12	145	50	50	7.21	571	140																			
27-Jun-12	146	50	50	7.13	530	126																			
4-Jul-12	147	50	50	7.72	560	123																			
11-Jul-12	148	50	50	7.78	555	115																			
18-Jul-12	149	50	50	7.70	588	162																			
25-Jul-12	150	50	50	7.28	518	156																			
1-Aug-12	151	50	50	7.28	568	156																			
8-Aug-12	152	50	50	7.62	553	166																			
15-Aug-12	153	50	50	7.13	550	155																			
22-Aug-12	154	50	50	7.09	656	156																			
29-Aug-12	155	50	50	7.38	661	133																			
5-Sep-12	156	160	160	7.27	596	131	#N/A	5.5	90.9	5	1.37	0.59	0.39	65.3	0.0097	-0.0001	0.00051	2.46	-0.00005	-0.000025	-0.25	-0.000025	20	-0.0005	0.000146
12-Sep-12	157	50	50	7.83	697	132																			
19-Sep-12	158	50	50	7.20	587	166																			
26-Sep-12	159	50	50	7.13	598	169																			
3-Oct-12	160	50	50	7.88	638	164																			
10-Oct-12	161	50	50	7.60	648	160																			
17-Oct-12	162	50	50	7.87	512	151																			
24-Oct-12	163	50	50	7.42	448	165																			
31-Oct-12	164	50	50	7.42	458	170																			
7-Nov-12	165	50	50	6.91	561	172																			
14-Nov-12	166	50	50	7.20	603	175																			
21-Nov-12	167	50	50	7.22	574	167																			
28-Nov-12	168	160	160	7.24	510	170	#N/A	11.6	97.8	9	2.38	-0.5	0.29	73.1	0.0102	-0.0001	0.00039	2.58	-0.00005	-0.000025	-0.25	#N/A	22.6	0.00055	0.000089
5-Dec-12	169	50	50	7.25	552	167																			
12-Dec-12	170	50	50	7.52	467	174																			
19-Dec-12	171	50	50	7.22	618	170																			
26-Dec-12	172	50	50	7.52	637	171																			
2-Jan-13	173	50	50	7.50	638	166																			
9-Jan-13	174	50	50	7.02	618	168																			
16-Jan-13	175	50	50	7.71	576	171																			
23-Jan-13	176	50	50	7.08	576	170																			
30-Jan-13	177	50	50	7.33	585	167																			
6-Feb-13	178	50	50	7.11	527	167																			
13-Feb-13	179	50	50	7.26	561	172																			
20-Feb-13	180	160	160	7.67	549	167	#N/A	6.9	98.2	8	1.62	0.96	0.29	71.4	0.0077	0.00026	0.00035	2.35	-0.00005	-0.000025	-0.25	-0.000025	21.9	-0.0005	0.000187
27-Feb-13	181	50	50	7.01	594	108																			
6-Mar-13	182	50	50	7.96	630	164																			
13-Mar-13	183	50	50	7.39	594	171																			
20-Mar-13	184	50	50	8.01	582	175																			
27-Mar-13	185	50	50	6.97	566	166																			
3-Apr-13	186	50	50	6.98	420	170																			
10-Apr-13	187	50	50	7.18	602	166																			
17-Apr-13	188	50	50	7.42	593	170																			
24-Apr-13	189	50	50	7.67	488	165																			
1-May-13	190	50	50	7.31	445	165																			
8-May-13	191	50	50	6.67	552	166																			
15-May-13	192	160	160	6.40	518	169	#N/A	10.5	84.1	6	1.08	-0.5	0.27	69.9	0.0104	0.00012	0.00034	2.29	-0.00005	-0.000025	-0.25	-0.000025	21.5	-0.0005	0.000193
22-May-13	193	50	50	7.03	575	172																			
29-May-13	194	50	50	7.22	588	169																			

Col 1 Bottom

Sample = 2351-33&34 Composite

Date	Cycle No.	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
13-Jun-12	144	0.00169	0.0126	0.000648	-0.0025	3.55	0.0176	-0.05	0.00718	0.00033	0.013	4.11	-0.0002	3.84	0.000063	1.61	0.727	-50	0.000014	0.0021	-0.0025	0.000514	-0.001	0.00299	-0.0005
20-Jun-12	145																								
27-Jun-12	146																								
4-Jul-12	147																								
11-Jul-12	148																								
18-Jul-12	149																								
25-Jul-12	150																								
1-Aug-12	151																								
8-Aug-12	152																								
15-Aug-12	153																								
22-Aug-12	154																								
29-Aug-12	155																								
5-Sep-12	156	0.00189	0.0098	#N/A	-0.0025	3.72	0.0107	-0.05	0.00589	0.00074	0.011	4.18	-0.0002	3.13	#N/A	1.71	0.682	-50	-0.00001	-0.001	-0.0025	0.000504	0.003	0.00687	-0.0005
12-Sep-12	157																								
19-Sep-12	158																								
26-Sep-12	159																								
3-Oct-12	160																								
10-Oct-12	161																								
17-Oct-12	162																								
24-Oct-12	163																								
31-Oct-12	164																								
7-Nov-12	165																								
14-Nov-12	166																								
21-Nov-12	167																								
28-Nov-12	168	0.00148	0.0121	0.000538	-0.0025	4.06	0.022	-0.01	0.0064	0.00037	-0.01	3.98	-0.0002	3.67	-0.000025	1.77	0.742	-15	0.000043	0.0011	-0.0025	0.000626	-0.001	0.0137	-0.0005
5-Dec-12	169																								
12-Dec-12	170																								
19-Dec-12	171																								
26-Dec-12	172																								
2-Jan-13	173																								
9-Jan-13	174																								
16-Jan-13	175																								
23-Jan-13	176																								
30-Jan-13	177																								
6-Feb-13	178																								
13-Feb-13	179																								
20-Feb-13	180	0.00123	0.0066	0.000319	-0.0025	4.05	0.0218	-0.05	0.00546	0.00035	0.066	4.63	-0.0002	3.96	0.000107	1.79	0.706	-15	0.000043	-0.001	-0.0025	0.000573	0.0011	0.00395	-0.0005
27-Feb-13	181																								
6-Mar-13	182																								
13-Mar-13	183																								
20-Mar-13	184																								
27-Mar-13	185																								
3-Apr-13	186																								
10-Apr-13	187																								
17-Apr-13	188																								
24-Apr-13	189																								
1-May-13	190																								
8-May-13	191																								
15-May-13	192	0.00142	0.0771	0.000217	-0.0025	3.97	0.022	-0.05	0.00745	0.00063	0.012	3.74	-0.0002	3.51	-0.000025	1.48	0.688	-15	0.000018	-0.001	-0.0025	0.000556	-0.001	0.00286	-0.0005
22-May-13	193																								
29-May-13	194																								

Oct 21/09 Acidity 16.1 and alkalinity 279.9. Suspect instrument error. Not repeated.
Mar 10/10 Fe 0.101 and Zn 0.0188. Repeat Fe 0.096 and Zn 0.0155, confirmed.
Feb 4/11 Change in analytical schedule.
April 6 pH 6.36. Suspect probe malfunction.
April 20/11 Ag 0.00006. Cannot repeat. Suspect analytical error or contamination
Jan 12/11 U 0.000762 and Zr 0.0018. Cannot repeat.
April 20/11 Pb 0.00046. Repeat =0.00037, data confirmed, suspect contamination
Oct 5/11 Pb=0.00087, repeat=0.00087.Data confirmed, suspect contamination
Oct 5/11 Cl=1.9, cannot repeat, suspect contamination or analytical error.
Dec 29/11 Cu=0.0082, Pb=0.00076, Ni=0.001, repeat Cu= 0.003, Pb= 0.00035, Ni= 0.0003 data accepted
Mar 21/12 Pb=0.00309, repeat=0.00317. Data confirmed, suspect contamination
Sept 5/12 Sb=0.00446, Ag=0.000227. repeat Sb=-0.0001. Data accepted. Ag=0.000229, data confirmed suspect contamination
Nov 28/12 Sb=0.00284, Cd=0.000065. repeat Sb=-0.0001. Data accepted. Cd=0.000065, data confirmed suspect contamination
Sept 5/12 Pb=0.00146, Cannot repeat suspect contamination or analytical error

Col 2 Surface

CONFIDENTIAL *DRAFT*

Sample = 2351-35&36 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L
9-Sep-09	0	160	160	6.98	232	47	#N/A	2.7	23.9	8	7.00	0.5	0.19	18.3	0.0159	0.00012	0.00017	0.0483	-0.00001	-0.000005	-0.05	0.00002	5.85	-0.0001	0.000124	0.0073
16-Sep-09	1	50	50	6.98	381	30					7.60															
23-Sep-09	2	160	160	7.03	285	36	#N/A	4.5	22.3	6	9.00	0.7	0.14	15.4	0.0082	0.00018	0.00024	0.046	-0.00001	-0.000005	-0.05	0.000039	4.93	-0.0001	0.000142	0.00305
30-Sep-09	3	50	50	6.72	394	33					8.20															
7-Oct-09	4	160	160	6.98	445	39	#N/A	4.6	23.3	7	8.40	-0.5	0.14	17.2	0.0066	0.00008	0.00034	0.0426	-0.00001	-0.000005	-0.05	0.000021	5.35	-0.0001	0.000123	0.00439
14-Oct-09	5	50	50	7.35	304	27					8.60															
21-Oct-09	6	160	160	7.13	316	36	#N/A	3.5	21.1	2	8.50	0.6	0.16	17.6	0.019	0.00017	0.00033	0.0395	-0.00001	-0.000005	-0.05	0.00002	5.38	0.0003	0.000084	0.0032
28-Oct-09	7	50	50	6.70	371	32					8.20															
4-Nov-09	8	160	160	6.20	327	32	#N/A	4.2	21.3	2	9.80	-0.5	0.1	16.8	0.0077	0.00019	0.00018	0.0348	-0.00001	-0.000005	-0.05	0.000022	5.04	0.0003	0.000059	0.00224
11-Nov-09	9	50	50	6.91	299	34					7.30															
18-Nov-09	10	160	160	6.85	335	44	#N/A	6.6	26.1	-2	8.10	-0.5	0.07	17.1	0.0079	0.00009	0.00009	0.0333	-0.00001	-0.000005	-0.05	0.000015	5.15	-0.0001	0.000078	0.00154
25-Nov-09	11	50	50	6.91	339	38					7.30															
2-Dec-09	12	160	160	6.63	376	42	#N/A	4.2	21.0	3	8.10	-0.5	0.06	16.2	0.0225	0.00009	0.00026	0.0291	-0.00001	-0.000005	-0.05	0.000012	4.85	-0.0001	0.000061	0.00859
9-Dec-09	13	50	50	6.62	358	43					8.20															
16-Dec-09	14	160	160	7.10	364	47	#N/A	3.4	23.9	-2	7.50	-0.5	0.05	19.2	0.0114	0.00008	0.00013	0.0338	-0.00001	-0.000005	-0.05	0.000008	5.85	0.0002	0.000041	0.00233
23-Dec-09	15	50	50	6.99	157	42					7.60															
30-Dec-09	16	160	160	7.00	220	48	#N/A	3.1	23.9	3	7.00	0.6	0.06	19.5	0.0103	0.00005	0.0003	0.0374	-0.00001	-0.000005	-0.05	0.000009	5.82	-0.0001	0.000042	0.00256
6-Jan-10	17	50	50	6.73	204	44					7.80															
13-Jan-10	18	160	160	6.43	256	45	#N/A	4.5	23.3	-2	6.70	-0.5	0.14	19.1	0.011	-0.0004	0.0011	0.0361	-0.0002	-0.0001	-1	-0.0001	5.7	-0.002	-0.0001	0.002
20-Jan-10	19	50	50	5.80	321	40					7.50															
27-Jan-10	20	160	160	5.64	287	44	#N/A	2.9	22.8	-2	7.50	-0.5	0.03	17.6	0.008	-0.0002	0.0004	0.0302	-0.0001	-0.00005	-0.5	-0.00005	5.15	-0.001	-0.00005	0.003
3-Feb-10	21	50	50	6.06	290	39					7.80															
10-Feb-10	22	160	160	7.02	258	43	#N/A	2.8	22.5	-2	7.50	-0.5	0.05	20	0.009	0.0001	0.0006	0.0401	-0.00005	-0.00003	-0.3	-0.00003	5.88	-0.0005	0.00003	0.0019
17-Feb-10	23	50	50	7.02	321	40					7.80															
24-Feb-10	24	160	160	6.96	339	41	#N/A	2.5	22.0	3	6.56	-0.5	0.03	14.7	0.008	-0.0004	-0.0004	0.0341	-0.0002	-0.0001	-1	-0.0001	4.3	-0.002	-0.0001	0.003
3-Mar-10	25	50	50	7.13	319	38					5.80															
10-Mar-10	26	160	160	6.92	402	40	#N/A	2.4	20.9	5	5.80	-0.5	0.04	17.7	0.009	-0.0002	-0.0002	0.0352	-0.0001	-0.00005	-0.5	-0.00005	5.2	-0.001	0.00006	0.0017
17-Mar-10	27	50	50	6.78	334	35					6.10															
24-Mar-10	28	160	160	6.79	298	38	#N/A	2.4	17.6	5	6.60	-0.5	0.04	14.5	0.008	0.0001	0.0002	0.0337	-0.00005	-0.00003	-0.3	-0.00003	4.2	-0.0005	0.00005	0.0015
31-Mar-10	29	50	50	6.83	291	33					9.20															
7-Apr-10	30	160	160	6.38	411	36	#N/A	2.6	16.3	3	9.18	-0.5	0.03	15.1	0.007	-0.0001	0.0001	0.036	-0.00005	-0.00003	-0.3	-0.00003	4.43	-0.0005	0.00011	0.0014
14-Apr-10	31	50	50	6.55	331	32					6.90															
21-Apr-10	32	160	160	6.46	450	35	#N/A	2.6	17.0	-2	9.80	-0.5	0.1	14.2	0.0081	0.00009	0.00014	0.0267	-0.00001	-0.000005	-0.05	0.000017	4.15	0.0001	0.00008	0.00148
28-Apr-10	33	50	50	6.47	365	30					9.60															
5-May-10	34	160	160	6.05	451	33	#N/A	2.6	17.0	-2	9.60	-0.5	0.05	14.7	0.0062	0.00008	0.0001	0.0267	-0.00001	-0.000005	-0.05	0.000013	4.26	0.0001	0.000086	0.00112
12-May-10	35	50	50	6.36	393	30					9.80															
19-May-10	36	160	160	6.37	326	38	#N/A	2.2	17.3	2	9.80	-0.5	0.03	16.7	0.0071	0.00006	0.00071	0.0377	-0.00001	0.000007	-0.05	0.000011	4.83	0.0002	0.000081	0.00138
26-May-10	37	50	50	6.21	468	36					9.80															
2-Jun-10	38	160	160	6.29	474	39	#N/A	2.2	17.3	7	8.03	-0.5	0.05	14.8	0.0083	0.00006	0.00045	0.0274	-0.00001	-0.000005	-0.05	0.000015	4.22	-0.0001	0.000087	0.00164
9-Jun-10	39	50	50	6.23	353	27					8.49															
16-Jun-10	40	160	160	6.27	450	31	#N/A	2.4	15.8	-2	8.60	-0.5	0.01	12.7	0.0066	0.00004	0.00008	0.0244	-0.00001	-0.000005	-0.05	0.000014	3.61	0.0002	0.000078	0.00142
23-Jun-10	41	50	50	6.14	421	31					8.75															
30-Jun-10	42	160	160	5.56	364	33	#N/A	2.5	17.4	2	8.62	-0.5	0.03	14.7	0.0077	0.00011	0.00019	0.0259	-0.00001	0.000034	-0.05	0.000017	4.23	-0.0001	0.00008	0.00245
7-Jul-10	43	50	50	5.95	365	29					8.63															
14-Jul-10	44	160	160	5.74	365	34	#N/A	3.0	16.9	-2	8.73	-0.5	0.05	13.6	0.0094	0.00003	0.00027	0.0255	-0.00001	-0.000005	-0.05	0.000036	3.87	-0.0001	0.000279	0.00203
21-Jul-10	45	50	50	5.66	405	30					8.73															
28-Jul-10	46	160	160	5.64	452	34	#N/A	3.5	17.8	-2	8.73	-0.5	0.05	13.7	0.0065	0.00003	0.00051	0.0246	-0.00001	-0.000005	-0.05	0.000015	3.82	-0.0001	0.000093	0.00136
4-Aug-10	47	50	50	5.82	388	31					8.46															
11-Aug-10	48	160	160	5.80	321	34	#N/A	4.7	20.7	-2	8.65	-0.5	0.05	14.1	0.0081	0.00002	0.00033	0.0289	-0.00001	-0.000005	-0.05	0.000009	3.92	0.0003	0.000065	0.00151
18-Aug-10	49	50	50	5.74	402	31					8.47															
25-Aug-10	50	160	160	5.55	473	33	#N/A	3.3	17.5	4	8.68	-0.5	0.02	13.2	0.0005	-0.00002	0.00033	0.0212	-0.00001	-0.000005	-0.05	-0.000005	3.68	-0.0001	0.000027	0.00069
1-Sep-10	51	50	50	6.48	450	29					8.63															
8-Sep-10	52	160	160	6.34	475	33	#N/A	3.8	16.8	3	8.57	-0.5	0.12	13.2	0.0069	-0.00002	0.00004	0.0258	-0.00001	-0.000005	-0.05	0.000017	3.62	0.0001	0.000085	0.00097
15-Sep-10	53	50	50	6.06	450	28					8.56															
22-Sep-10	54	160	160	6.78	458	34	#N/A	2.6	17.0	4	8.02	-0.5	-0.05	14.5	0.0123	0.00002	0.00004	0.0272	-0.00001	-0.000005	-0.05	0.000012	4.11	0.0003	0.00008	0.00176
29-Sep-10	55	50	50	6.64	417	28					8.18															
6-Oct-10	56	160	160	6.30	386	32	#N/A	2.9	17.2	3	8.28	-0.5	0.08	14.4	0.0087	-0.00002	0.00008	0.0259	-0.00001	-0.000005	-0.05	0.000013	4.01	0.0003	0.000073	0.00174
13-Oct-10	57	50	50	6.38	360	31					8.18															
20-Oct-10	58	160	160	6.62	396	35	#N/A	3.0	20.3	4	8.25	-0.5	0.07	14.3	0.0061	-0.00002	0.00002	0.027	-0.00001	-0.000005	-0.05	0.000008	4.04	0.0001	0.000146	0.00148
27-Oct-10	59	50	50	6.71	344	29					8.46															
3-Nov-10	60	160	160	6.81	391	31	#N/A	2.3	21.4	2	8.41	-0.5	0.04	14.2	0.0059	-0.00002	0.00003	0.0291	-0.00001	-0.000005	-0.05	0.000018	3.9	-0.0001	0.000058	0.00155
10-Nov-10	61	50	50	7.03	320	29					8.12															
17-Nov-10	62	160	160	7.06	312	32	#N/A	3.0	17.3	-2	8.06	-0.5	0.05	13.7	0.0057	0.00003	0.00018	0.0345	-0.00001	-0.000005	-0.05	0.000019	3.85	-0.0001	0.000056	0.00416
24-Nov-10	63	50	50	6.82	445	29					8.67															
1-Dec-10	64	160	160	6.91	437	33	#N/A	3.7	17.6	-2	8.08	-0.5	0.55	13.6	0.0068	0.00007	0.00037	0.0289	-0.00001	-0.000005	-0.05	0.000015	3.81	-0.0001	0.000051	0.00186
8-Dec-10	65	50	50	7.02	463	30					8.20															
15-Dec-10	66	160	160	7.20	461	31	#N/A	3.5	16.4	-2	9.00	-0.5	0.03	12.2	0.0044	-0.00002	0.00005	0.0229	-0.00001	-0.000005	-0.05	0.000012	3.42	-0.0001	0.000038	0.00208
22-Dec-10	67	50	50	7.38	398	29					8.45															
29-Dec-10	68	160	160	7.26	442	32	#N/A	4.3	17.2	2	8.37	-0.5	0.02	12.5	0.0077	0.00004	0.00031	0.023	-0.00001	-0.000005	-0.05	0.00002	3.42	-0.0001	0.000041	0.00159
5-Jan-11	69	50	50	7.28	430	25					9.18															
12-Jan-11	70	160	160	7.35	443	26	#N/A	3.2	13.2	-2	9.38	-0.5	0.05	11.1	0.0056	0.00003	0.00008	0.0208	-0.00001	-0.000005	-0.05	0.000012	3.07	-0.0001	0.000041	0.00124

Col 2 Surface

Sample = 2351-35&36 Composite

Date	Cycle No.	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
9-Sep-09	0	0.005	0.000034	0.0007	0.89	0.0244	-0.01	0.00178	0.00044	0.02	3.12	0.00106	0.905	-0.000005	2.13	0.0386	-3	0.000022	0.00158	-0.0005	0.000011	0.0004	0.0028	-0.0001
16-Sep-09	1																							
23-Sep-09	2	0.005	0.000021	0.0008	0.76	0.0244	-0.01	0.0015	0.00045	0.212	3.16	0.00076	0.865	-0.000005	1.97	0.0307	-3	0.000015	0.00193	-0.0005	0.000006	-0.0002	0.0037	-0.0001
30-Sep-09	3																							
7-Oct-09	4	0.001	0.000027	0.0008	0.92	0.0237	-0.01	0.00126	0.00047	0.031	2.89	0.00069	1.04	-0.000005	1.75	0.0343	-3	0.000007	0.00493	0.0007	0.000003	0.0005	0.0029	-0.0001
14-Oct-09	5																							
21-Oct-09	6	0.013	0.000115	0.0006	1.02	0.0221	0.01	0.00101	0.00071	0.037	2.17	0.00051	1.03	0.000005	1.48	0.0367	-3	0.000013	0.011	-0.0005	0.000006	-0.0002	0.0037	-0.0001
28-Oct-09	7																							
4-Nov-09	8	0.007	0.000036	-0.0005	1.01	0.0182	-0.01	0.0007	0.00032	0.034	1.82	0.00046	0.986	-0.000005	1.01	0.0345	-3	0.000008	0.0153	-0.0005	0.000004	-0.0002	0.0027	-0.0001
11-Nov-09	9																							
18-Nov-09	10	0.002	0.000019	-0.0005	1.02	0.0194	-0.01	0.00052	0.00037	0.036	1.55	0.00031	0.843	-0.000005	0.77	0.0307	-3	0.000012	0.0172	-0.0005	0.000005	-0.0002	0.0021	-0.0001
25-Nov-09	11																							
2-Dec-09	12	0.01	0.000342	-0.0005	0.99	0.0182	0.02	0.00043	0.00049	0.033	1.26	0.00027	0.861	0.000011	0.64	0.0294	-3	0.000008	0.0174	-0.0005	0.000006	-0.0002	0.0078	-0.0001
9-Dec-09	13																							
16-Dec-09	14	0.005	0.000014	-0.0005	1.11	0.0213	-0.01	0.00035	0.00028	0.035	1.17	0.00027	0.973	-0.000005	0.55	0.0311	-3	0.000008	0.0318	-0.0005	0.000011	-0.0002	0.0025	-0.0001
23-Dec-09	15																							
30-Dec-09	16	0.003	0.000018	-0.0005	1.2	0.0199	-0.01	0.0003	0.00037	0.031	1.11	0.00026	1.13	-0.000005	0.51	0.0313	-3	0.000004	0.0317	-0.0005	0.000008	-0.0002	0.0014	-0.0001
6-Jan-10	17																							
13-Jan-10	18	-0.02	0.0002	-0.01	1.2	0.019	-0.2	-0.001	0.0061	-0.04	0.9	-0.0008	-2	0.0001	0.5	0.03	-10	-0.00004	0.0278	0.013	-0.00004	-0.004	0.004	-0.002
20-Jan-10	19																							
27-Jan-10	20	-0.01	0.00019	-0.005	1.14	0.0171	-0.1	0.0006	0.0035	0.027	0.9	-0.0004	1.01	-0.00005	0.46	0.0258	-6	-0.00002	0.0294	0.006	0.00002	0.002	0.003	-0.001
3-Feb-10	21																							
10-Feb-10	22	-0.005	-0.00003	-0.003	1.29	0.0204	-0.05	-0.0003	0.0003	0.03	1.16	-0.0002	1.23	-0.00003	0.45	0.0291	-3	-0.00001	0.0326	0.003	-0.00001	-0.001	0.0018	-0.0005
17-Feb-10	23																							
24-Feb-10	24	-0.02	-0.0001	-0.01	1	0.018	-0.2	-0.001	0.0048	-0.04	0.8	-0.0008	-2	-0.0001	0.3	0.026	-10	-0.00004	0.0335	-0.01	-0.00004	-0.004	0.003	-0.002
3-Mar-10	25																							
10-Mar-10	26	-0.01	-0.00005	-0.005	1.2	0.0229	-0.1	-0.0005	0.0004	-0.02	0.9	-0.0004	1.31	-0.00005	-0.5	0.0254	#N/A	-0.00002	0.0307	-0.005	-0.00002	-0.002	0.003	-0.001
17-Mar-10	27																							
24-Mar-10	28	-0.005	-0.00003	-0.003	1	0.021	-0.05	-0.0003	0.0003	0.017	0.7	-0.0002	1.24	-0.00003	0.3	0.0241	-10	0.00002	0.0245	-0.003	-0.00001	-0.001	0.0024	-0.0005
31-Mar-10	29																							
7-Apr-10	30	0.019	-0.00003	-0.003	0.99	0.0223	-0.05	-0.0003	0.0004	0.021	0.81	-0.0002	1.43	-0.00003	0.33	0.0235	-10	-0.00001	0.0181	-0.003	-0.00001	-0.001	0.0036	-0.0005
14-Apr-10	31																							
21-Apr-10	32	0.002	0.000018	-0.0005	0.93	0.0223	-0.01	0.00037	0.00028	0.021	0.71	0.0002	1.5	0.00001	0.29	0.021	-10	0.000011	0.0194	-0.0005	0.000007	-0.0002	0.0034	-0.0001
28-Apr-10	33																							
5-May-10	34	0.003	0.000017	-0.0005	0.98	0.024	-0.01	0.00013	0.00042	0.018	0.77	0.00011	1.77	-0.000005	0.31	0.0205	-10	0.00001	0.0177	-0.0005	-0.000002	-0.0002	0.002	-0.0001
12-May-10	35																							
19-May-10	36	0.002	0.000017	-0.0005	1.13	0.0251	0.01	0.00048	0.00035	0.025	0.81	0.00012	1.97	-0.000005	0.39	0.0244	-10	0.000005	0.0193	-0.0005	0.000006	-0.0002	0.0016	-0.0001
26-May-10	37																							
2-Jun-10	38	0.001	0.000014	-0.0005	1.04	0.0234	-0.01	0.00021	0.0004	0.014	0.69	0.00012	2	-0.000005	0.37	0.0204	-10	0.000004	0.0181	-0.0005	0.000004	-0.0002	0.0018	-0.0001
9-Jun-10	39																							
16-Jun-10	40	0.006	0.000034	-0.0005	0.9	0.0217	-0.01	0.00016	0.00034	0.012	0.52	0.00012	1.57	0.000012	0.39	0.0183	-10	0.00001	0.0138	-0.0005	0.000005	-0.0002	0.0017	-0.0001
23-Jun-10	41																							
30-Jun-10	42	0.007	0.000158	-0.0005	1	0.0234	-0.01	0.00033	0.0003	0.018	0.64	0.00016	1.83	-0.000005	0.37	0.0185	-10	0.000015	0.0131	-0.0005	0.000005	-0.0002	0.0023	-0.0001
7-Jul-10	43																							
14-Jul-10	44	0.007	0.000028	-0.0005	0.96	0.0255	-0.01	0.00009	0.00039	0.011	0.62	0.00012	1.62	-0.000005	0.29	0.0196	-10	0.000007	0.0138	-0.0005	0.000011	-0.0002	0.005	-0.0001
21-Jul-10	45																							
28-Jul-10	46	-0.001	0.000069	-0.0005	1.02	0.0236	-0.01	0.00018	0.00031	0.038	0.68	0.00012	1.61	-0.000005	0.32	0.0189	-10	0.000005	0.0127	-0.0005	0.000004	0.0003	0.0025	-0.0001
4-Aug-10	47																							
11-Aug-10	48	0.004	0.00001	-0.0005	1.04	0.0238	-0.01	0.00011	0.00022	0.012	0.62	0.00012	1.66	-0.000005	0.33	0.0199	-10	0.000006	0.014	-0.0005	-0.000002	-0.0002	0.001	-0.0001
18-Aug-10	49																							
25-Aug-10	50	-0.001	0.000018	-0.0005	0.98	0.0178	-0.01	0.00032	0.00008	0.007	0.65	0.00013	1.78	-0.000005	0.32	0.0168	-10	0.000009	0.00173	-0.0005	-0.000002	-0.0002	0.0003	-0.0001
1-Sep-10	51																							
8-Sep-10	52	0.002	0.000036	-0.0005	1.02	0.0236	-0.01	0.00019	0.00027	0.006	0.62	0.00008	1.56	-0.000005	0.29	0.0181	-10	0.000007	0.0116	-0.0005	0.000002	-0.0002	0.0011	-0.0001
15-Sep-10	53																							
22-Sep-10	54	0.004	0.000022	-0.0005	1.03	0.0244	-0.01	0.0002	0.00034	0.012	0.57	0.00013	1.64	-0.000005	0.33	0.0186	-10	0.000005	0.0116	-0.0005	0.000017	-0.0002	0.0023	-0.0001
29-Sep-10	55																							
6-Oct-10	56	0.004	0.000029	-0.0005	1.07	0.0241	-0.01	0.00027	0.00038	0.011	0.67	0.00011	1.59	-0.000005	0.4	0.018	-10	0.000063	0.0104	-0.0005	0.000008	-0.0002	0.0012	-0.0001
13-Oct-10	57																							
20-Oct-10	58	0.001	0.000095	-0.0005	1.03	0.025	-0.01	0.00015	0.0004	0.006	0.58	0.00009	1.63	-0.000005	0.26	0.0181	-10	0.000011	0.0115	-0.0005	0.000006	-0.0002	0.0032	-0.0001
27-Oct-10	59																							
3-Nov-10	60	-0.001	0.000015	-0.0005	1.08	0.0245	-0.01	0.00026	0.00009	0.009	0.6	0.00008	1.58	-0.000005	0.25	0.0189	-10	0.000004	0.0125	-0.0005	#N/A	-0.0002	0.0013	-0.0001
10-Nov-10	61																							
17-Nov-10	62	-0.001	0.000019	-0.0005	0.99	0.022	-0.01	0.00024	0.00022	0.008	0.63	0.0001	1.69	-0.000005	0.27	0.0189	-10	0.000007	0.00969	-0.0005	#N/A	-0.0002	0.0022	-0.0001
24-Nov-10	63																							
1-Dec-10	64	-0.001	0.000029	-0.0005	1	0.0213	-0.01	0.00017	0.00024	0.018	0.6	0.00011	1.64	-0.000005	0.33	0.0201	-10	0.000006	0.0112	-0.0005	0.00002	-0.0002	0.0022	-0.0001
8-Dec-10	65																							
15-Dec-10	66	-0.001	0.000011	-0.0005	0.9	0.0209	-0.01	0.00008	0.00025	0.005	0.53	0.0001	1.48	0.000006	0.26	0.0161	-10	0.000005	0.0102	0.0005	-0.000002	-0.0002	0.0011	-0.0001
22-Dec-10	67																							
29-Dec-10	68	0.005	0.000041	-0.0005	0.95	0.0211	-0.01	0.00007	0.00032	0.011	0.47	0.00009	1.52	-0.000005	0.42	0.0184	-10	0.000007	0.00584	-0.0005	0.000229	-0.0002	0.003	-0.0001
5-Jan-11	69																							
12-Jan-11	70	-0.001	0.000021	-0.0005	0.83	0.0186	-0.01	0.00013	0.0003	0.004	0.44	0.00007	1.31	-0.000005	0.25	0.0144	-10	0.000009	0.00785	-0.0005	0.00001	-0.0002	0.0015	-0.0001

Col 2 Surface

CONFIDENTIAL *DRAFT*

Sample = 2351-35&36 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L
19-Jan-11	71	50	50	7.23	420	23					9.45															
26-Jan-11	72	160	160	7.30	445	28	#N/A	3.5	13.9	-2	9.52	-0.5	0.62	11.7	0.0059	0.00007	0.00016	0.024	-0.00001	-0.000005	-0.05	0.000013	3.21	-0.0001	0.000036	0.00091
2-Feb-11	73	50	50	7.15	451	24					8.20															
9-Feb-11	74	50	50	6.78	415	26																				
16-Feb-11	75	50	50	6.72	427	28																				
23-Feb-11	76	50	50	6.74	393	28																				
2-Mar-11	77	50	50	6.17	436	31																				
9-Mar-11	78	50	50	6.59	427	31																				
16-Mar-11	79	50	50	6.74	397	33																				
23-Mar-11	80	50	50	6.06	435	34																				
30-Mar-11	81	50	50	#N/A	443	35																				
6-Apr-11	82	50	50	#N/A	406	36																				
13-Apr-11	83	50	50	7.00	412	37																				
20-Apr-11	84	160	160	7.32	400	34	#N/A	4.6	16.6	4	9.08	1.2	0.03	16	0.0055	0.00008	0.00013	0.0254	-0.00001	-0.000005	-0.05	0.000018	4.31	0.0001	0.000007	0.0013
27-Apr-11	85	50	50	7.18	392	34																				
4-May-11	86	50	50	7.11	402	36																				
11-May-11	87	50	50	7.22	376	34																				
18-May-11	88	50	50	7.19	446	36																				
25-May-11	89	50	50	7.37	449	40																				
1-Jun-11	90	50	50	6.87	383	40																				
8-Jun-11	91	50	50	7.63	289	41																				
15-Jun-11	92	50	50	7.38	324	38																				
22-Jun-11	93	50	50	7.30	363	22																				
29-Jun-11	94	50	50	6.89	370	23																				
6-Jul-11	95	50	50	6.79	353	26																				
13-Jul-11	96	160	160	6.77	341	28	#N/A	4.8	14.3	3	8.67	-0.5	0.02	11.4	0.0054	-0.00002	0.00004	0.0189	-0.00001	-0.000005	-0.05	0.000021	3.12	0.0005	-0.000005	0.00202
20-Jul-11	97	50	50	7.20	354	26																				
27-Jul-11	98	50	50	6.72	397	28																				
3-Aug-11	99	50	50	7.01	398	38																				
10-Aug-11	100	50	50	7.12	408	39																				
17-Aug-11	101	50	50	7.41	377	40																				
24-Aug-11	102	50	50	7.21	347	41																				
31-Aug-11	103	50	50	7.31	373	45																				
7-Sep-11	104	160	160	7.68	401	41																				
14-Sep-11	105	50	50	7.20	449	44																				
21-Sep-11	106	160	160	7.32	443	45																				
28-Sep-11	107	50	50	6.82	480	46																				
5-Oct-11	108	160	160	7.63	392	41	#N/A	3.2	25.0	3	9.65	0.5	0.04	18	0.0075	0.00008	0.00022	0.0355	-0.00001	-0.000005	-0.05	0.000014	4.86	-0.0001	-0.000005	0.00151
12-Oct-11	109	50	50	7.28	438	36																				
19-Oct-11	110	50	50	7.03	435	37																				
26-Oct-11	111	50	50	7.16	444	38																				
2-Nov-11	112	50	50	6.94	449	39																				
9-Nov-11	113	50	50	7.08	456	42																				
16-Nov-11	114	50	50	7.07	469	20																				
23-Nov-11	115	50	50	6.86	261	22																				
30-Nov-11	116	50	50	7.21	438	23																				
7-Dec-11	117	50	50	7.44	483	25																				
14-Dec-11	118	50	50	7.28	518	26																				
21-Dec-11	119	50	50	7.30	515	28																				
28-Dec-11	120	160	160	7.32	576	30	#N/A	3.1	20.8	2	9.66	0.8	0.021	12.8	0.011	-0.00002	#N/A	0.0211	-0.00001	0.000016	-0.05	0.00001	3.6	0.0001	0.000031	0.00152
4-Jan-12	121	50	50	7.67	650	26																				
11-Jan-12	122	50	50	7.77	679	26																				
18-Jan-12	123	50	50	7.72	709	27																				
25-Jan-12	124	50	50	7.13	691	27																				
1-Feb-12	125	50	50	7.75	625	30																				
8-Feb-12	126	50	50	7.67	565	30																				
15-Feb-12	127	50	50	7.51	568	31																				
22-Feb-12	128	50	50	7.74	672	32																				
29-Feb-12	129	50	50	7.89	591	31																				
7-Mar-12	130	50	50	7.88	673	31																				
14-Mar-12	131	50	50	7.40	460	31																				
21-Mar-12	132	160	160	7.07	516	41	#N/A	3.6	23.2	3	8.98	-0.5	0.022	15.5	0.006	-0.00002	0.0001	0.0249	-0.00001	-0.000005	-0.05	0.000007	4.2	-0.0001	-0.000005	#N/A
28-Mar-12	133	50	50	7.40	696	31																				
4-Apr-12	134	50	50	6.99	583	31																				
11-Apr-12	135	50	50	6.90	650	31																				
18-Apr-12	136	50	50	7.15	601	33																				
25-Apr-12	137	50	50	7.21	701	34																				
2-May-12	138	50	50	7.24	688	35																				
9-May-12	139	50	50	6.89	658	27																				
16-May-12	140	50	50	7.16	647	35																				
23-May-12	141	50	50	6.91	635	26																				

Col 2 Surface

Sample = 2351-35&36 Composite

Date	Cycle No.	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
19-Jan-11	71																							
26-Jan-11	72	0.003	0.000119	-0.0005	0.88	0.0188	-0.01	0.00009	0.00027	0.009	0.48	0.00012	1.24	-0.000005	0.28	0.0148	-10	0.000008	0.00743	0.0006	0.000004	0.0002	0.003	-0.0001
2-Feb-11	73																							
9-Feb-11	74																							
16-Feb-11	75																							
23-Feb-11	76																							
2-Mar-11	77																							
9-Mar-11	78																							
16-Mar-11	79																							
23-Mar-11	80																							
30-Mar-11	81																							
6-Apr-11	82																							
13-Apr-11	83																							
20-Apr-11	84	0.001	#N/A	-0.0005	1.26	0.0174	-0.01	0.00007	0.00017	0.006	1.44	0.00013	1.42	#N/A	0.29	0.0205	-10	0.000012	0.00574	-0.0005	0.000009	-0.0002	0.0036	-0.0001
27-Apr-11	85																							
4-May-11	86																							
11-May-11	87																							
18-May-11	88																							
25-May-11	89																							
1-Jun-11	90																							
8-Jun-11	91																							
15-Jun-11	92																							
22-Jun-11	93																							
29-Jun-11	94																							
6-Jul-11	95																							
13-Jul-11	96	0.002	0.000029	-0.0005	0.86	0.0082	-0.01	0.00013	0.0002	0.005	0.42	0.00009	1.04	0.00001	0.24	0.0136	-10	0.000004	0.00427	0.0012	-0.000002	-0.0002	0.0018	-0.0001
20-Jul-11	97																							
27-Jul-11	98																							
3-Aug-11	99																							
10-Aug-11	100																							
17-Aug-11	101																							
24-Aug-11	102																							
31-Aug-11	103																							
7-Sep-11	104																							
14-Sep-11	105																							
21-Sep-11	106																							
28-Sep-11	107																							
5-Oct-11	108	0.001	0.000016	-0.0005	1.43	0.00467	0.02	#N/A	0.0001	-0.002	0.98	0.00037	1.4	0.000007	0.31	0.0275	-10	0.000013	0.00485	-0.0005	0.000009	0.0002	0.0024	-0.0001
12-Oct-11	109																							
19-Oct-11	110																							
26-Oct-11	111																							
2-Nov-11	112																							
9-Nov-11	113																							
16-Nov-11	114																							
23-Nov-11	115																							
30-Nov-11	116																							
7-Dec-11	117																							
14-Dec-11	118																							
21-Dec-11	119																							
28-Dec-11	120	#N/A	#N/A	-0.0005	0.93	0.00681	-0.01	0.00017	#N/A	#N/A	1.55	0.00009	1.02	#N/A	0.27	0.0152	-10	0.000009	0.00343	-0.0005	0.000009	0.0003	0.0019	-0.0001
4-Jan-12	121																							
11-Jan-12	122																							
18-Jan-12	123																							
25-Jan-12	124																							
1-Feb-12	125																							
8-Feb-12	126																							
15-Feb-12	127																							
22-Feb-12	128																							
29-Feb-12	129																							
7-Mar-12	130																							
14-Mar-12	131																							
21-Mar-12	132	0.004	0.000056	-0.0005	1.21	0.0021	-0.01	0.00016	0.00019	#N/A	0.93	0.00008	1.09	#N/A	0.26	0.0178	-10	0.000008	0.0041	-0.0005	0.000016	0.0004	0.0017	-0.0001
28-Mar-12	133																							
4-Apr-12	134																							
11-Apr-12	135																							
18-Apr-12	136																							
25-Apr-12	137																							
2-May-12	138																							
9-May-12	139																							
16-May-12	140																							
23-May-12	141																							

Col 2 Surface

CONFIDENTIAL ***DRAFT***

Sample = 2351-35&36 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L
30-May-12	142	50	50	7.13	634	27																				
6-Jun-12	143	50	50	7.38	553	40																				
13-Jun-12	144	160	160	7.05	584	37	#N/A	5.9	26.9	5	9.86	-0.5	0.021	16.6	0.00434	-0.00002	0.000225	0.0263	-0.00001	-0.000005	-0.05	-0.000005	4.47	0.00016	-0.000005	0.00125
20-Jun-12	145	50	50	6.96	588	28																				
27-Jun-12	146	50	50	6.72	559	24																				
4-Jul-12	147	50	50	7.27	574	25																				
11-Jul-12	148	50	50	7.55	578	24																				
18-Jul-12	149	50	50	7.36	611	37																				
25-Jul-12	150	50	50	6.86	580	34																				
1-Aug-12	151	50	50	6.82	592	36																				
8-Aug-12	152	50	50	7.29	590	38																				
15-Aug-12	153	50	50	6.88	558	37																				
22-Aug-12	154	50	50	7.21	575	36																				
29-Aug-12	155	50	50	7.55	691	28																				
5-Sep-12	156	160	160	7.48	627	28	#N/A	3.9	22.9	4	9.36	0.53	0.02	16	0.00508	0.00002	0.000244	0.0232	-0.00001	-0.000005	-0.05	0.000006	4.25	0.00023	0.000014	0.00206
12-Sep-12	157	50	50	7.96	676	23																				
19-Sep-12	158	50	50	7.43	567	30																				
26-Sep-12	159	50	50	6.92	608	34																				
3-Oct-12	160	50	50	7.50	632	33																				
10-Oct-12	161	50	50	7.40	680	33																				
17-Oct-12	162	50	50	7.68	522	30																				
24-Oct-12	163	50	50	7.09	473	35																				
31-Oct-12	164	50	50	7.62	491	35																				

Col 2 Surface

Sample = 2351-35&36 Composite

Date	Cycle No.	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
30-May-12	142																							
6-Jun-12	143																							
13-Jun-12	144	0.0015	0.0000568	-0.0005	1.31	0.00076	-0.01	0.00049	0.00013	0.0053	0.554	0.000106	1.15	0.0000113	0.224	0.0188	-10	0.0000094	0.0019	-0.0005	0.0000028	-0.0002	0.00172	-0.0001
20-Jun-12	145																							
27-Jun-12	146																							
4-Jul-12	147																							
11-Jul-12	148																							
18-Jul-12	149																							
25-Jul-12	150																							
1-Aug-12	151																							
8-Aug-12	152																							
15-Aug-12	153																							
22-Aug-12	154																							
29-Aug-12	155																							
5-Sep-12	156	0.0041	0.000032	-0.0005	1.29	0.00067	-0.01	0.00016	0.00024	0.0174	0.641	0.000066	1.03	#N/A	0.242	0.0165	-10	0.000007	0.00171	-0.0005	0.000014	0.00098	0.00084	-0.0001
12-Sep-12	157																							
19-Sep-12	158																							
26-Sep-12	159																							
3-Oct-12	160																							
10-Oct-12	161																							
17-Oct-12	162																							
24-Oct-12	163																							
31-Oct-12	164																							

Col 2 Surface

CONFIDENTIAL ***DRAFT***

Sample = 2351-35&36 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L
7-Nov-12	165	50	50	7.08	566	36																				
14-Nov-12	166	50	50	7.37	657	37																				
21-Nov-12	167	50	50	7.08	622	36																				
28-Nov-12	168	160	160	7.09	530	38	#N/A	6.8	27.3	6	9.50	-0.5	0.019	16.3	0.00593	0.00004	0.000059	0.0258	-0.00001	-0.000005	-0.05	0.000011	4.41	-0.0001	0.00001	0.00331
5-Dec-12	169	50	50	7.52	565	31																				
12-Dec-12	170	50	50	7.85	482	31																				
19-Dec-12	171	50	50	7.62	642	20																				
26-Dec-12	172	50	50	7.90	636	20																				
2-Jan-13	173	50	50	7.98	684	19																				
9-Jan-13	174	50	50	7.60	628	19																				
16-Jan-13	175	50	50	7.18	604	19																				
23-Jan-13	176	50	50	6.54	594	20																				
30-Jan-13	177	50	50	7.05	598	23																				
6-Feb-13	178	50	50	6.52	522	26																				
13-Feb-13	179	50	50	6.92	583	28																				
20-Feb-13	180	160	160	7.04	525	28	#N/A	4.2	20.5	4	8.55	-0.5	0.015	12.3	0.00533	0.000028	0.000025	0.0195	-0.00001	-0.000005	-0.05	0.000008	3.33	0.00019	0.000007	0.00196
27-Feb-13	181	50	50	7.15	550	26																				
6-Mar-13	182	50	50	7.31	665	23																				
13-Mar-13	183	50	50	7.03	580	26																				
20-Mar-13	184	50	50	7.43	614	28																				
27-Mar-13	185	50	50	6.72	583	27																				
3-Apr-13	186	50	50	6.97	484	28																				
10-Apr-13	187	50	50	6.98	641	28																				
17-Apr-13	188	50	50	7.13	603	29																				
24-Apr-13	189	50	50	6.88	483	29																				
1-May-13	190	50	50	6.46	464	29																				
8-May-13	191	50	50	6.08	560	30																				
15-May-13	192	160	160	6.21	534	31	#N/A	6.6	21.1	3	8.78	-0.5	0.02	14.4	0.00405	0.000022	0.000044	0.0221	-0.00001	-0.000005	-0.05	-0.000005	3.89	-0.0001	0.000006	0.00071
22-May-13	193	50	50	7.01	643	27																				
29-May-13	194	50	50	7.34	582	27																				

Col 2 Surface

Sample = 2351-35&36 Composite

Date	Cycle No.	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
7-Nov-12	165																							
14-Nov-12	166																							
21-Nov-12	167																							
28-Nov-12	168	0.0097	#N/A	-0.0005	1.29	0.00077	-0.01	0.0002	0.00022	0.0193	0.568	0.000098	1.28	0.00001	0.206	0.0174	-3	0.000009	0.00223	-0.0005	0.000014	0.00038	#N/A	-0.0001
5-Dec-12	169																							
12-Dec-12	170																							
19-Dec-12	171																							
26-Dec-12	172																							
2-Jan-13	173																							
9-Jan-13	174																							
16-Jan-13	175																							
23-Jan-13	176																							
30-Jan-13	177																							
6-Feb-13	178																							
13-Feb-13	179																							
20-Feb-13	180	0.0075	0.000323	-0.0005	0.973	0.0014	-0.01	8.7E-05	0.00013	0.0125	0.628	-0.00004	0.975	0.000029	0.197	0.0123	-3	0.000005	0.00107	-0.0005	0.000002	0.00031	0.00112	-0.0001
27-Feb-13	181																							
6-Mar-13	182																							
13-Mar-13	183																							
20-Mar-13	184																							
27-Mar-13	185																							
3-Apr-13	186																							
10-Apr-13	187																							
17-Apr-13	188																							
24-Apr-13	189																							
1-May-13	190																							
8-May-13	191																							
15-May-13	192	0.0021	0.000012	-0.0005	1.15	0.00129	-0.01	0.00014	0.00014	0.004	0.49	0.000071	1.01	0.000008	0.197	0.0146	-3	0.000006	0.00105	-0.0005	-0.000002	-0.0002	0.00073	-0.0001
22-May-13	193																							
29-May-13	194																							

Dec 18/09 checked neoprene pump tubing for possible source of Sn contamination. Found that recirculating nanopure water at ~1 mL/min over 18 days increased Sn from <0.00001 ppm to 0.00046 ppm. All neoprene tubing being replaced with Tygon or Silicon.
Mar 10/10 S <100. Repeat
Nov 3/10 U 0.000346. Cannot repeat. Sample discarded.
Nov 17/10 Cl 1.6. Repeat = -0.5.
Nov 17/10 U 0.000408. Cannot repeat. Samples discarded.
Feb 4/11 Change in analytical schedule.
Mar 30/11 pH 5.73. Suspect probe malfunction.
April 6/11 pH 5.59. Suspect probe malfunction.
April 20/11 Ag 0.00107 and Pb 000603. Repeat =0.000626. Data confirmed, suspect contamination. Cannot repeat Ag, suspect contamination or analytical error
Oct 5/11 Mo=0.00065, repeat= 0.00058. data confirmed, suspect contamination
Dec 28/11 Fe=0.026, Pb= 0.00017, Ni=0.00044, P=0.012, repeat, Fe= 0.025, Pb= 0.000183, Ni= 0.00045, P= 0.013. Data confirmed, suspect contamination
Dec 28/11 As=0.00077, Ag=0.000038. Repeat As=0.000763, Ag=0.000367. Data confirmed, suspect contamination
Mar 21/12 P=0.013, Ag=0.000034, repeat P=0.0147, Ag=0.0000424. Data confirmed suspect contamination
Mar 21/12 Cu=0.00489. Cannot repeat suspect contamination or analytical error
Sept 5/12 Ag=0.000867, repeat=0.00093. Data confirmed suspect contamination
Nov 28/12 Pb=0.000243, Zn=0.00334, repeat Pb=0.000243, Zn=0.00334. Data confirmed, suspect contamination

Col 2 Bottom

CONFIDENTIAL *DRAFT*

Sample = 2351-35&36 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L
9-Sep-09	0	160	160	7.48	351	30	#N/A	1.2	78.5	22	4.10	-0.5	1.08	72.6	0.0556	0.00036	0.0002	0.271	-0.00001	-0.000005	-0.05	0.000115	23.3	-0.0001	0.000104
16-Sep-09	1	50	50	7.51	337	28					5.80														
23-Sep-09	2	160	160	7.76	309	217	#N/A	2.2	126.2	33	7.40	0.9	1.15	100	0.0238	0.00032	0.00026	0.294	-0.00001	-0.000005	-0.05	0.000051	30.3	0.0001	0.000062
30-Sep-09	3	50	50	8.02	276	252					5.90														
7-Oct-09	4	160	160	7.40	375	342	#N/A	8.8	159.9	71	6.10	4.3	1.22	145	0.0193	0.0004	0.00051	0.266	-0.00001	-0.000005	0.057	0.000134	42.3	-0.0001	0.000083
14-Oct-09	5	50	50	8.02	196	434					6.40														
21-Oct-09	6	160	160	8.02	158	494	#N/A	5.9	203.8	101	5.50	4.7	1.18	179	0.0138	0.00045	0.00032	0.129	-0.00001	-0.000005	0.069	0.000063	49.8	0.0003	0.000062
28-Oct-09	7	50	50	8.03	165	473					5.70														
4-Nov-09	8	160	160	7.30	215	420	#N/A	5.9	223.7	56	6.20	5.7	1.36	164	0.0095	0.0003	0.00029	0.0919	-0.00001	-0.000005	0.078	0.000024	44.6	-0.0001	0.000039
11-Nov-09	9	50	50	7.91	221	389					5.20														
18-Nov-09	10	160	160	7.82	25	394	#N/A	9.0	207.6	31	5.20	1.9	1.53	150	0.0096	0.00086	0.00027	0.0948	-0.00001	-0.000005	0.063	0.000013	40	-0.0001	0.000038
25-Nov-09	11	50	50	7.72	19	356					5.10														
2-Dec-09	12	160	160	7.57	23	368	#N/A	6.2	190.8	23	5.20	0.7	1.7	135	0.0198	0.00047	0.00028	0.0947	-0.00001	-0.000005	0.061	0.000026	35.4	-0.0001	0.000069
9-Dec-09	13	50	50	7.87	359	259					5.20														
16-Dec-09	14	160	160	7.71	-59	333	#N/A	3.8	187.6	16	4.90	-0.5	1.83	126	0.0085	0.00025	0.00016	0.102	-0.00001	-0.000005	0.05	0.000017	32.7	0.0002	0.000069
23-Dec-09	15	50	50	7.89	120	316					5.80														
30-Dec-09	16	160	160	6.78	149	339	#N/A	4.7	177.6	14	4.30	1.2	1.72	128	0.0074	0.0001	0.00058	0.129	-0.00001	-0.000005	-0.05	0.000012	33.3	-0.0001	0.000048
6-Jan-10	17	50	50	7.60	176	340					4.20														
13-Jan-10	18	160	160	7.83	88	341	#N/A	6.7	177.1	11	5.70	-0.5	1.84	126	0.009	-0.0004	0.0004	0.154	-0.0002	-0.0001	-1	-0.0001	31.1	-0.002	-0.0001
20-Jan-10	19	50	50	7.50	258	336					3.80														
27-Jan-10	20	160	160	8.18	85	332	#N/A	3.7	178.3	13	4.20	-0.5	1.82	119	0.007	0.0002	0.0004	0.153	-0.00005	-0.00003	-0.3	-0.00003	29.9	-0.0005	-0.00003
3-Feb-10	21	50	50	7.81	195	336					4.20														
10-Feb-10	22	160	160	8.06	100	336	#N/A	3.9	181.4	12	5.30	0.8	1.75	147	0.011	0.0002	0.0006	0.19	-0.00005	-0.00003	-0.3	-0.00003	37.9	-0.0005	0.00003
17-Feb-10	23	50	50	7.91	119	331					4.10														
24-Feb-10	24	160	160	7.91	136	338	#N/A	3.3	179.7	14	5.10	-0.5	1.74	123	0.007	-0.0002	-0.0002	0.209	-0.0001	-0.00005	-0.5	-0.00005	31.3	-0.001	-0.00005
3-Mar-10	25	50	50	7.68	290	362					5.40														
10-Mar-10	26	160	160	7.77	78	357	#N/A	3.9	177.2	14	4.50	-0.5	1.78	136	0.0065	0.00005	0.00024	0.226	-0.00001	-0.000005	-0.05	0.000013	34.8	-0.0001	0.00004
17-Mar-10	27	50	50	7.56	176	335					4.60														
24-Mar-10	28	160	160	7.73	123	353	#N/A	3.9	175.3	14	4.70	-0.5	-2	130	0.007	0.0001	0.0005	0.221	-0.00005	-0.00003	-0.3	-0.00003	32.2	-0.0005	-0.00003
31-Mar-10	29	50	50	7.70	261	318					6.53														
7-Apr-10	30	160	160	7.56	184	351	#N/A	3.7	169.4	14	7.20	-0.5	1.66	135	0.01	0.0001	0.0001	0.229	-0.00005	-0.00003	-0.3	-0.00003	34.2	-0.0005	-0.00003
14-Apr-10	31	50	50	7.92	175	340					4.60														
21-Apr-10	32	160	160	7.94	296	349	#N/A	3.6	168.8	9	4.60	-0.5	1.65	125	0.011	0.00007	0.00026	0.232	-0.00001	-0.000005	-0.05	0.000023	32.6	0.0002	0.000036
28-Apr-10	33	50	50	7.72	326	310					4.20														
5-May-10	34	160	160	7.18	220	311	#N/A	4.9	168.8	8	4.40	-0.5	1.64	131	0.0067	0.00007	0.00034	0.235	-0.00001	-0.000005	-0.05	0.000015	35.3	-0.0001	0.000037
12-May-10	35	50	50	7.61	312	313					4.30														
19-May-10	36	160	160	7.45	279	350	#N/A	3.0	173.5	6	4.30	-0.5	1.64	144	0.0064	0.00005	0.00033	0.271	-0.00001	-0.000005	-0.05	0.000011	39.3	-0.0001	0.000032
26-May-10	37	50	50	7.39	360	340					4.70														
2-Jun-10	38	160	160	6.91	353	358	#N/A	3.0	170.5	10	4.80	-0.5	1.69	140	0.0111	0.00005	#N/A	0.271	-0.00001	-0.000005	-0.05	0.000019	37.9	0.0002	0.000042
9-Jun-10	39	50	50	7.72	302	317					3.20														
16-Jun-10	40	160	160	7.31	382	317	#N/A	2.5	169.6	4	4.85	-0.5	1.6	124	0.0051	0.00005	0.00023	0.262	-0.00001	-0.000005	-0.05	0.000014	33	0.0001	0.000041
23-Jun-10	41	50	50	7.40	316	310					2.80														
30-Jun-10	42	160	160	7.30	278	309	#N/A	3.5	167.9	6	4.35	-0.5	1.61	128	0.006	0.00006	0.00059	0.275	-0.00001	-0.000005	-0.05	0.000011	34.2	-0.0001	0.000099
7-Jul-10	43	50	50	7.39	336	297					2.70														
14-Jul-10	44	160	160	6.78	371	327	#N/A	6.0	161.9	2	3.51	0.5	1.45	118	0.0071	0.00005	0.0011	0.274	-0.00001	-0.000005	-0.05	0.000026	32.6	-0.0001	0.000151
21-Jul-10	45	50	50	6.93	260	295					2.38														
28-Jul-10	46	160	160	6.68	410	306	#N/A	5.4	157.3	4	3.25	-0.5	1.33	122	0.0085	0.00004	0.00054	0.291	-0.00001	-0.000005	-0.05	0.000018	34.2	0.0003	0.000067
4-Aug-10	47	50	50	6.95	310	302					3.10														
11-Aug-10	48	160	160	6.71	283	312	#N/A	6.1	157.6	4	0.65	-0.5	1.33	124	0.0126	0.00004	0.00012	0.284	-0.00001	-0.000005	-0.05	0.000013	34.7	-0.0001	0.000045
18-Aug-10	49	50	50	7.08	346	311					1.80														
25-Aug-10	50	160	160	6.72	416	292	#N/A	5.8	158.0	7	0.75	-0.5	1.3	123	0.001	0.00005	0.00011	0.291	-0.00001	-0.000005	-0.05	0.000019	35.5	-0.0001	0.000029
1-Sep-10	51	50	50	7.43	380	276					1.10														
8-Sep-10	52	160	160	7.29	423	292	#N/A	7.9	158.4	6	0.98	-0.5	1.22	116	0.0082	0.00004	0.00012	0.306	-0.00001	-0.000005	-0.05	0.000032	32.9	0.0002	0.000058
15-Sep-10	53	50	50	7.35	389	282					1.75														

Col 2 Bottom

Sample = 2351-35&36 Composite

Date	Cycle No.	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
9-Sep-09	0	0.00922	0.002	0.000018	0.0039	3.52	0.0246	-0.01	0.0128	0.0004	0.011	7.68	0.00211	2.82	-0.000005	2.84	0.174	8	0.000029	0.0425	-0.0005	0.000121	0.0012	0.0035	-0.0001
16-Sep-09	1																								
23-Sep-09	2	0.0131	0.004	0.00335	0.0072	5.93	0.0438	-0.01	0.0196	0.00035	0.013	11.7	0.00277	3.48	-0.000005	6.92	0.26	9	0.000041	0.034	-0.0005	0.000274	0.0005	0.0046	-0.0001
30-Sep-09	3																								
7-Oct-09	4	0.0383	0.012	0.00135	0.0097	9.69	0.0658	-0.01	0.0279	0.00105	0.009	18.5	0.00677	4.45	0.000007	18.9	0.375	25	0.000107	0.0223	0.0015	0.000643	0.001	0.0058	-0.0001
14-Oct-09	5																								
21-Oct-09	6	0.0123	0.019	0.000301	0.0114	13.2	0.0846	0.01	0.029	0.00047	0.01	22.4	0.00634	4.73	-0.000005	30.4	0.419	30	0.000053	0.0332	-0.0005	0.000375	0.0003	0.0031	-0.0001
28-Oct-09	7																								
4-Nov-09	8	0.00528	0.008	0.000034	0.0105	12.8	0.0832	-0.01	0.00473	0.00022	0.008	21.9	0.00108	4	-0.000005	26.3	0.385	19	0.000013	0.0351	-0.0005	0.000093	-0.0002	0.0007	-0.0001
11-Nov-09	9																								
18-Nov-09	10	0.00243	0.014	0.000037	0.0087	12.1	0.0762	-0.01	0.00164	0.00019	0.01	22.4	0.00008	3.58	-0.000005	17.9	0.352	12	0.000021	0.0295	-0.0005	0.000066	-0.0002	0.001	-0.0001
25-Nov-09	11																								
2-Dec-09	12	0.00378	0.025	0.000656	0.0082	11.3	0.0747	-0.01	0.00264	0.00067	0.017	21.6	0.00006	3.24	-0.000005	12.7	0.338	9	0.000094	0.0349	-0.0005	0.00015	-0.0002	0.005	-0.0001
9-Dec-09	13																								
16-Dec-09	14	0.0043	0.007	0.000025	0.0068	10.8	0.0753	-0.01	0.00185	0.00069	0.134	21.5	0.00007	3.09	-0.000005	9.89	0.324	6	0.000014	0.0286	-0.0005	0.000092	-0.0002	0.0008	-0.0001
23-Dec-09	15																								
30-Dec-09	16	0.00523	0.003	0.000019	0.0069	11	0.0683	-0.01	0.00179	0.00081	0.008	21.7	0.00004	3.46	-0.000005	8.17	0.366	6	0.000005	0.0302	-0.0005	0.000385	-0.0002	0.0007	-0.0001
6-Jan-10	17																								
13-Jan-10	18	0.012	-0.02	0.0013	-0.01	11.8	0.055	-0.2	0.002	0.0045	-0.04	21.6	-0.0008	3.76	0.0001	7.3	0.388	-10	-0.00004	0.0231	0.00008	0.00008	-0.004	0.003	-0.002
20-Jan-10	19																								
27-Jan-10	20	0.0086	0.016	0.00093	0.007	10.9	0.0496	-0.05	0.0023	0.0019	-0.01	20	-0.0002	3.47	-0.00003	6.52	0.373	-3	0.00005	0.0211	0.005	0.00007	-0.001	0.0022	-0.0005
3-Feb-10	21																								
10-Feb-10	22	0.0077	0.011	0.00011	0.007	12.6	0.0596	-0.05	0.0032	0.0007	0.016	24.6	-0.0002	3.88	-0.00003	7.46	0.427	-3	0.00004	0.0232	-0.003	0.00011	-0.001	0.0021	-0.0005
17-Feb-10	23																								
24-Feb-10	24	0.0046	0.014	0.00019	0.007	10.8	0.0605	-0.1	0.0043	0.0074	-0.02	18	-0.0004	3.77	-0.00005	5.76	0.416	8	-0.00002	0.019	-0.005	0.00004	-0.002	0.003	-0.001
3-Mar-10	25																								
10-Mar-10	26	0.00272	0.004	0.000029	0.0075	11.9	0.0561	-0.01	0.00544	0.00029	0.008	18.7	-0.00004	4.51	-0.000005	6.56	0.452	-10	0.000037	0.0163	-0.0005	0.000046	-0.0002	0.0012	-0.0001
17-Mar-10	27																								
24-Mar-10	28	0.0032	-0.005	0.0001	0.007	12	0.044	-0.05	0.0067	0.0003	-0.01	17	-0.0002	4.5	-0.00003	6.3	0.446	-10	0.00005	0.0134	-0.003	0.00005	-0.001	0.0013	-0.0005
31-Mar-10	29																								
7-Apr-10	30	0.0028	0.026	0.00004	0.007	12.1	0.0428	-0.05	0.0081	0.0005	-0.01	17	-0.0002	4.56	-0.00003	6.03	0.448	-10	0.00002	0.0109	-0.003	0.00005	-0.001	0.0019	-0.0005
14-Apr-10	31																								
21-Apr-10	32	0.00488	0.011	0.000192	0.0068	10.5	0.0422	-0.01	0.0108	0.0004	0.013	15.2	0.00008	4.82	0.000024	5.7	0.44	-10	0.000023	0.0106	0.001	0.00006	-0.0002	0.0036	-0.0001
28-Apr-10	33																								
5-May-10	34	0.00145	0.007	0.000009	0.0061	10.4	0.0416	-0.01	0.0124	0.00031	0.009	14.5	0.00004	5.11	-0.000005	5.46	0.441	-10	0.000033	0.0123	-0.0005	0.000065	-0.0002	0.0008	-0.0001
12-May-10	35																								
19-May-10	36	0.00183	0.007	0.000038	0.0069	11.1	0.0347	0.02	0.0166	0.00057	0.006	14.9	0.00004	5.93	-0.000005	5.69	0.489	-10	0.000037	0.0122	-0.0005	0.000073	-0.0002	0.0009	-0.0001
26-May-10	37																								
2-Jun-10	38	0.00189	0.003	0.000017	0.006	11.1	0.0386	0.01	0.0176	0.00045	0.006	14.1	0.00006	5.75	-0.000005	5.9	0.466	-10	0.000008	0.0113	-0.0005	0.000089	-0.0002	0.0007	-0.0001
9-Jun-10	39																								
16-Jun-10	40	0.00152	0.002	0.000019	0.006	9.99	0.0421	-0.01	0.0206	0.00046	0.006	12.6	0.00006	5.78	-0.000005	5.42	0.454	-10	0.000039	0.0101	-0.0005	0.000089	-0.0002	0.0005	-0.0001
23-Jun-10	41																								
30-Jun-10	42	0.002	0.002	0.000072	0.0057	10.3	0.0687	-0.01	0.0237	0.00056	0.016	12.2	0.00012	6.33	-0.000005	5.74	0.46	-10	0.000017	0.00983	-0.0005	0.000122	-0.0002	0.0018	-0.0001
7-Jul-10	43																								
14-Jul-10	44	0.00249	0.001	0.000101	0.0057	8.91	0.05	-0.01	0.0266	0.00055	0.008	10.6	0.00009	5.88	-0.000005	4.76	0.468	-10	0.000025	0.00935	-0.0005	0.000217	-0.0002	0.0015	-0.0001
21-Jul-10	45																								
28-Jul-10	46	0.00124	0.006	0.00007	0.0052	8.85	0.0468	-0.01	0.0285	0.00058	0.005	10.1	0.00007	5.75	-0.000005	4.59	0.459	-10	0.000008	0.00728	-0.0005	0.000128	-0.0002	0.0008	-0.0001
4-Aug-10	47																								
11-Aug-10	48	0.00122	0.005	0.000022	0.0054	8.96	0.049	-0.01	0.0308	0.00083	0.006	10.3	0.00007	5.82	-0.000005	4.69	0.461	-10	0.000005	0.00614	-0.0005	0.000115	-0.0002	0.0006	-0.0001
18-Aug-10	49																								
25-Aug-10	50	0.00081	0.009	0.000063	0.0054	8.48	0.0416	-0.01	0.0344	0.00033	0.003	9.77	0.00012	6.05	-0.000005	4.5	0.445	-10	0.000014	0.00126	-0.0005	0.000113	-0.0002	0.0007	-0.0001
1-Sep-10	51																								
8-Sep-10	52	0.00133	0.033	0.0001	0.0048	8.13	0.0423	-0.01	0.0328	0.00083	0.003	9.32	0.00008	5.87	-0.000005	4.34	0.434	-10	0.000008	0.00491	-0.0005	0.000135	-0.0002	0.001	-0.0001
15-Sep-10	53																								

Col 2 Bottom

CONFIDENTIAL *DRAFT*

Sample = 2351-35&36 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L
22-Sep-10	54	160	160	7.12	418	293	#N/A	5.3	151.9	9	0.75	-0.5	1.27	124	0.016	0.00005	0.0003	0.324	-0.00001	-0.000005	-0.05	0.000018	36.4	0.0002	0.000062
29-Sep-10	55	50	50	8.07	318	270					1.02														
6-Oct-10	56	160	160	7.32	339	278	#N/A	5.4	158.7	8	0.50	-0.5	1.29	120	0.009	0.00004	0.00025	0.36	-0.00001	-0.000005	-0.05	0.000012	35.7	0.0003	0.000043
13-Oct-10	57	50	50	7.44	309	292					0.55														
20-Oct-10	58	160	160	7.26	345	288	#N/A	5.7	156.6	9	1.20	-0.5	1.2	117	0.004	0.00004	0.00016	0.333	-0.00001	-0.000005	-0.05	0.000014	35.1	-0.0001	0.000055
27-Oct-10	59	50	50	7.38	304	258					1.40														
3-Nov-10	60	160	160	7.31	301	261	#N/A	2.9	157.9	5	1.30	-0.5	1.05	117	0.0045	-0.00002	0.00014	0.401	-0.00001	-0.000005	-0.05	0.000016	35.3	-0.0001	0.000011
10-Nov-10	61	50	50	7.08	362	254					0.60														
17-Nov-10	62	160	160	7.06	327	270	#N/A	3.9	154.3	4	0.72	-0.5	1.12	118	0.0088	0.00006	0.00014	0.376	-0.00001	-0.000005	-0.05	0.000023	36	-0.0001	0.000013
24-Nov-10	63	50	50	7.10	385	258					0.60														
1-Dec-10	64	160	160	7.19	409	263	#N/A	6.9	149.5	4	0.60	-0.5	0.94	111	0.0044	0.00006	0.00015	0.365	-0.00001	-0.000005	-0.05	0.000015	34.4	-0.0001	0.000016
8-Dec-10	65	50	50	7.10	396	262					0.68														
15-Dec-10	66	160	160	7.16	400	263	#N/A	6.9	140.1	5	0.76	-0.5	1.02	104	0.0051	0.00006	0.0003	0.363	-0.00001	-0.000005	-0.05	0.000013	32.4	-0.0001	0.000013
22-Dec-10	67	50	50	7.30	373	230					0.85														
29-Dec-10	68	160	160	7.18	404	267	#N/A	7.5	143.7	5	0.80	-0.5	0.74	105	0.0078	0.00006	0.00017	0.466	-0.00001	-0.000005	-0.05	0.000009	32.3	-0.0001	0.000016
5-Jan-11	69	50	50	7.30	366	268					0.70														
12-Jan-11	70	160	160	7.31	399	239	#N/A	7.1	141.7	4	0.90	-0.5	0.94	112	0.0095	0.00005	0.00022	0.381	-0.00001	-0.000005	-0.05	0.000024	35	0.0001	0.000035
19-Jan-11	71	50	50	7.38	365	236					0.80														
26-Jan-11	72	160	160	7.33	410	252	#N/A	7.5	138.8	4	0.75	-0.5	0.84	111	0.0095	0.00014	0.0003	0.38	-0.00001	-0.000005	-0.05	0.000017	34.6	-0.0001	0.00001
2-Feb-11	73	50	50	7.36	382	233					0.85														
9-Feb-11	74	50	50	7.76	352	242																			
16-Feb-11	75	50	50	7.56	386	237																			
23-Feb-11	76	50	50	7.78	345	238																			
2-Mar-11	77	50	50	7.62	388	230																			
9-Mar-11	78	50	50	7.54	368	240																			
16-Mar-11	79	50	50	7.68	363	248																			
23-Mar-11	80	50	50	7.20	394	241																			
30-Mar-11	81	50	50	#N/A	349	241																			
6-Apr-11	82	50	50	#N/A	341	247																			
13-Apr-11	83	50	50	7.94	380	257																			
20-Apr-11	84	160	160	7.86	358	256	#N/A	8.5	144.7	5	0.70	0.8	0.83	108	0.0114	0.00016	0.00019	0.385	-0.00001	-0.000005	-0.05	-0.000005	34.9	0.0001	0.000071
27-Apr-11	85	50	50	8.04	380	255																			
4-May-11	86	50	50	7.86	360	257																			
11-May-11	87	50	50	7.95	358	260																			
18-May-11	88	50	50	7.91	363	278																			
25-May-11	89	50	50	7.95	365	263																			
1-Jun-11	90	50	50	7.64	358	267																			
8-Jun-11	91	50	50	7.44	298	266																			
15-Jun-11	92	50	50	7.40	296	240																			
22-Jun-11	93	50	50	8.19	335	254																			
29-Jun-11	94	50	50	7.77	330	265																			
6-Jul-11	95	50	50	7.48	353	271																			
13-Jul-11	96	160	160	7.49	345	272	#N/A	8.7	136.3	3	0.80	-0.5	0.71	108	0.0039	0.00005	0.0003	0.468	-0.00001	-0.000005	-0.05	-0.000005	33.9	0.0002	0.000019
20-Jul-11	97	50	50	7.35	340	266																			
27-Jul-11	98	50	50	7.16	330	268																			
3-Aug-11	99	50	50	7.63	342	238																			
10-Aug-11	100	50	50	7.52	347	239																			
17-Aug-11	101	50	50	7.63	338	240																			
24-Aug-11	102	50	50	7.67	321	245																			
31-Aug-11	103	50	50	7.63	336	270																			
7-Sep-11	104	160	160	7.91	362	255																			
14-Sep-11	105	50	50	7.89	394	265																			

Col 2 Bottom

Sample = 2351-35&36 Composite

Date	Cycle No.	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
22-Sep-10	54	0.0013	0.013	0.000096	0.0048	7.99	0.0395	-0.01	0.0352	0.00073	0.023	9.04	0.00009	6.66	-0.000005	4.18	0.443	-10	0.000009	0.00333	-0.0005	0.000306	-0.0002	0.0023	0.0002
29-Sep-10	55																								
6-Oct-10	56	0.001	0.015	0.000049	0.0048	7.64	0.0314	-0.01	0.0376	0.00073	0.008	9.01	0.0001	6.56	-0.000005	3.81	0.455	-10	#N/A	0.00427	-0.0005	0.000197	-0.0002	0.0009	-0.0001
13-Oct-10	57																								
20-Oct-10	58	0.00109	0.004	0.000087	0.0045	7.19	0.0363	-0.01	0.0357	0.00067	0.006	8.24	0.00007	6.29	-0.000005	3.61	0.436	-10	0.000013	0.00524	-0.0005	0.000148	-0.0002	0.0013	-0.0001
27-Oct-10	59																								
3-Nov-10	60	0.00122	0.004	0.000012	0.0044	7.05	0.00446	-0.01	0.0373	0.00042	0.007	8.11	0.00007	6.34	-0.000005	3.6	0.453	-10	0.000004	0.00447	-0.0005	#N/A	-0.0002	0.0005	-0.0001
10-Nov-10	61																								
17-Nov-10	62	0.00174	0.015	0.000151	0.0042	6.77	0.00401	-0.01	0.0298	0.00065	0.009	7.47	0.00008	6.43	-0.000005	3.4	0.437	-10	0.000009	0.00224	-0.0005	#N/A	-0.0002	0.0017	-0.0001
24-Nov-10	63																								
1-Dec-10	64	0.00224	0.015	0.000051	0.0037	6.12	0.00425	-0.01	0.0351	0.00059	0.015	7.04	0.00006	6.25	-0.000005	3.02	0.416	-10	0.000038	0.00274	-0.0005	0.000138	-0.0002	0.0011	-0.0001
8-Dec-10	65																								
15-Dec-10	66	0.00319	0.041	0.00005	0.0037	5.58	0.00235	-0.01	0.035	0.00048	0.009	6.54	0.0001	5.85	-0.000005	2.65	0.413	-10	0.000004	0.00287	-0.0005	0.000168	-0.0002	0.0013	-0.0001
22-Dec-10	67																								
29-Dec-10	68	0.00257	0.016	0.000052	0.0036	5.94	0.00171	-0.01	0.0327	0.00059	0.016	6.87	0.00006	5.79	-0.000005	2.78	0.435	-10	0.00004	0.00337	-0.0005	0.000255	-0.0002	0.0012	-0.0001
5-Jan-11	69																								
12-Jan-11	70	0.00212	0.042	0.00016	0.0033	5.91	0.0164	-0.01	0.0336	0.00051	0.011	6.22	0.00005	6.07	0.000011	2.76	0.388	-10	0.000036	0.00321	-0.0005	#N/A	-0.0002	0.0016	#N/A
19-Jan-11	71																								
26-Jan-11	72	0.00104	0.003	0.00005	0.0031	5.91	0.00547	-0.01	0.0317	0.00033	0.01	6.27	0.00007	5.78	-0.000005	2.8	0.393	-10	0.000034	0.00233	-0.0005	0.000122	-0.0002	0.0017	-0.0001
2-Feb-11	73																								
9-Feb-11	74																								
16-Feb-11	75																								
23-Feb-11	76																								
2-Mar-11	77																								
9-Mar-11	78																								
16-Mar-11	79																								
23-Mar-11	80																								
30-Mar-11	81																								
6-Apr-11	82																								
13-Apr-11	83																								
20-Apr-11	84	0.00134	0.059	#N/A	0.0027	5.16	#N/A	-0.01	0.0244	0.00057	0.02	5.69	0.00004	5.93	#N/A	2.36	0.388	-10	0.000019	0.00186	-0.0005	0.000155	-0.0002	0.0027	-0.0001
27-Apr-11	85																								
4-May-11	86																								
11-May-11	87																								
18-May-11	88																								
25-May-11	89																								
1-Jun-11	90																								
8-Jun-11	91																								
15-Jun-11	92																								
22-Jun-11	93																								
29-Jun-11	94																								
6-Jul-11	95																								
13-Jul-11	96	0.00231	0.03	0.000101	0.0031	5.79	0.00478	-0.01	0.0208	0.00044	0.013	5.61	-0.00004	5.78	0.000006	2.71	0.405	-10	0.000013	0.00113	-0.0005	0.000147	-0.0002	0.0013	-0.0001
20-Jul-11	97																								
27-Jul-11	98																								
3-Aug-11	99																								
10-Aug-11	100																								
17-Aug-11	101																								
24-Aug-11	102																								
31-Aug-11	103																								
7-Sep-11	104																								
14-Sep-11	105																								

Col 2 Bottom

CONFIDENTIAL *DRAFT*

Sample = 2351-35&36 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L
21-Sep-11	106	160	160	7.90	416	269																			
28-Sep-11	107	50	50	7.53	442	265																			
5-Oct-11	108	160	160	7.62	378	243	#N/A	5.5	132.8	3	0.65	0.6	0.59	111	0.0087	#N/A	0.00027	0.484	-0.00001	-0.000005	-0.05	0.000013	37.1	0.0002	0.000023
12-Oct-11	109	50	50	7.89	390	240																			
19-Oct-11	110	50	50	7.82	378	238																			
26-Oct-11	111	50	50	7.88	393	241																			
2-Nov-11	112	50	50	7.56	395	249																			
9-Nov-11	113	50	50	7.54	392	262																			
16-Nov-11	114	50	50	7.80	390	238																			
23-Nov-11	115	50	50	7.45	200	238																			
30-Nov-11	116	50	50	7.30	407	241																			
7-Dec-11	117	50	50	7.31	429	237																			
14-Dec-11	118	50	50	7.33	470	235																			
21-Dec-11	119	50	50	7.23	492	240																			
28-Dec-11	120	160	160	7.73	560	241	#N/A	4.8	148.1	2	0.85	-0.5	0.52	107	0.0041	0.00006	0.00031	0.462	-0.00001	-0.000005	-0.05	-0.000005	34.4	-0.0001	0.00005
4-Jan-12	121	50	50	7.45	584	239																			
11-Jan-12	122	50	50	7.56	617	230																			
18-Jan-12	123	50	50	7.55	645	233																			
25-Jan-12	124	50	50	7.63	623	291																			
1-Feb-12	125	50	50	7.54	573	236																			
8-Feb-12	126	50	50	7.41	526	228																			
15-Feb-12	127	50	50	7.41	535	233																			
22-Feb-12	128	50	50	7.43	629	227																			
29-Feb-12	129	50	50	7.64	551	217																			
7-Mar-12	130	50	50	7.67	612	210																			
14-Mar-12	131	50	50	7.85	430	248																			
21-Mar-12	132	160	160	7.68	480	239	#N/A	5.5	133.5	5	0.80	-0.5	0.46	110	0.0063	0.00005	0.00024	0.484	-0.00001	-0.000005	-0.05	0.000012	36.1	0.0001	0.000086
28-Mar-12	133	50	50	7.95	633	230																			
4-Apr-12	134	50	50	7.62	542	227																			
11-Apr-12	135	50	50	7.52	586	224																			
18-Apr-12	136	50	50	7.78	566	230																			
25-Apr-12	137	50	50	7.85	628	231																			
2-May-12	138	50	50	7.72	630	221																			
9-May-12	139	50	50	7.51	629	188																			
16-May-12	140	50	50	7.51	601	225																			
23-May-12	141	50	50	7.64	584	183																			
30-May-12	142	50	50	7.78	585	180																			
6-Jun-12	143	50	50	7.74	531	243																			
13-Jun-12	144	160	160	7.53	570	218	#N/A	8.4	135.5	4	1.18	0.91	0.45	105	0.0047	0.000031	0.00026	0.504	-0.00001	-0.000005	-0.05	-0.000005	33.9	#N/A	0.0000344
20-Jun-12	145	50	50	7.50	557	200																			
27-Jun-12	146	50	50	7.28	520	180																			
4-Jul-12	147	50	50	7.82	545	176																			
11-Jul-12	148	50	50	7.99	541	162																			
18-Jul-12	149	50	50	7.84	578	222																			
25-Jul-12	150	50	50	7.64	499	215																			
1-Aug-12	151	50	50	7.58	556	216																			
8-Aug-12	152	50	50	7.78	545	223																			
15-Aug-12	153	50	50	7.41	540	215																			
22-Aug-12	154	50	50	7.17	643	209																			
29-Aug-12	155	50	50	7.47	648	180																			
5-Sep-12	156	160	160	7.20	596	176	#N/A	6.2	123.8	5	1.12	#N/A	0.38	97.3	0.00482	0.000046	0.00019	0.474	-0.00001	-0.000005	-0.05	-0.000005	31.6	-0.0001	0.000024
12-Sep-12	157	50	50	7.78	664	174																			
19-Sep-12	158	50	50	7.40	564	215																			

Col 2 Bottom

Sample = 2351-35&36 Composite

Date	Cycle No.	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
21-Sep-11	106																								
28-Sep-11	107																								
5-Oct-11	108	0.00105	0.046	#N/A	0.0031	4.57	0.0182	-0.01	0.0209	0.00042	0.008	4.98	0.00008	5.78	0.00001	1.94	0.382	-10	#N/A	0.00164	-0.0005	0.000184	-0.0002	0.0023	-0.0001
12-Oct-11	109																								
19-Oct-11	110																								
26-Oct-11	111																								
2-Nov-11	112																								
9-Nov-11	113																								
16-Nov-11	114																								
23-Nov-11	115																								
30-Nov-11	116																								
7-Dec-11	117																								
14-Dec-11	118																								
21-Dec-11	119																								
28-Dec-11	120	0.00197	0.038	0.000161	0.0026	5.07	0.0346	-0.01	0.0175	0.0005	0.02	5.5	0.00009	5.29	0.00002	2.19	0.363	-10	0.000014	0.00084	-0.0005	0.000144	-0.0002	0.002	-0.0001
4-Jan-12	121																								
11-Jan-12	122																								
18-Jan-12	123																								
25-Jan-12	124																								
1-Feb-12	125																								
8-Feb-12	126																								
15-Feb-12	127																								
22-Feb-12	128																								
29-Feb-12	129																								
7-Mar-12	130																								
14-Mar-12	131																								
21-Mar-12	132	0.00159	0.02	#N/A	0.0025	4.89	0.0241	-0.01	0.0163	#N/A	0.013	5.23	0.00004	5.35	0.000015	1.97	0.339	-10	0.00001	0.0008	-0.0005	0.000162	-0.0002	0.002	-0.0001
28-Mar-12	133																								
4-Apr-12	134																								
11-Apr-12	135																								
18-Apr-12	136																								
25-Apr-12	137																								
2-May-12	138																								
9-May-12	139																								
16-May-12	140																								
23-May-12	141																								
30-May-12	142																								
6-Jun-12	143																								
13-Jun-12	144	0.00072	0.0228	5.51E-05	0.00265	4.81	0.0284	-0.01	0.016	0.00036	0.008	4.6	0.000049	5.43	0.0000069	2.09	0.34	-10	1.17E-05	0.00089	-0.0005	0.000183	-0.0002	0.00248	-0.0001
20-Jun-12	145																								
27-Jun-12	146																								
4-Jul-12	147																								
11-Jul-12	148																								
18-Jul-12	149																								
25-Jul-12	150																								
1-Aug-12	151																								
8-Aug-12	152																								
15-Aug-12	153																								
22-Aug-12	154																								
29-Aug-12	155																								
5-Sep-12	156	0.00176	0.0108	0.000179	0.00211	4.49	0.0125	-0.01	0.0132	0.0004	0.0129	4.45	-0.00004	5.03	#N/A	2.37	0.3	-10	0.00001	0.0006	-0.0005	0.000244	-0.0002	0.00121	-0.0001
12-Sep-12	157																								
19-Sep-12	158																								

Col 2 Bottom

CONFIDENTIAL *DRAFT*

Sample = 2351-35&36 Composite

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	DO mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L
26-Sep-12	159	50	50	7.41	580	220																			
3-Oct-12	160	50	50	7.95	597	212																			
10-Oct-12	161	50	50	7.82	627	218																			
17-Oct-12	162	50	50	8.00	498	202																			
24-Oct-12	163	50	50	7.64	431	218																			
31-Oct-12	164	50	50	7.67	445	221																			
7-Nov-12	165	50	50	7.24	550	223																			
14-Nov-12	166	50	50	7.48	587	226																			
21-Nov-12	167	50	50	7.52	565	224																			
28-Nov-12	168	160	160	7.37	492	221	#N/A	11.7	134.7	9	2.11	0.82	0.29	98.6	0.011	#N/A	0.00029	0.486	-0.00001	-0.000005	-0.05	#N/A	32.2	0.00025	0.00004
5-Dec-12	169	50	50	7.47	530	216																			
12-Dec-12	170	50	50	7.53	448	222																			
19-Dec-12	171	50	50	7.26	604	216																			
26-Dec-12	172	50	50	7.58	613	213																			
2-Jan-13	173	50	50	7.51	621	207																			
9-Jan-13	174	50	50	6.92	597	208																			
16-Jan-13	175	50	50	7.87	545	198																			
23-Jan-13	176	50	50	7.31	560	222																			
30-Jan-13	177	50	50	7.22	585	215																			
6-Feb-13	178	50	50	7.32	476	215																			
13-Feb-13	179	50	50	7.40	551	226																			
20-Feb-13	180	160	160	7.69	531	221	#N/A	6.2	137.5	8	1.32	-0.5	0.29	101	0.00701	0.00012	0.0003	0.501	-0.00001	0.000039	-0.05	-0.000005	32.8	-0.0001	0.000046
27-Feb-13	181	50	50	7.21	602	190																			
6-Mar-13	182	50	50	8.00	618	208																			
13-Mar-13	183	50	50	7.69	577	215																			
20-Mar-13	184	50	50	8.07	570	228																			
27-Mar-13	185	50	50	7.29	550	212																			
3-Apr-13	186	50	50	7.39	401	220																			
10-Apr-13	187	50	50	7.49	581	217																			
17-Apr-13	188	50	50	7.50	582	222																			
24-Apr-13	189	50	50	7.76	469	219																			
1-May-13	190	50	50	7.43	420	216																			
8-May-13	191	50	50	7.17	528	219																			
15-May-13	192	160	160	6.96	490	223	#N/A	11.5	115.2	4	1.21	-0.5	0.29	99.9	0.00668	0.000052	0.00018	0.539	-0.00001	-0.000005	-0.05	0.000005	32.2	-0.0001	0.000039
22-May-13	193	50	50	7.18	552	219																			
29-May-13	194	50	50	7.18	565	220																			

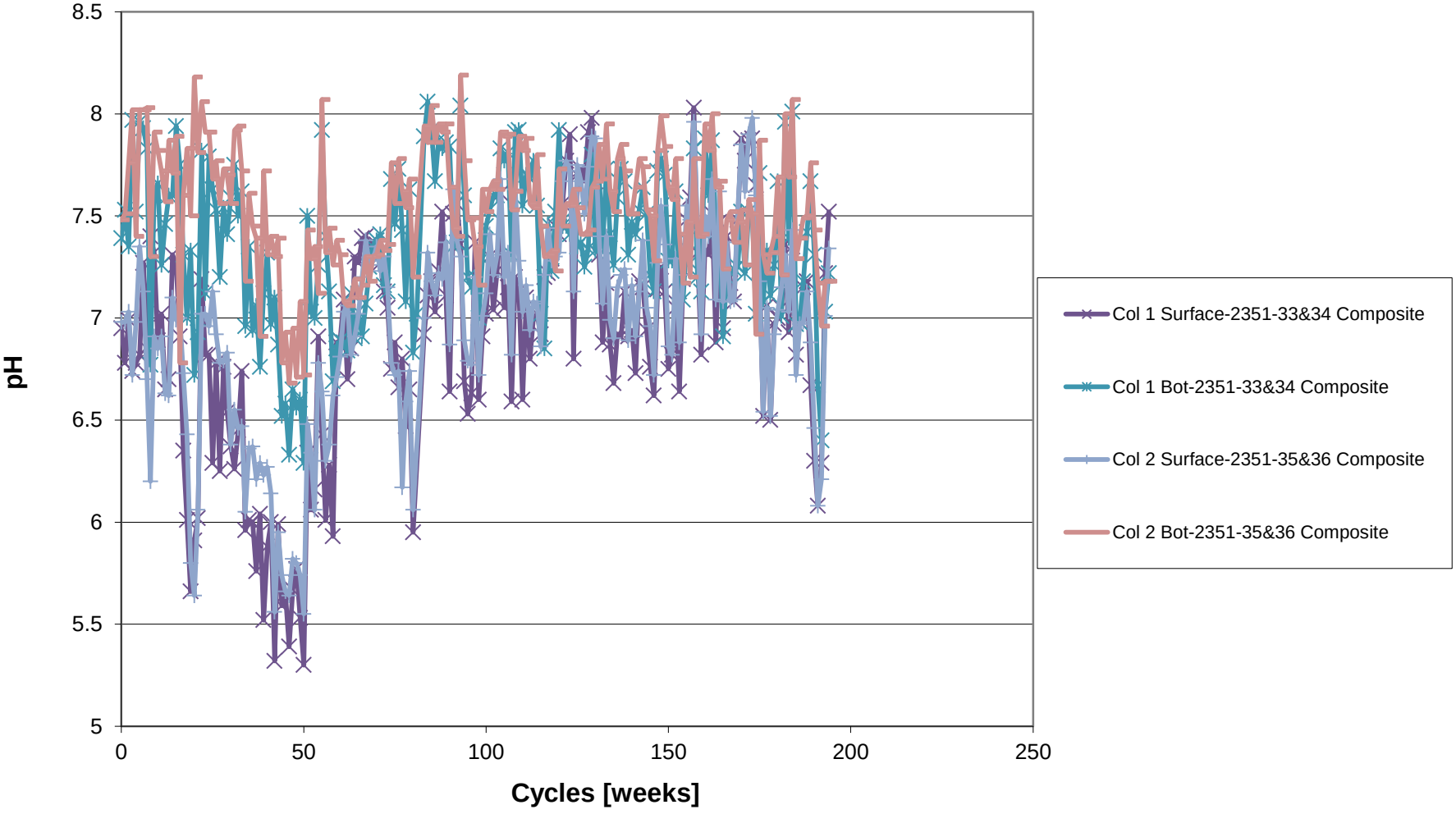
Col 2 Bottom

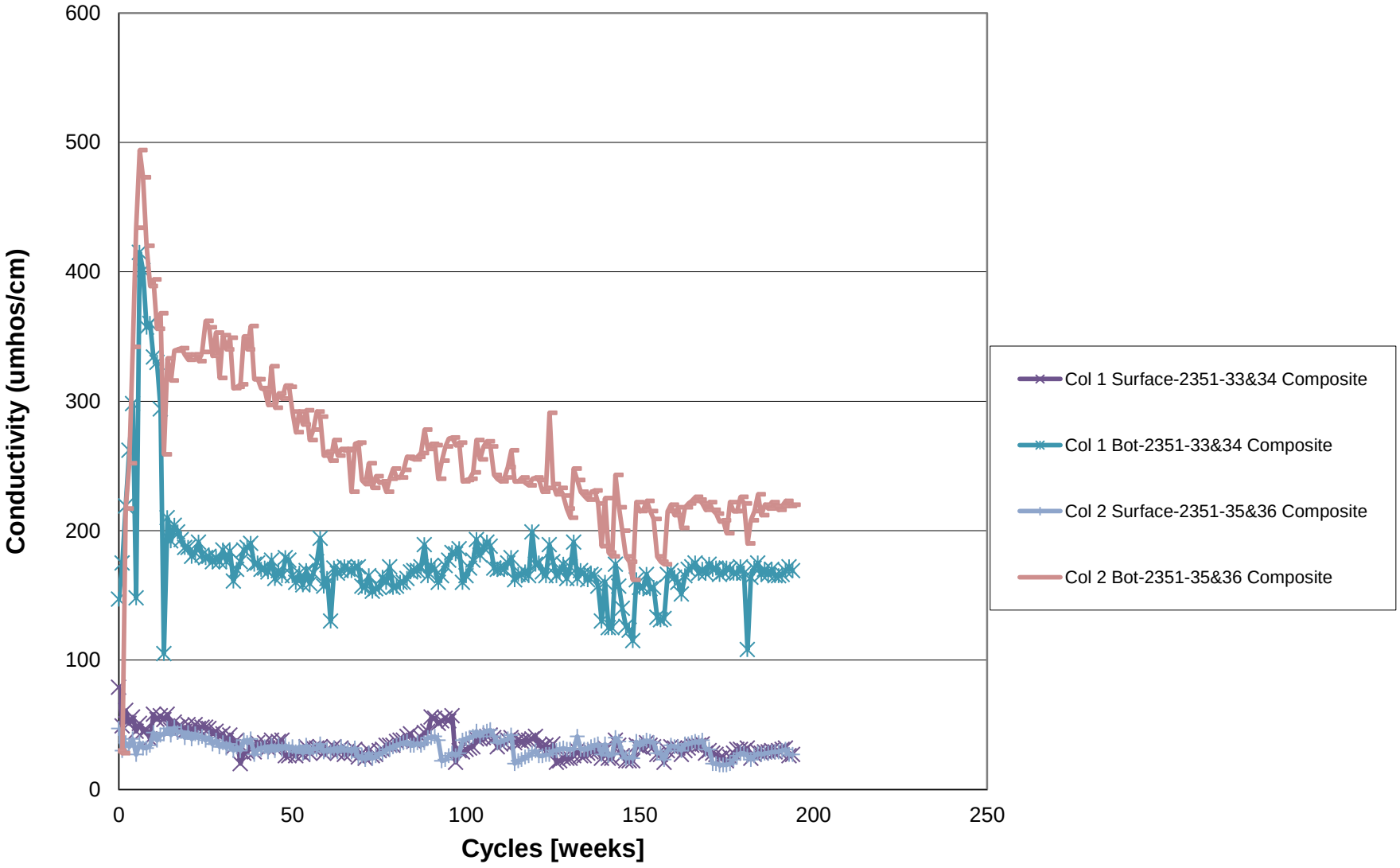
Sample = 2351-35&36 Composite

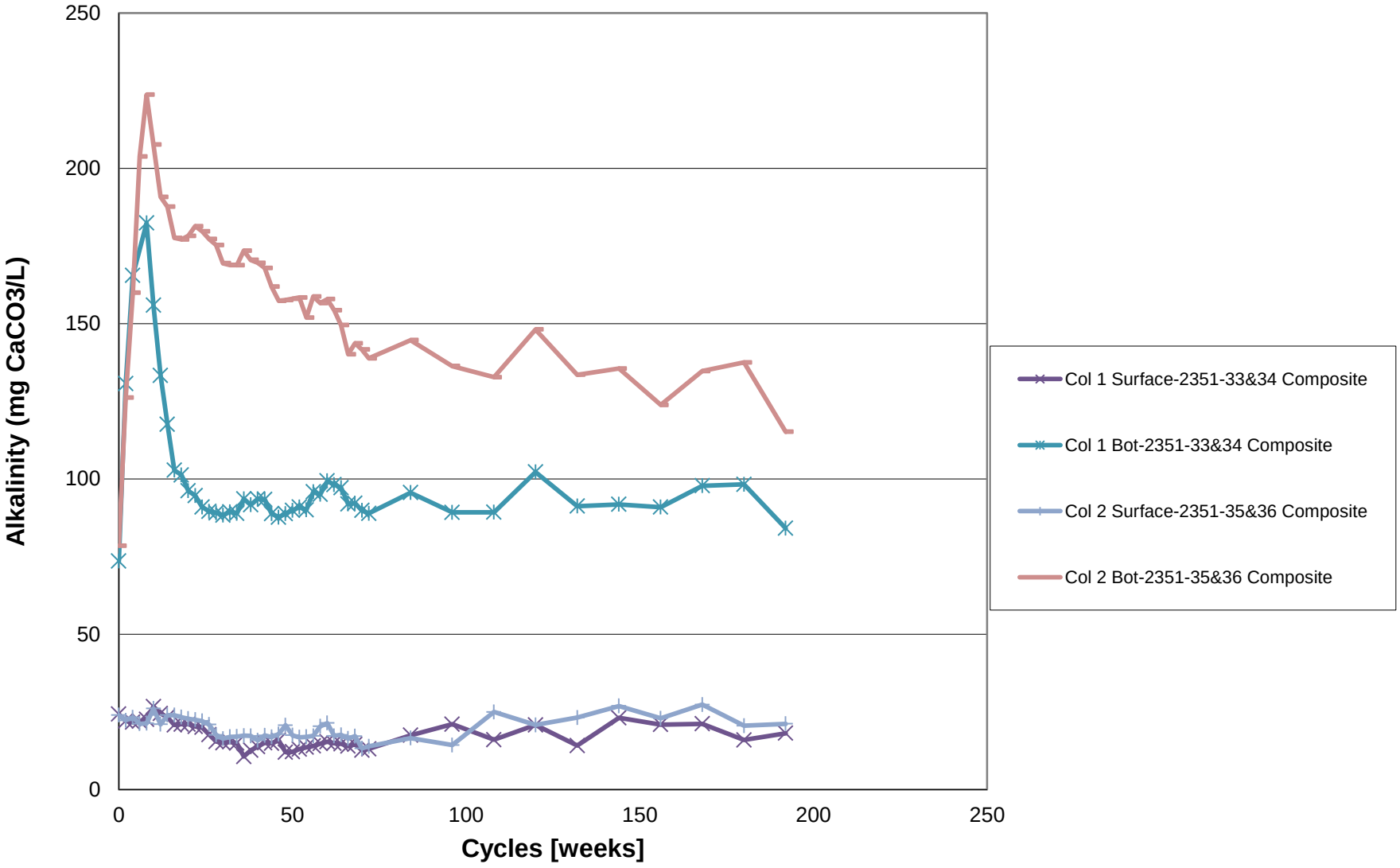
Date	Cycle No.	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
26-Sep-12	159																								
3-Oct-12	160																								
10-Oct-12	161																								
17-Oct-12	162																								
24-Oct-12	163																								
31-Oct-12	164																								
7-Nov-12	165																								
14-Nov-12	166																								
21-Nov-12	167																								
28-Nov-12	168	0.00137	0.0243	0.000168	0.00204	4.42	0.0407	-0.01	0.0119	0.00057	0.0163	4	0.000061	5.13	0.000005	1.73	0.294	-3	0.000013	0.00138	-0.0005	0.000166	0.00044	#N/A	-0.0001
5-Dec-12	169																								
12-Dec-12	170																								
19-Dec-12	171																								
26-Dec-12	172																								
2-Jan-13	173																								
9-Jan-13	174																								
16-Jan-13	175																								
23-Jan-13	176																								
30-Jan-13	177																								
6-Feb-13	178																								
13-Feb-13	179																								
20-Feb-13	180	0.00052	0.0119	0.000023	0.00195	4.59	0.0505	-0.01	0.0114	0.00042	0.015	4.23	-0.00004	5.2	0.000043	1.58	0.303	-3	0.000011	0.00063	-0.0005	0.000203	-0.0002	0.00203	-0.0001
27-Feb-13	181																								
6-Mar-13	182																								
13-Mar-13	183																								
20-Mar-13	184																								
27-Mar-13	185																								
3-Apr-13	186																								
10-Apr-13	187																								
17-Apr-13	188																								
24-Apr-13	189																								
1-May-13	190																								
8-May-13	191																								
15-May-13	192	0.00079	0.0154	0.000037	0.00199	4.72	0.0581	-0.01	0.0111	0.00056	0.012	4.13	-0.00004	4.73	0.000061	1.58	0.305	-3	0.000003	0.00046	-0.0005	0.000186	-0.0002	0.00157	-0.0001
22-May-13	193																								
29-May-13	194																								

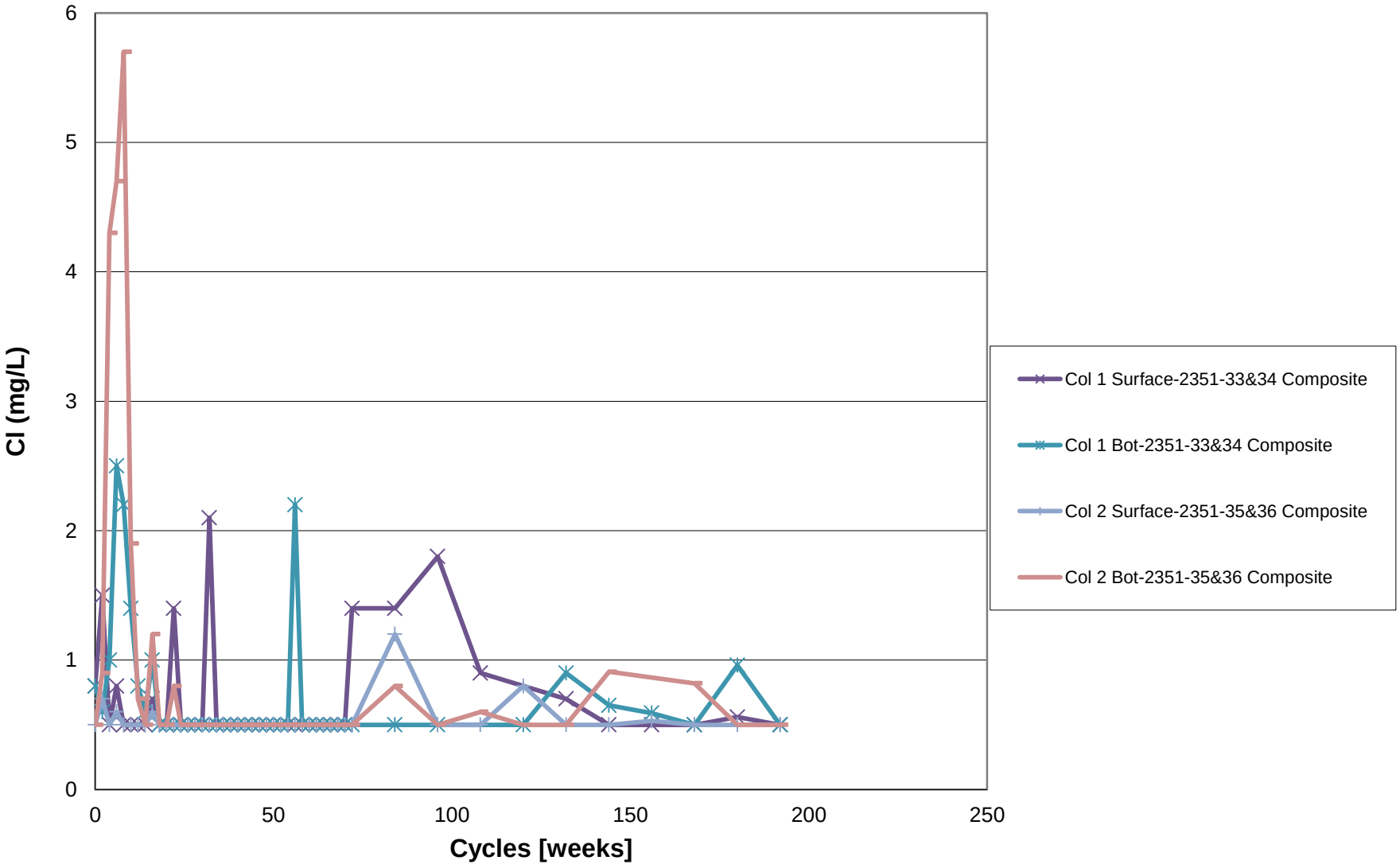
Jan 13/10 Ti 0.018. Repeat =0.00008.
May 5/10 F 0.51. Repeat = 1.64
June 2/10 As 0.00107. Repeat = 0.00106. Data confirmed.
Oct 6/10 Tl 0.000112. Repeat = sample discarded.
Nov 3/10 U 0.00268. Repeat = sample discarded.
Nov 17/10 Cl 1.4. Repeat = -0.5.
Nov 17/10 U 0.00156. Cannot repeat. Sample discarded.
Feb 4/11 Change in analytical schedule.
Mar 30/11 pH 6.71. Suspect probe malfunction.
April 6/11 pH 6.70. Suspect probe malfunction.
April 20/11 Ag 0.000065, Mn 0.043 and Pb 0.000392 . Repeat Pb= 0.000439, Mn= 0.051, data confirmed suspect contamination. Cannot repeat Ag, suspect contamination or analytical error
Jan 12/11 U 0.000644 and Zr 0.0013. Cannot repeat.
Oct 5/11 Pb=0.000295, repeat=0.000281. data confirmed, suspect contamination
Oct 5/11 Tl=0.000053, repeat=0.000056. Data confirmed suspect contamination
Oct 5/11 Sb=0.00013, repeat=0.00011. Data confirmed, suspect contamination
Mar 21/12 Pb=0.00201, repeat=0.00203. Data confirmed, suspect contamination
Mar 21/12 Ni=0.00135. Cannot repeat, suspect contamination or analytical error
Sept 5/12 Cl=1.7, Ag=0.000051. repeat Cl=1.3, Ag=0.000057. Data confirmed suspect contamination
Jun 13/12 Cr=0.00487, repeat=0.00525. Data confirmed, suspect contamination or analytical error
Nov 28/12 Sb=0.000498, Cd=0.000348, Zn=0.00458, Cannot repeat not enough sample. Suspect contamination or analytical error

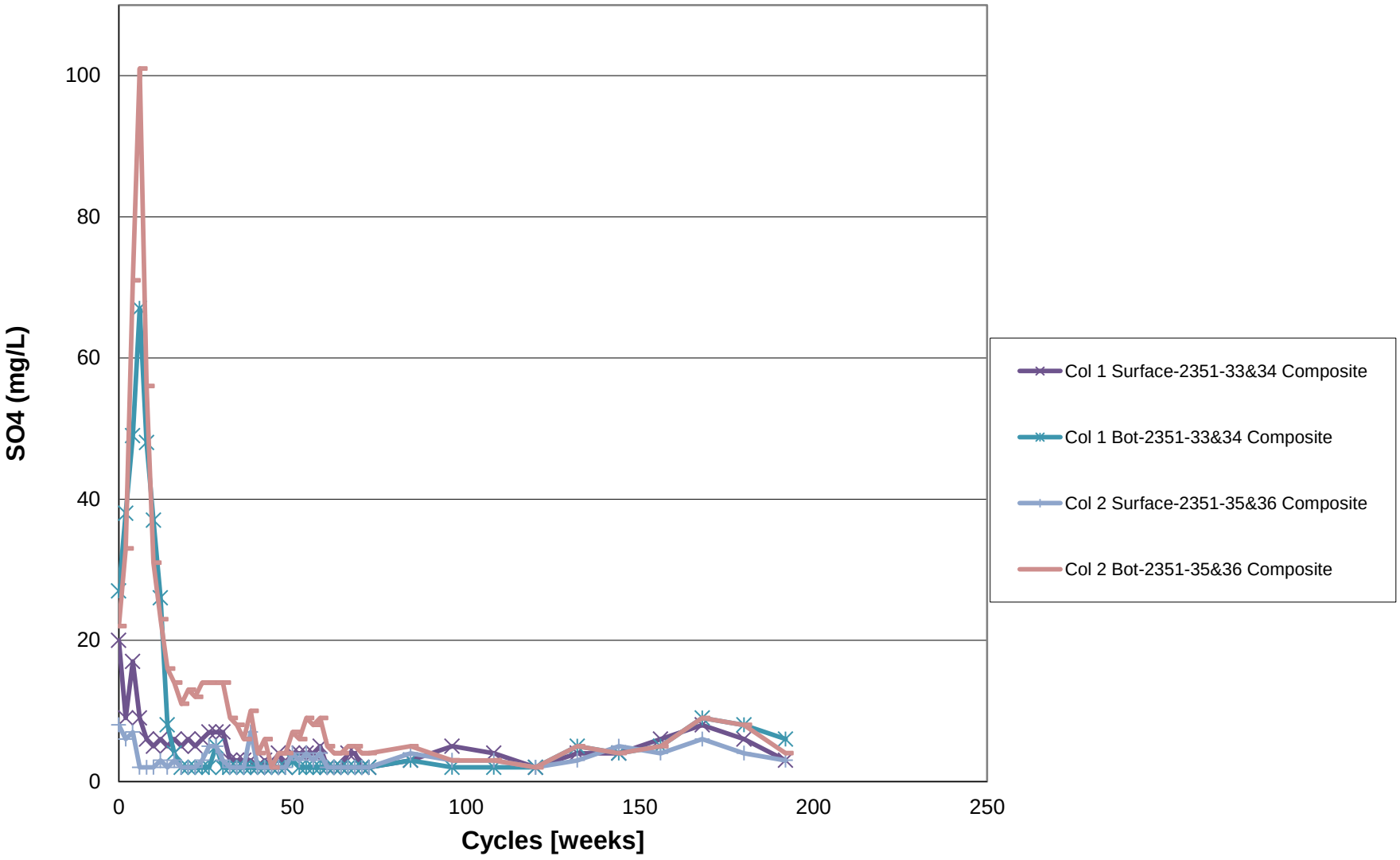
Appendix G4
Phase V/VI Tailings Saturated Column Test Results: Charts

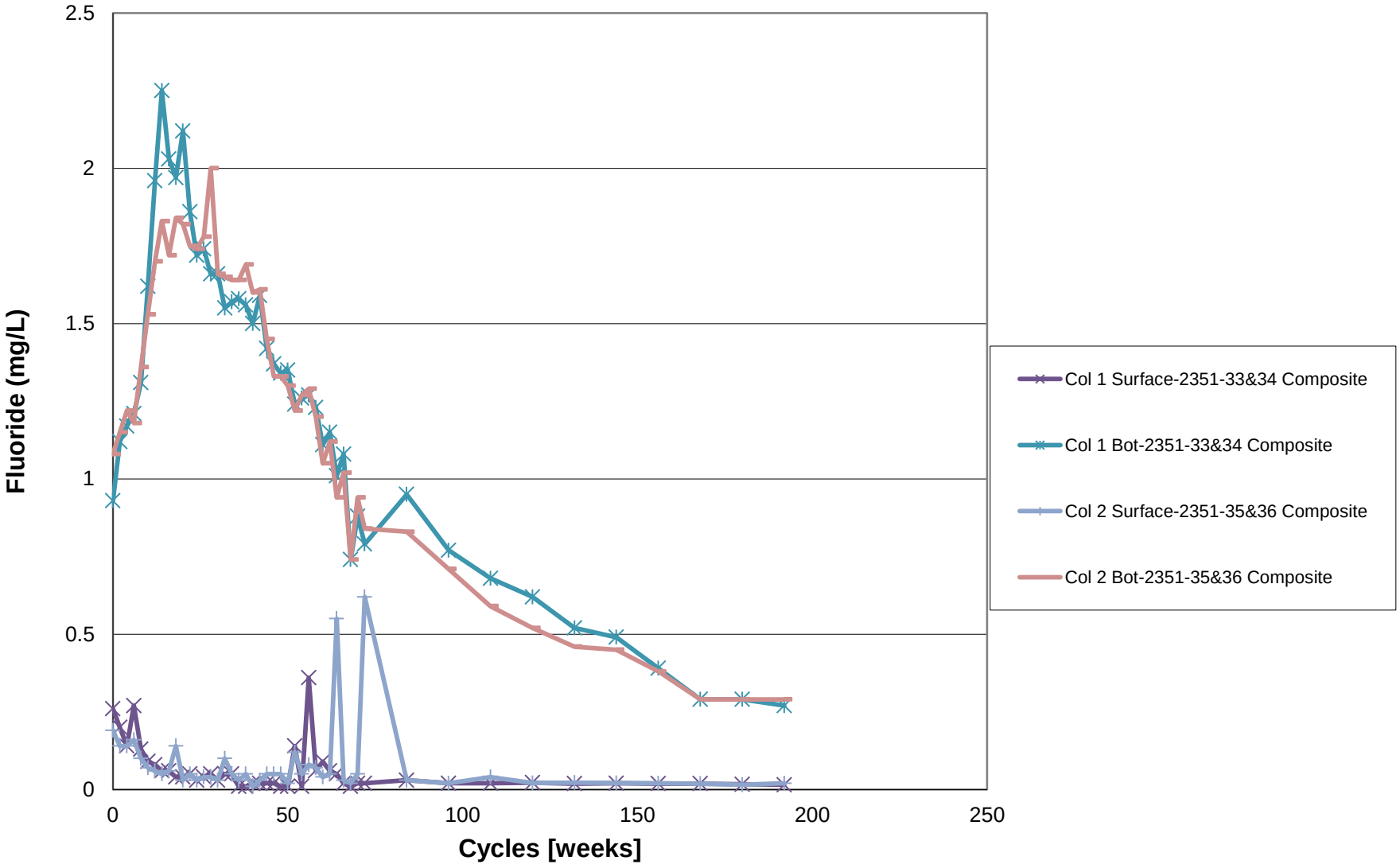

8.5
8
7.5
7
6.5
6
5.5
5
pH
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

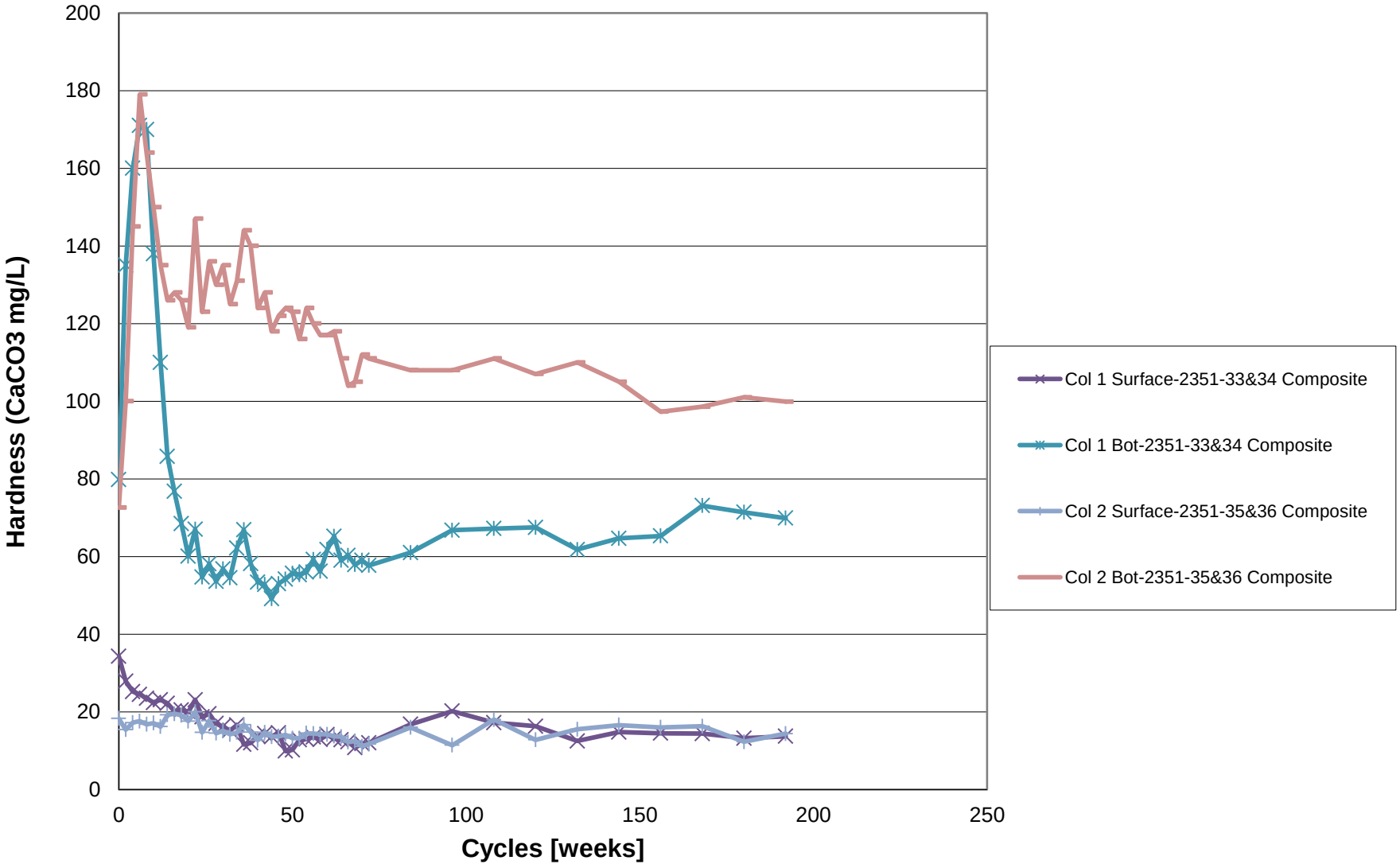

600
500
400
300
200
100
0
Conductivity (umhos/cm)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

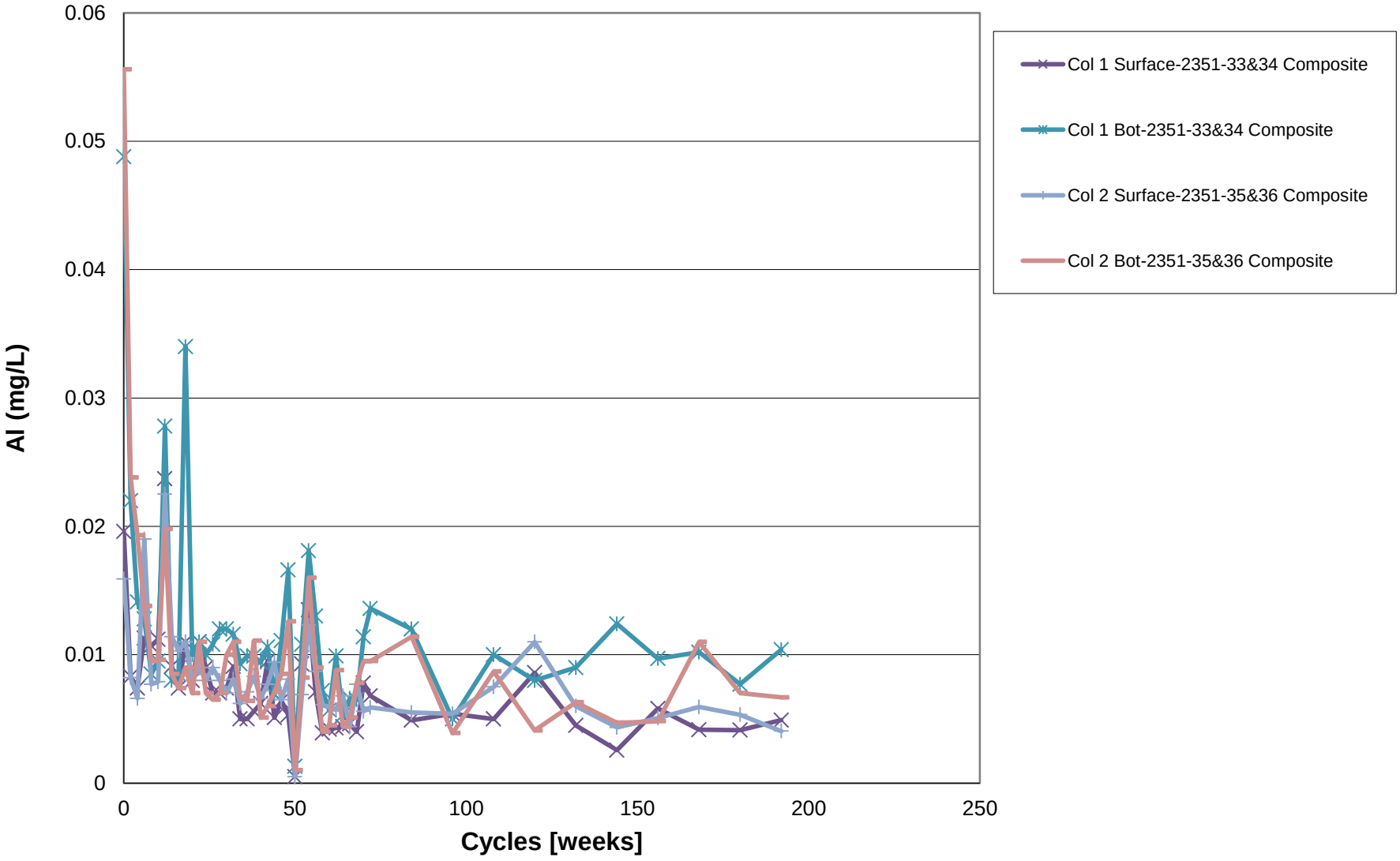

250
200
150
100
50
0
Alkalinity (mg CaCO3/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

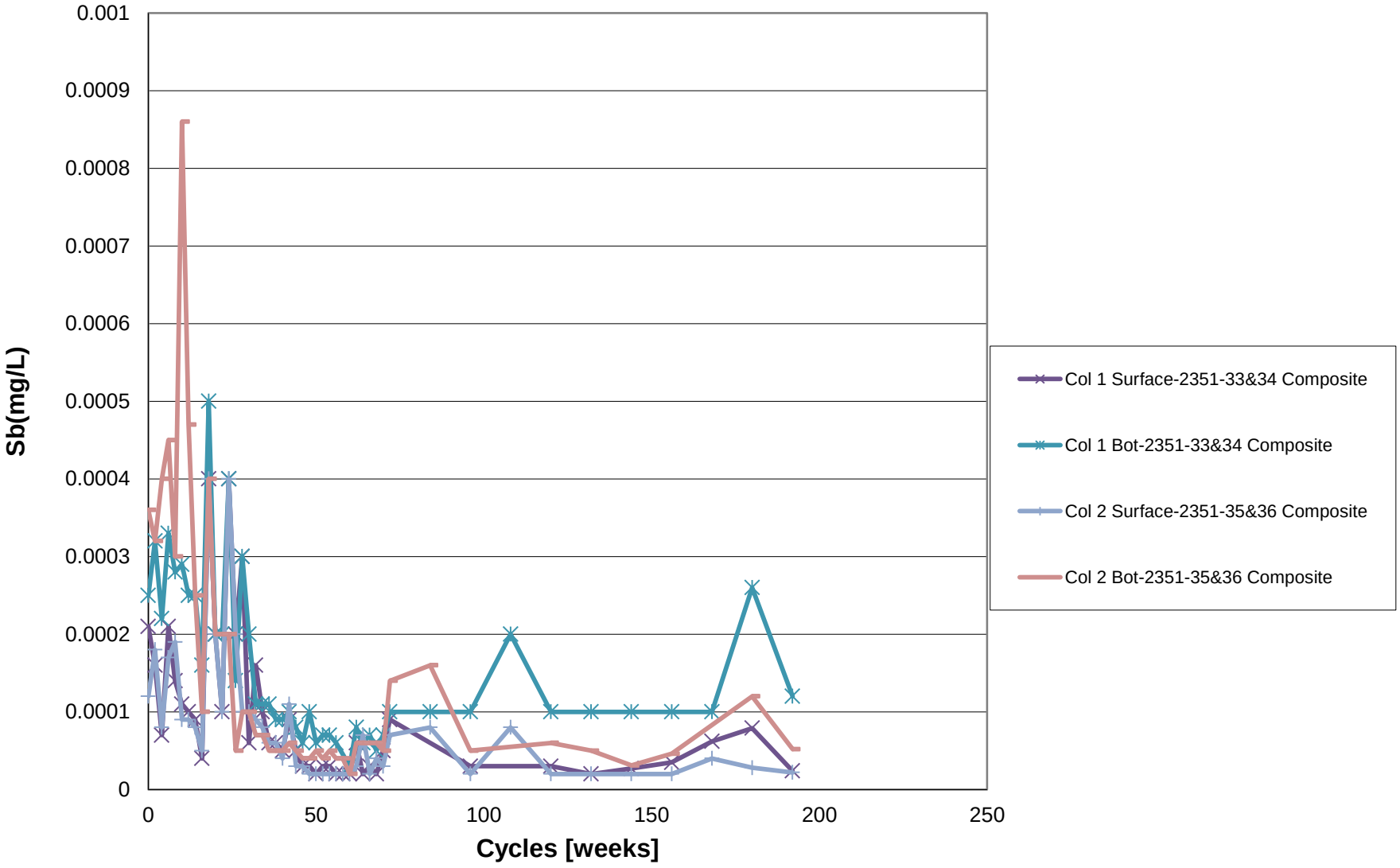

6
5
4
3
2
1
0
Cl (mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

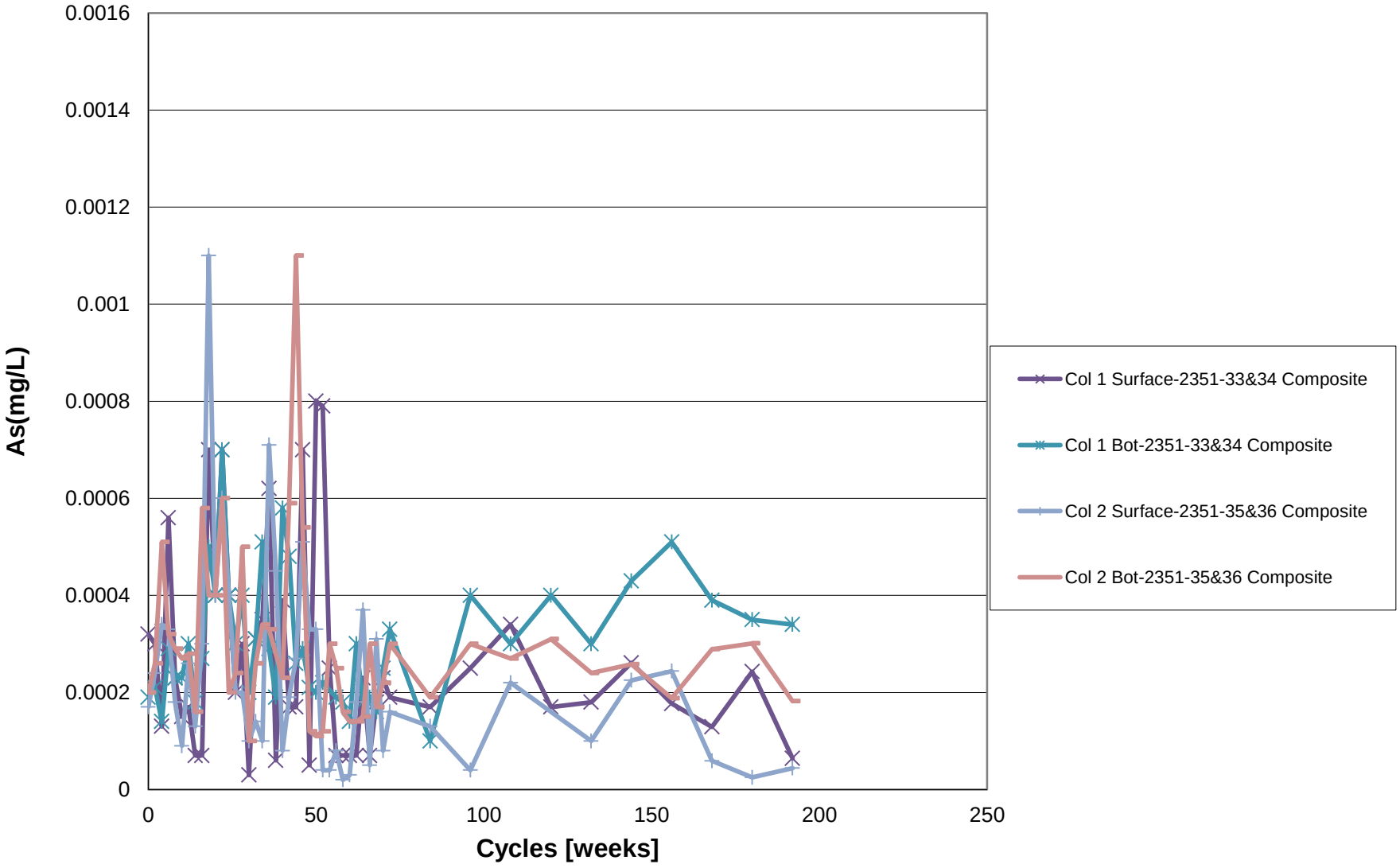

SO4 (mg/L)
100
80
60
40
20
0
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

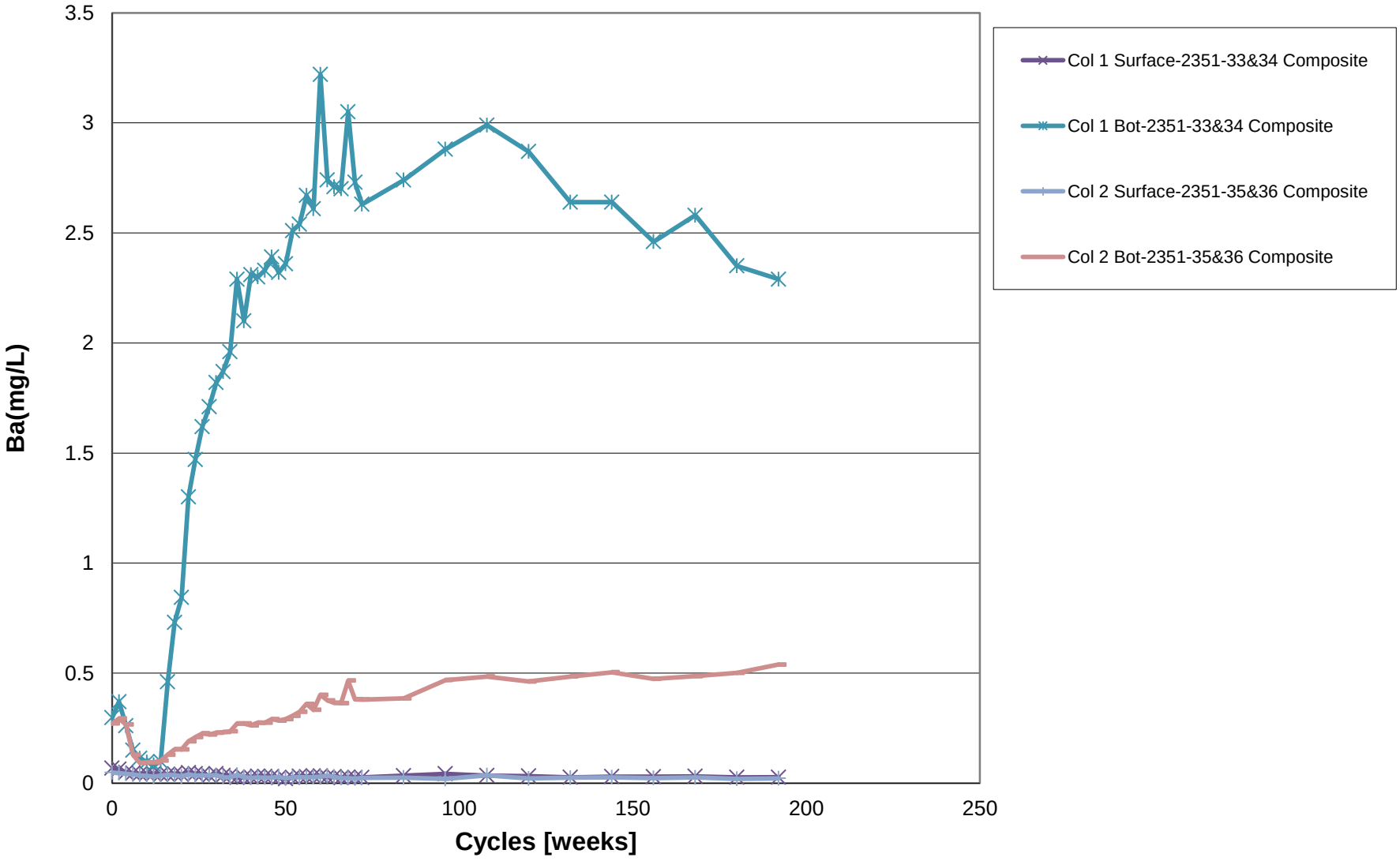

2.5
2
1.5
1
0.5
0
Fluoride (mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

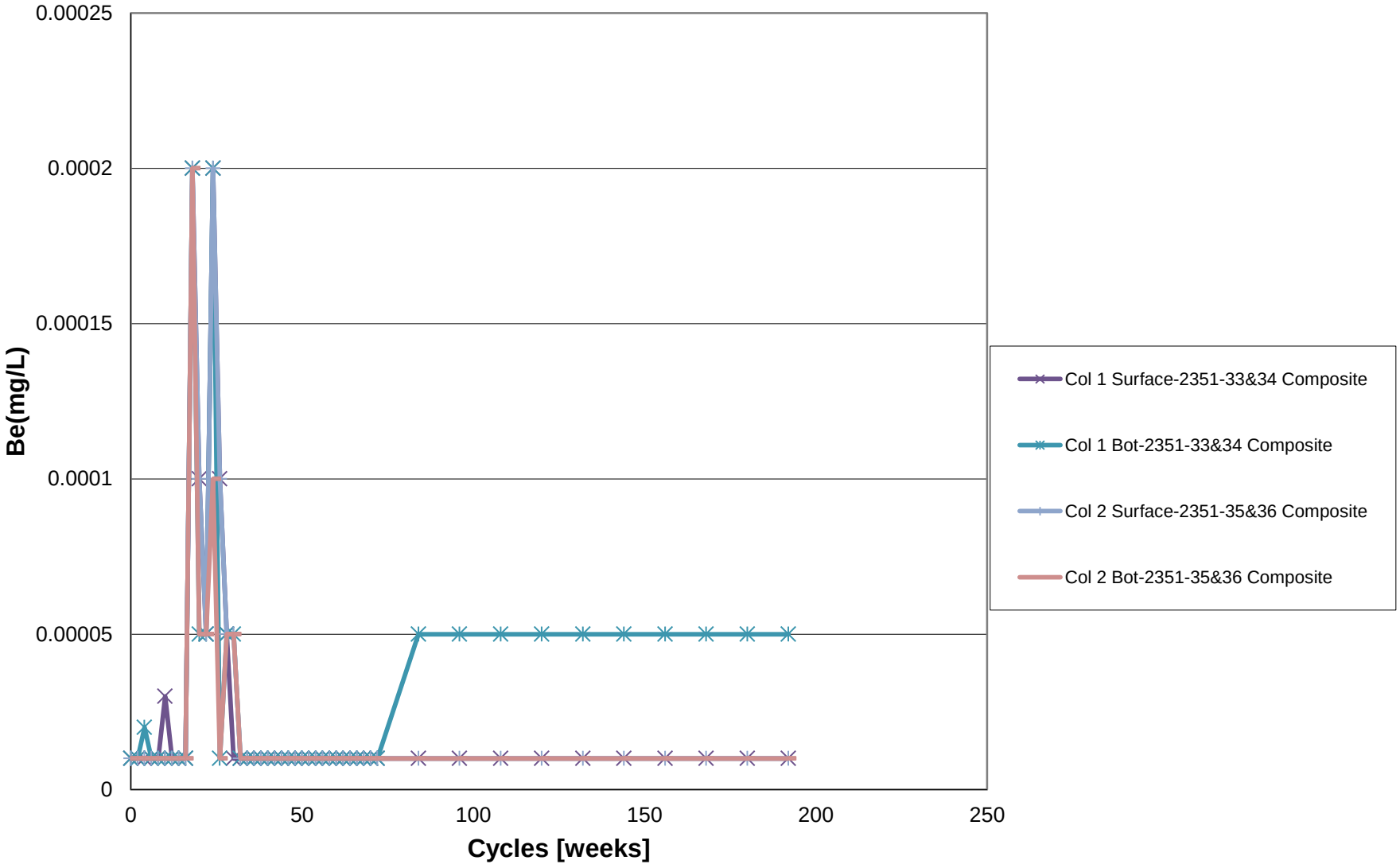

200
180
160
140
120
100
80
60
40
20
0
Hardness (CaCO3 mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

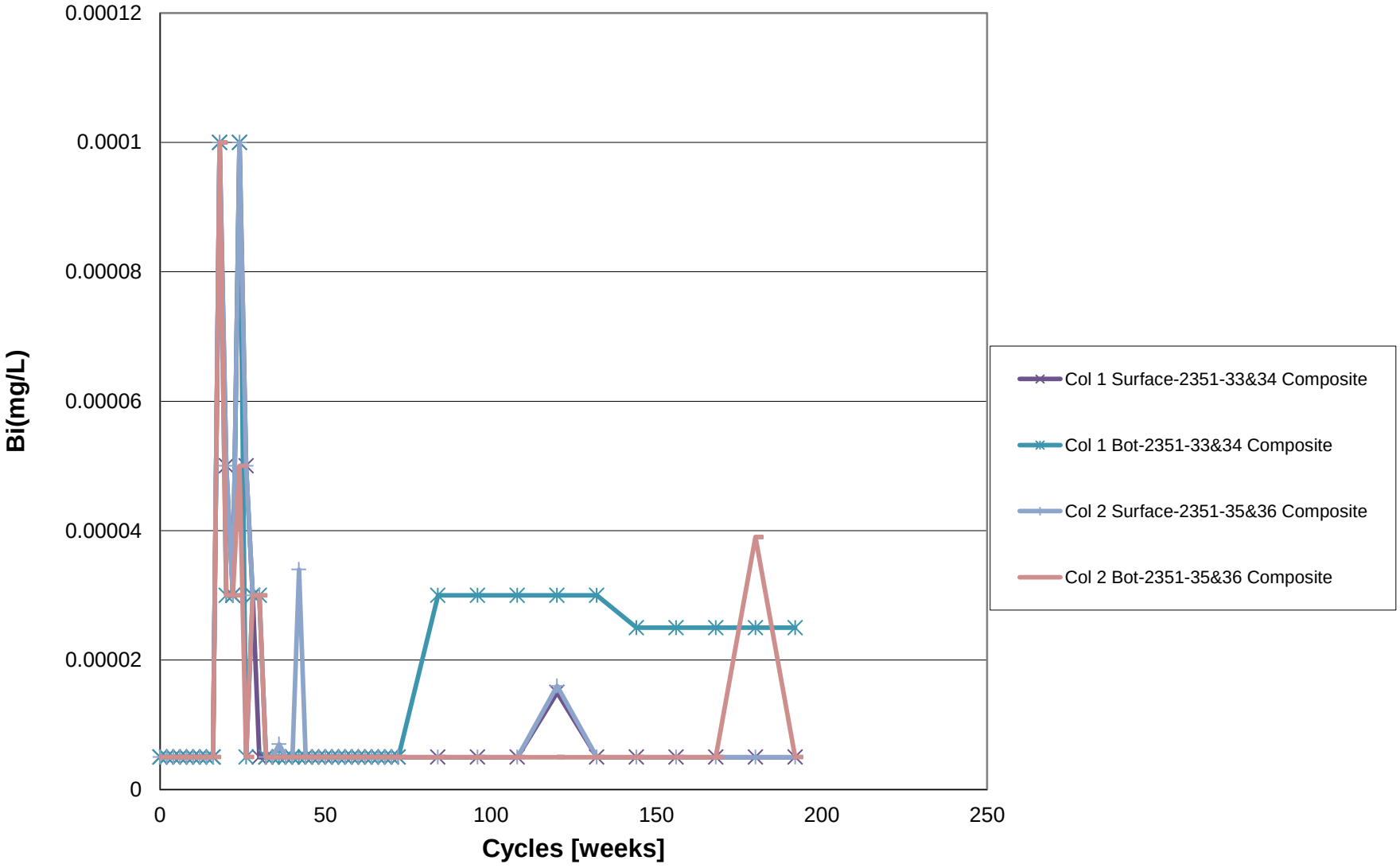

0.06
0.05
0.04
0.03
0.02
0.01
0
Al (mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

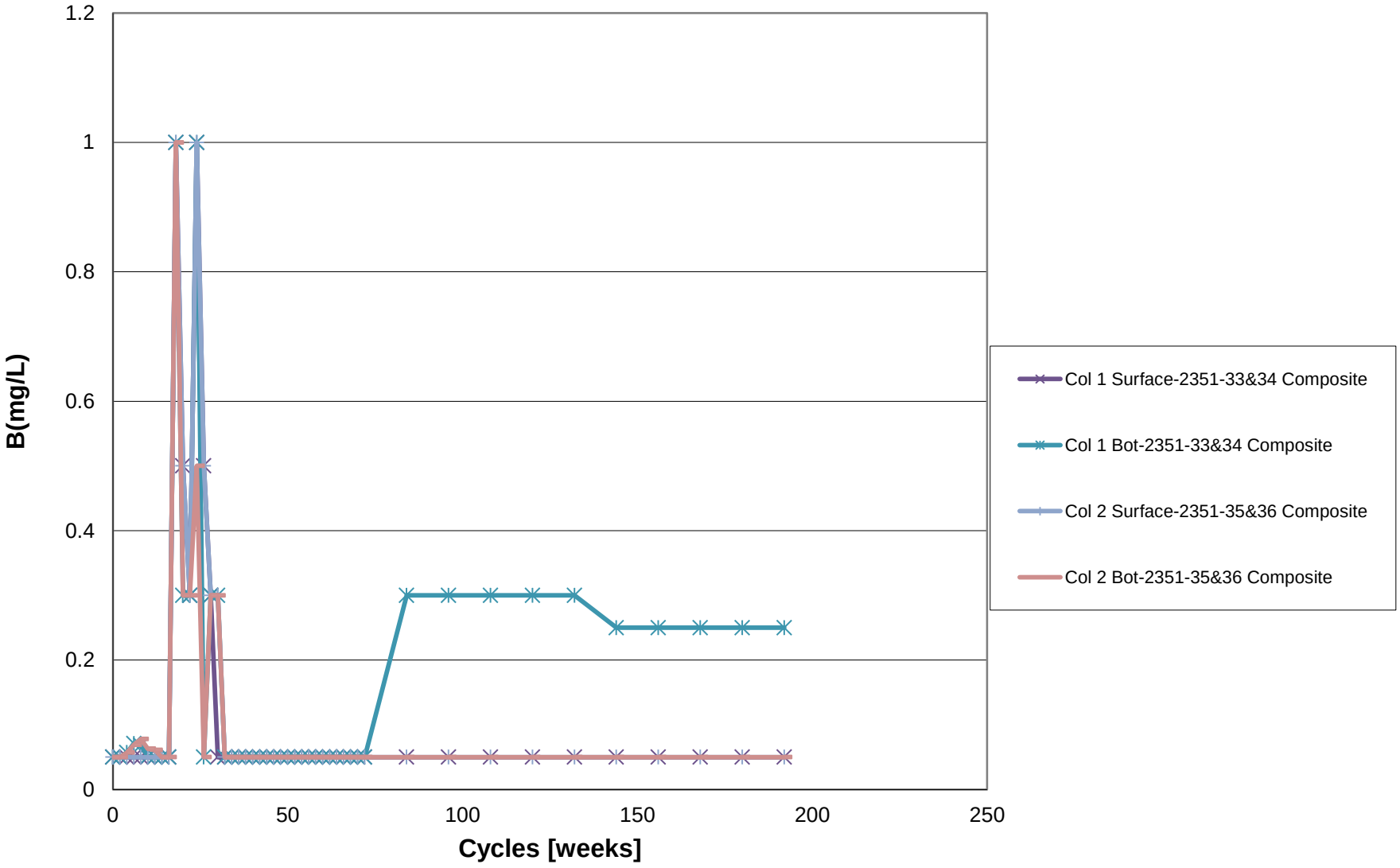

0.001
0.0009
0.0008
0.0007
0.0006
0.0005
0.0004
0.0003
0.0002
0.0001
0
Sb(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

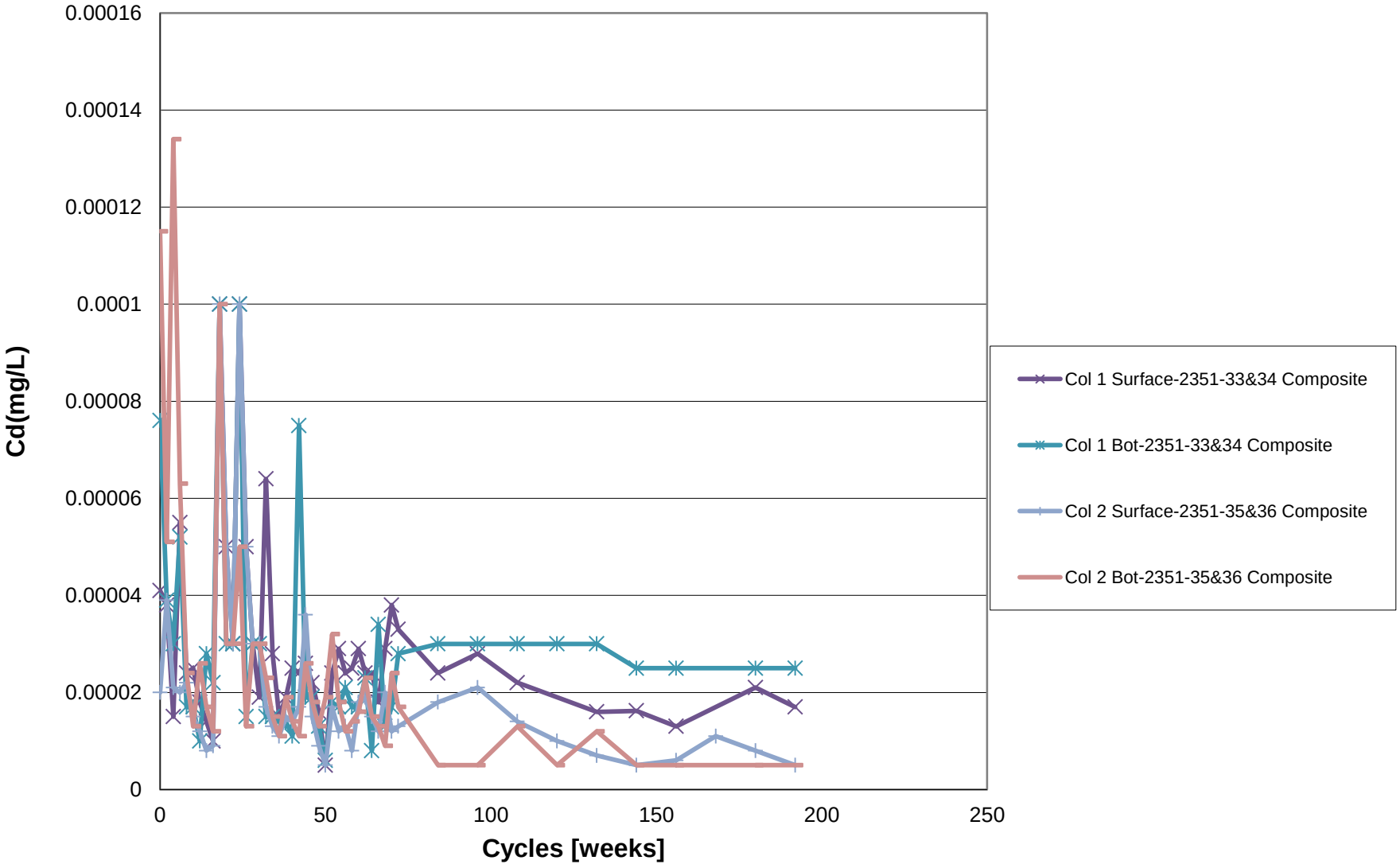

0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
As(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

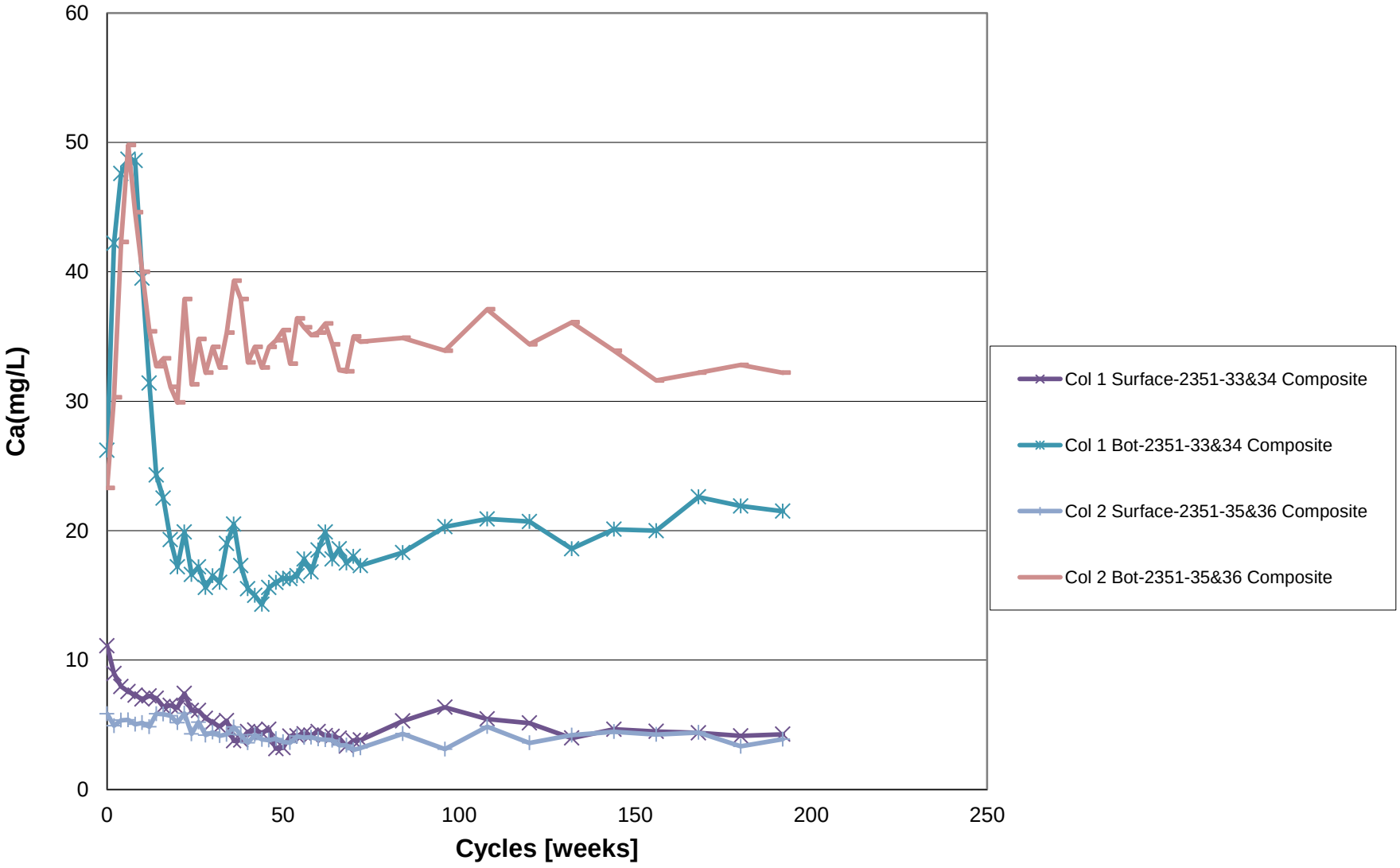

3.5
3
2.5
2
1.5
1
0.5
0
Ba(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

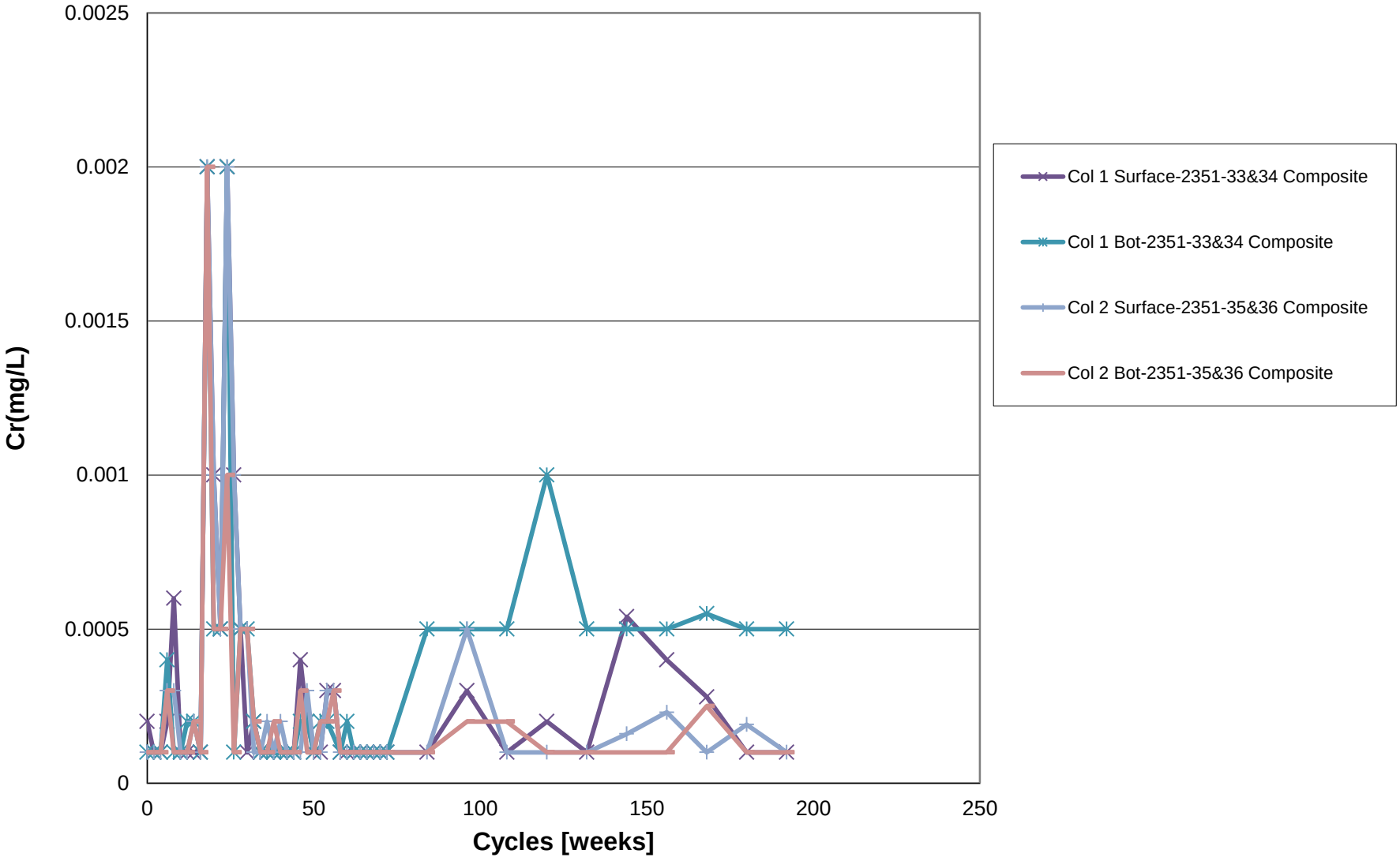

0.00025
0.0002
0.00015
0.0001
0.00005
0
Be(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

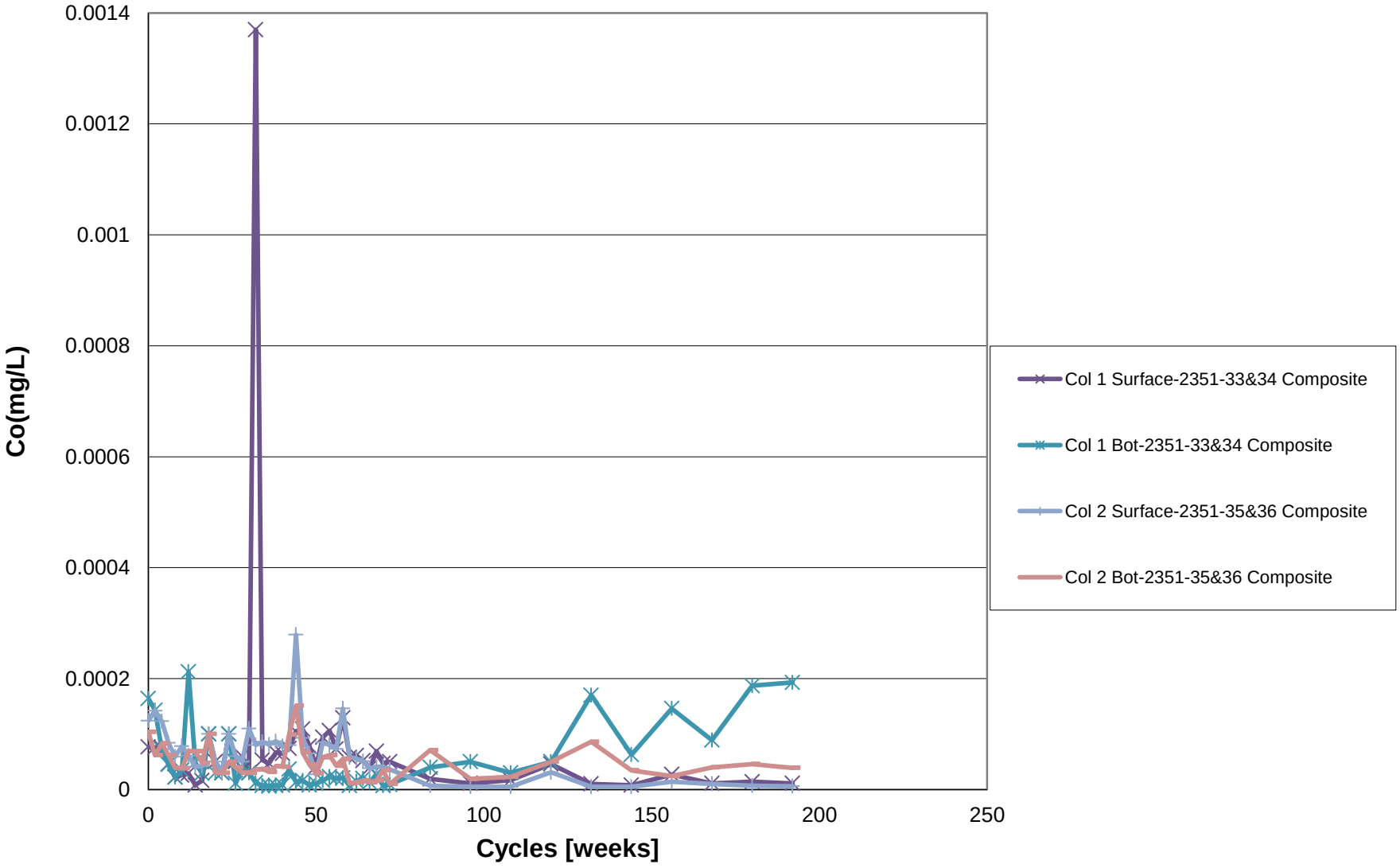

0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
Bi(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

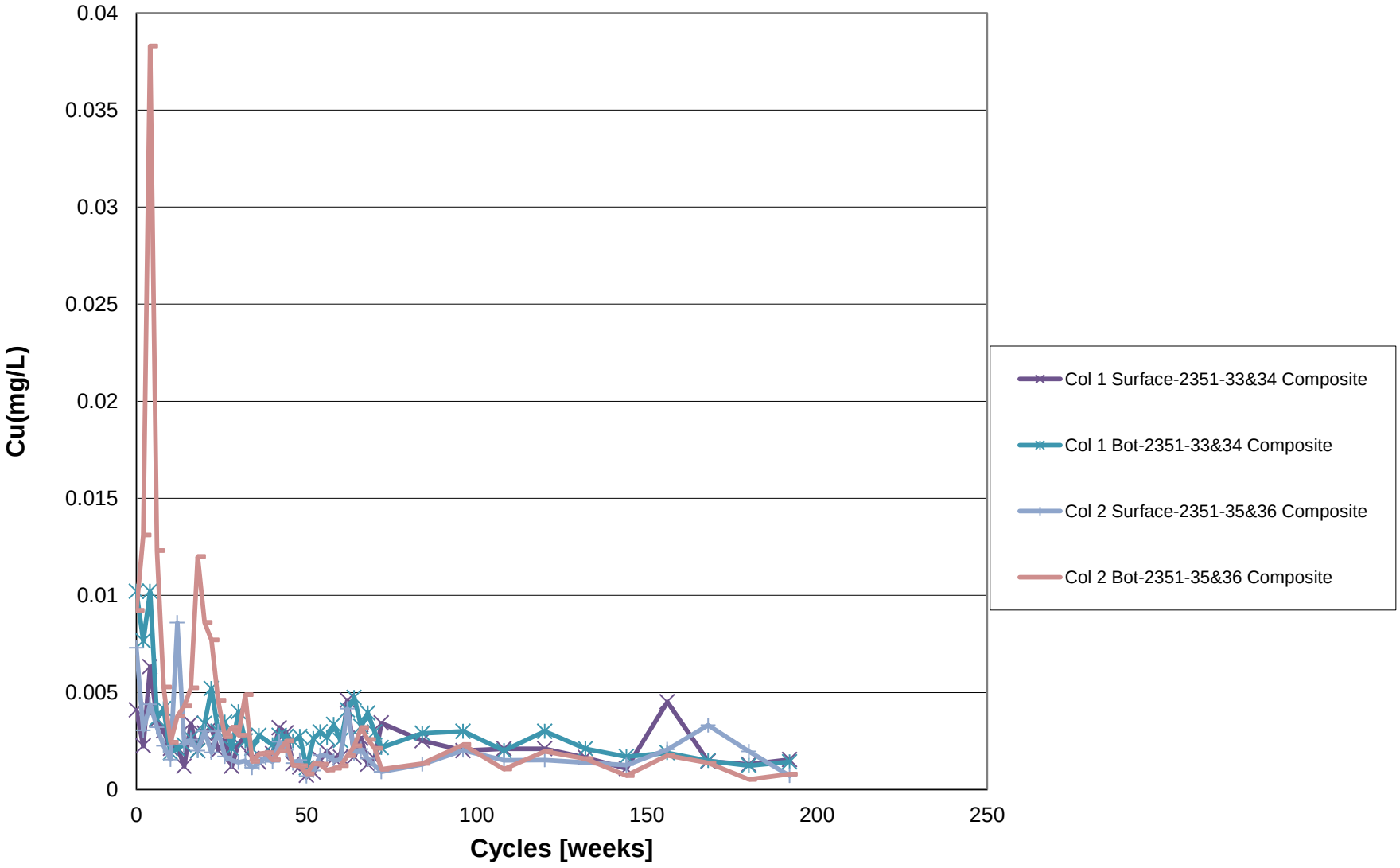

1.2
1
0.8
0.6
0.4
0.2
0
B(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

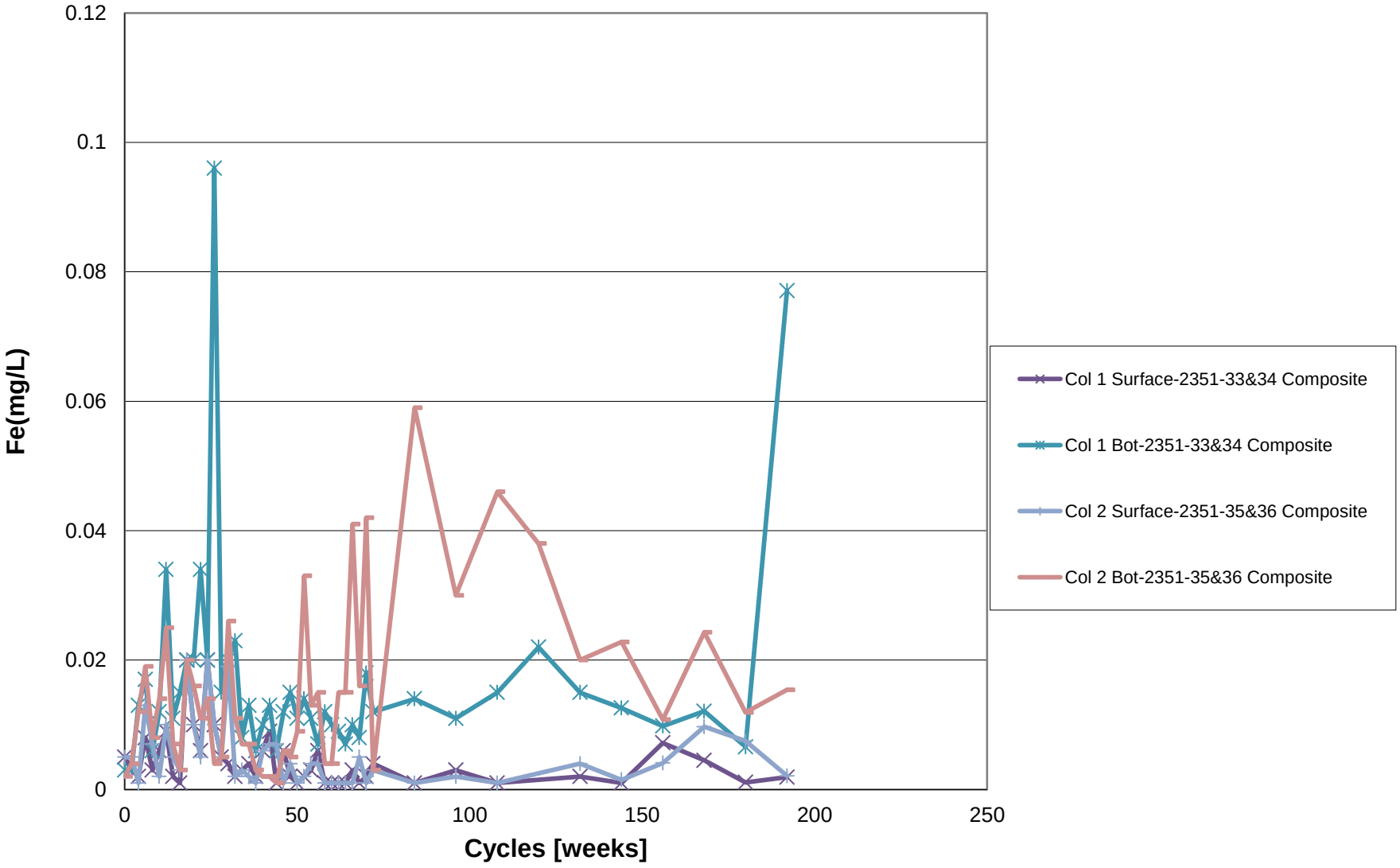

0.00016
0.00014
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
Cd(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

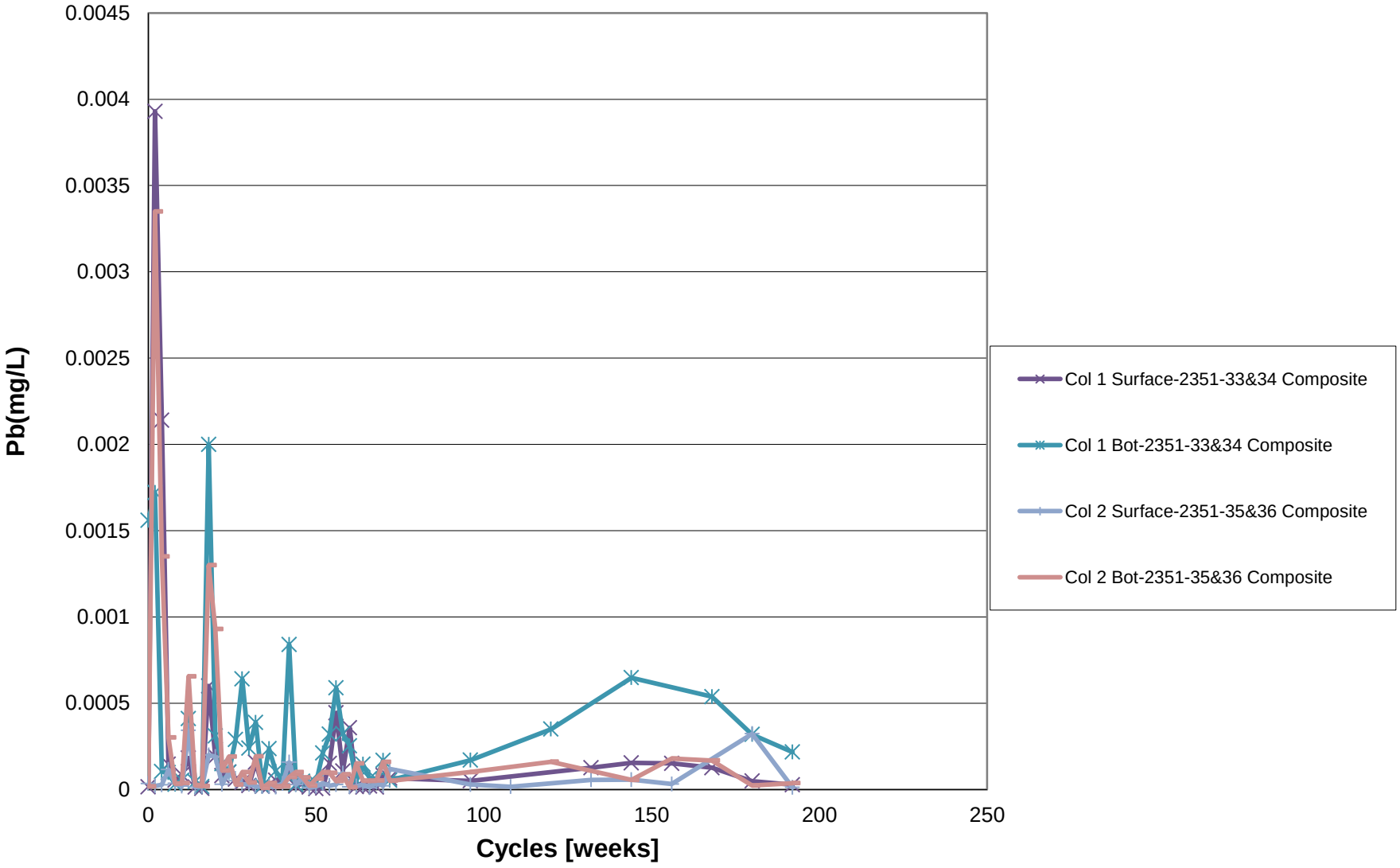

60
50
40
30
20
10
0
Ca(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

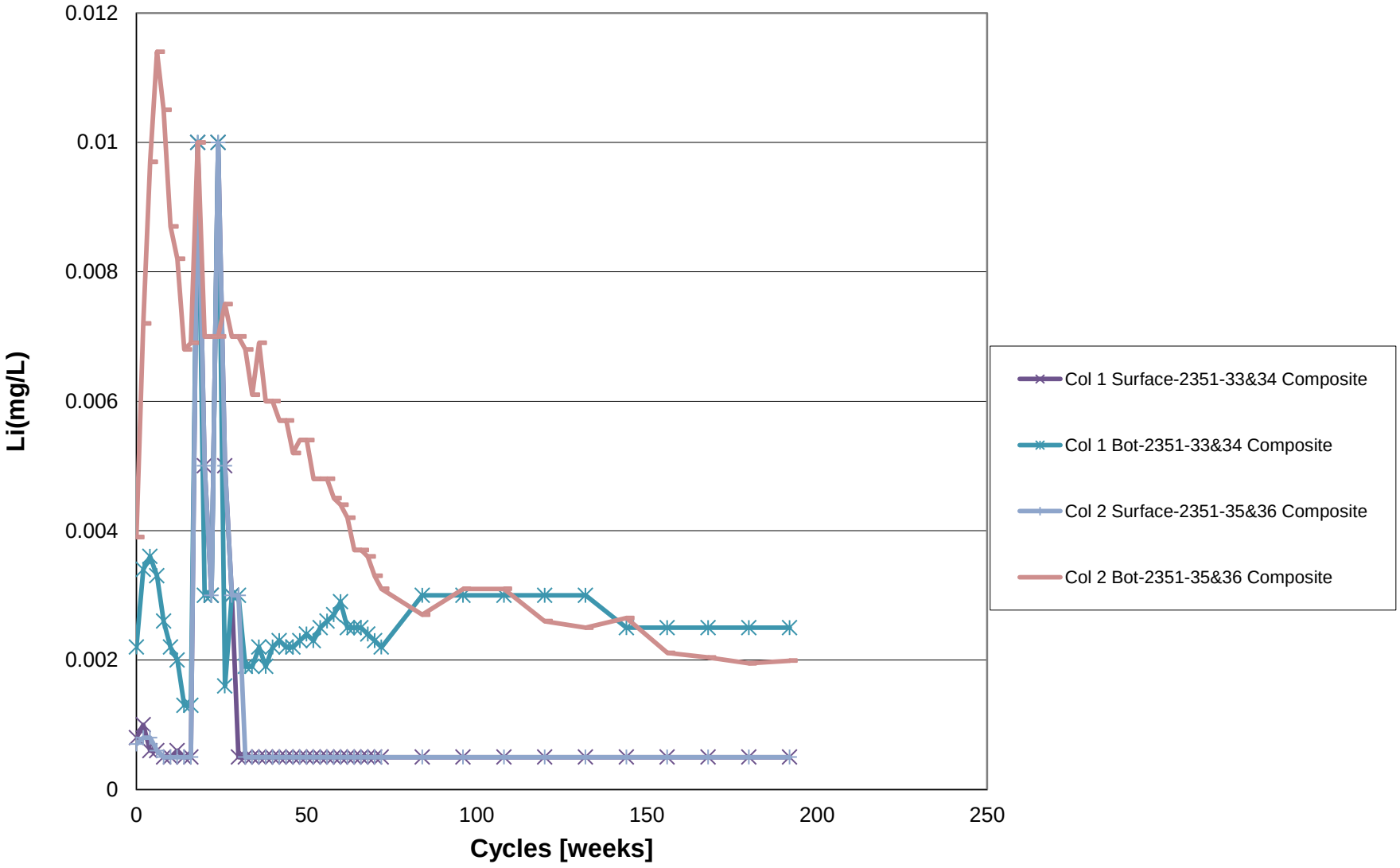

0.0025
0.002
0.0015
0.001
0.0005
0
Cr(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

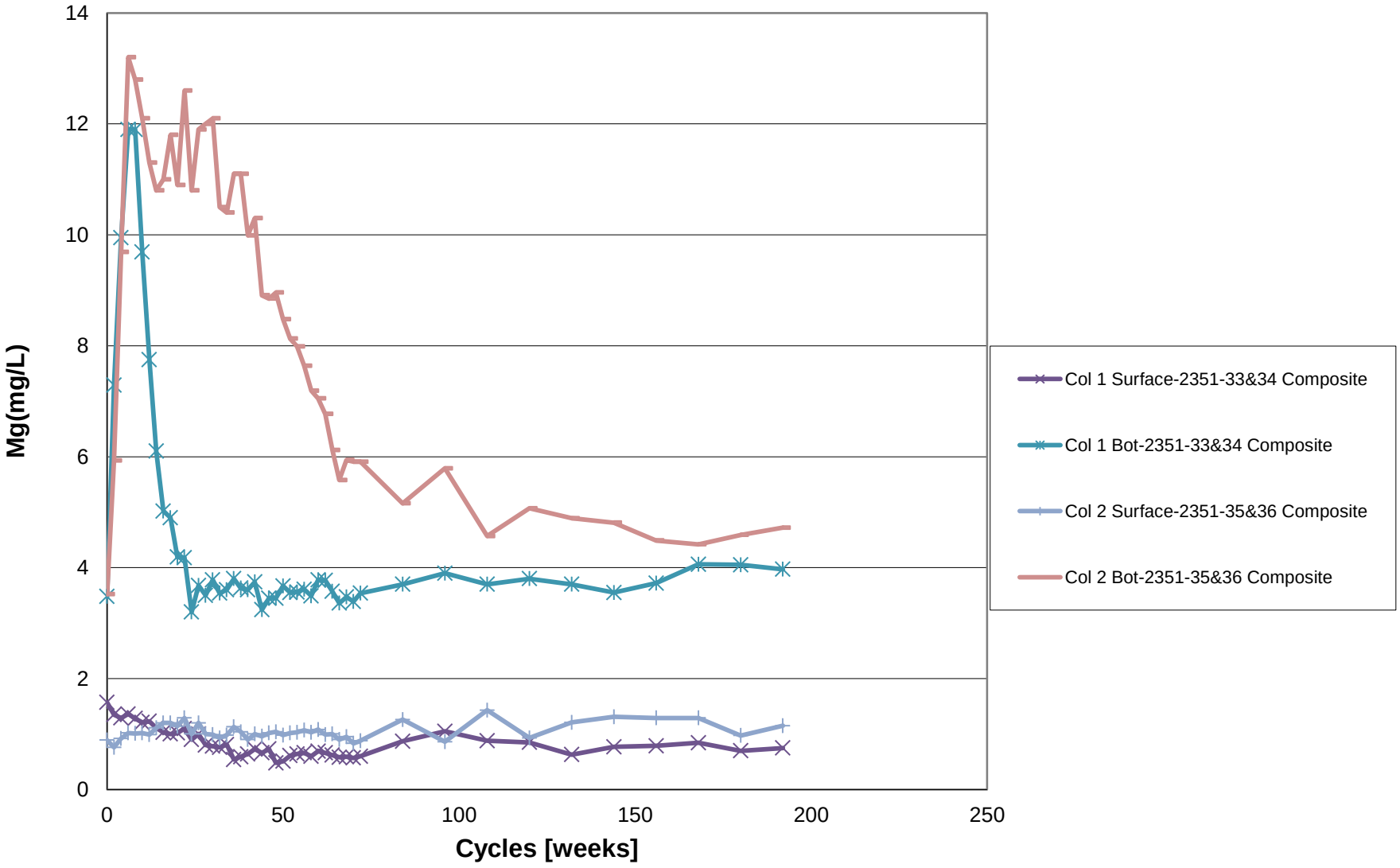

0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Co(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

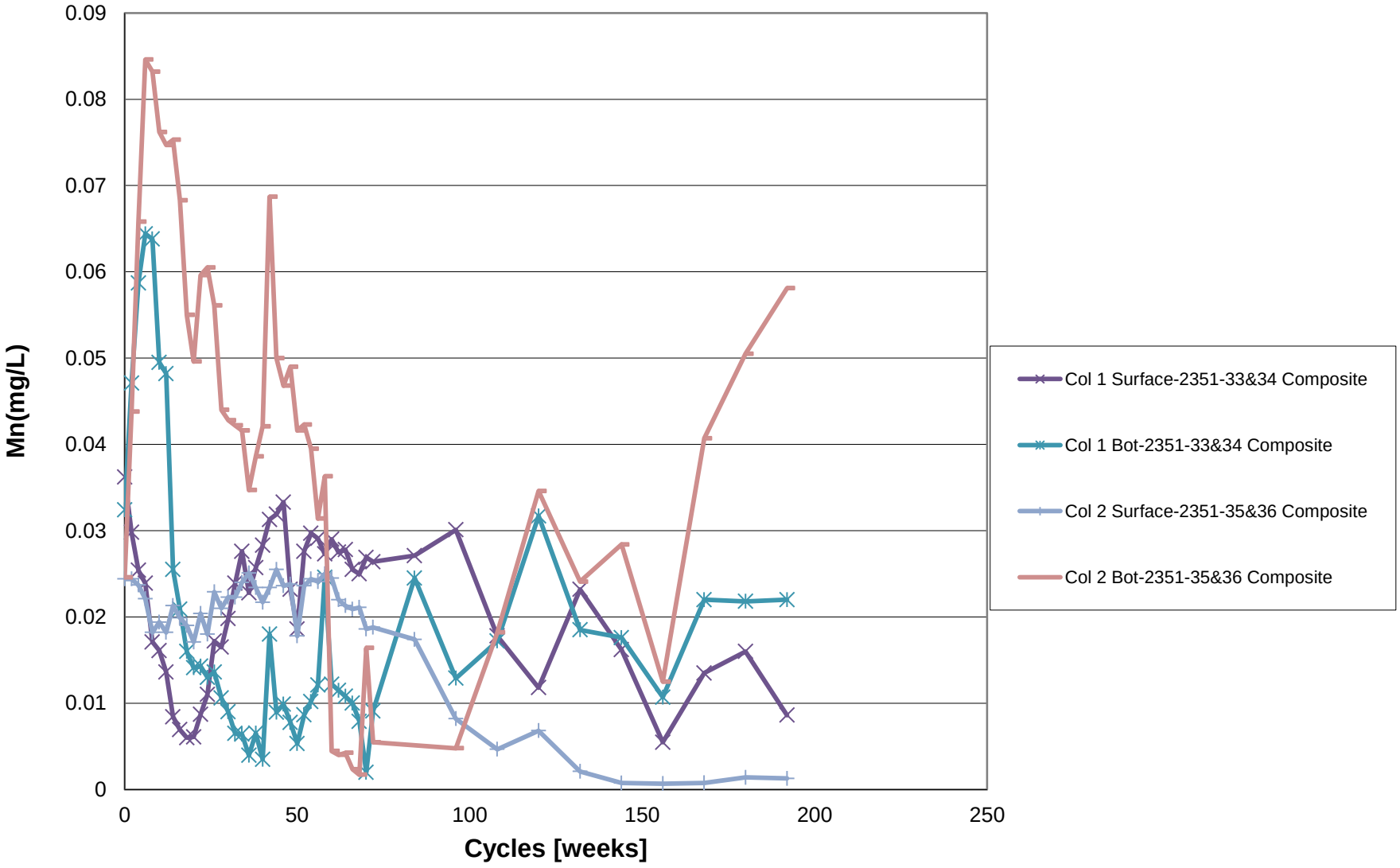

0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Cu(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

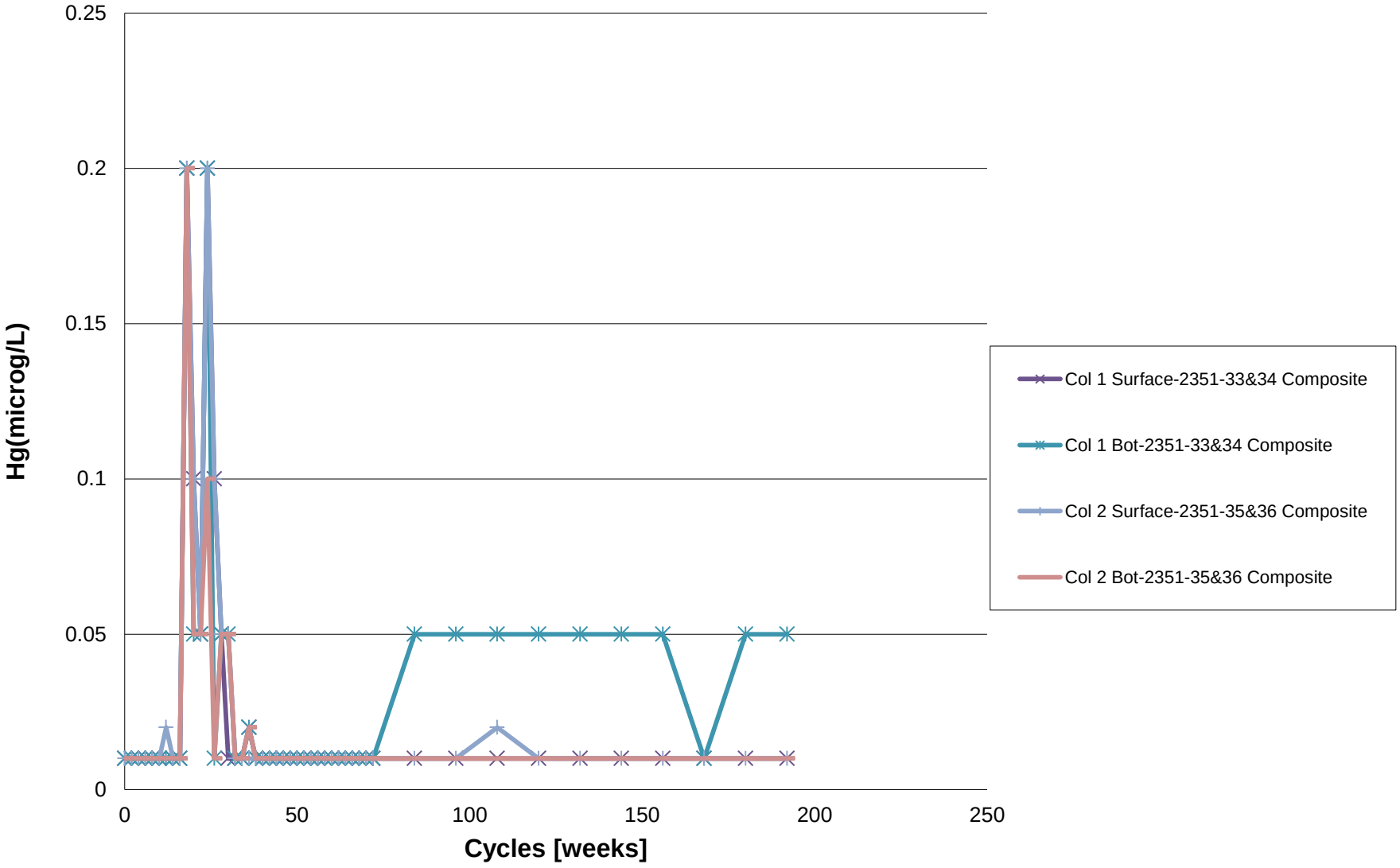

0.12
0.1
0.08
0.06
0.04
0.02
0
Fe(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

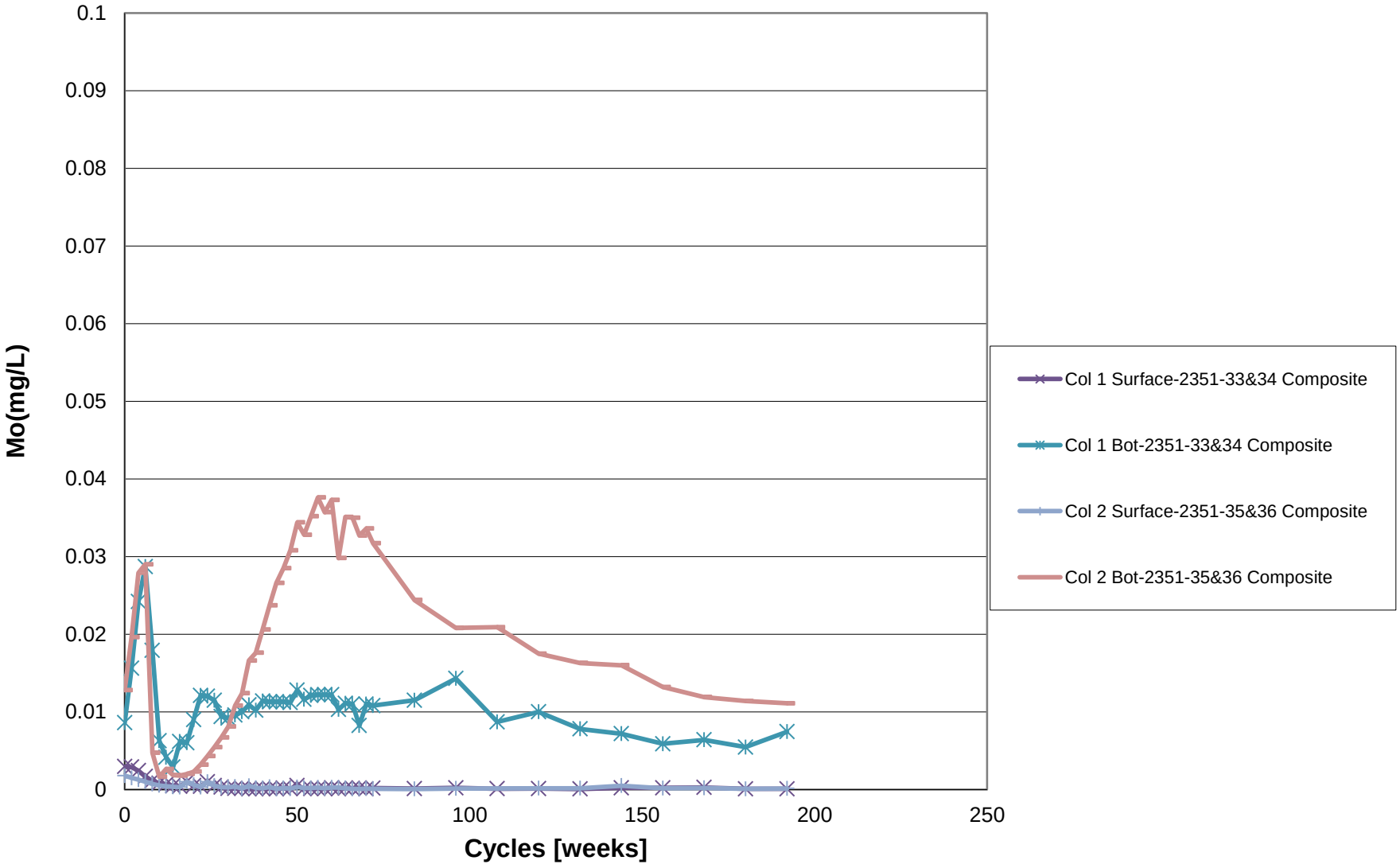

0.0045
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
Pb(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

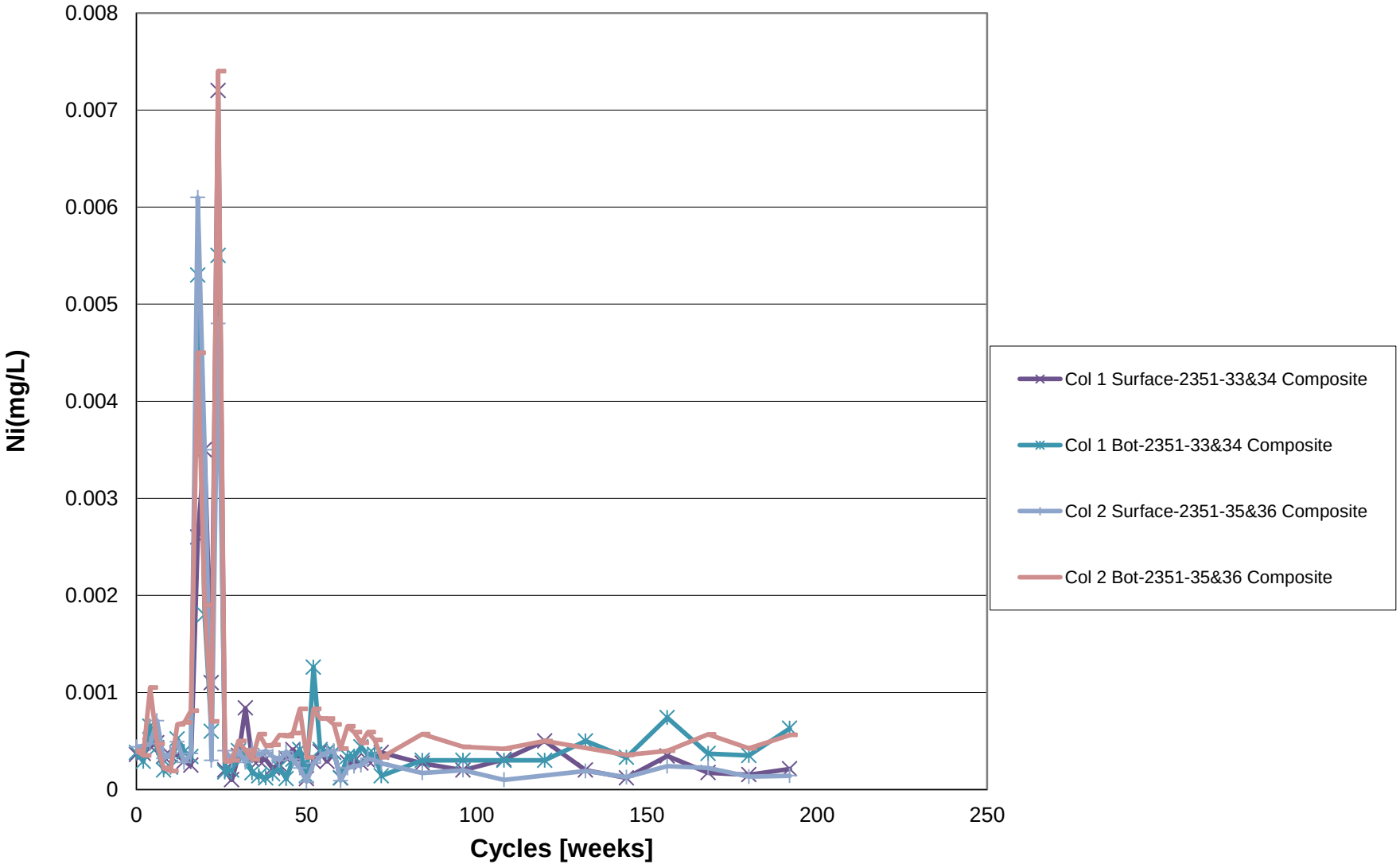

0.012
0.01
0.008
0.006
0.004
0.002
0
Li(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

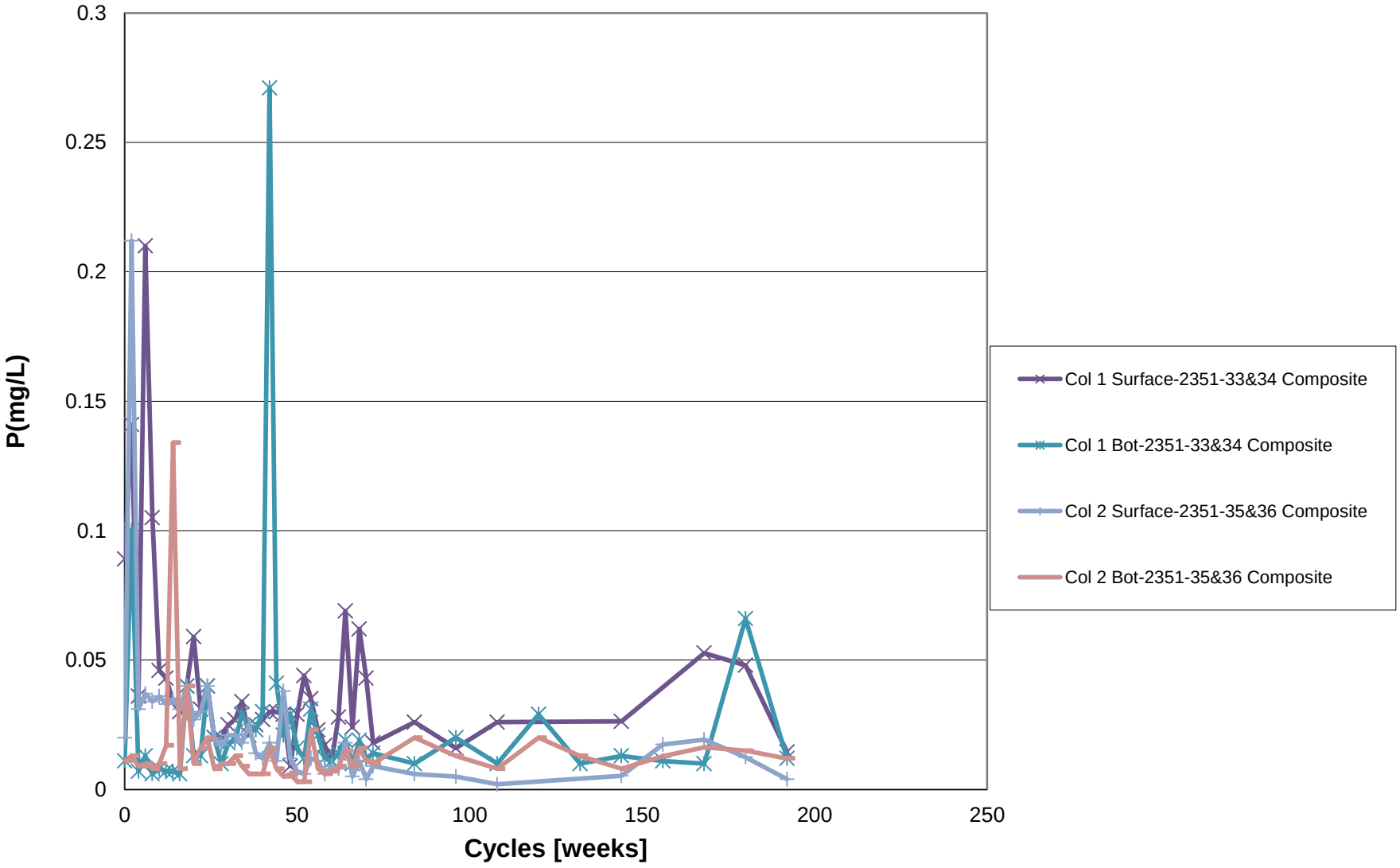

14
12
10
8
6
4
2
0
Mg(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

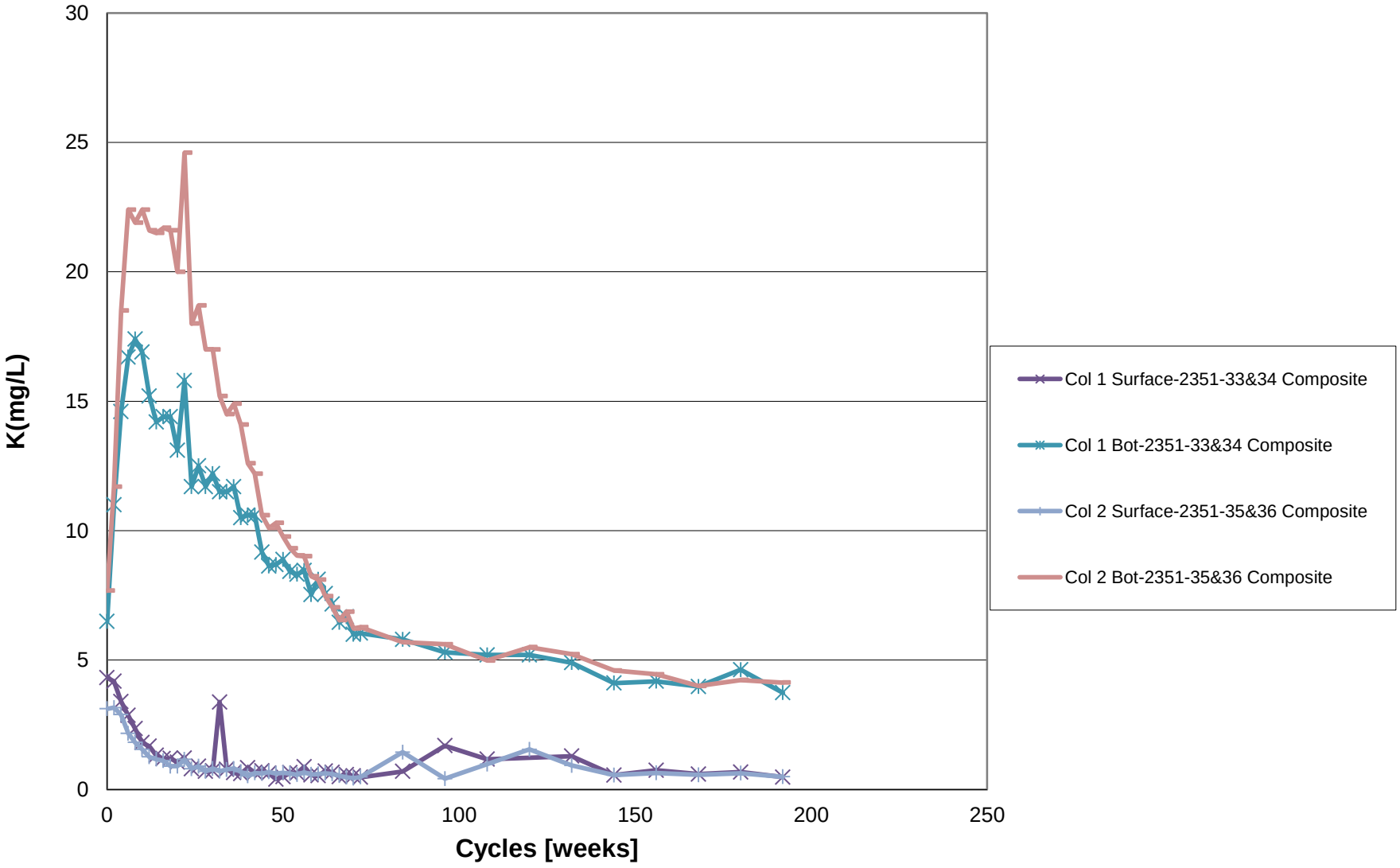

0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Mn(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

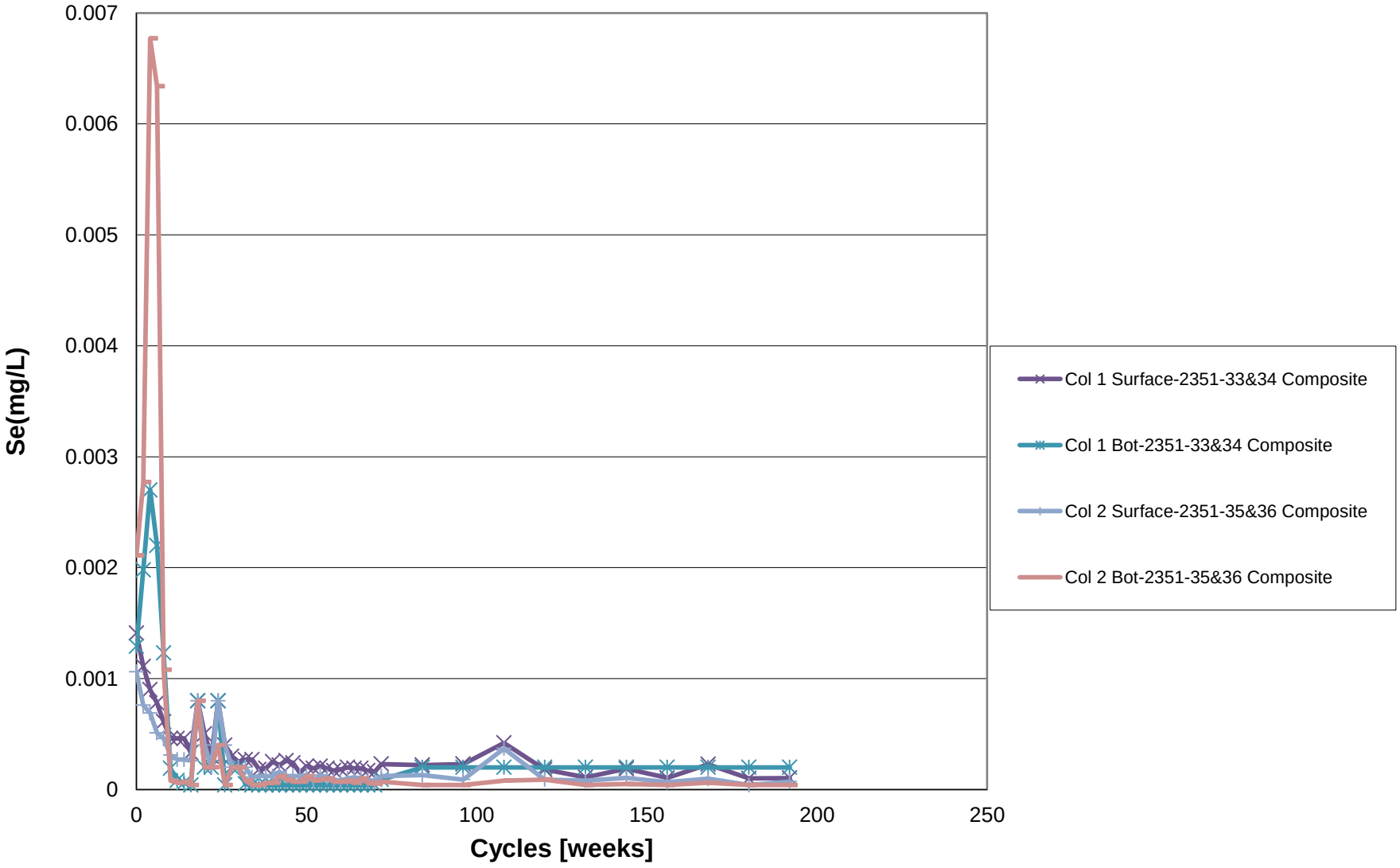

0.25
0.2
0.15
0.1
0.05
0
Hg(microg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

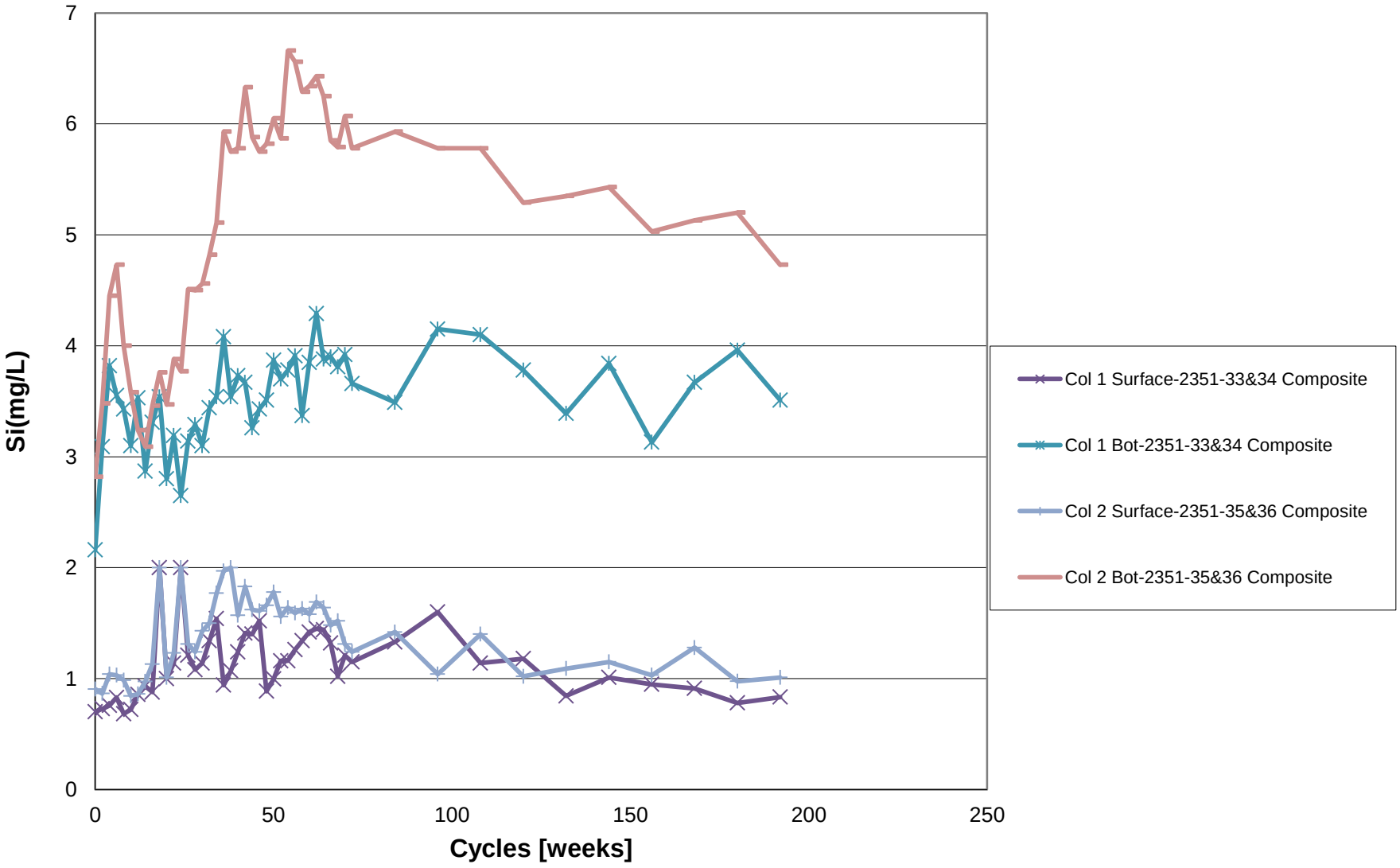

0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
Mo(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

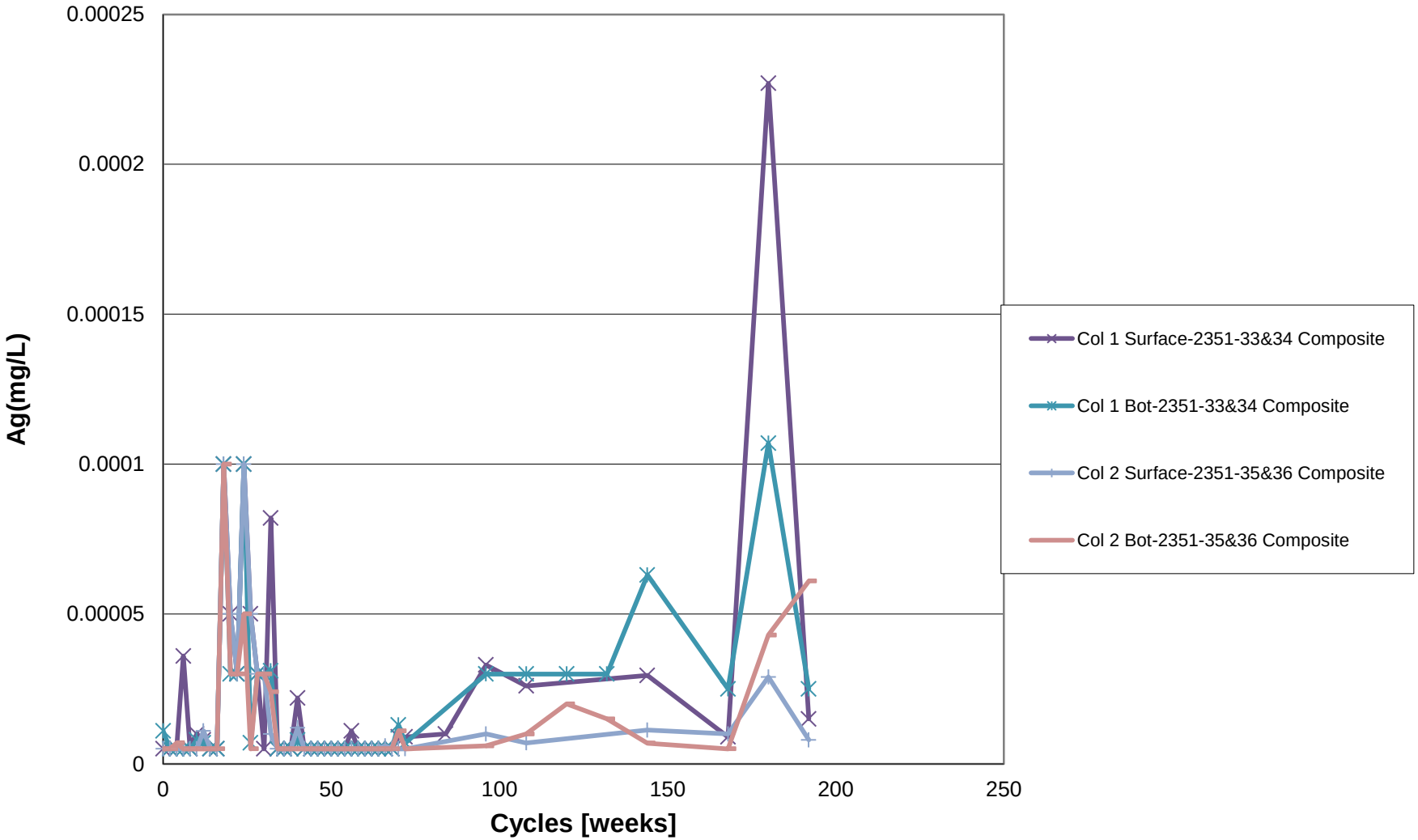

0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Ni(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

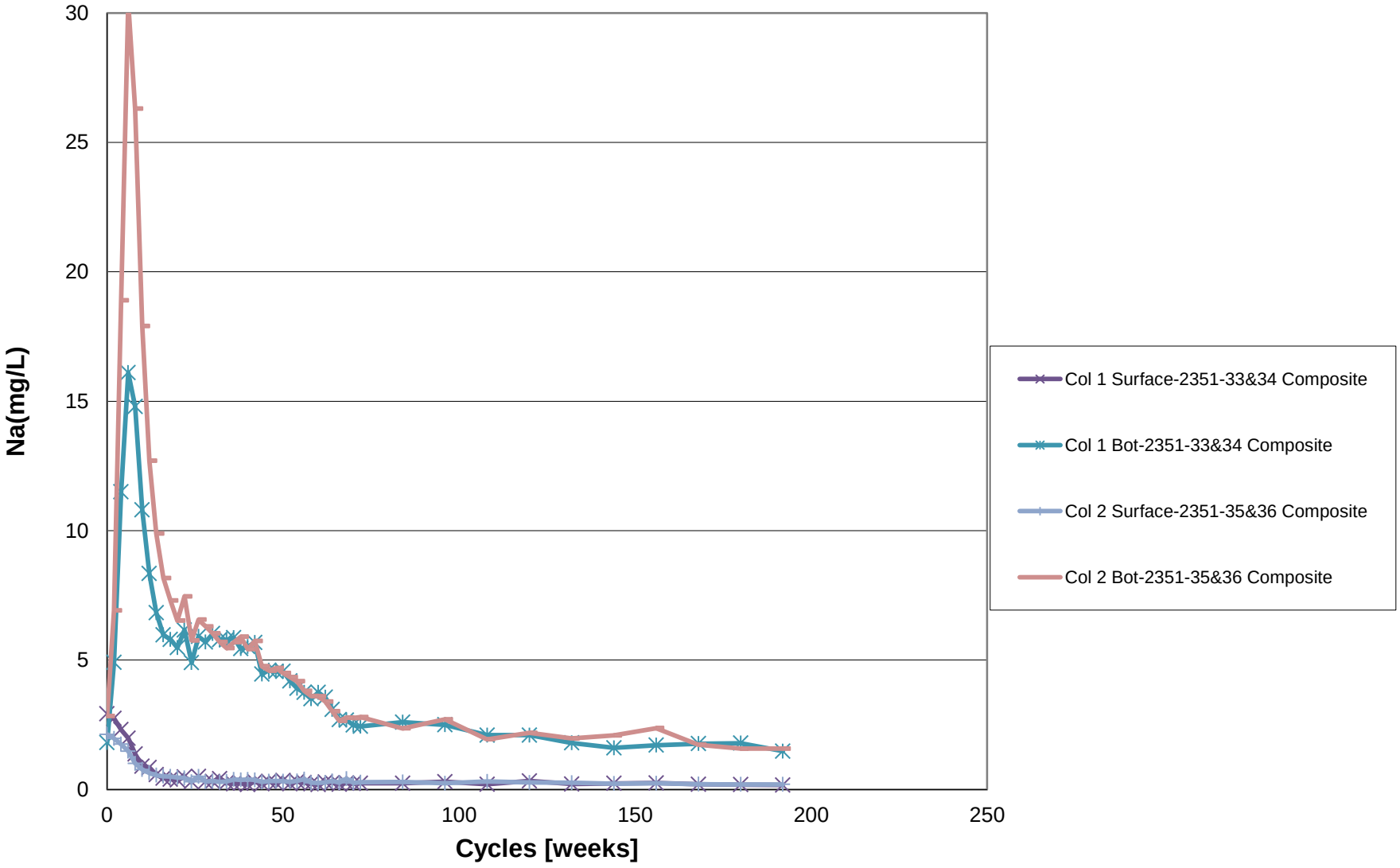

0.3
0.25
0.2
0.15
0.1
0.05
0
P(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

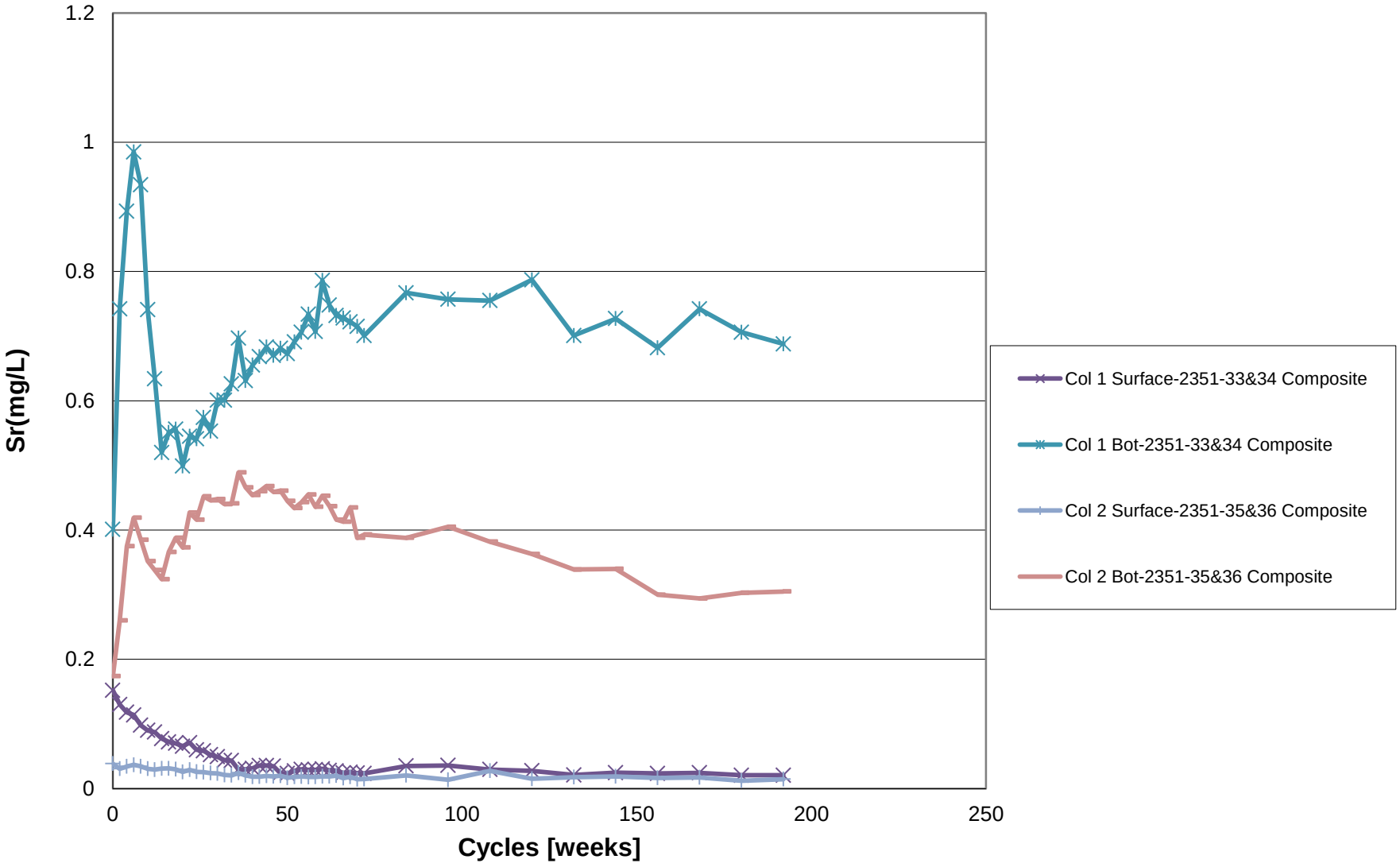

30
25
20
15
10
5
0
K(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

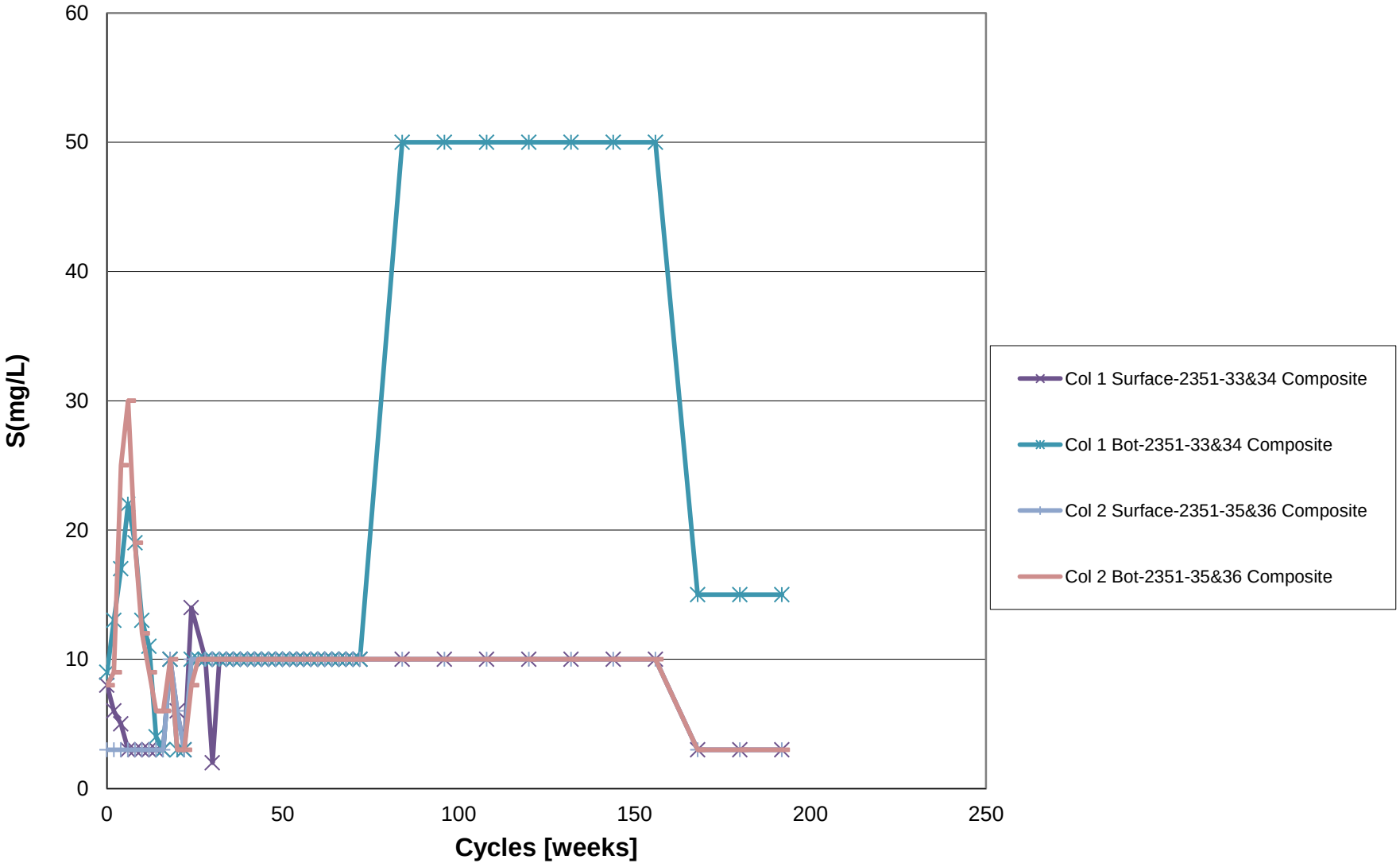

0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
Se(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

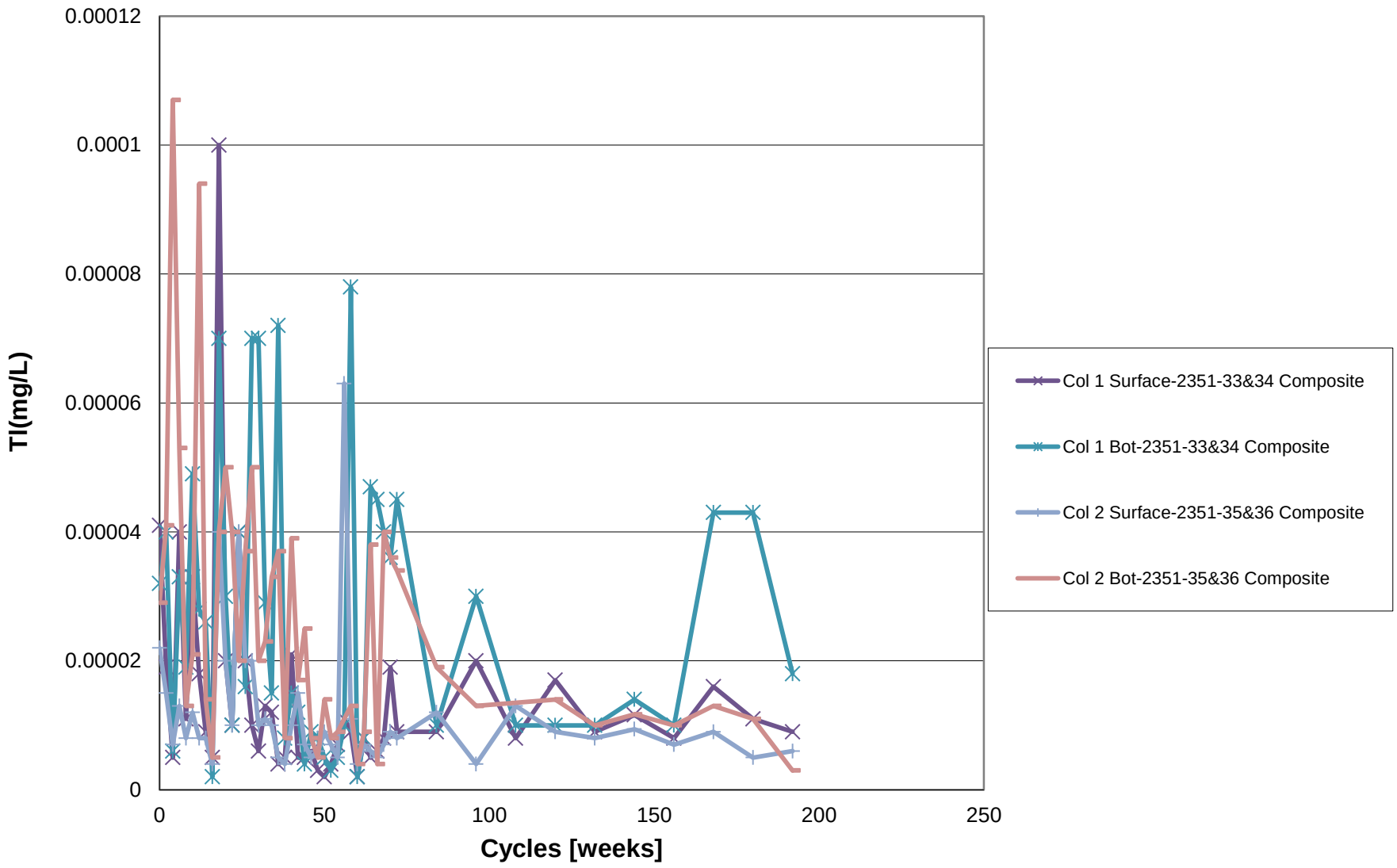

7
6
5
4
3
2
1
0
Si(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

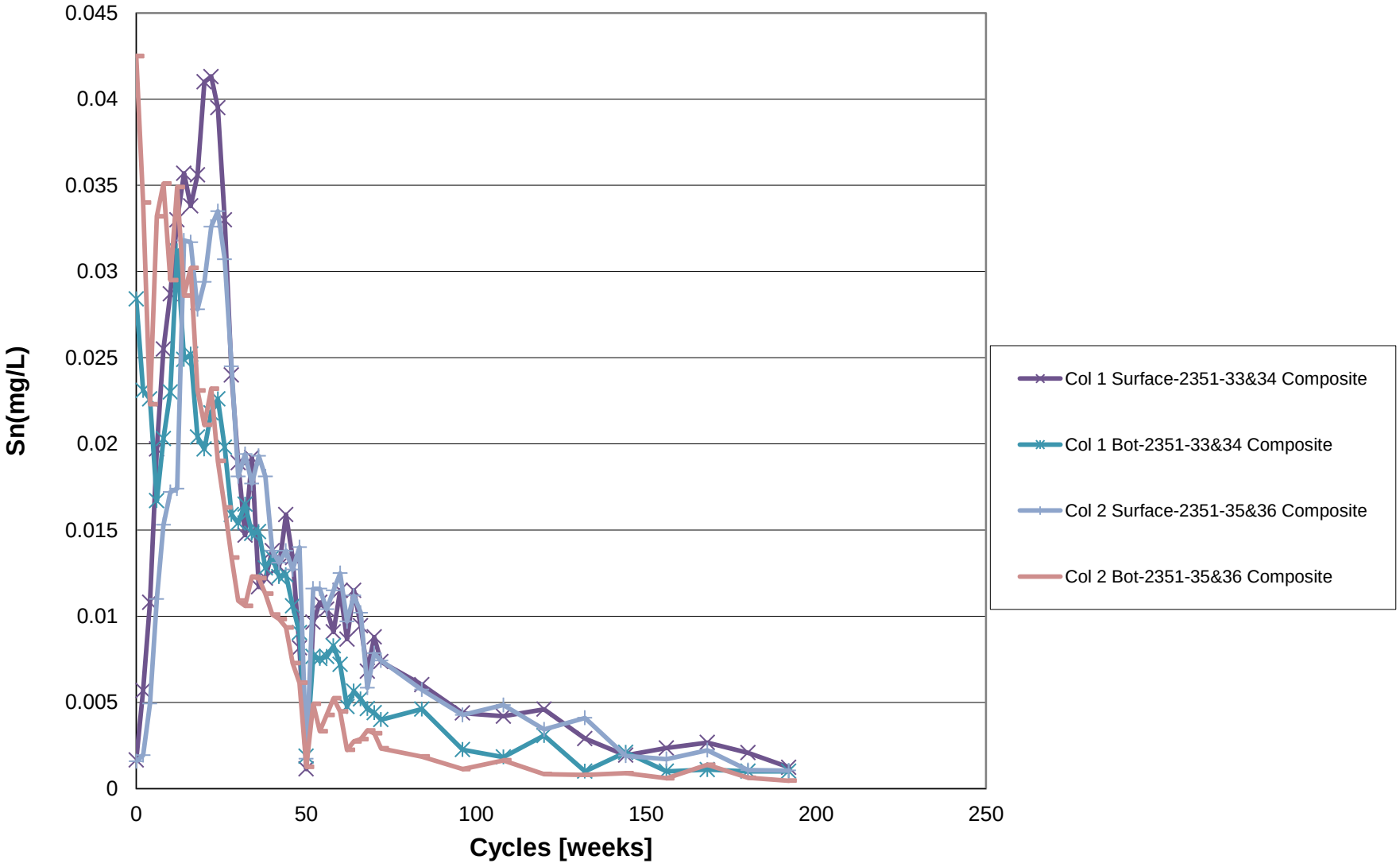

0.00025
0.0002
0.00015
0.0001
0.00005
0
Ag(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

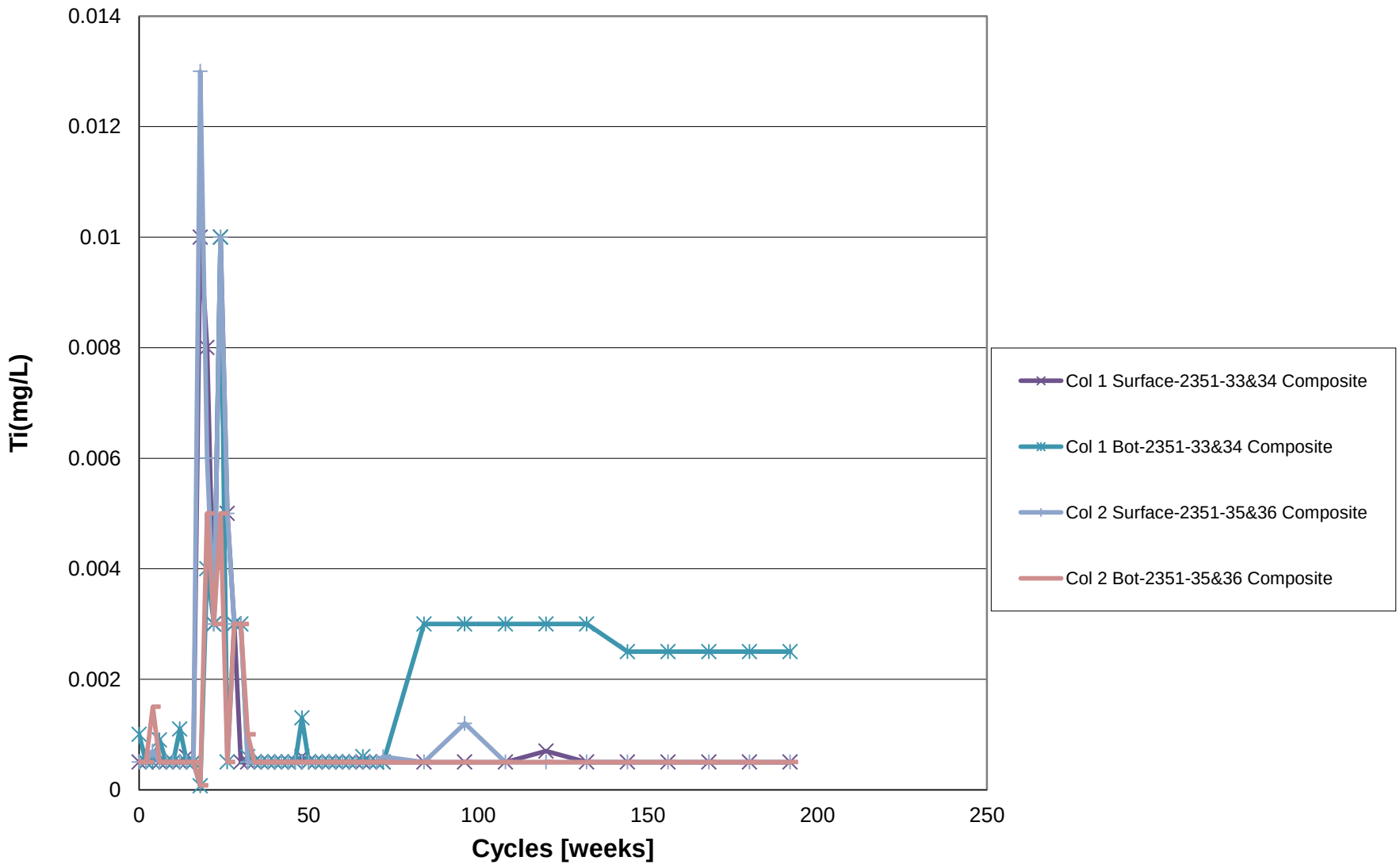

30
25
20
15
10
5
0
Na(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

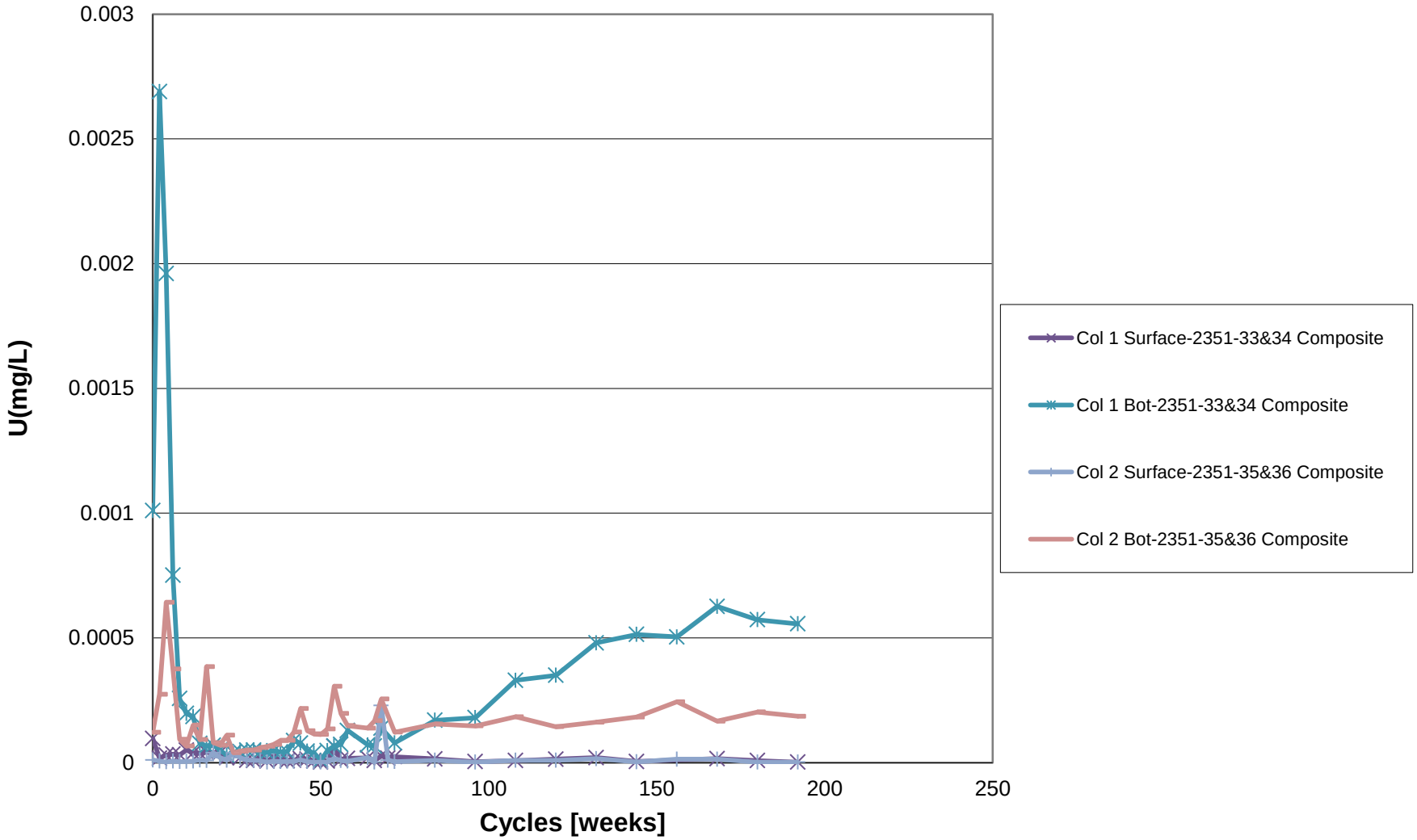

1.2
1
0.8
0.6
0.4
0.2
0
Sr(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

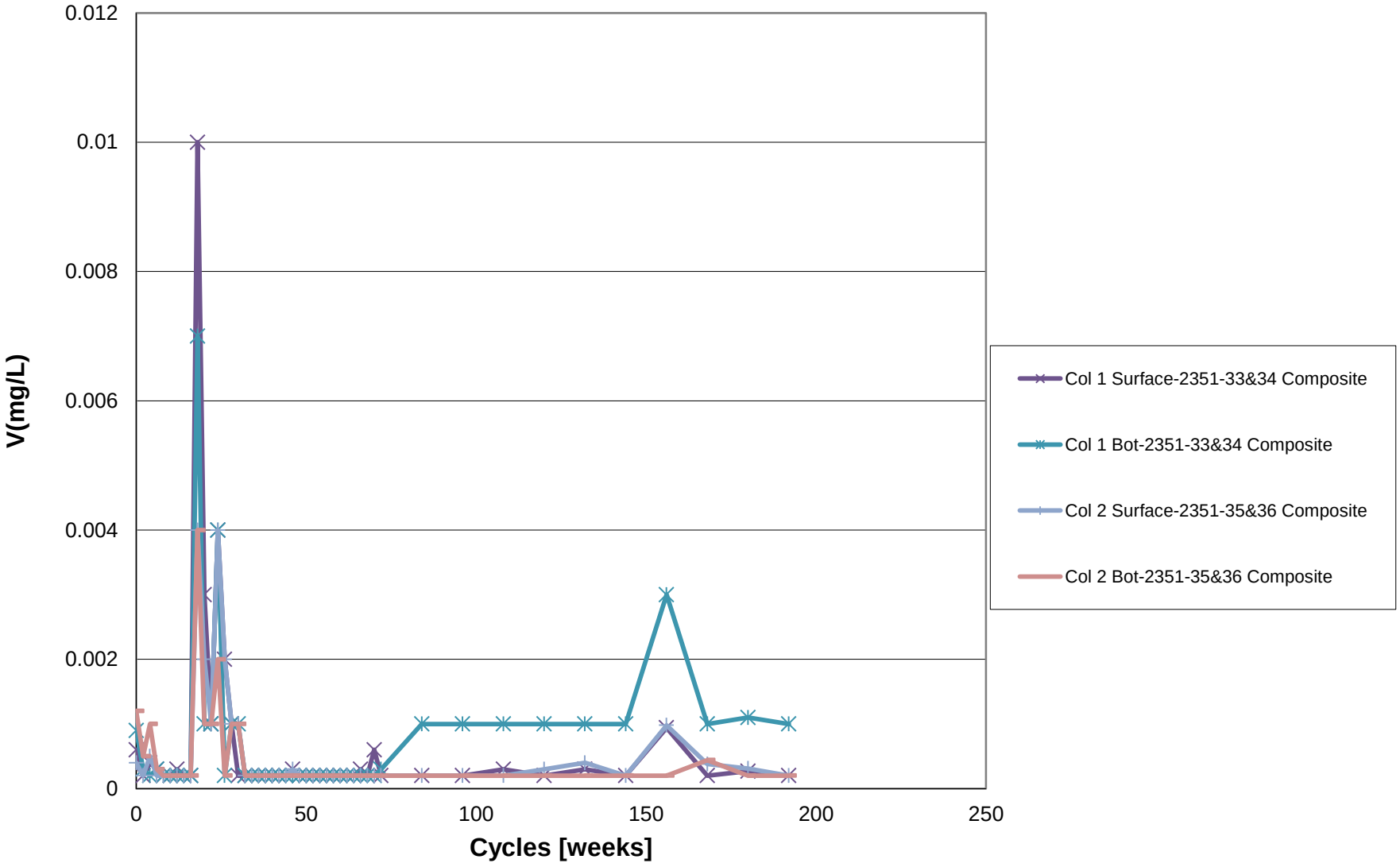

60
50
40
30
20
10
0
S(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

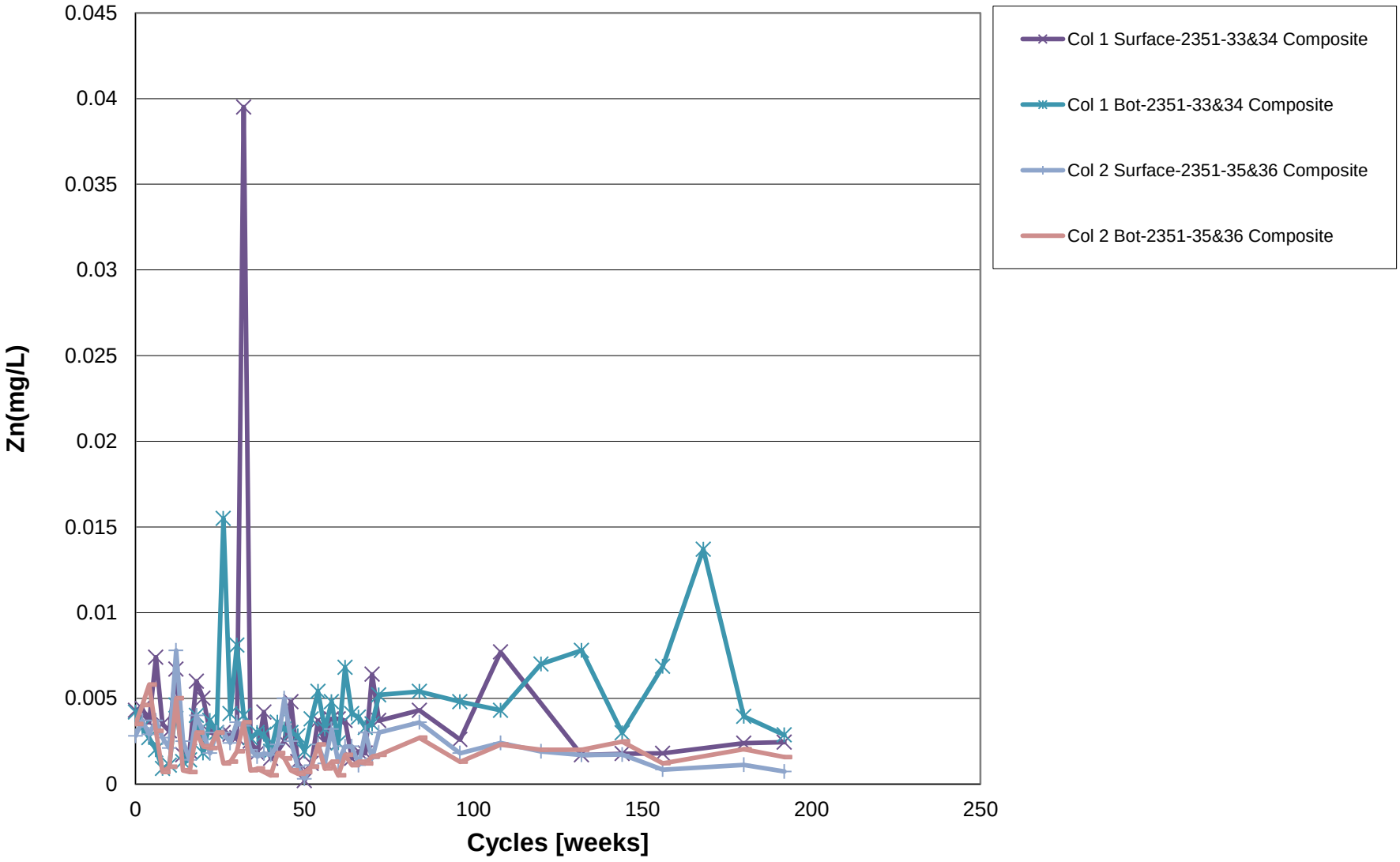

0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
Tl(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

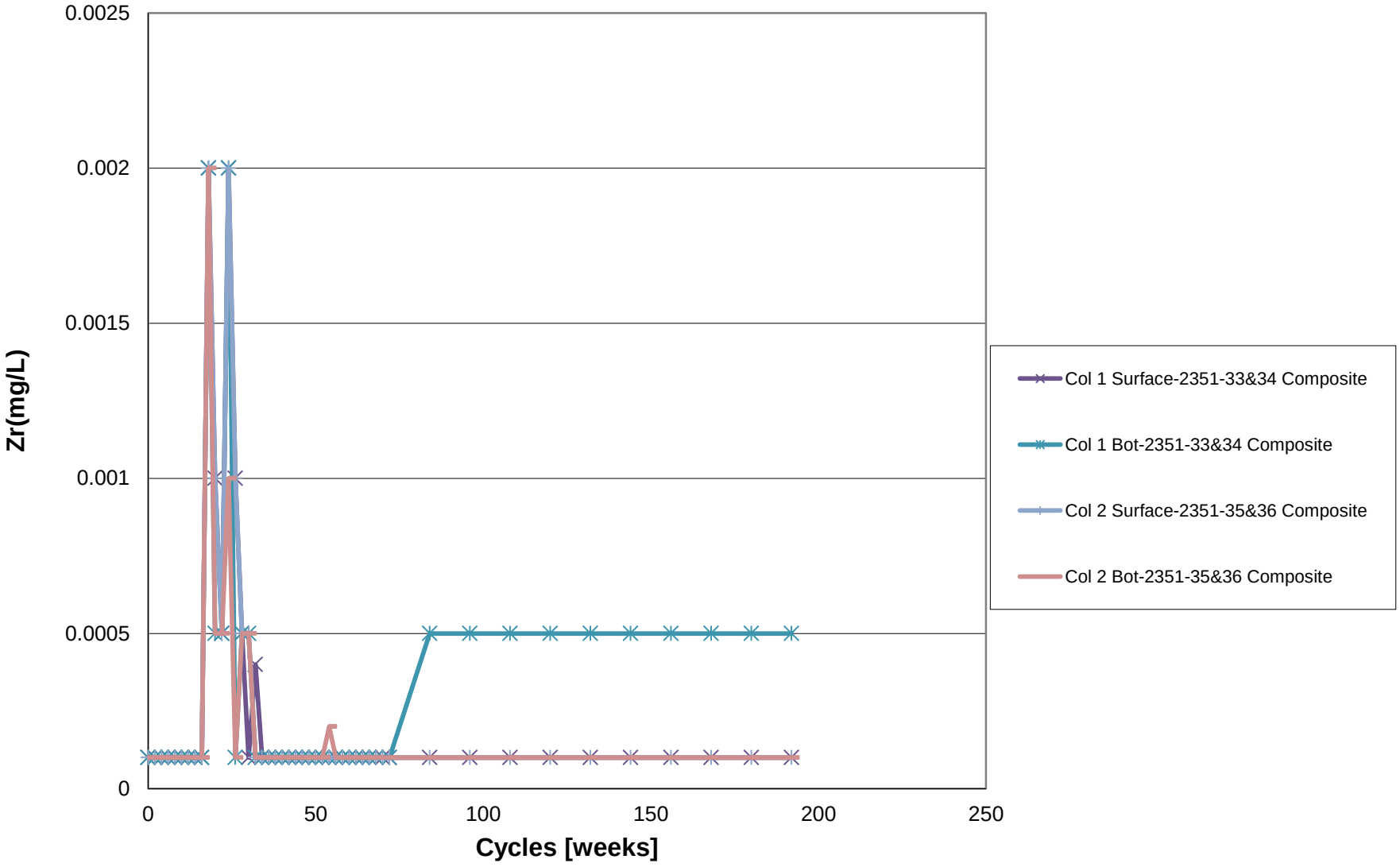

0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Sn(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite


0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
Ti(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite


0.003
0.0025
0.002
0.0015
0.001
0.0005
0
U(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite


0.012
0.01
0.008
0.006
0.004
0.002
0
V(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite


0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Zn(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite


0.0025
0.002
0.0015
0.001
0.0005
0
Zr(mg/L)
0
50
100
150
200
250
Cycles [weeks]
Col 1 Surface-2351-33&34 Composite
Col 1 Bot-2351-33&34 Composite
Col 2 Surface-2351-35&36 Composite
Col 2 Bot-2351-35&36 Composite

Appendix H
Source Terms for Use as Inputs to Water Quality Predictions: Minto Creek

DSTSF Source Terms

	Expected Case	Reasonable Worst Case
	Station W8- 50th percentile	Station W8- 95th percentile
	mg/L	mg/L
Ag	0.000020	0.00010
Al	0.010	0.069
Alk-T	220	410
Ammonia	0.12	0.98
As	0.00050	0.00090
Ba	0.12	0.21
B	0.062	0.11
Be	0.00010	0.00085
Bi	0.0010	0.0010
Ca	132	235
Cd	0.00011	0.00024
Cl	6.9	31
Co	0.00060	0.0022
Cr	0.0010	0.0020
Cu	0.094	0.32
Fe	0.089	0.39
F	0.32	1.4
Hg	0.000020	0.00020
K	6.6	18
Li	0.0050	0.010
Mg	31	48
Mn	0.60	3.2
Mo	0.0070	0.038
Na	24	46
Ni	0.0018	0.0050
NO3	22	84
NO2	0.12	2.5
Pb	0.00020	0.00064
Sb	0.00050	0.0011
S	48	83
Se	0.0039	0.014
Si	6.6	8.0
Sn	0.0050	0.0050
SO4-D	120	200
Sr	1.5	2.1
Ti	0.0050	0.010
Tl	0.000050	0.00010
U	0.0020	0.0037
V	0.0050	0.022
Zn	0.0050	0.010
Zr	0.00050	0.0020

W14 Data from November 2012 to March 2013

Parameter (Units mg/L)	Expected Case	Reasonable Worst Case
Ag	0.000020	0.000020
Al	0.070	0.110
Alk-T	179	185
Ammonia	0.82	1.1
As	0.00044	0.00047
Ba	0.087	0.10
B	0.11	0.12
Be	0.00010	0.00010
Bi	0.0010	0.0010
Ca	46	52
Cd	0.000021	0.000031
Cl	13	13
Co	0.00050	0.00050
Cr	0.0010	0.0010
Cu	0.0047	0.0091
Fe	0.010	0.022
F	1.3	1.5
Hg	0.000010	0.000010
K	30	35
Li	0.020	0.023
Mg	18	22
Mn	0.038	0.053
Mo	0.059	0.067
Na	65	69
Ni	0.0013	0.0019
NO3	22	25
NO2	0.42	0.46
Pb	0.00020	0.00020
Sb	0.00058	0.00075
S	50	58
Se	0.012	0.021
Si	2.2	2.4
Sn	0.0050	0.0050
SO4-D	131	151
Sr	3.8	5.2
Ti	0.0050	0.0050
Tl	0.000050	0.000050
U	0.00045	0.00077
V	0.0050	0.0050
Zn	0.0052	0.0057
Zr	0.00050	0.00050

Main Pit TMF Source Terms

	Expected Case	Reasonable Worst Case
	mg/yr	mg/yr
Ag	0.0E+00	0.0E+00
Al	1.8E+05	6.1E+05
Alk-T	2.4E+09	2.7E+09
Ammonia	7.8E+05	1.4E+06
As	4.0E+03	4.6E+03
Ba	9.9E+05	1.1E+06
B	0.0E+00	0.0E+00
Be	0.0E+00	0.0E+00
Bi	0.0E+00	0.0E+00
Ca	7.3E+08	8.3E+08
Cd	5.3E+02	5.9E+02
Cl	7.0E+07	7.9E+07
Co	0.0E+00	0.0E+00
Cr	0.0E+00	0.0E+00
Cu	4.9E+05	6.3E+05
Fe	6.3E+05	1.5E+06
F	3.4E+06	4.0E+06
Hg	0.0E+00	0.0E+00
K	4.4E+07	5.0E+07
Li	0.0E+00	0.0E+00
Mg	2.5E+08	2.9E+08
Mn	3.7E+06	4.2E+06
Mo	7.8E+04	1.1E+05
Na	1.9E+08	2.2E+08
Ni	1.0E+04	1.3E+04
NO3	8.6E+07	1.2E+08
NO2	7.5E+05	1.8E+06
Pb	0.0E+00	0.0E+00
Sb	0.0E+00	0.0E+00
S	2.3E+08	2.5E+08
Se	4.4E+04	5.6E+04
Si	5.9E+07	6.5E+07
Sn	0.0E+00	0.0E+00
SO4-D	6.8E+08	7.5E+08
Sr	9.6E+06	1.1E+07
Ti	7.9E+04	7.9E+04
Tl	0.0E+00	0.0E+00
U	2.1E+04	2.6E+04
V	0.0E+00	0.0E+00
Zn	4.9E+04	5.3E+04
Zr	0.0E+00	0.0E+00

Ridgetop North Pit TMF Source Terms

	Expected Case	Reasonable Worst Case
	mg/yr	mg/yr
Ag	0.0E+00	0.0E+00
Al	1.8E+05	6.1E+05
Alk-T	2.4E+09	2.7E+09
Ammonia	7.8E+05	1.4E+06
As	4.0E+03	4.6E+03
Ba	9.9E+05	1.1E+06
B	0.0E+00	0.0E+00
Be	0.0E+00	0.0E+00
Bi	0.0E+00	0.0E+00
Ca	7.3E+08	8.3E+08
Cd	5.3E+02	5.9E+02
Cl	7.0E+07	7.9E+07
Co	0.0E+00	0.0E+00
Cr	0.0E+00	0.0E+00
Cu	4.9E+05	6.3E+05
Fe	6.3E+05	1.5E+06
F	3.4E+06	4.0E+06
Hg	0.0E+00	0.0E+00
K	4.4E+07	5.0E+07
Li	0.0E+00	0.0E+00
Mg	2.5E+08	2.9E+08
Mn	3.7E+06	4.2E+06
Mo	7.8E+04	1.1E+05
Na	1.9E+08	2.2E+08
Ni	1.0E+04	1.3E+04
NO3	8.6E+07	1.2E+08
NO2	7.5E+05	1.8E+06
Pb	0.0E+00	0.0E+00
Sb	0.0E+00	0.0E+00
S	2.3E+08	2.5E+08
Se	4.4E+04	5.6E+04
Si	5.9E+07	6.5E+07
Sn	0.0E+00	0.0E+00
SO4-D	6.8E+08	7.5E+08
Sr	9.6E+06	1.1E+07
Ti	7.9E+04	7.9E+04
Tl	0.0E+00	0.0E+00
U	2.1E+04	2.6E+04
V	0.0E+00	0.0E+00
Zn	4.9E+04	5.3E+04
Zr	0.0E+00	0.0E+00

Waste Rock: Volume-based source term

	Expected Case	Reasonable Worst Case
	mg m^3-1 yr-1	mg m^3-1 yr-1
Ag	0.00048	0.0024
Al	0.90	3.6
Alk-T	3103	5591
Ammonia	1.5	4.5
As	0.012	0.021
Ba	2.3	3.6
B	1.2	2.4
Be	0.0024	0.0048
Bi	0.024	0.024
Ca	1180	2092
Cd	0.00072	0.0024
Cl	62	147
Co	0.012	0.029
Cr	0.024	0.048
Cu	0.45	1.0
Fe	10	22
F	3.1	4.2
Hg	0.00048	0.0048
K	57	102
Li	0.12	0.24
Mg	337	602
Mn	8.4	20
Mo	0.048	0.085
Na	167	309
Ni	0.024	0.048
NO3	103	436
NO2	1.2	6.3
Pb	0.0048	0.0048
Sb	0.012	0.012
S	360	1432
Se	0.024	0.075
Si	125	171
Sn	0.12	0.12
SO4-D	728	1734
Sr	9.8	21
Ti	0.12	0.24
Tl	0.0012	0.0012
U	0.014	0.037
V	0.12	0.12
Zn	0.12	0.24
Zr	0.012	0.048

Lower Minto Creek Background Water Quality

Parameter	pH-L	Cond-L	Hard-D	Hard-T	TDS	TSS	ANIONS	SO4-D	Chloride	Fluoride	NUTRIENTS	N-NO2	N-NO3	Ammonia	TOTAL META	Ag-T	Al-T	As-T	Ba-T	B-T	Be-T
Units	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	0	mg/L	mg/L	mg/L	0	mg/L	mg/L	mg/L	0	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
January	8.1	349	169	158	226	2.0	0	18.0	0.80	0.43	0	0.0025	0.32	0.005	0	0.00001	0.01	0.0004	0.087	0.025	0.00005
February	8.0	339	165	160	216	2.0	0	17.8	0.90	0.42	0	0.0025	0.29	0.006	0	0.00001	0.02	0.0003	0.082	0.025	0.00005
March	8.2	343	161	159	176	3.2	0	19.0	0.50	0.42	0	0.0025	0.20	0.007	0	0.00001	0.04	0.0004	0.083	0.025	0.00005
April	7.6	131	65	43	115	3.2	0	7.4	1.11	0.10	0	0.0216	0.01	0.013	0	0.00002	0.22	0.0004	0.036	0.015	0.00004
May	7.7	134	55	91	116	357.1	0	29.8	0.41	0.16	0	0.0024	0.03	0.042	0	0.00007	7.16	0.0037	0.188	0.043	0.00063
June	7.9	211	101	100	156	17.2	0	15.5	1.32	0.20	0	0.0051	0.04	0.025	0	0.00001	0.34	0.0006	0.057	0.006	0.00022
July	7.8	243	116	137	163	171.1	0	2.8	0.51	0.27	0	0.0040	0.05	0.039	0	0.00004	3.90	0.0024	0.140	0.010	0.00031
August	8.1	224	124	130	165	243.3	0	8.9	0.64	0.72	0	0.0037	0.04	0.036	0	0.00004	3.30	0.0026	0.156	0.040	0.00049
September	7.8	200	108	109	154	15.1	0	10.6	0.48	0.21	0	0.0015	0.02	0.014	0	0.00002	0.15	0.0005	0.055	0.042	0.00041
October	7.7	208	121	114	153	7.8	0	5.7	0.52	0.22	0	0.0037	0.06	0.018	0	0.00001	0.11	0.0005	0.052	0.007	0.00022
November	7.9	287	153	152	174	8.3	0	10.1	0.96	0.26	0	0.0025	0.09	0.024	0	0.00001	0.13	0.0005	0.075	0.025	0.00005
December	8.1	444	223	206	262	0.5	0	29.1	1.90	0.43	0	0.0025	0.06	0.025	0	0.00001	0.01	0.0004	0.104	0.025	0.00005

Lower Minto Creek Background Water Quality

Parameter	Bi-T	Ca-T	Cd-T	Co-T	Cr-T	Cu-T	Fe-T	Hg-T	K-T	Li-T	Mg-T	Mn-T	Mo-T	Na-T	Ni-T	Pb-T	P-T	Sb-T	S-T	Se-T	Si-T
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
January	0.0005	39.5	0.00001	0.0003	0.0005	0.001	0.11	0.00001	1.57	0.003	14.5	0.060	0.0010	8.4	0.001	0.0001	0.01	0.00025	5.90	0.0003	6.4
February	0.0005	41.0	0.00003	0.0003	0.0005	0.006	0.04	0.00001	1.51	0.003	13.9	0.004	0.0010	8.1	0.001	0.0001	0.01	0.00025	6.00	0.0003	6.3
March	0.0005	39.7	0.00001	0.0003	0.0005	0.007	0.11	0.00001	1.46	0.003	14.6	0.005	0.0010	8.4	0.001	0.0001	0.02	0.00025	5.60	0.0004	6.4
April	0.0004	15.9	0.00004	0.0002	0.0008	0.008	0.39	0.00001	1.70	0.002	6.5	0.028	0.0007	4.0	0.001	0.0001	0.07	0.00018	1.36	0.0002	3.2
May	0.0005	22.2	0.00016	0.0052	0.0145	0.023	12.32	0.00001	1.58	0.007	8.4	0.324	0.0009	3.4	0.014	0.0036	1.08	0.00040	2.62	0.0006	43.0
June	0.0003	27.5	0.00003	0.0004	0.0010	0.004	0.76	0.00004	0.97	0.002	9.5	0.036	0.0008	6.5	0.002	0.0002	0.18	0.00007	4.08	0.0005	6.0
July	0.0003	34.9	0.00009	0.0028	0.0075	0.014	6.50	0.00004	1.29	0.004	11.8	0.192	0.0012	6.5	0.008	0.0019	0.65	0.00021	3.79	0.0005	12.3
August	0.0005	33.7	0.00008	0.0031	0.0063	0.012	6.68	0.00001	1.23	0.004	10.8	0.310	0.0009	5.7	0.008	0.0020	0.59	0.00032	2.75	0.0004	20.1
September	0.0003	27.6	0.00001	0.0002	0.0006	0.005	0.63	0.00001	0.91	0.002	9.1	0.057	0.0006	5.2	0.002	0.0002	0.03	0.00023	4.53	0.0005	6.9
October	0.0003	27.8	0.00003	0.0002	0.0005	0.005	0.47	0.00001	0.97	0.002	9.3	0.073	0.0009	5.3	0.001	0.0001	0.04	0.00008	2.90	0.0005	6.2
November	0.0005	40.1	0.00007	0.0003	0.0006	0.005	0.32	0.00001	0.82	0.003	12.5	0.050	0.0008	6.7	0.002	0.0003	0.03	0.00025	3.65	0.0002	8.2
December	0.0005	49.6	0.00002	0.0003	0.0005	0.003	0.07	0.00001	2.29	0.003	19.9	0.041	0.0012	11.7	0.002	0.0001	0.02	0.00025	7.90	0.0003	7.7

Lower Minto Creek Background Water Quality

Parameter	Sn-T	Sr-T	Ti-T	Tl-T	U-T	V-T	Zn-T	Zr-T
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
January	0.0025	0.45	0.0025	0.00003	0.0019	0.0025	0.003	0.0003
February	0.0025	0.47	0.0025	0.00003	0.0015	0.0025	0.003	0.0003
March	0.0025	0.49	0.0025	0.00003	0.0015	0.0025	0.003	0.0003
April	0.0017	0.16	0.0073	0.00002	0.0006	0.0015	0.004	0.0002
May	0.0009	0.20	0.2465	0.00014	0.0010	0.0348	0.032	0.0030
June	0.0002	0.19	0.0151	0.00005	0.0006	0.0016	0.006	0.0006
July	0.0006	0.25	0.1226	0.00007	0.0012	0.0124	0.018	0.0022
August	0.0009	0.29	0.1002	0.00010	0.0009	0.0219	0.018	0.0018
September	0.0004	0.19	0.0062	0.00008	0.0003	0.0122	0.003	0.0005
October	0.0004	0.20	0.0053	0.00005	0.0004	0.0009	0.001	0.0003
November	0.0025	0.28	0.0069	0.00003	0.0008	0.0025	0.005	0.0003
December	0.0025	0.49	0.0025	0.00003	0.0012	0.0025	0.003	0.0003

Upper Minto Creek Background Water Quality

Parameter	pH-L	Cond-L	Hard-D	Hard-T	TDS	TSS	ANIONS	SO4-D	Chloride	Fluoride	NUTRIENTS	N-NO2	N-NO3	Ammonia	TOTAL METALS	Ag-T	Al-T	As-T
Units	pH units	µS/cm	mg/L	mg/L	mg/L	mg/L	0	mg/L	mg/L	mg/L	0	mg/L	mg/L	mg/L	0	mg/L	mg/L	mg/L
January	8.1	349	169	158	226	2.0	0	18.0	0.80	0.43	0	0.0025	0.32	0.005	0	0.00001	0.01	0.0004
February	8.0	339	165	160	216	2.0	0	17.8	0.90	0.42	0	0.0025	0.29	0.006	0	0.00001	0.02	0.0003
March	8.2	343	161	159	176	3.2	0	19.0	0.50	0.42	0	0.0025	0.20	0.007	0	0.00001	0.04	0.0004
April	7.6	166	81	50	135	1.5	0	11.4	0.75	0.09	0	0.0369	0.01	0.020	0	0.00002	0.08	0.0003
May	7.9	145	83	75	121	15.3	0	39.8	0.28	0.21	0	0.0014	0.03	0.019	0	0.00001	0.34	0.0005
June	7.9	212	104	104	157	16.1	0	15.7	1.33	0.20	0	0.0054	0.05	0.022	0	0.00001	0.27	0.0006
July	7.8	250	119	131	166	12.5	0	9.6	0.38	0.22	0	0.0016	0.04	0.011	0	0.00001	0.58	0.0006
August	8.1	216	121	110	160	6.4	0	11.0	0.33	0.36	0	0.0019	0.02	0.028	0	0.00002	0.17	0.0005
September	7.8	200	113	108	156	16.7	0	10.8	0.43	0.22	0	0.0016	0.02	0.015	0	0.00002	0.16	0.0005
October	7.7	206	122	112	152	5.1	0	10.4	0.47	0.23	0	0.0050	0.05	0.018	0	0.00001	0.09	0.0005
November	7.9	287	153	152	174	8.3	0	10.1	0.96	0.26	0	0.0025	0.09	0.024	0	0.00001	0.13	0.0005
December	8.1	444	223	206	262	0.5	0	29.1	1.90	0.43	0	0.0025	0.06	0.025	0	0.00001	0.01	0.0004

Upper Minto Creek Background Water Quality

Parameter	Ba-T	B-T	Be-T	Bi-T	Ca-T	Cd-T	Co-T	Cr-T	Cu-T	Fe-T	Hg-T	K-T	Li-T	Mg-T	Mn-T	Mo-T	Na-T
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
January	0.087	0.025	0.00005	0.0005	39.5	0.00001	0.0003	0.0005	0.001	0.11	0.00001	1.57	0.003	14.5	0.060	0.0010	8.4
February	0.082	0.025	0.00005	0.0005	41.0	0.00003	0.0003	0.0005	0.006	0.04	0.00001	1.51	0.003	13.9	0.004	0.0010	8.1
March	0.083	0.025	0.00005	0.0005	39.7	0.00001	0.0003	0.0005	0.007	0.11	0.00001	1.46	0.003	14.6	0.005	0.0010	8.4
April	0.038	0.009	0.00003	0.0003	19.6	0.00005	0.0001	0.0006	0.007	0.14	0.00001	1.80	0.001	8.5	0.018	0.0008	5.4
May	0.050	0.049	0.00048	0.0005	19.0	0.00003	0.0003	0.0011	0.008	0.61	0.00001	1.01	0.003	6.4	0.030	0.0007	3.4
June	0.056	0.006	0.00022	0.0003	27.5	0.00003	0.0003	0.0009	0.004	0.66	0.00005	0.97	0.002	9.5	0.035	0.0008	6.6
July	0.066	0.007	0.00023	0.0003	32.6	0.00003	0.0006	0.0014	0.008	0.96	0.00008	0.98	0.002	11.4	0.058	0.0011	6.8
August	0.059	0.043	0.00043	0.0004	28.1	0.00001	0.0002	0.0006	0.004	0.54	0.00002	0.96	0.002	9.4	0.044	0.0009	5.7
September	0.055	0.042	0.00041	0.0002	27.5	0.00001	0.0002	0.0007	0.005	0.62	0.00002	0.92	0.002	9.1	0.056	0.0006	5.2
October	0.051	0.006	0.00023	0.0003	27.4	0.00003	0.0002	0.0004	0.005	0.43	0.00002	1.00	0.002	9.2	0.069	0.0009	5.2
November	0.075	0.025	0.00005	0.0005	40.1	0.00007	0.0003	0.0006	0.005	0.32	0.00001	0.82	0.003	12.5	0.050	0.0008	6.7
December	0.104	0.025	0.00005	0.0005	49.6	0.00002	0.0003	0.0005	0.003	0.07	0.00001	2.29	0.003	19.9	0.041	0.0012	11.7

Upper Minto Creek Background Water Quality

Parameter	Ni-T	Pb-T	P-T	Sb-T	S-T	Se-T	Si-T	Sn-T	Sr-T	Ti-T	Tl-T	U-T	V-T	Zn-T	Zr-T
Units	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
January	0.001	0.0001	0.01	0.00025	5.90	0.0003	6.4	0.0025	0.45	0.0025	0.00003	0.0019	0.0025	0.003	0.0003
February	0.001	0.0001	0.01	0.00025	6.00	0.0003	6.3	0.0025	0.47	0.0025	0.00003	0.0015	0.0025	0.003	0.0003
March	0.001	0.0001	0.02	0.00025	5.60	0.0004	6.4	0.0025	0.49	0.0025	0.00003	0.0015	0.0025	0.003	0.0003
April	0.001	0.0001	0.07	0.00013	1.22	0.0002	3.0	0.0012	0.22	0.0025	0.00001	0.0008	0.0008	0.005	0.0002
May	0.002	0.0003	0.04	0.00025	11.56	0.0005	7.7	0.0004	0.21	0.0125	0.00010	0.0003	0.0144	0.004	0.0005
June	0.002	0.0002	0.19	0.00007	5.51	0.0005	5.8	0.0001	0.19	0.0127	0.00004	0.0006	0.0014	0.006	0.0006
July	0.002	0.0004	0.00	0.00008	12.63	0.0005	6.4	0.0002	0.24	0.0267	0.00005	0.0007	0.0021	0.004	0.0007
August	0.002	0.0002	0.02	0.00023	4.92	0.0005	6.7	0.0004	0.24	0.0068	0.00009	0.0005	0.0127	0.004	0.0008
September	0.002	0.0002	0.03	0.00023	6.58	0.0005	6.8	0.0003	0.19	0.0068	0.00008	0.0003	0.0123	0.003	0.0006
October	0.001	0.0001	0.02	0.00006	3.15	0.0005	6.0	0.0002	0.20	0.0050	0.00005	0.0004	0.0008	0.001	0.0004
November	0.002	0.0003	0.03	0.00025	3.65	0.0002	8.2	0.0025	0.28	0.0069	0.00003	0.0008	0.0025	0.005	0.0003
December	0.002	0.0001	0.02	0.00025	7.90	0.0003	7.7	0.0025	0.49	0.0025	0.00003	0.0012	0.0025	0.003	0.0003

Pit Wall Source Terms

	Expected Case	Reasonable Worst Case
	Average stable field release rates	Max stable field release rates
	mg/yr	mg/yr
Ag	7720	20089
Al	72692632	141800208
Alk-T	0	0
Ammonia	0	0
As	391898	1079195
Ba	41844240	59330344
B	0	0
Be	0	0
Bi	0	0
Ca	0	0
Cd	9934	48770
Cl	0	0
Co	0	0
Cr	163796	701594
Cu	2287835	5999847
Fe	8426326	24984539
F	176498613	296273802
Hg	12550	17944
K	0	0
Li	0	0
Mg	0	0
Mn	5597073	15592355
Mo	1360801	5826929
Na	0	0
Ni	118226	551124
NO3	0	0
NO2	0	0
Pb	46984	522343
Sb	54956	121824
S	0	0
Se	290983	551124
Si	0	0
Sn	0	0
SO4-D	3314665447	6632630784
Sr	91374017	146365307
Ti	0	0
Tl	3379	9815
U	0	0
V	0	0
Zn	738188	3469519
Zr	0	0

Ore Stockpile Source Terms- Operational Period

	Expected Case	Reasonable Worst Case
	Average seepage concentration	Max seepage concentration
	mg/L	mg/L
Ag	0.00006	0.000076
Al	0.11784	0.549
Alk-T	392.8	410
Ammonia	0.468	0.55
As	0.000598	0.00084
Ba	0.0907	0.115
B	0.054	0.056
Be	0.0001	0.0001
Bi	0.0001	0.0001
Ca	185	196
Cd	0.000364	0.000501
Cl	4.82	5.2
Co	0.0005	0.0005
Cr	0.001	0.001
Cu	0.2236	0.393
Fe	0.1676	0.656
F	0.45	0.47
Hg	0.00001	0.00001
K	6.416	7.21
Li	0.0051	0.0051
Mg	44.44	46.7
Mn	0.653	0.983
Mo	0.01686	0.0183
Na	22.26	22.6
Ni	0.0024	0.0024
NO3	46.3	48.5
NO2	0.3414	0.553
Pb	0.00115	0.00193
Sb	0.0005	0.0005
S	451.02	2070
Se	0.02358	0.0263
Si	7.84	8.68
Sn	0.005	0.005
SO4-D	132	136
Sr	3.26	3.86
Ti	0.005	0.005
Tl	0.00005	0.00005
U	0.00629	0.00944
V	0.005	0.005
Zn	0.006	0.0063
Zr	0.0005	0.0005

Ore Stockpile Source Terms- Post-closure Period

	Expected Case	Reasonable Worst Case
	Average stable field release rates	Max stable field release rates
	mg/yr	mg/yr
Ag	1678	4366
Al	15797582	30816058
Alk-T	0	0
Ammonia	0	0
As	85167	234531
Ba	9093601	12893686
B	0	0
Be	0	0
Bi	0	0
Ca	0	0
Cd	2159	10599
Cl	0	0
Co	0	0
Cr	35596	152471
Cu	497193	1303888
Fe	1831211	5429646
F	38356725	64386300
Hg	2727	3900
K	0	0
Li	0	0
Mg	0	0
Mn	1216357	3388535
Mo	295730	1266310
Na	0	0
Ni	25693	119771
NO3	0	0
NO2	0	0
Pb	10210	113516
Sb	11943	26475
S	0	0
Se	63237	119771
Si	0	0
Sn	0	0
SO4-D	720343961	1441405056
Sr	19857425	31808147
Ti	0	0
Tl	734	2133
U	0	0
V	0	0
Zn	160423	753997
Zr	0	0

Mill Area Source Terms

	Expected Case	Reasonable Worst Case
	Average stable field release rates	Max Stable Field Release Rates
	mg/yr	mg/yr
Ag	2018	5252
Al	19004610	37071950
Alk-T	0	0
Ammonia	0	0
As	102457	282143
Ba	10939671	15511201
B	0	0
Be	0	0
Bi	0	0
Ca	0	0
Cd	2597	12750
Cl	0	0
Co	0	0
Cr	42823	183423
Cu	598127	1568588
Fe	2202961	6531906
F	46143428	77457203
Hg	3281	4691
K	0	0
Li	0	0
Mg	0	0
Mn	1463287	4076433
Mo	355765	1523380
Na	0	0
Ni	30909	144085
NO3	0	0
NO2	0	0
Pb	12283	136560
Sb	14368	31849
S	0	0
Se	76074	144085
Si	0	0
Sn	0	0
SO4-D	866579202	1734021120
Sr	23888632	38265440
Ti	0	0
Tl	883	2566
U	0	0
V	0	0
Zn	192990	907064
Zr	0	0

Particulate Loading Source Term

For predictive purposes, mass added to each litre of water due to suspended solids:

Ag	Al	As	Ba	B	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Li	Mg	Mn	Mo
mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
7.6E-05	0.47	0.00022	0.015	0.0043	5.9E-06	0.00068	3.6	4.4E-05	0.00026	0.00050	0.0075	0.68	7.5E-06	0.25	0.0011	1.8	0.038	0.00054

Na	Ni	Pb	P	Sb	S	Se	Si	Sn	Sr	Te	Th	Ti	Tl	U	V	Zn	Zr
mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1.1	0.0010	0.00022	0.072	0.00038	1.1	0.00038	1.1	0	0.055	0	0.00012	0.017	4.19643E-06	0.00040	0.0011	0.0064	0.00019

Appendix I
Source Terms for Use as Inputs to Water Quality Predictions: McGinty Creek

McGinty Creek Background Source Term

	Units	Ag	Al	As	Cd	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Ni	Pb	Se	Sulphate	Tl	Zn
January	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	mg/L	3.43333E-06	0.1150333	0.0004097	3.04333E-05	0.0003267	0.00321	0.21	0.1266667	0.000005	0.014187	0.00029	0.001283	0.0000516	0.000104	1	0.000001	0.003877
May	mg/L	0.0000062	0.2188286	0.0005343	2.95286E-05	0.0005514	0.00322857	0.541	0.1414286	3.57214E-06	0.040934	0.000462	0.001791	0.000195857	0.000119	1.692857	1.75714E-06	0.002919
June	mg/L	0.000013475	1.0323	0.00134	0.000082375	0.0018875	0.00781	2.46075	0.2425	0.00000375	0.194525	0.000688	0.004868	0.001193	0.000155	4.3125	0.000006975	0.009075
July	mg/L	0.00002425	3.3262	0.00205	0.000091125	0.0061625	0.0114575	5.3965	0.255	0.00001	0.1813	0.000826	0.00741	0.00202275	0.000225	2.8475	0.00002425	0.017448
August	mg/L	0.0000115	1.6579667	0.0014133	0.000066	0.0032667	0.00850333	3.03366667	0.2266667	0.000005	0.14141	0.00064	0.005307	0.001294333	0.00015	2.516667	1.26667E-05	0.008967
September	mg/L	0.0000025	0.03455	0.000375	0.0000245	0.0003	0.00222	0.127	0.265	0.0000025	0.006735	0.000775	0.002455	0.0001065	0.00017	5.45	0.000001	0.03275
October	mg/L	0.0000025	0.0361333	0.0003733	1.06667E-05	0.0002667	0.0016	0.14366667	0.3033333	0.000005	0.012287	0.000897	0.00098	0.000046	0.000177	7.633333	0.000001	0.000967
November	mg/L	0.0000025	0.0085	0.00024	0.000019	0.0002	0.00154	0.012	0.35	0.000005	0.0005	0.00103	0.00053	0.000066	0.00017	9.1	0.000001	0.0015
December	mg/L	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Minto North Pit Source Term

	Ag	Al	As	Cd	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Ni	Pb	Se	Sulphate	Tl	Zn
	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month	mg/month
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	4927.3	1.8E+07	215303	6705.19	120008	527221	3565944	1.3E+08	2463.65	6266309	654709	55555.3	70404.5	84937.5	6.16E+08	2148.71	451458
May	4927.3	1.8E+07	215303	6705.19	120008	527221	3565944	1.3E+08	2463.65	6266309	654709	55555.3	70404.5	84937.5	6.16E+08	2148.71	451458
June	1407.8	5240429	61515.1	1915.77	34287.9	150635	1018841	3.6E+07	703.9	1790374	187060	15873	20115.6	24267.9	1.76E+08	613.917	128988
July	1407.8	5240429	61515.1	1915.77	34287.9	150635	1018841	3.6E+07	703.9	1790374	187060	15873	20115.6	24267.9	1.76E+08	613.917	128988
August	1407.8	5240429	61515.1	1915.77	34287.9	150635	1018841	3.6E+07	703.9	1790374	187060	15873	20115.6	24267.9	1.76E+08	613.917	128988
September	1407.8	5240429	61515.1	1915.77	34287.9	150635	1018841	3.6E+07	703.9	1790374	187060	15873	20115.6	24267.9	1.76E+08	613.917	128988
October	1407.8	5240429	61515.1	1915.77	34287.9	150635	1018841	3.6E+07	703.9	1790374	187060	15873	20115.6	24267.9	1.76E+08	613.917	128988
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report

Prepared for

Minto Explorations Ltd.

Prepared by

SRK Consulting (Canada) Inc.
1CM002.003
July 2013

Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report

July 2013

Prepared for

Minto Explorations Ltd.
Suite 900-99 West Hastings Street
Vancouver, BC V6C 2W2

Tel: +1 604 684 8894
Web: www.capstonemining.com

Prepared by

SRK Consulting (Canada) Inc.
2200–1066 West Hastings Street
Vancouver, BC V6E 3X2
Canada

Tel: +1 604 681 4196
Web: www.srk.com

Project No: 1CM002.003

File Name:
Minto_WQ_Model_Report_Phase_V_VI_1CM002_003_SRJ_DBM_FINAL_20130703

Copyright © SRK Consulting (Canada) Inc., 2013

srk consulting

Table of Contents

1 Introduction ... 1
2 Water Balance Model Description ... 3
2.1 Water Balance Overview ... 3
2.2 Water Balance Inputs ... 5
2.2.1 Precipitation ... 5
2.2.2 Evaporation ... 10
2.2.3 Catchments ... 11
2.2.4 Runoff Coefficient ... 15
2.2.5 Runoff Distribution ... 16
2.2.6 Reservoirs ... 17
3 Load Balance Inputs ... 19
4 Model Implementation ... 22
4.1 Model Version ... 22
4.2 General Modelling Approach ... 22
4.2.1 Stochastic Water Balance Model ... 22
4.2.2 Loading Balance Model ... 23
4.3 Water Management ... 24
4.3.1 Runoff and Mine Water Conveyance ... 24
4.3.2 Water Diversion Options ... 28
4.4 Tailings Slurry Deposition ... 29
4.5 Model Calibration ... 30
4.6 Water Treatment ... 30
5 Model Results ... 31
5.1 Water Balance Results ... 31
5.1.1 Minto Creek Water Balance Results ... 31
5.1.2 McGinty Creek Water Balance Results ... 31
5.2 Water Quality and Parameter Loadings Results ... 34
5.2.1 Minto Creek Water Quality Results ... 34
5.2.2 McGinty Creek Water Quality Results ... 46
6 Discussion ... 49
6.1 Limitations of the Water and Load Balance Model ... 49
6.2 Interpretation of Model Results ... 50
6.3 Dry Bulk Density of Tailings ... 50
7 References ... 53

List of Figures

Figure 1-1 Minto Mine General Arrangement, End of Phase V/VI 2
Figure 2-1 Water Balance Schematic 4
Figure 2-2 Simplified Water Balance Schematic 4
Figure 2-3 Comparing Minto Mine and Pelly Ranch Rainfall (Sept. 2005 to Sept. 2011) 7
Figure 2-4: Precipitation Frequency Analysis for the Minto Mine Site 9
Figure 2-5 Upper Minto Creek Sub-Catchments 13
Figure 2-6 McGinty Creek Sub-Catchments 14
Figure 2-7 Water Balance Runoff Coefficient vs. Total Annual Precipitation 16
Figure 2-8 Runoff Distribution Model 17
Figure 3-1 Source Term Allocation 21
Figure 4-1 Example of Result Generated by the Monte Carlo Simulation – Predicted Range of Average Flow from Upper Minto Creek to W3 in 2036 23
Figure 4-2 Modelled Routing of Water: 2014 25
Figure 4-3 Modelled Routing of Water: 2018 26
Figure 4-4 Modelled Routing of Water: Post-closure 27
Figure 5-1 Model Predictions of Discharge Volumes from Minto Mine 32
Figure 5-2 Modelled Area 2 Pit Water and Tailings Volumes 33
Figure 5-3 Model Predictions of Dissolved Copper Concentrations in Area 2 Pit Water 38
Figure 5-4 Model Predictions of Dissolved Selenium Concentrations in Area 2 Pit Water 39
Figure 5-5 Model Predictions of Total Copper Concentrations at W3 40
Figure 5-6 Model Predictions of Total Selenium Concentrations at W3 41
Figure 5-7 Model Predictions of Total Copper Concentrations in Lower Minto Creek 42
Figure 5-8 Model Predictions of Total Selenium Concentrations in Lower Minto Creek 43
Figure 5-9 Model Predictions of Nitrate-N Concentrations in Lower Minto Creek 44
Figure 5-10 Model Predictions of Ammonia-N Concentrations in Lower Minto Creek 45
Figure 5-11a McGinty Creek Water Quality Prediction: Worst Case Results (1 of 2) 47
Figure 5-11b McGinty Creek Water Quality Prediction: Worst Case Results (2 of 2) 48

List of Tables

Table 2-1 Input Required for Water Balance Model 5
Table 2-2 Monthly Rainfall and Total Precipitation Measured at Minto 5
Table 2-3 Regional Meteorological Stations 6
Table 2-4 Recorded Average Monthly Precipitation at Pelly Ranch (1951 to 2012) 7
Table 2-5 Estimated Average Precipitation at Minto Based On Pelly Ranch Precipitation Data 8
Table 2-6 Precipitation Frequency Analysis Statistics 10
Table 2-7 Estimated Monthly Open Water Evaporation Values for Minto 10
Table 2-8 Upper Minto Creek Catchment Areas 12
Table 2-9 McGinty Creek Sub-Catchments 15
Table 3-1 Summary of Load Balance Source Terms 20
Table 4-1 Modelled Routing of Runoff and Mine Water Conveyance 28
Table 4-2 Minto Phase V/VI Runoff Collection Sumps and Water Diversion Options, Average Year 29
Table 5-1 Modelling Predictions of Area 2 Pit Water Quality 35
Table 5-2 Modelling Predictions of W3 Water Quality 36
Table 5-3 Modelling Predictions of W2 Water Quality 37
Table 5-4 Water Quality Modelling Results for McGinty Creek at Mouth 49

Appendices

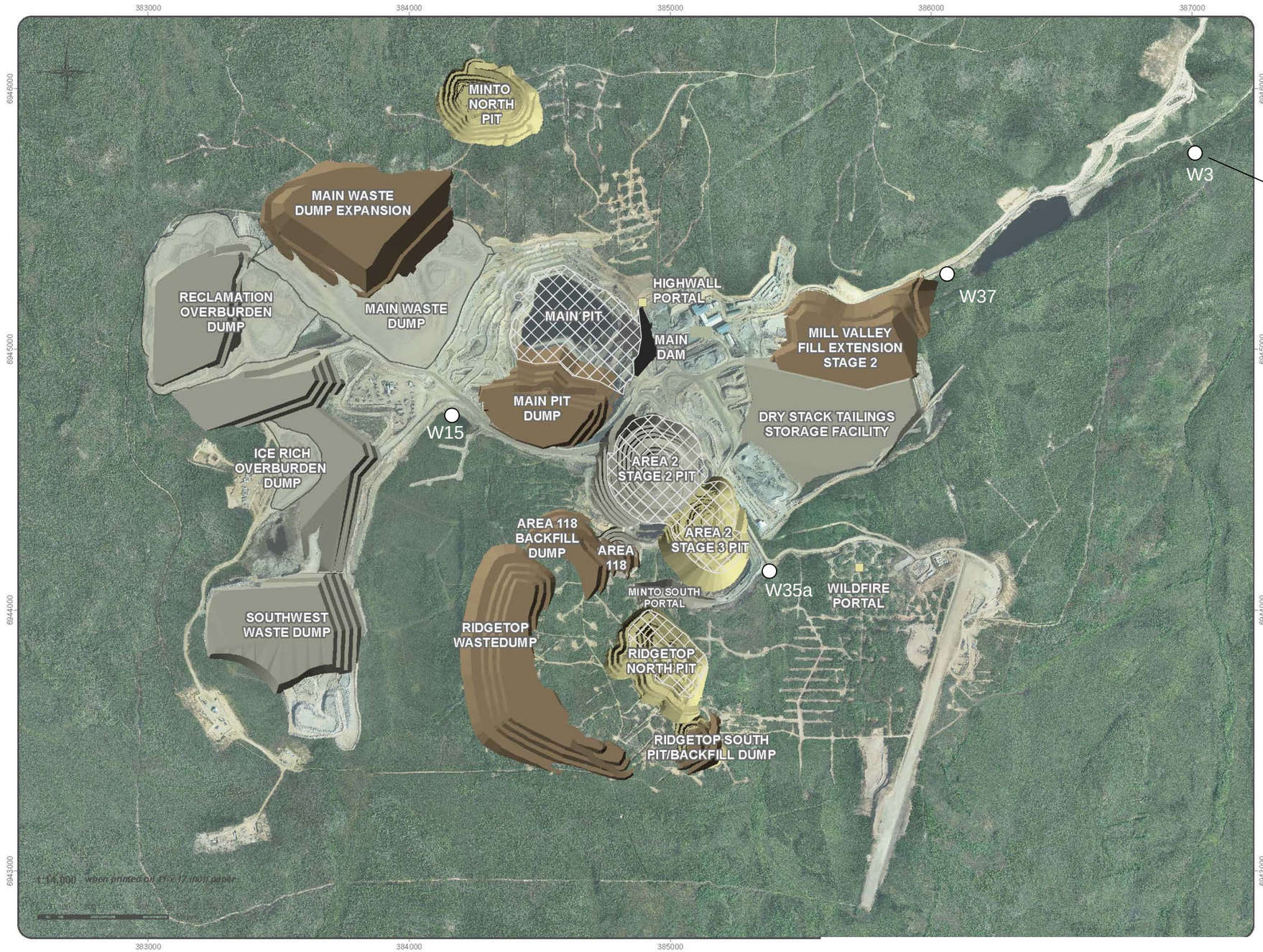
Appendix A: Minto Mine 2012 Water Balance Update
Appendix B: Monthly Water Quality Modelling Predictions

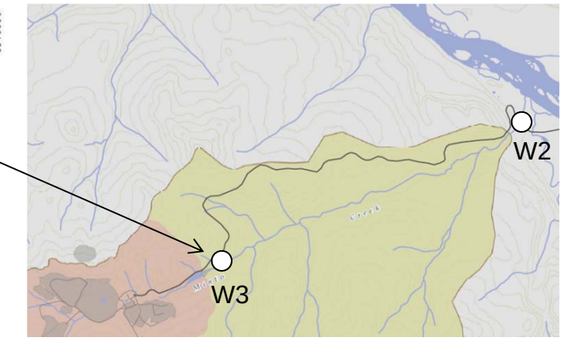
1 Introduction

This report describes the water and load balance model developed for the Minto Mine Phase V/VI expansion.

The water and load balance model builds on previous water balance modelling work prepared for the Phase IV Yukon Environmental and Socioeconomic Assessment Board (YESAB) application (SRK 2010) and for the Water License Amendment 8 application (SRK 2012). The model covers the end of Phase IV (current operation) and Phase V/VI though closure and post-closure. The water balance model uses a stochastic approach where annual precipitation rates are varied to evaluate potential effects of wet and dry climatic conditions. Water quality results are based on estimates of aqueous chemical loadings applied to modelled water flow. Model predictions of annual flow and quality of water within and downstream of the Minto Mine site are presented for 'Expected Case' and 'Reasonable Worst Case' scenarios. A map showing the general arrangement of the site configuration at the end of Phase V/VI is shown in Figure 1-1.

Section 2 describes inputs to and components of the water balance model. Section 3 summarizes the load balance model inputs. Model scenario implementation is described in Section 4 and modelling results are presented in Section 5 followed by a discussion in Section 6.





Legend

W3 Routine water quality monitoring station

Phase V/VI Tailings

Phase V/VI Pits

Phase V/VI Dumps

Phase V/VI Dam

Phase IV Features

Source: Adapted from Figure 1-1 (prepared by Access Consulting Group) in Minto Explorations Ltd. 2013a. Minto Mine Phase V/VI Expansion, Project Proposal: Phase V/VI Expansion of Mining and Milling, Minto Mine, Yukon.

srk consulting	CAPSTONE MINING CORP. MINTO MINE OPERATED BY MINTO EXPLORATIONS LTD.	Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report
Job No: 1CM002.003 Filename: Fig_1-1_PhaseV-VI_GeneralArrangement.pptx	Minto Mine	**General Arrangement- End of Phase V/VI**
		Date: June 2013 · Approved: DBM · Figure: **1-1**

2 Water Balance Model Description

2.1 Water Balance Overview

Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Model Report\Figures\ Figure 2.1 and 2.2 Water_Balance_Schematic_Minto_REV00.pptx

Figure 2-1 shows a schematic of the conceptual water balance for the Minto Site. The water balance can be described as:

$$Water\ Input = Water\ Storage + Water\ Output \tag{1}$$

Precipitation is the only source of water to site and therefore the only input. The open pits, tailings pores and the Water Storage Pond (WSP) are the primary water storage reservoirs on site. Water outputs include water released to Minto Creek and water lost to evapotranspiration. It follows that the net input of water can also be expressed as:

$$Net\ Surface\ Runoff = Precipitation - Evapotranspiration \tag{2}$$

Net surface runoff can also be described in terms of a runoff coefficient. In general terms, this can be represented as:

$$Net\ Surface\ Runoff = Precipitation \cdot Runoff\ Coefficient \tag{3}$$

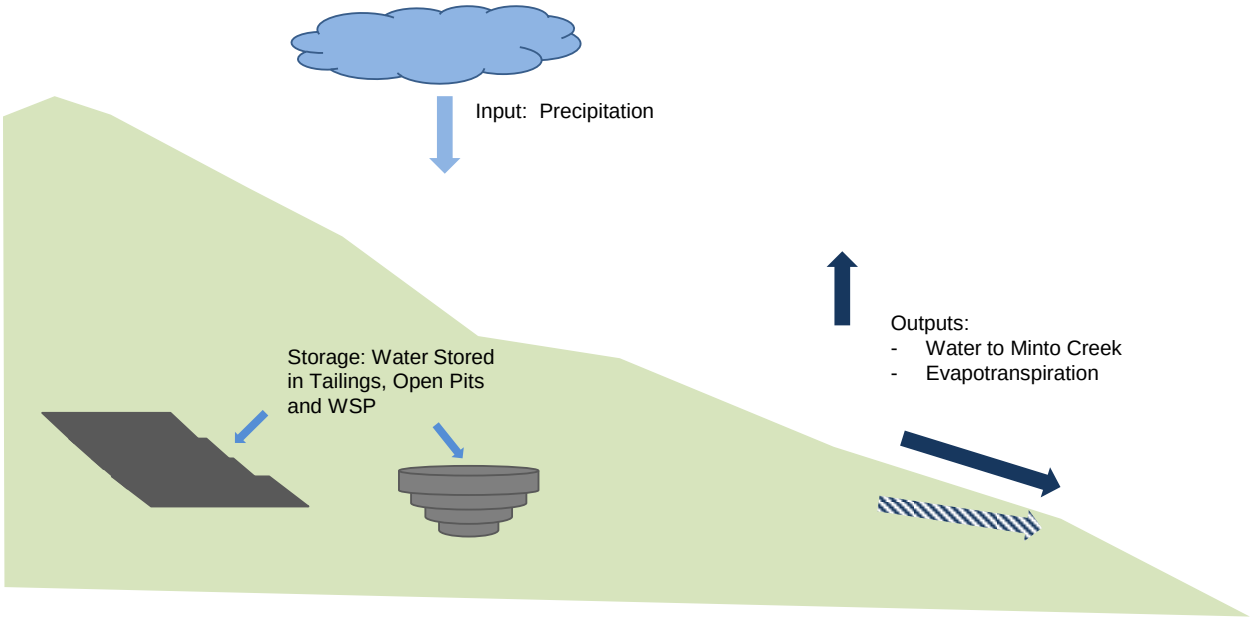
The runoff coefficient approach allows the water balance to be simplified to:

$$Net\ Surface\ Runoff - \text{Water}\ stored\ on\ Site = Water\ Released\ to\ Minto\ Creek \tag{4}$$

Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Model Report\Figures\ Figure 2.1 and 2.2 Water_Balance_Schematic_Minto_REV00.pptx

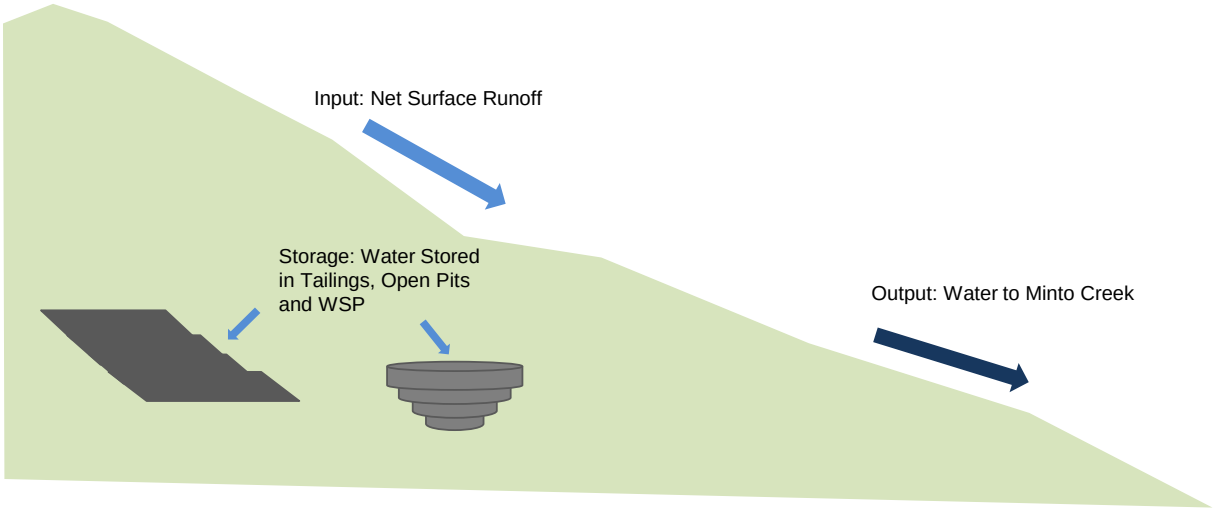
Figure 2-2 shows a schematic of the simplified water balance. In a year with average annual precipitation (329 mm/year) the net volume of surface runoff on the Minto Mine Site is approximately 1,000,000 m^3. Of that, approximately 550,000 m^3 will report to tailings pores during the period when the mill is running. This leaves (in an average year) approximately 450,000 m^3 of water that is available for release to Minto Creek, assuming no net change in the inventory of free water on site.

Infiltration could be included as an output term in equation (2) but for modelling purposes was assumed to be equivalent to discharge of groundwater to surface water. At Minto, the cross section of the Minto Creek Valley at the Water Storage Dam is narrow and bedrock is relatively shallow. As such, the majority of groundwater that flows toward Minto Creek is expected to report to the stream as surface water and only a small fraction is expected to flow from site via subsurface pathways (SRK, 2012). As such, it is considered acceptable to treat infiltration as equal to groundwater discharge, and to exclude both from the model.



Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Model Report\Figures\ Figure 2.1 and 2.2 Water_Balance_Schematic_Minto_REV00.pptx

Figure 2-1 Water Balance Schematic



Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Model Report\Figures\ Figure 2.1 and 2.2 Water_Balance_Schematic_Minto_REV00.pptx

Figure 2-2 Simplified Water Balance Schematic

2.2 Water Balance Inputs

Inputs required for the water balance model are summarized in Table 2-1 and are discussed in the following sections.

Table 2-1 Input Required for Water Balance Model

Water Balance Component	Input Required
Net surface runoff	Annual precipitation rates Open water evaporation rates Sub-catchment areas Site-wide (net) runoff coefficient Typical hydrograph
Water storage	Open pit volumes Tailings and waste rock deposition schedules
Water Released to Minto Creek	None (this is calculated by the water balance model)

2.2.1 Precipitation

Precipitation is the only input of water to the Minto Mine site water balance model. The water balance model calculates annual volumes of surface runoff based on annual precipitation and a site-wide runoff coefficient. Therefore, a reliable estimate of the frequency and intensity of total annual precipitation is important for the accuracy of model predictions.

Rainfall data collected on site was used in conjunction with long-term regional precipitation records to estimate the distribution of annual precipitation rates. The precipitation record for the Minto site is shown in Table 2-2. Rainfall data has been recorded at site beginning in September 2005. In October 2011, Minto installed an adapter for measuring snowfall as water equivalent. At the time of writing, on-site rainfall and total precipitation data were available for the period September 2005 through December 2012.

Table 2-2 Monthly Rainfall and Total Precipitation Measured at Minto

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2005	**	**	**	**	**	**	**	**	21.60	23.00	11.60	4.60	60.8
2006	0.00	0.40	2.80	**	22.84	35.80	28.63	29.20	12.20	12.20	0.00	0.00	144.1
2007	0.20	0.00	0.40	5.80	4.60	36.00	47.80	21.00	33.80	11.80	0.00	0.00	161.4
2008	1.20	2.00	0.80	1.80	9.60	26.20	**	100.60	21.80	6.40	0.00	0.00	170.4
2009	5.20	0.00	0.80	3.23	**	**	6.08	50.76	7.20	16.60	0.00	0.00	89.9
2010	0.00	0.00	0.00	0.00	7.60	48.8	75.6	46.4	18.0	16.3	3.05	0.00	215.8
2011	0.00	6.40	0.20	0.40	15.3	56.0	101.8	64.8	15.6	4.40[(A)]	0.15**	3.94**	269.0
2012	9.0**	9.9**	34.9	0.0	0.1**	32.1	44.8	20.6	26.1	16.5	17.1	18.4	229.5

Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\02_Hydrology_and_Meteorology\Met_Data\Minto_MasterStationFile_20120222.xlsx[MintoMemoTable]
Notes: ** partial data only.
[(A)] Measurement transitioned from rainfall to total precipitation on Oct. 15/2011.
Green highlight: total precipitation measurements.

Regional precipitation data were available from a number of meteorological stations in the Yukon (Table 2-3). Rainfall data from each station were correlated with precipitation data collected from the Minto site to determine whether long-term regional precipitation data would be suitable for use as a basis for estimating annual precipitation at the Minto Site.

As expected, the rainfall data at the closest regional meteorological station at Pelly Ranch (Climate ID: 2100880), located 23 km from the Minto Mine, resulted in the best correlation with rainfall data from the site. The precipitation record at Pelly Ranch dates back to December 1951 and has continued to the present day. Measured monthly and annual average precipitation at the Pelly Ranch station (1951 to 2012) are shown in Table 2-4. Figure 2-3 shows a plot of monthly rainfall values at Minto and at the Pelly Ranch station. The correlation can be expressed as:

$$Minto\ Rainfall = 0.88 * Pelly\ Ranch\ Rainfall \quad (6)$$

Table 2-3 Regional Meteorological Stations

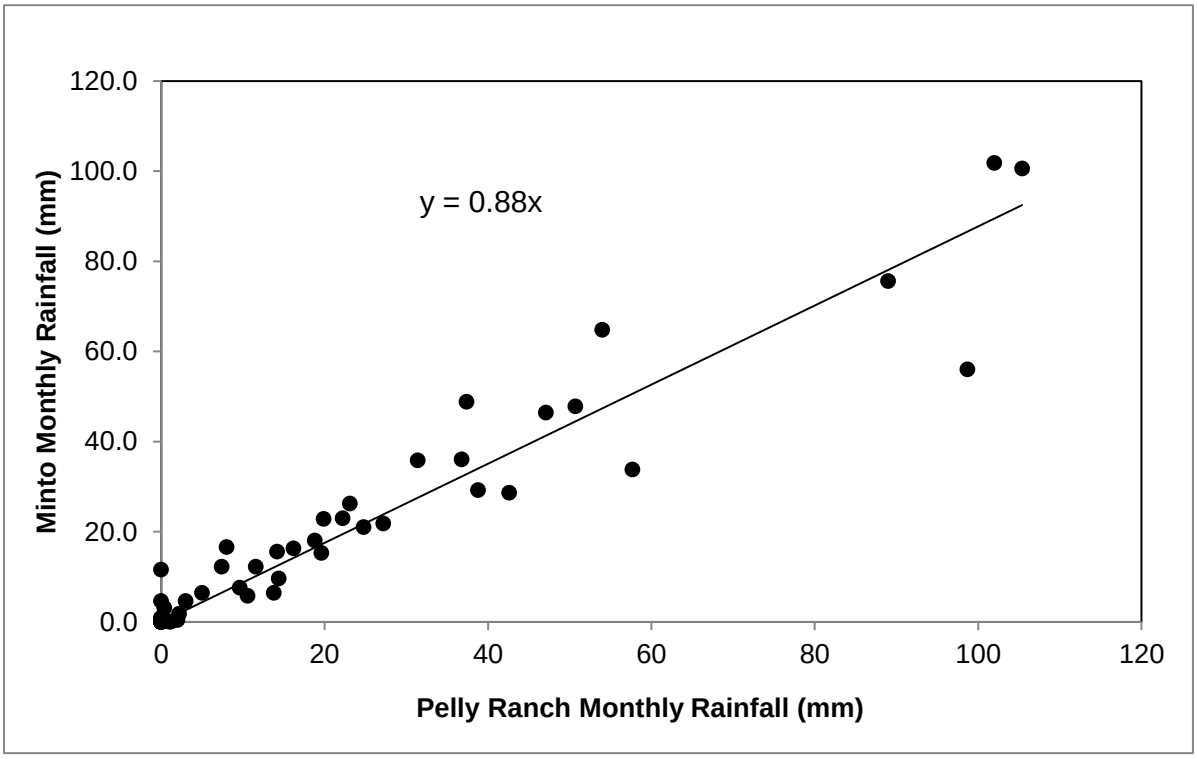
Station	Latitude	Longitude	Distance From Site (km)	Elevation (m)	Record Begins	Record Ends
Minto Site	62°36'59"	137°15'00"	0	887.0	Sep-05	Present
Burwash Airport	61°22'00"	139°03'00"	167.8	806.8	Oct-66	Present
Carmacks	62°06'00"	136°18'00"	109.2	524.9	Aug-63	Present
Dawson Airport	64°02'35"	139°07'40"	184.2	370.3	Jan-76	Present
Faro Airport	62°12'27"	133°22'33"	204.6	716.6	Dec-77	Present
Haines Junction	60°46'21"	137°34'49"	205.8	595.3	Oct-44	Present
Mayo Airport	63°37'00"	135°52'00"	131.2	503.8	Oct-11	Present
McQuesten	63°36'00"	137°31'00"	110.2	457.0	Oct-86	Present
Pelly Ranch	62°49'00"	137°22'00"	23.0	454.2	Dec-51	Present
Whitehorse Airport	60°42'34"	135°04'07"	241.3	706.2	Apr-42	Present

Source: SRK, :\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\02_Hydrology_and_Meteorology\Regional_Analysis\Regional Precipitation Data\Regional_Met_Station_Summary_1CM002.003_Rev01_TC.xlsx

Table 2-4 Recorded Average Monthly Precipitation at Pelly Ranch (1951 to 2012)

Month	Average Rainfall (mm/month)	Average Snowfall as Water Equivalent (mm/month)	Average Total Precipitation (mm/month)
Jan	0.09	20.1	20.2
Feb	0.09	14.2	14.3
Mar	0.16	11.1	11.3
Apr	3.53	6.5	10.0
May	21.84	0.4	22.3
Jun	36.92	0.0	36.9
Jul	54.56	0.0	54.6
Aug	39.88	0.0	39.9
Sep	26.12	2.2	28.3
Oct	7.66	15.5	23.1
Nov	0.34	26.2	26.5
Dec	0.09	21.3	21.4
Total (mm/year)	191.3	117.5	308.8

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\2_Hydrology_and_Meteorology\Met_Data\Minto_MasterStationFile_20130607.xlsx



Source:Z:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\02_Hydrology_and_Meteorology\Met_Data\Minto_MasterStationFile_20130607.xlsx

Figure 2-3 Comparing Minto Mine and Pelly Ranch Rainfall (Sept. 2005 to Sept. 2011)

A comparison of snow-water equivalent data from Minto and Pelly Ranch (not shown) resulted in the following correlation:

$$Minto\ Snowfall = 1.24 * Pelly\ Ranch\ Snowfall \quad (7)$$

Based on these correlations the annual precipitation at Minto correlates to the annual precipitation at Pelly Ranch as follows:

$$Minto\ Annual\ Total\ Precipitation = 1.09 * Pelly\ Ranch\ Annual\ Total\ Precipitation \quad (8)$$

Table 2-5 shows the estimated average total annual precipitation values for Minto based on the correlation with Pelly Ranch precipitation data.

A frequency (or probability) distribution of total annual precipitation was developed for the Minto site based on the long-term total precipitation record available for the Pelly Ranch station. Pelly Ranch precipitation values were only used if a calendar year contained valid information for more than 95% of the total number of days in that year. The use of this data quality criteria resulted in a total of 51 years of valid data to be included in the frequency distribution analysis.

The 51 years of annual precipitation data were fitted against six different statistical distributions: Normal, Log-Normal, Gumbel, Log-Pearson, Pearson III, and GEV. The best fit was obtained with a Pearson III Distribution (r^2 = 0.99). This Intensity/frequency distribution was used as input for the water balance model. The final results are presented in Figure 2-4 and Table 2-6.

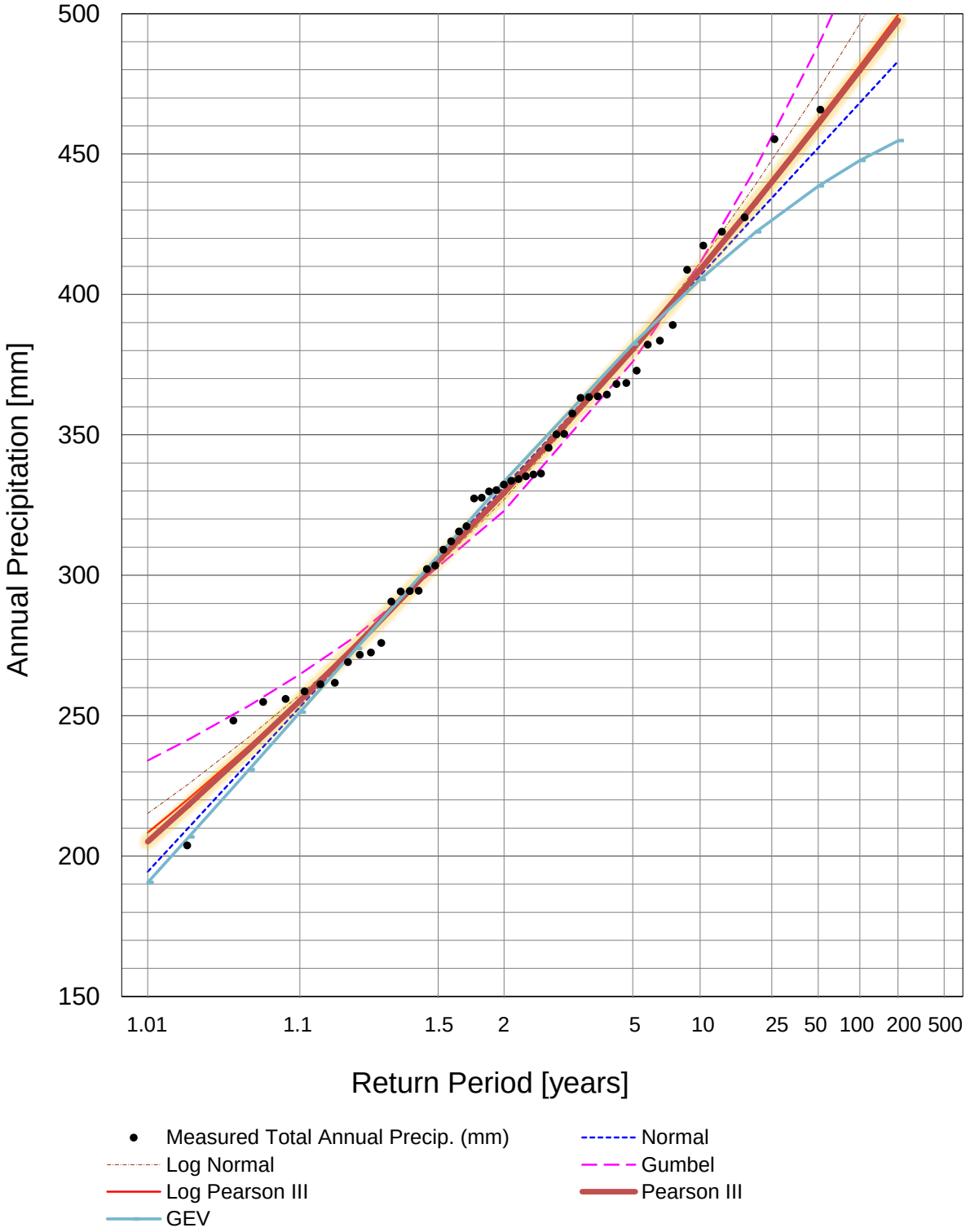
Table 2-5 Estimated Average Precipitation at Minto Based On Pelly Ranch Precipitation Data

Month	Average Rainfall (mm/month)	Average Snowfall (mm/month)	Average Total Precipitation (mm/month)
Jan	0.08	28.6	28.7
Feb	0.08	20.3	20.4
Mar	0.14	15.9	16.0
Apr	3.10	9.29	12.4
May	19.16	0.63	19.8
Jun	32.38	0.00	32.4
Jul	47.85	0.00	47.9
Aug	34.98	0.02	35.0
Sep	22.91	3.07	26.0
Oct	6.72	22.0	28.7
Nov	0.30	37.3	37.6
Dec	0.08	30.4	30.4
Total (mm/year)	167.8	167.5	335.3

Source:Z:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\2_Hydrology_and_Meteorology\Met_Data\Minto_MasterStationFile_20130607.xlsx

The estimated average total precipitation for Minto was slightly lower for the frequency analysis (329 mm/year) than for the direct computation using the average total precipitation value from Pelly Ranch (335 mm/year). This difference is a result of the imperfect fit between the data and the distribution model that is used. In the interest of consistency with frequency distribution

approach, the total precipitation value generated by the Pearson III distribution (329 mm) was used as input to the water balance model.



Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\PMP & PMF\PMP Hershfield Estimation & Freq Distribution_VM_Rev4_SRJ.xlsx

Figure 2-4: Precipitation Frequency Analysis for the Minto Mine Site

Table 2-6 Precipitation Frequency Analysis Statistics

Cumulative Probability	Return Period	Season	Normal	Log Normal	Gumbel	Log Pearson III	Pearson III	GEV
0.005	200	Wet	483	519	554	499	498	455
0.01	100		468	496	521	481	480	448
0.02	50		452	473	489	462	461	439
0.05	20		428	439	445	434	433	422
0.1	10		407	411	411	409	409	405
0.2	5		381	380	376	380	380	382
0.5	2		331	327	323	329	329	333
0.8	5	Dry	275	275	278	275	275	274
0.9	10		253	257	265	256	255	251
0.95	20		233	242	254	239	238	231
0.98	50		210	226	242	220	218	207
0.99	100		194	215	234	208	205	191
	R^2		0.98	0.98	0.97	0.98	0.99	0.97

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\PMP Hershfield Estimation & Freq Distribution_VM_Rev4_SRJ.xlsx

2.2.2 Evaporation

Evaporation is not measured at the Minto site. Monthly lake evaporation (aka potential evaporation) has been recorded at the Pelly Ranch station from 1965 to 2005; the mean annual lake evaporation value is 452 mm. In historical revisions of Minto's water balance, open water evaporation and evapotranspiration were estimated based on the regional data and model estimates.

Estimated evaporation values for the site were adopted from work completed by Clearwater Consultants Ltd. as part of the previous year's water balance update completed for the mine site (CCL 2010). Table 2-7 shows the adopted monthly evaporation values, which for modelling purposes were assumed to be constant for each year included in the scenario runs.

Evaporation estimates are associated with considerable uncertainty. However, in the present model revision, evaporation losses were only discretely applied to open water bodies, including the pit lakes and the Water Storage Pond. A sensitivity analysis was completed to quantify the effect of uncertainties associated with the annual evaporation rate. The analysis showed that a difference of +/- 100 mm of annual evaporation would make a +/- 2.6% difference to the annual water balance (net inflow) estimate, which was considered to be relatively insignificant in the context of other uncertainties and year-to-year variability.

Table 2-7 Estimated Monthly Open Water Evaporation Values for Minto

Month	April	May	June	July	August	September	Total
Evaporation (mm)	12	83	119	112	83	30	438

Source: Z:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\04_Amendment_8_Support\02_Source_Term_Archive\[Minto Mine Water Balance_2011 Update Modified Goldsim_SRJ_Rev01

2.2.3 Catchments

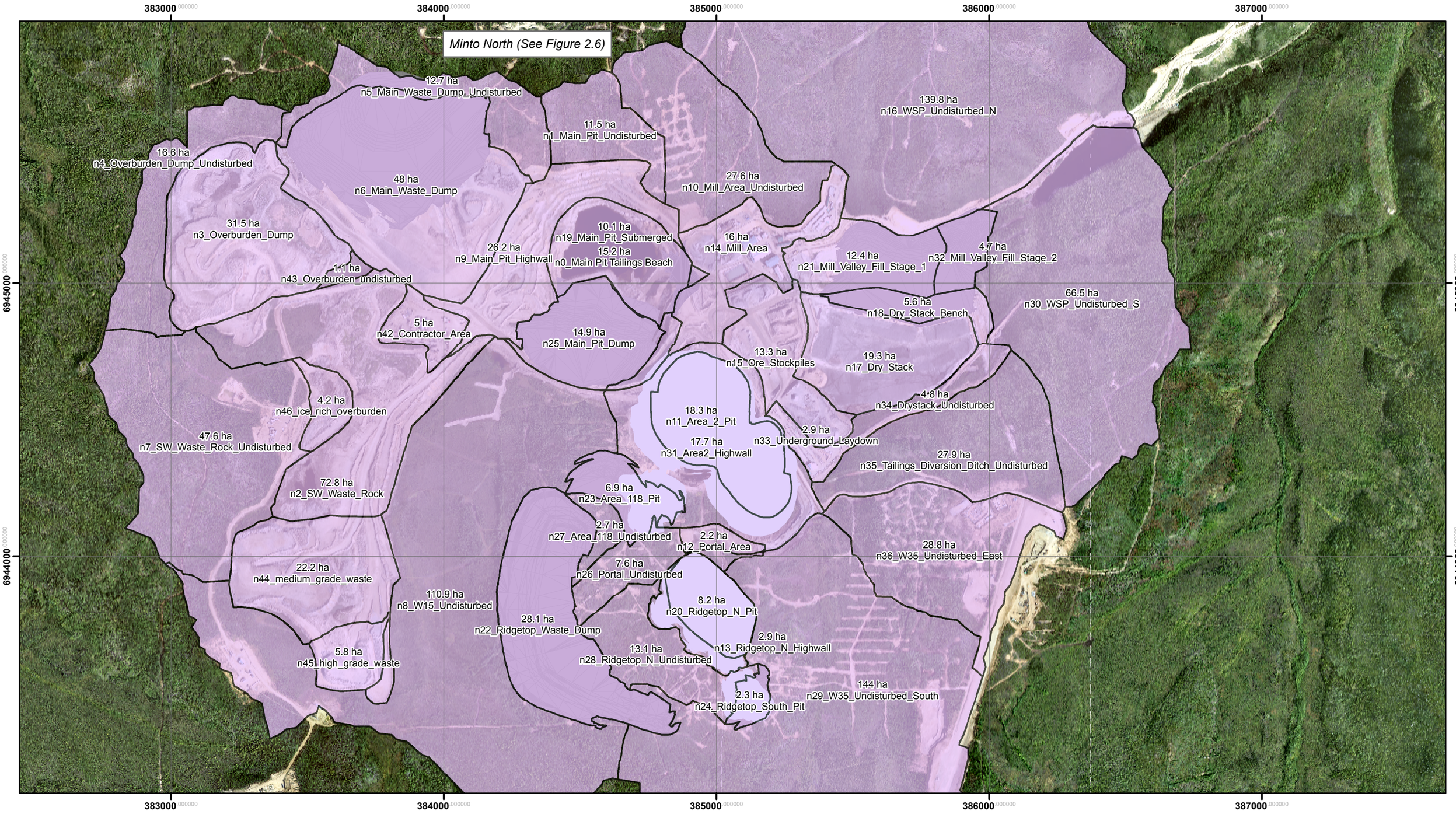
The Minto Mine site, excluding the proposed Minto North Pit, is located within the Upper Minto Creek watershed. For the purposes of this report, Upper Minto Creek will refer to the portion of the Minto Creek catchment upstream of the Water Storage Dam. The catchment downstream of the Water Storage Dam will be referred to as Lower Minto Creek. The Upper Minto Creek catchment covers an area of 1,065 ha, which has been divided into sub-catchments for modeling purposes. Table 2-8 and Figure 2-5 show Upper Minto Creek sub-catchments that were delineated for the Phase V/VI water balance model.

The Minto North Pit is located within the McGinty Creek catchment to the north of the Minto Mine. Table 2-9 and Figure 2-6 shows McGinty Creek sub-catchments delineated for the Phase V/VI water and load balance model.

Table 2-8 Upper Minto Creek Catchment Areas

Sub-Catchment	Area (ha)
n0_Main Pit Tailings Beach	15.2
n1_Main_Pit_Undisturbed	11.5
n2_SW_Waste_Rock	72.8
n3_Overburden_Dump	31.5
n4_Overburden_Dump_Undisturbed	16.6
n5_Main_Waste_Dump_Undisturbed	12.7
n6_Main_Waste_Dump	48.0
n7_SW_Waste_Rock_Undisturbed	47.6
n8_W15_Undisturbed	110.9
n9_Main_Pit_Highwall	26.2
n10_Mill_Area_Undisturbed	27.6
n11_Area_2_Pit	18.3
n12_Portal_Area	2.2
n13_Ridgetop_N_Highwall	2.9
n14_Mill_Area	16.0
n15_Ore_Stockpiles	13.3
n16_WSP_Undisturbed_N	139.8
n17_Dry_Stack	19.3
n18_Dry_Stack_Bench	5.6
n19_Main_Pit_Submerged	10.1
n20_Ridgetop_N_Pit	8.2
n21_Mill_Valley_Fill_Stage_1	12.4
n22_Ridgetop_Waste_Dump	28.1
n23_Area_118_Pit	6.9
n24_Ridgetop_South_Pit	2.3
n25_Main_Pit_Dump	14.9
n26_Portal_Undisturbed	7.6
n27_Area_118_Undisturbed	2.7
n28_Ridgetop_N_Undisturbed	13.1
n29_W35_Undisturbed_South	144.0
n30_WSP_Undisturbed_S	66.5
n31_Area2_Highwall	17.7
n32_Mill_Valley_Fill_Stage_2	4.7
n33_Underground_Laydown	2.9
n34_Drystack_Undisturbed	4.8
n35_Tailings_Diversion_Ditch_Undisturbed	27.9
n36_W35_Undisturbed_East	28.8
n42_Contractor_Area	5.0
n43_Overburden_undisturbed	1.1
n44_medium_grade_waste	22.2
n45_high_grade_waste	5.8
n46_ice_rich_overburden	4.2
Total Catchment Area	**1065.0**

Source:X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\04_Catchments\Phase_V_VI_Catchments\Minto_Phase_V_VI_Catchment_Table.xlsx



N

0 100 200 400 600 Meters

Legend

Upper Minto Creek Sub-Catchments

srk consulting

Job No: 1CM002.003

Filename: PhV_VI_Minto_Sub_Catchments_REV02_SRJ

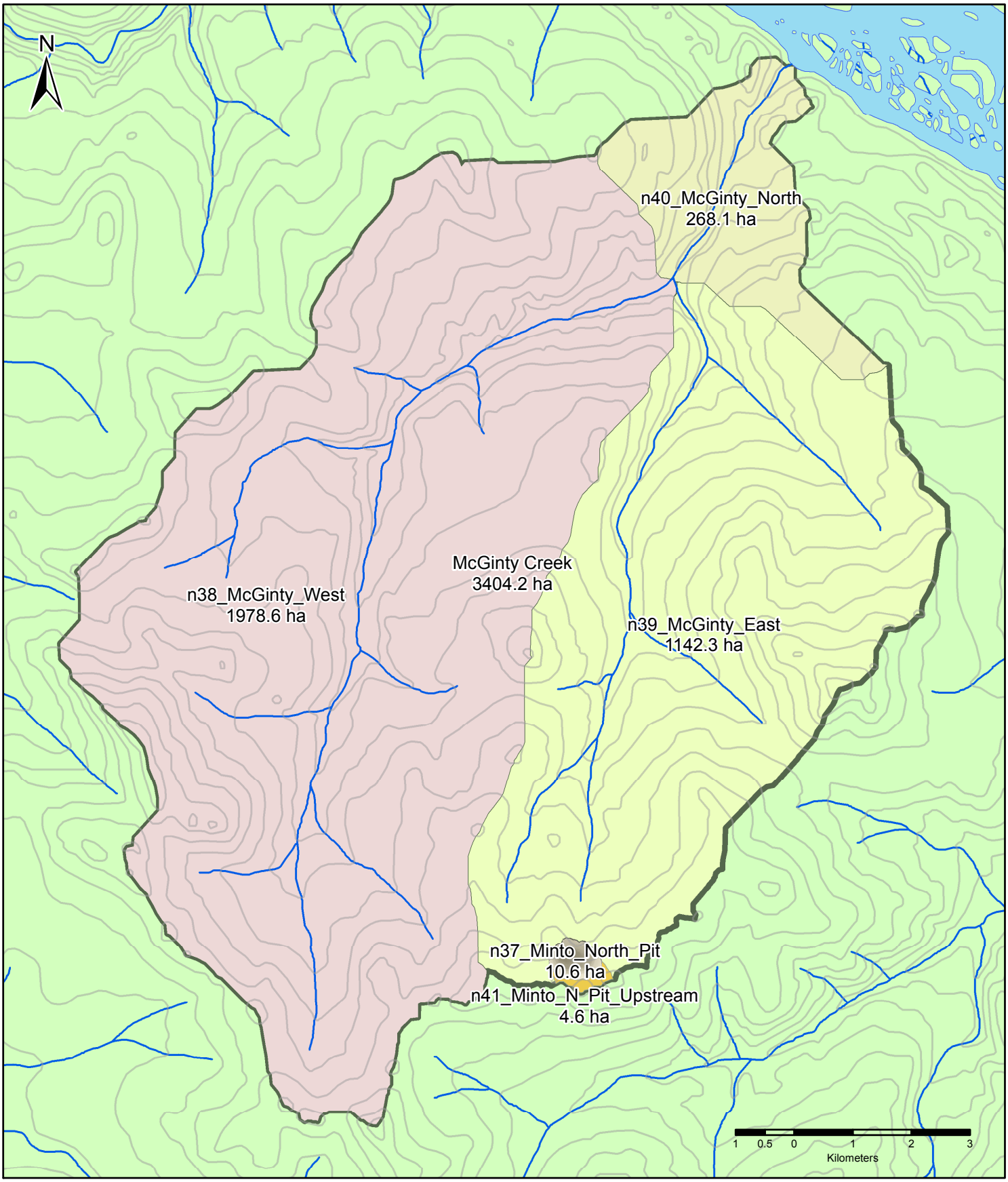
CAPSTONE MINING CORP. MINTO MINE

Minto Mine

Minto Mine Phase V/VI Expansion
Water and Load Balance Report

Upper Minto Creek Sub-Catchments

Date:	Approved:	Figure:
11 April 2013	SRJ	2.5



srk consulting	CAPSTONE MINING CORP. MINTO MINE	Minto Mine Phase V/VI Expansion Water and Load Balance Report
		McGinty Creek Sub-Catchments
Job No: 1CM002.003 Filename: PhV_VI_Minto_North_REV04_SRJ	Minto Mine	Date: 11 June 2013 · Approved: SRJ · Figure: **2.6**

Table 2-9 McGinty Creek Sub-Catchments

Sub-Catchment	Area (ha)
n37_Minto_North_pit	10.6
n38_McGinty_West	1978.6
n39_McGinty_East	1142.3
n40_McGinty_North	268.1
n41_Minto_N_Pit_Upstream	4.6
Total Catchment Area	**3404.2**

Source:X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\04_Catchments\Phase_V_VI_Catchments\Minto_Phase_V_VI_Catchment_Table.xlsx

2.2.4 Runoff Coefficient

As described in Section 2.1 the annual runoff volume can be estimated by multiplying the total annual precipitation by a site-wide runoff coefficient (Equation 3).

For the Phase V/VI water and load balance, the use of a site-wide runoff coefficient for land areas was found to be more appropriate than assigning specific runoff coefficients to areas with different land use and surface cover characteristics. Firstly, flow measurements on site (hydrological monitoring stations and flow meters) measure runoff collected from different land use areas, *i.e.* a combination of undisturbed and developed mine areas. This makes it difficult to evaluate runoff coefficients for any one type of land use area based on actual site performance data. Therefore, uncertainties associated with area-specific runoff coefficients would magnify the uncertainty of the site-wide water balance and it would be necessary to arbitrarily adjust each of the runoff coefficients to match the site-wide water balance. Secondly, during the operations and closure (pit filling) phases the available water storage capacity on site is generally greater than the annual volume of surface runoff, and therefore reliable forecasts of total site-wide annual runoff volumes are more important for water management planning than forecasts of runoff from individual sub-catchments.

Monitoring data collected on site since 2007 was used to estimate the value of the site-wide runoff coefficient for Upper Minto Creek. The runoff coefficient estimate is updated once a year in conjunction with the annual water balance update for the site. The 2012 water balance update (Appendix A) generally agreed with the established runoff coefficient value of 0.30, which was derived based on previous years' water balance data.

The estimated total annual precipitation at the Minto Mine has generally been greater than 300 mm/year for the period 2007 to 2012. Consequently, the site-wide runoff coefficient of 0.30 was effectively derived for annual precipitation greater than 300 mm/year. Therefore, this runoff coefficient may be inappropriately high for estimating runoff in relatively dry years. In order to account for this the site-wide runoff coefficient for dry years was assigned lower values in the water balance model. The dry year coefficients were based on work completed by Clearwater Consultants Ltd. (CCL 2010) for the Minto Mine site as follows:

- A runoff coefficient of 0.15 was used for dry years with less than 190 mm total precipitation.
- A runoff coefficient of 0.30 was used for years with greater than 309 mm total precipitation.

- Runoff coefficients for years with total precipitation between 190 mm and 309 mm were interpolated values between 0.15 and 0.30.

Figure 2-7 shows runoff coefficient values used in the model as a function of total annual precipitation.

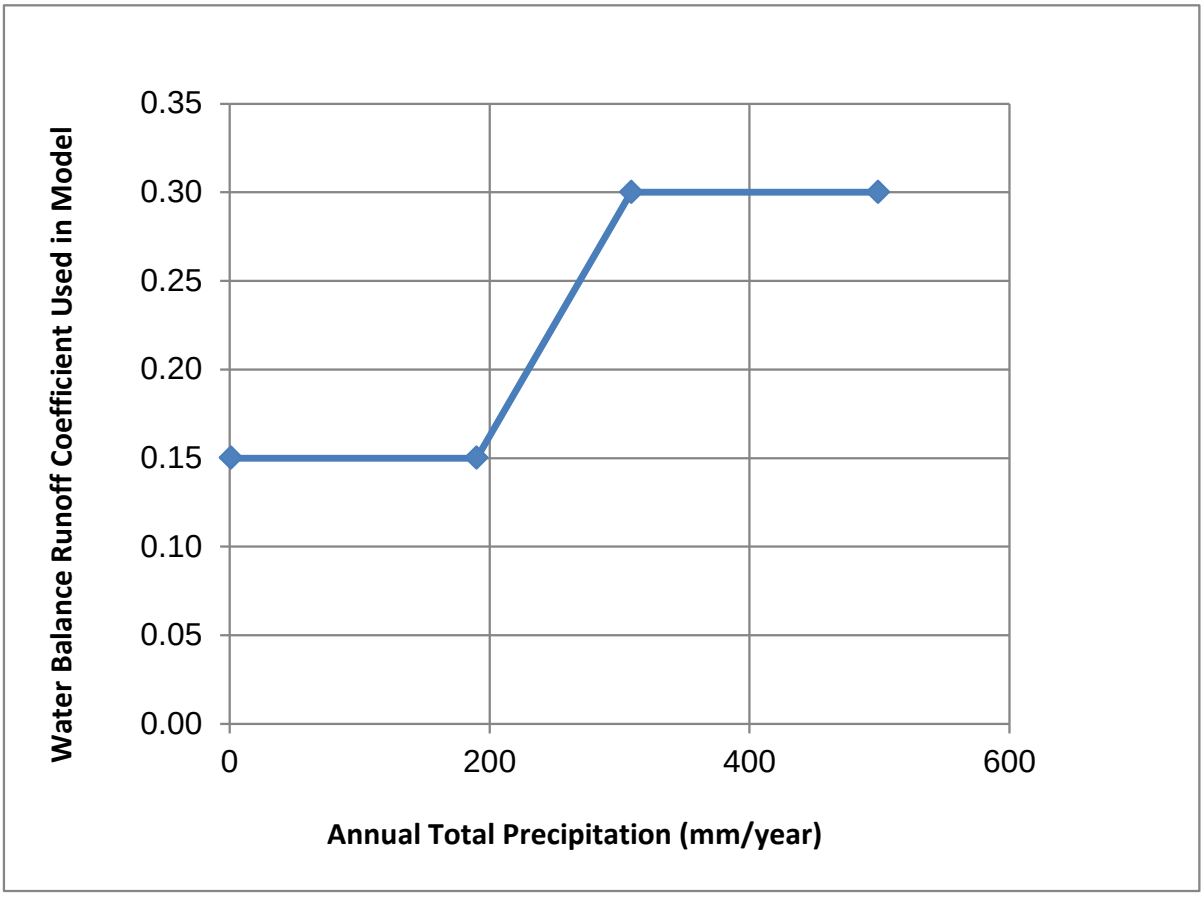


Figure 2-7 Water Balance Runoff Coefficient vs. Total Annual Precipitation

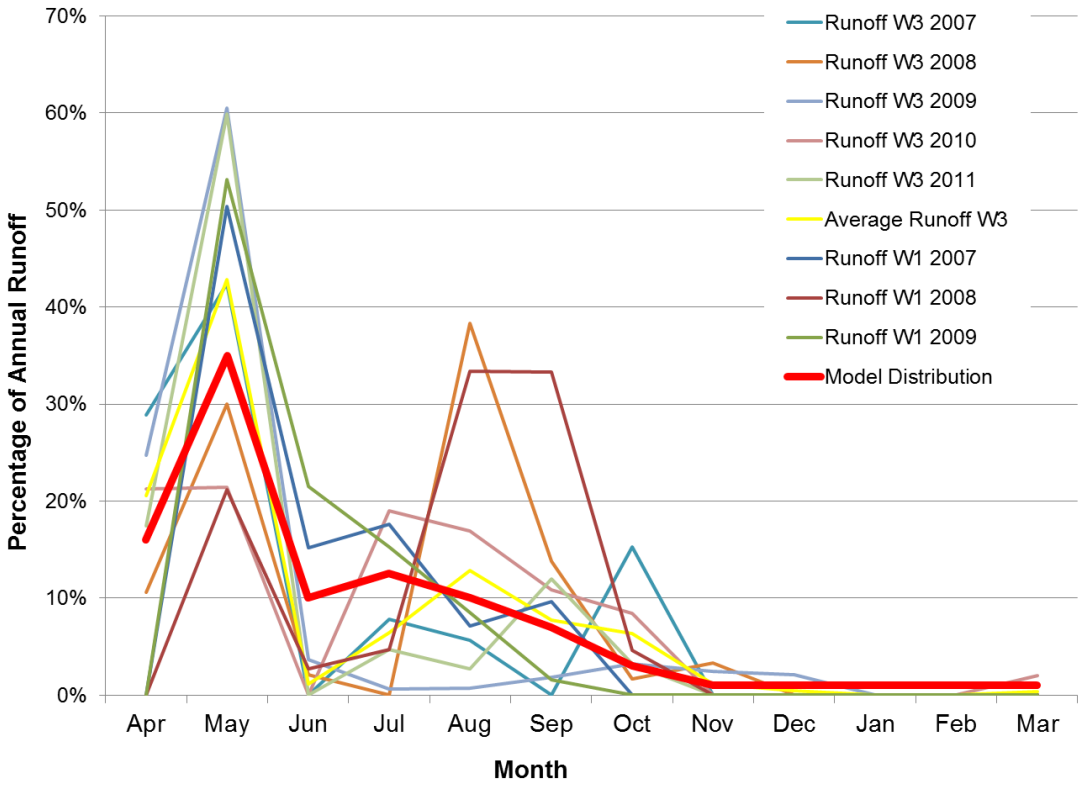
The one exception is that open water areas (flooded pits and the WSP) were treated differently than land areas. Open water were assigned a runoff coefficient of 1.0 along with an annual evaporation rate. This approach relies on the assumptions that any precipitation that falls on a water body becomes part of the water inventory and that the open water evaporation rate is relatively constant from year to year. As discussed in Section 2.2.2, the effect of uncertainty associated with the estimate of annual evaporation on the site-wide water balance is relatively insignificant.

2.2.5 Runoff Distribution

The natural hydrograph for the Minto Creek catchment can vary considerably from year to year. This variability is an important consideration when designing conveyance structures and storage reservoirs for shorter-term storm events. However, the specific daily or monthly runoff distribution does not significantly affect Minto's site-wide water balance during operations and closure. The Phase V/VI water management plan (Minto 2013a) has been developed to ensure that storage capacity is roughly equivalent to an average year's runoff from the Upper Minto Creek catchment is

available at all times, and specifically available on October 31 of each year. Therefore, regardless of the timing and intensity of freshet runoff or storm events Minto's ability to store and manage the total annual runoff volume will not be compromised.

Because Minto's site-wide water balance is relatively unaffected by short-term runoff events, a fixed monthly runoff distribution was adopted for the water balance model. The fixed monthly runoff distribution used in the water balance model was based on observed monthly flows rates at the hydrometric stations at W3 and W1 in Minto Creek. Figure 2-8 shows the measured runoff distributions at W3 and W1 as well as the distribution that was used in the model.



Source:Z:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\02_Hydrology_and_Meteorology\Hydrology_Data\Aggregated_Runoff_Data_1CM002.003_Rev01_TC

Figure 2-8 Runoff Distribution Model

2.2.6 Reservoirs

Reservoirs on the Minto Mine site include the open pits, the tailings pores, and the Water Storage Pond. In terms of the water and load balance, the available storage capacity is the attribute of greatest interest. In the model, the available storage capacity is defined as the volume that can be filled with water, waste rock and tailings solids. Requirements for freeboard and contingency storage are not considered to be available storage and are therefore not included in values for available storage capacity.

Main Pit

The Main Pit was mined between 2007 and 2011. Since completion of mining, the pit has been used for storage of mine water and for deposition of Phase IV waste rock and tailings. The estimated total storage capacity of the Main Pit below an elevation of 786 m is 4,225,000 m^3. In February 2013 approximately 1,600,000 m^3 of free mine water was stored in the Main Pit along with approximately 600,000 m^3 of bulk saturated waste rock and tailings. Because of a requirement for 975,000 m^3 of contingency storage the available storage capacity was approximately 1,000,000 m^3 at that time. The Main Pit is intended to be further developed as a tailings management facility (TMF) for Phase V/VI. The proposed TMF includes the construction of a tailings-retaining dam on the east side of the Main Pit; the conceptual design for the proposed dam calls for a crest elevation of 806 m, and a full supply level of 804 m. This would increase the total storage capacity to approximately 7,000,000 m^3. Details concerning tailing deposition and water management are presented in the Minto Phase V/VI Tailings Management Plan (Minto 2013b).

Area 2 Pit

Development of the Area 2 Pit commenced in 2011 and mining is expected to be completed in 2016. The available storage capacity of the Area 2 Pit is expected to be 2,000,000 m^3 as of mid-2014 when mining of Stage 2 has been complete and approximately 7,900,000 m^3 following the completion of Stage 3 in 2016. During the Phase V/VI development the Area 2 Pit will be used for storage of mine water and as a TMF. As the Main Pit is receiving tailings, the Area 2 Pit will transition to become the primary mine water management reservoir and eventually the source of reclaim water for the mill. At the end of the mine life in 2022 it is anticipated that approximately 2,500,000 m^3 of bulk tailings and more than 1,000,000 m^3 of waste rock will be stored sub-aqueously in the Area 2 Pit.

Ridgetop North Pit

The Ridgetop North Pit is scheduled for development in 2016/2017 and mining is expected to be complete by the end of 2017. The available storage capacity of the Ridgetop North Pit is approximately 1,900,000 m^3. The pit will be developed as a TMF and is expected to be filled with tailings within two years of completion. The Ridgetop North Pit will not be used as a reservoir for storage of mine water. Any water that may accumulate in the pit will be transferred to the Area 2 Pit. The deposition of tailings and subsequent placement of a reclamation cover result in there being no basin for water storage in the Ridgetop North Pit over the long term.

Ridgetop South Pit and Area 118

The Ridgetop South and Area 118 Pit are relatively small with estimated storage capacities of approximately 300,000 m^3 and 200,000 m^3, respectively. Both pits are expected to be filled in with overburden shortly after mining is completed. Therefore, neither pit is considered to be a reservoir for storage of mine water or runoff. Water that reports to the two pits during active mining will be transferred to the Area 2 Pit.

Minto North

The Minto North Pit is expected to be developed and mined in 2014 and 2015. During that time, mine water collected in the pit will be pumped to Main Pit TMF. When mining is complete the pit will be

allowed to fill and a pit lake is expected to form (based on baseline groundwater levels in the area). There are no plans to store tailings in the Minto North Pit.

Water Storage Pond

The WSP was constructed in 2007 and currently has a maximum water storage volume of 320,000 m^3. Historically, the WSP has been used as a source of process water for the mill. However, in Phase V/VI the WSP is intended as a storage reservoir for clean runoff destined for release to Minto Creek. During closure, the Water Storage Dam will be breached; the footprint of the existing WSP will most likely be reclaimed as a wetland, and the water storage capacity is expected to be on the order of magnitude of the WSP volume.

Tailings

Minto halted deposition of tailings to the Dry Stack Tailings Storage Facility in November 2012 and transitioned to sub-aqueous deposition of tailings in the Main Pit TMF. Through Phase V/VI tailings will primarily be deposited such that they will be saturated over the long term, with a minor volume forming unsaturated beaches in the Main Pit TMF and the Ridgetop North Pit TMF. Details concerning tailings deposition management are available in the Minto Phase V/VI Tailings Management Plan (Minto 2013b). The water and load balance model incorporates projected water volumes associated with tailings slurry, with mill reclaim water, and with pore-water in the settled tailings mass.

3 Load Balance Inputs

The load balance for Minto Mine Phase V/VI was developed to evaluate the potential effects of water quality parameter loadings from mine components on water quality in lower Minto Creek. Table 3-1 shows a summary of geochemical source terms developed for the Phase V/VI water and load balance. Figure 3-1 shows the allocation of source term by sub-catchments within Upper Minto Creek. Each source term represents an estimate of runoff water quality (mg/L) or parameter loadings (mg/year) contributed by a sub-catchment or mine component.

Source term estimates were generated for two scenarios described as “Expected Case” and “Reasonable Worst Case”. The Expected Case scenario is intended to typical geochemical loadings (including the scale of variability observed to date) while the Reasonable Worst Case represents an upper limit to water quality parameter concentrations that may be observed in the mine water on site and consequently in Lower Minto Creek.

Source terms defined as concentrations (mg/L) were incorporated in the load balance model by assigning the water quality to all flow from the corresponding sub-catchment. Alternately, source terms which were defined as loadings were added as a “dry” load to the appropriate flow or water reservoir.

Details concerning the development of source terms are described in the report “Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions” (SRK 2013).

Estimates of background water quality were developed by Minnow Environmental and Access Consulting Group. In 2009, Minnow Environmental compiled Minto Creek water quality monitoring

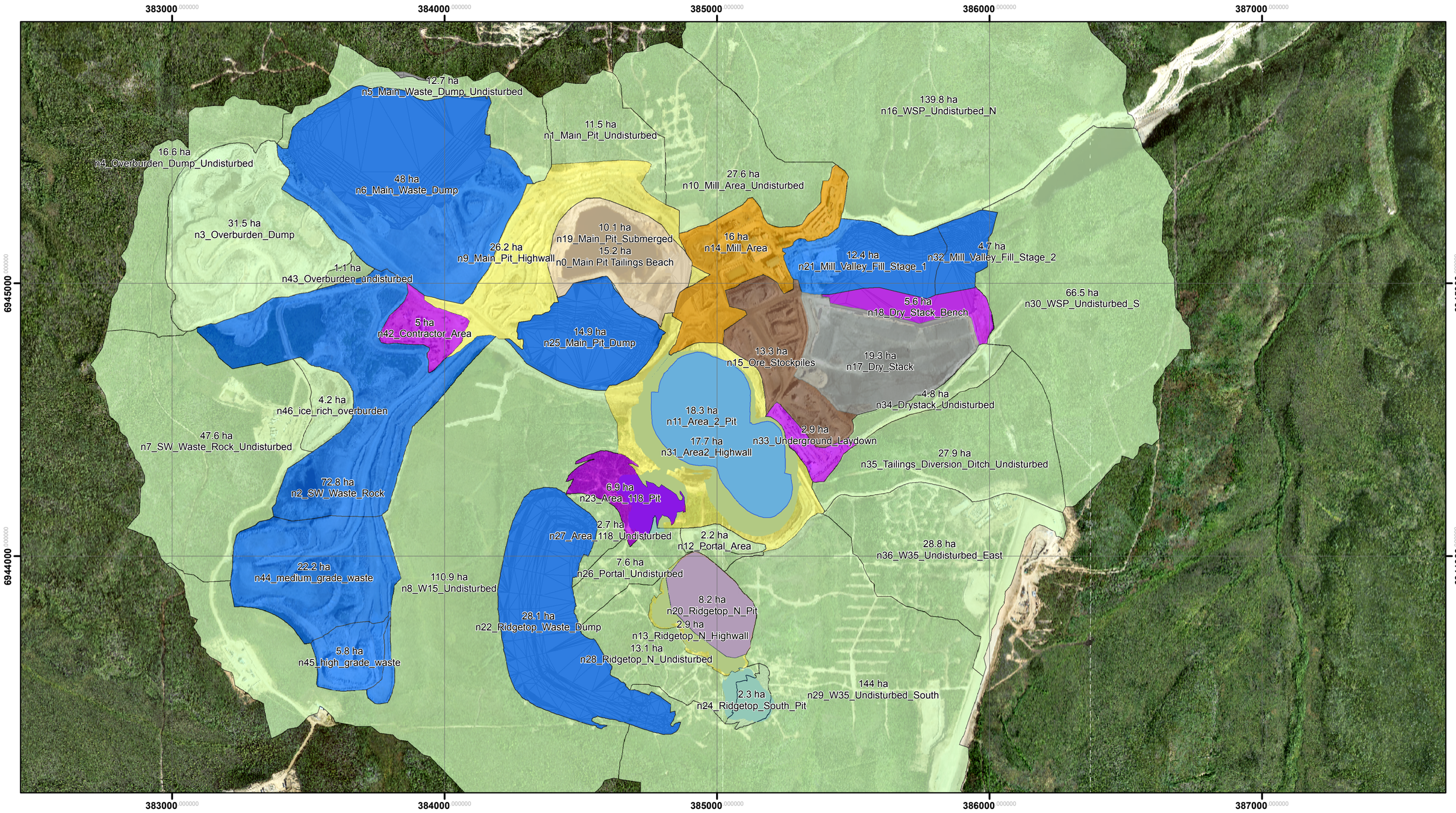
data into a pooled data set that reflected background conditions (i.e. conditions not affected by mine development activities). In 2012, data from background monitoring stations were added to the data set. A comparison of the summary statistics for the 2009 and 2012 datasets shows that there was a substantial change in the background water quality in Minto Creek in 2011 and 2012 and that this change was a result was caused by loadings from a tributary in Lower Minto Creek (a discussion of the change in background water quality can be found in Project Proposal Sections 6 and 7 (Minto 2013c)). In order to account for these loadings, the background data set developed in 2012 was applied to catchments in lower Minto Creek while the data set developed in 2009 was used to represent background conditions in Upper Minto Creek (Project Proposal Section 6 (Minto 2013c)).

Sources representing mine components were incorporated as dissolved loads. Background catchment runoff was also incorporated as dissolved load. To account for increases in parameter concentrations arising from suspended solids in mine discharge, a separate source term for suspended solids was introduced at the point of discharge in the model.

Table 3-1 Summary of Load Balance Source Terms

Source Term	Units	Applies to
Background Lower Minto Creek	mg/L	Undisturbed catchments downstream of the Minto Mine site
Background Upper Minto Creek	mg/L	Undisturbed catchments within the Minto Mine site
Dry Stack Talings Seepage	mg/L	Runoff from the Dry Stack Tailings Storage Facility
Main Pit TMF Unsaturated Tailings Load	mg/year	Main Pit TMF
Mill Area Loadings	mg/year	Mill Area
Minto North Background	mg/L	Undisturbed sub-catchments in McGinty Creek
Minto North Pit Loadings	mg/year	Minto North Pit
Nitrogen Contribution	mg/L	Added to all water released from the mine to account for loadings of nitrogen species
Ore Stockpile Concentrations	mg/L	Ore Stockpile Area, Operations
Ore Stockpile Loadings	mg/year	Ore Stockpile Area, Closure
Pit Wall Loadings	mg/year	All pit walls
Ridgetop TMF Unsaturated Tailings Load	mg/year	Ridgetop North TMF
Tailings Slurry	mg/L	Tailings slurry supernatant
TSS Contribution	mg/L	Added to all water released from the mine to account for composition of suspended solids
Waste Rock Loadings	$mg/m^3/year$	Large Waste Rock Dumps and Mill Valley Fill Expansion (Stage 1 and Stage 2)

Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Model Report\Tables\Source_terms_Summary_1CM002.003_REV00_SRJ.xlsx



N

Meters
0 75 150 300 450 600

Legend

Minto Phase V/VI Source Term Allocation
- Background Upper Minto Creek
- Drystack Seepage
- Main Pit TMF Unsaturated Tailings Load
- Mill Area Loadings
- None
- Ore Stockpile Loadings or Concentrations
- Pit Wall Loadings
- Ridgetop TMF Unsaturated Tailings Load
- Waste Rock Concentrations
- Waste Rock Loadings

srk consulting

Job No: 1CM002.003

Filename: PhV_VI_Source_Terms_REV01_SRJ

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine

Minto Mine Phase V/VI Expansion
Water and Load Balance Report

Source Term Allocation

Date:	Approved:	Figure:
11 June 2013	SRJ	3.1

4 Model Implementation

4.1 Model Version

The water and load balance model for Minto was developed using the GoldSim software package (version 10.5). The model scenarios described here were implemented in model Version #49.

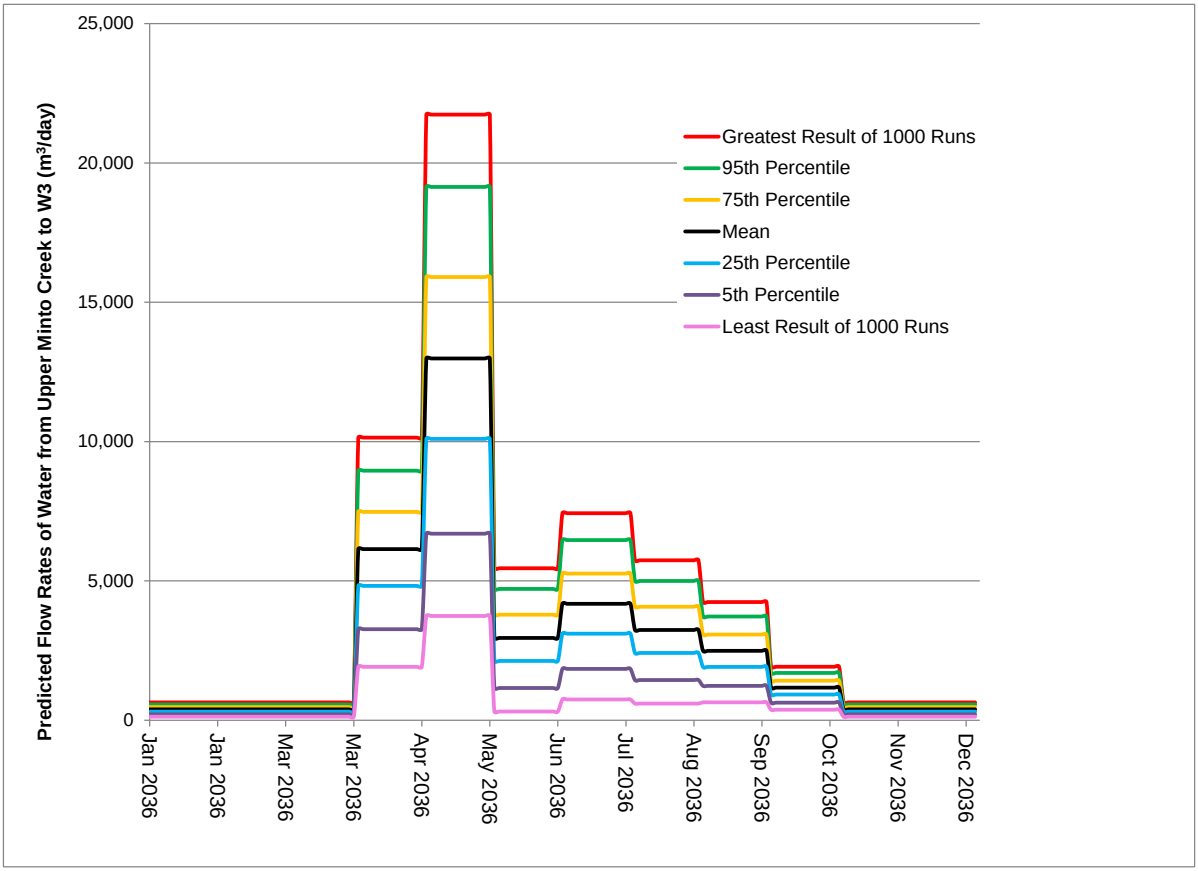
4.2 General Modelling Approach

4.2.1 Stochastic Water Balance Model

Water balance results for the Phase V/VI water balance model were generated by running the model as a Monte Carlo simulation. Monte Carlo simulations are well suited for situations where the value of a key input cannot be predicted but where the distribution of the input is known or can be adequately estimated. Total annual precipitation for the Minto site is an example of such a variable. Although it is not possible to predict the rate of annual precipitation in any given year, it is possible to develop a probability distribution (see Section 2.2.1).

In the Phase V/VI water balance Monte Carlo run, the model randomly selected a value for total annual precipitation from the probability distribution developed for the site (see the Pearson III distribution shown in Table 2-6, Section 2.2.1). Annual runoff volumes were then calculated by multiplying total annual precipitation by a runoff coefficient and catchment area (see Sections 2.2.3 and 2.2.4). The calculated runoff would then be distributed over all months of the year according to the typical hydrograph used in the model (described in Section 2.2.5). The model was run in this manner from year 2013 through 2045, each year with a randomly selected precipitation value, and all results were recorded and stored by the model. A total of 1000 model runs were completed in this way.

At the end of 1000 model runs, all results were compiled and probability distributions of the results were generated. Figure 4-1 shows an example of model results for a single year from the Monte Carlo simulation. For illustration purposes, a year well into the post-closure period is shown to avoid having the example be affected by active water management at site or by transient conditions that correspond to filling of pits in the closure period. The results show the possible range of flow rates from Upper Minto Creek to W3 as represented by the model. The most likely flow distribution is the mean flow (black line).



Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\Goldsim_Results_REV49_6_June_2-13.xls

Figure 4-1 Example of Result Generated by the Monte Carlo Simulation – Predicted Range of Average Flow from Upper Minto Creek to W3 in 2036

Routing of runoff in the model followed the plan detailed in the water management plan and closure plan for Phase V/VI as described in Section 4.3.1. The modelling period began on January 1, 2013 and ended on January 1, 2045. The operations period was modelled as ending at the end of August 2022, followed by a closure period of three to five years and then by the post-closure period.

4.2.2 Loading Balance Model

Loadings were incorporated in the model by associating loadings source terns with the corresponding water flows or mine components as follows:

- Concentration based source terms were applied as constant values to monthly runoff volumes from corresponding sub-catchments as described in Section 3.
- Loading based source terms were incorporated into the model as a “dry” load either to runoff or to water reservoirs. For example, loadings from tailings solids were applied to the water in the reservoir where tailings were deposited.

The development of loadings source terms is described in SRK (2013).

4.3 Water Management

The water management strategy developed for Phase V/VI (Minto 2013a) was incorporated in the water and load balance model. The focus of the water management strategy is to control the inventory of mine water stored on site. The water inventory will, to the extent possible, be managed by diverting clean (i.e. discharge compliant) surface runoff away from developed mine areas and towards the WSP and Minto Creek. Where necessary, treatment and subsequent discharge of mine-impacted water will be carried out as required to meet inventory targets. The modelling representation of water conveyance and water diversion options are described in the following sections.

4.3.1 Runoff and Mine Water Conveyance

Figure 4-2 to Figure 4-4 show examples of how water was routed in the water balance model at different stages of the Phase V/VI development.

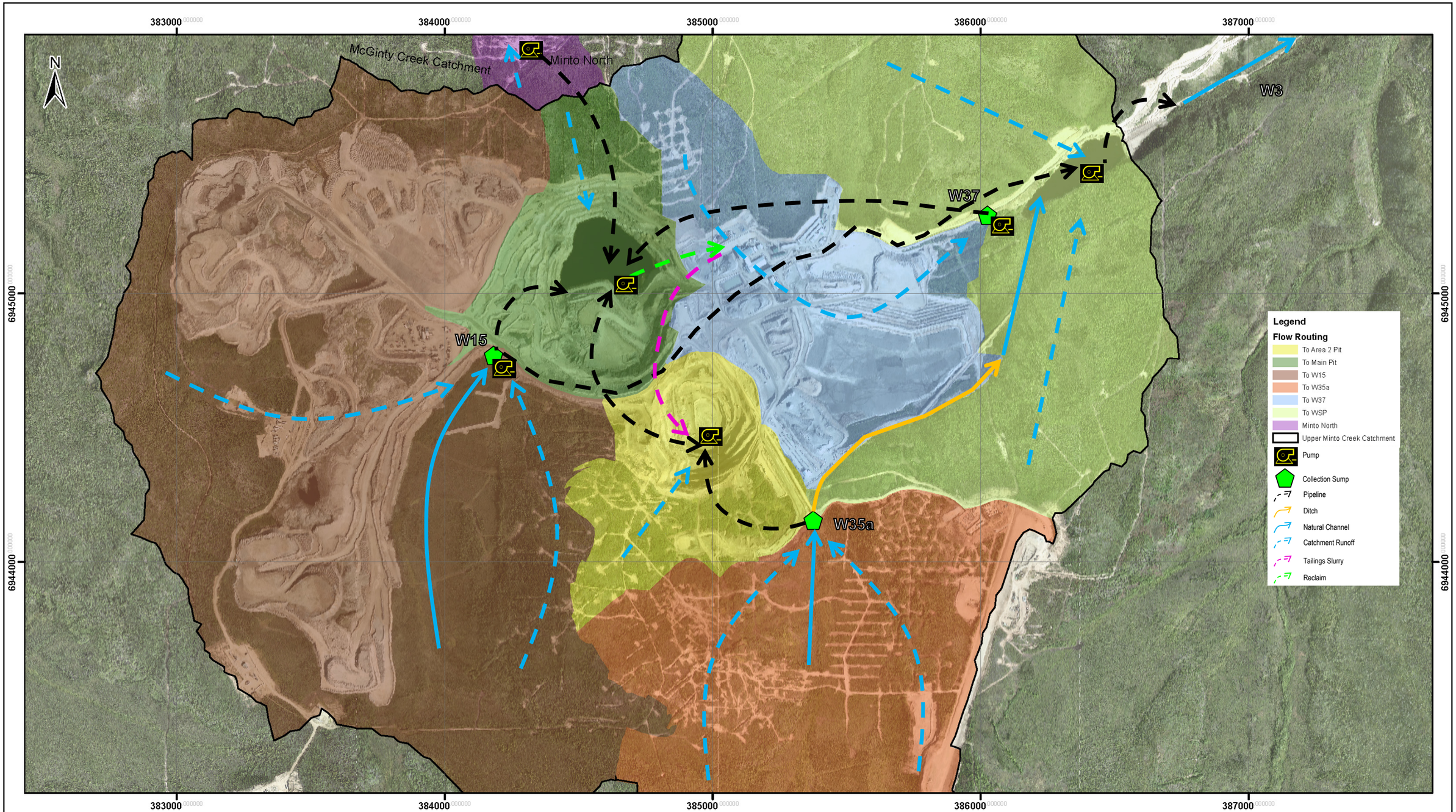
Early in the Phase V/VI development, routing of water was implemented in a manner similar to current (Phase IV) operational practices. In 2014 (Figure 4-2) water collected at W15 was directed to the Main Pit or to the WSP through the piping network on site. Runoff collected at W35a was partially directed to the WSP *via* the Tailings Diversion Ditch (60%) or to the Area 2 Pit (40%). Water reporting to the Area 2 Pit accumulated in the Stage 2 area and any excess water was transferred to the Main Pit. Mine water collected at W37 was pumped to the Main Pit, as was mine water from Minto North. In 2014, tailings were deposited in the Stage 2 area of the Area 2 Pit. However, reclaim water was sourced from the Main Pit.

In 2018 (Figure 4-3), the model assumed that the Area 2, Minto North and Ridgetop North pits had been completed and tailings were deposited in the Ridgetop North Pit. At that time, the Area 2 Pit was implemented as the main mine water management reservoir. All sources of mine water were conveyed to the Area 2 Pit, which was also the source of reclaim water.

At closure (Figure 4-4), water conveyance structures were assumed to be constructed to direct runoff as follows:

- Water collected at W15 reported to the Main Pit conveyance structure along with runoff from upstream catchment areas.
- The Main Pit conveyance structure reported to the Area 2 Pit, where a post-closure pit lake was assumed to form.
- Catchments upstream of the Area 2 Pit reported directly to the Area 2 pit lake.
- Water in the Area 2 Pit flowed via a spill-way through the former mill site and through a channel along the mine access road to the Minto Creek.
- Runoff from the former mill area and from slopes along the Mill Valley reported directly to Minto Creek.

Table 4-1 provides further details concerning the implementation of water routing in the water balance model.



Document Path: \\VAN-SVR0\Projects\01_SITES\Minto\I020_Site_Wide_Data\IGIS\0.figures\Minto_Water_Flow_V_VI_2014_REV00_SRJ.mxd

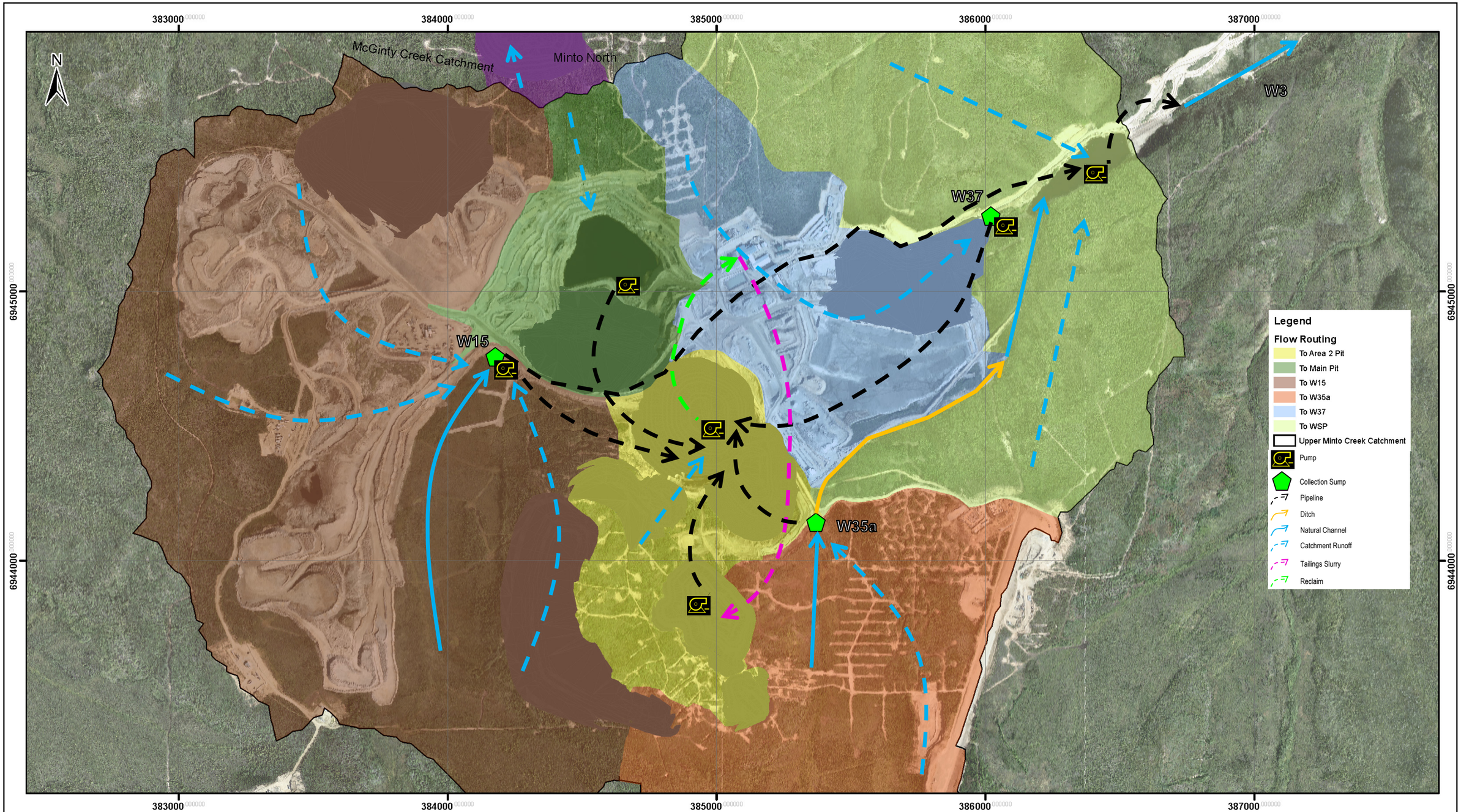
srk consulting

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report

Modelled Routing of Water: 2014

Job No: 1CM002.003	Minto Mine	Date: June 2013	Approved: SRJ	Figure: 4.2
Filename: Fig_4-1_WaterFlow+Conveyance_2014.pptx			



Document Path: \\VAN-SVR0\Projects\01_SITES\Minto\!020_Site_Wide_Data\!GIS\0.figures\Minto_Water_Flow_V_VI_2018_REV00_SRJ.mxd

srk consulting

Job No: 1CM002.003

Filename: Fig_4-1_WaterFlow+Conveyance_2018.pptx

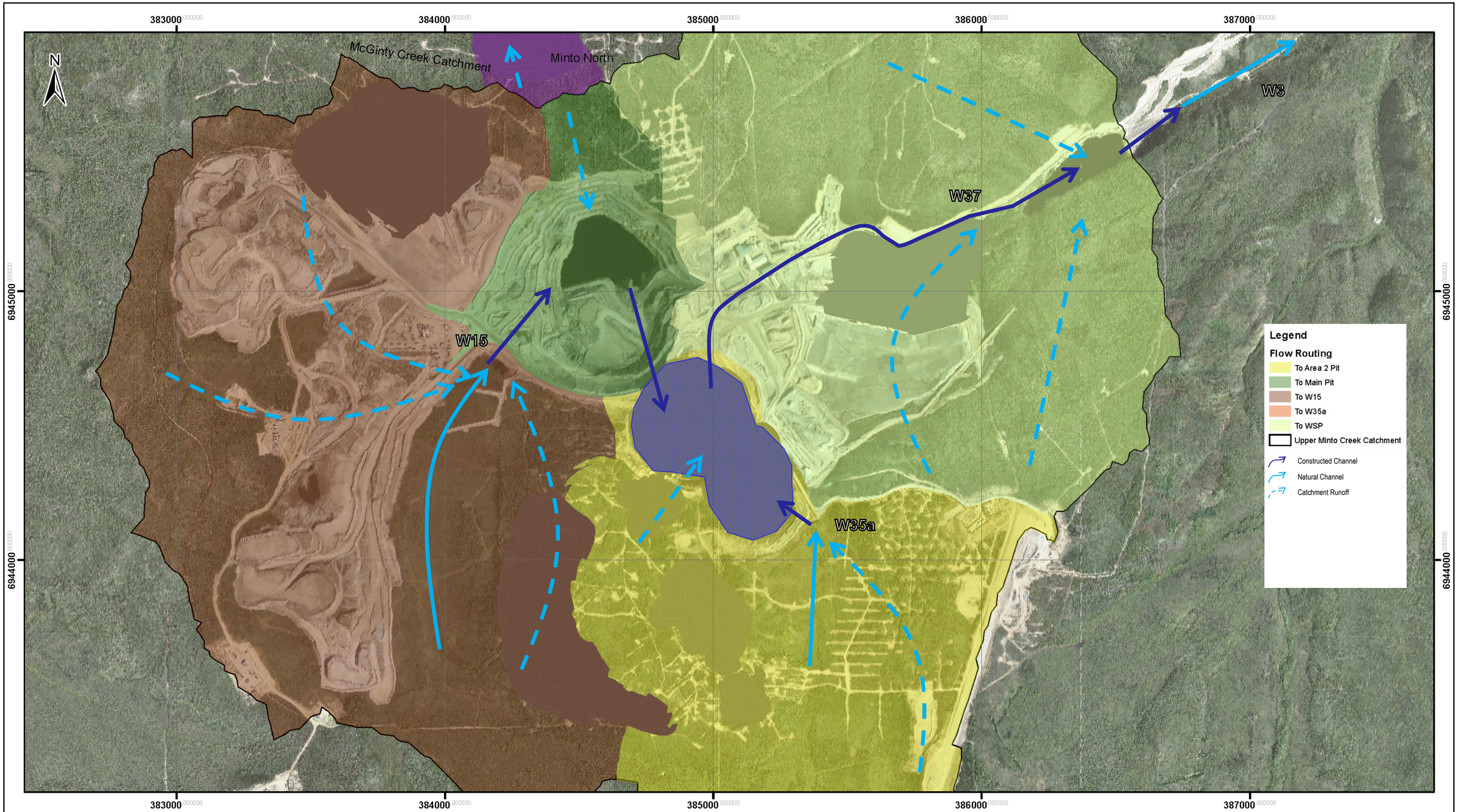
CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine

Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report

Modelled Routing of Water: 2018

Date:	Approved:	Figure:
June 2013	SRJ	4.3



Document Path: \\VAN-SVR0\Projects\01_SITES\Minto\!020_Site_Wide_Data\!GIS\0.figures\Minto_Water_Flow_V_VI_Closure_REV00_SRJ.mxd

srk consulting

Job No: 1CM002.003

Filename: Fig_4-1_WaterFlow+Conveyance_2018.pptx

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine

Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report

Modelled Routing of Water: Post-closure

Date:	Approved:	Figure:
June 2013	SRJ	4.4

Table 4-1 Modelled Routing of Runoff and Mine Water Conveyance

Input	Period	Reservoir	Output	Period
Surface Runoff	Always	WSP	Minto Creek	Always
W15	Until 2022			
W35a	Until 2022			
Area 2 Pit	2028 onwards			
W37	Until 2017	Main Pit	to Area 2	2018 onwards
Surface Runoff	Always			
Minto North Pit	2014 to 2015		to Water Treatment	Intermittently during operation
Area 2 Dewatering	2013-2014		Evaporation	Open water seasons
Tailings Slurry Water	Intermittently 2013 to 2021		Reclaim Water	2013 to 2018
W37	2017 to 2022	Area 2 Pit	Main Pit	2013-2014
Surface Runoff	Always			
W35a Sump	2022 onwards		to Water Treatment	Intermittently during operation
Ridgetop North Pit Water (Sump + Supernatant)	2015 to 2022		Evaporation	Open water seasons
Main Pit	2018 onwards		Reclaim Water	2018 to 2022
Tailings Slurry Water	Intermittently 2013 to 2021		to WSP	2028 onwards
Surface Runoff	Always	Ridgetop North Pit	to Area 2	2015 to 2022
Tailings Slurry Water	2018 to 2019		to W35a	2022 onwards
Surface Runoff	Always	Minto North Pit	to Main Pit	2014 to 2015
			to McGinty Creek	2018 onwards

4.3.2 Water Diversion Options

Table 4-2 shows a summary of major runoff collection points on the Minto Mine site, including W35a, W15 and the WSP. The runoff collection points offer opportunities for diverting clean runoff water away from developed mine areas.

The sub-catchments reporting to the WSP account for approximately 22% of the total catchment area of the Minto Creek catchment upstream of the Water Storage Dam. Runoff from the northwestern WSP catchment (n16_WSP_Undisturbed_N, see Figure 2-5) is collected in a ditch along the mine access road and flows through a culvert to the WSP. The western portion of the southern WSP catchment (n30_WSP_Undisturbed_S, see Figure 2-5) reports to the Tailings Diversion Ditch that follows the southern boundary of the Dry Stack Tailings Storage Facility. From the eastern terminus of the Tailings Diversion Ditch water will be piped to the WSP. Runoff from eastern-most portion of the southern catchment reports directly to the WSP.

Table 4-2 Minto Phase V/VI Runoff Collection Sumps and Water Diversion Options, Average Year

Sub-Catchment	Area (ha)	% of Minto Mine Site-Wide Catchment (%)	Diverted Clean Runoff, 60% Diversion Efficiency		Diverted Clean Runoff, 80% Diversion Efficiency	
			m^3/year	% of Site-Wide Runoff	m^3/year	% of Site-Wide Runoff
W35a	172	16%	120,000	14%	160,000	19%
WSP	235	22%	90,000	11%	120,000	14%
W15	374	36%	150,000	18%	200,000	24%
Diversion Options						
W35a + WSP	407	39%	210,000	25%	280,000	33%
W35a + WSP + W15	781	75%	360,000	42%	480,000	56%

If clean surface runoff does not meet the Phase V/VI water quality limits then water treatment may be required. Operational use of water treatment is discussed in Section 4.6.

The W35a catchments (n29_W35_Undisturbed_South and n36_W35_Undisturbed_East, see Figure 2-5) represent approximately 16% of the total catchment area of the Minto Mine site. During Phase V/VI, water collected at W35a will be conveyed to the Tailings Diversion Ditch and from there flow to the WSP.

Combined, the WSP and W35a catchments account for about 38% of the total Upper Minto Creek catchment area. The volume of runoff that can be diverted to the WSP depends on the collection and diversion efficiencies of the collection and conveyance system. Assuming that actual combined collection and diversion efficiencies range between 60% and 80%, the average annual runoff volume that would be diverted to the WSP would range between 210,000 m^3 and 280,000 m^3, or between 25% and 33% of the total runoff from Upper Minto Creek.

However, in order to reduce the current mine water inventory, or in the event that runoff volumes are greater than estimated, it may be advantageous or necessary to release additional water. If so, additional runoff may be diverted from W15 to the WSP (See Figure 4-2). W15 receives runoff from both undisturbed catchments and developed mine areas. However, the runoff that historically has reported to W15 has generally met water quality limits listed in Water Use License QZ96-006 for the months of May, June, July and August. The W15 catchment represents 36% of the total Upper Minto Creek catchment and could yield another 150,000 m^3 to 200,000 m^3 of relatively clean runoff. Therefore, with diversions in place for the WSP, W35a and W15 sub-catchments a total volume of 360,000 m^3 to 480,000 m^3 could potentially be available for release each year from the Minto Site.

In the water balance model it was assumed that 60% of all runoff that reports to W15 and W35a would be diverted to the WSP. If diversion of runoff is insufficient to control the water inventory then water collected in the Main or Area 2 pit was assumed to be treated and released to the WSP.

4.4 Tailings Slurry Deposition

Tailings slurry deposition was implemented in the water balance as follows:

- 2013 to Q1 2014: to Main Pit TMF
- Q1 2014 to Q2 2015: to Area 2 Pit TMF (Stage 2)
- Q2 2015 to Q1 2018: to Main Pit TMF
- Q1 2018 to Q4 2019: to Ridgetop North Pit TMF
- Q4 2019 to Q2 2021: to Main Pit TMF
- Q2 2021 to Q3 2022: Area 2 Pit TMF

The dry bulk tailings density was assumed to be 1.3 tonnes/m^3. Details concerning tailings slurry deposition for Phase V/VI are available in the Minto Mine Phase V/VI Tailings Management Plan (Minto 2013b).

4.5 Model Calibration

The approach used to calibrate the model was a site wide runoff coefficient that correlated the total annual precipitation to the total annual runoff. This approach avoids the large uncertainties inherent in quantifying appropriate input values for individual parameters (evaporation, evapotranspiration, sublimation, etc.) by determining a single site wide runoff coefficient based on measured values of both precipitation and catchment yield (stream flows) from historical records. The runoff coefficient approach integrates all catchment processes into a single empirical factor that describes the relationship between precipitation and catchment runoff.

In years for which the total annual precipitation was known, the actual (measured) total annual runoff was compared to the modelled total annual runoff. The modelled data was calibrated to the measured data by adjusting the runoff coefficient to achieve a best fit. After a suitable runoff coefficient was identified, it was used to model future site runoff estimates.

4.6 Water Treatment

The water treatment plant at Minto can be operated in a number of different configurations depending on the quality of feed water to be treated. Treatment options range from simple TSS removal to reverse osmosis (RO) treatment, which removes 95% to 99.5% of all constituents in the mine water.

In the load balance model, water treatment was assumed to be required if water from the Main Pit or Area 2 Pit had to be released from site during the operational period in order to manage water inventory. For periods when release of pit water was required, the model assumed that the RO process would be used for treatment during the operational period. The RO process was implemented in the model by removing 95% of loadings from the feed water and returning the removed loadings to the Main or Area 2 Pit, according to the origin of the feed water. In the model, water was not treated after operations ended.

5 Model Results

5.1 Water Balance Results

5.1.1 Minto Creek Water Balance Results

The primary water management challenge for the Minto Mine is to manage the inventory of mine water stored on site during the operational period, to ensure both that sufficient storage capacity is available to meet the anticipated life-of-mine storage requirements, and that sufficient stored water is available to meet the needs of the milling operation.

The volume of water that must be released from site each year in order to maintain an appropriate water inventory is an important factor for managing water on site in accordance with the life-of-mine water management plan. By quantifying the volume of water that can be added to the inventory in a given year, and consequently the volume of water that should be released, water management staff can implement diversions or plan water treatment campaigns, if required.

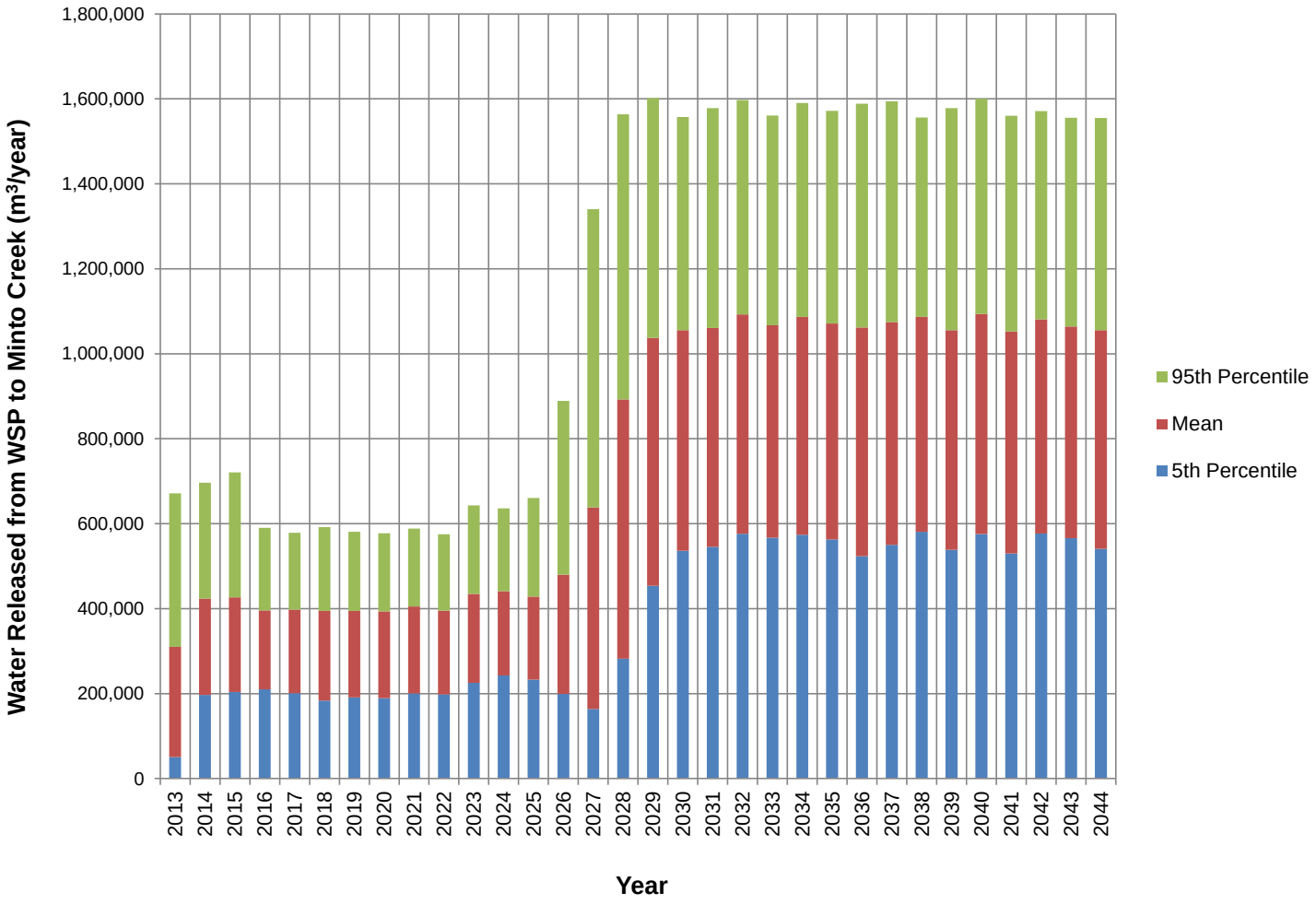
Figure 5-1 shows the model results for the volume of water that must be released from site each year to maintain the mine water inventory at manageable levels. The top extent of the blue and green bars correspond to the 5th and 95th percentile of the Monte Carlo results distribution. During active operations (2013 to 2022) approximately 200,000 to 600,000 m^3 of water must be released from site each year to maintain a manageable inventory of mine water.

Figure 5-2 shows projections of the volume of tailings and free mine water in the Area 2 Pit though the operations and post-closure periods assuming that 60% of runoff collected at W15 and W35a is diverted to the WSP and Minto Creek. As discussed above, these results indicate that in any given year, there is only a 5% chance that the Area 2 Pit volume will be less than or greater than the 5th and 95th percentile values indicated.

5.1.2 McGinty Creek Water Balance Results

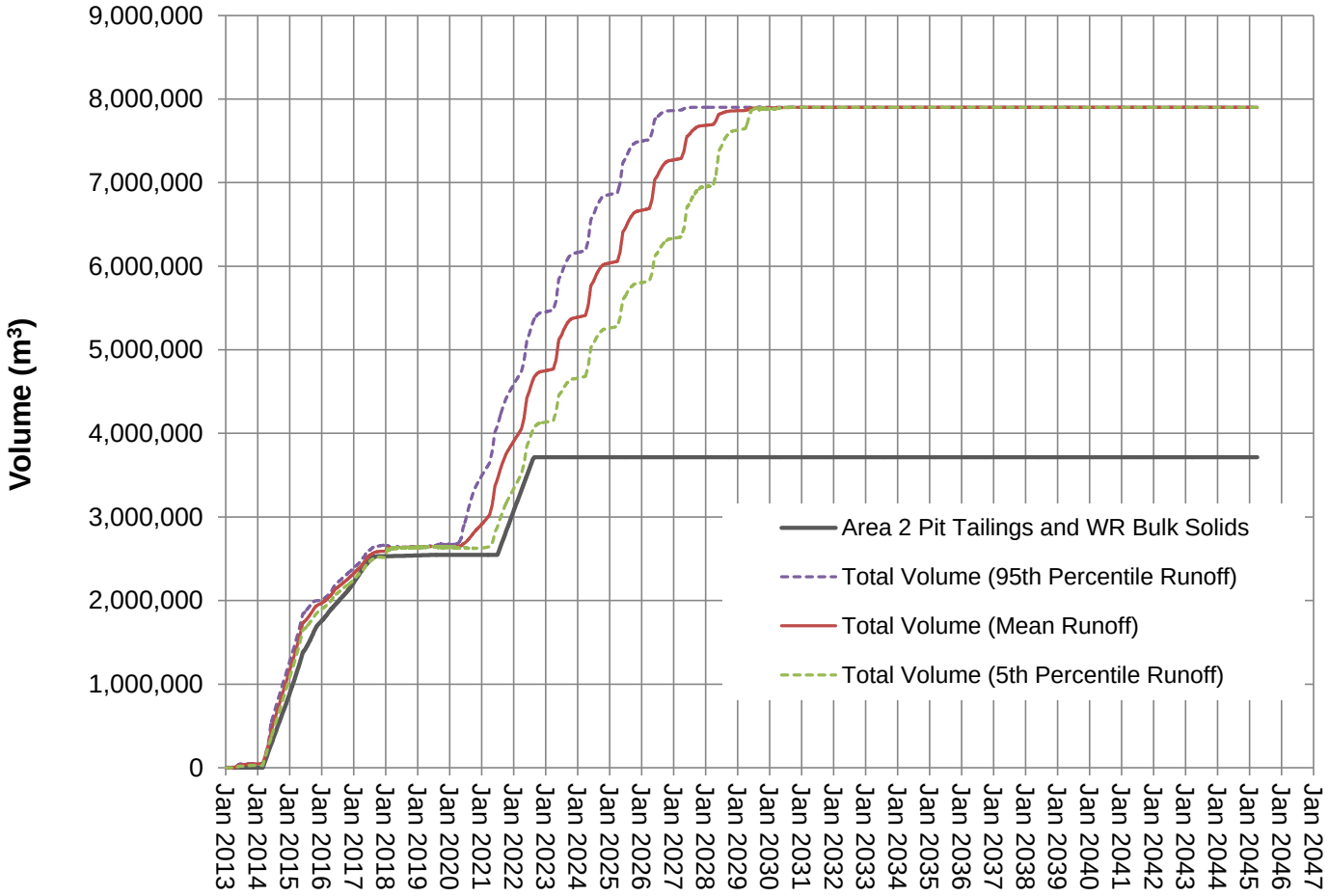
The water balance for the Minto North Pit simply consists of inflows from a small upgradient catchment and from direct precipitation on the open pit. During development and mining of the pit the mine water will be pumped to the Main Pit in the Upper Minto Creek catchment. After mining is complete, the open pit will be allowed to fill. Although it appears that there is a slight net positive water balance for the pit (including the contributions from the upgradient catchment), it is expected that it will take several decades for the pit to fill and discharge as surface flow to lower McGinty Creek. Depending on the rate of leakage out of the pit, it is conceivable that the pit may never in fact discharge via surface overflow; at this stage of the project, it is not possible to definitively predict whether a lake will form

The catchment area influenced by the proposed pit is a small component of the overall McGinty Creek catchment (roughly 15 ha vs. 3400 ha) and therefore the Minto North development is expected to have minimal effect on flow volumes in McGinty Creek.



T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

Figure 5-1 Model Predictions of Discharge Volumes from Minto Mine



T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

Figure 5-2 Modelled Area 2 Pit Water and Tailings Volumes

5.2 Water Quality and Parameter Loadings Results

5.2.1 Minto Creek Water Quality Results

Water quality predictions for Minto Phase V/VI were produced for the following four scenarios:

- Scenario 1: *Expected Case* source terms + no closure mitigation.
- Scenario 2: *Reasonable Worst Case* source terms + no closure mitigation.
- Scenario 3: *Expected Case* source terms + waste rock and tailings covers as closure mitigation
- Scenario 4: *Reasonable Worst Case* source terms + waste rock and tailings covers as closure mitigation

The *Reasonable Worst Case* is considered to be a conservative case while the *Expected Case* can be considered to be the most likely outcome. The *no closure mitigation* and *waste rock and tailings covers as closure mitigation* scenarios are intended to illustrate the estimated effect of covers on water quality. The water quality results shown below are focuses on concentrations of copper, selenium, nitrate and ammonia, which are considered to be parameters of potential concern. These four parameters are generally indicative of the behaviour of other parameters.

Model results for water quality in the Area 2 Pit, water released to station W3 in upper Minto Creek and at W2 in Lower Minto Creek are shown in Table 5-1 to Table 5-3 water for water quality parameters currently regulated. Tables with monthly water quality results are included in Appendix B.

Figure 5-3 and Figure 5-4 show predicted dissolved copper and selenium concentrations for mine water in the Area 2 Pit over time. In both cases, concentrations are expected to increase during the operational stage of Phase V/VI when waste rock and tailings are placed in the Area 2 Pit. Selenium concentrations increase markedly during periods when tailings are deposited to the pit. After closure, both copper and selenium concentrations are expected to decline to steady-state levels that are representative of long-term post-mining geochemical loading rates.

Figure 5-5 and Figure 5-6 show model predictions for total copper and selenium concentrations for mine water in the WSP as released to station W3 in Minto Creek. Both profiles show relatively low concentrations during the operational period followed by a modest increase in concentrations at closure. This is due to the fact that residual mine water stored in the Area 2 TMF begins reporting to Minto Creek at that time.

Figure 5-7 to Figure 5-10 shows modelled values total copper, selenium, nitrate-N and ammonia-N concentrations in Lower Minto Creek (the W2 water quality station). Copper and selenium concentrations follow the trends noted for the W3 water quality predictions but the difference between concentrations during the operations stage and post-closure is less pronounced because of dilution from the Lower Minto Creek catchment. Concentrations of nitrate, nitrite (not shown) and ammonia are expected to decrease gradually following the end of active mining in 2019. Residual ammonium nitrate/fuel oil (ANFO) explosives in tailings and water rock contribute the vast majority of nitrogen species to the mine water. Once mining is complete and ANFO use ends, there will be no new sources of nitrate and ammonia loadings.

Table 5-1 Modelling Predictions of Area 2 Pit Water Quality

		Modelling Predictions* of Area 2 Pit Water Quality											
		Phase V/VI Operations				Post-Closure (After 2028), No Mitigation				Post-Closure (After 2028), Covers in Effect			
		Best Estimate		Reasonable Worst Case		Best Estimate		Reasonable Worst Case		Best Estimate		Reasonable Worst Case	
		Average	**Max**	**Average**	**Max**	**Average**	**Max**	**Average**	**Max**	**Average**	**Max**	**Average**	**Max**
Ammonia	mg/L	0.52	0.64	0.84	1.0	0.066	0.29	0.11	0.47	0.066	0.29	0.11	0.47
F-	mg/L	2.2	3.0	2.8	5.0	0.86	1.6	1.2	2.0	0.84	1.5	1.2	2.0
N-NO2	mg/L	0.090	0.11	0.47	0.64	0.011	0.050	0.066	0.29	0.011	0.050	0.066	0.29
N-NO3	mg/L	7.1	8.8	18	23	0.91	3.9	2.3	10	0.91	3.9	2.3	10
SO2-4	mg/L	170	260	220	300	73	140	120	190	66	130	110	190
Al	mg/L	0.58	1.3	0.96	2.5	0.38	0.43	0.65	0.74	0.39	0.44	0.63	0.73
As	mg/L	0.0025	0.0067	0.0056	0.018	0.0017	0.0020	0.0036	0.0042	0.0016	0.0020	0.0034	0.0041
Cd	mg/L	0.000093	0.00018	0.00030	0.00083	0.000075	0.000090	0.00023	0.00026	0.000069	0.000088	0.00020	0.00025
Cr	mg/L	0.0025	0.0031	0.0052	0.012	0.0021	0.0025	0.0042	0.0047	0.0019	0.0024	0.0037	0.0046
Cu	mg/L	0.038	0.046	0.074	0.10	0.031	0.036	0.064	0.076	0.026	0.034	0.053	0.072
Fe	mg/L	0.49	0.71	0.79	1.2	0.79	0.82	1.3	1.4	0.72	0.73	1.1	1.1
Pb	mg/L	0.00060	0.00088	0.0026	0.0088	0.00049	0.00058	0.0015	0.0018	0.00046	0.00057	0.0015	0.0018
Mn	mg/L	0.27	0.41	0.59	0.95	0.39	0.41	0.90	0.93	0.30	0.36	0.67	0.83
Hg	mg/L	0.000082	0.00022	0.00018	0.00031	0.000064	0.000071	0.00025	0.00026	0.000060	0.000070	0.00020	0.00022
Mo	mg/L	0.060	0.093	0.087	0.12	0.014	0.043	0.027	0.061	0.014	0.043	0.026	0.061
Ni	mg/L	0.0031	0.0038	0.0059	0.0099	0.0026	0.0031	0.0046	0.0055	0.0024	0.0031	0.0042	0.0054
Se	mg/L	0.012	0.016	0.022	0.030	0.0038	0.0097	0.0079	0.018	0.0035	0.0096	0.0070	0.018
Ag	mg/L	0.000068	0.00014	0.00016	0.00034	0.000049	0.000060	0.00015	0.00016	0.000045	0.000058	0.00013	0.00015
Tl	mg/L	0.00011	0.00015	0.00014	0.00019	0.00010	0.00012	0.00012	0.00014	0.000096	0.00012	0.00011	0.00014
Zn	mg/L	0.012	0.015	0.026	0.060	0.0100	0.012	0.021	0.024	0.0089	0.012	0.018	0.023

Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\ Goldsim_Results_REV49_6_June_2013.xlsx
*: all concentrations are dissolved

Table 5-2 Modelling Predictions of W3 Water Quality

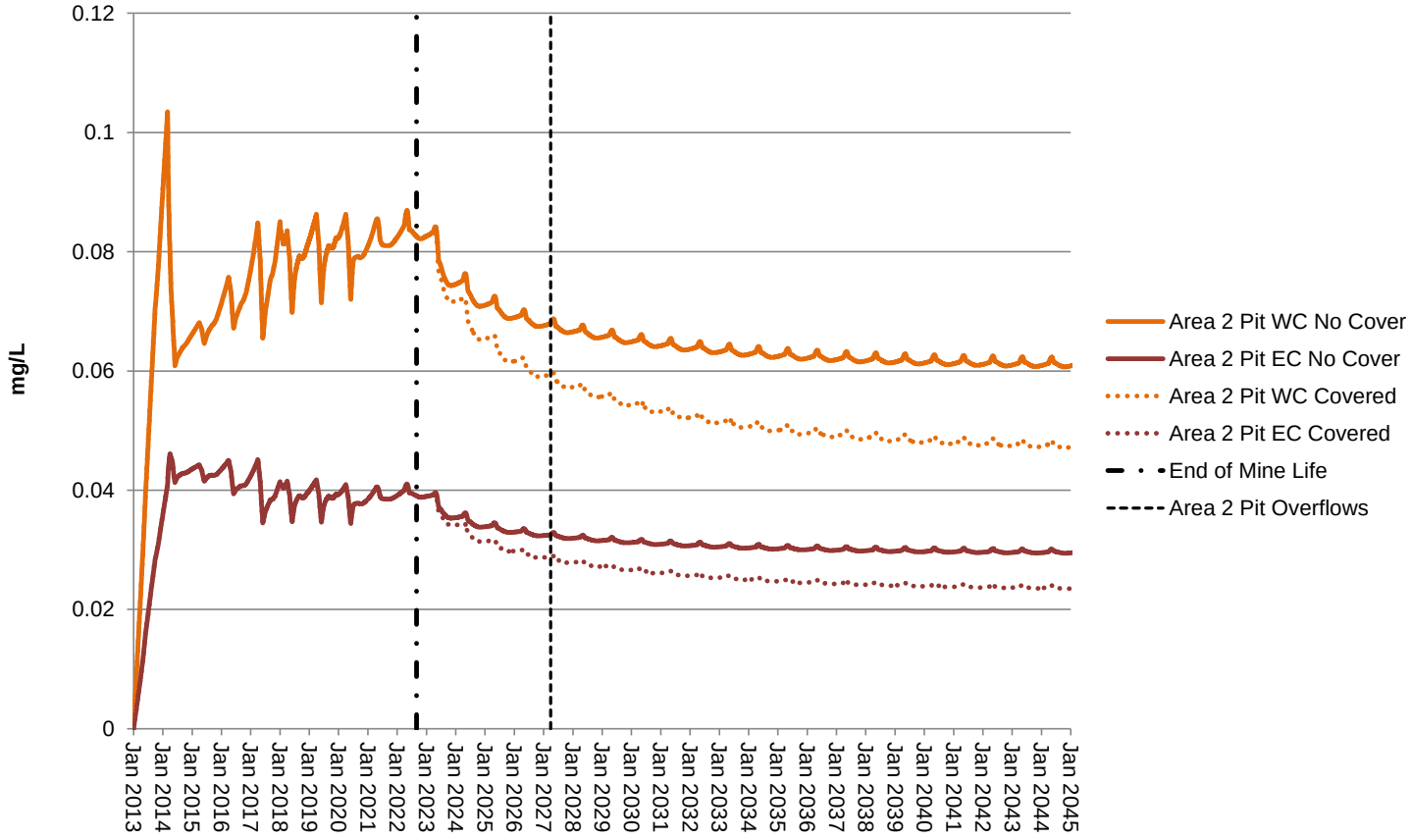
		Modelling Predictions* of W3 Water Quality											
		Phase V/VI Operations				Post-Closure (After 2028), No Mitigation				Post-Closure (After 2028), Covers in Effect			
		Best Estimate		Reasonable Worst Case		Best Estimate		Reasonable Worst Case		Best Estimate		Reasonable Worst Case	
		Average	**Max**	**Average**	**Max**	**Average**	**Max**	**Average**	**Max**	**Average**	**Max**	**Average**	**Max**
Ammonia	mg/L	0.59	0.64	0.96	1.0	0.066	0.29	0.11	0.47	0.066	0.29	0.11	0.47
F-	mg/L	0.26	0.34	0.30	0.40	0.52	0.75	0.74	1.0	0.49	0.71	0.68	0.96
N-NO2	mg/L	0.10	0.11	0.59	0.64	0.011	0.050	0.066	0.29	0.011	0.050	0.066	0.29
N-NO3	mg/L	8.1	8.8	21	23	0.91	3.9	2.3	10	0.91	3.9	2.3	10
SO2-4	mg/L	39	54	71	110	47	65	81	110	41	59	66	90
Al	mg/L	0.68	0.74	0.76	0.87	0.75	0.79	0.92	1.00	0.75	0.79	0.90	0.96
As	mg/L	0.00096	0.0012	0.0012	0.0017	0.0014	0.0016	0.0025	0.0031	0.0013	0.0015	0.0023	0.0028
Cd	mg/L	0.000086	0.00010	0.00014	0.00019	0.00010	0.00011	0.00020	0.00024	0.000094	0.00010	0.00018	0.00021
Cr	mg/L	0.0019	0.0024	0.0027	0.0037	0.0019	0.0022	0.0033	0.0039	0.0018	0.0020	0.0029	0.0034
Cu	mg/L	0.027	0.036	0.044	0.066	0.032	0.036	0.060	0.068	0.027	0.031	0.048	0.056
Fe	mg/L	1.4	1.7	1.8	2.3	1.3	1.3	1.6	1.8	1.2	1.3	1.5	1.6
Pb	mg/L	0.00054	0.00066	0.00054	0.00066	0.00058	0.00063	0.0012	0.0015	0.00055	0.00060	0.0011	0.0014
Mn	mg/L	0.34	0.53	0.71	1.1	0.33	0.38	0.71	0.82	0.26	0.30	0.52	0.62
Hg	mg/L	0.000041	0.000053	0.00018	0.00028	0.000052	0.000060	0.00018	0.00021	0.000048	0.000055	0.00014	0.00016
Mo	mg/L	0.0027	0.0037	0.0039	0.0057	0.0074	0.014	0.015	0.025	0.0068	0.014	0.014	0.023
Ni	mg/L	0.0030	0.0036	0.0037	0.0048	0.0029	0.0032	0.0042	0.0048	0.0028	0.0030	0.0039	0.0044
Se	mg/L	0.0011	0.0016	0.0027	0.0043	0.0023	0.0038	0.0048	0.0075	0.0020	0.0035	0.0039	0.0067
Ag	mg/L	0.000099	0.00011	0.00016	0.00021	0.00011	0.00012	0.00018	0.00020	0.00011	0.00011	0.00016	0.00018
Tl	mg/L	0.000089	0.00012	0.000089	0.00012	0.000080	0.000091	0.000090	0.00010	0.000075	0.000084	0.000083	0.000095
Zn	mg/L	0.013	0.016	0.017	0.022	0.013	0.015	0.020	0.023	0.013	0.014	0.018	0.021

Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\ Goldsim_Results_REV49_6_June_2013.xlsx
*: all concentrations are total concentrations

Table 5-3 Modelling Predictions of W2 Water Quality

		Modelling Predictions* of W1 Water Quality											
		Phase V/VI Operations				Post-Closure (After 2028), No Mitigation				Post-Closure (After 2028), Covers in Effect			
		Best Estimate		Reasonable Worst Case		Best Estimate		Reasonable Worst Case		Best Estimate		Reasonable Worst Case	
		Average	**Max**	**Average**	**Max**	**Average**	**Max**	**Average**	**Max**	**Average**	**Max**	**Average**	**Max**
Ammonia	mg/L	0.091	0.18	0.13	0.26	0.027	0.072	0.037	0.097	0.027	0.072	0.037	0.097
F-	mg/L	0.31	0.67	0.31	0.67	0.38	0.71	0.43	0.77	0.37	0.70	0.42	0.76
N-NO2	mg/L	0.016	0.033	0.075	0.14	0.0049	0.025	0.017	0.056	0.0049	0.025	0.017	0.056
N-NO3	mg/L	1.1	2.0	2.6	5.1	0.25	0.80	0.56	1.6	0.25	0.80	0.56	1.6
SO2-4	mg/L	17	32	21	38	23	39	32	51	21	38	28	47
Al	mg/L	1.2	7.2	1.3	7.2	1.2	6.3	1.2	6.3	1.2	6.3	1.2	6.3
As	mg/L	0.0011	0.0037	0.0011	0.0037	0.0012	0.0033	0.0015	0.0035	0.0011	0.0033	0.0014	0.0034
Cd	mg/L	0.000054	0.00016	0.000060	0.00016	0.000062	0.00015	0.000089	0.00018	0.000061	0.00015	0.000083	0.00017
Cr	mg/L	0.0028	0.015	0.0029	0.015	0.0026	0.013	0.0030	0.013	0.0026	0.013	0.0029	0.013
Cu	mg/L	0.010	0.024	0.012	0.027	0.014	0.026	0.021	0.035	0.013	0.025	0.018	0.032
Fe	mg/L	2.3	12	2.4	12	2.1	11	2.2	11	2.1	11	2.2	11
Pb	mg/L	0.00074	0.0036	0.00074	0.0036	0.00072	0.0032	0.00089	0.0032	0.00071	0.0032	0.00087	0.0032
Mn	mg/L	0.13	0.34	0.18	0.41	0.16	0.34	0.26	0.46	0.14	0.31	0.21	0.40
Hg	mg/L	0.000017	0.000041	0.000034	0.000058	0.000024	0.000045	0.000057	0.000078	0.000023	0.000044	0.000046	0.000068
Mo	mg/L	0.0011	0.0015	0.0013	0.0016	0.0027	0.0048	0.0048	0.0077	0.0025	0.0047	0.0044	0.0072
Ni	mg/L	0.0034	0.014	0.0035	0.014	0.0034	0.013	0.0037	0.013	0.0033	0.013	0.0036	0.013
Se	mg/L	0.00047	0.00067	0.00067	0.00097	0.00090	0.0015	0.0015	0.0025	0.00081	0.0014	0.0013	0.0023
Ag	mg/L	0.000031	0.000072	0.000039	0.000083	0.000044	0.000080	0.000062	0.00010	0.000043	0.000079	0.000057	0.000096
Tl	mg/L	0.000057	0.00014	0.000057	0.00014	0.000060	0.00013	0.000063	0.00013	0.000058	0.00013	0.000061	0.00013
Zn	mg/L	0.0088	0.032	0.0093	0.032	0.0096	0.029	0.011	0.029	0.0094	0.029	0.011	0.029

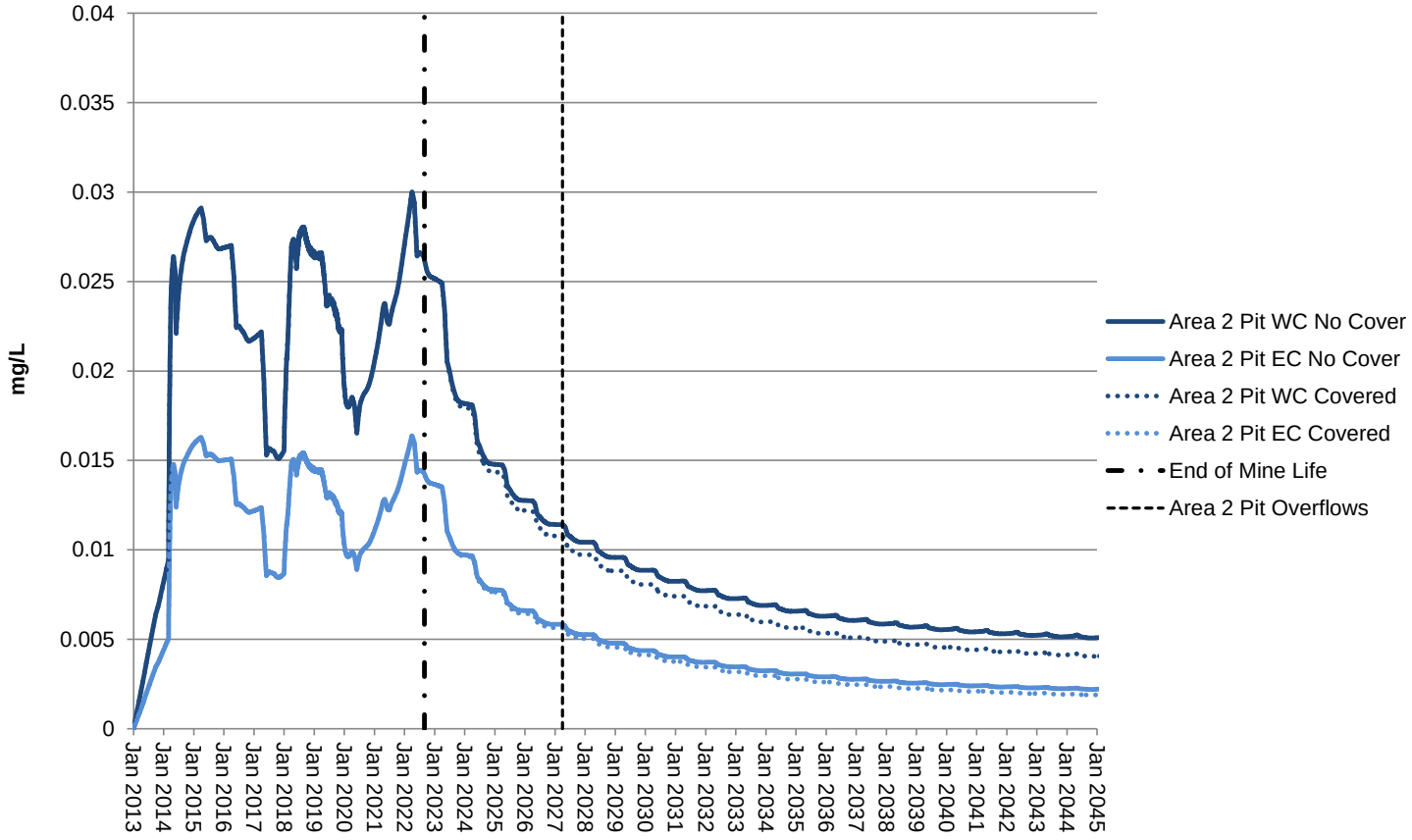
Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\ Goldsim_Results_REV49_6_June_2013.xlsx
*: all concentrations are total concentrations



EC - Expected Case, WC - Reasonable Worst Case.

T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

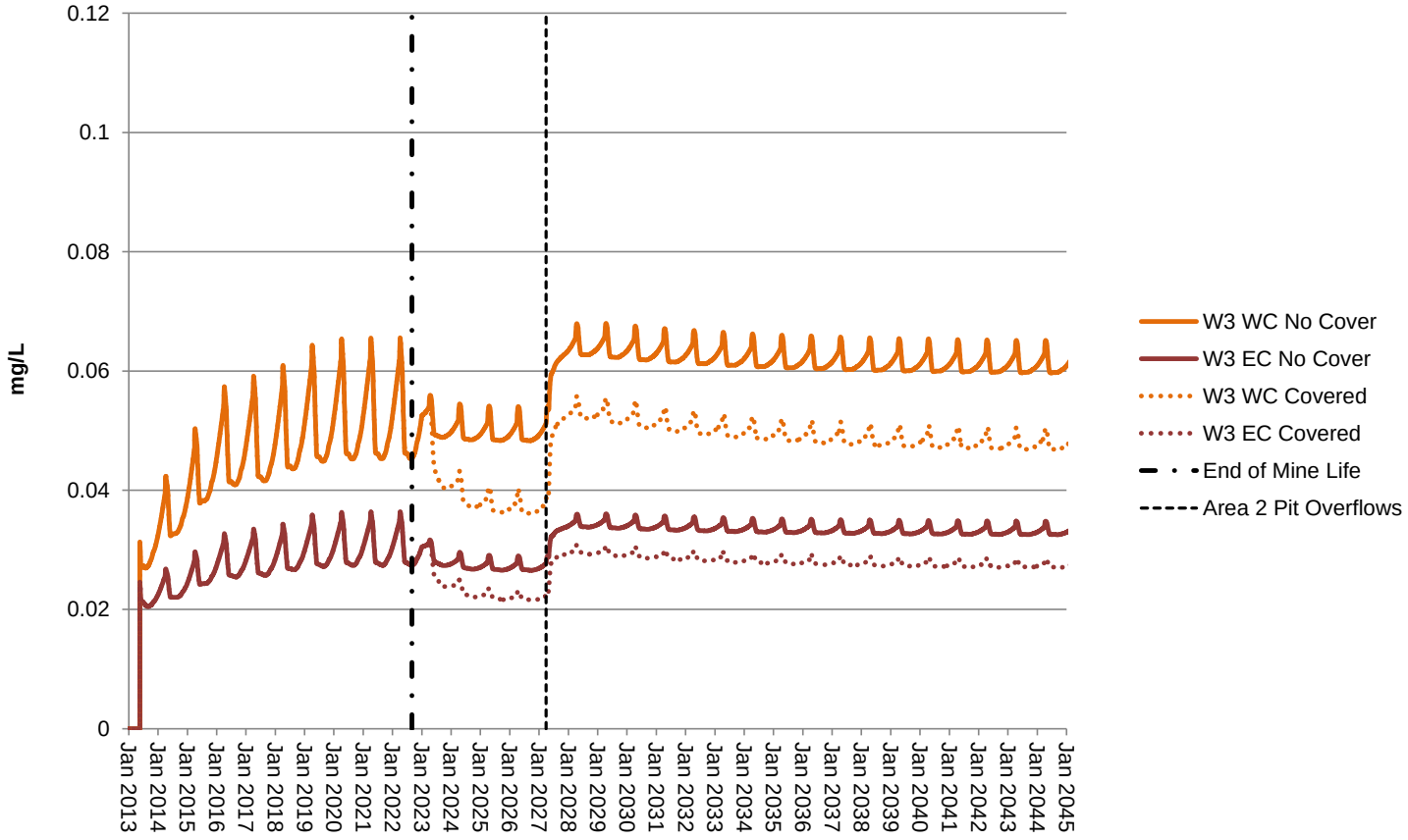
Figure 5-3 Model Predictions of Dissolved Copper Concentrations in Area 2 Pit Water



EC - Expected Case, WC - Reasonable Worst Case.

T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

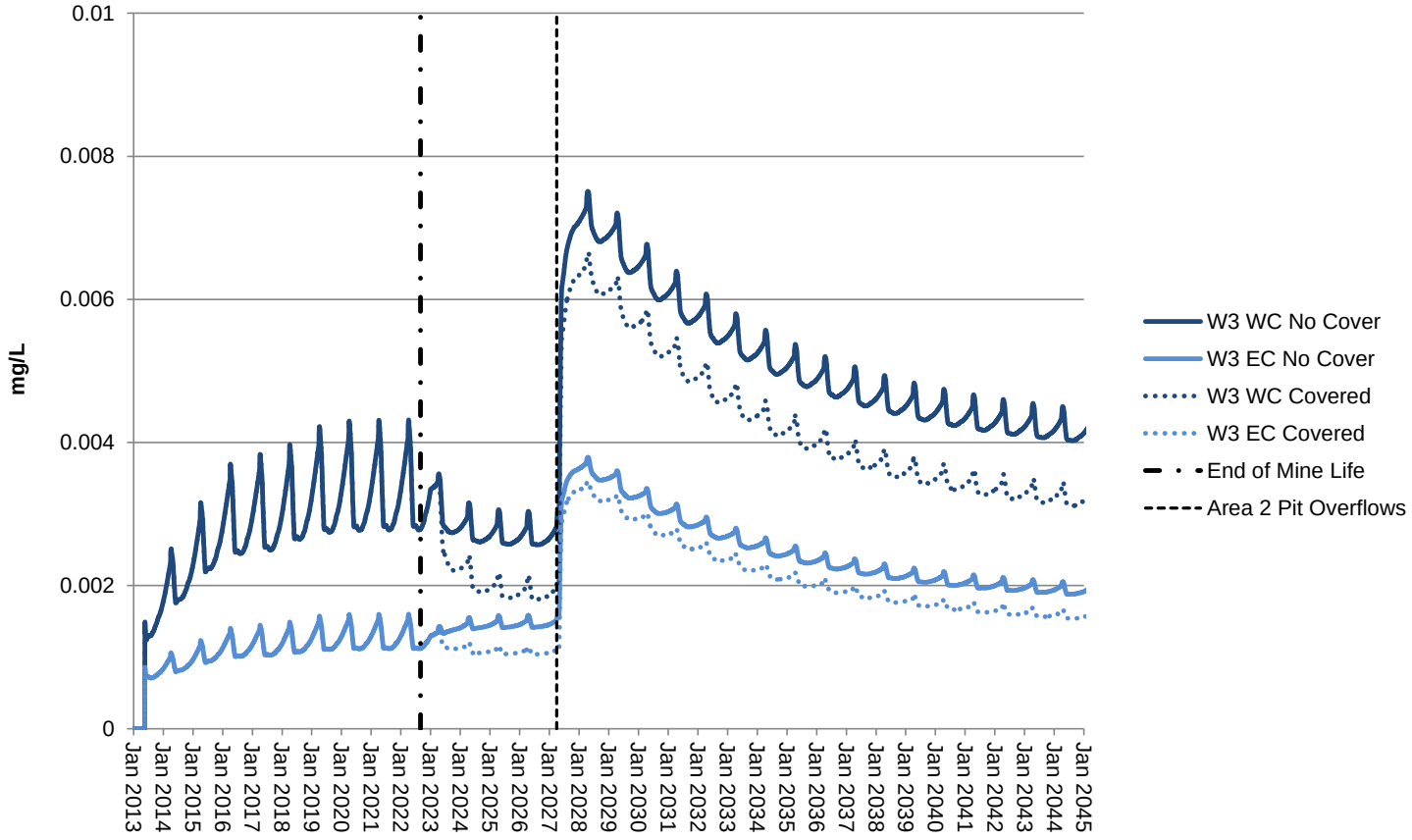
Figure 5-4 Model Predictions of Dissolved Selenium Concentrations in Area 2 Pit Water



EC - Expected Case, WC - Reasonable Worst Case.

T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

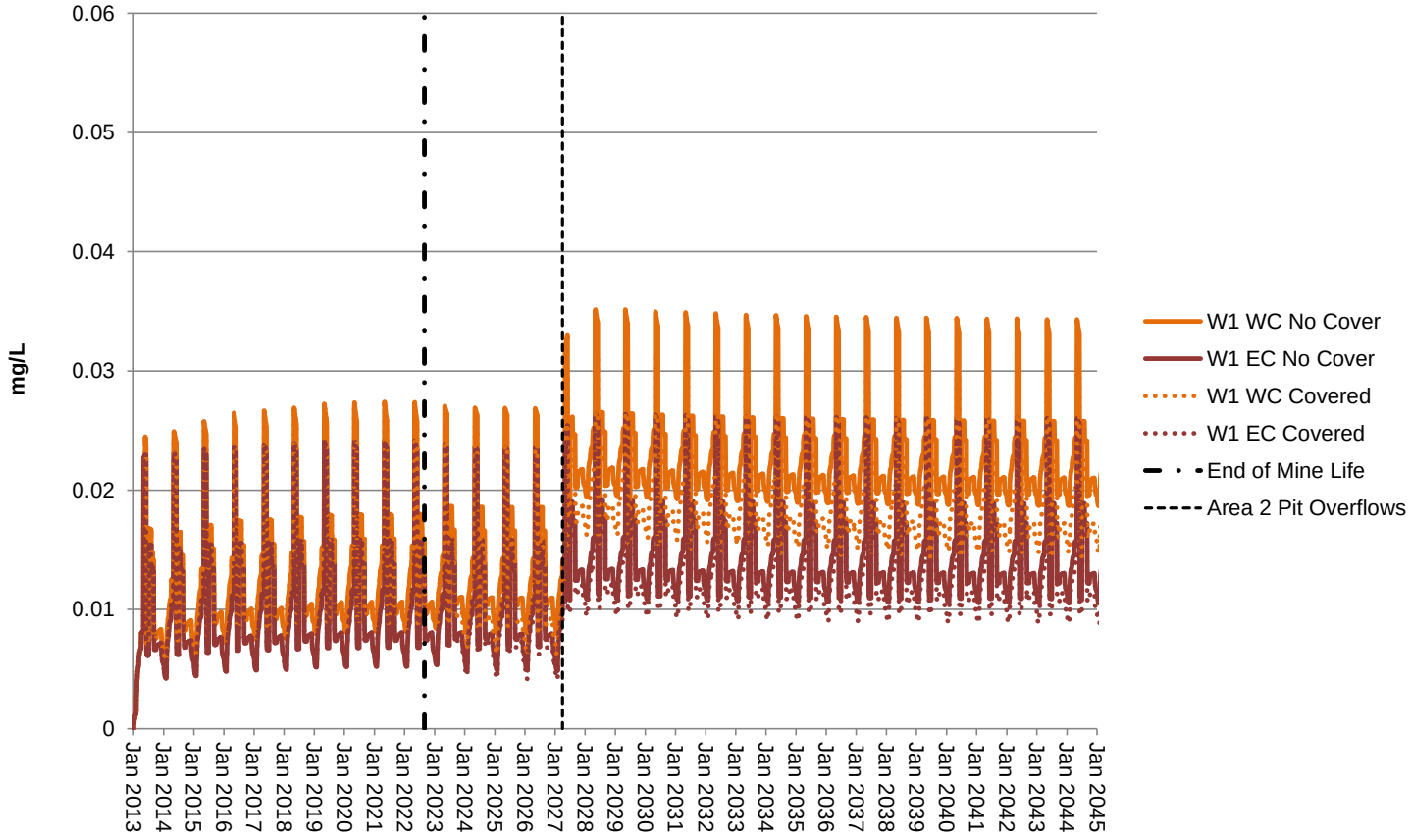
Figure 5-5 Model Predictions of Total Copper Concentrations at W3



EC - Expected Case, WC - Reasonable Worst Case.

T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

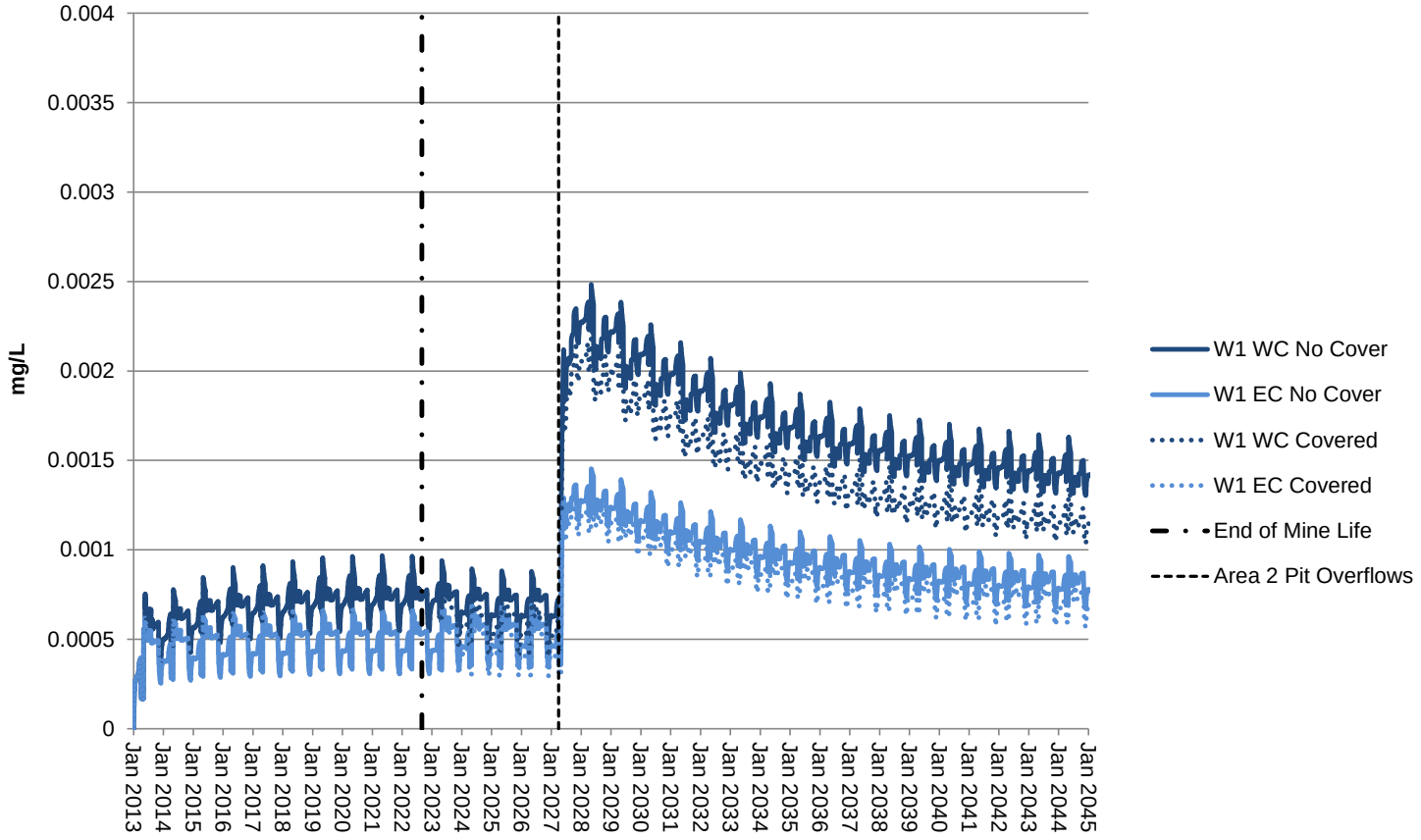
Figure 5-6 Model Predictions of Total Selenium Concentrations at W3



EC - Expected Case, WC - Reasonable Worst Case.

T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

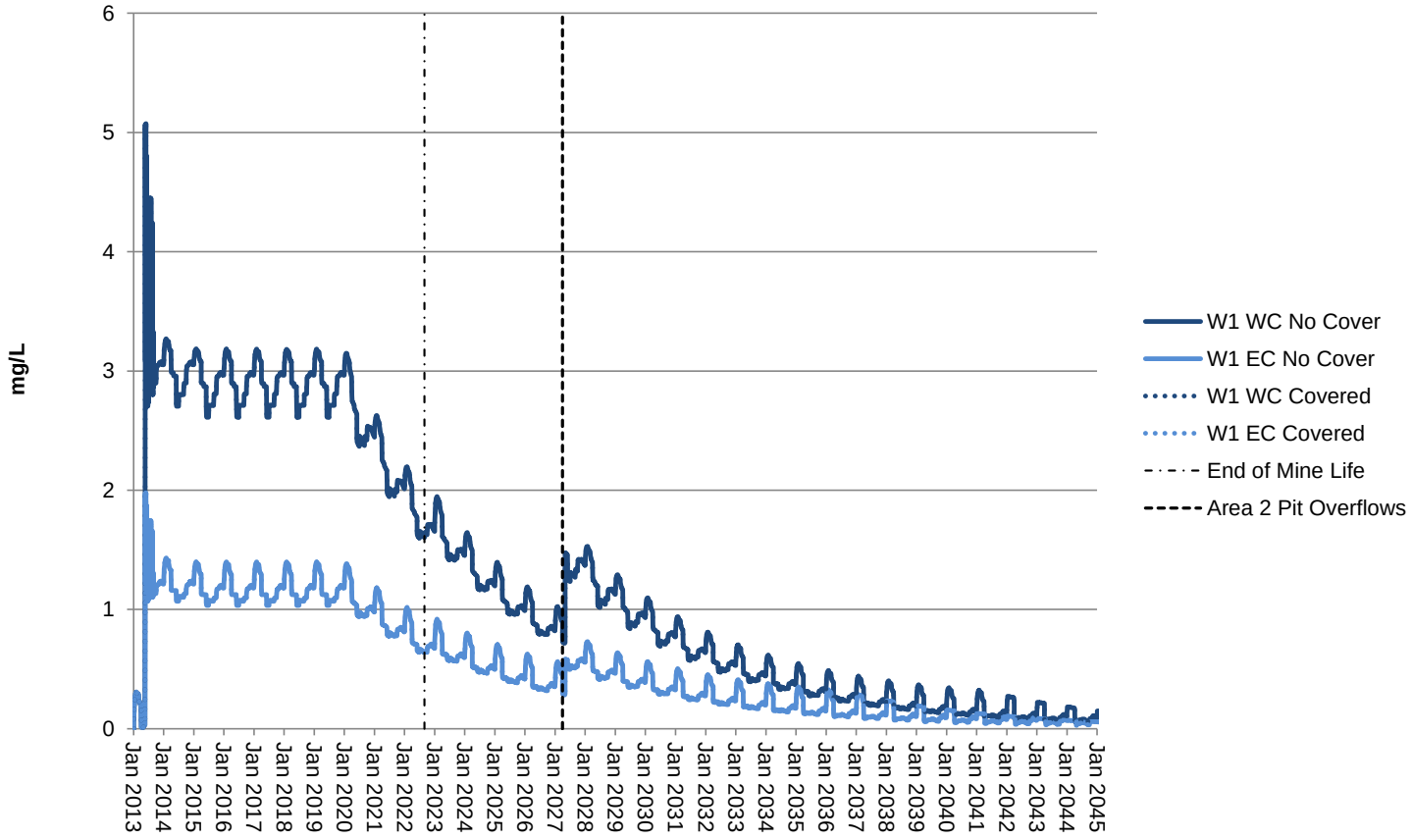
Figure 5-7 Model Predictions of Total Copper Concentrations in Lower Minto Creek



EC - Expected Case, WC - Reasonable Worst Case.

T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

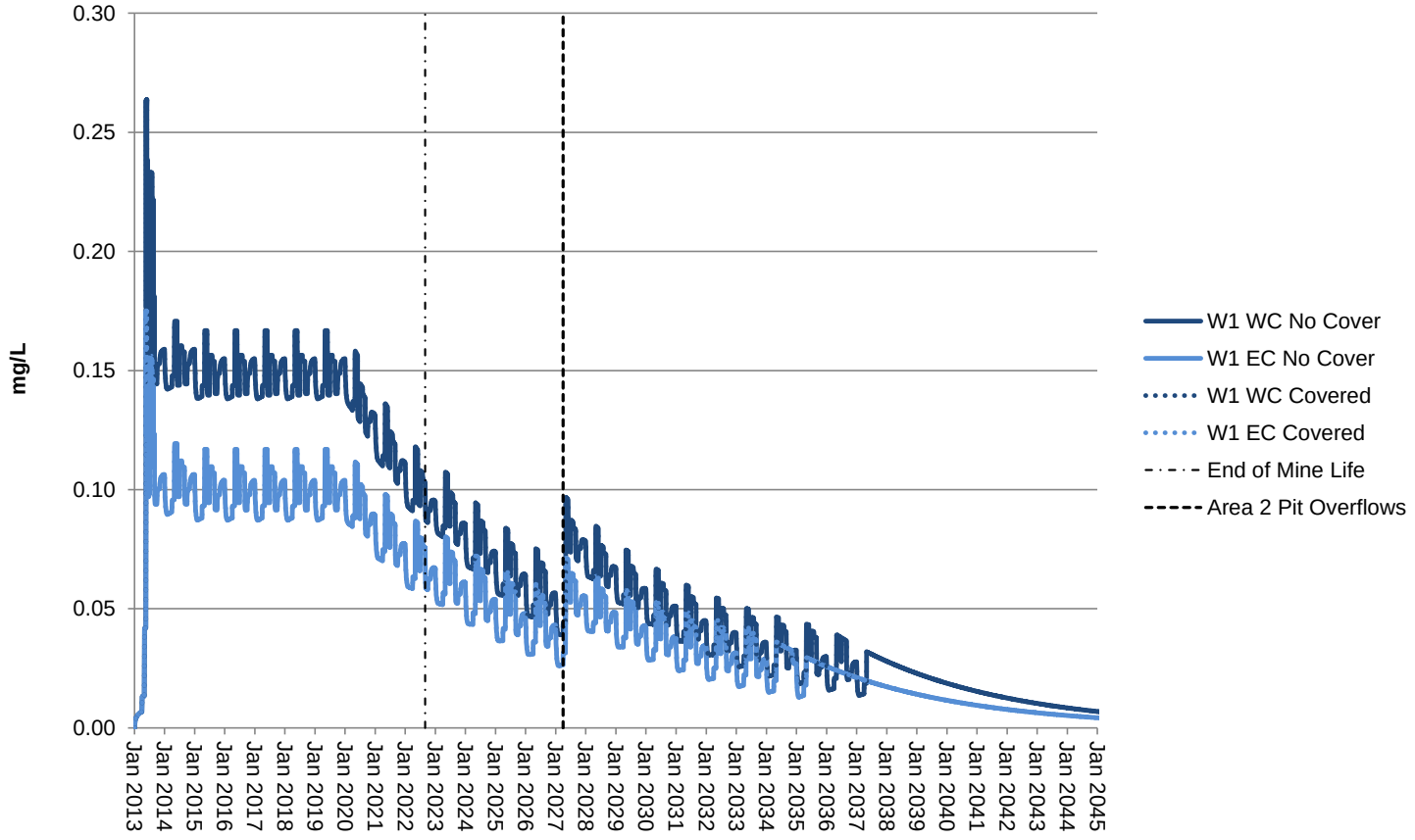
Figure 5-8 Model Predictions of Total Selenium Concentrations in Lower Minto Creek



EC - Expected Case, WC - Reasonable Worst Case.

T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

Figure 5-9 Model Predictions of Nitrate-N Concentrations in Lower Minto Creek



EC - Expected Case, WC - Reasonable Worst Case.
T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\[Goldsim_Results_REV49_7_June_2013.xlsx]

Figure 5-10 Model Predictions of Ammonia-N Concentrations in Lower Minto Creek

5.2.2 McGinty Creek Water Quality Results

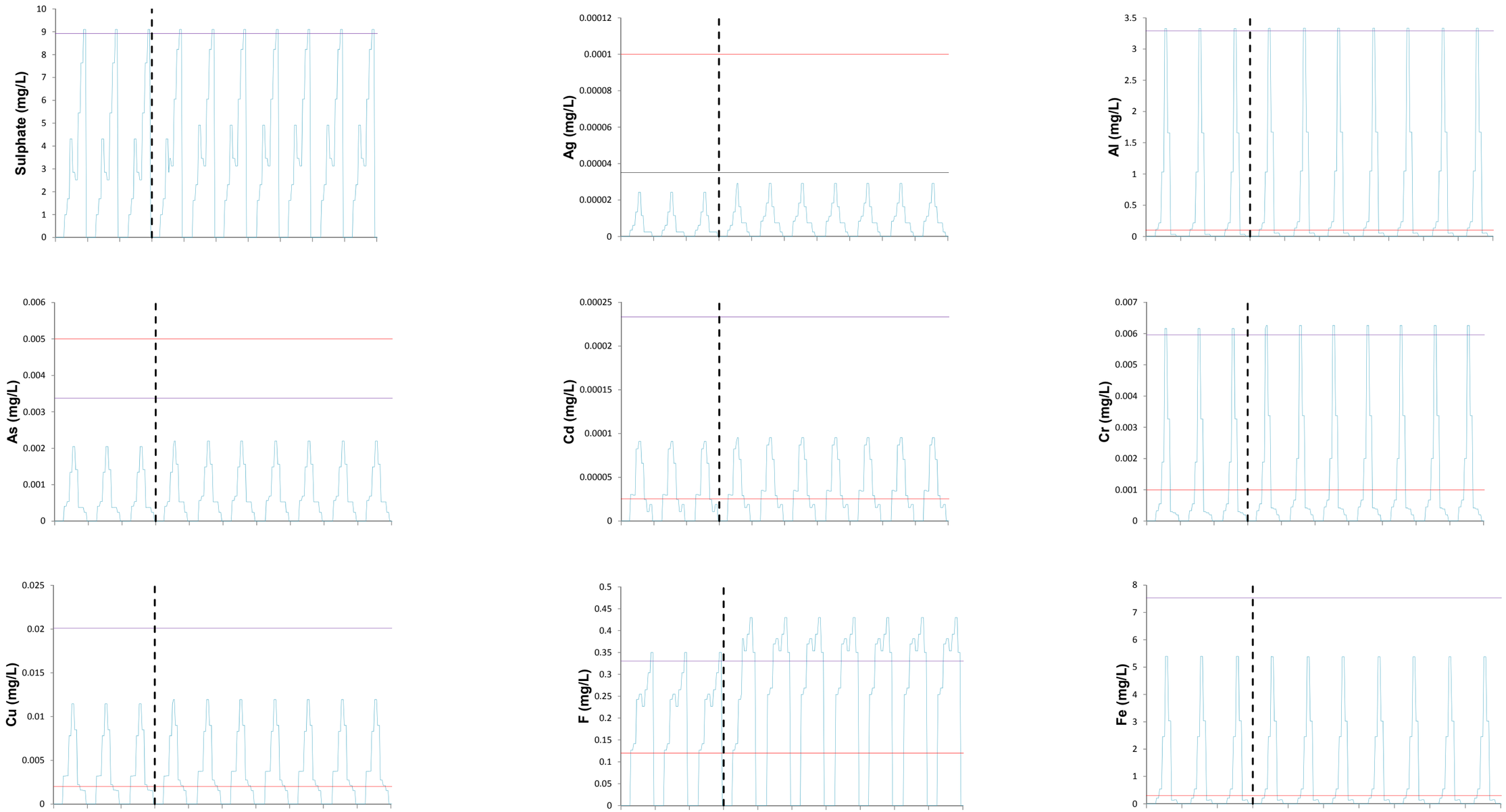
The McGinty Creek water quality modelling was carried out as a scoping exercise for a worst-case scenario that included the following assumptions:

- The magnitude of loadings was set to be equal to the loads determined for the full extent of the pit walls exposed at the end of mining (i.e. there was no gradual decrease in loadings estimates even if the pit was to fill).
- All geochemical loading generated by weathering of the pit walls is both flushed from the weathering sites and reports to water in the Minto North Pit.
- Accumulated loadings would report unattenuated to McGinty Creek by surface discharge and/ or via groundwater pathways.

Under this scenario, Minto North loadings are maximized. This highly conservative approach evaluates the upper limit of the magnitude of potential changes to McGinty Creek water quality from geochemical loadings from the Minto North Pit.

Average and maximum results of the scoping exercise for lower McGinty Creek are presented in Table 5-4, along with average and maximum values in the baseline water quality results. Results for selected parameters are shown in Figure 5-11a and Figure 5-11b, along with indicator values representing the 95th percentile concentrations in the baseline data. CCME Protection of Aquatic Life guidelines (for those parameters with guidelines) and an indicator marking the start of mining at Minto North are also shown. Although the assessment of aquatic effects is addressed elsewhere (Minto 2013c and references therein), inspection of the baseline and worst case post-mining results in Figure 5-11a and 5-11b reveals that the changes in water quality of McGinty Creek from mining Minto North will be minimal.

Table 5-4 indicates that no change from baseline range is expected in the post-mining period for concentrations of nitrogen species. These species are typically derived from soluble blasting residues in mined rock and in pit water. Since the mined rock will be stored in the Minto Creek watershed, and since pit sump water will also be directed to the Minto watershed during operations, it is expected that there will be minimal nitrogen loadings from Minto North to McGinty Creek.



Notes: X-axis tick marks represent a 1-year timeframe

Legend

- McGinty Creek at Mouth
- CCME PAL
- 95th Percentile_MN4.5_baseline
- Minto North Overflows to McGinty Ck

srk consulting

Job No: 1CM002.003

Filename: Fig_5-11_McGintyCk_WQ-Prediction_Charts

CAPSTONE MINING CORP. MINTO MINE OPERATED BY MINTO EXPLORATIONS LTD.

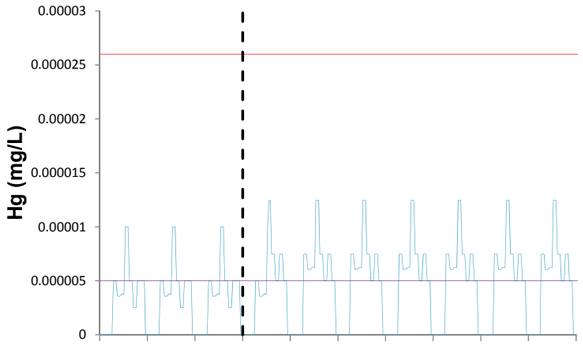
Minto Mine

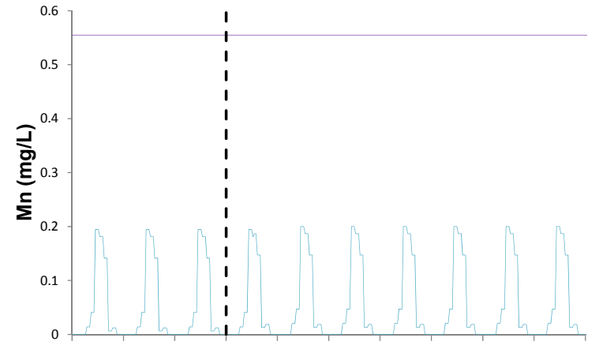
Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report

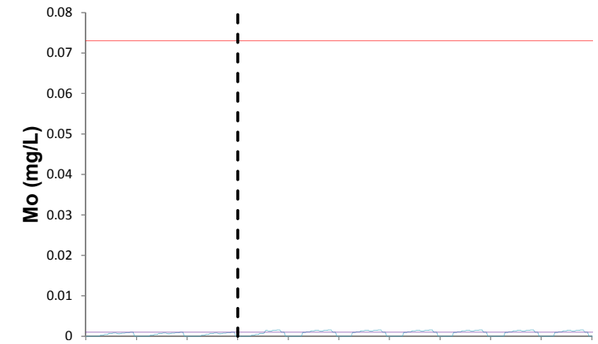
McGinty Creek Water Quality Prediction: Worst Case Results

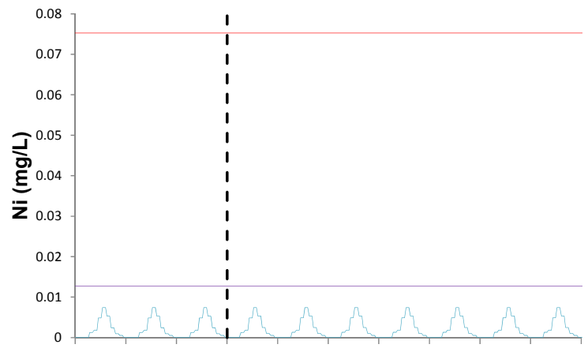
Date: June 2013 | Approved: DBM | Figure: **5-11a**

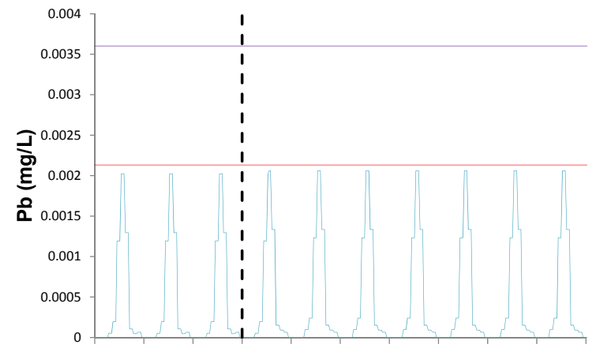
T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Model Report\Figures

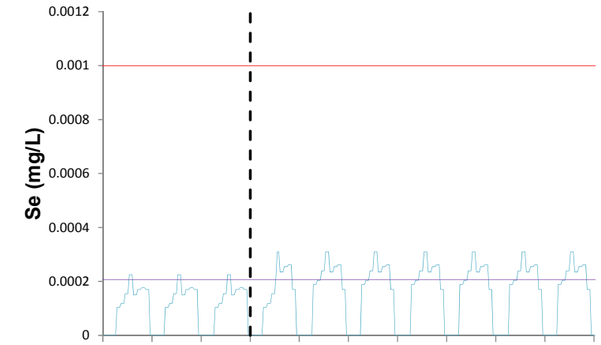


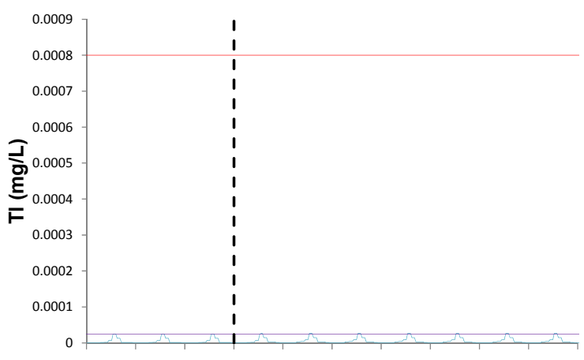


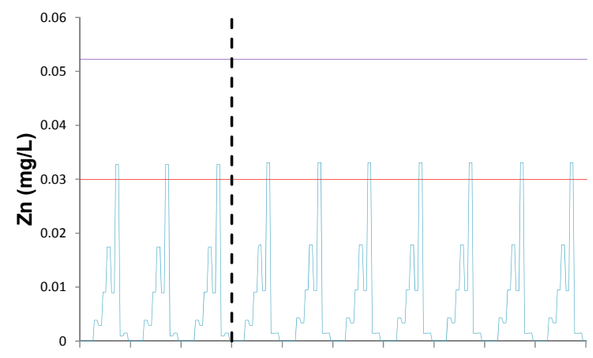












Notes: X-axis tick marks represent a 1-year timeframe

Legend
- McGinty Creek at Mouth
- CCME PAL
- 95th Percentile_MN4.5_baseline
- Minto North Overflows to McGinty Ck

srk consulting

Job No: 1CM002.003
Filename: Fig_5-11_McGintyCk_WQ-Prediction_Charts

CAPSTONE MINING CORP.
MINTO MINE
OPERATED BY MINTO EXPLORATIONS LTD.

Minto Mine

Minto Mine Phase V/VI Expansion:
Water and Load Balance Model Report

McGinty Creek Water Quality Prediction: Worst Case Results

Date:	Approved:	Figure:
June 2013	DBM	5-11b

T:\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Model Report\Figures

Table 5-4 Water Quality Modelling Results for McGinty Creek at Mouth

Parameter*/ Unit		Baseline Conditions		After Mining at Minto North	
				Worst Case	
		Average	Max	Average	Max
Ammonia	mg/L	0.0355	0.27	not predicted- expect no change	
F	mg/L	0.20	0.43	0.23	0.43
$N\text{-}NO_2$	mg/L	0.0064	0.025	not predicted- expect no change	
$N\text{-}NO_3$	mg/L	0.073	0.3	not predicted- expect no change	
Sulphate	mg/L	3.1	9.1	3.2	9.1
Al	mg/L	0.55	3.3	0.55	3.3
As	mg/L	0.00062	0.0022	0.00065	0.0022
Cd	mg/L	0.000031	0.000095	0.000032	0.000095
Cr	mg/L	0.0011	0.0063	0.0012	0.0063
Cu	mg/L	0.0035	0.012	0.0036	0.012
Fe	mg/L	1.0	5.4	1.00	5.4
Pb	mg/L	0.00043	0.0021	0.00044	0.0021
Mn	mg/L	0.052	0.20	0.053	0.20
Hg	mg/L	0.0000042	0.000012	0.0000047	0.000012
Mo	mg/L	0.00069	0.0016	0.00085	0.0016
Ni	mg/L	0.0021	0.0074	0.0021	0.0074
Se	mg/L	0.00014	0.00031	0.00015	0.00031
Ag	mg/L	0.0000073	0.000029	0.0000084	0.000029
Tl	mg/L	0.0000049	0.000026	0.0000054	0.000026
Zn	mg/L	0.0067	0.033	0.0067	0.033

Source: Source: \\VAN-SVR0\Projects\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Results\Minto_North\[1CM002-003_MintoNorth_WQ_Prediction_2013-06-26.xlsx]
*: all concentrations are total concentrations

6 Discussion

6.1 Limitations of the Water and Load Balance Model

The model results presented in this report are based on best available input data and are thought to be reasonably representative of the mine developments planned for Phase V/VI. However, as with any model representation of a complex system there are inherent uncertainties associated with inputs and modelled processes. In most cases, uncertainties are accounted for by incorporating conservative assumptions that are intended to capture the most adverse conditions. One obvious exception to this approach is the water quality results from the “Expected Case” scenarios.

Uncertainties that may affect the accuracy of the model outcome include:

- Geochemical factors that are not reflected in the model. Factors such as attenuation of constituents along surface and subsurface flowpaths, removal of chemical load in open pits, and exposure of mine waste materials with geochemical weathering properties that result in substantially higher loadings than previously-mined materials at Minto all may contribute to actual water quality performance being different than the predictions presented here indicate.
- Significant changes to the operations and closure plans used as a basis for the modelling scenarios.
- Change in local climatic conditions that cause the historical climatic record to inaccurately represent the duration, frequency and intensity of precipitation and runoff events.

6.2 Interpretation of Model Results

As discussed in Section 4.2.1, the stochastic water balance model results produced by the Monte Carlo simulation are probability distributions of water balance outcomes. The average values presented (for example the predicted average water volume in the Area 2 Pit, Figure 5-2) are the most likely outcomes. During the operational period when water storage is a key element, the average water volumes result from several years of average precipitation or from alternating dry and wet years. Only when several wet years occur in succession, which is relatively improbable, does the model produce results that show greater than average water volumes in the pit. In the results for the post-closure period (after the Area 2 Pit is full), the range of modelled discharge volumes reflects the range in precipitation as there is no longer any net change in water storage on site.

Evaluation of the effects of the predicted water quality on aquatic resources in Minto Creek and McGinty Creek has been addressed elsewhere (Minto 2013c) and is not considered here in detail. The predicted concentrations of water quality parameters include ‘Expected Case’ values and ‘Reasonable Worst Case’ values. In the context of actual project performance, the predicted ‘expected case’ concentrations should be considered to be typical performance values (including the range of variability observed over operations at the Minto Mine). The predictions which represent the ‘Reasonable Worst Case’ scenario are considered to be highly unlikely to occur, and should be considered to represent the extreme upper end of the range of potential water quality performance of the mine. In the unlikely event that water quality concentrations in the range of the ‘Reasonable Worst Case’ values occur, it is expected that this condition would be transient and of short duration (as observed with the upper range of water quality concentrations in the site monitoring results to date).

6.3 Dry Bulk Density of Tailings

For Minto Phase V/VI, the estimates of the bulk density of tailings to be placed in the TMFs are somewhat uncertain. This uncertainty is important both for the design of the TMFs and for the water and load balance results. When designing a TMF, best practice requires that the capacity

of the facility is sized such that it can contain the volume of tailings corresponding to the lower end of the conceivable range of bulk density. This is a conservative approach that ensures adequate storage capacity is available for operations.

However, using the lower end of the estimated density range is not a conservative assumption in developing a water and load balance model. Adopting a lower bulk tailings density value results in storage of more mine water in tailings pores and therefore greater removal of water quality parameter loadings. Furthermore, the volume of water stored in tailings pores is not available for release to the receiving environment. If the volume of tailings porewater is overestimated the volume of water to be released from site is underestimated, which would then lead to an underestimation of water quality parameter concentrations in the receiving environment. Therefore, selecting a dry bulk density value at the upper range of the expected range (i.e. 1.3 t/m^3) is an appropriately conservative assumption for a water and load balance model.

The water and load balance results presented here are the result of a modelled dry bulk tailings density of 1.3 $tonnes/m^3$, while the development of the Phase V/VI Tailings Management Plan relied on a density of 1.1 $tonnes/m^3$ in developing estimates of storage requirements.

This report, "*Minto Mine Phase V/VI Expansion: Water and Load Balance Model Report*", has been prepared by SRK Consulting (Canada) Inc.

Prepared by

This signature was scanned with the author's approval for exclusive use in this document; any other use is not authorized.

Soren Jensen, PEng (BC)

Senior Consultant

This signature was scanned with the author's approval for exclusive use in this document; any other use is not authorized.

Dylan MacGregor, PGeo (BC)

Principal Consultant

Reviewed by

This signature was scanned with the author's approval for exclusive use in this document; any other use is not authorized.

Tom Sharp, PEng (BC)

Principal Consultant

All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

Disclaimer—SRK Consulting (Canada) Inc. has prepared this document for Minto Explorations Ltd.Minto Explorations Ltd.Minto Explorations Ltd.. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

7 References

Clearwater Consultants Ltd., 2010. Memorandum CCL-MC7: Minto Mine – Phase IV Closure Water Balance. Memorandum to Access Consulting Group, 6 August 2010.

Minto Explorations Ltd. 2013a. Minto Mine Phase V/VI Expansion, Water Management Plan.

Minto Explorations Ltd. 2013b. Minto Mine Phase V/VI Expansion, Tailings Management Plan v.2013-01.

Minto Explorations Ltd. 2013c. Minto Mine Phase V/VI Expansion, Project Proposal: Phase V/VI Expansion of Mining and Milling, Minto Mine, Yukon.

SRK Consulting, 2010. Minto Mine Expansion- Phase IV ML/ARD Assessment and Post-closure Water Quality Prediction. Report prepared for Minto Explorations Ltd. August 2010.

SRK Consulting, 2012. Minto Mine Groundwater Monitoring Report. Report prepared for Minto Explorations Ltd. June 2012.

SRK Consulting, 2013. Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions. Report prepared for Minto Explorations Ltd. June 2013.

Appendix A: Minto Mine 2012 Water Balance Update

SRK Consulting (Canada) Inc.
Suite 2200 - 1066 West Hastings Street
Vancouver, BC V6E 3X2

T: +1.604.681.4196
F: +1.604.687.5532

vancouver@srk.com
www.srk.com

Memo

To:	Ryan Herbert, James Spencer	**Date:**	28 March 2013
Company:	Minto Explorations Ltd.	**From:**	Soren Jensen
Copy to:		**Project #:**	1CM002.0011
Subject:	2012 Water Balance and Water Quality Model Summary for the Minto Mine Site		

1 Introduction and Background

This memorandum provides a summary of water balance and water quality model updates for Minto Mine site for the period January 2012 through January 2013. The water quality update was limited to a comparison of water quality data collected in site in 2012 to water quality model predictions developed in 2011 and 2012 for the life of mine (Phase IV) and post-closure. The 2012 water balance is the latest in a series of water balance updates completed for the site annually since 2006. This water balance update is intended for inclusion in the 2012 Annual Water License Report for Minto Mine.

Annual water balance reports for the Minto Mine were completed by Access Consulting Group (ACG) and Clearwater Consultants Ltd. (Clearwater) from 2006 through 2011. Clearwater developed a monthly spreadsheet water balance model (Versions 1.0 to 1.5) using Microsoft Excel, which combined measured and modelled hydrological and meteorological inputs to produce a site-wide water balance.

In 2011/2012, Minto's water balance model was converted from Excel to the Goldsim software platform (version 10.5) by SRK Consulting (SRK). The primary benefit of the Goldsim model is the ability to incorporate stochastic variability in forecasts of annual precipitation and runoff volumes. Stochastic representation of future annual precipitation results in improved forecasts of runoff volumes, which in turn are helpful for developing appropriate water management plans. The water balance information presented here was used as a basis for developing a water management strategy for 2013; as in 2011/2012, the Goldsim water balance model for the site was used to carry out this update.

2 Water Balance Update

2.1 Precipitation

Table 1 shows a summary of monthly precipitation measured at the Minto Mine site in 2011/2012 along with precipitation data from the regional meteorological station at Pelly Ranch (Climate ID: 2100880). Minto Explorations Ltd. (Minto) operates two meteorological stations on the Minto Mine site: a HOBO Weather Station and a Campbell Scientific meteorological station. The HOBO station measures total rainfall and the Campbell Scientific station measures total precipitation. From October through May, total precipitation is measured using a snowfall conversion adaptor fitted on a tipping bucket rain gauge

Precipitation measurements from the Pelly Ranch weather station, which is located approximately 25 km north of Minto, have historically been reasonable well correlated with precipitation measurements collected at Minto Mine. Therefore, the long-term precipitation record available for the Pelly Ranch station is used as a basis for estimating the distribution of annual mean precipitation at the Minto Site. A description of correlation analysis was provided in the 2012 water balance update for the Minto Mine (Minto 2012).

Rainfall measurements for the two meteorological stations at Minto were in good agreement for the months of June, July and October 2012. However, the HOBO station measured considerably higher rates of rainfall than the Campbell Scientific station in August and September. The cause of this variability is not clear.

Table 1 Precipitation Records for Minto Mine and Pelly Ranch (Nov. 2011 to Dec. 2012)

		Minto Met. Stations		Regional Station
		HOBO	Campbell Scientific	Pelly Ranch (Climate ID 2100880)
		Mm	Mm	mm
2011	Oct	-	4.4	-
2011	Nov	-	0.15	56.7
2011	Dec	-	3.94	37.3
2012	Jan	-	9.0	39.4
2012	Feb	0.6	9.9	29
2012	Mar	0.6	34.9	29.5
2012	Apr	0.2	0.0	7.8
2012	May	8.6	0.1	27
2012	Jun	33.4	32.1	26.7
2012	Jul	44.0	44.8	71.4
2012	Aug	36.6	20.6	32.1
2012	Sept	36.0	26.1	28.3*
2012	Oct	13.8	16.5	25.6
2012	Nov	-	17.1	n/a
2012	Dec	-	18.4	23.5*
SUM Hydrological Year, Nov. 2011 to Oct. 2012		**174.2**	**198.2**	**324.8**

Notes: * - based on incomplete data set. n/a – not available.
Source: Minto Site Data: 01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\GoldSim_Input_Tracking_PhaseV_VI_1CM002.003_REV00_SRJ.xlsx
Pelly Ranch Data: obtained from Meteorological Service of Canada, Environment Canada.

Correlation analyses complete in past years have indicated that total annual precipitation at the Minto Site generally is 10% greater than at Pelly Ranch due to difference in mean elevation and micro-climatic conditions. However, in 2012 the total annual precipitation measurements at the Pelly Ranch station was approximately 125 mm or about 60% greater than the total annual precipitation measure at the mine site. The precipitation data from Pelly Ranch for 2012 does not meet SRK's quality criteria of 95% data availability for inclusion in the frequency distribution and correlation analysis for Minto. Therefore, the frequency distribution and correlation developed based on historical data up to 2011 remain unchanged.

Examination of the precipitation record from Minto shows that total precipitation measurements in November and December 2011 as well as January, February and March 2012 were much lower than expected based on a comparison with data from Pelly Ranch. Reports by environmental staff at the Minto Mine suggest that the precipitation adapter, which converts snowfall to total precipitation measurements, may not have operated correctly in the winter of 2011/2012 (the first season this adapter was used). Unfamiliarity with the operation of the precipitation adapter may in part explain the apparent unreliable performance of the unit in the 2011/2012 winter season. Total precipitation data for the November/ December 2012 period fall within the expected range.

Because of potential inaccuracies in the total precipitation measurements from site in 2011/2012, the total annual precipitation measured at Pelly Ranch was used as a basis for estimating the annual precipitation for the Minto Site for 2012.

2.2 Snow Course Data

Snow course surveys were completed at three snow survey stations at the Minto site in 2012. Table 2 shows a summary of the snow survey data from 2009 to 2012. The depth of the snow pack provides an indication of the volume of surface runoff that can be expected during freshet. Between January and late May 2012 approximately 525,000 m^3 of surface runoff flowed from catchments at the Minto Mine site upstream of the Water Storage Pond (WSP). This volume corresponds to roughly 55 mm of runoff, or about 40% of the snow pack water equivalent measured in April 2012. The remaining 60% of the water in the snow pack was assumed to be lost to sublimation, evaporation and to a lesser extent, groundwater recharge.

Table 2 Summary of Snow Survey Data for the Minto Mine Site

Year	February 1st			March 1st			April 1st		
	Snow Depth (cm)	Snow Density (%)	Water Equivalent (mm)	Snow Depth (cm)	Snow Density (%)	Water Equivalent (mm)	Snow Depth (cm)	Snow Density (%)	Water Equivalent (mm)
2009	55.6	16.6	92.7	70.2	15.7	110.0	67.4	22.3	150.7
2010	60.5	17.8	107.7	58.1	20.7	120.7	40.4	[A]13.9	56.0
2011	57.2	18.7	106.0	70.3	20.1	141.7	52.3	22.8	111.7
2012	54.7	20.3	111.0	64.6	19.6	127.0	61.3	21.5	132.7

Note: Source: Minto (2012). [A]zero snow at #3, density is an average of snowpack at #1 and #2, average depth and water-equivalent is average of all three sites

2.3 Surface Runoff

Figure 1 shows a schematic of water management infrastructure and piping in use at Minto in 2012. Primary infrastructure include:

- Main Pit: repository for surface water and seepage affected by the mine development. Water stored in the Main Pit is intended to be used as process water and for subaqueous tailings deposition.
- W15 sump: collects surface runoff and seepage from the Southwest Waste Dump, from part of the Main Waste Dump and from adjacent undisturbed catchments. Water collected at W15 is pumped to the Main Pit or to the WSP.
- W35a sump: collects surface runoff from the minimally disturbed southern catchments. Water collected at W35a is piped to the Main Pit or to the WSP.
- W36 sump (formerly W37 sump): collects surface runoff and seepage from the mill valley, including contributions from the DSTSF. Water collected at W36 is pumped to the Main Pit.
- South Diversion Ditch: diverts water from minimally disturbed southern catchments to the WSP.
- WSP: repository for water that meets discharge criteria and is destined for discharge to Minto Creek.

Surface runoff was managed as follows in 2012:

- ~ 170,000 m^3 of water was pumped from the WSP to Minto Creek.
- ~ 150,000 m^3 of water was pumped from the WSP to the Mill Pond for use as process water.
- ~ 165,000 m^3 of water collected at W15 was pumped to the Main Pit.
- ~100,000 m^3 of water collected at W35a was conveyed to the WSP.
- ~ 155,000 m^3 of water collected at W35a was pumped to the Main Pit.
- ~ 110,000 m^3 of surface runoff from the mine site, (including the Dry Stack Tailings Storage Facility (DSTSF) and the Mill Valley Fill Expansion (MVFE)) was collected in the W37 sump and pumped to the Main Pit.

In 2012, Minto and ACG monitored surface runoff at several hydrometric stations in Minto Creek and McGinty Creek. Results from the surface hydrology monitoring program are reported elsewhere (Minto 2013).

2.4 Site Water Inventory

The primary water reservoirs at the Minto Mine include the Main Pit, the WSP and the DSTSF. Changes to the total water inventory at Minto in 2012 were estimated as follows:

- Main Pit:
  - The water level increased from 754.39 m to 765.06 m between January 1, 2012 and January 3, 2013.
  - This water level increase corresponded to a volume increase of ~ 800,000 m^3.
  - ~ 85,000 bank meter cubed (BCM) of tailings and ~100,000 BCM of waste rock was deposited in the Main Pit over the same period.
  - Therefore, the net water inventory increase in the Main Pit (including water in the pores of tailings and waste rock) in 2012 was ~ 615,000 m^3.
- WSP:
  - inventory in the WSP changed from 258,000 m^3 on January 1, 2012 to 239,000 m^3 on January 3, 2013 – a net reduction of 19,000 m^3 in 2012.
- DSTSF:
  - The net water inventory increase in the DSTSF was approximately 150,000 m^3 in 2012 (assuming an average water content of the compacted tailings of 16%). Placement of tailings in the DSTSF ceased at the beginning of November 2012, and therefore there will be no future changes in water inventory related to the DSTSF.

The water inventory in the mill and mill pond are negligible compared to the inventory in the Main Pit, the WSP and the DSTSF and are therefore not reported here.

2.5 Water Balance Summary

Table 3 shows a summary of the 2012 water balance for the Minto site. The total surface runoff collected on site was estimated to be approximately 920,000 m^3 based on the change in the water inventory and the known volume of water released to Minto Creek.

The total catchment upstream of the WSP measures approximately 1040 ha. Approximately 920,000 m^3 of runoff from 1040 ha gives a yield of approximately 88 mm/year. The current water and load balance (Goldsim) model that is used for forecasting surface runoff volumes, the annual average runoff coefficient is assumed to be 0.30. Based on this runoff coefficient, the total annual precipitation can be estimated as:

Annual Yield/Runoff Coefficient = Total Annual Precipitation, or

88 mm / 0.30 = 294 mm

As discussed above, the measured annual precipitation at Pelly Ranch for the hydrological year of 2012 was 324.8 mm. Based on the measured value at Pelly Ranch, it is reasonable to expect the total annual precipitation for the 2012 hydrological year at Minto was in the range of 300 mm to 350 mm. In other words, the estimates of total surface runoff and precipitation at the Minto Mine in 2012 indicate that an average runoff coefficient of approximately 0.30 is likely a reasonable estimate for forecasting purposes.

Table 3 Water Balance Summary of the Minto Mine Site (January 1, 2012 through January 3, 2013)

	Units		
Pit Volume Increase 2012 (754.4 m to 765.1 m Level)	m^3	800,000	
Tailings to Main Pit, total	BCM	85,000	
PAG, deposited sub-aqueously in Main Pit	BCM	100,000	
Main Pit Water Volume Increase 2012	m^3		615,000
WSP Net Water Volume Increase 2012	m^3		-19,000
Water stored in DSTSF tailings	m^3		150,000
Water Discharged to Minto Creek in 2012	m^3		170,000
Total Surface Runoff Above WSP in 2012	**m^3**		**~920,000**

Source: X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\07_Phase_5_6\Minto_Global_Mass_Balance._1CM002_003_REV00_SRJ.xlsx

3 Water Quality Model Update

Table 4 shows model predictions of water quality for the Main Pit at Minto for the Phase IV operational phase (2012 to 2017) along with maximum concentrations measured in Main Pit in 2012. Main Pit represents the primary repository of both water and load, and a comparison of actual water quality from this location with concentrations predicted for pit water during pre-production environmental assessment provides a good measure of actual vs. expect geochemical performance of the site.

The majority sources of chemical loading at Minto are the DSTSF and the upland waste rock. Seepage chemistry was used as a basis for both tailings and waste rock source terms in the pre-production water quality prediction. For this update, the 2012 tailings and waste rock seepage chemistry data were reviewed, and concentrations were found to be similar to (or lower than) the concentrations previously adopted as source terms. As a result, the water quality model was not updated, as the mid-2012 prediction remains the most appropriate prediction of future reasonable worst case conditions.

As expected, all measured maximum concentrations are well below predicted maximum concentrations. The model predictions of maximum concentrations were developed as conservative estimates that are unlikely to be exceeded at any time during the Phase IV operation. Measured concentrations of arsenic, cadmium, copper, molybdenum, nickel, selenium and zinc are factors of 3 to 8 times less than predicted maximum concentrations. Measured dissolved aluminum and iron concentrations, which are sensitive to the pH of the mine water, are factors of 25 and 60 times less than predicted maximum concentrations.

Subaqueous deposition of tailings began in November 2012. The potential effect of tailings deposition on the chemistry of the pit lake will be evaluated through pit lake monitoring though 2013 and will be revisited during preparation of the 2013 annual report.

Table 4 Water Quality Model Predictions and Measured Concentrations in 2012

		Water Use Licence QZ96-006				Modelling Predictions of Main Pit Water Quality[B, C] Maximum Values (2012 to 2017)	Main Pit Concentrations Observed in 2012
Parameter		**From WTP to Minto Creek**	**Freshet[A] at W50 and W17**	**Non-Freshet at W50 and W17**	**Non-Freshet at W2**	**Max Concentration**	**Max Dissolved**
Ammonia	mg/L	0.89	0.89	0.89	0.35	-	0.32
N-NO2	mg/L	0.15	0.15	0.15	0.06	-	0.26
N-NO3	mg/L	7.65	7.65	7.65	2.9	>15	33.1
P		-	-	-	0.02	-	0.089
Al	mg/L	2.7	2.7	2.7	0.62	3.1	0.12
As	mg/L	-	-	-	0.005	0.0055	0.0010
Cd	mg/L	0.00015	0.00015	0.00015	0.00004	0.00065	0.00011
Cr	mg/L	0.008	0.008	0.008	0.002	0.0056	<DL
Cu	mg/L	0.05	0.08	0.05	0.013	0.40	0.081
Fe	mg/L	3.5	3.5	3.5	1.1	3.60	0.060
Pb	mg/L	0.02	0.02	0.02	0.004	0.0030	<DL
Mo	mg/L	0.4	0.4	0.4	0.073	0.13	0.029
Ni	mg/L	0.5	0.5	0.5	0.11	0.012	0.0030
Se	mg/L	0.003	0.003	0.003	0.001	0.057	0.007
Zn	mg/L	0.15	0.15	0.15	0.03	0.065	0.022

Notes: [A]April 1 to May 31
[B]Operational Predictions are for dissolved phases only. Effluent from the Minto Mine is assumed to be sourced from the Main Pit in the operational period from 2012 to 2017.
[C]Model Results from:
X:\01_SITES\Minto\!020_Site_Wide_Data\Water_and_Load_Balance_Files\01_Project_Phases\04_Amendment_8_Support\01_Goldsim_Model\MintoAmend8Support_1CM002.003_Rev34_TC_SRJ_500.gsm
Source: \\VAN-SVR0\Projects\01_SITES\Minto\1CM002.011_OperationalSupport_Environmental_2013\2013_Water_Balance_Update_For_Annual_Report\[All_Model_Results_for_WQ_Model_Comparison_for_2012_An_Report_1CM002_011_SRJ_Rev00.xlsx]WQ Summ Rev34

4 References

Minto Explorations Ltd. 2012. 2011 Annual Water Licence and Quartz Mining License Report.

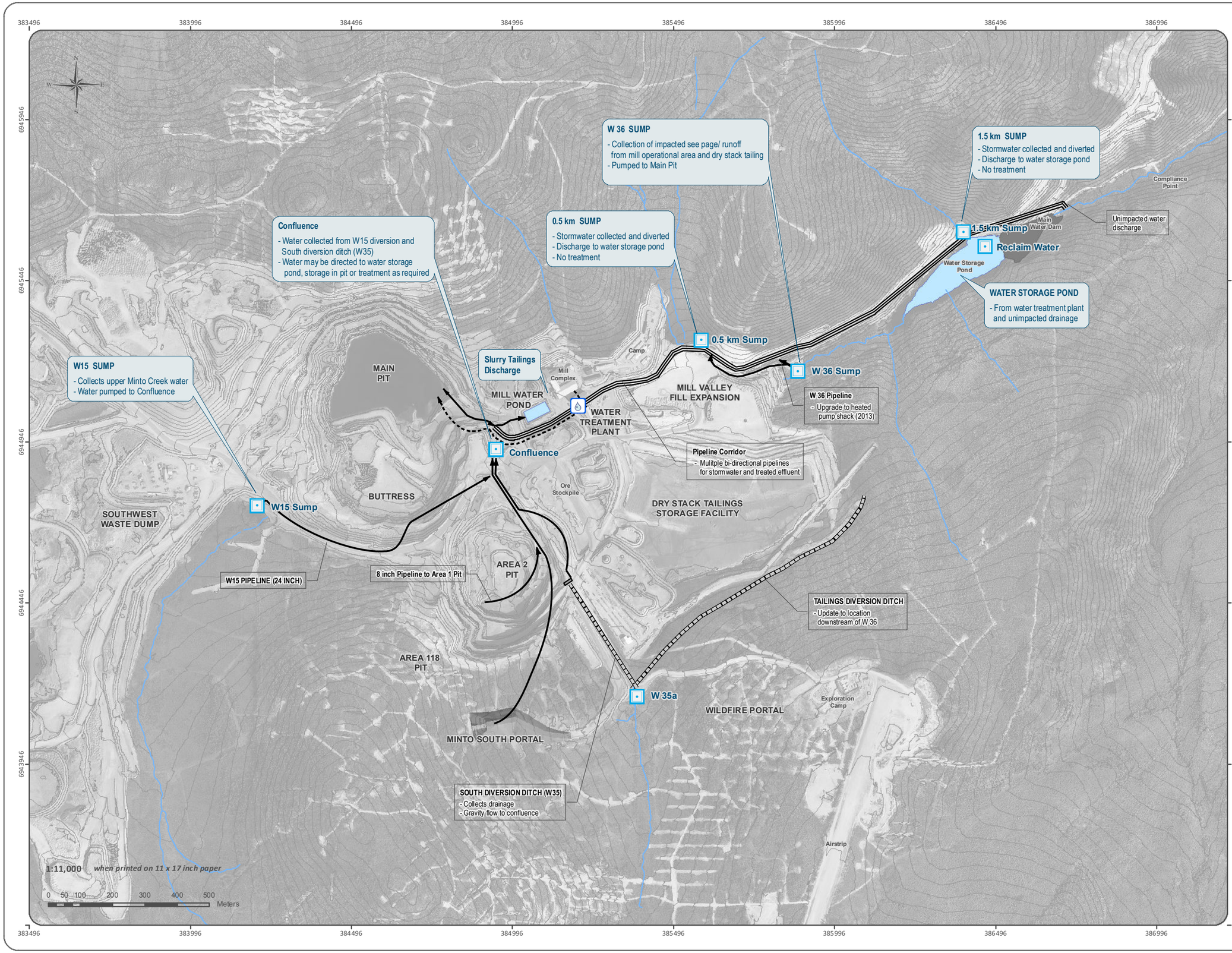
Minto Explorations Ltd. 2013. 2012 Annual Water Licence and Quartz Mining License Report.

MINTO MINE

ANNUAL REPORT

FIGURE 1
OPERATIONAL WATER MANAGEMENT

MARCH 2013



Collection Point

Water Treatment Plant

Pipe Alignment

Piping Corridor

Tailings Slury Discharge

Diversion Ditch

Minto Explorations Ltd.
A SUBSIDIARY OF CAPSTONE MINING LTD.

ACCESS

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14th 2012.
Site contours derived from 2012 aerial imagery obtained from Challenger Geomatics.

Hydrology data provided by Minto Explorations Ltd, May 2009.

Datum: NAD 83 Projection: UTM Zone 8N

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Reports\Annual_Report\2011-2012\Operational Water Management_20130327.mxd
(Last edited by: mducharme;28/03/2013/09:50 AM)

Appendix B: Monthly Water Quality Modelling Predictions

Table 1 Area 2 Pit Monthly Summary - BE WQ Cover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Best Estimate Average Operations																								
Jan	0.000068	0.59	0.48	0.0026	0.000093	0.00078	0.0024	0.037	0.46	2.1	0.000084	0.25	0.055	59	0.0029	6.6	0.083	0.00059	0.011	0.0067	160	4.2	0.00011	0.012
Feb	0.000070	0.60	0.48	0.0027	0.000096	0.00080	0.0025	0.038	0.47	2.2	0.000087	0.26	0.057	61	0.0030	6.5	0.083	0.00060	0.011	0.0070	160	4.4	0.00011	0.012
Mar	0.000070	0.59	0.52	0.0026	0.000095	0.00087	0.0025	0.039	0.48	2.2	0.000084	0.27	0.062	67	0.0031	7.2	0.092	0.00061	0.012	0.0076	170	4.8	0.00011	0.012
Apr	0.000067	0.56	0.54	0.0024	0.000091	0.00090	0.0025	0.039	0.47	2.2	0.000078	0.28	0.065	71	0.0031	7.3	0.093	0.00060	0.013	0.0080	180	5.0	0.00011	0.012
May	0.000064	0.53	0.53	0.0023	0.000087	0.00086	0.0024	0.037	0.46	2.1	0.000073	0.26	0.061	68	0.0030	7.3	0.092	0.00057	0.012	0.0076	170	4.7	0.00011	0.012
Jun	0.000063	0.53	0.53	0.0023	0.000086	0.00084	0.0024	0.036	0.46	2.0	0.000073	0.26	0.059	65	0.0030	7.3	0.092	0.00056	0.012	0.0073	170	4.5	0.00011	0.012
Jul	0.000065	0.55	0.53	0.0024	0.000090	0.00086	0.0025	0.037	0.49	2.1	0.000076	0.27	0.060	66	0.0031	7.2	0.092	0.00059	0.012	0.0075	170	4.6	0.00011	0.012
Aug	0.000067	0.58	0.53	0.0025	0.000092	0.00087	0.0025	0.038	0.50	2.1	0.000080	0.27	0.061	67	0.0031	7.2	0.091	0.00060	0.012	0.0075	170	4.7	0.00011	0.012
Sep	0.000069	0.60	0.54	0.0026	0.000094	0.00085	0.0025	0.038	0.49	2.2	0.000084	0.26	0.060	65	0.0031	7.4	0.094	0.00061	0.012	0.0073	170	4.6	0.00011	0.012
Oct	0.000070	0.61	0.54	0.0027	0.000096	0.00084	0.0025	0.039	0.49	2.2	0.000086	0.26	0.060	65	0.0031	7.4	0.094	0.00062	0.012	0.0073	170	4.6	0.00011	0.012
Nov	0.000072	0.63	0.54	0.0028	0.000098	0.00084	0.0026	0.039	0.50	2.2	0.000089	0.26	0.060	65	0.0032	7.3	0.093	0.00063	0.012	0.0073	170	4.6	0.00011	0.013
Dec	0.000075	0.65	0.53	0.0029	0.00010	0.00085	0.0026	0.040	0.50	2.3	0.000093	0.27	0.060	65	0.0032	7.3	0.092	0.00064	0.012	0.0073	170	4.7	0.00012	0.013
Best Estimate Max Operations																								
Jan	0.00013	1.2	0.64	0.0063	0.00017	0.0011	0.0029	0.044	0.69	2.8	0.00021	0.38	0.093	110	0.0036	8.8	0.11	0.00083	0.016	0.010	250	7.5	0.00014	0.014
Feb	0.00013	1.3	0.64	0.0067	0.00018	0.0012	0.0031	0.044	0.70	3.0	0.00022	0.39	0.093	110	0.0037	8.8	0.11	0.00087	0.016	0.010	250	7.6	0.00014	0.014
Mar	0.00014	1.3	0.64	0.0067	0.00018	0.0012	0.0031	0.046	0.71	3.0	0.00022	0.40	0.093	110	0.0038	8.8	0.11	0.00088	0.016	0.010	260	7.6	0.00014	0.015
Apr	0.000090	0.87	0.64	0.0038	0.00012	0.0012	0.0030	0.046	0.71	2.9	0.00012	0.41	0.093	110	0.0038	8.8	0.11	0.00071	0.016	0.010	260	7.6	0.00015	0.015
May	0.000084	0.80	0.64	0.0035	0.00011	0.0012	0.0030	0.045	0.70	2.7	0.00011	0.41	0.091	100	0.0038	8.8	0.11	0.00069	0.016	0.010	250	7.4	0.00014	0.015
Jun	0.000076	0.75	0.64	0.0033	0.00010	0.0011	0.0028	0.042	0.68	2.5	0.00010	0.40	0.087	99	0.0036	8.8	0.11	0.00065	0.015	0.0098	240	7.1	0.00014	0.014
Jul	0.000080	0.80	0.64	0.0036	0.00011	0.0011	0.0028	0.043	0.68	2.5	0.00012	0.39	0.087	99	0.0036	8.8	0.11	0.00067	0.015	0.0098	240	7.1	0.00014	0.014
Aug	0.000084	0.84	0.64	0.0042	0.00011	0.0011	0.0029	0.043	0.68	2.5	0.00014	0.39	0.087	99	0.0036	8.8	0.11	0.00067	0.015	0.0098	240	7.2	0.00014	0.014
Sep	0.000094	0.93	0.64	0.0047	0.00012	0.0011	0.0028	0.043	0.68	2.5	0.00015	0.38	0.088	100	0.0036	8.8	0.11	0.00067	0.015	0.0099	240	7.3	0.00014	0.014
Oct	0.00010	0.99	0.64	0.0050	0.00013	0.0011	0.0028	0.043	0.68	2.5	0.00016	0.38	0.090	100	0.0036	8.8	0.11	0.00067	0.015	0.0100	250	7.4	0.00013	0.014
Nov	0.00011	1.1	0.64	0.0054	0.00014	0.0011	0.0028	0.043	0.68	2.6	0.00018	0.38	0.091	100	0.0035	8.8	0.11	0.00072	0.016	0.010	250	7.4	0.00014	0.014
Dec	0.00012	1.2	0.64	0.0059	0.00015	0.0011	0.0028	0.044	0.69	2.6	0.00019	0.38	0.092	100	0.0036	8.8	0.11	0.00077	0.016	0.010	250	7.5	0.00014	0.014
Best Estimate Average Postclosure																								
Jan	0.000046	0.40	0.084	0.0017	0.000070	0.00068	0.0019	0.027	0.72	0.90	0.000061	0.30	0.016	21	0.0025	1.2	0.015	0.00047	0.0040	0.0048	71	1.4	0.000098	0.0091
Feb	0.000046	0.40	0.083	0.0017	0.000070	0.00068	0.0019	0.027	0.72	0.90	0.000061	0.30	0.016	21	0.0025	1.1	0.014	0.00047	0.0041	0.0049	72	1.4	0.000098	0.0092
Mar	0.000046	0.40	0.082	0.0017	0.000071	0.00068	0.0019	0.027	0.72	0.90	0.000061	0.30	0.016	21	0.0025	1.1	0.014	0.00047	0.0041	0.0049	72	1.4	0.000098	0.0092
Apr	0.000047	0.40	0.085	0.0017	0.000071	0.00068	0.0019	0.027	0.72	0.91	0.000062	0.31	0.017	22	0.0025	1.2	0.015	0.00047	0.0041	0.0049	73	1.4	0.000098	0.0092
May	0.000047	0.39	0.083	0.0017	0.000071	0.00068	0.0019	0.027	0.72	0.89	0.000061	0.31	0.016	21	0.0025	1.1	0.014	0.00047	0.0040	0.0049	71	1.4	0.000098	0.0092
Jun	0.000046	0.39	0.082	0.0016	0.000070	0.00067	0.0019	0.026	0.71	0.87	0.000060	0.30	0.015	21	0.0025	1.1	0.014	0.00046	0.0039	0.0048	70	1.4	0.000097	0.0091
Jul	0.000046	0.39	0.081	0.0016	0.000070	0.00067	0.0019	0.026	0.71	0.87	0.000060	0.30	0.015	20	0.0025	1.1	0.014	0.00046	0.0038	0.0048	69	1.3	0.000097	0.0091
Aug	0.000045	0.39	0.079	0.0016	0.000069	0.00067	0.0019	0.026	0.72	0.86	0.000060	0.30	0.015	20	0.0025	1.1	0.014	0.00046	0.0038	0.0048	69	1.3	0.000097	0.0090
Sep	0.000045	0.39	0.078	0.0016	0.000069	0.00067	0.0019	0.026	0.72	0.86	0.000060	0.30	0.015	20	0.0025	1.1	0.013	0.00046	0.0038	0.0047	68	1.3	0.000097	0.0090
Oct	0.000045	0.39	0.077	0.0016	0.000069	0.00066	0.0019	0.026	0.72	0.86	0.000060	0.30	0.015	20	0.0025	1.0	0.013	0.00046	0.0037	0.0047	68	1.3	0.000097	0.0090
Nov	0.000045	0.39	0.075	0.0016	0.000069	0.00066	0.0019	0.026	0.72	0.86	0.000060	0.30	0.015	20	0.0025	1.0	0.013	0.00046	0.0037	0.0047	68	1.3	0.000097	0.0090
Dec	0.000045	0.39	0.074	0.0016	0.000069	0.00066	0.0019	0.026	0.72	0.86	0.000060	0.30	0.015	20	0.0025	1.0	0.013	0.00046	0.0037	0.0047	68	1.3	0.000097	0.0090
Best Estimate Max Postclosure																								
Jan	0.000048	0.40	0.13	0.0017	0.000073	0.00072	0.0020	0.028	0.73	1.0	0.000062	0.31	0.021	27	0.0026	1.8	0.022	0.00048	0.0050	0.0053	83	1.7	0.00010	0.0096
Feb	0.000048	0.40	0.13	0.0017	0.000074	0.00072	0.0020	0.028	0.73	1.0	0.000063	0.31	0.021	27	0.0026	1.7	0.022	0.00048	0.0050	0.0053	83	1.7	0.00010	0.0096
Mar	0.000049	0.40	0.12	0.0017	0.000074	0.00072	0.0020	0.028	0.73	1.0	0.000063	0.31	0.021	27	0.0026	1.7	0.022	0.00049	0.0050	0.0053	83	1.7	0.00010	0.0096
Apr	0.000049	0.40	0.12	0.0017	0.000074	0.00072	0.0020	0.028	0.73	1.0	0.000063	0.32	0.021	27	0.0026	1.7	0.021	0.00049	0.0050	0.0053	83	1.7	0.00010	0.0096
May	0.000049	0.40	0.12	0.0017	0.000074	0.00072	0.0020	0.028	0.73	1.0	0.000063	0.32	0.021	26	0.0026	1.6	0.021	0.00048	0.0050	0.0053	82	1.7	0.00010	0.0096
Jun	0.000048	0.39	0.12	0.0017	0.000073	0.00071	0.0020	0.028	0.72	0.97	0.000061	0.31	0.020	25	0.0026	1.6	0.020	0.00048	0.0047	0.0052	80	1.6	0.00010	0.0095
Jul	0.000047	0.40	0.12	0.0017	0.000072	0.00071	0.0020	0.028	0.73	0.97	0.000061	0.31	0.019	25	0.0026	1.6	0.020	0.00048	0.0047	0.0052	79	1.6	0.00010	0.0095
Aug	0.000047	0.40	0.11	0.0017	0.000072	0.00070	0.0020	0.027	0.73	0.96	0.000061	0.31	0.019	25	0.0026	1.6	0.020	0.00047	0.0046	0.0052	78	1.6	0.000100	0.0094
Sep	0.000047	0.40	0.11	0.0017	0.000072	0.00070	0.0019	0.027	0.73	0.95	0.000061	0.31	0.019	24	0.0025	1.5	0.019	0.00047	0.0046	0.0051	78	1.6	0.000100	0.0094
Oct	0.000047	0.40	0.11	0.0017	0.000072	0.00070	0.0019	0.027	0.73	0.95	0.000061	0.31	0.019	24	0.0025	1.5	0.019	0.00047	0.0046	0.0051	77	1.6	0.000100	0.0094
Nov	0.000047	0.40	0.11	0.0017	0.000072	0.00070	0.0019	0.027	0.73	0.95	0.000061	0.31	0.019	24	0.0025	1.5	0.019	0.00047	0.0045	0.0051	77	1.6	0.000100	0.0094
Dec	0.000047	0.40	0.11	0.0017	0.000072	0.00070	0.0019	0.027	0.73	0.95	0.000062	0.31	0.019	24	0.0025	1.5	0.018	0.00047	0.0045	0.0051	77	1.6	0.000100	0.0094

Table 2 Area 2 Pit Monthly Summary - WC WQ Cover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reasonable Worst Case Average Operations																								
Jan	0.00016	0.99	0.78	0.0060	0.00031	0.0011	0.0053	0.072	0.74	2.8	0.00018	0.55	0.082	64	0.0058	17	0.44	0.0028	0.020	0.0067	200	5.7	0.00014	0.027
Feb	0.00016	1.0	0.78	0.0062	0.00032	0.0011	0.0055	0.075	0.77	2.9	0.00019	0.57	0.085	67	0.0060	17	0.45	0.0029	0.020	0.0070	210	5.9	0.00014	0.028
Mar	0.00016	0.99	0.84	0.0058	0.00031	0.0012	0.0054	0.076	0.78	2.9	0.00019	0.59	0.089	73	0.0060	18	0.48	0.0027	0.022	0.0076	220	6.4	0.00014	0.027
Apr	0.00015	0.92	0.87	0.0053	0.00029	0.0012	0.0051	0.074	0.77	2.8	0.00018	0.60	0.090	78	0.0058	19	0.50	0.0025	0.023	0.0080	230	6.7	0.00014	0.026
May	0.00014	0.87	0.86	0.0050	0.00027	0.0012	0.0048	0.070	0.74	2.7	0.00017	0.57	0.085	74	0.0055	19	0.47	0.0023	0.022	0.0076	220	6.3	0.00013	0.024
Jun	0.00014	0.87	0.86	0.0050	0.00027	0.0011	0.0047	0.069	0.74	2.6	0.00017	0.56	0.082	71	0.0055	19	0.46	0.0023	0.021	0.0073	210	6.1	0.00013	0.024
Jul	0.00015	0.90	0.86	0.0052	0.00028	0.0012	0.0049	0.072	0.78	2.7	0.00018	0.58	0.085	72	0.0057	19	0.48	0.0024	0.021	0.0075	220	6.2	0.00014	0.025
Aug	0.00015	0.94	0.85	0.0054	0.00029	0.0012	0.0051	0.074	0.80	2.8	0.00018	0.59	0.086	73	0.0058	19	0.48	0.0025	0.022	0.0075	220	6.2	0.00014	0.026
Sep	0.00016	0.99	0.88	0.0058	0.00030	0.0011	0.0053	0.074	0.78	2.9	0.00018	0.56	0.087	71	0.0059	19	0.49	0.0027	0.021	0.0073	220	6.2	0.00014	0.027
Oct	0.00016	1.0	0.88	0.0060	0.00031	0.0011	0.0054	0.075	0.78	2.9	0.00019	0.57	0.088	70	0.0060	19	0.48	0.0028	0.021	0.0073	220	6.2	0.00014	0.027
Nov	0.00017	1.0	0.87	0.0062	0.00033	0.0011	0.0056	0.077	0.79	3.0	0.00019	0.57	0.089	71	0.0062	19	0.48	0.0029	0.021	0.0073	220	6.2	0.00015	0.028
Dec	0.00017	1.1	0.86	0.0066	0.00034	0.0012	0.0058	0.079	0.80	3.1	0.00020	0.58	0.091	70	0.0063	19	0.48	0.0031	0.022	0.0073	220	6.3	0.00015	0.029
Reasonable Worst Case Max Operations																								
Jan	0.00032	2.3	1.0	0.017	0.00077	0.0017	0.011	0.097	1.1	4.7	0.00029	0.90	0.11	110	0.0093	23	0.64	0.0083	0.029	0.010	300	9.5	0.00018	0.056
Feb	0.00034	2.5	1.0	0.018	0.00082	0.0017	0.012	0.10	1.2	5.0	0.00031	0.91	0.11	110	0.0098	23	0.64	0.0088	0.029	0.010	300	9.6	0.00019	0.059
Mar	0.00034	2.5	1.0	0.018	0.00083	0.0018	0.012	0.10	1.2	5.0	0.00031	0.93	0.12	110	0.0099	23	0.64	0.0088	0.030	0.010	300	9.6	0.00019	0.060
Apr	0.00020	1.4	1.0	0.0091	0.00043	0.0018	0.0071	0.087	1.2	3.9	0.00025	0.95	0.12	110	0.0073	23	0.64	0.0043	0.030	0.010	300	9.6	0.00017	0.036
May	0.00019	1.3	1.0	0.0086	0.00041	0.0018	0.0066	0.087	1.2	3.5	0.00025	0.95	0.11	110	0.0067	23	0.64	0.0041	0.029	0.010	290	9.4	0.00016	0.034
Jun	0.00017	1.3	1.0	0.0083	0.00038	0.0017	0.0061	0.084	1.1	3.1	0.00024	0.92	0.11	110	0.0063	23	0.64	0.0040	0.027	0.0098	280	9.0	0.00016	0.031
Jul	0.00018	1.3	1.0	0.0097	0.00044	0.0017	0.0065	0.084	1.1	3.2	0.00023	0.91	0.11	110	0.0064	23	0.64	0.0047	0.028	0.0098	280	9.0	0.00016	0.033
Aug	0.00021	1.5	1.0	0.011	0.00051	0.0017	0.0075	0.083	1.1	3.4	0.00023	0.90	0.11	100	0.0067	23	0.64	0.0054	0.028	0.0098	280	9.0	0.00016	0.037
Sep	0.00024	1.7	1.0	0.013	0.00057	0.0016	0.0083	0.081	1.1	3.5	0.00023	0.88	0.11	110	0.0069	23	0.64	0.0061	0.028	0.0099	280	9.1	0.00016	0.041
Oct	0.00025	1.8	1.0	0.013	0.00061	0.0016	0.0089	0.081	1.1	3.7	0.00023	0.88	0.11	110	0.0074	23	0.64	0.0065	0.028	0.0100	290	9.2	0.00016	0.044
Nov	0.00027	2.0	1.0	0.015	0.00066	0.0017	0.0097	0.083	1.1	4.0	0.00025	0.88	0.11	110	0.0080	23	0.64	0.0071	0.028	0.010	290	9.4	0.00016	0.048
Dec	0.00030	2.2	1.0	0.016	0.00072	0.0017	0.011	0.090	1.1	4.4	0.00027	0.89	0.11	110	0.0087	23	0.64	0.0077	0.028	0.010	290	9.4	0.00017	0.052
Reasonable Worst Case Average Postclosure																								
Jan	0.00013	0.64	0.14	0.0035	0.00021	0.0012	0.0038	0.054	1.1	1.2	0.00020	0.68	0.029	26	0.0043	3.0	0.084	0.0015	0.0079	0.0048	110	2.1	0.00011	0.019
Feb	0.00013	0.64	0.13	0.0035	0.00021	0.0012	0.0038	0.054	1.1	1.2	0.00020	0.68	0.029	26	0.0043	2.9	0.083	0.0015	0.0079	0.0049	110	2.1	0.00011	0.019
Mar	0.00013	0.64	0.13	0.0035	0.00021	0.0012	0.0038	0.054	1.1	1.2	0.00020	0.68	0.029	26	0.0043	2.9	0.082	0.0015	0.0080	0.0049	110	2.1	0.00011	0.019
Apr	0.00013	0.64	0.14	0.0035	0.00021	0.0012	0.0038	0.055	1.1	1.3	0.00020	0.69	0.030	27	0.0043	3.0	0.084	0.0016	0.0081	0.0049	110	2.2	0.00011	0.019
May	0.00013	0.64	0.14	0.0035	0.00021	0.0012	0.0038	0.055	1.1	1.2	0.00020	0.70	0.029	26	0.0043	3.0	0.083	0.0015	0.0079	0.0049	110	2.1	0.00011	0.019
Jun	0.00013	0.63	0.13	0.0034	0.00021	0.0012	0.0038	0.054	1.1	1.2	0.00020	0.69	0.028	26	0.0042	2.9	0.082	0.0015	0.0077	0.0048	110	2.1	0.00011	0.019
Jul	0.00013	0.63	0.13	0.0034	0.00021	0.0012	0.0038	0.054	1.1	1.2	0.00020	0.68	0.028	25	0.0042	2.9	0.080	0.0015	0.0076	0.0048	110	2.0	0.00011	0.019
Aug	0.00013	0.63	0.13	0.0034	0.00020	0.0011	0.0037	0.053	1.1	1.2	0.00020	0.68	0.027	25	0.0042	2.8	0.079	0.0015	0.0075	0.0048	110	2.0	0.00011	0.019
Sep	0.00013	0.63	0.13	0.0034	0.00020	0.0011	0.0037	0.053	1.1	1.2	0.00020	0.68	0.027	25	0.0042	2.8	0.078	0.0015	0.0074	0.0047	110	2.0	0.00011	0.018
Oct	0.00013	0.63	0.12	0.0034	0.00020	0.0011	0.0037	0.053	1.1	1.2	0.00020	0.67	0.027	25	0.0042	2.7	0.076	0.0015	0.0074	0.0047	110	2.0	0.00011	0.018
Nov	0.00013	0.63	0.12	0.0034	0.00020	0.0011	0.0037	0.053	1.1	1.2	0.00020	0.67	0.027	25	0.0042	2.7	0.075	0.0015	0.0074	0.0047	110	2.0	0.00011	0.018
Dec	0.00013	0.63	0.12	0.0034	0.00021	0.0011	0.0037	0.053	1.1	1.2	0.00020	0.67	0.027	25	0.0042	2.6	0.074	0.0015	0.0074	0.0047	110	2.0	0.00011	0.019
Reasonable Worst Case Max Postclosure																								
Jan	0.00013	0.65	0.21	0.0036	0.00022	0.0012	0.0039	0.057	1.1	1.4	0.00020	0.71	0.035	32	0.0045	4.5	0.13	0.0016	0.0097	0.0053	130	2.6	0.00012	0.020
Feb	0.00013	0.65	0.20	0.0036	0.00022	0.0012	0.0039	0.057	1.1	1.4	0.00020	0.71	0.035	32	0.0045	4.5	0.13	0.0016	0.0097	0.0053	130	2.6	0.00012	0.020
Mar	0.00013	0.66	0.20	0.0036	0.00022	0.0012	0.0039	0.058	1.1	1.4	0.00020	0.71	0.035	32	0.0045	4.4	0.12	0.0016	0.0097	0.0053	130	2.6	0.00012	0.020
Apr	0.00014	0.66	0.20	0.0036	0.00022	0.0012	0.0040	0.058	1.1	1.4	0.00021	0.72	0.035	32	0.0045	4.3	0.12	0.0016	0.0097	0.0053	130	2.6	0.00012	0.020
May	0.00014	0.65	0.19	0.0036	0.00022	0.0012	0.0040	0.058	1.1	1.4	0.00021	0.72	0.034	32	0.0045	4.3	0.12	0.0016	0.0096	0.0053	130	2.5	0.00012	0.020
Jun	0.00013	0.64	0.19	0.0035	0.00021	0.0012	0.0039	0.057	1.1	1.3	0.00020	0.71	0.033	30	0.0044	4.2	0.12	0.0015	0.0092	0.0052	120	2.4	0.00012	0.019
Jul	0.00013	0.64	0.19	0.0035	0.00021	0.0012	0.0039	0.056	1.1	1.3	0.00020	0.70	0.033	30	0.0044	4.1	0.12	0.0015	0.0091	0.0052	120	2.4	0.00011	0.019
Aug	0.00013	0.64	0.19	0.0035	0.00021	0.0012	0.0038	0.056	1.1	1.3	0.00020	0.70	0.032	30	0.0044	4.0	0.11	0.0015	0.0090	0.0052	120	2.4	0.00011	0.019
Sep	0.00013	0.64	0.18	0.0035	0.00021	0.0012	0.0038	0.056	1.1	1.3	0.00020	0.70	0.032	30	0.0044	4.0	0.11	0.0015	0.0089	0.0051	120	2.4	0.00011	0.019
Oct	0.00013	0.64	0.18	0.0035	0.00021	0.0012	0.0038	0.056	1.1	1.3	0.00020	0.69	0.032	29	0.0044	3.9	0.11	0.0015	0.0089	0.0051	120	2.3	0.00011	0.019
Nov	0.00013	0.64	0.18	0.0035	0.00021	0.0012	0.0038	0.056	1.1	1.3	0.00020	0.69	0.032	29	0.0044	3.8	0.11	0.0015	0.0088	0.0051	120	2.3	0.00011	0.019
Dec	0.00013	0.64	0.17	0.0035	0.00021	0.0012	0.0038	0.056	1.1	1.3	0.00020	0.69	0.032	29	0.0044	3.8	0.11	0.0015	0.0088	0.0051	120	2.3	0.00011	0.019

Table 3 Area 2 Pit Monthly Summary - BE WQ NoCover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Best Estimate Average Operations																								
Jan	0.000068	0.59	0.48	0.0026	0.000093	0.00078	0.0024	0.037	0.46	2.1	0.000084	0.25	0.055	59	0.0029	6.6	0.083	0.00059	0.011	0.0067	160	4.2	0.00011	0.012
Feb	0.000070	0.60	0.48	0.0027	0.000096	0.00080	0.0025	0.038	0.47	2.2	0.000087	0.26	0.057	61	0.0030	6.5	0.083	0.00060	0.011	0.0070	160	4.4	0.00011	0.012
Mar	0.000070	0.59	0.52	0.0026	0.000095	0.00087	0.0025	0.039	0.48	2.2	0.000084	0.27	0.062	67	0.0031	7.2	0.092	0.00061	0.012	0.0076	170	4.8	0.00011	0.012
Apr	0.000067	0.56	0.54	0.0024	0.000091	0.00090	0.0025	0.039	0.47	2.2	0.000078	0.28	0.065	71	0.0031	7.3	0.093	0.00060	0.013	0.0080	180	5.0	0.00011	0.012
May	0.000064	0.53	0.53	0.0023	0.000087	0.00086	0.0024	0.037	0.46	2.1	0.000073	0.26	0.061	68	0.0030	7.3	0.092	0.00057	0.012	0.0076	170	4.7	0.00011	0.012
Jun	0.000063	0.53	0.53	0.0023	0.000086	0.00084	0.0024	0.036	0.46	2.0	0.000073	0.26	0.059	65	0.0030	7.3	0.092	0.00056	0.012	0.0073	170	4.5	0.00011	0.012
Jul	0.000065	0.55	0.53	0.0024	0.000090	0.00086	0.0025	0.037	0.49	2.1	0.000076	0.27	0.060	66	0.0031	7.2	0.092	0.00059	0.012	0.0075	170	4.6	0.00011	0.012
Aug	0.000067	0.58	0.53	0.0025	0.000092	0.00087	0.0025	0.038	0.50	2.1	0.000080	0.27	0.061	67	0.0031	7.2	0.091	0.00060	0.012	0.0075	170	4.7	0.00011	0.012
Sep	0.000069	0.60	0.54	0.0026	0.000094	0.00085	0.0025	0.038	0.49	2.2	0.000084	0.26	0.060	65	0.0031	7.4	0.094	0.00061	0.012	0.0073	170	4.6	0.00011	0.012
Oct	0.000070	0.61	0.54	0.0027	0.000096	0.00084	0.0025	0.039	0.49	2.2	0.000086	0.26	0.060	65	0.0031	7.4	0.094	0.00062	0.012	0.0073	170	4.6	0.00011	0.012
Nov	0.000072	0.63	0.54	0.0028	0.000098	0.00084	0.0026	0.039	0.50	2.2	0.000089	0.26	0.060	65	0.0032	7.3	0.093	0.00063	0.012	0.0073	170	4.6	0.00011	0.013
Dec	0.000075	0.65	0.53	0.0029	0.00010	0.00085	0.0026	0.040	0.50	2.3	0.000093	0.27	0.060	65	0.0032	7.3	0.092	0.00064	0.012	0.0073	170	4.7	0.00012	0.013
Best Estimate Max Operations																								
Jan	0.00013	1.2	0.64	0.0063	0.00017	0.0011	0.0029	0.044	0.69	2.8	0.00021	0.38	0.093	110	0.0036	8.8	0.11	0.00083	0.016	0.010	250	7.5	0.00014	0.014
Feb	0.00013	1.3	0.64	0.0067	0.00018	0.0012	0.0031	0.044	0.70	3.0	0.00022	0.39	0.093	110	0.0037	8.8	0.11	0.00087	0.016	0.010	250	7.6	0.00014	0.014
Mar	0.00014	1.3	0.64	0.0067	0.00018	0.0012	0.0031	0.046	0.71	3.0	0.00022	0.40	0.093	110	0.0038	8.8	0.11	0.00088	0.016	0.010	260	7.6	0.00014	0.015
Apr	0.000090	0.87	0.64	0.0038	0.00012	0.0012	0.0030	0.046	0.71	2.9	0.00012	0.41	0.093	110	0.0038	8.8	0.11	0.00071	0.016	0.010	260	7.6	0.00015	0.015
May	0.000084	0.80	0.64	0.0035	0.00011	0.0012	0.0030	0.045	0.70	2.7	0.00011	0.41	0.091	100	0.0038	8.8	0.11	0.00069	0.016	0.010	250	7.4	0.00014	0.015
Jun	0.000076	0.75	0.64	0.0033	0.00010	0.0011	0.0028	0.042	0.68	2.5	0.00010	0.40	0.087	99	0.0036	8.8	0.11	0.00065	0.015	0.0098	240	7.1	0.00014	0.014
Jul	0.000080	0.80	0.64	0.0036	0.00011	0.0011	0.0028	0.043	0.68	2.5	0.00012	0.39	0.087	99	0.0036	8.8	0.11	0.00067	0.015	0.0098	240	7.1	0.00014	0.014
Aug	0.000084	0.84	0.64	0.0042	0.00011	0.0011	0.0029	0.043	0.68	2.5	0.00014	0.39	0.087	99	0.0036	8.8	0.11	0.00067	0.015	0.0098	240	7.2	0.00014	0.014
Sep	0.000094	0.93	0.64	0.0047	0.00012	0.0011	0.0028	0.043	0.68	2.5	0.00015	0.38	0.088	100	0.0036	8.8	0.11	0.00067	0.015	0.0099	240	7.3	0.00014	0.014
Oct	0.00010	0.99	0.64	0.0050	0.00013	0.0011	0.0028	0.043	0.68	2.5	0.00016	0.38	0.090	100	0.0036	8.8	0.11	0.00067	0.015	0.0100	250	7.4	0.00013	0.014
Nov	0.00011	1.1	0.64	0.0054	0.00014	0.0011	0.0028	0.043	0.68	2.6	0.00018	0.38	0.091	100	0.0035	8.8	0.11	0.00072	0.016	0.010	250	7.4	0.00014	0.014
Dec	0.00012	1.2	0.64	0.0059	0.00015	0.0011	0.0028	0.044	0.69	2.6	0.00019	0.38	0.092	100	0.0036	8.8	0.11	0.00077	0.016	0.010	250	7.5	0.00014	0.014
Best Estimate Average Postclosure																								
Jan	0.000050	0.38	0.084	0.0018	0.000076	0.00079	0.0021	0.031	0.78	0.92	0.000064	0.39	0.017	23	0.0026	1.2	0.015	0.00050	0.0043	0.0061	78	1.5	0.00011	0.010
Feb	0.000050	0.39	0.083	0.0018	0.000076	0.00079	0.0021	0.031	0.78	0.92	0.000065	0.39	0.017	23	0.0026	1.1	0.014	0.00050	0.0043	0.0061	78	1.5	0.00011	0.010
Mar	0.000050	0.39	0.082	0.0018	0.000076	0.00079	0.0021	0.031	0.79	0.92	0.000065	0.39	0.017	23	0.0026	1.1	0.014	0.00050	0.0043	0.0061	78	1.5	0.00011	0.010
Apr	0.000051	0.39	0.085	0.0018	0.000077	0.00080	0.0021	0.032	0.79	0.93	0.000065	0.40	0.017	23	0.0026	1.2	0.015	0.00050	0.0044	0.0062	79	1.5	0.00011	0.010
May	0.000051	0.38	0.083	0.0018	0.000077	0.00080	0.0021	0.032	0.79	0.91	0.000065	0.40	0.017	23	0.0026	1.1	0.014	0.00050	0.0043	0.0062	78	1.5	0.00011	0.010
Jun	0.000050	0.38	0.082	0.0017	0.000076	0.00079	0.0021	0.031	0.79	0.89	0.000063	0.40	0.016	22	0.0026	1.1	0.014	0.00049	0.0041	0.0061	77	1.5	0.00011	0.010
Jul	0.000050	0.38	0.081	0.0017	0.000076	0.00078	0.0021	0.031	0.79	0.89	0.000063	0.39	0.016	22	0.0026	1.1	0.014	0.00049	0.0041	0.0061	76	1.4	0.00011	0.010
Aug	0.000049	0.38	0.079	0.0017	0.000075	0.00078	0.0021	0.031	0.79	0.88	0.000064	0.39	0.016	22	0.0026	1.1	0.014	0.00049	0.0041	0.0060	76	1.4	0.00010	0.010
Sep	0.000049	0.38	0.078	0.0017	0.000075	0.00078	0.0021	0.031	0.79	0.88	0.000064	0.39	0.015	22	0.0026	1.1	0.013	0.00049	0.0040	0.0060	75	1.4	0.00010	0.010
Oct	0.000049	0.38	0.077	0.0017	0.000075	0.00078	0.0021	0.031	0.79	0.87	0.000064	0.39	0.015	21	0.0026	1.0	0.013	0.00049	0.0040	0.0060	75	1.4	0.00010	0.010
Nov	0.000049	0.38	0.075	0.0017	0.000075	0.00078	0.0021	0.031	0.79	0.88	0.000064	0.39	0.015	21	0.0026	1.0	0.013	0.00049	0.0040	0.0060	75	1.4	0.00010	0.010
Dec	0.000050	0.38	0.074	0.0017	0.000075	0.00078	0.0021	0.031	0.79	0.88	0.000064	0.39	0.015	21	0.0026	1.0	0.013	0.00049	0.0040	0.0060	75	1.4	0.00010	0.010
Best Estimate Max Postclosure																								
Jan	0.000052	0.39	0.13	0.0018	0.000078	0.00081	0.0022	0.032	0.81	1.0	0.000065	0.40	0.021	28	0.0027	1.8	0.022	0.00051	0.0053	0.0064	88	1.8	0.00011	0.010
Feb	0.000052	0.39	0.13	0.0018	0.000079	0.00081	0.0022	0.032	0.81	1.0	0.000065	0.40	0.021	28	0.0027	1.7	0.022	0.00051	0.0053	0.0064	88	1.8	0.00011	0.010
Mar	0.000052	0.39	0.12	0.0018	0.000079	0.00081	0.0022	0.032	0.82	1.0	0.000066	0.40	0.021	28	0.0027	1.7	0.022	0.00051	0.0053	0.0064	88	1.8	0.00011	0.010
Apr	0.000052	0.39	0.12	0.0018	0.000079	0.00082	0.0022	0.032	0.82	1.0	0.000066	0.41	0.021	28	0.0027	1.7	0.021	0.00051	0.0053	0.0065	88	1.8	0.00011	0.011
May	0.000052	0.39	0.12	0.0018	0.000079	0.00082	0.0022	0.032	0.82	1.0	0.000066	0.41	0.021	28	0.0027	1.6	0.021	0.00051	0.0052	0.0065	88	1.8	0.00011	0.011
Jun	0.000051	0.38	0.12	0.0018	0.000078	0.00081	0.0021	0.032	0.81	0.99	0.000064	0.40	0.020	27	0.0027	1.6	0.020	0.00051	0.0050	0.0064	86	1.7	0.00011	0.010
Jul	0.000051	0.39	0.12	0.0018	0.000078	0.00081	0.0021	0.032	0.81	0.98	0.000064	0.40	0.020	26	0.0027	1.6	0.020	0.00051	0.0049	0.0064	85	1.7	0.00011	0.010
Aug	0.000051	0.39	0.11	0.0018	0.000077	0.00081	0.0021	0.032	0.82	0.98	0.000064	0.40	0.020	26	0.0027	1.6	0.020	0.00050	0.0049	0.0063	84	1.7	0.00011	0.010
Sep	0.000051	0.39	0.11	0.0018	0.000077	0.00080	0.0021	0.032	0.82	0.97	0.000064	0.40	0.019	26	0.0027	1.5	0.019	0.00050	0.0048	0.0063	84	1.7	0.00011	0.010
Oct	0.000051	0.39	0.11	0.0018	0.000077	0.00080	0.0021	0.032	0.81	0.97	0.000064	0.40	0.019	26	0.0027	1.5	0.019	0.00050	0.0048	0.0063	83	1.7	0.00011	0.010
Nov	0.000051	0.39	0.11	0.0018	0.000077	0.00080	0.0021	0.032	0.81	0.97	0.000064	0.40	0.019	25	0.0027	1.5	0.019	0.00050	0.0048	0.0062	83	1.7	0.00011	0.010
Dec	0.000051	0.39	0.11	0.0018	0.000077	0.00080	0.0021	0.032	0.81	0.97	0.000065	0.40	0.019	25	0.0027	1.5	0.018	0.00050	0.0048	0.0062	83	1.7	0.00011	0.010

Table 4 Area 2 Pit WC Monthly Summary - WQ NoCover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reasonable Worst Case Average Operations																								
Jan	0.00016	0.99	0.78	0.0060	0.00031	0.0011	0.0053	0.072	0.74	2.8	0.00018	0.55	0.082	64	0.0058	17	0.44	0.0028	0.020	0.0067	200	5.7	0.00014	0.027
Feb	0.00016	1.0	0.78	0.0062	0.00032	0.0011	0.0055	0.075	0.77	2.9	0.00019	0.57	0.085	67	0.0060	17	0.45	0.0029	0.020	0.0070	210	5.9	0.00014	0.028
Mar	0.00016	0.99	0.84	0.0058	0.00031	0.0012	0.0054	0.076	0.78	2.9	0.00019	0.59	0.089	73	0.0060	18	0.48	0.0027	0.022	0.0076	220	6.4	0.00014	0.027
Apr	0.00015	0.92	0.87	0.0053	0.00029	0.0012	0.0051	0.074	0.77	2.8	0.00018	0.60	0.090	78	0.0058	19	0.50	0.0025	0.023	0.0080	230	6.7	0.00014	0.026
May	0.00014	0.87	0.86	0.0050	0.00027	0.0012	0.0048	0.070	0.74	2.7	0.00017	0.57	0.085	74	0.0055	19	0.47	0.0023	0.022	0.0076	220	6.3	0.00013	0.024
Jun	0.00014	0.87	0.86	0.0050	0.00027	0.0011	0.0047	0.069	0.74	2.6	0.00017	0.56	0.082	71	0.0055	19	0.46	0.0023	0.021	0.0073	210	6.1	0.00013	0.024
Jul	0.00015	0.90	0.86	0.0052	0.00028	0.0012	0.0049	0.072	0.78	2.7	0.00018	0.58	0.085	72	0.0057	19	0.48	0.0024	0.021	0.0075	220	6.2	0.00014	0.025
Aug	0.00015	0.94	0.85	0.0054	0.00029	0.0012	0.0051	0.074	0.80	2.8	0.00018	0.59	0.086	73	0.0058	19	0.48	0.0025	0.022	0.0075	220	6.2	0.00014	0.026
Sep	0.00016	0.99	0.88	0.0058	0.00030	0.0011	0.0053	0.074	0.78	2.9	0.00018	0.56	0.087	71	0.0059	19	0.49	0.0027	0.021	0.0073	220	6.2	0.00014	0.027
Oct	0.00016	1.0	0.88	0.0060	0.00031	0.0011	0.0054	0.075	0.78	2.9	0.00019	0.57	0.088	70	0.0060	19	0.48	0.0028	0.021	0.0073	220	6.2	0.00014	0.027
Nov	0.00017	1.0	0.87	0.0062	0.00033	0.0011	0.0056	0.077	0.79	3.0	0.00019	0.57	0.089	71	0.0062	19	0.48	0.0029	0.021	0.0073	220	6.2	0.00015	0.028
Dec	0.00017	1.1	0.86	0.0066	0.00034	0.0012	0.0058	0.079	0.80	3.1	0.00020	0.58	0.091	70	0.0063	19	0.48	0.0031	0.022	0.0073	220	6.3	0.00015	0.029
Reasonable Worst Case Max Operations																								
Jan	0.00032	2.3	1.0	0.017	0.00077	0.0017	0.011	0.097	1.1	4.7	0.00029	0.90	0.11	110	0.0093	23	0.64	0.0083	0.029	0.010	300	9.5	0.00018	0.056
Feb	0.00034	2.5	1.0	0.018	0.00082	0.0017	0.012	0.10	1.2	5.0	0.00031	0.91	0.11	110	0.0098	23	0.64	0.0088	0.029	0.010	300	9.6	0.00019	0.059
Mar	0.00034	2.5	1.0	0.018	0.00083	0.0018	0.012	0.10	1.2	5.0	0.00031	0.93	0.12	110	0.0099	23	0.64	0.0088	0.030	0.010	300	9.6	0.00019	0.060
Apr	0.00020	1.4	1.0	0.0091	0.00043	0.0018	0.0071	0.087	1.2	3.9	0.00025	0.95	0.12	110	0.0073	23	0.64	0.0043	0.030	0.010	300	9.6	0.00017	0.036
May	0.00019	1.3	1.0	0.0086	0.00041	0.0018	0.0066	0.087	1.2	3.5	0.00025	0.95	0.11	110	0.0067	23	0.64	0.0041	0.029	0.010	290	9.4	0.00016	0.034
Jun	0.00017	1.3	1.0	0.0083	0.00038	0.0017	0.0061	0.084	1.1	3.1	0.00024	0.92	0.11	110	0.0063	23	0.64	0.0040	0.027	0.0098	280	9.0	0.00016	0.031
Jul	0.00018	1.3	1.0	0.0097	0.00044	0.0017	0.0065	0.084	1.1	3.2	0.00023	0.91	0.11	110	0.0064	23	0.64	0.0047	0.028	0.0098	280	9.0	0.00016	0.033
Aug	0.00021	1.5	1.0	0.011	0.00051	0.0017	0.0075	0.083	1.1	3.4	0.00023	0.90	0.11	100	0.0067	23	0.64	0.0054	0.028	0.0098	280	9.0	0.00016	0.037
Sep	0.00024	1.7	1.0	0.013	0.00057	0.0016	0.0083	0.081	1.1	3.5	0.00023	0.88	0.11	110	0.0069	23	0.64	0.0061	0.028	0.0099	280	9.1	0.00016	0.041
Oct	0.00025	1.8	1.0	0.013	0.00061	0.0016	0.0089	0.081	1.1	3.7	0.00023	0.88	0.11	110	0.0074	23	0.64	0.0065	0.028	0.0100	290	9.2	0.00016	0.044
Nov	0.00027	2.0	1.0	0.015	0.00066	0.0017	0.0097	0.083	1.1	4.0	0.00025	0.88	0.11	110	0.0080	23	0.64	0.0071	0.028	0.010	290	9.4	0.00016	0.048
Dec	0.00030	2.2	1.0	0.016	0.00072	0.0017	0.011	0.090	1.1	4.4	0.00027	0.89	0.11	110	0.0087	23	0.64	0.0077	0.028	0.010	290	9.4	0.00017	0.052
Reasonable Worst Case Average Postclosure																								
Jan	0.00015	0.66	0.14	0.0036	0.00023	0.0014	0.0042	0.065	1.3	1.3	0.00025	0.89	0.030	29	0.0047	3.0	0.084	0.0016	0.0087	0.0061	130	2.3	0.00012	0.021
Feb	0.00015	0.66	0.13	0.0037	0.00023	0.0014	0.0042	0.065	1.3	1.3	0.00025	0.90	0.030	29	0.0047	2.9	0.083	0.0016	0.0088	0.0061	130	2.3	0.00012	0.021
Mar	0.00015	0.66	0.13	0.0037	0.00023	0.0014	0.0043	0.065	1.3	1.3	0.00025	0.90	0.030	29	0.0047	2.9	0.082	0.0016	0.0088	0.0061	130	2.3	0.00012	0.021
Apr	0.00016	0.66	0.14	0.0037	0.00024	0.0015	0.0043	0.066	1.3	1.3	0.00025	0.91	0.031	30	0.0047	3.0	0.084	0.0016	0.0089	0.0062	130	2.4	0.00012	0.021
May	0.00016	0.66	0.14	0.0037	0.00024	0.0015	0.0043	0.066	1.3	1.3	0.00025	0.92	0.030	29	0.0047	3.0	0.083	0.0016	0.0087	0.0062	130	2.3	0.00012	0.021
Jun	0.00015	0.65	0.13	0.0036	0.00023	0.0015	0.0042	0.065	1.3	1.2	0.00025	0.91	0.029	29	0.0046	2.9	0.082	0.0015	0.0085	0.0061	130	2.3	0.00012	0.021
Jul	0.00015	0.65	0.13	0.0036	0.00023	0.0014	0.0042	0.065	1.3	1.2	0.00025	0.90	0.029	28	0.0046	2.9	0.080	0.0015	0.0084	0.0061	130	2.3	0.00012	0.021
Aug	0.00015	0.65	0.13	0.0036	0.00023	0.0014	0.0042	0.064	1.3	1.2	0.00025	0.90	0.028	28	0.0046	2.8	0.079	0.0015	0.0083	0.0060	130	2.2	0.00012	0.021
Sep	0.00015	0.65	0.13	0.0036	0.00023	0.0014	0.0042	0.064	1.3	1.2	0.00025	0.90	0.028	28	0.0046	2.8	0.078	0.0015	0.0082	0.0060	130	2.2	0.00012	0.021
Oct	0.00015	0.65	0.12	0.0036	0.00023	0.0014	0.0042	0.064	1.3	1.2	0.00025	0.90	0.028	28	0.0046	2.7	0.076	0.0015	0.0082	0.0060	130	2.2	0.00012	0.021
Nov	0.00015	0.65	0.12	0.0036	0.00023	0.0014	0.0042	0.064	1.3	1.2	0.00025	0.90	0.028	28	0.0046	2.7	0.075	0.0015	0.0082	0.0060	130	2.2	0.00012	0.021
Dec	0.00015	0.65	0.12	0.0036	0.00023	0.0014	0.0042	0.064	1.3	1.2	0.00025	0.90	0.028	28	0.0046	2.6	0.074	0.0015	0.0082	0.0060	130	2.2	0.00012	0.021
Reasonable Worst Case Max Postclosure																								
Jan	0.00015	0.67	0.21	0.0037	0.00024	0.0015	0.0043	0.067	1.3	1.4	0.00025	0.91	0.036	35	0.0048	4.5	0.13	0.0016	0.010	0.0064	140	2.7	0.00012	0.021
Feb	0.00015	0.67	0.20	0.0037	0.00024	0.0015	0.0043	0.067	1.3	1.4	0.00025	0.91	0.036	35	0.0048	4.5	0.13	0.0016	0.010	0.0064	140	2.7	0.00012	0.022
Mar	0.00016	0.67	0.20	0.0038	0.00024	0.0015	0.0043	0.067	1.3	1.4	0.00026	0.91	0.036	35	0.0048	4.4	0.12	0.0016	0.010	0.0064	140	2.8	0.00012	0.022
Apr	0.00016	0.67	0.20	0.0038	0.00024	0.0015	0.0044	0.068	1.3	1.4	0.00026	0.93	0.036	35	0.0048	4.3	0.12	0.0016	0.010	0.0065	140	2.7	0.00012	0.022
May	0.00016	0.67	0.19	0.0038	0.00024	0.0015	0.0044	0.068	1.4	1.4	0.00026	0.93	0.035	34	0.0048	4.3	0.12	0.0016	0.010	0.0065	140	2.7	0.00012	0.022
Jun	0.00016	0.66	0.19	0.0037	0.00024	0.0015	0.0043	0.067	1.3	1.3	0.00026	0.92	0.034	33	0.0048	4.2	0.12	0.0016	0.0099	0.0064	140	2.6	0.00012	0.021
Jul	0.00015	0.66	0.19	0.0037	0.00023	0.0015	0.0043	0.066	1.3	1.3	0.00026	0.91	0.033	33	0.0048	4.1	0.12	0.0016	0.0099	0.0064	140	2.6	0.00012	0.021
Aug	0.00015	0.66	0.19	0.0036	0.00023	0.0015	0.0043	0.066	1.3	1.3	0.00025	0.91	0.033	33	0.0047	4.0	0.11	0.0016	0.0098	0.0063	140	2.6	0.00012	0.021
Sep	0.00015	0.66	0.18	0.0036	0.00023	0.0015	0.0043	0.066	1.3	1.3	0.00025	0.91	0.033	32	0.0047	4.0	0.11	0.0016	0.0097	0.0063	140	2.6	0.00012	0.021
Oct	0.00015	0.66	0.18	0.0036	0.00023	0.0015	0.0042	0.066	1.3	1.3	0.00025	0.90	0.033	32	0.0047	3.9	0.11	0.0016	0.0096	0.0063	140	2.5	0.00012	0.021
Nov	0.00015	0.66	0.18	0.0037	0.00023	0.0014	0.0043	0.066	1.3	1.3	0.00025	0.90	0.033	32	0.0047	3.8	0.11	0.0016	0.0096	0.0062	140	2.5	0.00012	0.021
Dec	0.00015	0.66	0.17	0.0037	0.00023	0.0014	0.0043	0.066	1.3	1.3	0.00025	0.90	0.033	32	0.0047	3.8	0.11	0.0016	0.0096	0.0062	140	2.5	0.00012	0.021

Table 5 WSP Monthly Summary - BE WQ Cover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Best Estimate Average Operations																								
Jan	0.000094	0.63	0.61	0.00092	0.000081	0.00084	0.0018	0.026	1.3	0.26	0.000040	0.34	0.0026	10	0.0028	8.3	0.11	0.00052	0.0011	0.0042	37	0.52	0.000086	0.012
Feb	0.000095	0.64	0.61	0.00096	0.000083	0.00088	0.0019	0.027	1.4	0.27	0.000041	0.36	0.0028	11	0.0029	8.3	0.10	0.00053	0.0011	0.0045	39	0.55	0.000089	0.013
Mar	0.000097	0.64	0.60	0.00099	0.000086	0.00092	0.0019	0.028	1.4	0.28	0.000042	0.39	0.0029	11	0.0030	8.2	0.10	0.00055	0.0012	0.0049	41	0.58	0.000092	0.013
Apr	0.000098	0.63	0.60	0.0010	0.000088	0.00094	0.0020	0.030	1.4	0.28	0.000042	0.41	0.0030	12	0.0029	8.2	0.10	0.00055	0.0013	0.0053	43	0.60	0.000092	0.013
May	0.000098	0.64	0.60	0.00093	0.000086	0.00085	0.0018	0.027	1.3	0.25	0.000037	0.34	0.0027	10	0.0029	8.2	0.10	0.00052	0.0011	0.0044	40	0.53	0.000085	0.013
Jun	0.00010	0.69	0.60	0.00091	0.000087	0.00083	0.0018	0.026	1.3	0.24	0.000035	0.31	0.0026	9.6	0.0030	8.1	0.10	0.00053	0.0010	0.0038	40	0.50	0.000087	0.013
Jul	0.00010	0.71	0.59	0.00093	0.000087	0.00085	0.0019	0.026	1.4	0.24	0.000039	0.31	0.0026	9.8	0.0030	8.1	0.10	0.00054	0.0010	0.0038	39	0.50	0.000085	0.013
Aug	0.00010	0.73	0.59	0.00094	0.000087	0.00086	0.0019	0.025	1.4	0.25	0.000043	0.31	0.0026	9.9	0.0030	8.1	0.10	0.00055	0.0010	0.0037	37	0.50	0.000085	0.013
Sep	0.00010	0.72	0.61	0.00094	0.000085	0.00085	0.0019	0.025	1.4	0.26	0.000042	0.31	0.0026	10.0	0.0030	8.4	0.11	0.00055	0.0010	0.0037	36	0.50	0.000087	0.013
Oct	0.00010	0.71	0.61	0.00095	0.000086	0.00086	0.0019	0.026	1.4	0.26	0.000042	0.32	0.0026	10	0.0030	8.3	0.11	0.00055	0.0010	0.0038	37	0.51	0.000089	0.013
Nov	0.00010	0.71	0.61	0.00097	0.000087	0.00088	0.0019	0.026	1.4	0.27	0.000042	0.34	0.0027	10	0.0030	8.3	0.11	0.00056	0.0011	0.0040	38	0.53	0.000091	0.013
Dec	0.00010	0.71	0.61	0.00099	0.000089	0.00091	0.0020	0.027	1.5	0.27	0.000043	0.35	0.0028	11	0.0031	8.3	0.10	0.00057	0.0011	0.0043	39	0.55	0.000093	0.013
Best Estimate Max Operations																								
Jan	0.00011	0.72	0.64	0.0011	0.000096	0.0010	0.0022	0.032	1.6	0.31	0.000049	0.44	0.0032	12	0.0034	8.8	0.11	0.00062	0.0014	0.0055	47	0.64	0.00011	0.015
Feb	0.00011	0.72	0.64	0.0012	0.000098	0.0011	0.0023	0.033	1.6	0.32	0.000050	0.47	0.0033	13	0.0035	8.8	0.11	0.00064	0.0014	0.0059	49	0.68	0.00011	0.015
Mar	0.00011	0.72	0.64	0.0012	0.00010	0.0011	0.0024	0.035	1.6	0.34	0.000051	0.50	0.0035	14	0.0035	8.8	0.11	0.00065	0.0015	0.0064	51	0.71	0.00011	0.015
Apr	0.00011	0.72	0.64	0.0012	0.00010	0.0012	0.0024	0.036	1.7	0.34	0.000053	0.53	0.0037	14	0.0036	8.8	0.11	0.00066	0.0016	0.0068	54	0.75	0.00012	0.016
May	0.00011	0.71	0.64	0.0012	0.00010	0.0011	0.0023	0.034	1.6	0.31	0.000048	0.48	0.0034	13	0.0033	8.8	0.11	0.00062	0.0015	0.0063	49	0.70	0.00010	0.015
Jun	0.00010	0.71	0.64	0.00100	0.000090	0.00091	0.0020	0.028	1.4	0.26	0.000040	0.36	0.0027	10	0.0032	8.8	0.11	0.00057	0.0011	0.0044	44	0.55	0.000097	0.014
Jul	0.00010	0.74	0.64	0.0010	0.000090	0.00093	0.0020	0.028	1.5	0.26	0.000046	0.36	0.0027	11	0.0032	8.8	0.11	0.00058	0.0011	0.0044	44	0.54	0.000096	0.014
Aug	0.00010	0.74	0.64	0.0010	0.000090	0.00093	0.0020	0.028	1.5	0.28	0.000046	0.35	0.0027	11	0.0032	8.8	0.11	0.00058	0.0011	0.0042	41	0.54	0.000094	0.014
Sep	0.00010	0.74	0.64	0.0010	0.000089	0.00093	0.0020	0.028	1.5	0.28	0.000045	0.36	0.0027	11	0.0032	8.8	0.11	0.00058	0.0011	0.0044	40	0.55	0.000097	0.014
Oct	0.00011	0.73	0.64	0.0010	0.000090	0.00095	0.0021	0.028	1.5	0.29	0.000046	0.38	0.0028	11	0.0032	8.8	0.11	0.00059	0.0012	0.0046	41	0.57	0.000099	0.014
Nov	0.00011	0.72	0.64	0.0011	0.000091	0.00097	0.0021	0.029	1.5	0.29	0.000046	0.39	0.0029	11	0.0033	8.8	0.11	0.00060	0.0012	0.0048	42	0.58	0.00010	0.014
Dec	0.00011	0.72	0.64	0.0011	0.000093	0.0010	0.0022	0.030	1.6	0.30	0.000047	0.42	0.0030	12	0.0033	8.8	0.11	0.00061	0.0013	0.0051	44	0.61	0.00010	0.014
Best Estimate Average Postclosure																								
Jan	0.00011	0.75	0.084	0.0012	0.000093	0.00072	0.0018	0.027	1.2	0.49	0.000048	0.25	0.0070	12	0.0028	1.2	0.015	0.00054	0.0020	0.0029	41	0.75	0.000074	0.012
Feb	0.00011	0.75	0.083	0.0013	0.000093	0.00072	0.0018	0.027	1.2	0.49	0.000048	0.26	0.0071	12	0.0028	1.1	0.014	0.00054	0.0021	0.0029	41	0.76	0.000074	0.012
Mar	0.00011	0.75	0.082	0.0013	0.000094	0.00073	0.0018	0.027	1.2	0.50	0.000048	0.26	0.0071	12	0.0028	1.1	0.014	0.00055	0.0021	0.0030	41	0.76	0.000075	0.012
Apr	0.00011	0.74	0.085	0.0013	0.000096	0.00073	0.0018	0.028	1.2	0.51	0.000049	0.27	0.0074	12	0.0028	1.2	0.015	0.00055	0.0021	0.0031	42	0.78	0.000074	0.013
May	0.00011	0.74	0.083	0.0013	0.000095	0.00072	0.0018	0.028	1.2	0.50	0.000046	0.26	0.0074	12	0.0028	1.1	0.014	0.00054	0.0021	0.0030	43	0.78	0.000073	0.013
Jun	0.00011	0.75	0.082	0.0012	0.000094	0.00071	0.0018	0.027	1.2	0.49	0.000045	0.25	0.0073	12	0.0028	1.1	0.014	0.00054	0.0021	0.0029	44	0.76	0.000075	0.012
Jul	0.00010	0.75	0.081	0.0012	0.000094	0.00072	0.0018	0.027	1.2	0.48	0.000047	0.25	0.0072	12	0.0028	1.1	0.014	0.00054	0.0021	0.0028	43	0.76	0.000073	0.012
Aug	0.00010	0.76	0.079	0.0012	0.000094	0.00073	0.0018	0.027	1.2	0.49	0.000049	0.25	0.0072	12	0.0028	1.1	0.014	0.00055	0.0021	0.0028	42	0.76	0.000073	0.012
Sep	0.00011	0.76	0.078	0.0012	0.000093	0.00072	0.0018	0.027	1.2	0.49	0.000049	0.25	0.0072	12	0.0028	1.1	0.013	0.00055	0.0021	0.0028	41	0.76	0.000074	0.012
Oct	0.00011	0.75	0.077	0.0013	0.000093	0.00072	0.0018	0.027	1.2	0.49	0.000048	0.25	0.0072	12	0.0028	1.0	0.013	0.00054	0.0021	0.0028	41	0.75	0.000074	0.012
Nov	0.00011	0.75	0.075	0.0013	0.000093	0.00072	0.0018	0.027	1.2	0.50	0.000048	0.25	0.0072	12	0.0028	1.0	0.013	0.00055	0.0021	0.0028	41	0.76	0.000074	0.012
Dec	0.00011	0.75	0.074	0.0013	0.000093	0.00072	0.0018	0.027	1.2	0.50	0.000048	0.25	0.0073	12	0.0028	1.0	0.013	0.00055	0.0021	0.0029	41	0.76	0.000075	0.012
Best Estimate Max Postclosure																								
Jan	0.00011	0.78	0.13	0.0014	0.00010	0.00080	0.0020	0.030	1.3	0.67	0.000054	0.28	0.013	19	0.0030	1.8	0.022	0.00059	0.0034	0.0036	56	1.2	0.000083	0.013
Feb	0.00011	0.78	0.13	0.0015	0.00010	0.00080	0.0020	0.030	1.3	0.68	0.000054	0.29	0.013	19	0.0030	1.7	0.022	0.00059	0.0034	0.0037	57	1.2	0.000083	0.013
Mar	0.00011	0.78	0.12	0.0015	0.00010	0.00081	0.0020	0.030	1.3	0.69	0.000054	0.29	0.013	19	0.0030	1.7	0.022	0.00059	0.0034	0.0037	57	1.2	0.000083	0.014
Apr	0.00011	0.78	0.12	0.0015	0.00010	0.00081	0.0020	0.031	1.3	0.71	0.000055	0.30	0.014	19	0.0030	1.7	0.021	0.00060	0.0035	0.0040	58	1.2	0.000084	0.014
May	0.00011	0.78	0.12	0.0015	0.00010	0.00080	0.0020	0.031	1.3	0.70	0.000054	0.29	0.014	19	0.0030	1.6	0.021	0.00059	0.0034	0.0040	59	1.2	0.000084	0.014
Jun	0.00011	0.78	0.12	0.0014	0.00010	0.00079	0.0020	0.030	1.3	0.67	0.000051	0.27	0.013	18	0.0030	1.6	0.020	0.00058	0.0033	0.0036	59	1.2	0.000084	0.013
Jul	0.00011	0.79	0.12	0.0014	0.00010	0.00080	0.0020	0.029	1.3	0.65	0.000054	0.27	0.013	18	0.0030	1.6	0.020	0.00059	0.0033	0.0036	58	1.1	0.000083	0.013
Aug	0.00011	0.79	0.11	0.0014	0.00010	0.00080	0.0020	0.029	1.3	0.65	0.000054	0.27	0.013	18	0.0030	1.6	0.020	0.00059	0.0032	0.0035	56	1.1	0.000081	0.013
Sep	0.00011	0.79	0.11	0.0014	0.000100	0.00080	0.0020	0.029	1.3	0.65	0.000054	0.27	0.013	18	0.0030	1.5	0.019	0.00059	0.0032	0.0035	55	1.1	0.000082	0.013
Oct	0.00011	0.78	0.11	0.0014	0.000099	0.00079	0.0019	0.029	1.3	0.66	0.000053	0.28	0.013	18	0.0030	1.5	0.019	0.00059	0.0032	0.0035	55	1.1	0.000083	0.013
Nov	0.00011	0.78	0.11	0.0014	0.000100	0.00079	0.0020	0.029	1.3	0.66	0.000053	0.28	0.013	18	0.0030	1.5	0.019	0.00059	0.0032	0.0036	55	1.1	0.000083	0.013
Dec	0.00011	0.78	0.11	0.0014	0.000100	0.00080	0.0020	0.029	1.3	0.66	0.000053	0.28	0.013	18	0.0030	1.5	0.018	0.00059	0.0032	0.0036	55	1.1	0.000083	0.013

Table 6 WSP Monthly Summary WC WQ Cover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reasonable Worst Case Average Operations																								
Jan	0.00015	0.72	0.98	0.0012	0.00013	0.0014	0.0026	0.043	1.7	0.29	0.00018	0.70	0.0038	15	0.0036	21	0.61	0.00052	0.0027	0.0042	69	0.87	0.000086	0.016
Feb	0.00016	0.73	0.98	0.0013	0.00014	0.0014	0.0027	0.046	1.8	0.30	0.00019	0.76	0.0041	16	0.0037	21	0.60	0.00053	0.0029	0.0045	74	0.94	0.000089	0.017
Mar	0.00017	0.74	0.98	0.0013	0.00015	0.0015	0.0028	0.049	1.8	0.32	0.00020	0.82	0.0043	16	0.0039	21	0.60	0.00055	0.0031	0.0049	79	1.00	0.000092	0.018
Apr	0.00018	0.73	0.97	0.0014	0.00016	0.0016	0.0029	0.052	1.8	0.32	0.00022	0.87	0.0045	17	0.0039	21	0.60	0.00055	0.0033	0.0053	83	1.1	0.000092	0.018
May	0.00016	0.73	0.97	0.0012	0.00014	0.0014	0.0026	0.045	1.7	0.28	0.00018	0.72	0.0039	15	0.0036	21	0.60	0.00052	0.0027	0.0044	72	0.90	0.000085	0.017
Jun	0.00015	0.76	0.96	0.0012	0.00013	0.0013	0.0025	0.041	1.7	0.27	0.00015	0.62	0.0036	14	0.0036	21	0.59	0.00053	0.0024	0.0038	68	0.81	0.000087	0.016
Jul	0.00015	0.78	0.96	0.0012	0.00013	0.0013	0.0025	0.041	1.7	0.28	0.00016	0.63	0.0036	14	0.0037	21	0.59	0.00054	0.0024	0.0038	67	0.81	0.000085	0.016
Aug	0.00015	0.80	0.96	0.0012	0.00013	0.0013	0.0025	0.040	1.7	0.28	0.00016	0.62	0.0036	14	0.0037	21	0.59	0.00055	0.0024	0.0037	65	0.81	0.000085	0.016
Sep	0.00015	0.79	0.99	0.0012	0.00013	0.0013	0.0025	0.040	1.7	0.29	0.00016	0.63	0.0036	14	0.0036	22	0.61	0.00055	0.0024	0.0037	64	0.81	0.000087	0.016
Oct	0.00016	0.79	0.99	0.0012	0.00013	0.0013	0.0026	0.042	1.8	0.30	0.00017	0.65	0.0037	14	0.0037	22	0.61	0.00055	0.0025	0.0038	66	0.84	0.000089	0.016
Nov	0.00016	0.79	0.99	0.0012	0.00014	0.0014	0.0026	0.043	1.8	0.30	0.00017	0.69	0.0038	15	0.0038	22	0.61	0.00056	0.0026	0.0040	68	0.87	0.000091	0.017
Dec	0.00017	0.80	0.98	0.0013	0.00014	0.0014	0.0027	0.045	1.8	0.31	0.00018	0.73	0.0040	15	0.0039	21	0.60	0.00057	0.0028	0.0043	72	0.91	0.000093	0.017
Reasonable Worst Case Max Operations																								
Jan	0.00019	0.84	1.0	0.0015	0.00017	0.0017	0.0033	0.056	2.1	0.36	0.00023	0.94	0.0048	19	0.0044	23	0.64	0.00062	0.0036	0.0055	90	1.1	0.00011	0.020
Feb	0.00020	0.85	1.0	0.0016	0.00018	0.0018	0.0034	0.059	2.1	0.37	0.00025	1.0	0.0051	20	0.0046	23	0.64	0.00064	0.0038	0.0059	95	1.2	0.00011	0.021
Mar	0.00021	0.86	1.0	0.0017	0.00018	0.0019	0.0036	0.062	2.2	0.39	0.00027	1.1	0.0054	21	0.0047	23	0.64	0.00065	0.0041	0.0064	100	1.3	0.00011	0.021
Apr	0.00021	0.87	1.0	0.0017	0.00019	0.0020	0.0037	0.066	2.3	0.40	0.00028	1.1	0.0057	22	0.0048	23	0.64	0.00066	0.0043	0.0068	110	1.3	0.00012	0.022
May	0.00020	0.82	1.0	0.0016	0.00018	0.0019	0.0034	0.061	2.1	0.36	0.00026	1.0	0.0052	20	0.0045	23	0.64	0.00062	0.0039	0.0063	98	1.2	0.00010	0.021
Jun	0.00017	0.80	1.0	0.0013	0.00015	0.0015	0.0028	0.046	1.8	0.30	0.00018	0.74	0.0040	15	0.0040	23	0.64	0.00057	0.0028	0.0044	78	0.92	0.000097	0.018
Jul	0.00017	0.83	1.0	0.0013	0.00015	0.0015	0.0028	0.046	1.9	0.30	0.00019	0.74	0.0040	15	0.0040	23	0.64	0.00058	0.0028	0.0044	77	0.92	0.000096	0.018
Aug	0.00017	0.83	1.0	0.0013	0.00014	0.0015	0.0028	0.045	1.9	0.31	0.00019	0.73	0.0039	15	0.0040	23	0.64	0.00058	0.0028	0.0042	74	0.91	0.000094	0.017
Sep	0.00017	0.82	1.0	0.0013	0.00014	0.0015	0.0028	0.046	1.9	0.32	0.00019	0.75	0.0040	16	0.0040	23	0.64	0.00058	0.0029	0.0044	74	0.93	0.000097	0.018
Oct	0.00017	0.82	1.0	0.0014	0.00015	0.0015	0.0029	0.048	1.9	0.32	0.00020	0.79	0.0042	16	0.0041	23	0.64	0.00059	0.0030	0.0046	77	0.96	0.000099	0.018
Nov	0.00018	0.82	1.0	0.0014	0.00015	0.0016	0.0030	0.050	2.0	0.33	0.00021	0.82	0.0043	17	0.0041	23	0.64	0.00060	0.0031	0.0048	80	1.00	0.00010	0.018
Dec	0.00018	0.83	1.0	0.0014	0.00016	0.0016	0.0031	0.052	2.0	0.34	0.00022	0.88	0.0045	18	0.0043	23	0.64	0.00061	0.0033	0.0051	84	1.1	0.00010	0.019
Reasonable Worst Case Average Postclosure																								
Jan	0.00016	0.89	0.14	0.0022	0.00017	0.0010	0.0028	0.047	1.5	0.68	0.00013	0.52	0.014	15	0.0038	3.0	0.084	0.0011	0.0040	0.0029	65	1.1	0.000082	0.018
Feb	0.00016	0.89	0.13	0.0023	0.00017	0.0010	0.0029	0.048	1.5	0.68	0.00014	0.53	0.014	15	0.0038	2.9	0.083	0.0011	0.0040	0.0029	66	1.1	0.000083	0.018
Mar	0.00016	0.89	0.13	0.0023	0.00018	0.0011	0.0029	0.048	1.5	0.69	0.00014	0.53	0.014	15	0.0039	2.9	0.082	0.0011	0.0040	0.0030	66	1.1	0.000083	0.018
Apr	0.00016	0.89	0.14	0.0024	0.00018	0.0011	0.0030	0.050	1.5	0.71	0.00014	0.55	0.015	16	0.0039	3.0	0.084	0.0012	0.0042	0.0031	68	1.2	0.000083	0.019
May	0.00016	0.89	0.14	0.0023	0.00018	0.0010	0.0029	0.048	1.5	0.69	0.00014	0.53	0.015	15	0.0038	3.0	0.083	0.0011	0.0041	0.0030	68	1.2	0.000082	0.018
Jun	0.00015	0.88	0.13	0.0022	0.00017	0.0010	0.0028	0.047	1.4	0.67	0.00013	0.51	0.014	15	0.0038	2.9	0.082	0.0011	0.0040	0.0029	68	1.1	0.000083	0.018
Jul	0.00015	0.89	0.13	0.0022	0.00017	0.0010	0.0028	0.047	1.5	0.67	0.00013	0.51	0.014	15	0.0038	2.9	0.080	0.0011	0.0040	0.0028	66	1.1	0.000082	0.018
Aug	0.00015	0.90	0.13	0.0022	0.00017	0.0010	0.0028	0.047	1.5	0.67	0.00013	0.51	0.014	15	0.0038	2.8	0.079	0.0011	0.0040	0.0028	65	1.1	0.000081	0.018
Sep	0.00015	0.89	0.13	0.0022	0.00017	0.0010	0.0028	0.047	1.5	0.68	0.00013	0.51	0.014	15	0.0038	2.8	0.078	0.0011	0.0040	0.0028	65	1.1	0.000082	0.018
Oct	0.00015	0.89	0.12	0.0022	0.00017	0.0010	0.0028	0.047	1.5	0.68	0.00013	0.51	0.014	15	0.0038	2.7	0.076	0.0011	0.0040	0.0028	65	1.1	0.000083	0.018
Nov	0.00016	0.89	0.12	0.0022	0.00017	0.0010	0.0028	0.047	1.5	0.69	0.00013	0.52	0.014	15	0.0038	2.7	0.075	0.0011	0.0040	0.0028	65	1.1	0.000083	0.018
Dec	0.00016	0.89	0.12	0.0023	0.00017	0.0010	0.0029	0.047	1.5	0.69	0.00013	0.52	0.014	15	0.0038	2.6	0.074	0.0011	0.0041	0.0029	66	1.1	0.000083	0.018
Reasonable Worst Case Max Postclosure																								
Jan	0.00017	0.95	0.21	0.0027	0.00020	0.0012	0.0033	0.053	1.5	0.91	0.00015	0.59	0.022	22	0.0043	4.5	0.13	0.0013	0.0064	0.0036	86	1.7	0.000093	0.020
Feb	0.00017	0.95	0.20	0.0027	0.00020	0.0012	0.0033	0.053	1.5	0.92	0.00016	0.59	0.022	23	0.0043	4.5	0.13	0.0013	0.0064	0.0037	86	1.7	0.000094	0.020
Mar	0.00017	0.95	0.20	0.0027	0.00020	0.0012	0.0033	0.054	1.6	0.93	0.00016	0.60	0.023	23	0.0043	4.4	0.12	0.0013	0.0065	0.0037	87	1.7	0.000094	0.020
Apr	0.00018	0.96	0.20	0.0028	0.00021	0.0012	0.0034	0.056	1.6	0.96	0.00016	0.62	0.023	23	0.0044	4.3	0.12	0.0014	0.0067	0.0040	90	1.8	0.000095	0.021
May	0.00018	0.95	0.19	0.0028	0.00021	0.0012	0.0034	0.055	1.5	0.95	0.00016	0.62	0.023	23	0.0043	4.3	0.12	0.0014	0.0066	0.0040	90	1.8	0.000094	0.021
Jun	0.00017	0.94	0.19	0.0026	0.00020	0.0011	0.0032	0.053	1.5	0.90	0.00015	0.57	0.022	22	0.0043	4.2	0.12	0.0013	0.0063	0.0036	88	1.7	0.000094	0.020
Jul	0.00017	0.96	0.19	0.0026	0.00019	0.0011	0.0032	0.052	1.5	0.89	0.00015	0.57	0.022	22	0.0043	4.1	0.12	0.0013	0.0062	0.0036	87	1.7	0.000093	0.020
Aug	0.00017	0.96	0.19	0.0026	0.00019	0.0011	0.0032	0.052	1.5	0.88	0.00015	0.57	0.021	22	0.0042	4.0	0.11	0.0013	0.0061	0.0035	85	1.6	0.000091	0.020
Sep	0.00017	0.95	0.18	0.0026	0.00019	0.0011	0.0032	0.052	1.5	0.88	0.00015	0.57	0.021	21	0.0042	4.0	0.11	0.0013	0.0061	0.0035	84	1.6	0.000092	0.020
Oct	0.00017	0.95	0.18	0.0026	0.00019	0.0011	0.0032	0.052	1.5	0.89	0.00015	0.57	0.021	21	0.0042	3.9	0.11	0.0013	0.0061	0.0035	84	1.6	0.000093	0.020
Nov	0.00017	0.95	0.18	0.0026	0.00019	0.0011	0.0032	0.052	1.5	0.89	0.00015	0.58	0.021	22	0.0042	3.8	0.11	0.0013	0.0061	0.0036	84	1.6	0.000093	0.020
Dec	0.00017	0.95	0.17	0.0026	0.00020	0.0012	0.0032	0.053	1.5	0.90	0.00015	0.58	0.022	22	0.0043	3.8	0.11	0.0013	0.0061	0.0036	84	1.7	0.000093	0.020

Table 7 WSP Monthly Summary - BE WQ NoCover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Best Estimate Average Operations																								
Jan	0.000094	0.63	0.61	0.00092	0.000081	0.00084	0.0018	0.026	1.3	0.26	0.000040	0.34	0.0026	10	0.0028	8.3	0.11	0.00052	0.0011	0.0042	37	0.52	0.000086	0.012
Feb	0.000095	0.64	0.61	0.00096	0.000083	0.00088	0.0019	0.027	1.4	0.27	0.000041	0.36	0.0028	11	0.0029	8.3	0.10	0.00053	0.0011	0.0045	39	0.55	0.000089	0.013
Mar	0.000097	0.64	0.60	0.00099	0.000086	0.00092	0.0019	0.028	1.4	0.28	0.000042	0.39	0.0029	11	0.0030	8.2	0.10	0.00055	0.0012	0.0049	41	0.58	0.000092	0.013
Apr	0.000098	0.63	0.60	0.0010	0.000088	0.00094	0.0020	0.030	1.4	0.28	0.000042	0.41	0.0030	12	0.0029	8.2	0.10	0.00055	0.0013	0.0053	43	0.60	0.000092	0.013
May	0.000098	0.64	0.60	0.00093	0.000086	0.00085	0.0018	0.027	1.3	0.25	0.000037	0.34	0.0027	10	0.0029	8.2	0.10	0.00052	0.0011	0.0044	40	0.53	0.000085	0.013
Jun	0.00010	0.69	0.60	0.00091	0.000087	0.00083	0.0018	0.026	1.3	0.24	0.000035	0.31	0.0026	9.6	0.0030	8.1	0.10	0.00053	0.0010	0.0038	40	0.50	0.000087	0.013
Jul	0.00010	0.71	0.59	0.00093	0.000087	0.00085	0.0019	0.026	1.4	0.24	0.000039	0.31	0.0026	9.8	0.0030	8.1	0.10	0.00054	0.0010	0.0038	39	0.50	0.000085	0.013
Aug	0.00010	0.73	0.59	0.00094	0.000087	0.00086	0.0019	0.025	1.4	0.25	0.000043	0.31	0.0026	9.9	0.0030	8.1	0.10	0.00055	0.0010	0.0037	37	0.50	0.000085	0.013
Sep	0.00010	0.72	0.61	0.00094	0.000085	0.00085	0.0019	0.025	1.4	0.26	0.000042	0.31	0.0026	10.0	0.0030	8.4	0.11	0.00055	0.0010	0.0037	36	0.50	0.000087	0.013
Oct	0.00010	0.71	0.61	0.00095	0.000086	0.00086	0.0019	0.026	1.4	0.26	0.000042	0.32	0.0026	10	0.0030	8.3	0.11	0.00055	0.0010	0.0038	37	0.51	0.000089	0.013
Nov	0.00010	0.71	0.61	0.00097	0.000087	0.00088	0.0019	0.026	1.4	0.27	0.000042	0.34	0.0027	10	0.0030	8.3	0.11	0.00056	0.0011	0.0040	38	0.53	0.000091	0.013
Dec	0.00010	0.71	0.61	0.00099	0.000089	0.00091	0.0020	0.027	1.5	0.27	0.000043	0.35	0.0028	11	0.0031	8.3	0.10	0.00057	0.0011	0.0043	39	0.55	0.000093	0.013
Best Estimate Max Operations																								
Jan	0.00011	0.72	0.64	0.0011	0.000096	0.0010	0.0022	0.032	1.6	0.31	0.000049	0.44	0.0032	12	0.0034	8.8	0.11	0.00062	0.0014	0.0055	47	0.64	0.00011	0.015
Feb	0.00011	0.72	0.64	0.0012	0.000098	0.0011	0.0023	0.033	1.6	0.32	0.000050	0.47	0.0033	13	0.0035	8.8	0.11	0.00064	0.0014	0.0059	49	0.68	0.00011	0.015
Mar	0.00011	0.72	0.64	0.0012	0.00010	0.0011	0.0024	0.035	1.6	0.34	0.000051	0.50	0.0035	14	0.0035	8.8	0.11	0.00065	0.0015	0.0064	51	0.71	0.00011	0.015
Apr	0.00011	0.72	0.64	0.0012	0.00010	0.0012	0.0024	0.036	1.7	0.34	0.000053	0.53	0.0037	14	0.0036	8.8	0.11	0.00066	0.0016	0.0068	54	0.75	0.00012	0.016
May	0.00011	0.71	0.64	0.0012	0.00010	0.0011	0.0023	0.034	1.6	0.31	0.000048	0.48	0.0034	13	0.0033	8.8	0.11	0.00062	0.0015	0.0063	49	0.70	0.00010	0.015
Jun	0.00010	0.71	0.64	0.00100	0.000090	0.00091	0.0020	0.028	1.4	0.26	0.000040	0.36	0.0027	10	0.0032	8.8	0.11	0.00057	0.0011	0.0044	44	0.55	0.000097	0.014
Jul	0.00010	0.74	0.64	0.0010	0.000090	0.00093	0.0020	0.028	1.5	0.26	0.000046	0.36	0.0027	11	0.0032	8.8	0.11	0.00058	0.0011	0.0044	44	0.54	0.000096	0.014
Aug	0.00010	0.74	0.64	0.0010	0.000090	0.00093	0.0020	0.028	1.5	0.28	0.000046	0.35	0.0027	11	0.0032	8.8	0.11	0.00058	0.0011	0.0042	41	0.54	0.000094	0.014
Sep	0.00010	0.74	0.64	0.0010	0.000089	0.00093	0.0020	0.028	1.5	0.28	0.000045	0.36	0.0027	11	0.0032	8.8	0.11	0.00058	0.0011	0.0044	40	0.55	0.000097	0.014
Oct	0.00011	0.73	0.64	0.0010	0.000090	0.00095	0.0021	0.028	1.5	0.29	0.000046	0.38	0.0028	11	0.0032	8.8	0.11	0.00059	0.0012	0.0046	41	0.57	0.000099	0.014
Nov	0.00011	0.72	0.64	0.0011	0.000091	0.00097	0.0021	0.029	1.5	0.29	0.000046	0.39	0.0029	11	0.0033	8.8	0.11	0.00060	0.0012	0.0048	42	0.58	0.00010	0.014
Dec	0.00011	0.72	0.64	0.0011	0.000093	0.0010	0.0022	0.030	1.6	0.30	0.000047	0.42	0.0030	12	0.0033	8.8	0.11	0.00061	0.0013	0.0051	44	0.61	0.00010	0.014
Best Estimate Average Postclosure																								
Jan	0.00011	0.74	0.084	0.0014	0.00010	0.00080	0.0019	0.032	1.3	0.52	0.000051	0.32	0.0076	13	0.0029	1.2	0.015	0.00057	0.0024	0.0038	47	0.84	0.000080	0.013
Feb	0.00011	0.74	0.083	0.0014	0.00010	0.00081	0.0019	0.032	1.3	0.53	0.000052	0.33	0.0077	13	0.0029	1.1	0.014	0.00058	0.0024	0.0039	47	0.86	0.000080	0.013
Mar	0.00011	0.75	0.082	0.0014	0.00010	0.00081	0.0019	0.033	1.3	0.53	0.000052	0.33	0.0078	13	0.0029	1.1	0.014	0.00058	0.0024	0.0039	48	0.86	0.000081	0.013
Apr	0.00011	0.75	0.085	0.0014	0.00010	0.00082	0.0020	0.034	1.3	0.56	0.000053	0.34	0.0081	14	0.0029	1.2	0.015	0.00059	0.0025	0.0041	49	0.89	0.000080	0.014
May	0.00011	0.74	0.083	0.0014	0.00010	0.00080	0.0019	0.033	1.3	0.53	0.000050	0.33	0.0080	13	0.0029	1.1	0.014	0.00057	0.0025	0.0040	49	0.88	0.000079	0.013
Jun	0.00011	0.74	0.082	0.0013	0.00010	0.00079	0.0019	0.032	1.3	0.51	0.000048	0.31	0.0079	13	0.0029	1.1	0.014	0.00057	0.0024	0.0038	49	0.85	0.000080	0.013
Jul	0.00011	0.75	0.081	0.0013	0.00010	0.00080	0.0019	0.032	1.3	0.51	0.000050	0.31	0.0078	13	0.0029	1.1	0.014	0.00057	0.0024	0.0037	48	0.85	0.000078	0.013
Aug	0.00011	0.76	0.079	0.0013	0.00010	0.00080	0.0019	0.032	1.3	0.51	0.000052	0.32	0.0078	13	0.0029	1.1	0.014	0.00057	0.0024	0.0037	47	0.85	0.000078	0.013
Sep	0.00011	0.75	0.078	0.0013	0.000100	0.00080	0.0019	0.032	1.3	0.52	0.000051	0.32	0.0078	13	0.0029	1.1	0.013	0.00057	0.0024	0.0037	47	0.85	0.000079	0.013
Oct	0.00011	0.75	0.077	0.0013	0.000100	0.00080	0.0019	0.032	1.3	0.52	0.000051	0.32	0.0078	13	0.0029	1.0	0.013	0.00057	0.0024	0.0037	47	0.85	0.000080	0.013
Nov	0.00011	0.75	0.075	0.0014	0.00010	0.00080	0.0019	0.032	1.3	0.52	0.000051	0.32	0.0078	13	0.0029	1.0	0.013	0.00057	0.0024	0.0038	47	0.85	0.000080	0.013
Dec	0.00011	0.75	0.074	0.0014	0.00010	0.00080	0.0019	0.032	1.3	0.53	0.000052	0.32	0.0079	13	0.0029	1.0	0.013	0.00058	0.0024	0.0038	47	0.86	0.000080	0.013
Best Estimate Max Postclosure																								
Jan	0.00011	0.77	0.13	0.0015	0.00011	0.00088	0.0021	0.034	1.3	0.70	0.000057	0.36	0.014	20	0.0031	1.8	0.022	0.00062	0.0037	0.0046	62	1.3	0.000089	0.014
Feb	0.00011	0.78	0.13	0.0016	0.00011	0.00088	0.0021	0.035	1.3	0.71	0.000057	0.36	0.014	20	0.0031	1.7	0.022	0.00062	0.0037	0.0046	62	1.3	0.000089	0.014
Mar	0.00012	0.78	0.12	0.0016	0.00011	0.00089	0.0021	0.035	1.3	0.72	0.000058	0.37	0.014	20	0.0031	1.7	0.022	0.00062	0.0037	0.0047	63	1.3	0.000090	0.014
Apr	0.00012	0.78	0.12	0.0016	0.00011	0.00091	0.0022	0.036	1.3	0.75	0.000060	0.38	0.014	20	0.0032	1.7	0.021	0.00063	0.0038	0.0049	65	1.3	0.000091	0.015
May	0.00012	0.77	0.12	0.0016	0.00011	0.00089	0.0022	0.036	1.3	0.74	0.000058	0.37	0.014	20	0.0031	1.6	0.021	0.00062	0.0038	0.0049	64	1.3	0.000089	0.015
Jun	0.00011	0.77	0.12	0.0015	0.00011	0.00086	0.0021	0.034	1.3	0.69	0.000054	0.34	0.014	19	0.0031	1.6	0.020	0.00061	0.0036	0.0045	64	1.2	0.000089	0.014
Jul	0.00011	0.78	0.12	0.0015	0.00011	0.00087	0.0021	0.034	1.3	0.68	0.000057	0.34	0.013	19	0.0031	1.6	0.020	0.00061	0.0035	0.0044	63	1.2	0.000087	0.014
Aug	0.00011	0.79	0.11	0.0015	0.00011	0.00087	0.0021	0.034	1.3	0.67	0.000057	0.34	0.013	19	0.0031	1.6	0.020	0.00061	0.0035	0.0044	61	1.2	0.000086	0.014
Sep	0.00011	0.78	0.11	0.0015	0.00011	0.00087	0.0021	0.034	1.3	0.68	0.000056	0.34	0.013	19	0.0031	1.5	0.019	0.00061	0.0035	0.0044	60	1.2	0.000087	0.014
Oct	0.00011	0.77	0.11	0.0015	0.00011	0.00087	0.0021	0.034	1.3	0.68	0.000056	0.35	0.013	19	0.0031	1.5	0.019	0.00061	0.0035	0.0044	60	1.2	0.000088	0.014
Nov	0.00011	0.77	0.11	0.0015	0.00011	0.00087	0.0021	0.034	1.3	0.68	0.000056	0.35	0.013	19	0.0031	1.5	0.019	0.00061	0.0035	0.0045	60	1.2	0.000088	0.014
Dec	0.00011	0.77	0.11	0.0015	0.00011	0.00087	0.0021	0.034	1.3	0.69	0.000056	0.35	0.013	19	0.0031	1.5	0.018	0.00062	0.0035	0.0045	61	1.2	0.000088	0.014

Table 8 WSP Monthly Summary WC WQ NoCover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reasonable Worst Case Average Operations																								
Jan	0.00015	0.72	0.98	0.0012	0.00013	0.0014	0.0026	0.043	1.7	0.29	0.00018	0.70	0.0038	15	0.0036	21	0.61	0.00052	0.0027	0.0042	69	0.87	0.000086	0.016
Feb	0.00016	0.73	0.98	0.0013	0.00014	0.0014	0.0027	0.046	1.8	0.30	0.00019	0.76	0.0041	16	0.0037	21	0.60	0.00053	0.0029	0.0045	74	0.94	0.000089	0.017
Mar	0.00017	0.74	0.98	0.0013	0.00015	0.0015	0.0028	0.049	1.8	0.32	0.00020	0.82	0.0043	16	0.0039	21	0.60	0.00055	0.0031	0.0049	79	1.00	0.000092	0.018
Apr	0.00018	0.73	0.97	0.0014	0.00016	0.0016	0.0029	0.052	1.8	0.32	0.00022	0.87	0.0045	17	0.0039	21	0.60	0.00055	0.0033	0.0053	83	1.1	0.000092	0.018
May	0.00016	0.73	0.97	0.0012	0.00014	0.0014	0.0026	0.045	1.7	0.28	0.00018	0.72	0.0039	15	0.0036	21	0.60	0.00052	0.0027	0.0044	72	0.90	0.000085	0.017
Jun	0.00015	0.76	0.96	0.0012	0.00013	0.0013	0.0025	0.041	1.7	0.27	0.00015	0.62	0.0036	14	0.0036	21	0.59	0.00053	0.0024	0.0038	68	0.81	0.000087	0.016
Jul	0.00015	0.78	0.96	0.0012	0.00013	0.0013	0.0025	0.041	1.7	0.28	0.00016	0.63	0.0036	14	0.0037	21	0.59	0.00054	0.0024	0.0038	67	0.81	0.000085	0.016
Aug	0.00015	0.80	0.96	0.0012	0.00013	0.0013	0.0025	0.040	1.7	0.28	0.00016	0.62	0.0036	14	0.0037	21	0.59	0.00055	0.0024	0.0037	65	0.81	0.000085	0.016
Sep	0.00015	0.79	0.99	0.0012	0.00013	0.0013	0.0025	0.040	1.7	0.29	0.00016	0.63	0.0036	14	0.0036	22	0.61	0.00055	0.0024	0.0037	64	0.81	0.000087	0.016
Oct	0.00016	0.79	0.99	0.0012	0.00013	0.0013	0.0026	0.042	1.8	0.30	0.00017	0.65	0.0037	14	0.0037	22	0.61	0.00055	0.0025	0.0038	66	0.84	0.000089	0.016
Nov	0.00016	0.79	0.99	0.0012	0.00014	0.0014	0.0026	0.043	1.8	0.30	0.00017	0.69	0.0038	15	0.0038	22	0.61	0.00056	0.0026	0.0040	68	0.87	0.000091	0.017
Dec	0.00017	0.80	0.98	0.0013	0.00014	0.0014	0.0027	0.045	1.8	0.31	0.00018	0.73	0.0040	15	0.0039	21	0.60	0.00057	0.0028	0.0043	72	0.91	0.000093	0.017
Reasonable Worst Case Max Operations																								
Jan	0.00019	0.84	1.0	0.0015	0.00017	0.0017	0.0033	0.056	2.1	0.36	0.00023	0.94	0.0048	19	0.0044	23	0.64	0.00062	0.0036	0.0055	90	1.1	0.00011	0.020
Feb	0.00020	0.85	1.0	0.0016	0.00018	0.0018	0.0034	0.059	2.1	0.37	0.00025	1.0	0.0051	20	0.0046	23	0.64	0.00064	0.0038	0.0059	95	1.2	0.00011	0.021
Mar	0.00021	0.86	1.0	0.0017	0.00018	0.0019	0.0036	0.062	2.2	0.39	0.00027	1.1	0.0054	21	0.0047	23	0.64	0.00065	0.0041	0.0064	100	1.3	0.00011	0.021
Apr	0.00021	0.87	1.0	0.0017	0.00019	0.0020	0.0037	0.066	2.3	0.40	0.00028	1.1	0.0057	22	0.0048	23	0.64	0.00066	0.0043	0.0068	110	1.3	0.00012	0.022
May	0.00020	0.82	1.0	0.0016	0.00018	0.0019	0.0034	0.061	2.1	0.36	0.00026	1.0	0.0052	20	0.0045	23	0.64	0.00062	0.0039	0.0063	98	1.2	0.00010	0.021
Jun	0.00017	0.80	1.0	0.0013	0.00015	0.0015	0.0028	0.046	1.8	0.30	0.00018	0.74	0.0040	15	0.0040	23	0.64	0.00057	0.0028	0.0044	78	0.92	0.000097	0.018
Jul	0.00017	0.83	1.0	0.0013	0.00015	0.0015	0.0028	0.046	1.9	0.30	0.00019	0.74	0.0040	15	0.0040	23	0.64	0.00058	0.0028	0.0044	77	0.92	0.000096	0.018
Aug	0.00017	0.83	1.0	0.0013	0.00014	0.0015	0.0028	0.045	1.9	0.31	0.00019	0.73	0.0039	15	0.0040	23	0.64	0.00058	0.0028	0.0042	74	0.91	0.000094	0.017
Sep	0.00017	0.82	1.0	0.0013	0.00014	0.0015	0.0028	0.046	1.9	0.32	0.00019	0.75	0.0040	16	0.0040	23	0.64	0.00058	0.0029	0.0044	74	0.93	0.000097	0.018
Oct	0.00017	0.82	1.0	0.0014	0.00015	0.0015	0.0029	0.048	1.9	0.32	0.00020	0.79	0.0042	16	0.0041	23	0.64	0.00059	0.0030	0.0046	77	0.96	0.000099	0.018
Nov	0.00018	0.82	1.0	0.0014	0.00015	0.0016	0.0030	0.050	2.0	0.33	0.00021	0.82	0.0043	17	0.0041	23	0.64	0.00060	0.0031	0.0048	80	1.00	0.00010	0.018
Dec	0.00018	0.83	1.0	0.0014	0.00016	0.0016	0.0031	0.052	2.0	0.34	0.00022	0.88	0.0045	18	0.0043	23	0.64	0.00061	0.0033	0.0051	84	1.1	0.00010	0.019
Reasonable Worst Case Average Postclosure																								
Jan	0.00018	0.91	0.14	0.0025	0.00020	0.0013	0.0032	0.060	1.6	0.73	0.00017	0.70	0.015	17	0.0042	3.0	0.084	0.0012	0.0048	0.0038	80	1.3	0.000089	0.020
Feb	0.00018	0.92	0.13	0.0025	0.00020	0.0013	0.0033	0.060	1.6	0.75	0.00017	0.71	0.016	18	0.0042	2.9	0.083	0.0012	0.0049	0.0039	81	1.3	0.000090	0.020
Mar	0.00018	0.92	0.13	0.0026	0.00020	0.0013	0.0033	0.061	1.6	0.76	0.00018	0.72	0.016	18	0.0042	2.9	0.082	0.0012	0.0049	0.0039	82	1.3	0.000090	0.020
Apr	0.00018	0.93	0.14	0.0027	0.00021	0.0013	0.0034	0.063	1.6	0.79	0.00019	0.75	0.017	18	0.0043	3.0	0.084	0.0013	0.0051	0.0041	85	1.4	0.000091	0.021
May	0.00018	0.92	0.14	0.0026	0.00021	0.0013	0.0033	0.061	1.6	0.76	0.00018	0.72	0.016	18	0.0042	3.0	0.083	0.0012	0.0050	0.0040	83	1.4	0.000089	0.020
Jun	0.00017	0.91	0.13	0.0024	0.00020	0.0012	0.0032	0.059	1.6	0.72	0.00017	0.68	0.016	17	0.0041	2.9	0.082	0.0012	0.0048	0.0038	82	1.3	0.000089	0.020
Jul	0.00017	0.91	0.13	0.0024	0.00020	0.0012	0.0032	0.059	1.6	0.72	0.00017	0.68	0.015	17	0.0041	2.9	0.080	0.0012	0.0048	0.0037	80	1.3	0.000088	0.020
Aug	0.00017	0.92	0.13	0.0024	0.00020	0.0012	0.0032	0.059	1.6	0.72	0.00017	0.68	0.016	17	0.0041	2.8	0.079	0.0012	0.0048	0.0037	79	1.3	0.000087	0.020
Sep	0.00017	0.92	0.13	0.0024	0.00020	0.0012	0.0032	0.059	1.6	0.73	0.00017	0.68	0.015	17	0.0041	2.8	0.078	0.0012	0.0048	0.0037	79	1.3	0.000088	0.020
Oct	0.00017	0.91	0.12	0.0024	0.00020	0.0012	0.0032	0.059	1.6	0.73	0.00017	0.69	0.016	17	0.0041	2.7	0.076	0.0012	0.0048	0.0037	79	1.3	0.000089	0.020
Nov	0.00018	0.91	0.12	0.0025	0.00020	0.0012	0.0032	0.059	1.6	0.74	0.00017	0.69	0.016	17	0.0042	2.7	0.075	0.0012	0.0049	0.0038	80	1.3	0.000089	0.020
Dec	0.00018	0.92	0.12	0.0025	0.00020	0.0013	0.0032	0.060	1.6	0.75	0.00017	0.70	0.016	18	0.0042	2.6	0.074	0.0012	0.0049	0.0038	80	1.3	0.000090	0.020
Reasonable Worst Case Max Postclosure																								
Jan	0.00019	0.97	0.21	0.0029	0.00022	0.0014	0.0036	0.064	1.7	0.96	0.00020	0.77	0.024	25	0.0046	4.5	0.13	0.0014	0.0071	0.0046	99	1.9	0.000100	0.022
Feb	0.00019	0.98	0.20	0.0029	0.00022	0.0014	0.0037	0.065	1.7	0.97	0.00020	0.78	0.024	25	0.0047	4.5	0.13	0.0014	0.0072	0.0046	100	1.9	0.00010	0.022
Mar	0.00019	0.98	0.20	0.0030	0.00023	0.0014	0.0037	0.066	1.7	0.99	0.00020	0.79	0.024	25	0.0047	4.4	0.12	0.0014	0.0073	0.0047	100	1.9	0.00010	0.023
Apr	0.00020	1.00	0.20	0.0031	0.00024	0.0014	0.0039	0.068	1.8	1.0	0.00021	0.82	0.025	26	0.0048	4.3	0.12	0.0015	0.0075	0.0049	110	2.0	0.00010	0.023
May	0.00020	0.99	0.19	0.0031	0.00024	0.0014	0.0038	0.067	1.7	1.0	0.00021	0.81	0.025	26	0.0047	4.3	0.12	0.0015	0.0075	0.0049	110	2.0	0.000100	0.023
Jun	0.00019	0.96	0.19	0.0028	0.00022	0.0013	0.0036	0.063	1.7	0.94	0.00019	0.74	0.023	24	0.0046	4.2	0.12	0.0013	0.0070	0.0045	100	1.9	0.000100	0.022
Jul	0.00018	0.97	0.19	0.0028	0.00021	0.0013	0.0035	0.063	1.7	0.93	0.00019	0.74	0.023	24	0.0045	4.1	0.12	0.0013	0.0069	0.0044	100	1.8	0.000098	0.022
Aug	0.00018	0.97	0.19	0.0027	0.00021	0.0013	0.0035	0.063	1.7	0.92	0.00019	0.74	0.023	24	0.0045	4.0	0.11	0.0013	0.0069	0.0044	98	1.8	0.000097	0.021
Sep	0.00019	0.97	0.18	0.0028	0.00021	0.0013	0.0035	0.063	1.7	0.93	0.00019	0.74	0.022	24	0.0045	4.0	0.11	0.0013	0.0068	0.0044	97	1.8	0.000098	0.021
Oct	0.00019	0.96	0.18	0.0028	0.00022	0.0013	0.0036	0.063	1.7	0.94	0.00019	0.75	0.023	24	0.0045	3.9	0.11	0.0013	0.0068	0.0044	97	1.8	0.000098	0.022
Nov	0.00019	0.97	0.18	0.0028	0.00022	0.0014	0.0036	0.063	1.7	0.94	0.00019	0.75	0.023	24	0.0046	3.8	0.11	0.0014	0.0069	0.0045	98	1.8	0.000099	0.022
Dec	0.00019	0.97	0.17	0.0028	0.00022	0.0014	0.0036	0.064	1.7	0.95	0.00019	0.76	0.023	24	0.0046	3.8	0.11	0.0014	0.0069	0.0045	98	1.8	0.000099	0.022

Table 9 W1 Monthly Summary BE WQ Cover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Best Estimate Average Operations																								
Jan	0.000021	0.091	0.079	0.00046	0.000020	0.00032	0.00066	0.0047	0.26	0.40	0.0000093	0.089	0.0012	9.1	0.0010	1.2	0.014	0.00015	0.00039	0.0026	22	0.45	0.000032	0.0037
Feb	0.000021	0.096	0.075	0.00041	0.000032	0.00033	0.00068	0.0071	0.23	0.41	0.0000096	0.065	0.0012	8.6	0.00082	1.2	0.014	0.00016	0.00041	0.0028	21	0.48	0.000033	0.0038
Mar	0.000021	0.11	0.075	0.00045	0.000025	0.00034	0.00069	0.0092	0.26	0.41	0.0000098	0.053	0.0013	8.7	0.00082	1.1	0.014	0.00016	0.00048	0.0028	22	0.50	0.000034	0.0039
Apr	0.000027	0.27	0.080	0.00048	0.000048	0.00033	0.00094	0.011	0.51	0.13	0.000014	0.076	0.0010	5.2	0.0011	0.95	0.030	0.00020	0.00032	0.0022	12	0.23	0.000026	0.0054
May	0.000069	6.2	0.11	0.0033	0.00015	0.0045	0.013	0.023	11	0.17	0.000014	0.32	0.0011	4.3	0.012	1.0	0.015	0.0031	0.00062	0.0013	31	0.24	0.00013	0.029
Jun	0.000024	0.69	0.092	0.00078	0.000041	0.00064	0.0017	0.0075	1.4	0.20	0.000038	0.080	0.0010	6.7	0.0026	0.99	0.016	0.00042	0.00053	0.00064	19	0.23	0.000054	0.0079
Jul	0.000046	3.4	0.11	0.0021	0.000088	0.0025	0.0065	0.015	5.7	0.26	0.000041	0.20	0.0014	6.9	0.0072	1.0	0.016	0.0017	0.00057	0.00100	7.7	0.27	0.000070	0.017
Aug	0.000048	3.0	0.10	0.0024	0.000082	0.0028	0.0058	0.014	6.0	0.64	0.000017	0.30	0.0011	6.3	0.0077	1.0	0.016	0.0018	0.00052	0.0012	12	0.31	0.000094	0.017
Sep	0.000031	0.39	0.089	0.00066	0.000024	0.00046	0.0011	0.0075	1.1	0.24	0.000017	0.10	0.00087	5.8	0.0022	1.1	0.014	0.00037	0.00052	0.00087	14	0.23	0.000085	0.0051
Oct	0.000021	0.19	0.094	0.00055	0.000035	0.00030	0.00065	0.0075	0.61	0.22	0.000014	0.10	0.0011	5.9	0.0017	1.1	0.017	0.00018	0.00053	0.00081	10	0.24	0.000055	0.0031
Nov	0.000021	0.20	0.098	0.00056	0.000061	0.00032	0.00074	0.0077	0.50	0.25	0.000012	0.093	0.0011	6.8	0.0017	1.1	0.016	0.00027	0.00036	0.0021	12	0.29	0.000039	0.0052
Dec	0.000022	0.13	0.100	0.00051	0.000038	0.00033	0.00072	0.0065	0.31	0.37	0.000010	0.083	0.0013	10	0.0018	1.1	0.016	0.00020	0.00038	0.0027	25	0.44	0.000034	0.0045
Best Estimate Max Operations																								
Jan	0.000023	0.11	0.11	0.00051	0.000026	0.00035	0.00072	0.0064	0.30	0.41	0.000011	0.11	0.0014	12	0.0018	1.4	0.017	0.00017	0.00044	0.0029	30	0.50	0.000035	0.0041
Feb	0.000023	0.11	0.090	0.00049	0.000038	0.00035	0.00073	0.0088	0.30	0.42	0.000011	0.11	0.0013	9.0	0.00090	1.4	0.017	0.00017	0.00044	0.0029	22	0.49	0.000036	0.0041
Mar	0.000023	0.13	0.091	0.00050	0.000038	0.00036	0.00074	0.010	0.30	0.42	0.000011	0.067	0.0013	9.0	0.00089	1.4	0.017	0.00017	0.00054	0.0030	23	0.51	0.000036	0.0041
Apr	0.000029	0.28	0.096	0.00051	0.000050	0.00036	0.00099	0.012	0.55	0.42	0.000015	0.091	0.0013	9.0	0.0012	1.3	0.033	0.00021	0.00054	0.0030	23	0.51	0.000036	0.0057
May	0.000072	7.2	0.18	0.0037	0.00016	0.0052	0.015	0.024	12	0.18	0.000015	0.34	0.0014	5.2	0.014	2.0	0.033	0.0036	0.00067	0.0023	32	0.26	0.00014	0.032
Jun	0.000070	6.3	0.15	0.0034	0.00015	0.0046	0.013	0.023	11	0.20	0.000040	0.33	0.0012	7.0	0.013	1.9	0.027	0.0032	0.00063	0.0013	32	0.24	0.00013	0.029
Jul	0.000050	3.5	0.16	0.0022	0.000091	0.0026	0.0068	0.016	5.9	0.27	0.000041	0.21	0.0015	7.0	0.0075	1.7	0.025	0.0017	0.00059	0.0011	19	0.28	0.000072	0.017
Aug	0.000050	3.5	0.16	0.0024	0.000091	0.0029	0.0068	0.016	6.1	0.67	0.000041	0.31	0.0015	7.0	0.0077	1.7	0.025	0.0018	0.00059	0.0013	13	0.32	0.000097	0.018
Sep	0.000048	3.0	0.11	0.0024	0.000082	0.0029	0.0058	0.014	6.1	0.67	0.000017	0.31	0.0011	6.3	0.0077	1.1	0.017	0.0018	0.00054	0.0013	14	0.32	0.000097	0.018
Oct	0.000030	0.22	0.10	0.00056	0.000037	0.00031	0.00079	0.0079	0.73	0.23	0.000017	0.11	0.0011	6.0	0.0019	1.2	0.018	0.00028	0.00055	0.00092	14	0.25	0.000085	0.0044
Nov	0.000022	0.20	0.11	0.00057	0.000070	0.00034	0.00081	0.0081	0.60	0.26	0.000014	0.11	0.0011	7.2	0.0017	1.2	0.018	0.00031	0.00055	0.0027	14	0.32	0.000052	0.0061
Dec	0.000022	0.20	0.11	0.00057	0.000070	0.00034	0.00081	0.0081	0.48	0.41	0.000011	0.094	0.0014	12	0.0018	1.2	0.017	0.00031	0.00044	0.0028	30	0.50	0.000035	0.0061
Best Estimate Average Postclosure																								
Jan	0.000035	0.20	0.027	0.00064	0.000033	0.00037	0.00084	0.0084	0.40	0.45	0.000016	0.11	0.0027	10	0.0013	0.41	0.0050	0.00022	0.00078	0.0026	27	0.54	0.000038	0.0051
Feb	0.000035	0.21	0.024	0.00059	0.000042	0.00038	0.00084	0.010	0.37	0.45	0.000017	0.084	0.0027	9.3	0.0011	0.43	0.0050	0.00022	0.00078	0.0026	24	0.55	0.000038	0.0051
Mar	0.000035	0.22	0.024	0.00062	0.000036	0.00038	0.00084	0.012	0.39	0.45	0.000017	0.072	0.0027	9.4	0.0011	0.39	0.0049	0.00022	0.00084	0.0027	25	0.56	0.000038	0.0051
Apr	0.000039	0.34	0.027	0.00064	0.000055	0.00037	0.0010	0.013	0.59	0.23	0.000020	0.089	0.0025	6.5	0.0014	0.25	0.011	0.00025	0.00071	0.0022	17	0.35	0.000031	0.0064
May	0.000074	5.2	0.042	0.0029	0.00014	0.0038	0.011	0.023	8.9	0.25	0.000020	0.29	0.0027	5.8	0.011	0.26	0.0065	0.0027	0.00096	0.0015	32	0.36	0.00011	0.025
Jun	0.000035	0.86	0.034	0.00095	0.000051	0.00075	0.0020	0.010	1.6	0.26	0.000039	0.10	0.0024	7.6	0.0029	0.24	0.0062	0.00051	0.00085	0.00085	23	0.33	0.000058	0.0090
Jul	0.000054	3.0	0.039	0.0020	0.000089	0.0022	0.0058	0.017	5.0	0.32	0.000043	0.20	0.0027	7.9	0.0065	0.25	0.0057	0.0015	0.00089	0.0011	13	0.37	0.000069	0.016
Aug	0.000056	2.8	0.038	0.0023	0.000085	0.0026	0.0053	0.016	5.4	0.64	0.000022	0.29	0.0025	7.3	0.0070	0.24	0.0055	0.0016	0.00085	0.0014	17	0.40	0.000090	0.017
Sep	0.000042	0.53	0.029	0.00084	0.000036	0.00055	0.0013	0.011	1.2	0.32	0.000022	0.12	0.0024	7.0	0.0025	0.24	0.0046	0.00044	0.00088	0.0011	18	0.35	0.000083	0.0065
Oct	0.000034	0.28	0.030	0.00070	0.000045	0.00035	0.00082	0.011	0.69	0.30	0.000021	0.12	0.0026	7.1	0.0018	0.27	0.0054	0.00024	0.00090	0.0010	16	0.36	0.000057	0.0046
Nov	0.000035	0.29	0.032	0.00071	0.000067	0.00037	0.00090	0.011	0.60	0.32	0.000019	0.11	0.0027	7.9	0.0018	0.29	0.0051	0.00031	0.00076	0.0022	18	0.40	0.000043	0.0063
Dec	0.000036	0.23	0.033	0.00067	0.000047	0.00038	0.00087	0.0098	0.44	0.42	0.000017	0.10	0.0029	11	0.0019	0.28	0.0049	0.00026	0.00078	0.0026	29	0.53	0.000039	0.0057
Best Estimate Max Postclosure																								
Jan	0.000039	0.24	0.052	0.00071	0.000040	0.00041	0.00092	0.011	0.45	0.50	0.000019	0.12	0.0046	13	0.0020	0.73	0.0082	0.00024	0.0012	0.0028	36	0.68	0.000042	0.0057
Feb	0.000039	0.24	0.041	0.00070	0.000050	0.00041	0.00093	0.012	0.45	0.50	0.000019	0.12	0.0046	11	0.0012	0.73	0.0081	0.00024	0.0012	0.0028	29	0.67	0.000042	0.0057
Mar	0.000039	0.26	0.041	0.00071	0.000050	0.00041	0.00093	0.013	0.45	0.50	0.000019	0.087	0.0046	11	0.0012	0.70	0.0080	0.00024	0.0013	0.0029	30	0.69	0.000042	0.0057
Apr	0.000044	0.38	0.044	0.00072	0.000060	0.00041	0.0011	0.015	0.64	0.49	0.000023	0.11	0.0044	11	0.0015	0.54	0.021	0.00028	0.0012	0.0029	30	0.68	0.000042	0.0070
May	0.000079	5.4	0.064	0.0031	0.00014	0.0039	0.011	0.025	9.2	0.31	0.000023	0.31	0.0045	8.0	0.011	0.48	0.017	0.0028	0.0014	0.0024	38	0.49	0.00012	0.027
Jun	0.000078	5.4	0.063	0.0031	0.00014	0.0039	0.011	0.025	9.2	0.31	0.000042	0.31	0.0044	9.3	0.011	0.48	0.0088	0.0028	0.0013	0.0016	38	0.47	0.00012	0.026
Jul	0.000058	3.1	0.058	0.0021	0.000094	0.0023	0.0061	0.018	5.2	0.37	0.000044	0.21	0.0042	9.4	0.0068	0.44	0.0087	0.0016	0.0012	0.0014	26	0.47	0.000072	0.017
Aug	0.000058	3.1	0.056	0.0023	0.000093	0.0025	0.0061	0.018	5.3	0.70	0.000044	0.30	0.0040	9.1	0.0070	0.43	0.0079	0.0016	0.0012	0.0016	21	0.50	0.000093	0.017
Sep	0.000058	2.7	0.055	0.0023	0.000086	0.0025	0.0052	0.016	5.3	0.70	0.000024	0.30	0.0039	8.8	0.0070	0.43	0.0077	0.0016	0.0012	0.0016	23	0.50	0.000093	0.017
Oct	0.000044	0.32	0.045	0.00076	0.000050	0.00038	0.00098	0.012	0.80	0.35	0.000024	0.13	0.0043	8.9	0.0021	0.48	0.0081	0.00033	0.0012	0.0013	23	0.47	0.000083	0.0059
Nov	0.000039	0.32	0.048	0.00077	0.000077	0.00041	0.0010	0.012	0.70	0.37	0.000022	0.13	0.0043	9.9	0.0019	0.49	0.0080	0.00036	0.0012	0.0028	23	0.53	0.000056	0.0074
Dec	0.000039	0.32	0.049	0.00077	0.000077	0.00041	0.0010	0.012	0.60	0.50	0.000020	0.12	0.0045	13	0.0020	0.49	0.0072	0.00036	0.0012	0.0028	36	0.67	0.000042	0.0074

Table 10 W1 Monthly Summary - WC WQ Cover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reasonable Worst Case Average Operations																								
Jan	0.000028	0.10	0.12	0.00050	0.000027	0.00038	0.00075	0.0069	0.30	0.40	0.000026	0.14	0.0014	9.7	0.0011	2.7	0.072	0.00015	0.00060	0.0026	26	0.50	0.000032	0.0042
Feb	0.000029	0.11	0.12	0.00045	0.000039	0.00040	0.00078	0.0095	0.28	0.41	0.000028	0.11	0.0014	9.2	0.00092	2.7	0.072	0.00016	0.00063	0.0028	25	0.53	0.000033	0.0043
Mar	0.000030	0.13	0.12	0.00050	0.000033	0.00041	0.00080	0.012	0.31	0.41	0.000030	0.11	0.0014	9.4	0.00093	2.7	0.072	0.00016	0.00072	0.0028	26	0.55	0.000034	0.0044
Apr	0.000037	0.28	0.12	0.00053	0.000056	0.00041	0.0011	0.014	0.57	0.14	0.000036	0.14	0.0012	5.9	0.0013	2.4	0.087	0.00020	0.00058	0.0022	18	0.29	0.000026	0.0060
May	0.000077	6.2	0.15	0.0033	0.00016	0.0046	0.013	0.025	11	0.17	0.000032	0.37	0.0013	4.9	0.012	2.6	0.074	0.0031	0.00083	0.0013	35	0.29	0.00013	0.029
Jun	0.000030	0.70	0.14	0.00081	0.000046	0.00069	0.0018	0.0092	1.4	0.20	0.000051	0.12	0.0011	7.2	0.0026	2.5	0.074	0.00042	0.00069	0.00064	22	0.27	0.000054	0.0083
Jul	0.000053	3.4	0.15	0.0021	0.000094	0.0026	0.0066	0.017	5.7	0.27	0.000055	0.24	0.0015	7.4	0.0073	2.6	0.075	0.0017	0.00074	0.00100	11	0.31	0.000070	0.017
Aug	0.000054	3.0	0.15	0.0024	0.000088	0.0029	0.0059	0.015	6.1	0.65	0.000031	0.34	0.0013	6.7	0.0078	2.6	0.074	0.0018	0.00068	0.0012	15	0.35	0.000094	0.018
Sep	0.000037	0.40	0.14	0.00069	0.000029	0.00051	0.0012	0.0094	1.1	0.25	0.000031	0.14	0.00100	6.3	0.0023	2.7	0.077	0.00037	0.00069	0.00087	17	0.27	0.000085	0.0055
Oct	0.000028	0.20	0.14	0.00058	0.000041	0.00036	0.00074	0.0096	0.65	0.23	0.000030	0.15	0.0012	6.4	0.0017	2.8	0.081	0.00018	0.00072	0.00081	14	0.28	0.000055	0.0036
Nov	0.000029	0.21	0.15	0.00060	0.000067	0.00038	0.00084	0.0099	0.55	0.25	0.000029	0.14	0.0012	7.3	0.0018	2.8	0.081	0.00027	0.00055	0.0021	16	0.34	0.000039	0.0056
Dec	0.000030	0.14	0.15	0.00055	0.000045	0.00040	0.00081	0.0087	0.36	0.37	0.000028	0.13	0.0015	11	0.0019	2.8	0.080	0.00020	0.00059	0.0027	30	0.49	0.000034	0.0050
Reasonable Worst Case Max Operations																								
Jan	0.000033	0.12	0.16	0.00055	0.000035	0.00044	0.00085	0.0091	0.36	0.42	0.000034	0.17	0.0016	12	0.0019	3.3	0.087	0.00017	0.00071	0.0029	36	0.55	0.000035	0.0047
Feb	0.000034	0.12	0.14	0.00054	0.000047	0.00045	0.00087	0.012	0.36	0.42	0.000036	0.17	0.0015	9.7	0.0010	3.3	0.087	0.00017	0.00074	0.0029	28	0.56	0.000036	0.0048
Mar	0.000035	0.15	0.14	0.00055	0.000048	0.00046	0.00089	0.014	0.37	0.42	0.000038	0.14	0.0016	9.9	0.0010	3.2	0.087	0.00017	0.00086	0.0030	29	0.58	0.000036	0.0049
Apr	0.000042	0.30	0.15	0.00057	0.000062	0.00046	0.0012	0.015	0.63	0.42	0.000044	0.17	0.0016	9.9	0.0014	3.1	0.10	0.00021	0.00086	0.0030	29	0.58	0.000036	0.0065
May	0.000083	7.2	0.26	0.0037	0.00016	0.0052	0.015	0.027	12	0.18	0.000041	0.41	0.0015	6.1	0.014	5.1	0.14	0.0036	0.00097	0.0023	38	0.33	0.00014	0.032
Jun	0.000079	6.4	0.24	0.0034	0.00016	0.0047	0.013	0.026	11	0.21	0.000056	0.38	0.0013	7.5	0.013	4.8	0.14	0.0032	0.00084	0.0013	36	0.29	0.00013	0.030
Jul	0.000055	3.5	0.23	0.0022	0.000098	0.0027	0.0069	0.018	6.0	0.27	0.000058	0.26	0.0016	7.5	0.0076	4.4	0.13	0.0017	0.00079	0.0011	23	0.32	0.000072	0.018
Aug	0.000055	3.5	0.23	0.0024	0.000098	0.0029	0.0069	0.018	6.1	0.67	0.000058	0.36	0.0016	7.5	0.0078	4.4	0.13	0.0018	0.00078	0.0013	17	0.36	0.000097	0.018
Sep	0.000055	3.0	0.16	0.0024	0.000088	0.0029	0.0059	0.016	6.1	0.67	0.000035	0.36	0.0013	6.8	0.0078	2.9	0.082	0.0018	0.00075	0.0013	18	0.36	0.000097	0.018
Oct	0.000038	0.23	0.15	0.00060	0.000045	0.00038	0.00088	0.010	0.78	0.23	0.000035	0.16	0.0013	6.6	0.0020	3.0	0.088	0.00028	0.00078	0.00092	18	0.30	0.000085	0.0049
Nov	0.000031	0.22	0.16	0.00062	0.000078	0.00042	0.00092	0.011	0.65	0.27	0.000034	0.16	0.0013	7.9	0.0018	3.1	0.088	0.00031	0.00078	0.0027	19	0.37	0.000052	0.0066
Dec	0.000032	0.22	0.16	0.00062	0.000078	0.00043	0.00092	0.011	0.53	0.41	0.000032	0.15	0.0016	12	0.0019	3.1	0.087	0.00031	0.00069	0.0028	35	0.55	0.000035	0.0066
Reasonable Worst Case Average Postclosure																								
Jan	0.000048	0.24	0.037	0.00091	0.000055	0.00046	0.0011	0.014	0.46	0.50	0.000040	0.18	0.0046	11	0.0016	0.79	0.019	0.00038	0.0013	0.0026	33	0.64	0.000040	0.0066
Feb	0.000049	0.24	0.034	0.00086	0.000064	0.00046	0.0011	0.016	0.43	0.50	0.000040	0.16	0.0046	10	0.0014	0.82	0.019	0.00038	0.0013	0.0026	31	0.65	0.000041	0.0066
Mar	0.000049	0.26	0.034	0.00090	0.000059	0.00046	0.0011	0.017	0.45	0.50	0.000041	0.15	0.0047	10	0.0014	0.76	0.019	0.00038	0.0014	0.0027	32	0.66	0.000041	0.0067
Apr	0.000054	0.39	0.038	0.00094	0.000078	0.00046	0.0014	0.019	0.66	0.28	0.000045	0.16	0.0046	7.4	0.0017	0.62	0.031	0.00042	0.0013	0.0022	24	0.45	0.000034	0.0080
May	0.000088	5.2	0.055	0.0032	0.00016	0.0039	0.011	0.029	9.0	0.30	0.000044	0.37	0.0046	6.6	0.011	0.64	0.021	0.0028	0.0015	0.0015	39	0.46	0.00012	0.027
Jun	0.000047	0.89	0.045	0.0012	0.000070	0.00082	0.0023	0.015	1.6	0.31	0.000059	0.16	0.0040	8.3	0.0031	0.57	0.019	0.00065	0.0013	0.00085	29	0.41	0.000060	0.010
Jul	0.000066	3.0	0.052	0.0023	0.00011	0.0023	0.0060	0.021	5.0	0.36	0.000063	0.26	0.0044	8.6	0.0067	0.59	0.019	0.0016	0.0014	0.0011	19	0.46	0.000071	0.017
Aug	0.000068	2.8	0.050	0.0025	0.00010	0.0026	0.0056	0.020	5.5	0.69	0.000043	0.35	0.0042	8.1	0.0073	0.58	0.018	0.0018	0.0013	0.0014	22	0.49	0.000092	0.018
Sep	0.000055	0.56	0.039	0.0011	0.000057	0.00063	0.0016	0.016	1.3	0.37	0.000044	0.19	0.0042	7.8	0.0027	0.58	0.017	0.00059	0.0014	0.0011	25	0.44	0.000085	0.0079
Oct	0.000048	0.32	0.041	0.00098	0.000067	0.00043	0.0011	0.016	0.75	0.35	0.000044	0.19	0.0046	8.0	0.0021	0.63	0.019	0.00040	0.0014	0.0010	22	0.46	0.000060	0.0061
Nov	0.000049	0.33	0.043	0.00099	0.000089	0.00046	0.0012	0.016	0.66	0.37	0.000042	0.18	0.0046	8.7	0.0021	0.64	0.019	0.00048	0.0013	0.0022	24	0.50	0.000045	0.0078
Dec	0.000050	0.27	0.044	0.00096	0.000070	0.00046	0.0012	0.015	0.50	0.47	0.000041	0.17	0.0048	12	0.0022	0.63	0.018	0.00042	0.0013	0.0026	35	0.63	0.000041	0.0073
Reasonable Worst Case Max Postclosure																								
Jan	0.000056	0.28	0.075	0.0011	0.000068	0.00051	0.0013	0.017	0.53	0.57	0.000048	0.21	0.0072	15	0.0024	1.5	0.039	0.00045	0.0021	0.0028	45	0.83	0.000045	0.0076
Feb	0.000057	0.29	0.063	0.0010	0.000079	0.00052	0.0013	0.019	0.53	0.57	0.000048	0.21	0.0072	12	0.0016	1.5	0.038	0.00045	0.0021	0.0028	38	0.83	0.000045	0.0076
Mar	0.000057	0.31	0.063	0.0011	0.000078	0.00052	0.0013	0.020	0.53	0.57	0.000049	0.18	0.0072	13	0.0016	1.5	0.038	0.00046	0.0022	0.0029	39	0.85	0.000045	0.0077
Apr	0.000063	0.43	0.066	0.0011	0.000090	0.00052	0.0015	0.022	0.73	0.57	0.000054	0.20	0.0072	12	0.0019	1.3	0.050	0.00050	0.0021	0.0029	39	0.83	0.000045	0.0091
May	0.000096	5.4	0.085	0.0034	0.00017	0.0040	0.011	0.032	9.3	0.38	0.000053	0.40	0.0072	9.2	0.011	1.2	0.044	0.0030	0.0023	0.0024	47	0.64	0.00012	0.029
Jun	0.000094	5.4	0.084	0.0034	0.00017	0.0040	0.011	0.031	9.3	0.37	0.000065	0.39	0.0069	10	0.011	1.2	0.035	0.0030	0.0022	0.0016	46	0.62	0.00012	0.028
Jul	0.000072	3.2	0.077	0.0024	0.00012	0.0024	0.0064	0.024	5.2	0.42	0.000068	0.29	0.0064	10	0.0071	1.1	0.032	0.0017	0.0020	0.0014	33	0.61	0.000075	0.018
Aug	0.000073	3.2	0.074	0.0026	0.00012	0.0026	0.0064	0.024	5.4	0.76	0.000068	0.37	0.0062	10.0	0.0073	1.1	0.032	0.0018	0.0019	0.0016	28	0.63	0.000096	0.019
Sep	0.000073	2.7	0.073	0.0026	0.00011	0.0026	0.0055	0.022	5.4	0.76	0.000050	0.37	0.0062	9.7	0.0073	1.1	0.032	0.0018	0.0020	0.0016	30	0.63	0.000096	0.018
Oct	0.000060	0.37	0.064	0.0011	0.000077	0.00048	0.0013	0.019	0.87	0.41	0.000050	0.22	0.0068	10.0	0.0024	1.2	0.034	0.00052	0.0021	0.0013	30	0.62	0.000086	0.0076
Nov	0.000056	0.36	0.068	0.0011	0.00010	0.00051	0.0014	0.019	0.78	0.44	0.000050	0.22	0.0068	11	0.0023	1.2	0.034	0.00057	0.0021	0.0028	31	0.68	0.000059	0.0093
Dec	0.000056	0.36	0.068	0.0011	0.00010	0.00051	0.0014	0.019	0.67	0.56	0.000048	0.20	0.0071	15	0.0024	1.2	0.033	0.00056	0.0020	0.0028	45	0.82	0.000045	0.0093

Table 11 W1 Monthly Summary BE WQ NoCover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Best Estimate Average Operations																								
Jan	0.000021	0.091	0.079	0.00046	0.000020	0.00032	0.00066	0.0047	0.26	0.40	0.0000093	0.089	0.0012	9.1	0.0010	1.2	0.014	0.00015	0.00039	0.0026	22	0.45	0.000032	0.0037
Feb	0.000021	0.096	0.075	0.00041	0.000032	0.00033	0.00068	0.0071	0.23	0.41	0.0000096	0.065	0.0012	8.6	0.00082	1.2	0.014	0.00016	0.00041	0.0028	21	0.48	0.000033	0.0038
Mar	0.000021	0.11	0.075	0.00045	0.000025	0.00034	0.00069	0.0092	0.26	0.41	0.0000098	0.053	0.0013	8.7	0.00082	1.1	0.014	0.00016	0.00048	0.0028	22	0.50	0.000034	0.0039
Apr	0.000027	0.27	0.080	0.00048	0.000048	0.00033	0.00094	0.011	0.51	0.13	0.000014	0.076	0.0010	5.2	0.0011	0.95	0.030	0.00020	0.00032	0.0022	12	0.23	0.000026	0.0054
May	0.000069	6.2	0.11	0.0033	0.00015	0.0045	0.013	0.023	11	0.17	0.000014	0.32	0.0011	4.3	0.012	1.0	0.015	0.0031	0.00062	0.0013	31	0.24	0.00013	0.029
Jun	0.000024	0.69	0.092	0.00078	0.000041	0.00064	0.0017	0.0075	1.4	0.20	0.000038	0.080	0.0010	6.7	0.0026	0.99	0.016	0.00042	0.00053	0.00064	19	0.23	0.000054	0.0079
Jul	0.000046	3.4	0.11	0.0021	0.000088	0.0025	0.0065	0.015	5.7	0.26	0.000041	0.20	0.0014	6.9	0.0072	1.0	0.016	0.0017	0.00057	0.00100	7.7	0.27	0.000070	0.017
Aug	0.000048	3.0	0.10	0.0024	0.000082	0.0028	0.0058	0.014	6.0	0.64	0.000017	0.30	0.0011	6.3	0.0077	1.0	0.016	0.0018	0.00052	0.0012	12	0.31	0.000094	0.017
Sep	0.000031	0.39	0.089	0.00066	0.000024	0.00046	0.0011	0.0075	1.1	0.24	0.000017	0.10	0.00087	5.8	0.0022	1.1	0.014	0.00037	0.00052	0.00087	14	0.23	0.000085	0.0051
Oct	0.000021	0.19	0.094	0.00055	0.000035	0.00030	0.00065	0.0075	0.61	0.22	0.000014	0.10	0.0011	5.9	0.0017	1.1	0.017	0.00018	0.00053	0.00081	10	0.24	0.000055	0.0031
Nov	0.000021	0.20	0.098	0.00056	0.000061	0.00032	0.00074	0.0077	0.50	0.25	0.000012	0.093	0.0011	6.8	0.0017	1.1	0.016	0.00027	0.00036	0.0021	12	0.29	0.000039	0.0052
Dec	0.000022	0.13	0.100	0.00051	0.000038	0.00033	0.00072	0.0065	0.31	0.37	0.000010	0.083	0.0013	10	0.0018	1.1	0.016	0.00020	0.00038	0.0027	25	0.44	0.000034	0.0045
Best Estimate Max Operations																								
Jan	0.000023	0.11	0.11	0.00051	0.000026	0.00035	0.00072	0.0064	0.30	0.41	0.000011	0.11	0.0014	12	0.0018	1.4	0.017	0.00017	0.00044	0.0029	30	0.50	0.000035	0.0041
Feb	0.000023	0.11	0.090	0.00049	0.000038	0.00035	0.00073	0.0088	0.30	0.42	0.000011	0.11	0.0013	9.0	0.00090	1.4	0.017	0.00017	0.00044	0.0029	22	0.49	0.000036	0.0041
Mar	0.000023	0.13	0.091	0.00050	0.000038	0.00036	0.00074	0.010	0.30	0.42	0.000011	0.067	0.0013	9.0	0.00089	1.4	0.017	0.00017	0.00054	0.0030	23	0.51	0.000036	0.0041
Apr	0.000029	0.28	0.096	0.00051	0.000050	0.00036	0.00099	0.012	0.55	0.42	0.000015	0.091	0.0013	9.0	0.0012	1.3	0.033	0.00021	0.00054	0.0030	23	0.51	0.000036	0.0057
May	0.000072	7.2	0.18	0.0037	0.00016	0.0052	0.015	0.024	12	0.18	0.000015	0.34	0.0014	5.2	0.014	2.0	0.033	0.0036	0.00067	0.0023	32	0.26	0.00014	0.032
Jun	0.000070	6.3	0.15	0.0034	0.00015	0.0046	0.013	0.023	11	0.20	0.000040	0.33	0.0012	7.0	0.013	1.9	0.027	0.0032	0.00063	0.0013	32	0.24	0.00013	0.029
Jul	0.000050	3.5	0.16	0.0022	0.000091	0.0026	0.0068	0.016	5.9	0.27	0.000041	0.21	0.0015	7.0	0.0075	1.7	0.025	0.0017	0.00059	0.0011	19	0.28	0.000072	0.017
Aug	0.000050	3.5	0.16	0.0024	0.000091	0.0029	0.0068	0.016	6.1	0.67	0.000041	0.31	0.0015	7.0	0.0077	1.7	0.025	0.0018	0.00059	0.0013	13	0.32	0.000097	0.018
Sep	0.000048	3.0	0.11	0.0024	0.000082	0.0029	0.0058	0.014	6.1	0.67	0.000017	0.31	0.0011	6.3	0.0077	1.1	0.017	0.0018	0.00054	0.0013	14	0.32	0.000097	0.018
Oct	0.000030	0.22	0.10	0.00056	0.000037	0.00031	0.00079	0.0079	0.73	0.23	0.000017	0.11	0.0011	6.0	0.0019	1.2	0.018	0.00028	0.00055	0.00092	14	0.25	0.000085	0.0044
Nov	0.000022	0.20	0.11	0.00057	0.000070	0.00034	0.00081	0.0081	0.60	0.26	0.000014	0.11	0.0011	7.2	0.0017	1.2	0.018	0.00031	0.00055	0.0027	14	0.32	0.000052	0.0061
Dec	0.000022	0.20	0.11	0.00057	0.000070	0.00034	0.00081	0.0081	0.48	0.41	0.000011	0.094	0.0014	12	0.0018	1.2	0.017	0.00031	0.00044	0.0028	30	0.50	0.000035	0.0061
Best Estimate Average Postclosure																								
Jan	0.000036	0.20	0.027	0.00066	0.000035	0.00040	0.00088	0.0097	0.41	0.46	0.000017	0.13	0.0029	10	0.0014	0.41	0.0050	0.00023	0.00087	0.0029	28	0.57	0.000040	0.0053
Feb	0.000036	0.20	0.024	0.00061	0.000044	0.00040	0.00088	0.012	0.38	0.46	0.000017	0.10	0.0029	9.6	0.0011	0.43	0.0050	0.00023	0.00087	0.0029	26	0.57	0.000040	0.0053
Mar	0.000036	0.22	0.024	0.00065	0.000038	0.00040	0.00088	0.013	0.40	0.46	0.000018	0.092	0.0029	9.7	0.0011	0.39	0.0049	0.00023	0.00093	0.0029	27	0.59	0.000040	0.0053
Apr	0.000041	0.35	0.027	0.00068	0.000057	0.00039	0.0011	0.015	0.60	0.24	0.000021	0.11	0.0027	6.9	0.0014	0.25	0.011	0.00026	0.00080	0.0025	19	0.38	0.000033	0.0066
May	0.000075	5.2	0.042	0.0030	0.00014	0.0038	0.011	0.025	8.9	0.26	0.000021	0.31	0.0028	6.1	0.011	0.26	0.0065	0.0027	0.0010	0.0017	34	0.38	0.00012	0.026
Jun	0.000036	0.86	0.034	0.00097	0.000052	0.00077	0.0021	0.012	1.6	0.27	0.000040	0.12	0.0025	7.9	0.0029	0.24	0.0062	0.00052	0.00092	0.0011	24	0.35	0.000059	0.0092
Jul	0.000055	3.0	0.039	0.0020	0.000090	0.0022	0.0058	0.018	5.0	0.32	0.000043	0.21	0.0028	8.1	0.0065	0.25	0.0057	0.0015	0.00097	0.0014	14	0.39	0.000070	0.016
Aug	0.000057	2.7	0.038	0.0023	0.000087	0.0026	0.0054	0.017	5.4	0.65	0.000023	0.31	0.0027	7.6	0.0071	0.24	0.0055	0.0017	0.00093	0.0016	18	0.42	0.000092	0.017
Sep	0.000043	0.53	0.029	0.00086	0.000038	0.00057	0.0014	0.012	1.2	0.33	0.000023	0.14	0.0025	7.3	0.0025	0.24	0.0046	0.00045	0.00095	0.0013	20	0.37	0.000084	0.0067
Oct	0.000035	0.28	0.030	0.00073	0.000046	0.00037	0.00086	0.012	0.70	0.30	0.000021	0.14	0.0028	7.5	0.0018	0.27	0.0054	0.00025	0.00099	0.0013	17	0.38	0.000059	0.0048
Nov	0.000036	0.29	0.032	0.00074	0.000069	0.00039	0.00094	0.012	0.61	0.33	0.000019	0.13	0.0028	8.2	0.0019	0.29	0.0051	0.00032	0.00084	0.0024	19	0.43	0.000045	0.0065
Dec	0.000037	0.23	0.033	0.00070	0.000049	0.00040	0.00091	0.011	0.45	0.43	0.000018	0.12	0.0030	11	0.0019	0.28	0.0049	0.00026	0.00087	0.0029	30	0.55	0.000040	0.0059
Best Estimate Max Postclosure																								
Jan	0.000040	0.23	0.052	0.00074	0.000042	0.00043	0.00097	0.012	0.47	0.51	0.000020	0.15	0.0048	14	0.0020	0.73	0.0082	0.00025	0.0013	0.0031	38	0.70	0.000043	0.0059
Feb	0.000040	0.24	0.041	0.00073	0.000052	0.00043	0.00097	0.014	0.47	0.51	0.000020	0.15	0.0047	12	0.0013	0.73	0.0081	0.00025	0.0013	0.0031	31	0.70	0.000044	0.0059
Mar	0.000041	0.26	0.041	0.00074	0.000052	0.00044	0.00097	0.015	0.46	0.51	0.000020	0.11	0.0048	12	0.0013	0.70	0.0080	0.00025	0.0014	0.0031	32	0.72	0.000044	0.0059
Apr	0.000046	0.38	0.044	0.00076	0.000062	0.00044	0.0012	0.016	0.66	0.50	0.000024	0.13	0.0046	12	0.0015	0.54	0.021	0.00029	0.0013	0.0031	31	0.70	0.000044	0.0073
May	0.000080	5.4	0.064	0.0031	0.00015	0.0040	0.011	0.026	9.2	0.32	0.000024	0.34	0.0047	8.4	0.011	0.48	0.017	0.0028	0.0015	0.0027	39	0.51	0.00012	0.027
Jun	0.000079	5.4	0.063	0.0031	0.00015	0.0040	0.011	0.026	9.2	0.31	0.000043	0.33	0.0045	9.6	0.011	0.48	0.0088	0.0028	0.0014	0.0019	39	0.49	0.00012	0.027
Jul	0.000059	3.1	0.058	0.0021	0.000095	0.0023	0.0061	0.019	5.2	0.37	0.000045	0.23	0.0043	9.7	0.0068	0.44	0.0087	0.0016	0.0013	0.0016	27	0.49	0.000073	0.017
Aug	0.000059	3.1	0.056	0.0023	0.000095	0.0026	0.0061	0.019	5.3	0.71	0.000045	0.32	0.0041	9.4	0.0070	0.43	0.0079	0.0016	0.0012	0.0018	22	0.52	0.000095	0.017
Sep	0.000059	2.7	0.055	0.0023	0.000087	0.0026	0.0052	0.018	5.3	0.71	0.000025	0.32	0.0040	9.1	0.0070	0.43	0.0077	0.0016	0.0013	0.0018	24	0.52	0.000095	0.017
Oct	0.000045	0.32	0.045	0.00078	0.000052	0.00040	0.0010	0.013	0.82	0.35	0.000025	0.15	0.0044	9.2	0.0021	0.48	0.0081	0.00034	0.0013	0.0015	24	0.49	0.000085	0.0061
Nov	0.000040	0.31	0.048	0.00080	0.000079	0.00043	0.0010	0.013	0.72	0.38	0.000023	0.15	0.0044	10	0.0020	0.49	0.0080	0.00037	0.0013	0.0030	25	0.55	0.000057	0.0076
Dec	0.000040	0.31	0.049	0.00079	0.000079	0.00043	0.0010	0.013	0.62	0.50	0.000021	0.14	0.0046	14	0.0020	0.49	0.0072	0.00037	0.0012	0.0031	38	0.70	0.000043	0.0076

Table 12 W1 Monthly Summary - WC WQ NoCover

	Ag	Al	Ammonia	As	Cd	Co	Cr	Cu	Fe	Fluoride	Hg	Mn	Mo	Na	Ni	Nitrate	Nitrite	Pb	Se	Sn	Sulphate	Sr	Tl	Zn
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Reasonable Worst Case Average Operations																								
Jan	0.000028	0.10	0.12	0.00050	0.000027	0.00038	0.00075	0.0069	0.30	0.40	0.000026	0.14	0.0014	9.7	0.0011	2.7	0.072	0.00015	0.00060	0.0026	26	0.50	0.000032	0.0042
Feb	0.000029	0.11	0.12	0.00045	0.000039	0.00040	0.00078	0.0095	0.28	0.41	0.000028	0.11	0.0014	9.2	0.00092	2.7	0.072	0.00016	0.00063	0.0028	25	0.53	0.000033	0.0043
Mar	0.000030	0.13	0.12	0.00050	0.000033	0.00041	0.00080	0.012	0.31	0.41	0.000030	0.11	0.0014	9.4	0.00093	2.7	0.072	0.00016	0.00072	0.0028	26	0.55	0.000034	0.0044
Apr	0.000037	0.28	0.12	0.00053	0.000056	0.00041	0.0011	0.014	0.57	0.14	0.000036	0.14	0.0012	5.9	0.0013	2.4	0.087	0.00020	0.00058	0.0022	18	0.29	0.000026	0.0060
May	0.000077	6.2	0.15	0.0033	0.00016	0.0046	0.013	0.025	11	0.17	0.000032	0.37	0.0013	4.9	0.012	2.6	0.074	0.0031	0.00083	0.0013	35	0.29	0.00013	0.029
Jun	0.000030	0.70	0.14	0.00081	0.000046	0.00069	0.0018	0.0092	1.4	0.20	0.000051	0.12	0.0011	7.2	0.0026	2.5	0.074	0.00042	0.00069	0.00064	22	0.27	0.000054	0.0083
Jul	0.000053	3.4	0.15	0.0021	0.000094	0.0026	0.0066	0.017	5.7	0.27	0.000055	0.24	0.0015	7.4	0.0073	2.6	0.075	0.0017	0.00074	0.00100	11	0.31	0.000070	0.017
Aug	0.000054	3.0	0.15	0.0024	0.000088	0.0029	0.0059	0.015	6.1	0.65	0.000031	0.34	0.0013	6.7	0.0078	2.6	0.074	0.0018	0.00068	0.0012	15	0.35	0.000094	0.018
Sep	0.000037	0.40	0.14	0.00069	0.000029	0.00051	0.0012	0.0094	1.1	0.25	0.000031	0.14	0.00100	6.3	0.0023	2.7	0.077	0.00037	0.00069	0.00087	17	0.27	0.000085	0.0055
Oct	0.000028	0.20	0.14	0.00058	0.000041	0.00036	0.00074	0.0096	0.65	0.23	0.000030	0.15	0.0012	6.4	0.0017	2.8	0.081	0.00018	0.00072	0.00081	14	0.28	0.000055	0.0036
Nov	0.000029	0.21	0.15	0.00060	0.000067	0.00038	0.00084	0.0099	0.55	0.25	0.000029	0.14	0.0012	7.3	0.0018	2.8	0.081	0.00027	0.00055	0.0021	16	0.34	0.000039	0.0056
Dec	0.000030	0.14	0.15	0.00055	0.000045	0.00040	0.00081	0.0087	0.36	0.37	0.000028	0.13	0.0015	11	0.0019	2.8	0.080	0.00020	0.00059	0.0027	30	0.49	0.000034	0.0050
Reasonable Worst Case Max Operations																								
Jan	0.000033	0.12	0.16	0.00055	0.000035	0.00044	0.00085	0.0091	0.36	0.42	0.000034	0.17	0.0016	12	0.0019	3.3	0.087	0.00017	0.00071	0.0029	36	0.55	0.000035	0.0047
Feb	0.000034	0.12	0.14	0.00054	0.000047	0.00045	0.00087	0.012	0.36	0.42	0.000036	0.17	0.0015	9.7	0.0010	3.3	0.087	0.00017	0.00074	0.0029	28	0.56	0.000036	0.0048
Mar	0.000035	0.15	0.14	0.00055	0.000048	0.00046	0.00089	0.014	0.37	0.42	0.000038	0.14	0.0016	9.9	0.0010	3.2	0.087	0.00017	0.00086	0.0030	29	0.58	0.000036	0.0049
Apr	0.000042	0.30	0.15	0.00057	0.000062	0.00046	0.0012	0.015	0.63	0.42	0.000044	0.17	0.0016	9.9	0.0014	3.1	0.10	0.00021	0.00086	0.0030	29	0.58	0.000036	0.0065
May	0.000083	7.2	0.26	0.0037	0.00016	0.0052	0.015	0.027	12	0.18	0.000041	0.41	0.0015	6.1	0.014	5.1	0.14	0.0036	0.00097	0.0023	38	0.33	0.00014	0.032
Jun	0.000079	6.4	0.24	0.0034	0.00016	0.0047	0.013	0.026	11	0.21	0.000056	0.38	0.0013	7.5	0.013	4.8	0.14	0.0032	0.00084	0.0013	36	0.29	0.00013	0.030
Jul	0.000055	3.5	0.23	0.0022	0.000098	0.0027	0.0069	0.018	6.0	0.27	0.000058	0.26	0.0016	7.5	0.0076	4.4	0.13	0.0017	0.00079	0.0011	23	0.32	0.000072	0.018
Aug	0.000055	3.5	0.23	0.0024	0.000098	0.0029	0.0069	0.018	6.1	0.67	0.000058	0.36	0.0016	7.5	0.0078	4.4	0.13	0.0018	0.00078	0.0013	17	0.36	0.000097	0.018
Sep	0.000055	3.0	0.16	0.0024	0.000088	0.0029	0.0059	0.016	6.1	0.67	0.000035	0.36	0.0013	6.8	0.0078	2.9	0.082	0.0018	0.00075	0.0013	18	0.36	0.000097	0.018
Oct	0.000038	0.23	0.15	0.00060	0.000045	0.00038	0.00088	0.010	0.78	0.23	0.000035	0.16	0.0013	6.6	0.0020	3.0	0.088	0.00028	0.00078	0.00092	18	0.30	0.000085	0.0049
Nov	0.000031	0.22	0.16	0.00062	0.000078	0.00042	0.00092	0.011	0.65	0.27	0.000034	0.16	0.0013	7.9	0.0018	3.1	0.088	0.00031	0.00078	0.0027	19	0.37	0.000052	0.0066
Dec	0.000032	0.22	0.16	0.00062	0.000078	0.00043	0.00092	0.011	0.53	0.41	0.000032	0.15	0.0016	12	0.0019	3.1	0.087	0.00031	0.00069	0.0028	35	0.55	0.000035	0.0066
Reasonable Worst Case Average Postclosure																								
Jan	0.000054	0.25	0.037	0.00097	0.000061	0.00052	0.0012	0.017	0.50	0.52	0.000050	0.23	0.0050	12	0.0017	0.79	0.019	0.00040	0.0015	0.0029	37	0.69	0.000042	0.0071
Feb	0.000054	0.25	0.034	0.00092	0.000071	0.00052	0.0012	0.019	0.47	0.52	0.000051	0.20	0.0051	11	0.0015	0.82	0.019	0.00040	0.0015	0.0029	35	0.70	0.000042	0.0072
Mar	0.000055	0.27	0.034	0.00097	0.000066	0.00052	0.0013	0.021	0.49	0.52	0.000051	0.19	0.0051	11	0.0015	0.76	0.019	0.00041	0.0016	0.0029	36	0.72	0.000043	0.0072
Apr	0.000060	0.39	0.038	0.0010	0.000086	0.00052	0.0015	0.022	0.70	0.30	0.000056	0.22	0.0050	8.1	0.0018	0.62	0.031	0.00045	0.0015	0.0025	29	0.51	0.000036	0.0086
May	0.000093	5.2	0.055	0.0033	0.00017	0.0039	0.011	0.032	9.0	0.32	0.000054	0.41	0.0050	7.3	0.011	0.64	0.021	0.0029	0.0017	0.0017	43	0.51	0.00012	0.028
Jun	0.000051	0.89	0.045	0.0012	0.000075	0.00087	0.0024	0.018	1.7	0.32	0.000067	0.20	0.0043	8.9	0.0032	0.57	0.019	0.00066	0.0015	0.0011	32	0.45	0.000061	0.011
Jul	0.000070	3.0	0.052	0.0023	0.00011	0.0023	0.0061	0.024	5.0	0.38	0.000071	0.30	0.0047	9.2	0.0068	0.59	0.019	0.0016	0.0016	0.0014	22	0.50	0.000072	0.018
Aug	0.000072	2.8	0.050	0.0026	0.00011	0.0027	0.0057	0.023	5.5	0.70	0.000052	0.39	0.0045	8.6	0.0074	0.58	0.018	0.0018	0.0015	0.0016	26	0.54	0.000094	0.019
Sep	0.000060	0.57	0.039	0.0011	0.000063	0.00069	0.0017	0.019	1.3	0.38	0.000053	0.23	0.0045	8.4	0.0028	0.58	0.017	0.00061	0.0016	0.0013	28	0.49	0.000087	0.0084
Oct	0.000053	0.32	0.041	0.0010	0.000073	0.00049	0.0012	0.019	0.79	0.36	0.000054	0.24	0.0049	8.6	0.0022	0.63	0.019	0.00042	0.0017	0.0013	26	0.51	0.000061	0.0066
Nov	0.000054	0.33	0.043	0.0011	0.000096	0.00051	0.0013	0.020	0.70	0.39	0.000052	0.23	0.0050	9.4	0.0022	0.64	0.019	0.00050	0.0015	0.0024	28	0.56	0.000047	0.0083
Dec	0.000055	0.28	0.044	0.0010	0.000076	0.00052	0.0013	0.018	0.54	0.49	0.000051	0.22	0.0052	12	0.0023	0.63	0.018	0.00044	0.0016	0.0029	40	0.68	0.000043	0.0078
Reasonable Worst Case Max Postclosure																								
Jan	0.000062	0.29	0.075	0.0011	0.000075	0.00057	0.0014	0.020	0.58	0.58	0.000060	0.26	0.0076	15	0.0025	1.5	0.039	0.00047	0.0023	0.0031	49	0.88	0.000047	0.0081
Feb	0.000062	0.30	0.063	0.0011	0.000086	0.00058	0.0014	0.023	0.58	0.58	0.000061	0.26	0.0076	13	0.0017	1.5	0.038	0.00048	0.0023	0.0031	42	0.88	0.000047	0.0082
Mar	0.000063	0.31	0.063	0.0011	0.000085	0.00058	0.0014	0.024	0.58	0.58	0.000062	0.23	0.0077	13	0.0017	1.5	0.038	0.00048	0.0024	0.0031	43	0.90	0.000047	0.0083
Apr	0.000069	0.44	0.066	0.0012	0.000099	0.00058	0.0017	0.025	0.78	0.58	0.000067	0.26	0.0077	13	0.0020	1.3	0.050	0.00053	0.0023	0.0031	43	0.89	0.000047	0.0097
May	0.00010	5.4	0.085	0.0035	0.00018	0.0041	0.012	0.035	9.4	0.40	0.000066	0.46	0.0077	9.9	0.011	1.2	0.044	0.0030	0.0025	0.0027	51	0.70	0.00013	0.029
Jun	0.000099	5.4	0.084	0.0035	0.00018	0.0041	0.011	0.034	9.3	0.38	0.000075	0.44	0.0072	11	0.011	1.2	0.035	0.0030	0.0024	0.0019	50	0.67	0.00013	0.029
Jul	0.000077	3.2	0.077	0.0025	0.00012	0.0025	0.0065	0.027	5.3	0.43	0.000078	0.33	0.0067	11	0.0072	1.1	0.032	0.0018	0.0021	0.0016	36	0.65	0.000076	0.019
Aug	0.000077	3.2	0.074	0.0026	0.00012	0.0027	0.0065	0.026	5.4	0.77	0.000078	0.42	0.0065	11	0.0074	1.1	0.032	0.0018	0.0021	0.0018	31	0.68	0.000097	0.019
Sep	0.000077	2.7	0.073	0.0026	0.00011	0.0027	0.0056	0.025	5.4	0.77	0.000061	0.42	0.0066	10	0.0074	1.1	0.032	0.0018	0.0022	0.0018	34	0.68	0.000097	0.019
Oct	0.000065	0.37	0.064	0.0012	0.000084	0.00054	0.0014	0.022	0.92	0.43	0.000062	0.27	0.0072	11	0.0025	1.2	0.034	0.00054	0.0023	0.0015	34	0.67	0.000088	0.0081
Nov	0.000061	0.37	0.068	0.0012	0.00011	0.00057	0.0015	0.022	0.82	0.46	0.000062	0.27	0.0072	12	0.0024	1.2	0.034	0.00058	0.0023	0.0030	35	0.73	0.000061	0.0098
Dec	0.000062	0.37	0.068	0.0012	0.00011	0.00057	0.0015	0.022	0.72	0.58	0.000060	0.25	0.0075	15	0.0025	1.2	0.033	0.00058	0.0022	0.0031	49	0.88	0.000047	0.0098

APPENDIX B

MINTO MINE CLOSURE HYDROLOGY REPORT

MINTO MINE PHASE IV CLOSURE HYDROLOGY REPORT

September 2013

Prepared for:

MINTO EXPLORATIONS LTD.

ACCESS CONSULTING GROUP SIGNATURES

Report prepared by:

Holly Goulding, B.Eng., M.Sc
Environmental Engineer (EIT)

Report prepared by:

David Morissette, P. Eng. M. Eng
Water Resources Engineer

Report reviewed by:

Jim Theriault, P.Eng
Senior Geological Engineer

TABLE OF CONTENTS

1 INTRODUCTION 1

2 AVAILABLE DATA 2

2.1 PREVIOUS STUDIES 2
2.2 TOPOGRAPHY 3
2.3 METEOROLOGICAL DATA 3
2.4 HYDROLOGICAL DATA 4

3 SITE CONDITIONS AND LAYOUT 6

3.1 DESCRIPTION 6
3.2 LOCAL CLIMATE 6
3.3 CHALLENGES 6
3.4 SITE LAYOUT 7

4 HYDROLOGICAL ANALYSIS 10

4.1 CONTEXT 10
4.2 CATCHMENT DELINEATION 11
4.3 DETERMINATION OF DESIGN FLOWS FOR PRIMARY DITCHES 11
4.3.1 UPPER PRIMARY DITCH CATCHMENTS 11
4.3.2 LOWER PRIMARY DITCH CATCHMENTS 16
4.3.3 SUMMARY OF DESIGN FLOWS 20
4.4 DETERMINATION OF DESIGN FLOWS FOR SECONDARY AND TERTIARY DITCHES 20
4.4.1 VALIDATION 21

5 HYDRAULIC DESIGN 23

5.1 DESIGN CRITERIA 23
5.1.1 CHANNEL SIZING 23
5.1.2 CONSTRUCTION METHODS AND AVAILABLE MATERIALS 24
5.2 DRAINAGE DITCH DESIGN 25
5.2.1 DITCH PROFILES 25
5.2.2 METHODOLOGY 26
5.2.3 CHANNEL EROSION PROTECTION 27
5.2.4 PRIMARY DITCHES 28
5.2.5 SECONDARY DITCHES 30
5.2.6 TERTIARY DITCHES 31

6 ENERGY DISSIPATION STRUCTURES 32

6.1 SPILLWAYS AND DROP STRUCTURES 32
6.2 CHANNEL INTAKES 32
6.3 STILLING BASINS 33

7 REFERENCES 34

LIST OF TABLES

Table 2-1 Available relevant reference studies 2
Table 4-1 Rainfall intensities from Pelly Ranch IDF curve 13
Table 4-2 Upper primary ditch catchment characteristics 15
Table 4-3 Upper primary ditch catchment flows 15
Table 4-4 Lower primary ditch catchment characteristics 18
Table 4-5 Minto Mine site snow data 18
Table 4-6 Snowmelt base flow analysis 19
Table 4-7 Area 2 Pit outlet and ditch 450 design flows 19
Table 4-8 Main Pit outlet and ditch 400 design flows 20
Table 4-9 Design flows for primary ditches 20
Table 4-10 Secondary and tertiary ditch design flows 21
Table 4-11 Small streams 22
Table 5-1 Primary ditch profile characteristics 26
Table 5-2 Design parameters for primary ditches 29
Table 5-3 Design parameters for secondary ditches 31

LIST OF FIGURES

Figure 2-1 Hydrometric and snow survey stations 5
Figure 3-1 Closure water management layout 9
Figure 4-1 Upper primary ditch catchments 12
Figure 4-2 Lower primary ditch catchments 17
Figure 5-1 Required Rip rap D_{50} to Resist a Given Flow Velocity 28

1 INTRODUCTION

This document presents the methodology and results of hydrological analysis and hydraulic design undertaken in support of Minto Mine's ongoing reclamation and closure planning work. This work builds on the design of water conveyance structures presented in the previous Decommissioning and Reclamation Plan (DRP Revision 3.2), and more recent planning (i.e. for Phase V/VI, including outcomes of a preliminary Failure Modes Effects Assessment conducted in January 2013). In particular, the importance of hydrology and the safe conveyance of site water in the closure condition were recognized, given their influence on the ultimate closure objectives related to site water quality and structural stability in closure. This work is intended to support all closure planning initiatives and documents going forward, but is first and foremost being developed to support the Reclamation and Closure Plan for the Phase IV mine configuration. The development and submission of this plan is required under both of the project's main authorizations – the Quartz Mining Licence and the Water Use Licence. Under both licences it is required for submission by September 16, 2013.

The objective of the current study is to produce a preliminary design for site water conveyance structures, including sizing and erosion protection, to route flow downstream of the mine site. A hydrological analysis was performed to determine design flows.

The design considerations and criteria, methodologies and results of the hydrological analysis and hydraulic design completed for Minto Mine closure are presented in the report.

2 AVAILABLE DATA

Numerous sources of data have been obtained to support the current study. These include previous reports, Minto Mine site topography and end of Phase IV contours, meteorological data gathered on the Minto Mine site and from Environment Canada regional stations, and hydrology data gathered downstream of the Minto Mine and at Environment Yukon hydrometric stations.

2.1 PREVIOUS STUDIES

Several previous studies have focused on the site hydrology and meteorological conditions, water balance and ditch design (operational and for closure) for Minto Mine (Table 2-1). These were reviewed to evaluate past methodologies used and layouts proposed or constructed for water conveyance design on site.

Table 2-1 Available relevant reference studies

Study	Author	Year
Review of Hydrology for Minto Project	Remi J.P. Allard Rescan Environmental Services Ltd.	1997
Minto Copper Project – Site Hydrology Update	Clearwater Consultants Ltd.	2006
Minto Copper Project - Water Balance Model	Clearwater Consultants Ltd.	2008, 2009, 2010
Minto Copper Project – Surface Water Hydrology Conditions	Clearwater Consultants Ltd.	2010
Phase IV Closure Water Balance	Clearwater Consultants Ltd.	2010
Design Drawings of Water Conveyance at Closure	EBA Engineering Consultants Ltd	2011
2012 Water Balance Update for the Minto Mine Site	SRK Consulting	2012
Pipe Design for South Diversion Ditch Realignment	EBA Engineering Consultants Ltd	2012
Precipitation Analysis for the Minto Mine	SRK Consulting	2012
South Diversion Ditch Realignment and Overflow Spillway	SRK Consulting	2013
2013 Water Balance Update for the Minto Mine Site	SRK Consulting	2013
Minto Surface Water Hydrology Baseline Report	Access Consulting Group	2013
Minto Climate Baseline Report	Access Consulting Group	2013

EBA Engineering Consultants Ltd.'s Design Drawings of Water Conveyance at Closure, prepared for the DRP Revision 3.2, were used as the basis to updating channel design. From these designs, channel alignments were altered to accommodate the placement of potential passive treatment elements (i.e. bioreactors, wetlands). Additional changes were made to address concerns raised during review of the DRP Revision 3.2 and during the Preliminary Failure Modes Effects Assessment conducted in January 2013.

Minto Mine sub-catchments were delineated and presented in Clearwater Consultants Ltd.'s Phase IV Closure Water Balance (Clearwater Consultants Ltd, 2010). Given updated end of life footprints for Phase IV, these sub-catchment delineations have been updated.

Recent ditch realignment work for operations (EBA Engineering Consultants Ltd, 2012, SRK Consulting, 2013) was also reviewed in addition to other methods recently used for hydraulic design at the recently constructed Bellekeno Mine near Keno City, Yukon (Interralogic, Inc, 2013) and the Wolverine Mine near Frances Lake, Yukon (Klohn Crippen Berger Ltd and Yukon Zinc Corporation, 2009) mines, such that comparable methodologies might be utilized to achieve a reasonably conservative closure water conveyance design. The intent of this comparison was to evaluate the design methodologies at comparable sites in order to ensure that the current design is consistent with recently developed northern projects and to facilitate the design of reasonably conservative closure water conveyancee systems.

Review of the above noted design work suggested SRK Consulting's most recent hydraulic design completed for the South Diversion Ditch Realignment (SRK Consulting 2013), using a statistical approach developed by USGS (Curran et al., 2003), provided flows that are very high for small catchments like at the Minto Mine Site. The calculated values per km^2 for different flood recurrences are significantly higher than those presented for other mine sites within the Yukon.

Meteorological and hydrology data outlined in the Minto Climate Baseline Report (ACG, 2013a) and the Minto Surface Water Hydrology Baseline Report (ACG, 2013b) were used for the hydrological analysis, as described in sections 2.3 and 2.4.

2.2 TOPOGRAPHY

End of Phase IV contour data (1 metre interval) were provided by Minto Mine. This included the footprints and elevations of proposed covers on waste rock dumps and resurfacing of the dry stack tailings and the Mill Valley Fill. Contour data was also provided for the mine pits. Two sets of contour data were provided for the Mill Valley Fill Extension (MVFE) - representing Stage 1 and a potential maximum limits of Stage 2 MVFE. Only the Stage 1 contours were considered for this analysis, although the addition of Stage 2 MVFE would have s relatively minor effect on the hydraulic design at closure.

The topography data were analysed and treated in ESRI ArcGIS software. Quality topographical data allowed the accurate determination of watershed boundaries within the mine site and to accurately determine optimal profiles for all ditches.

2.3 METEOROLOGICAL DATA

A variety of meteorological data have been utilized to complement the hydrological analysis.

Meteorological data are available for the Minto Mine site from two meteorological stations that have been operational since 2005 and 2010, respectively. They provide a continuous but short record of air temperature, wind velocity and direction, pressure, and precipitation. More information is available in the Minto Climate Baseline Report (ACG, 2013a).

Two Environment Canada stations provide a long-term climate record for the region: Pelly Ranch (Fort Selkirk – Climate ID#2100880), 25 km northeast of the Minto Mine, provides a continuous record of daily air temperatures and precipitation in the form of rainfall and snowfall from 1956 to present (57 years), while Carmacks (Climate ID#2100300) 70 km southeast of the Mine) provides a continuous record of daily air temperatures and precipitation in the form of rainfall and snowfall from 1963 to 2008. For the current

analyses the Pelly Ranch data were used given the longer record and the closer proximity of the station to the mine.

Intensity-Duration-Frequency curves (IDF curves), short-duration rainfall intensity statistics, were obtained for both Pelly Ranch and Carmacks climate stations from Environment Canada. Last updated in 2009 for stations across Canada, the Pelly Ranch and Carmacks IDF curves were calculated from 33 and 13 years of record, respectively. The curves provide estimates of the rates and amounts of rainfall for 5, 10, 15, 30 and 60 minute, and 2, 6, 12, and 24 hour durations for return periods of 2, 5, 10, 25, 50 and 100 years. The rainfall amounts and rates for various return periods are calculated by fitting a series of annual maximum rainfall rates for the corresponding durations to the Gumbel extreme value distribution using the method of moments. Estimates of rates and amounts for the 200-year return period were calculated using the same methodology as applied by Environment Canada.

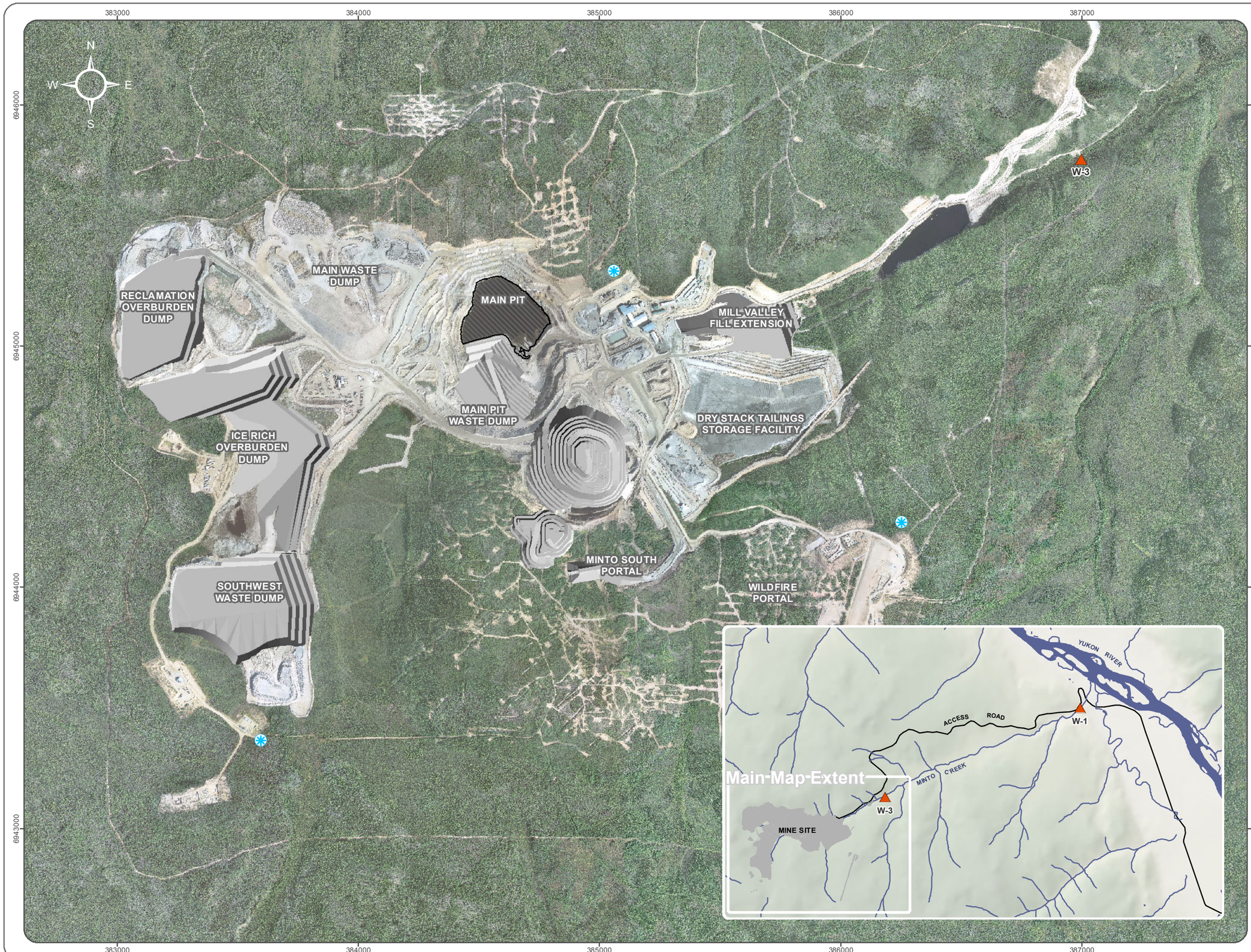
Snow surveys have been conducted at Minto Mine in 1994, 1995, 1998, and annually from 2006 to date, at three locations in the Minto Creek catchment area. Minto#1 is located north of the airstrip with a north-facing aspect. Minto#2 is located near the explosives storage area with an east-facing aspect. Minto#3 is located north of the mill with a south-facing aspect. The locations of snow surveys are shown in Figure 2-1 in the next sub-section. Due to site operations, the snow survey sites were relocated to their present positions in 2007 at the approximate aspects and elevations of the previous sites. Snow surveys have been conducted on the first day of March, April and May, or within 2 days before or after these dates, as conditions allowed. Due to the lack of snow remaining on site by May 1, February snow surveys were begun in 2009 to ensure a consistent annual 3-month record. A snow course at Pelly Ranch provides a long term record for the region, with 27 years of record. However, since Pelly Ranch is located at a much lower altitude (454 m) than Minto this data has only been used for comparison purposes.

2.4 HYDROLOGICAL DATA

Hydrological data collected downstream of the Minto Mine, and data from small streams (<100 km^2) in the same hydrographic region as Minto were utilized to validate design storm flood magnitudes calculated for water conveyance structure design.

Hydrometric data have been collected intermittently on Minto Creek since 1993 at two stations: W1, Minto Creek near the mouth, with a catchment area of 42 km^2 and W3, Minto Creek downstream of water storage pond dam, with a catchment of 10.4 km^2. Data at W3 should be used with caution for the period since 2007, as mining operations have resulted in the storage of a significant amount of water within the mine site.

Environment Yukon has operated a small stream network over the last four decades, collecting mostly seasonal flow records on streams ranging from 4 to 500 km^2. Records from 11 small streams less than 100 km^2 in the interior hydrographic region (Janowicz, 2004) were reviewed to determine peak flows in cubic metres per second per square kilometre, for use in comparisons with the calculated design floods. These streams, with contributing basins not more than 10 times larger than the Minto Mine catchment, were considered useful for comparison purposes, while the Water Survey of Canada station Big Creek Near the Mouth was not used for the analysis given its large size (1800 km^2) resulting in a different hydrological response.



capstone
MINTO MINE

MINTO MINE PHASE IV

CLOSURE HYDROLOGY REPORT

FIGURE 2-1

HYDROMETRIC AND SNOW SURVEY STATIONS

SEPTEMBER 2013

Hydrometric Station

Snow Monitoring Station

0 100 200 300 400 500 Meters

ACCESS

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14th 2012.
Site contours derived from 2012 aerial imagery obtained from Challenger Geomatics.

Hydrology data provided by Minto Explorations Ltd, May 2009.

Datum: NAD 83 Projection: UTM Zone 8N

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\HydrologyReport\WQ_Stns_Loc_20130912.mxd
(*Last edited by: mducharme;12/09/2013/14:11 PM*)

3 SITE CONDITIONS AND LAYOUT

3.1 DESCRIPTION

The Minto Mine is located in central Yukon, approximately 35 km south-west of the community of Pelly Crossing. The area is characterized by rolling hills ranging between 750 and 975 m at the mine site. Minto is located in the extensive discontinuous permafrost zone, thus the areal extent of permafrost ranges from 50-90%, located mostly on north-westerly to north-easterly slopes.

The watershed encompassing the mine site has approximately 50% natural forest cover, with the remaining area having been altered due to mining operations. This includes the excavation of two large pits, having a combined surface area of 0.45 km^2, and several waste rock dumps and a tailings storage facility.

The Minto Mine started operations in 2007. Currently authorized Phase IV mining operations are scheduled to be completed in early 2014, and it is anticipated that Phase V/VI mining operations will commence around the same time – pending authorization. For the purpose of developing the RCP for the Phase IV mine configuration, it is assumed that the site will be decommissioned once Phase IV mining and milling has been completed.

3.2 LOCAL CLIMATE

Minto is located in the subarctic continental climate zone, which is characterized by long, cold winters and short, warm summers. Annual precipitation ranges from 300 to 500 mm. Mean annual temperatures are near –5°C with mean mid-winter temperatures of –23°C to –32°C, in July from +10°C to +15°C and extremes in the lower valleys ranging from –60°C to +35°C.

Extensive analysis of meteorological data available at the Minto Mine site has been conducted, both to determine baseline conditions and to compare site records with the longer data record available at Pelly Ranch. The results show that total annual precipitation is slightly larger at Minto. However, Minto has less rainfall annually than Pelly Ranch, and greater snowfall.

Details of the climate baseline and precipitation analysis are available in the Minto Climate Baseline Report (ACG, 2013a) and the Precipitation Analysis for the Minto Mine Memorandum (SRK Consulting, 2012).

3.3 CHALLENGES

The Minto Mine site presents some key challenges to the design of water conveyance structures. These include:

- Characterizing site hydrology given small catchments with rapid responses to hydrological events, and the compounding influence of discontinuous permafrost at the site, a cold climate, and limited hydrology, meteorological and other climatological data given Minto's remote location;

- Designing water conveyance structures given uncertainty regarding the final topography at closure, especially on and near waste rock dumps. As a result flow direction assumptions are required for sub-catchment delineation in certain areas;

- Addressing topographical/foundation constraints, including steep slopes that occur naturally in the basin and in constructed areas such as the waste rock dumps; and
- Limiting erosion and sedimentation through controlled energy dissipation.

Given these design challenges, a water conveyance layout was established with the primary goal of conveying flows into and throughout the mine footprint, and off of the site in a controlled fashion under a reasonable range of anticipated conditions.

3.4 SITE LAYOUT

The proposed site layout of water conveyance channels has been determined based on the layout proposed in the previous decommissioning and reclamation plan (DRP Revision 3.2), and the mine site topographical constraints at closure. The main objective is to safely convey water downstream of the site, avoiding erosion of waste rock dump covers, tailings and other remaining works at closure.

A combination of primary, secondary and tertiary ditches are proposed (Figure 3-1). Primary water conveyance channels are the main channels that will route the accumulated overland flow through the mine site. They will convey highly variable, intermittent and potentially significant flows. Erosion protection measures will be incorporated to ensure the stability of the channels. Energy dissipation measures will be required to ensure that flow across steep slopes is managed safely and energy is dissipated in controlled locations.

Five primary ditches have been incorporated into the water conveyance design, and are described below.

The South Diversion Ditch (labelled Ditch 100) has been constructed as part of mine operations to intercept flow to protect the Dry Stack Tailings Storage Facility (DSTSF) from run-on flow. This ditch will be upgraded for closure, and will route flows into the Area 2 Pit. The ditch currently has the capacity to carry up to 13.3 m^3/s (SRK, 2013). Currently, during operations, flows are diverted around Area 2 Pit by a pipe which has an estimated capacity of 1.08 m^3/s, while any additional flows enter the pit through a recently constructed spillway.

Flows from the Main Waste Dump and the Reclamation Overburden Dump will be captured in Ditch 300. Ditch 350 will control flow predominantly originating from the Southwest Dump, out of the constructed wetland area. Ditch 300 will discharge its flow into Ditch 350, routing flows into the Main Pit. The alignments of these ditches have been located to minimize flow over erodible buttress soils.

The Main Pit and Area 2 Pit will provide detention for upper catchment flows in the form of pit lakes at closure. The outlets of these pits will direct flow in Ditch 400 and 450, respectively. Ditch 450 will discharge to Ditch 400 in the mill area. Thus, Ditch 400 will convey the majority of on-site flows. The Ditch 400 alignment will stay as far north as possible when crossing the MVFE, hugging the existing hillside, and will be routed down the MVFE NE slope and continuing in the valley bottom (to the north of the W37 collection point) and ultimately terminating up gradient of the water storage pond current location.

Secondary water conveyance channels are ditches that will route runoff water from elevated catchments (i.e. from the top of waste rock dumps and the DSTSF) into the primary ditches and/or energy dissipation and sediment control ponds. These will convey flow from much smaller catchment areas than primary ditches,

but will route water down relatively steep slopes (e.g., 2H:1V), which can lead to high flow velocities. The design of secondary ditches will incorporate structures to drop water along the waste rock dump steep faces (i.e spillways, drop structure, baffles) in addition to energy dissipation/sediment control ponds at the base of steep slopes. Their final alignment will be determined at closure.

The Tailings Diversion Ditch being upgraded in fall 2013 as part of operations, has also been retained to assist in preventing run-on flows from entering the DSTSF. It is treated as a secondary ditch, and routes flows to the water storage pond, and will be upgraded as required for closure.

Tertiary water conveyance channels are relatively minor ditches and swales that will direct overland flow on the elevated catchment areas towards secondary ditches, protecting the steep slopes from concentrated surface flow. They will be designed to intercept flow before it can concentrate and potentially erode cover materials. These ditches will route small flows with low flow velocities due to the very small areas of surface runoff being managed.

capstone
MINTO MINE

MINTO MINE PHASE IV

CLOSURE HYDROLOGY REPORT

FIGURE 3-1
CLOSURE WATER MANAGEMENT LAYOUT

SEPTEMBER 2013

- Proposed Diversion Structure (Primary Ditch)
- Proposed Diversion Structure (Secondary Ditch)
- Proposed Diversion Structure (Tertiary Ditch)
- Existing (Primary) Diversion Ditch (to be consolidated at closure)
- Existing Diversion Ditch
- Pit Lake
- Sediment Pond

THE LAYOUT OF THE DITCHES IS CONCEPTUAL AND WILL BE FINALIZED IN CONJUNCTION WITH THE DETAILED CLOSURE DESIGN. THE MAIN WASTE DUMP DITCHES ARE NOT SHOWN ON THIS FIGURE AND WILL BE DESIGNED AT CLOSURE

0 100 200 300 400 500 Meters

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14th 2012.

NAD 83 UTM Zone 8N

ACCESS

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. AccessMining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_6-2_ClosureWaterManagement_20130912.mxd
(*Last edited by: mducharme;13/09/2013;07:59 AM*)

4 HYDROLOGICAL ANALYSIS

4.1 CONTEXT

The Minto Mine footprint is within a small upper catchment of the Minto creek watershed. The total catchment upstream of W3 (located at the downstream end of the mine site) is 10.4 km^2, with monthly average flows at W3 ranging from 0.02 to 0.16 m^3/s for the pre-mining record, with the exception of one spot measurement in May 1997 that reached 0.55 m^3/s. The water conveyance infrastructure designed for closure is intended to control flows into, within and beyond the mine footprint, including controlled energy dissipation to limit erosion and sedimentation. As described above, water conveyance channels can be classified as:

- Primary ditches, with sub-catchments ranging from ~1 km^2 for the primary drainage ditches in the upper catchment to 8 km^2 for ditches 400/450 routing most of the water to the outlet of the mine site;

- Secondary ditches routing flows off the covers (i.e. waste rock dumps and DSTSF) with sub-catchments mainly under 1 km^2; and

- Tertiary ditches directing flows on the covers to the secondary ditches.

The small size of the sub-catchments creates inherent uncertainty in the calculation of design flows, because smaller basins have more rapid responses to hydrological events and are highly influenced by local conditions. In addition, disturbed and reclaimed areas present a challenge to the hydrological design as they require the characterization of non-natural and irregular topography. In particular, the waste rock dumps are characterized by flat covers and steep slopes on downgradient faces. The presence of discontinuous permafrost at the site has been incorporated into the hydrological design where possible through the characterization of groundcover and runoff rates. Where limitations in data quantity and quality were identified, conservative methodologies were applied.

For the larger sub-catchments encompassing the pits (related to ditches 400 and 450) the additional routing of water through the pits provides significant attenuation of flows for design storms. As such, a study was conducted to determine the hydrological inputs that would tend to produce the greatest flows, and resulted in the consideration of constant spring snowmelt flows combined with a 24-hour rainfall event to estimate peak flow events in these sub-catchments. Efforts have been made to validate the methodology using local and regional data.

The 200-year flood (0.5% probability of exceedance in any single year) was selected as the baseline design flood for these closure planning initiatives. The closure planning team feels that this is an appropriate criteria for the design of closure water conveyance structures at the Minto Mine site. Preliminary sizing of water conveyance and diversion channels for closure was conducted to provide minimum dimensions that are required to safely convey the 1:200 year flood. It is recognized that the flow capacity of channels has the potential to be reduced due to possible partial obstructions (e.g., ice damming, sediment accumulation, debris). Adequate freeboard will be applied to all channels to ensure that they have additional hydraulic capacity to convey larger flows if required, or to offset any part of the cross-section that could be obstructed.

4.2 CATCHMENT DELINEATION

Catchment delineation presents a challenge at the Minto Mine site, due to the small size of the catchments and the presence of waste rock dumps and tailings storage that may be modified at closure.

Delineation of the primary ditch sub-catchments was performed using ESRI Spatial Analyst Software in ArcGIS. Raster data were created using a one metre resolution. The end-of-Phase-IV contour data was used to create a one metre resolution digital elevation model (DEM) of the site. This DEM was then used to anticipate how water will flow over the landscape at closure.

The DEM was altered to reflect the proposed diversion structures, "forcing" the water to move into ditches at the desired locations. Using ESRI Spatial Analyst Watershed tools, a fill was applied to the DEM to eliminate artifacts in the DEM. It was determined that a fill of 5 metres was most appropriate, filling artifact sinks and not forcing water around legitimate obstacles. The flow direction and flow accumulation were determined in order to delineate the catchments above each ditch.

General characteristics of each catchment were derived from the contour data, including average channel slope, longest flow path, and forested and disturbed/reclaimed coverage. This data was used in the determination of design flows, as presented in the following section.

The primary ditch sub-catchments are presented in Figures 4-1 and 4-2.

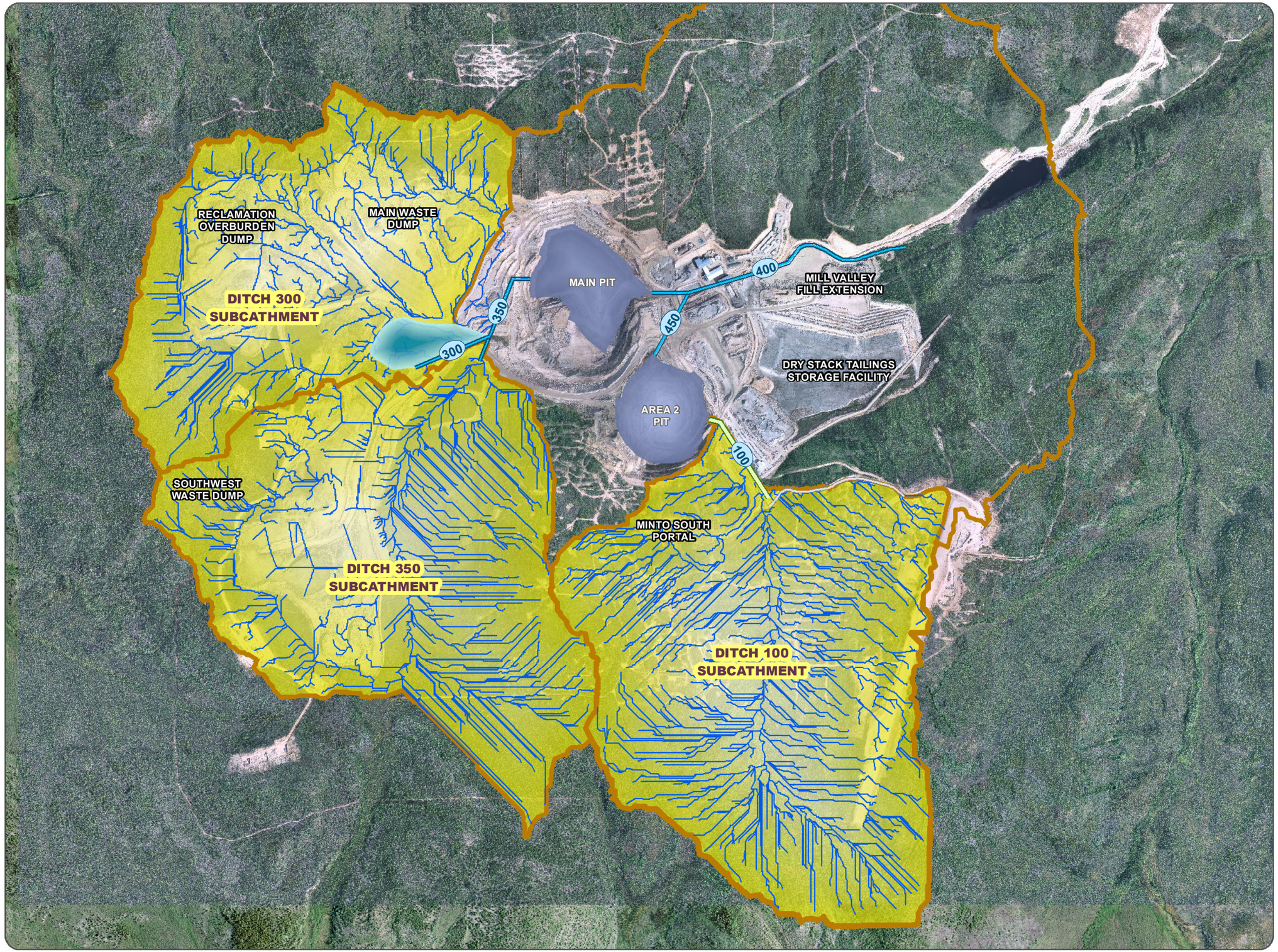
Catchment delineation for secondary ditches was performed using the same methodology. The surface area of each cover contributing to a secondary channel was calculated, and average channel slope and longest flow path were derived.

4.3 DETERMINATION OF DESIGN FLOWS FOR PRIMARY DITCHES

Design flood flows for primary ditches were calculated using the rational method, based on the catchment area. The rational method is widely used for flood estimation in small (<25 km^2) rural and urban drainage basins (MTQ, 2004). Given that extreme rainfall events tend to yield the largest instantaneous flows for small watersheds like the Minto Mine site, the rational method provides a methodology to calculate extreme flows from design rainfall events. For all ditches located upstream of the Main Pit and Area 2 Pit the values calculated using the rational method were used directly for hydraulic design, since flows entering these ditches won't experience any significant routing through water bodies. For ditches 400 and 450 located downstream of the pits, flow routing through the pits was considered given the significant surface area of the pits compared to the calculated flows. Freshet flows resulting from snowmelt were considered for the routing study since this is the hydrological scenario that will produce the highest flows for ditches 400 and 450, maximising the inflow volume. The methodology used and the resulting design flows are presented in the following sections.

4.3.1 Upper primary ditch catchments

Upper primary ditch catchments include all ditches located upstream of the Main Pit and Area 2 Pit. The delineated sub- catchments are shown in Figure 4-1.



capstone
MINTO MINE

MINTO MINE PHASE IV

CLOSURE HYDROLOGY REPORT

FIGURE 4-1

UPPER PRIMARY DITCH CATCHMENTS

SEPTEMBER 2013

- Proposed Diversion Structure (Primary Ditch)
- Existing Primary Ditch
- Existing Secondary Ditches
- Modelled Water Flow
- SubCatchment
- Pit Lake
- Sediment Pond

THE LAYOUT OF THE DITCHES IS CONCEPTUAL AND WILL BE FINALIZED IN CONJUNCTION WITH THE DETAILED CLOSURE DESIGN.

0 100 200 300 400 500 Meters

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14th 2012.

NAD 83 UTM Zone 8N

ACCESS

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. AccessMining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_6-3_Primary_Upper_Catchment_20130912.mxd
(Last edited by: mduchame;13/09/2013;08:53 AM)

Flows for the upper catchment ditches have been calculated using the rational method. Design flows are calculated based on the area of the catchment, a selected rainfall intensity of a given return period, and a runoff coefficient accounting for all factors affecting the relation between peak flow and average rainfall intensity, particularly ground cover and soil type that influence the rate of runoff. The general formula for the rational method is:

$$Q = \frac{AIC}{3.6}$$

Where,

Q is the flow in m^3/s;
A is the catchment area in km^2;
I is the rainfall intensity in mm/h; and
C is the runoff coefficient

Catchment areas delineated for each ditch (primary and secondary), as presented in section 4.2. The catchment area of each ditch located upstream of the pits was used directly to calculate peak flows of different return periods with the rational method.

The rainfall intensity was derived from the Pelly Ranch IDF curve due to the proximity of the weather station to the site. As noted above, Pelly Ranch is situated ~400m lower in elevation than the Minto Mine site, however monthly rainfall at Minto was shown to be 12% less on average than at Pelly Ranch (SRK Consulting, 2012). A preliminary analysis of measured daily rainfall at Pelly Ranch and the Minto Mine site for 2011 and 2012 showed relatively good correlation, although Pelly Ranch typically had higher values for daily precipitation greater than 5 mm. Thus, using Pelly Ranch rainfall intensities could be considered conservative. Table 4-1 presents the IDF curve rainfall intensities derived by Environment Canada for the Pelly Ranch weather station. Rainfall intensities for the 200-year recurrence period were derived using the same methodology.

Table 4-1 Rainfall intensities from Pelly Ranch IDF curve

Duration	Rainfall intensity (mm/h) – Recurrence period					
	2 years	10 years	25 years	50 years	100 years	*200 years*
5min	39	77	96.2	110.4	124.4	*140.3*
10min	27.9	54.3	67.5	77.4	87.1	*96.8*
15min	22.6	45.4	56.9	65.4	73.9	*82.6*
30min	13.7	27.4	34.2	39.3	44.4	*49.0*
1h	8.2	16.5	20.7	23.8	26.9	*30.1*
2h	5.1	9.4	11.6	13.3	14.9	*16.5*
6h	2.2	3.7	4.4	5	5.5	*6.0*
12h	1.4	2.1	2.5	2.8	3.1	*3.3*
24h	0.8	1.2	1.5	1.6	1.8	*1.9*

The length of the rainfall event was adjusted to the time of concentration of each sub-catchment. The time of concentration is defined as the theoretical time it would take for water to travel from the headwaters of the basin to the outlet, or the time it would take for the entire catchment to contribute to flow. Various equations are available in the literature to calculate the time of concentration. Most of them were developed based on site observations and measurements, and are linked to the catchment's main characteristics. The Quebec Ministry of Transport (MTQ, 2004) suggests the following equation for catchments with a runoff coefficient lower than 0.4 which will used in the current analysis:

$$t_c = \frac{3.26\ x\ (1.1 - C)\ x\ L^{0.5}}{{S_c}^{0.33}}$$

Where,

C is the runoff coefficient;
L is the creek length (longest flow path) in m; and
S_c is the 85-10 slope in % (slope of the longest flow path excluding the upper and lower extremities).

The 1 hour rainfall intensity I is then multiplied by a factor F to adjust the value to the time of concentration. The 1 hour rainfall intensity is used because all of the sub-catchments have a time of concentration smaller than 2 hours. The rational method then considers a storm occurring over a duration equal to the time of concentration. The formula for F is:

$$F = 12.25\ x\ {t_c}^{-0.612} \qquad \text{if } t_c < 1 \text{ hour}$$

$$F = 17.07\ x\ {t_c}^{-0.693} \qquad \text{if } t_c > 1 \text{ hour}$$

The last parameter required for the rational method is the runoff coefficient, which is used to account for the speed flows tend to travel through the basin, based on the catchment's physical characteristics. Determination of the runoff coefficient is based on soil type, cover type (natural forest or land disturbed by mine operations, including tailings storage, mine pits, waste rock dumps, etc), average basin slope and anticipated retention time. The runoff coefficient is chosen based on tables extracted from various references (i.e, Pilgrim and Cordery, 1993, Alaska Department of Environmental Conservation 2011, MTQ 2004). It is the parameter within the rational method that has the largest influence on the calculated flows, although there is no specific equation based on empirical values that can be used to determine the runoff coefficient. For reference, a runoff coefficient of 1 would be applied to a soil that is fully impervious and has no friction in a catchment with a steep average slope, while a runoff coefficient close to 0 would be applied to a highly permeable soil capable of absorbing most of the rainfall and located within a flat catchment. Conservative values were chosen for the current study, in particular given the presence of permafrost which can reduce infiltration and increase runoff. The following values were used for the calculations of flows:

- Forested area: C = 0.25 (largest value recommended in the literature for forested areas)
- Disturbed land (by mine operations): C = 0.5 (corresponding to values suggested for graded soils with a slope greater than 6 to 8%)

Finally, the calculated flows from the rational method were multiplied by a routing coefficient to consider the lag effects that wetlands, swampy areas, and depressions would have on floods. This is especially relevant for

areas where waste rock dumps and tailings piles are located, given the presence of small localized depressions generating temporary storage. A coefficient of 0.8 was selected, based on the assumption that approximately 5% of catchment area provided temporary water retention (MTQ, 2004).

Table 4-2 presents the characteristics for each primary ditch sub-catchment that were used in the application of the rational method. The weighted runoff coefficient, based on the percent cover of forested area and of disturbed land, varies between 0.27 and 0.40 for all sub-catchments. The time of concentration varied between 48 and 74 minutes for the upper catchment ditches.

Table 4-2 Upper primary ditch catchment characteristics

Parameter	Ditch 100 basin	Ditch 300 basin	Ditch 350 basin
Catchment area (km²)	2.2	1.7	3.9
Average catchment slope (%)	13	18	9
Forest area (%)	95	40	55
Longest flow path length (m)	2400	1500	2500
85% elevation (m)	920	920	925
10% elevation (m)	815	850	840
Longest flow path slope (%)	5.8	6.2	4.5
Weighted runoff coefficient	0.27	0.40	0.36
Time of concentration (min)	74	48	76

Flows of various return periods were calculated for primary ditches located upstream of pits. Table 4-3 presents the calculated flows for the primary ditches upstream of the Main Pit and Area 2 Pit. The 200-year flood flow has been selected as the design flood for the primary ditches.

Table 4-3 Upper primary ditch catchment flows

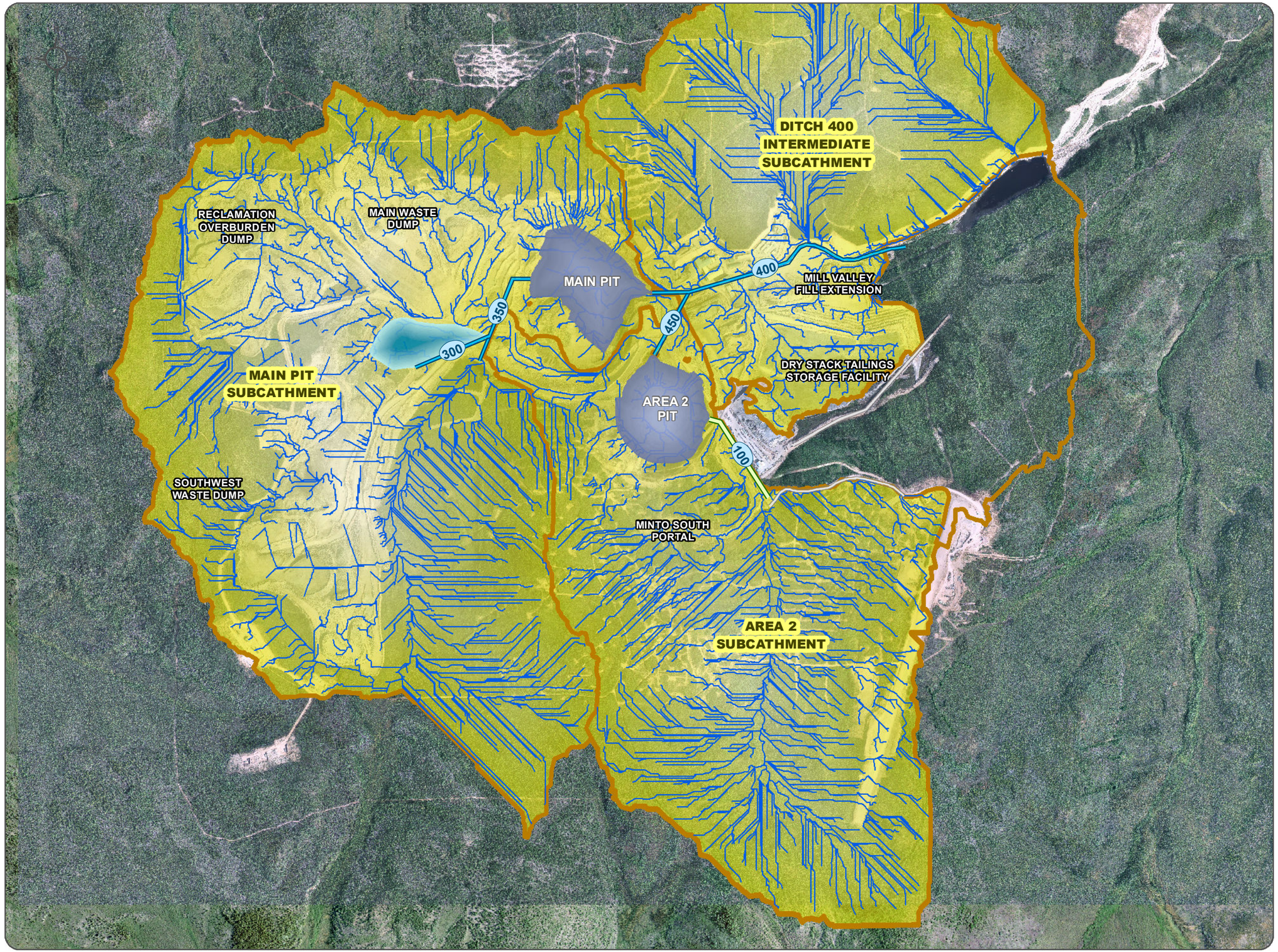
	Catchment area (km²)	Flood flows (m³/s)			
		1:2 years	1:25 years	1:100 years	1:200 years
Ditch 100	2.2	0.9	2.4	**3.1**	3.5
Ditch 300	1.7	1.4	1.4	**4.5**	5.0
Ditch 350	3.9	2.2	5.5	**7.2**	8.0

The above calculated values were verified using the HEC HMS software developed by Hydrologic Engineering Center (HEC) of the United States Army Corps of Engineers (USACE). The software allows users to perform watershed modelling using various methods to simulate precipitation runoff processes. A model of the watershed is first created by entering physical characteristics for each sub-catchment and connecting reaches. The design rainfall event is then entered to provide a basis for the flow calculations. Finally, various methods are available to account for base flows or for reduction in the potential runoff, due to infiltration, friction, storage areas, etc. Routing of inflows was also performed using HEC HMS for the Main and Area 2 pits (see section 4.3.2).

Simplified simulations were run for the Minto Mine site watershed to determine the inflows for each sub-catchment. The SCS Curve Number loss method was used to account for the variation in the runoff coefficient between different catchments (Curve number between 70 and 85), and the SCS Unit Hydrograph transform method to account for the calculated time of concentration. Resulting flows for the upper sub-catchments were generally within 10% of the values presented in Table 4-3, thus confirming the values calculated with the rational method. The rational method in its application considers more of the physical characteristics of catchments (i.e., percent forested area, flow path length and slope, etc) compared to HEC-HMS, which relies more on soil characteristics and infiltration parameters. Since comprehensive data about all site soil characteristics is not available, the rational method provides a better approach by utilizing the available topographical information.

4.3.2 Lower primary ditch catchments

Ditches 400 and 450 are located downstream of the Main Pit and Area 2 Pit. Flows in these ditches will be influenced directly by the routing of upgradient flows through the pits. This routing through the pits is significant due to the large surface area of the pits compared to the inflows. Ditch 450 drains the sub-catchment of the Area 2 Pit, while ditch 400 drains the sub-catchment of the Main Pit and the intermediate watershed below the pit. The delineated sub-catchments of ditches 400 and 450 are presented in Figure 4-2. The main characteristics of each sub-catchment is presented in Table 4-4.



capstone
MINTO MINE

MINTO MINE PHASE IV

CLOSURE HYDROLOGY REPORT

FIGURE 4-2

LOWER PRIMARY DITCH CATCHMENTS

SEPTEMBER 2013

- Proposed Diversion Structure (Primary Ditch)
- Existing Primary Ditch
- Existing Secondary Ditches
- Modelled Water Flow
- Sediment Pond
- Pit Lake
- Subcatchment

THE LAYOUT OF THE DITCHES IS CONCEPTUAL AND WILL BE FINALIZED IN CONJUNCTION WITH THE DETAILED CLOSURE DESIGN.

0 50 100 200 300 400 500 Meters

Aerial imagery obtained from Challenger Geomatics. Imagery acquired August 14th 2012.

NAD 83 UTM Zone 8N

ACCESS

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. AccessMining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-ClosurePlan_2013\Fig_6-4_Primary_Lower_Catchment_20130912.mxd
(Last edited by: mduchame;13/09/2013;08:54 AM)

Table 4-4 Lower primary ditch catchment characteristics

Parameter	Ditch 400 basin	Ditch 450 basin
Catchment area (km^2)	8.8	2.4
Average catchment slope (%)	20	17
Forest area (%)	65	85
Weighted runoff coefficient	0.34	0.28

As a result of significant routing through the pits, flows calculated for ditches 400 and 450 using the rational method over the total surface area of their respective sub-catchments would be overestimated for an extreme rainfall event. As such, routing of the inflows from the upper sub-catchments was undertaken using HEC HMS, with the addition of intermediate sub-catchment flows to the system. The resulting flows for the 200-year flood are 2.2 and 0.4 m^3/s for ditches 400 and 450, respectively, considerably smaller than the contributing upper catchment ditch flows. This is due to the relatively small overall inflow volume resulting from a short but intense rainfall event, and the extensive storage provided by the pits.

Thus, another approach to estimating design flood flows for these ditches was considered, focusing on the freshet period. Specifically, a constant base flow resulting from snowmelt was estimated and superimposed on a 24-hour rainfall event with a 200-year recurrence. Using this method, it is assumed that the inflows to the pits will be constant over a period of time and lead to a balance between inflows and outflows.

Available snow data from the Minto Mine site was used to estimate an appropriate snowmelt flow. For the purpose of determining an event of approximately 200 years in recurrence, the snowmelt flow was maximized based on the available data and local knowledge of freshet occurrence. Nine years of spring snow data is available at Minto, with measurements taken at three different sites in early March, April and May. Data is available as snow water equivalent (SWE) in mm. The maximum SWE is observed in most years in April, or sometimes in March, while there is generally minimal to no snow left on the ground by early May. Given that snowmelt occurs primarily in April at the site (Clearwater Consultants Limited, 2006), for the purpose of the estimation of a snowmelt base flow, the maximum SWE values observed in April at any of the stations was utilized. The values are presented in Table 4-5.

Table 4-5 Minto Mine site snow data

Year	Maximum April SWE (mm)
1994	112
1995	73
1998	76
2006	101
2007	107
2008	101
2009	170
2010	86
2011	143
Average	108

A frequency analysis was done with the above data to determine SWE values of different return periods. Given only nine years of data available, the estimation of SWE values for return periods of more than 20 years was not considered appropriate. Results of the frequency analysis using various methods (Gumbel, GEV, Log-Pearson III) suggest that the maximum measured SWE value of 170 mm has a recurrence interval greater than 20 years, likely in the 25 to 30-year recurrence interval range. This value was therefore used to determine the resulting snowmelt base flow, assuming complete snowmelt over 7 days, with a 12-hour melting period per day. This hypothesis is based on local knowledge and observations, and is considered conservative to maximise the resulting flow. Table 4-6 summarizes the snowmelt base flow estimation.

Table 4-6 Snowmelt base flow analysis

Parameter	Value
Maximum Snow Water Equivalent– ~25-year return period	170 mm
Snowmelt period (12 hours per day)	7 days and 12 hours per day
Resulting constant snowmelt flow	0.56 $m^3/s/km^2$

The snowmelt base flow was then calculated for each of the upper sub-catchments that flow into the pits (ditches 100, 300 and 350) using the unit value per km^2 presented above.

A 24-hour rainfall event with 200-year return period was then added to the snowmelt base flow using the data presented in Table 4-1 which yields a total rainfall of 45.6 mm in a 24-hour period. This was added as a constant flow, assuming that the resulting flow from rainfall is constant for a prolonged period of time, leading to the pits reaching a steady state (equal flows entering and exiting the pits). The rational method was again used for this analysis, for a storm duration of 24 hours. The flows calculated in the previous section are larger, for a storm lasting only the time of concentration of each watershed. However, routing those flows through the pits leads to smaller flows downstream in ditches 400 and 450 compared with the constant flow resulting from a 24-hour rainfall event. This is a conservative assumption that increases outflows from the pits given a greater inflow volume.

Finally, a snowmelt base flow and a 24-hour event rainfall flow were also calculated for the intermediate watershed of ditch 400 below the Main Pit, using the same methods outlined previously.

Table 4-7 and 4-8 present the resulting calculated flows for each lower sub-catchment. All values calculated are added together to obtain the resulting maximum flow in ditches 400 and 450.

Table 4-7 Area 2 Pit outlet and ditch 450 design flows

Component	Snowmelt flow (m^3/s)	24 hr rainfall flow (m^3/s)
Sub-catchment 100	1.3	0.3
Area 2 Pit sub-catchment	0.1	0.1
Total at outlet of Area 2 Pit	**1.4**	**0.4**
Ditch 450 – TOTAL ESTIMATED DESIGN FLOW	**1.8**	

Table 4-8 Main Pit outlet and ditch 400 design flows

Component	Freshet flow (m^3/s)	24 hr rainfall flow (m^3/s)
Sub-catchment 350	2.2	0.8
Main Pit sub-catchment	0.3	0.1
Total at outlet of Main Pit	**2.5**	**0.9**
Outlet of Main Pit – TOTAL ESTIMATED FLOW	**3.4**	
Intermediate sub-catchment of ditch 400 (including the DSTSF)	1.0	0.4
Flow from ditch 450	1.4	0.4
Ditch 400– TOTAL DESIGN FLOW	**6.6**	

4.3.3 Summary of design flows

Design flows were determined for all primary ditches. The 200-year flood was chosen as the design flood, with the most severe hydrological scenario considered for each type of ditch. The ditches will be designed to ensure that the design flows can pass safely and respect all of the selected design criteria. Table 4-9 summarizes the selected design flows for all primary ditches

Table 4-9 Design flows for primary ditches

Component	Design flow (m^3/s)
Ditch 100	3.5
Ditch 300	5.0
Ditch 350	8.0
Ditch 400	6.6
Ditch 450	1.8
Main Pit outlet structure	3.4
Area 2 Pit outlet structure	1.8

4.4 DETERMINATION OF DESIGN FLOWS FOR SECONDARY AND TERTIARY DITCHES

We refer to secondary and tertiary ditches as all ditches that will convey water from the various waste rock dumps and the DSTSF to the primary ditches. These ditches will be constructed to prevent surface water from eroding cover materials. Tertiary ditches will be laid out on the waste rock dumps and tailings surface and will connect to a main secondary ditch that will convey water to the bottom of each waste rock dump and of the DSTSF.

The rational method outlined in the previous section was also used to compute flows for all secondary ditches, with a simplified approach to determine catchment characteristics. A runoff coefficient of 0.5 was used for the waste rock dumps and the DSTSF. The small surface area of sub-catchments (less than 1 km^2) combined with a high runoff coefficient yields a small time of concentration of less than 30 minutes for most secondary ditch sub-catchments. Given the small size of the sub-catchments contributing flow to tertiary ditches, conservative design flows were selected in comparison to calculated secondary ditch flows.

Figure 3-1 in section 3.4 presents a potential layout of secondary and tertiary ditches, while Table 4-9 summarizes the design flows. Selected values were based on the 200-year flood. All secondary and tertiary ditches will be sized and protected to resist at a minimum the flows presented below. The final layout of secondary and tertiary ditches will be determined at closure. It will be laid out to accommodate the final topography of the waste rock dumps and DSTSF, and to minimize the risk of erosion.

Table 4-10 Secondary and tertiary ditch design flows

		Design flow (m^3/s)
Secondary ditches	- DSTSF	3.0
	- Main Overburden Dump - Southwest Dump (South section)	2.0
	- Southwest Dump (Middle and North sections) - South Overburden Dump - Main Waste Dump - Tailings Diversion Ditch	1.0
Tertiary ditches		0.5

4.4.1 Validation

As validation for the design flows calculated for the primary and secondary ditches, hydrometric data collected on Minto Creek and for small streams less than 100 km^2 in Yukon's interior hydrographic region collected by Environment Yukon were reviewed. In particular, maximum daily flows were extracted from the hydrometric records to establish the observed range of maximum daily flows per square kilometre.

Table 4-10 lists the characteristics and peak flows of the 11 small streams reviewed for validation of design flows. Ranging from 4.5 to 93 km^2, measurements on these streams have reported peak flows ranging from 0.04 to 0.96 $m^3/s/km^2$. For Minto Creek, hydrometric data have been collected intermittently at two stations, however continuous data logging only began after mining at Minto Mine had begun, and runoff storage in the water storage pond had been initiated (April 2007). From these data a peak flow of 0.02 $m^3/s/km^2$ for W3 and 0.05 $m^3/s/km^2$ for W1 was observed. Prior to 2007 only spot measurements were taken, although a value of 0.55 m^3/s was reported for W3 in May 1997, resulting in a peak flow of 0.05 $m^3/s/km^2$. Thus the Minto Creak measurements are at the lower end of the peak flows reported regionally.

Table 4-11 Small streams

Station ID	Station Name	Watershed Area (km^2)	Years of Record	Max Daily Flow (m^3/s)	Peak Flow ($m^3/s/km^2$)
29AB007	Granger Creek	4.5	8	4.29	0.96
30HA001	Dale Creek at ford on Amax Road	14.2	2	4.91	0.35
29AB006	Wolf Creek - Upper	14.5	6	3.38	0.23
29AC005	Haeckel Creek near Km 1493 Alaska Highway	30.5	3	1.20	0.04
30BE003	Cosh Creek	32.5	6	1.63	0.05
30AD005	Flood Creek at Km 100.3 Nahanni Range Road	42.8	3	8.09	0.19
29AE003	Partridge Creek at Km 1184.9 Alaska Highway	63.7	11	16.0	0.25
29BA002	180 Mile Creek at Km 295.8 North Canol Highway	83.1	7	23.43	0.28
29BB001	Boulder Creek at Km 387.0 North Canol Highway	84.1	6	21.27	0.25
29BC003	Vangorda Creek at Faro Townsite Road	91.2	17	10.60	0.12
30BE002	Contact Creek - Upper	93.0	5	13.30	0.14

In comparison, the peak flows calculated for the design of water conveyance structures for Minto Mine closure range from 1.4 to 2.7 $m^3/s/km^2$ for the upper catchment primary ditches. These peak flows are higher than for all small streams reviewed and well above the Minto Creek values. For the lower catchment primary ditches routing plays a significant role in attenuating peak flows, however relatively high values close to 0.7$m^3/s/km^2$ for ditches 450 and 400 were calculated.

This analysis confirms that the design flows calculated are reasonably conservative and appropriate for the chosen design event.

5 HYDRAULIC DESIGN

This section presents the preliminary design of all water conveyance structures at the Minto Mine. Design was undertaken at a conceptual level to be able to determine a ±30% cost estimate for the construction of the closure works. The selected design criteria, methodology and channel sizes are presented hereafter.

5.1 DESIGN CRITERIA

The design criteria for drainage ditch sizing were selected based on the level of risk associated with failure of the proposed infrastructure and previous experience in mine closure. Several assumptions were chosen as part of the design process and are outlined below. The purpose of the drainage ditches is to safely convey surface water through and downstream of the Minto Mine site at closure. Drainage ditches need to be sized to resist a design flow. Appropriate ditch dimensions to prevent overtopping and adequate means of erosion protection will provide a safe and reliable design. Erosion protection can be provided by adequate channel protection (riprap or other types of liners), and drop structures and energy dissipation works when slopes are too steep.

5.1.1 Channel sizing

The design flows for all ditches (primary, secondary and tertiary) were selected as the 200-year flood. Primary ditches will be designed using the calculated design flows, while secondary and tertiary ditches will be designed using selected values that can safely convey the 200-year flood. The calculation of design flows was not done for tertiary ditches in the current study as these will only require minor swales.

The selected values for the primary ditches were presented in section 4.3.3 (Table 4-9) and the selected values for secondary and tertiary ditches were presented in section 4.4. (Table 4-10).

The selected design criteria for all drainage ditches are outlined below. These design criteria, however, will not apply to additional structures that may be required to convey water down steeper slopes. This includes the steep sections and spillways that need to be constructed as part of the secondary ditches to convey water from the top of the waste rock dumps and the DSTSF to the bottom. These works are discussed in Section 6 of this report.

Flow velocity

- The maximum allowable flow velocity is set at **3.5 m/s** in all primary ditches.

This velocity will limit the required riprap size to a D_{50} of 300 mm or less which is a size that is assumed to be easily available on the Minto Mine site. Other means of erosion protection considered, such as synthetic liners, will work best with velocities equal or less than 3.5 m/s. Channel slopes will be limited such that the flow velocities don't exceed this value. When a ditch slope exceeds the allowable slope (for the design velocity), additional works will be required to safely convey the flow. Two options are envisioned depending on the ditch considered; either conveying water through steeper slopes using drop structures and stilling basins configured to ensure the formation of a hydraulic jump in a controlled location and dissipating energy,

or adding fill along the ditch profile to lower the slope and designing a spillway at the channel outlet. Potential additional works are discussed in more detail in Section 6.

- The maximum allowable flow velocity is set at **2.5 m/s** for all secondary ditches, except in their steep sections where spillways will be constructed.

Secondary ditches will flow for the majority of their length on top of covers with mild slopes (lower than 2%). The design velocity chosen for these ditches is lower than for the primary ditches to simplify the construction and ensure the use readily available materials. A riprap size with a D_{50} of 150 mm will resist such velocities. Spillways for waste rock dumps faces are discussed in Section 6.

The maximum allowable slope for each ditch will be based on this maximum allowable velocity criteria. The slope has been determined for each ditch for a given cross-section,.

Channel geometry

All drainage ditches will have a trapezoidal cross-section, with the following characteristics.

- Side slopes of 2.5H:1V;
- A minimum channel slope of 0.5% is selected for all ditches;
- A target ratio of 2 is selected as the maximum ratio of base width over maximum water depth.

These design criteria are assumed to provide the optimal and most economical ratio to minimize cut and fill volumes, and to limit the size of riprap required for erosion protection. When the closure plan is implemented, further optimization studies will be required to determine the optimal channel size and alignments.

Freeboard allowance

The following freeboard allowances were selected to protect the ditches against overtopping and provide a safety margin against potential obstructions (debris, sediment deposition, settlement, etc.). These provide an additional margin of safety for calculated flows that present uncertainty as stated in section 4.

- Primary ditches: 0.5 m
- Secondary ditches: 0.3 m

A larger freeboard allowance is selected for the primary ditches since they will capture most of the flow coming out of the mine, especially for ditches 400 and 450.

5.1.2 Construction methods and available materials

The drainage ditches will be either excavated through earthfill material or constructed with available fill, depending on the location. Construction materials will need to meet licensed requirements for construction grade materials.

In general, any channel that will run over placed fill at the site is unlikely to encounter permafrost. It is however possible that some of the fill already in place is non-engineered fill, such that it may have inconsistent levels of compaction and may contain frozen soils and ice. It could than result in significant differential settlement, thus modification of the constructed ditches profile which could provide to be a mechanism of failure Excavation of the fill already in place may be required in some location, or the placement of additional material, to provide a proper foundation for the ditches in the long term. In the event that permafrost is encountered along the proposed alignments, gravel pads or additional means of protection may have to be put in place to ensure long term stability of the ditches.

Cross-sectional dimensions and optimal slopes will require further optimization when the closure plan is implemented to determine the most economical solutions for each ditch. The ditches will be laid out along the proposed alignments within the calculated range of longitudinal slopes that allow the design criteria to be met. Grading of the alignment will be required in many locations.

Erosion protection will be provided by rip rap or synthetic liners, such as "Geoweb". Small to medium rip rap should be easily available without any significant blasting and sorting required on site. It is assumed that rip rap with a D_{50} equal to or smaller than 300 mm can be obtained at a reasonable cost. As an alternative, Geoweb could be used where ground conditions can't provide adequate stability to rip rap. Geoweb can be filled with crushed stone with a diameter equal to or smaller than 100 mm, and provide an equivalent means of protection to rip rap. In areas where larger velocities will be experienced (spillways, energy dissipation basins), grouted Geoweb could provide resistance against larger flow velocities. Concrete may also be used in a few specific locations, but its use will be minimized to limit costs. A geotextile will be installed under all riprap material.

5.2 DRAINAGE DITCH DESIGN

The preliminary design of ditches was completed based on the previously calculated design flows. The longitudinal profiles along the proposed ditch alignment were extracted to determine the optimal profile.

5.2.1 Ditch profiles

The proposed site layout for water conveyance structures and other infrastructure at closure has been discussed in detail in Section 3.4.4. Ditch profiles were then extracted from ArcGIS for each primary ditch to determine the variation in longitudinal slope along the proposed alignment. Table 5-1 summarizes the main characteristics of the current natural ground profile along each proposed primary ditch. The average slope was calculated along the entire path length, excluding steeper slopes at the downstream end of the proposed ditches. Minimum and maximum slopes were estimated over a minimum distance of at least 20 m. If steeper slopes exist in certain location, they are classified as `steeper drops'.

Table 5-1 Primary ditch profile characteristics

Ditch	Average slope (%)	Min Slope (%)	Max slope (%)	Steeper slopes	Outlet
100	1.1	0.5	2.5	No	Flows into Area 2 pit
300	4.8	0.5	6	Yes (26% over 25 m and 21 % over 15 m)	Flows into Ditch 350
350	0.5	0	6.6	No	Flows into Main Pit
400	5.9	0	18	No	Connects with Water Storage Pond
450	8.8	0	11	Yes (up to 40% over 20 m)	Connect with Ditch 400

Secondary ditches collect flow from the tertiary ditches and will span both the relatively flat tops of the WRDs and will also convey surface flows down the steep faces of the WRDs – down slopes as steep as 1.5H:1V and across flat benches. The secondary ditches will be fortified with both rip rap and geosynthetic liner reinforcement. It is anticipated that steep sections may require concrete reinforcement. The secondary ditches will drain into energy dissipation ponds at the base of the WRDs and the DSTSF.

Tertiary ditches will flow entirely on top of covers such that they will be laid out on fairly mild slopes, have relatively minor flows and will require minimal engineering reinforcement. .

5.2.2 Methodology

Ditches dimensions were determined using the Manning's equation for open channel flow, using trapezoidal cross-sections. The design criteria outlined before were used as target values. The equations is:

$$Q = \frac{1}{n} A R^{\frac{2}{3}} S^{\frac{1}{2}}$$

Where,

Q is the flow in m^3/s;
n is the Manning's roughness coefficient;
A is the flow cross-sectional area in m^2;
R is the hydraulic radius in m (defined as A/P, where A is the flow cross-section area and P the wetted perimeter);
S is the channel slope in %

Solving this equation for a given flow requires the determination of the water depth that matches a given slope for a fixed Manning's coefficient. Iterative solving is required to obtain the solution to the depth that influences both the cross-sectional area A, the wetted perimeter P and hence the hydraulic radius R.

A Manning's roughness coefficient of 0.035 was selected as it applies to engineered channels with rockfill elements. If a geosynthetic liner is selected in certain locations, it would lower the roughness and thus lower the Manning's coefficient. The value could then vary between 0.012 and 0.025 depending on the type of fill that is used (ODOT, 2005).

The design process involves solving the above equation for two distinct configurations, i.e. to determine the minimum and maximum allowable slope for each ditch. The objective is to provide channel dimensions that can apply to a range of slopes within the proposed alignments. The two step process is as follows:

1) The minimum channel slope leads to the largest water depth in the channel. The depth of each ditch is sized based on the minimum slope. Subcritical flow is observed in this condition

2) The maximum channel slope leads to the fastest velocities. The maximum channel slope was defined based on the maximum allowable velocity of 3.5 m/s that was selected as the design criteria. Supercritical flow is observed for most primary ditches in these conditions, although the resulting Froude numbers are 2 or less, thus indicating limited turbulence within the channels.

The optimal base width to meet the design criteria and obtain the largest maximum slope was determined based on a trial and error exercise. Various ditch configurations were considered for both primary and secondary ditches.

5.2.3 Channel erosion protection

All ditches will require protection against erosion resulting from flow velocities and shear stresses. Rip rap or synthetic liners will be used, depending on site specific conditions and cost efficiency.

The Isbash equation has been used to determine the appropriate size of rip rap that is required to ensure adequate channel protection to resist flow velocities and resulting shear stresses. The Isbash equation is widely used in engineering applications and relates the mean diameter of rip rap (D_{50} in mm) required to resist a given flow velocity:

$$D_{50} = \frac{V^2}{2g\ C^2 \left(\frac{\gamma_r - \gamma_e}{\gamma_e}\right) \cos\alpha}$$

Where,

V is the flow velocity in m/s;
g is the gravitational constant of 9.81 m^2/s;
C is the Isbash coefficient for turbulence (0.86 for low turbulence, up to 1.20 for high turbulence where hydraulic jumps form);
γ_r is the specific weight of rock, approximately equal to 2.65 x 9810 N/m^3;
γ_e is the specific weight of water, approximately equal to 1 x 9810 N/m^3;
α is the angle of repose of rip rap (based on side slope of channel).

The following graph presents curves for different turbulence coefficients for given velocities. A side slope of 2.5H:1V was used to determine the angle α, which is the side slope proposed for all drainage ditches.

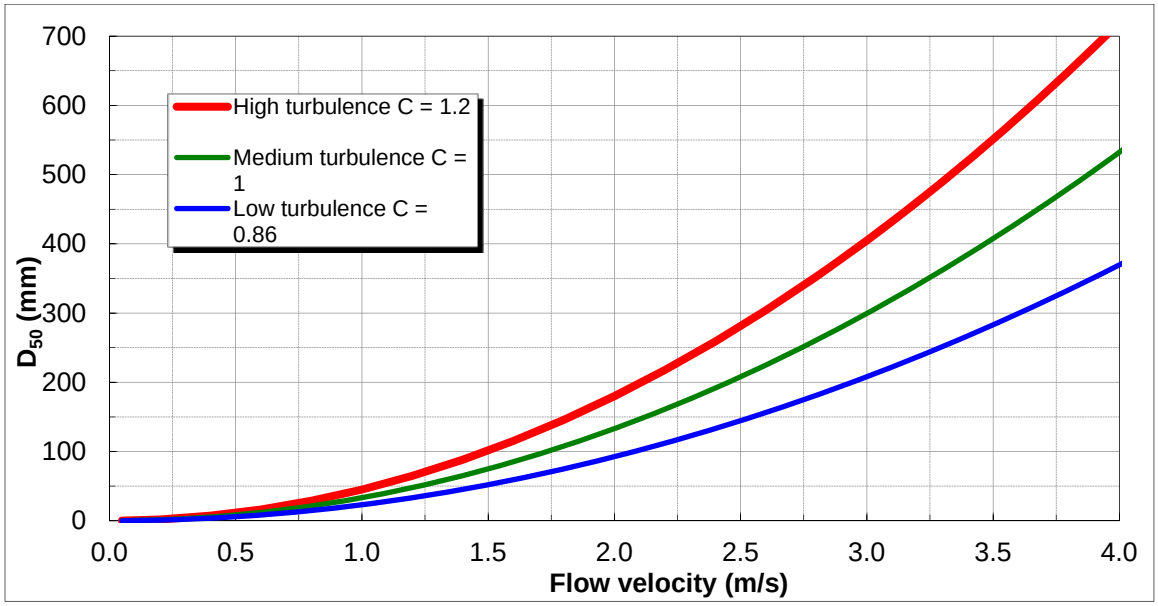


Figure 5-1 Required Rip rap D_{50} to Resist a Given Flow Velocity

It is anticipated that low turbulence will be observed along the ditches (except where spillways or drop structures will be required), as such we adopt a C coefficient equal to 0.86. For the primary ditches, the maximum allowable velocity of 3.5 m/s will require rip rap with a D_{50} of 300 mm. For the secondary ditches, rip rap with a D_{50} of 150 mm will be sufficient to resist a maximum velocity of 2.5 m/s. The required D_{50} for each primary ditch is presented in Table 5-2 in the next section.

5.2.4 Primary ditches

Each primary ditch was analyzed separately, to determine an adequate minimum cross-section and range of longitudinal slopes that would meet the design criteria. Table 5-2 presents the selected base width, slopes and the required rip rap mean diameter (D_{50}) for each primary ditch. The relevant calculated hydraulic parameters are also presented. Those dimensions are the minimum required to ensure an adequate design for the 200-year flood. A 0.5 m freeboard will be applied to all primary ditches to ensure an adequate safety margin against overtopping. The minimum depth of each ditch should then be equal to the maximum flow depth plus 0.5 m.

A short discussion for each ditch is presented below. The constructed profile could vary within the established minimum and maximum slopes at construction to optimize the profile, by minimizing cut and fill. Final ditch alignments, profiles and cross-section should be optimized in the detailed design phase.

Table 5-2 Design parameters for primary ditches

Ditch	Design flow (m^3/s)	Base width (m)	Minimum slope (%)	Maximum slope (%)	Maximum flow depth (m)	Maximum flow velocity (m/s)	Maximum rip rap size – D_{50} (mm)	Steep slopes/stilling basin
100	3.5	1	0.8	1.5	0.8	1.9	100	No*
300	5.0	1.5	2	6.5	0.7	3.5	300	Yes (at outlet)
350	8.0	2	1	4.5	0.9	3.4	300	No*
400	6.6	1.5	1	5	1.0	3.4	300	Yes (MVF)
450	1.8	1	1	10	0.6	3.2	250	No

*Ditches 100 and 350 will required an overflow spillway at their outlet to discharge water into the Main Pit and Area 2 Pit

Ditch 100

Ditch 100 already exists on the Minto site and is known as the South Diversion Ditch. It currently intercepts water from the hills to the south east of the mine site and conveys it towards and around the Area 2 Pit. This ditch will be upgraded and consolidated as needed at closure, but will remain the same dimensions. The current ditch has an estimated total capacity of 13.3 m^3/s (SRK, 2013) which is nearly 4 times the calculated 200-year design flow of 3.5 m^3/s. If the ditch was to be reconstructed, only a 1 m channel base width is required. The ditch can be constructed on a slope between 0.8 and 1.5%, which easily follows the current topography with only grading required and no significant excavation or fill. The minimum required depth of the ditch is 1.3 m (0.8 m maximum flow depth and 0.5 m freeboard allowance). A minimum D_{50} of 100 mm is required for the rip rap. The current ditch has rip rap with a D_{50} of 200 mm, which is sufficient to resist the calculated flow velocities resulting from the design flood.

Ditch 100 empties into the Area 2 Pit through an overflow spillway. Such a spillway is already constructed and should only be consolidated if required at closure.

Ditch 300

Ditch 300 will intercept water from the northwest corner of the mine site, i.e. from the Reclamation Overburden Dump and the Main Waste Dump. It will connect with Ditch 350 which flows into the Main Pit. A minimum base width of 1.5 m is required to convey the 5 m^3/s design flow. The depth of the ditch should be at least 1.2 m (0.7 m maximum flow depth and a 0.5 m freeboard allowance). Such a cross-section can be constructed on a slope varying between 2 and 6.5% to safely convey the flow. A minimum D_{50} of 300 mm is required for the rip rap.

Ditch 300 will require a steeper section at its outlet to join ditch 350. Larger riprap or another means of protection will be required in this location. An energy dissipation basin will also be required at the junction of the two ditches.

Ditch 350

Ditch 350 is the primary ditch with the highest design flow at 8 m^3/s. It will convey water from the western half of the mine site, where the waste rock dumps are located. It captures flow from the Southwest corner of

the mine site (Overburden Dump and Southwest Waste Sump), and also intercepts flow coming from Ditch 300. A minimum base width of 2 m is required along with a minimum depth of 1.4 m (0.9 m maximum flow depth and 0.5 m freeboard allowance). Such a cross-section can be constructed on a slope varying between 1 and 4.5 %. A minimum D_{50} of 300 mm is required for the rip rap.

Ditch 350 will empty into Main Pit through an overflow spillway. Such a spillway will be designed and constructed at closure.

Ditch 400

Ditch 400 will convey most of the surface water out of the mine site. It act as the outflow from Main Pit which captures the flow from Ditch 350. It also captures the outflows from Area 2 Pit (through Ditch 450) and flows coming from its intermediate watershed downstream of the Main Pit. It will run adjacent to the main access road downstream from Main Pit, to the north of the Mill Valley Fill Extension (MVFE). It will then drop on the MVF east face to reach the bottom of the main valley that leads to the water storage pond at the downstream end of the mine site.

Ditch 400 has a design flow of 6.4 m^3/s. Flows from the upper catchments will experience significant routing through the two pits, such that the flood peaks are attenuated. A minimum base width of 1.5 m and a minimum depth of 1.5 m (1.0 m flow depth and 0.5 m freeboard allowance) is required for Ditch 400. The longitudinal slope of the constructed ditch can vary between 1 and 5%. A minimum D_{50} of 300 mm is required for the rip rap.

Ditch 400 will require the construction of an intake structure at the outlet of Main Pit. The confluence with ditch 450 will also require another structure to properly merge the flows. If possible, those two structures could be combined in a single larger intake basin. A spillway will also need to be designed along the MVFE east slope. A stilling basin will be constructed at its toe to dissipate energy coming from the spillway.

Ditch 450

Ditch 450 will convey the routed outflows from Area 2 Pit. Area 2 Pit will only receive inflows from Ditch 100, such that the design flow of Ditch 450 is of 1.8 m^3/s. Ditch 450 will connect with Ditch 400 after 300 m. A minimum base width of 1 m and a minimum depth of 1.1 m is required (0.6 m maximum flow depth and 0.5 m freeboard). Such a cross-section is adequate for a longitudinal slope varying between 1 and 10%. A minimum D_{50} of 250 mm is required for the rip rap.

Ditch 450 will require the construction of an intake structure at the outlet of the Area 2 Pit. It will empty into Ditch 400 in an energy dissipation basin. These structure will be designed in detail at closure.

5.2.5 Secondary ditches

Secondary ditches will flow on top of covers and convey water from high flat ground down on the steep faces towards the primary ditches. Their design includes two parts:

- a typical channel cross-section on mild slope (less than 10%)
- a steep section down the waste rock dump and DSTSF faces, with a slope up to 65% (1.5H:1V)

Secondary ditches will be laid out as a single main channel on the top of covers, but will be required in certain locations to be divided into numerous smaller parallel channels to drop from the steep faces to the primary ditches. Smaller channels will allow a reduction in discharge and flow velocities in each channel, and thus reduce the importance of the erosion protection measures required. Stilling basins at the toe of the steep faces will be required to dissipate the energy of the flow coming from higher ground, before it enters the primary ditches.

A single minimal cross-section was developed for all secondary ditches to meet the design criteria and safely convey the 200-year flood at a minimum. This cross-section is applicable to the section of secondary ditches flowing on top of covers, or on mild slopes, but not going down the steep faces of the waste rock dumps and the DSTSF. Since three different design flows were determined for secondary ditches (1, 2 and 3 m^3/s, see section 4.4), the maximum slope limitation varies for each secondary ditch. Table 5-3 presents the calculated values.

Table 5-3 Design parameters for secondary ditches

Ditch	Design flow (m^3/s)	Base width (m)	Minimum slope (%)	Maximum slope (%)	Maximum flow depth (m)	Maximum flow velocity (m/s)	Maximum rip rap size – D_{50} (mm)
Secondary ditches	1	1	0.5	9	0.5	2.5	150
	2	1	0.5	5	0.7	2.5	150
	3	1	0.5	3.5	0.8	2.5	150

A cross-section with a minimum base width of 1 m and a minimum depth of 1.1 m (0.8 m maximum flow depth for 3 m^3/s and 0.3 m freeboard allowance) will work properly for all reaches of secondary ditches within the define slopes. This design will be finalized at closure.

5.2.6 Tertiary ditches

Tertiary ditches will be minor swales that will convey water on top of the covers towards the secondary ditches. All tertiary ditches are designed for a flow of 0.5 m^3/s. They will be laid out over most of the site where needed, to accommodate topography at closure. No preliminary design of tertiary ditches is provided at the current level of study. They will be designed when closure is implemented.

6 ENERGY DISSIPATION STRUCTURES

Section 5 presented the design of ditches and cross-sections that can safely convey water around the site at closure. Additional structures will be required to convey water over steeper slopes and at convergences. The current section outlines the additional structures that are envisioned at the current state of design of closure. It is possible that additional structures may be required at closure depending on the updated site conditions.

6.1 SPILLWAYS AND DROP STRUCTURES

Spillways will be required at every location where a ditch has to be constructed over a slope steeper than its defined maximum allowable slope (see Table 5-2). Spillways allow high velocities and energy levels to be concentrated into confined reaches. All drop structures and spillways will empty into larger water bodies to safely dissipate the energy of the flow (stilling basins or pit lakes).

For the primary ditches, four spillways or drop structures will be designed prior to closure:

1) Ditch 100 spillway into Area 2 Pit (free overflow)

2) Ditch 300 spillway, at its outlet to connect with Ditch 350 (requires stilling basin at toe)

3) Ditch 350 spillway into Main Pit (free overflow)

4) Ditch 400 spillway down the MVFE slope (requires stilling basin at toe)

For secondary ditches, spillways may be required to drop flow from the top of the covers to the primary ditches. Slopes of up to 60% are possible with such a scheme, thus secondary ditches may be divided into additional channels in such location to limit the flow transiting through steep slopes.

Spillways will be design to resist higher flow velocity than the defined maximum allowable velocity criteria. They can be constructed with larger riprap, grouted geosynthetic liners, concrete, or a combination of such materials. If bedrock is found near the surface at the spillway locations, flow will convey straight on profiled bedrock. Spillways will require the construction of energy dissipation ponds at their toe to dissipate the high energy supercritical flow and allow the formation of a hydraulic jump within the basin. The spillway at the end of ditches 100 and 350 will however empty directly into the two pit lakes which will allow to dissipate energy through those large water bodies.

6.2 CHANNEL INTAKES

Two intake structures are required for the Minto Mine Closure at the end of Phase IV: one to convey water from Main Pit into Ditch 400 and one to convey water from Area 2 Pit into Ditch 450.

Main Pit average water elevation = 785 m

Area 2 Pit average water elevation = 802 m

Intakes to Ditch 400 (for Main Pit) and Ditch 450 (for Area 2 Pit) will be designed to flow at water elevations greater than the average values presented above. The invert elevation of both intake structure should be set at those elevations. The intake structures will provide a smooth transition from the deep and slow moving pit lakes flow to the shallow and fast flowing ditches. If required, geotechnical consolidation of the pit edges at the intake structure will be done to ensure adequate long term stability of the structure.

6.3 STILLING BASINS

Stilling basins (or energy dissipation ponds) will be required at the toe of each spillway on site, except for the overflow spillways at the downstream end of ditches 100 and 350 that empty into the pit lakes. This will allow the formation of a hydraulic jump resulting from supercritical flow (with a Froude number larger than 2) in a controlled location. Stilling basins will also be required at the junction of ditches, to properly merge flow and provide an adequate transition to the downstream ditch. They will be required at the following locations:

1) Toe of MVF spillway in ditch 400

2) Ditch 350 – at the confluence with Ditch 300

3) Ditch 400 – at the confluence with Ditch 450

4) At the bottom of most secondary ditches dropping down a steep slope

Stilling basins will be sized independently for each channel and protected with riprap or a synthetic liner to prevent erosion and significant washing of the ground, due to both high velocity and turbulence levels. Stilling basins will de be designed at closure, especially to determine proper foundation conditions and required dimensions.

7 REFERENCES

Access Consulting Group (ACG), 2013a. Minto Climate Baseline Report.

Access Consulting Group (ACG), 2013b. Minto Surface Water Hydrology Baseline Conditions.

Alaska Department of Environmental Conservation, 2011. Alaska Storm Water Guide, Division of Water.

Clearwater Consultants Limited, 2006. Memorandum CCL-MC1: Minto Copper Project – Site Hydrology Update.

Clearwater Consultants Limited, 2010. Memorandum CCL-MC7: Minto Copper Project - Phase IV Closure Water Balance.

Curran, J.H., Meyer, D.F., and Tasker, G.D., 2003. Estimating the magnitude and frequency of peak streamflows for ungaged sites on streams in Alaska and conterminous basins in Canada: U.S. Geological Survey Water-Resources Investigations Report 03-4188.

EBA Engineering Consultants Ltd, 2012. Technical Memo 013.09: Pipe Design for South Diversion Ditch Realignment, Minto Mine, YT.

Interralogic, Inc, 2013. Final Report: 2013 Keno Surface Water Hydrology Report.

Janowicz, J.R. 2004. Yukon overview: watersheds and hydrologic regions. In: Smith, C. A. S., Meikle, J. C. & Roots, C. F. (eds) Ecoregions of the Yukon Territory—Biophysical Properties of Yukon Landscapes. PARC Technical Bulletin 04-01. PARC, Summerland, BC, pp. 15–18.

Klohn Crippen Berger Ltd and Yukon Zinc Corporation, 2009. Wolverine Project: Tailings and Related Infrastructure Design and Construction Plan Version 2009-02.

Ministere des Transport du Quebec (MTQ), 2004. Manuel de Conception des Ponceaux.

Pilgrim, D.H. and Cordery, I., 1993. Flood Runoff. In: Maidment, D.R. (ed) Handbook of Hydrology. McGraw-Hill, Inc, New York, pp 9.1-9.42.

SRK Consulting, 2012. Precipitation Analysis for the Minto Mine.

SRK Consulting, 2013. Memo: South Diversion Ditch Realignment and Overflow Spillway.

Oregon Department of Transportation (ODOT) – Highway Division. (2005). Hydraulics manual, prepared by Engineering and Asset Management Unit Geo-Environmental Section.

APPENDIX C

MINTO CLOSURE PRELIMINARY FAILURE MODES AND EFFECTS ASSESSMENT - RISK REGISTER

	Closure Scenario 1: Source Control Focus	Consequence		Likelihood	Risk Rating	NOTES
		Type	Severity	Probability	Descriptive	
1	**Source Terms**					
A	Source water quality (source term) worse than expected and causes unacceptable water quality conditions **downstream of site**	Env. Imp.	Critical	Possible	High	assuming no AMP in place
B	Source water quality (source term) worse than expected and causes unacceptable water quality conditions **downstream of site**	Env. Imp.	Moderate	Possible	Moderately High	assumed AMP in place so Severity moderate, critical to understand chemistry as fully as possible - reflected in likelihood designation, concern about reliance on AMP
C		Conseq. Costs	Major	Possible	High	
D		Spec. Cons.	Moderate	Possible	Moderately High	
E	Source water quality (source term) worse than expected and causes unacceptable water quality conditions **on site**	Env. Imp.	Moderate	Unlikely	Moderate	
F		Legal Obl.	Major	Possible	High	This could apply to the preceding mode if there were W2 standards in place
G		Conseq. Costs	Moderate	Possible	Moderately High	
H	Precipitation higher than expected resulting in failure of water conveyance structures because structures are underdesigned	Conseq. Costs	Moderate	Possible	Moderately High	assuming 200 yr flood design, note - sensitivity analysis for precip on water quality,
I	Localized precip > regional => less dilution in downstream in downstream environment resulting in unacceptable water quality conditions downstream of site	Env. Imp.	Minor	Likely	Moderate	
2	**Cover Performance**					
A	Covers don't perform as designed re: infiltration resulting in unacceptable water quality conditions **downstream of site**	Env. Imp.	Moderate	Unlikely	Moderate	Assuming AMP and monitoring will respond to any defects
B		Conseq. Costs	Major	Unlikely	Moderately High	
3	**Geotechnical Stability**					
A	Geotechnical failure of any waste facility (slope stability) resulting in waste material exposure to water leading to unacceptable water quality conditions downstream of site	Env. Imp.	Moderate	Possible	Moderately High	this is a result of there being permafrost considerations under some facilities, and uncertainty associated. Could result from differential settlement of pockets of more moist materials
B		Conseq. Costs	Moderate	Possible	Moderately High	
C	Geotechnical failure of any waste facility (differential settlement) resulting in rupture of cover and waste material exposure to water leading to unacceptable water quality conditions downstream of site	Env. Imp.	Moderate	Likely	Moderately High	Could result from differential settlement of pockets of high moisture materials. Could be moderated by waste mgmt practices limiting wet waste in waste dumps
D	Geotechnical failure of any waste facility (slope stability) resulting in debris dam, breaching, mobilizing materials and pulse of water into Main Pit, and sediments/tailings leaving pit, leading to unacceptable water quality conditions downstream of site	Env. Imp.	Minor	Possible	Moderate	
4	**Conveyance Structures**					
A	Undiverted runoff upstream of waste mgmt facilities leads to runon water, extra infiltration, leading to ongoing maintenance costs	Conseq. Costs	Moderate	Unlikely	Moderate	Need to do landscape design carefully to avoid this failure mode
B	Undiverted runoff upstream of waste mgmt facilities leads to excessive infiltration into upgradient base of dump, resulting in higher flows of poor quality water and unacceptable water quality conditions downstream	Env. Imp.	Moderate	Unlikely	Moderate	
5	**Administrative**					
A	Failure to implement AMP, resulting in unacceptable water quality conditions downstream	Env. Imp.	Critical	Possible	High	
B	Failure to design an appropriate AMP, resulting in unacceptable water quality conditions downstream	Env. Imp.	Major	Unlikely	Moderately High	Important to recognize that AMP is more than just monitoring - but careful identification of potential issues, thresholds and appropriate responses. AMP not just an add-on. Needs to be critical component of closure plan at same detail as rest of plan
C	Departure from design of engineered structures, resulting in unacceptable water quality conditions downstream	Env. Imp.	Major	Possible	High	

	Scenario 2: Hybrid Source Control/Passive Treatment Focus	Consequence		Likelihood	Risk Rating	NOTES
		Type	Severity	Probability	Descriptive	
1	**Bioreactors**					
A	Bioreactors don't perform as designed - overwhelmed, freeze, resulting in unacceptable water quality conditions downstream	Env. Imp.	Moderate	Almost Certain	High	Assumption: effective AMP in place Notes: cryo-concentration in seeps, ice cleaner, residual seeps higher concentration Leslie: make sure that any supporting work here has data - not just stories that they work -i.e. Andre Sobolewski's work at G900 didn't work, but MPERG report still says it does.
2	**Wetlands**					
A	Wetlands don't perform as designed - overwhelmed, freeze, resulting in unacceptable water quality conditions downstream	Env. Imp.	Moderate	Almost Certain	High	
B	High flow blow out wetland, causing damage and maintenance requirements, assuming high flows designed to bypass	Env. Imp.	Moderate	Unlikely	Moderate	Assumption: peak flows not treated by wetlands - need to understand the implications of this during freshet and also during peak flow events. Wetlands are not designed nor capable of treating peak flows, so this is a significant red-flag for planning - needs very careful consideration.
C		Conseq. Costs	Moderate	Unlikely	Moderate	Need to understand the implications of this during freshet and also during peak flow events.
3	**Pit Lake Treatment**					
A	Non-Flow through Pit:					
i	Non-flow through Area 2 Pit treatment compromised because of diversion ditch failure, resulting in flow through condition	Env. Imp.	Minor	Possible	Moderate	Assuming pit water quality has moderate initial contamination level - make sure this is covered in AMP. What if WQ in Area 2 pit were higher than anticipated?
ii	Non-flow through pit treatment does not perform	Env. Imp.	Minor	Possible	Moderate	
iii	Pit Wall Failure in Area 2 results in wave of water released from pit causing damage to downstream facilities and tailings mobilization from bottom of Area 2 pit	Conseq. Costs	Major	Unlikely	Moderately High	Resolution would be difficult - would mean appropriate sizing of the spillway, locating of facilities downgradient
B	Flow through Pit:					
	Flow through Pit treatment does not perform as expected	Env. Imp.	Minor	Unlikely	Low	Assume treatment expectations consider flow through condition and limitations
	Flow through Pit source term underestimated, resulting in higher than expected loading from pit and unacceptable water quality results downstream	Env. Imp.	Moderate	Unlikely	Moderate	
	Pit Wall Failure in Area 2 results in wave of water released from pit causing damage to downstream facilities and tailings mobilization from bottom of Area 2 pit	Conseq. Costs	Major	Very Unlikely	Moderate	In the flow through pit condition, the downstream channels and facilities would be designed for hitgher flows, so likelihood lower than in the non-flow through condition.
4	**Cover Performance**					
A	Does not achieved expected infiltration reduction, leads to increased loading and unacceptable downstream WQ effects	Env. Imp.	Moderate	Possible	Moderately High	
B	Erosion leads to increased infiltration and unacceptable downstream WQ effects	Env. Imp.	Moderate	Unlikely	Moderate	Risks different for DSTSF than for other facilities, potential effects of erosion still need to be considered in design, maintenance costing, etc.
5	**Conveyance Structures**					
A	Undiverted runoff upstream of waste mgmt facilities leads to runon water, extra infiltration, leading to ongoing maintenance costs	Conseq. Costs	Minor	Unlikely	Low	Need to do landscape design carefully to avoid this failure mode
B	Undiverted runoff upstream of waste mgmt facilities leads to excessive infiltration into upgradient base of dump, resulting in higher flows of poor quality water and unacceptable water quality conditions downstream	Env. Imp.	Moderate	Possible	Moderately High	
6	**Administrative**					
A	General failure to maintain site requirements as required - passive treatment, cover maintenance, etc.	Env. Imp.	Major	Possible	High	

	Scenario 3: Treatment Focus	Consequence		Likelihood	Risk Rating	NOTES
		Type	Severity	Probability	Descriptive	
	Assumption is that this option needs redesign compared with existing collection/treatment system in place - many risks could be addressed through this redesign, or batch treatment, etc.					
1	**Collection Systems**					
A	Tailings seepage collection systems inadequate, leading to unacceptable WQ downstream	Env. Imp.	Moderate	Possible	Moderately High	design, size, location, construction, operation - all contributors to the potential issue, these need to be thought through more for the mitigation
B		Conseq. Costs	Major	Possible	High	
C	SWD toe seepage collection systems inadequate, leading to unacceptable WQ downstream	Env. Imp.	Minor	Likely	Moderate	minor because pit is downstream
D		Conseq. Costs	Moderate	Likely	Moderately High	Feasiblilty of this collection system questionable - due to ice-rich area and deformations, and no clear segregation from valley flows. Mitigation might be to avoid collection system altogher and focus on treatment of full W15 flow in pit.
E	Collection of cleaner runoff in inadequate, leading to mixing with water requiring treatment and increased treatment costs	Conseq. Costs	Minor	Likely	Moderate	
2	**Cover Performance**					
A	Does not achieved expected infiltration reduction, leads to increased loading and unacceptable downstream WQ effects	Env. Imp.	Moderate	Possible	Moderately High	Assumption that these Option 3 covers are thinner than Option 2
B	Erosion leads to increased infiltration and unacceptable downstream WQ effects	Env. Imp.	Moderate	Possible	Moderately High	risks different for DSTSF than for other facilities, potential effects of erosion still need to be considered in design, maintenance costing, etc.
C	Undiverted runoff upstream of waste mgmt facilities leads to runon water, extra infiltration, leading to ongoing maintenance costs	Conseq. Costs	Moderate	Unlikely	Moderate	Need to do landscape design carefully to avoid this failure mode
D	Undiverted runoff upstream of waste mgmt facilities leads to excessive infiltration into upgradient base of dump, resulting in higher flows of poor quality water and unacceptable water quality conditions downstream	Env. Imp.	Moderate	Possible	Moderately High	
3	**Dam - assume reduced height**					**may want to consider removing top level at least - man/made materials**
A	Seismic or extreme flood event larger than design leads to dam failure, resulting in surge of water and solids into Minto Creek	Env. Imp.	Moderate	Very Unlikely	Low	
B	Dam maintenance requirements not met, resulting in failure and surge of water and solids into Minto Creek	Env. Imp.	Moderate	Very Unlikely	Low	assumes design with maintenance requirements
4	**Treatment Plant (plant, any byproduct, and storage capacity)**	**Env. Imp.**	**Very Low**	**Very Unlikely**	**Low**	
A	Flow rates exceed plant/surge capacity, resulting in unnacceptable water quality downstream	Env. Imp.	Moderate	Possible	Moderately High	Mitigation : increase surge capacity and/or operate surge volumes better - depending on why surge capacity was overwhelmed
B		Conseq. Costs	Major	Unlikely	Moderately High	assume worst case - plant/surge exceeded because not sufficient
C	Contaminant loading exceeds treatment capacity, resulting in unnacceptable water quality downstream	Env. Imp.	Moderate	Unlikely	Moderate	Function of geochemical source term identification
D		Conseq. Costs	Major	Unlikely	Moderately High	
E	Treatment technology ineffective for contaminants of concern, resulting in unnacceptable water quality downstream	Env. Imp.	Moderate	Very Unlikely	Low	
F		Conseq. Costs	Major	Very Unlikely	Moderate	
G	Inadequate capacity for storage of byproducts, leads to costs for removal off site	Conseq. Costs	Moderate	Very Unlikely	Low	
5	**Administrative**	**Env. Imp.**	**Very Low**	**Very Unlikely**	**Low**	
A	General failure to maintain site requirements as required - collection/conveyance, active treatment, cover maintenance, etc.	Env. Imp.	Major	Possible	High	

APPENDIX D

MINTO MINE CLOSURE ADAPTIVE MANAGEMENT PLAN

MINTO PHASE IV RECLAMATION AND CLOSURE

PRELIMINARY ADAPTIVE MANAGEMENT PLAN

Version 1.0

September 2013

Prepared for:

MINTO EXPLORATIONS LTD.

ACCESS CONSULTING GROUP SIGNATURES

Report prepared by:

Ethan Allen, M.Sc.
Environmental Geoscientist

Report reviewed by:

Scott Keesey, B.Sc., EPt
Sr. Environmental Manager

Report reviewed by:

Jim Theriault , P. Eng
Senior Geological Engineer

TABLE OF CONTENTS

1 INTRODUCTION 6

1.1 ADAPTIVE MANAGEMENT PLAN BACKGROUND AND VERSION HISTORY 6
1.2 CLOSURE AND RECLAMATION ADAPTIVE MANAGEMENT PLAN (AMP) 7
1.2.1 AMP OBJECTIVES 7
1.2.2 AMP APPROACH 8
1.2.3 AMP COMPONENTS 8
1.2.4 AMP SPECIFIC TRIGGERS AND THRESHOLDS 8
1.2.5 AMP MONITORING 9
1.2.6 AMP ELEMENTS 11
1.2.7 GENERAL APPROACH TO AMP RESPONSES 12
1.2.8 ANNUAL REVIEW AND ANNUAL REPORTING 12
1.3 RECLAMATION RESEARCH INTO PASSIVE TREATMENT (CONTINGENCY AMP ELEMENTS) 12
1.3.1 CONSTRUCTED WETLAND TREATMENT SYSTEMS 13
1.3.2 BIOREACTORS 14
1.3.3 BATCH TREATMENT OF OPEN PITS 14

2 AMP COMPONENT – SURFACE WATER 17

2.1 SURFACE WATER – DESCRIPTIONS 17
2.2 SURFACE WATER – NARRATIVE TRIGGERS 19
2.3 SURFACE WATER – MONITORING REQUIREMENTS 19
2.4 SURFACE WATER – EVALUATION OF MONITORING 19
2.5 SURFACE WATER – SPECIFIC INDICATORS 19
2.6 SURFACE WATER – SPECIFIC THRESHOLDS 19
2.7 SURFACE WATER – RESPONSE APPROACHES 20

3 AMP COMPONENT – GROUNDWATER 22

3.1 GROUNDWATER – DESCRIPTIONS 22
3.2 GROUNDWATER – NARRATIVE TRIGGERS 22
3.3 GROUNDWATER – MONITORING REQUIREMENTS 22
3.4 GROUNDWATER – EVALUATION OF MONITORING 22
3.5 GROUNDWATER – SPECIFIC INDICATORS 22
3.6 GROUNDWATER – SPECIFIC THRESHOLDS 22
3.7 GROUNDWATER – RESPONSE APPROACHES 23

4 AMP COMPONENT – PIT LAKE WATER QUALITY 24

4.1 PIT LAKE WATER QUALITY – DESCRIPTIONS 24

4.2 PIT LAKE WATER QUALITY – NARRATIVE TRIGGERS 24
4.3 PIT LAKE WATER QUALITY – MONITORING REQUIREMENTS 24
4.4 PIT LAKE WATER QUALITY – EVALUATION OF MONITORING 24
4.5 PIT LAKE WATER QUALITY – SPECIFIC INDICATORS 25
4.6 PIT LAKE WATER QUALITY – SPECIFIC THRESHOLDS 25
4.7 PIT LAKE WATER QUALITY – RESPONSE APPROACHES 25

5 AMP COMPONENT – WASTE ROCK AND TAILINGS COVER PERFORMANCE 26

5.1 WASTE ROCK AND TAILINGS COVER PERFORMANCE – DESCRIPTIONS 26
5.2 WASTE ROCK AND TAILINGS COVER PERFORMANCE – NARRATIVE TRIGGERS 26
5.3 WASTE ROCK AND TAILINGS COVER PERFORMANCE – MONITORING REQUIREMENTS 26
5.4 WASTE ROCK AND TAILINGS COVER PERFORMANCE – EVALUATION OF MONITORING 27
5.5 WASTE ROCK AND TAILINGS COVER PERFORMANCE – SPECIFIC INDICATORS 27
5.6 WASTE ROCK AND TAILINGS COVER PERFORMANCE – SPECIFIC THRESHOLDS 27
5.7 WASTE ROCK AND TAILINGS COVER PERFORMANCE – RESPONSE APPROACHES 28

6 AMP COMPONENT – WATER COLLECTION AND CONVEYANCE STRUCTURES 29

6.1 WATER COLLECTION AND CONVEYANCE STRUCTURES – DESCRIPTIONS 29
6.2 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – NARRATIVE TRIGGERS 29
6.3 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – MONITORING REQUIREMENTS 29
6.4 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – EVALUATION OF MONITORING 29
6.5 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – SPECIFIC INDICATORS 29
6.6 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – SPECIFIC THRESHOLDS 30
6.7 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – RESPONSE APPROACHES 30

7 AMP COMPONENT – ADMINISTRATIVE FAILURES 31

7.1 ADMINISTRATIVE FAILURES – DESCRIPTIONS 31
7.2 ADMINISTRATIVE FAILURES – NARRATIVE TRIGGERS 31
7.3 ADMINISTRATIVE FAILURES – MONITORING REQUIREMENTS 31
7.4 ADMINISTRATIVE FAILURES – EVALUATION OF MONITORING 32
7.5 ADMINISTRATIVE FAILURES – SPECIFIC INDICATORS 32
7.6 ADMINISTRATIVE FAILURES – SPECIFIC THRESHOLDS 33
7.7 ADMINISTRATIVE FAILURES – RESPONSE APPROACHES 33

8 MAJOR CONTINGENCY AMP ELEMENTS 35

8.1 AMP COMPONENT – BIOREACTOR TREATMENT SYSTEMS 35
8.1.1 BIOREACTOR TREATMENT SYSTEM – DESCRIPTIONS 35
8.1.2 BIOREACTOR TREATMENT SYSTEM – NARRATIVE TRIGGERS 35
8.1.3 BIOREACTOR TREATMENT SYSTEM – MONITORING REQUIREMENTS 35

8.1.4 BIOREACTOR TREATMENT SYSTEM – EVALUATION OF MONITORING 36
8.1.5 BIOREACTOR TREATMENT SYSTEM – SPECIFIC INDICATORS 36
8.1.6 BIOREACTOR TREATMENT SYSTEM – SPECIFIC THRESHOLDS 36
8.1.7 BIOREACTOR TREATMENT SYSTEM – RESPONSE APPROACHES 36
8.2 AMP COMPONENT – WETLANDS 37
8.2.1 WETLANDS – DESCRIPTIONS 37
8.2.2 WETLANDS – NARRATIVE TRIGGERS 37
8.2.3 WETLANDS – MONITORING REQUIREMENTS 37
8.2.4 WETLANDS – EVALUATION OF MONITORING 38
8.2.5 WETLANDS – SPECIFIC INDICATORS 38
8.2.6 WETLANDS – SPECIFIC THRESHOLDS 38
8.2.7 WETLANDS – RESPONSE APPROACHES 38

9 AMP COMPONENT – GENERAL RECLAMATION MEASURES 39

9.1 RECLAMATION COVER MATERIAL – DESCRIPTIONS 39
9.1.1 RECLAMATION COVER MATERIAL – NARRATIVE TRIGGERS 39
9.1.2 RECLAMATION COVER MATERIAL – MONITORING REQUIREMENTS 39
9.1.3 RECLAMATION COVER MATERIAL – EVALUATION OF MONITORING 39
9.1.4 RECLAMATION COVER MATERIAL – SPECIFIC INDICATORS 40
9.1.5 RECLAMATION COVER MATERIAL – SPECIFIC THRESHOLDS 40
9.1.6 RECLAMATION COVER MATERIAL – RESPONSE APPROACHES 40
9.2 CONTAMINATED SOILS – DESCRIPTIONS 40
9.2.1 CONTAMINATED SOILS – NARRATIVE TRIGGERS 40
9.2.2 CONTAMINATED SOILS – MONITORING REQUIREMENTS 41
9.2.3 CONTAMINATED SOILS – EVALUATION OF MONITORING 41
9.2.4 CONTAMINATED SOILS – SPECIFIC INDICATORS 41
9.2.5 CONTAMINATED SOILS – SPECIFIC THRESHOLDS 41
9.2.6 CONTAMINATED SOILS – RESPONSE APPROACHES 41

10 REFERENCES 43

LIST OF TABLES

Table 1-1: Summary of the five key surface water quality monitoring stations for Minto mine site listed from distal to proximal 10

LIST OF FIGURES

Figure 1-1: Sequential components of the AMP (Adapted from AECOM, 2010) 16
Figure 2-1: Conceptual closure map and key monitoring stations 18
Figure 7-1: Responsibility hierarchy for the Minto closure process 34

1 INTRODUCTION

Minto Explorations Ltd. (Minto), a wholly owned subsidiary of Capstone Mining Corp. (Capstone), owns and operates the Minto copper mine. The Minto mine site is located within Selkirk First Nation (SFN) Category-A Settlement Land (Parcel R-6A), and is approximately 240 km northwest of Whitehorse, Yukon. The Minto mine commenced commercial operations in October 2007.

An AMP is an iterative process. This implies that an AMP is never complete in nature, but in a continuous state of refinement in response to feedback from monitoring, analysis of data and changing conditions. The ideas presented within this document build on information gathered through the operations and environmental monitoring at Minto. Phase IV is part of a sequence of stages in the evolution of the life cycle of the Minto mine site. Until final closure, the project is anticipated to continue to evolve and change. For example, as Phase IV proceeds into the reclamation and closure process, mining and development of Phase V/VI may be commencing. The various components and activities related to the phases do not occur in isolation, and plans such as this AMP must be dynamic in order to effectively deal with change. As a result, any future developments that occur at the Minto mine site will necessitate updates to the AMP. Thus the AMP is considered a "living document". Subsequent iterations of the closure AMP will take these changes into account.

Anticipated events, response planning, and results are normally contained within site management plans. AMPs are typically designed to guide responses to unforeseen or contingency events. This AMP is designed to guide responses to unanticipated results and also provide a framework to guide responses to potential but low probability events where uncertainty exists.

Since it is difficult to predict the specific environmental condition that may arise which requires a response from management, the AMP does not necessarily provide specific detailed descriptions of responses to a situation. The AMP provides a range of possible responses to use as a guide to respond to specific environmental conditions encountered. Management should use the information provided in the AMP to identify and undertake the appropriate response.

1.1 ADAPTIVE MANAGEMENT PLAN BACKGROUND AND VERSION HISTORY

A number of iterations and versions of operational adaptive management plans have been utilized by the Minto project. A new water management plan (WMP) was created as part of WUL QZ96-006 Amendment #7 with a focus on the protection of the receiving environment. An adaptive monitoring and management plan (AMMP) was established as a starting point from which Minto intended to improve its understanding and management of water at the Minto mine site. The WMP was developed based on predicted water quality and quantities at the Minto site. The AMMP was established to measure water quality and quantities and to test the assumptions that underlie the WMP. The WMP and supporting documents represented a significant effort to better understand and predict the scale and frequency of events as well as their expected impact on the operations at the Minto mine site. These efforts to increase the comprehension of the water quality and quantities at the Minto mine site included:

- monitor the environment
- detect changing conditions by evaluating monitoring
- appropriate reactions and responses

The AMMP also provided a framework for re-evaluating key elements of the WMP in a systematic and adaptive way. This adaptive approach continues to evaluate and adjust activities in the WMP including:

- when monitoring frequency will increase
- where monitoring will take place
- when the mine will discharge water downstream
- when the mine will stop discharging downstream

The AMMP included processes for changing the WMP in a systematic and adaptive way. It also included a reporting schedule as well as mechanisms for incorporating stakeholder inputs to ensure the principles on which the WMP was approved are being applied.

The AMMP was used as a starting source for the establishment of his AMP (Phase IV Preliminary AMP). Details in this document (specific triggers, thresholds and responses)_are still being developed through the 'living document process" in ongoing discussions with Selkirk First Nations (SFN). This Phase IV AMP has beendrafted in conjunction with the updated Phase IV RCP – however, the Minto mine site is currently actively developing the Phase V/VI mine plan and developing the updated mine closure configurations. There are no plans to end the mining operations in the configuration presented in the Phase IV RCP; however, this AMP provides direction regarding how the Phase IV AMP would be implemented in the unlikely event that the Minto Mine was to close prior initiation of the Phase V/VI closure configuration.

1.2 CLOSURE AND RECLAMATION ADAPTIVE MANAGEMENT PLAN (AMP)

1.2.1 AMP Objectives

This adaptive management plan (AMP) aims to identify areas of uncertainty within the Phase IV RCP and its predictive elements. This AMP, or subsequent iterations, will develop monitoring commitments, thresholds, triggers, and responses to underperforming elements or emerging risks within the Phase IV reclamation and closure process.

The primary objective of this AMP is to protect the quality of off-site water by isolating and controlling the on-site water, if necessary. The AMP also focuses on internal component within the disturbed mining footprint in order to ensure that the entire site is maintained in a state that is consistent with land use objectives and SFN expectations. Active water treatment is held as a contingency measure within the Phase IV AMP.

Within this Phase IV AMP, active water treatment is to be considered the ultimate fail safe in the event that mine discharge water quality is unable to meet the specified closure standards in the near term, following closure. If the mine was to closure at the end of Phase IV – the existing treatment plant would remain online, treating as necessary. Studies are currently underway looking at passive treatment technologies, and would be advanced to the point of "proof of concept" well within the first three years of necessitated active water treatment.

1.2.2 AMP Approach

The approach presented in this AMP follows the Environmental Code of Practice for Metal Mines, Environment Canada, Section 4.1.17 on Adaptive Management:

"Mine owners/operators should use adaptive management methods to revise and refine the environmental management strategy. Adaptive management should consider a wide range of factors, including:

- the results of environmental audits or other evaluation activities;
- the results of environmental monitoring;
- the results of monitoring of the performance or condition of environmental infrastructure, such as containment structures, water management systems or treatment facilities;
- technological developments; and
- changing environmental conditions."

1.2.3 AMP Components

The following AMP components have been identified through various processes including the water licencing amendment process, consultation with SFN and their agents, site operations including monitoring/ management, and input from Access Consulting Group (Access) as well as other consultants. The activities associated with the mining life cycle of Phase IV may contribute to future environmental conditions (particularly water quality) that may require the implementation of an adaptive management plan for:

- Surface water quality
- Groundwater quality
- Pit lake water quality
- Waste rock and tailings cover performance
- Water collection and conveyance structures
- Administrative failures
- General reclamation measures

1.2.4 AMP Specific Triggers and Thresholds

Specific AMP triggers and thresholds for most of the major components remain to be developed and are not yet presented in this AMP. For example, Section 2 describing AMP responses to changes in surface water quality,

refers generically to "exceedances of corresponding AMP thresholds." Development of these thresholds is still subject to ongoing discussions with regulators and key stakeholders including SFN.

In concept, it is Minto's position that these thresholds and triggers will be selected in order to maintain suitable and protective water quality to protect environmental values at and surrounding the project site during operations and post-closure. Conceptually, Minto believes that "suitable water quality" metrics and corresponding AMP triggers and thresholds will be selected based on closure configuration and primary closure mitigation and designed to ensure that any water leaving the mine site is protective of the aquatic environment – the most sensitive receiver – such that the water chemistry of the discharge water is always below the "no effects level" for protection of sensitive aquatic habit. Further to this point:

- The "no effects" concentration of the various constituents of concern (i.e., Cu, Cd, Se..,) have been calculated using an environmental effects assessment.
- Minto, in consultation with SFN, recognizes that it is desirable to maintain the concentration of constituents of concern as low as practicable. To that end, Minto will propose a series of environmental triggers, well below the calculated no effects level that would initiate a progressive series of steps to both investigate potential reasons for the observed changes to metal concentrations in the water and, if warranted, implement plans to mitigate against undesirable changes to discharge water quality.
- The primary point of compliance for mine water discharge is proposed to be W3
- Several additional internal monitoring points (i.e., W15, W37…) will also be tracked and compared against discharge water quality standards. Trends and instantaneous water quality will be monitored to determine if additional investigation and/or mitigation is warranted to address changes to water make-up.

1.2.5 AMP Monitoring

The keystone environmental component for the Minto mine site is the water quality within Minto Creek, which flows into the Yukon River.

To evaluate Minto Creek water quality, routine water quality monitoring at key locations within the physical footprint of the Minto mine site and at the lowest point of control (monitoring station W3) will be the primary monitoring method used to identify the need for adaptive management. The locations of the various AMP monitoring stations are shown in Figure 2-1.

Drainage from the Southwest Waste Dump is to be collected in a pond and to be monitored by station W15 (monitoring stations are shown in Figure 2-1) and routed to the Main Pit prior to discharge. Monitoring results obtained from W15 will indicate the performance of the closure system components upgradient of this location including waste rock cover systems, and water diversion and conveyance systems.

The final point of control for drainage from the Minto mine site will occur at W3 on Minto Creek, which is at the base of the disturbed footprint. Monitoring results from W3 will indicate the water quality inputs from the whole mine site into Minto Creek. A contingency collection system will allow for the capture and return of water to the active water treatment plant (WTP), if necessary. Monitoring results obtained from W3 will indicate the

performance of all closure mitigation system components upgradient of this collection point, and for the whole mine site that sits with the Minto Creek drainage basin.

Monitoring and the interpretation of monitoring results will serve as key indicators of the effectiveness of the onsite natural and constructed systems. Specific triggers and thresholds will be developed and refined through interpretation of monitoring results, site specific closure system trials, and in response to changing environmental conditions.

Trends and instantaneous water quality will be monitored to determine if additional investigation and/or mitigation is warranted to address changes to water make-up.

A summary of the four key surface water quality monitoring stations are listed from distal to proximal to the mine site and are described in Table 1-1:

Table 1-1: Summary of the five key surface water quality monitoring stations for Minto mine site listed from distal to proximal

Water Quality Monitoring Station	Description
W2	Monitoring point in lower Minto Creek prior to confluence with Yukon River,.
W3	Located at the toe of the WSP dam, currently the main discharge compliance point in the current water licence. Receives all surface drainage from the upgradient mine site.
W37	Located at the collection pond at the toe of the dry stack tailings storage facility (DSTSF) and the mill valley fill extension (MVFE) prior to discharge to Minto Creek.
W35	Top of the South Diversion Ditch, prior to flow into Area 2 Pit.
W15	Located at the outlet of the contingency collection pond below the bioreactor and wetland systems which treats drainage from the Southwest Dump.

Specific indicators and thresholds at these key monitoring locations will be used as the primary triggers for adaptive management. Once this AMP water quality trigger has occurred an investigative adaptive management response will be used to determine the cause of the water quality trigger, and develop the appropriate response(s).

Example 1:

A specific threshold for a key indicator (total copper) is exceeded at monitoring station W15. Contingency collection and pumping of this water to the active WTP is conducted in the short term prior to release, and an investigation to determine the root cause of the trigger is conducted. This investigation determines that a major failure in the upper diversion structures on the Southwest dump has resulted in excessive run-on of upgradient water into and through the southwest dump.

For the example above, the routine water quality monitoring results at W3 and W15 were the primary monitoring methods used to identify the need for adaptive management. Other routine and periodic monitoring for specific components may initiate an AMP trigger, even though the water quality at stations W3 or W15 may be below threshold levels.

Increasing trends in constituents of concern at this location would also trigger a re-evaluation of the potential role of passive and semi-passive treatment technologies to supplement the existing closure measures.

Example 2:

An annual geotechnical inspection revealed erosion and significant cracks forming in the cover of the DSTSF. This triggered the adaptive management plan for cover system failures and a response is initiated. The cover system is repaired, and increased monitoring and result evaluations are conducted for stations W37 and W3.

1.2.6 AMP Elements

Each of the AMP components within this document are described according to the elements listed below. A common element approach was taken for each component. This was done to create consistency across, and within, all of the AMP components. The common elements and resulting processes are summarized below and illustrated in Figure 1-1

1. Component description and possible environmental consequences (resulting in)
    a. Possible environmental impacts (resulting in)
        i. Narrative triggers and specific thresholds
2. Narrative triggers (resulting in)
    a. Specific Indicators
3. Monitoring requirements (resulting in)
    a. Monitoring frequency and scheduling of specific indicators
4. Evaluation of monitoring (resulting in)
    a. Examination if thresholds have been crossed
5. Specific indicators (resulting in)
    a. Environmental parameters to be monitored and assessed
6. Specific thresholds (resulting in)
    a. Conditions defined for specific indicator(s) – There may be a series of staged thresholds
    b. Management action plan activated

7. Response approaches (resulting in)
    a. Implementation of response plan(s) for any thresholds that have been crossed

1.2.7 General Approach to AMP Responses

The following general steps may be taken if any AMP trigger(s) have been exceeded:

- Internal notification to management, followed by notification to SFN and the Water Inspector that a trigger has been exceeded (within a timely period)
- Investigation of the root cause of the exceedance
- If a root cause of the exceedance can be readily identified and remedied, the remedy will be implemented in a timely manner, and the water inspector will be notified of the remedy and the implementation in a timely manner according to permit requirements
- If a root cause cannot be readily identified, a study plan will be outlined and communicated to involve qualified professionals to assist in the identification of the root cause(s)
- An action plan will be devised for the mediation of the problem
- Increased monitoring / sampling frequencies to monitor the situation and see if prescribed mitigation is appropriate and effective
- Inspect and monitor any modification to infrastructure

1.2.8 Annual Review and Annual Reporting

An annual review of the AMP will be performed and any necessary amendments or updates to the AMP elements will be conducted. The annual review will include a review of the relevant monitored data and AMP elements.

Updates, amendments, thresholds crossed, and trigger activated will be provided to the appropriate governmental (including SFN) organizations as required and will be part of the annual report.

1.3 RECLAMATION RESEARCH INTO PASSIVE TREATMENT (CONTINGENCY AMP ELEMENTS)

Research is ongoing into a variety of passive and semi-passive treatment technologies that could potentially be incorporated into closure planning at the Minto Site to provide supplementary treatment of mining impacted waters. A detailed screening process and literature review identified three primary candidate passive/semi-passive treatment technologies that warranted further consideration for possible incorporation into closure planning at Minto. The short-listed technologies include: constructed wetland treatment systems (CWTS), bioreactors and batch treatment of open-pit water.

Minto is committed to continuing to evaluate and develop all three of these technologies to the "proof of concept" level such that these technologies could, if necessary, be rapidly deployed and efficiently incorporated as long-term, post closure supplementary treatment of mining impacted waters. The research is designed to have the each of these technologies developed to an advanced stage (ready for full scale implementation) within the next three to five years (or within three years of the commencement of final closure).

It is currently anticipated that the existing proposed source control measures (covers and water diversions) will be sufficient to ensure that discharge water quality will be protective of the most sensitive aquatic receivers and well below (to be determined) final discharge water quality standards. The passive/semi-passive treatment technologies being evaluated as part of the ongoing reclamation research would only be implemented in the event that water quality is significantly worse than predicted and the "base case" mitigation measure prove to be inadequate.

Brief summaries of the passive treatment technologies being evaluated in connection with the Reclamation Research Plan are presented below.

1.3.1 Constructed Wetland Treatment Systems

Constructed wetlands are considered to be one of the most established passive treatment methods for remediating mine-impacted water and have been used by the mining industry since the mid-1980s. There have been many wetland systems that have had long-term success but there have also been failures among improperly designed systems. Many of the systems that failed or were not effective at remediating the contaminants of concern were either improperly sized or designed, all of which can be corrected through a systematically designed piloting program (INAP 2010). A research program is currently underway to evaluate

Proposed as contingency load reduction measures, CWTSs have good potential for success at the Minto site, should additional load reduction beyond the proposed source control measures be required. The ability to achieve water quality targets by any type of technology is reliant upon accurate knowledge of input parameters and clearly defined objectives. Many of these have been assessed for the Minto site, and a research program has been designed to obtain additional necessary information for the successful development and implementation of the CWTS. This preliminary site data will then be applied to pilot-scale CWTS on site and in testing in Contango Strategies Ltd.'s (CSL's) year-round greenhouse in order to develop the design basis for the eventual demonstration and full-scale CWTS on site.

Areas that have been identified as potential locations for construction of passive treatment wetlands on the Minto Site include the:

- W15 Area – Upgradient of the runoff collection sump at the toe of the Southwest Dump; and
- W37 Area – vicinity of the existing Water Storage Pond and Dam location, below the toe of the MVFE.

More information on CTWS research program and how they could be implemented at these candidate locations is presented in the Phase IV RCP - Section 4.5.4.2.

1.3.2 Bioreactors

Bioreactors are proposed as the complimentary contingency passive treatment technology to CTWSs for Minto closure. In the broadest sense, a bioreactor can be defined as permeable treatment zone that uses biochemical processes. Biological reactors use the degradation of organic materials for the purposes of treatment and often involve installation of the treatment materials into lined trenches or pond systems.

These systems have been used in mining applications to treat groundwater discharges from underground workings and also for shallow groundwater systems. Treatment media for biological reactors in the documented studies are often derived from local municipal and industrial waste sources; however, it would be necessary to determine whether these sources exist in the local area or can be sourced and transported to site in a cost effective manner. Wood chips or peat are local products that could be utilized. These systems could also be operated in a semi-passive mode where an alcohol tank can be set up to drip into the influent end of the biological reactor, and only require infrequent refilling.

A primary challenge with the design of bioreactors (and PRB systems), which can lead to poor performance, is the inadequate characterization of the in situ flow conditions within the permeable reactive media which results in the bioreactor failing to achieve suitable hydraulic performance and residence time. The nature of potential failures includes improper sizing of the reactor for the flow conditions at the site, and problems with the substrate composition. Examples of flow-related failures are cases where the range flow is too great, causing—at certain times of the year—situations where not all of the flow can be routed through the bioreactor (because of physical limitations of the media), or where the concentration of seepage varies through the year, and the mass loading exceeds the potential mass removal. Examples of these substrate-related failures includes insufficient inclusion of porous media (typically gravel), layered substrates where one layer becomes a flow barrier, and changes in hydraulic properties of organic substrates as they degrade. Other design considerations that affect the potential for bioreactors to work are the physical configuration of the reactor, with some configurations more susceptible to dead zones where substrate is partially or entirely unused for treatment because flow does not pass through these zones.

To avoid these potential pitfalls, the scope of work for evaluating the potential application of bioreactor technology at the Minto Site has been divided into several stages—beginning with detailed characterization of the seepage inputs and foundation conditions in the areas where bioreactors are being considered and advancing to laboratory characterization and bench scale testing of substrate mixtures before ultimately advancing to field scale pilot trials.

More details of the ongoing evaluation of bioreactor technologies and application at the Minto Site is presented in the Phase IV RCP – in Section 4.5.4.3.

1.3.3 Batch Treatment of Open Pits

Investigations are currently underway to evaluate the feasibility and effectiveness of batch treating pit-lake water by adding additional carbon sources (e.g., sugars and alcohols) to create reducing conditions that would facilitate the precipitation of metals as sulphides. In 2012, four limnocorrals were placed into the Main Pit, filled with pit water, and amended with reagents to encourage microbial reductive treatment of selenium, copper, and nitrate. The treatment method for the removal of these constituents is biochemical reduction,

where nitrate is reduced to nitrogen (gas), selenium (as selenite/selenite) is reduced to elemental selenium (solid precipitate). In the higher doses of organic carbon sources, sulphate reduction is also expected; in this case, some metals such as copper may be removed as sulphide precipitates. This limnocorral study is part of an ongoing program to evaluate the feasibility of passive treatment at the Minto Mine site, and the results of this study will be used to design possible larger scale trials in the lake and/or will inform other potential passive treatment studies, including constructed wetlands and bioreactors, at the site.

Initial limnocoral tests have provided promising results for sequestering metals. More details of the ongoing pit-lake treatment evaluation are presented in the Phase IV RCP - Section 4.5.4.1.

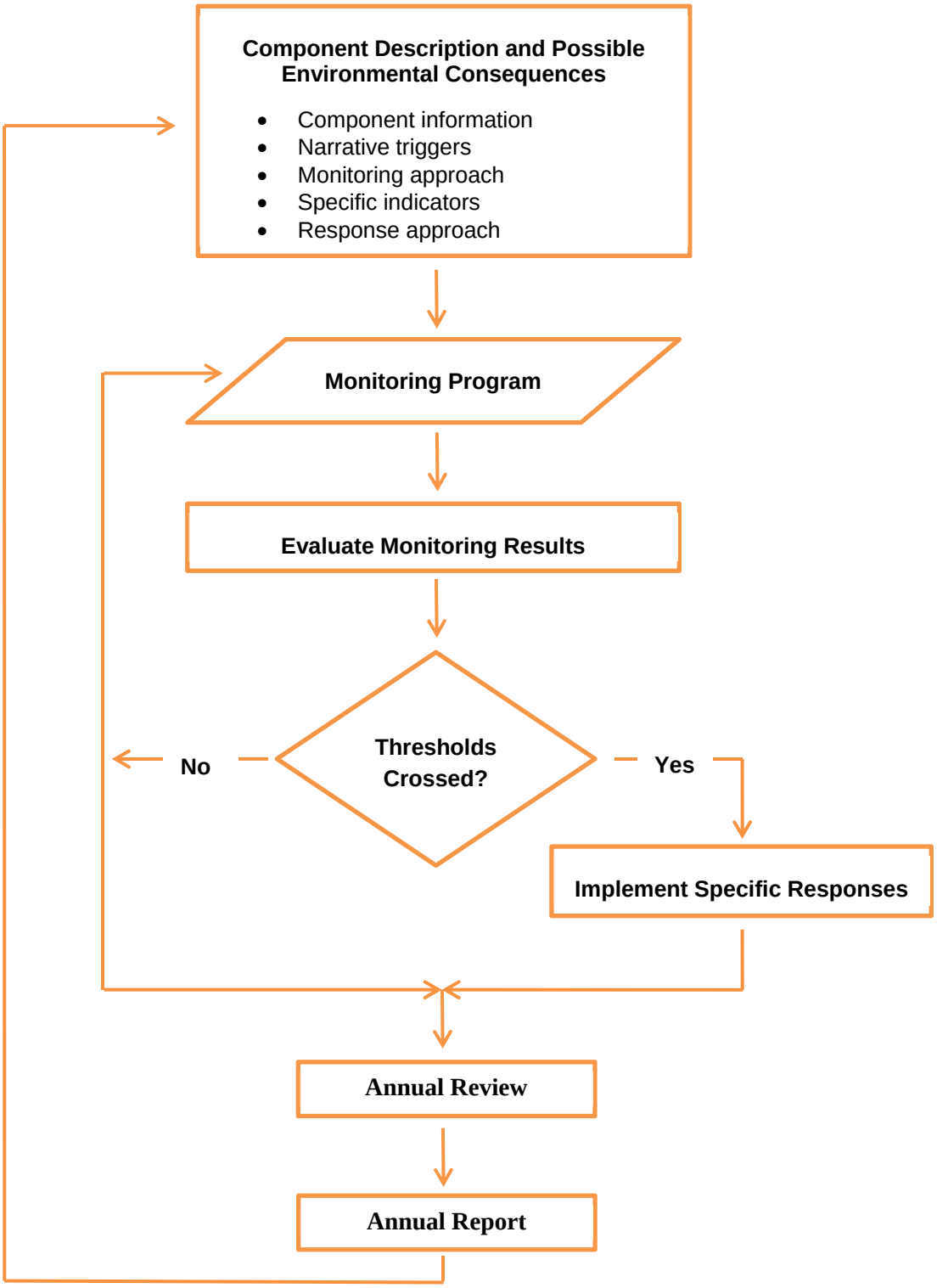


Figure 1-1: Sequential components of the AMP (Adapted from AECOM, 2010)

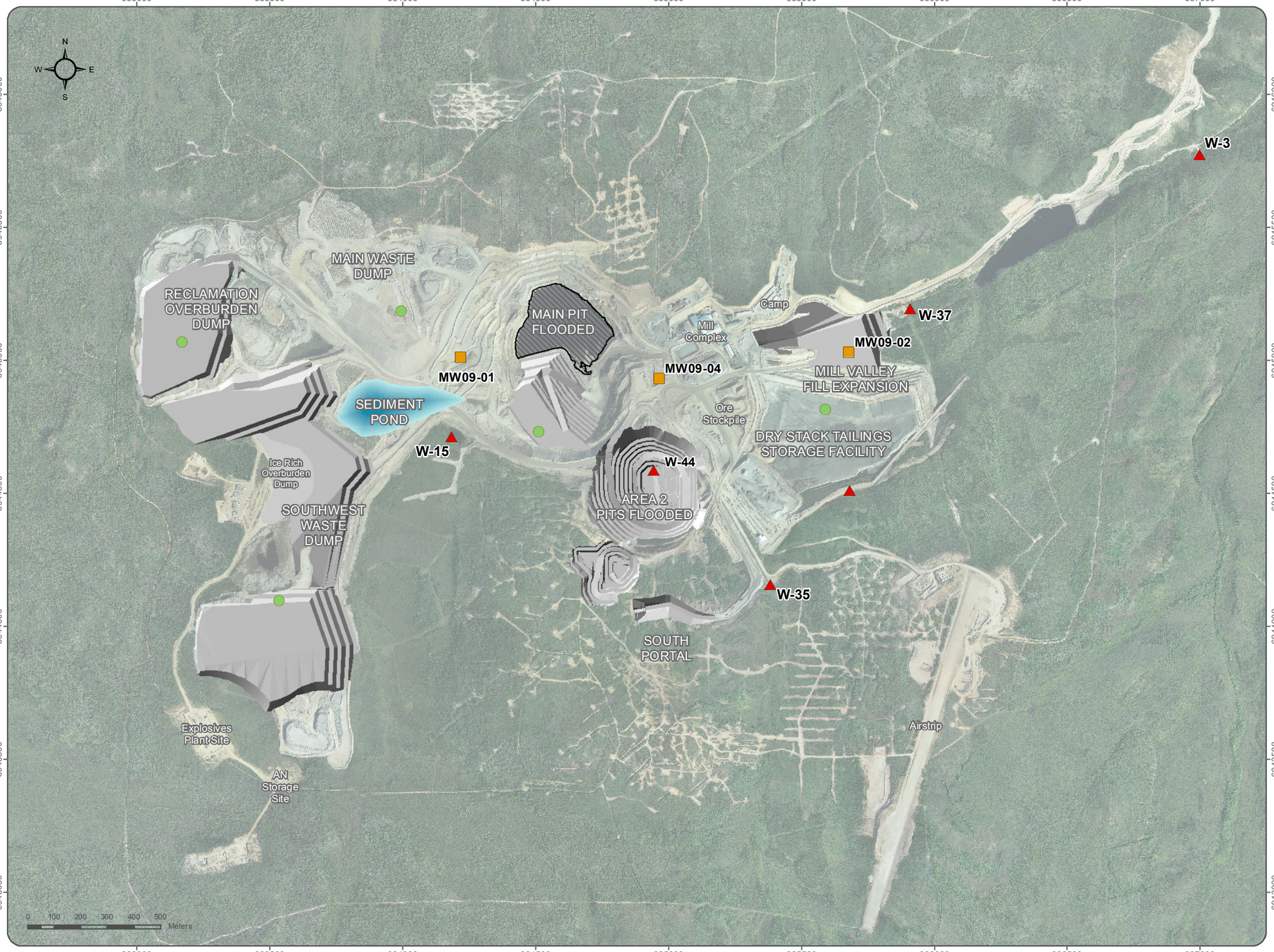
2 AMP COMPONENT – SURFACE WATER

2.1 SURFACE WATER – DESCRIPTIONS

Station W3 (Figure 2-1) is to be considered the main control point on Minto Creek. It is also the last surface monitoring point on the mine site property and is considered a discharge compliance point under the current water licence.

Additional key surface water monitoring locations upgradient of W3 and within the mine footprint are located at W37, W35, and W15 (Figure 2-1). It is anticipated that all mine site surface drainage will flow through at least one of the monitoring stations mentioned above, with all surface water reporting through monitoring station W3.

It is recognized that the W2 (Table 1-1) monitoring point is well beyond the final mine water discharge point controlled by Minto, and is subject to a broad range of influences from tributaries and catchment areas that are beyond Minto's control; however, Minto is committed to monitoring the water quality at W2 and working collaboratively with SFN to develop a series of progressive triggers by which Minto would respond proactively to unanticipated changes.



capstone
MINTO MINE

MINTO MINE PHASE IV

ADAPTIVE MANAGEMENT PLAN

FIGURE 2-1

CONCEPTUAL CLOSURE AMP MONITORING

- Ground Water Monitoring
- Pysical and Geotech Monitoring
- Surface Water Quality Monitoring

ACCESS

Aerial imagery obtained from Challenger Geomatics.
Imagery acquired August 14 th 2012.
Site contours derived from 2012 aerial imagery obtained from Challenger Geomatics.

Datum: NAD 83 Projection: UTM Zone 8N

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law or for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

I:\Minto\gis\mxd\Closure\09-

2.2 SURFACE WATER – NARRATIVE TRIGGERS

Surface water quality specific indicators exceed their corresponding AMP thresholds.

2.3 SURFACE WATER – MONITORING REQUIREMENTS

Routine surface water monitoring is to take place at stations W3, W37, W35, and W15 for the full suite of recommended parameters. The regular monitoring schedule, and list of parameters may vary over time as the mine site advances through the closure and reclamation process towards steady state.

Minto is committed to monitoring the water quality at W2 and working collaboratively with SFN to develop a series of progressive triggers by which Minto would respond proactively to unanticipated changes.

2.4 SURFACE WATER – EVALUATION OF MONITORING

Regularly scheduled reviews and interpretations (tied to the monitoring frequencies) of surface water monitoring results are needed in order to determine if the specific thresholds or triggers within the AMP have been exceeded.

The surface water quality results are to be circulated to the appropriate internal and/or external personnel for evaluation and comparison to specific indicators and thresholds.

2.5 SURFACE WATER – SPECIFIC INDICATORS

Specific indicators of water quality will most likely include total metal concentrations. Currently, constituents of potential concern (COPCs) for the site include total Cu, Cd and Se. Other non-metal parameters for water quality may be included as specific indicators, for example total suspended solids (TSS).

The number of surface water parameters, or the parameter's specific thresholds, may change over time as the mine site advances through the closure and reclamation process towards steady state (Table 1-1).

2.6 SURFACE WATER – SPECIFIC THRESHOLDS

To be determined, pending interpretations and results from monitoring and modeling work. The specific thresholds need to consider the following:

- Water Use License (WUL) effluent compliance limits – (currently being redeveloped)
- Metal Mining Effluent Regulations (MMER) effluent limits are applicable for 3 years after written notice has been submitted to Environment Canada that the mine site will be closed.
- Performance evaluation of cover systems and semi-passive treatment systems
- Predictive work which includes interpretations and results from monitoring and modeling work

2.7 SURFACE WATER – RESPONSE APPROACHES

A response is initiated once the AMP is triggered by a threshold exceedance and may consist of:

- Internal notification to management, followed by notification to SFN and the Water Inspector that a trigger has been exceeded within a timely period
- Investigation of the root cause of the exceedance
- Check mitigation systems for integrity (i.e., covers, treatment systems, conveyance structures)
- If a root cause of the exceedance can be readily identified and remedied, the remedy will be implemented in a timely manner, and the water inspector notified of the remedy implementation in a timely manner according to permit requirements
- If a root cause cannot be readily identified, a study plan will be outlined and communicated to involve qualified professionals to assist in the identification of the root cause
- Prepare action plan for the mediation of the problem
- Sample monitoring locations, with a systematic approach from the furthest known contaminated downstream point moving upstream and review results
- Increase monitoring frequencies and locations. For example, set up monitoring stations before and after bioreactors to isolate issues if it has been traced to the bioreactor area
- Isolate location of elevated values
- Increase monitoring / sampling frequencies to monitor status and see if mediation is appropriate and effective
- Inspect and monitor any modification to infrastructure
- Initiate active treatment if determined an appropriate response

Example:

> Total copper concentrations exceeding threshold levels were reported in 2 consecutive sampling events at station W3 (Figure 2-1).

Example Response:

- Minto staff, SFN, and Water resources notified that a trigger has been exceeded within a timely period
- Samples taken at monitoring stations W37, W35, and at W15. Results indicate elevated or increasing copper concentrations occur at station W15, but not at station W35

- Investigate potential root cause of observed changes to water chemistry including the performance of the cover system, water diversions and water conveyance.
- Address any observed deficiencies and increase sampling locations and frequencies around the deficient infrastructure to evaluate the impact of the system upgrades/repairs
- Evaluate potential benefits of incorporating passive and/or semi-passive treatment technologies to treat mining impacted water in this location
- Increase monitoring frequency at W3 and at W15 for the near term until steady state and / or expected performance returns
- Active treatment (contingency) initiated / increased if determined an appropriate response

3 AMP COMPONENT – GROUNDWATER

3.1 GROUNDWATER – DESCRIPTIONS

The groundwater conditions at the Minto mine site are monitored according to the Groundwater Monitoring Plan. Groundwater monitoring is conducted through routine sampling of groundwater wells and / or piezometers at key locations around the site. This work has shown that the groundwater is controlled topographically, and is assumed to report to surface before monitoring station W3. The groundwater may be influenced by the construction, operation, and infrastructure located on site. These infrastructures include, but are not limited to: the underground workings, waste rock, tailings, pits, as well as their interactions with the natural systems.

3.2 GROUNDWATER – NARRATIVE TRIGGERS

Groundwater quality parameters exceed their corresponding AMP thresholds.

3.3 GROUNDWATER – MONITORING REQUIREMENTS

Monitoring locations to be picked, and may include: groundwater wells, underground workings, pits, etc. which are located down gradient of significant infrastructure on site and to follow the groundwater monitoring plan.

3.4 GROUNDWATER – EVALUATION OF MONITORING

Regularly scheduled reviews and interpretations (tied to the monitoring frequencies) of groundwater monitoring results are needed in order to determine if the specific thresholds or triggers within the AMP have been exceeded.

The groundwater quality results are to be circulated to the appropriate internal and / or external personnel.

3.5 GROUNDWATER – SPECIFIC INDICATORS

Specific indicators of water quality will mostly likely include dissolved metal concentrations. Currently, constituents of potential concern (COPCs) for the site include Cu, Cd and Se.

The number of groundwater parameters, or the parameter's specific thresholds, may change over time as the mine site advances through the closure and reclamation process towards steady state.

3.6 GROUNDWATER – SPECIFIC THRESHOLDS

To be determined, pending interpretations and results from monitoring and modeling work.

3.7 GROUNDWATER – RESPONSE APPROACHES

- Internal notification to management, followed by notification to SFN and the Water Inspector that a trigger has been exceeded within a timely period
- Investigation of the root cause of the exceedance
- Check upgradient mitigation systems which could influence groundwater for integrity (i.e., covers, treatment systems and water conveyance structures)
- If a root cause of the exceedance can be readily identified and remedied, the remedy will be implemented in a timely manner, and the water inspector notified of the remedy implementation in a timely manner according to permit requirements
- If a root cause cannot be readily identified, a study plan will be outlined and communicated to involve qualified professionals to assist in the identification of the root cause
- Prepare action plan for the mediation of the problem
- Sample monitoring locations, with a systematic approach and review results, from the furthest known contaminated down gradient point moving up gradient
- Isolate location of elevated values
- Increase monitoring / sampling frequencies and locations to monitor status and see if mitigation is appropriate and effective
- Inspect and monitor any modification to infrastructure
- Evaluate the potential benefits of incorporation passive/semi-passive treatment technologies (i.e., permeable reactive barriers (PRBs)) to treat contaminant plumes where conditions allow
- Initiate seepage interception and pump-back to active treatment if determined an appropriate response

4 AMP COMPONENT – PIT LAKE WATER QUALITY

4.1 PIT LAKE WATER QUALITY – DESCRIPTIONS

This AMP section will focus on the following water quality variables for the Main and Area 2 Pit Lakes:

- Open pits slope stability and extent of fracturing
- Flooding events and the effects on Pit Lake water quality, and the water and materials within the open pits
- Source(s) and quality of surface and groundwater entering and leaving the Pit Lakes

4.2 PIT LAKE WATER QUALITY – NARRATIVE TRIGGERS

Within this AMP, pit lake water quality refers to the discharge water conditions from the Area 1 and Area 2 Pit Lakes, which are both anticipated to be 'flow through' pit lakes. This means that they have engineered channels carrying collected site runoff entering and exiting the pit.. . Example possible failures related to the pit lakes include:

A. Water quality flow through the open pits does not perform as expected

B. Source terms are underestimated, resulting in higher than expected loading from the Pit Lakes and unacceptable water quality results downstream

C. Pit wall failure results in a displacement wave, of water released from either Pit Lake causing damage to downstream facilities and / or the mobilization of tailings

4.3 PIT LAKE WATER QUALITY – MONITORING REQUIREMENTS

Specific indicators will be established from the surface water quality results Pit Lakes as well as from the monitoring stations results from W15, W37, W35, W2 and W15.

4.4 PIT LAKE WATER QUALITY – EVALUATION OF MONITORING

A performance evaluation is to be conducted on the Pit Lakes water quality. Periodical inspections, maintenance, sampling, and geotechnical monitoring are also to be performed.

The performance evaluation will consist of (in part):

- The surface water quality results and monitoring stations W3, W37, W35, W2 and W15
- Periodical physical inspections and maintenance

4.5 PIT LAKE WATER QUALITY – SPECIFIC INDICATORS

Specific indicators of water quality will most likely include total metal concentrations. Currently, constituents of potential concern (COPCs) for the site include total Cu, Cd and Se. Other non-metal parameters for water quality may be included as specific indicators, for example total suspended solids (TSS).

The number of surface water parameters, or the parameter's specific thresholds, may change over time as the mine site advances through the closure and reclamation process towards steady state (Table 1-1).

Specific indicators will be established from the surface water quality parameters at monitoring stations W15, W37, W35, W2 and W15.

4.6 PIT LAKE WATER QUALITY – SPECIFIC THRESHOLDS

Specific thresholds will be related to, or triggered by, unacceptable water quality measurements at key downstream monitoring stations.

4.7 PIT LAKE WATER QUALITY – RESPONSE APPROACHES

- The basic assumption for this subsection is that the Pit Lakes water quality will contain a moderate initial contamination level, particularly during active flooding. Adaptive management maybe required if water quality conditions are elevated or show increasing trends above this base assumption.

- Lake water quality conditions are not as expected. In response, an adaptive management approach is initiated to address these issues.

- downstream channels and facilities will be designed and constructed for peak flow conditions. This approach will help to decrease the possible impact of storm events.. A general adaptive management response is described in Section 1.2.6.

5 AMP COMPONENT – WASTE ROCK AND TAILINGS COVER PERFORMANCE

5.1 WASTE ROCK AND TAILINGS COVER PERFORMANCE – DESCRIPTIONS

The main waste rock dumps and tailings facilities that will exist at the end of Phase V/VI and will be covered include the following (Figure 2-1):

- Main waste dump (MWD)
- Southwest waste dump (SWD)
- South wall buttress (SWB) in the Main Pit
- Area 118 Pit
- Mill valley fill extension (MVFE), which stabilizes the toe of the dry stack tailings facility (DSTSF)
- DSTSF
- Ore stockpile pads and mill area

As described in the Phase IV RCP, all waste rock dumps will be covered with an isolating soil cover constructed from available overburden materials at site. These will then be revegetated. These cover are designed to limit exposure of the waste materials to the atmosphere and vegetation, and provide a modest reduction in infiltration of precipitation.

Potential failure modes of the cover systems were considered in the preliminary FMEA and the failure of these systems may affect the quality and / or quantity of drainage from waste rock dumps and tailings areas.

5.2 WASTE ROCK AND TAILINGS COVER PERFORMANCE – NARRATIVE TRIGGERS

Example narrative triggers based on identified potential failure mechanisms include:

- Waste rock and tailing pile and covers do not produce expected infiltration reduction which leads to an increase in metal loading and results in unacceptable downstream water quality effects.
- Erosion issues lead to increased infiltration rates and unacceptable downstream water quality effects.

5.3 WASTE ROCK AND TAILINGS COVER PERFORMANCE – MONITORING REQUIREMENTS

A performance evaluation is to be conducted on the effectiveness of the covers and waste rock storage areas. Periodic inspections and maintenance, sampling, and geotechnical monitoring are also to be performed on the waste rock storage facilities and for the tailings covers. Conceptual monitoring stations are shown on Figure 2-1.

The performance evaluation will consist of (in part):

- The surface water quality results from the waste rock dumps and the covered DSTSF
- The surface water quality results from monitoring stations W3, W37, W35, and W15
- Periodic physical inspection and maintenance

It should be noted that the risks are different for DSTSF than for other facilities on site. The DSTSF has the potential for migrating, slumping or erosion which still needs to be considered in the design, maintenance costing, etc. stages of closure and reclamation.

5.4 WASTE ROCK AND TAILINGS COVER PERFORMANCE – EVALUATION OF MONITORING

Periodic evaluations and inspections to determine:

- Geotechnical integrity and stability
- Downgradient surface and groundwater monitoring
- cover effectiveness related to vegetative success and erosion control

5.5 WASTE ROCK AND TAILINGS COVER PERFORMANCE – SPECIFIC INDICATORS

- Cover integrity and geotechnical stability, including erosion/slumping evidence
- Infiltration rates
- Surface and groundwater results
- Vegetation success

5.6 WASTE ROCK AND TAILINGS COVER PERFORMANCE – SPECIFIC THRESHOLDS

Specific thresholds will be related to, or triggered by, unacceptable water quality measurements at key downstream monitoring stations as well as the following:

- Failure to meet expected performance
- Partial or complete cover failure

5.7 WASTE ROCK AND TAILINGS COVER PERFORMANCE – RESPONSE APPROACHES

Appropriate corrective actions should take place if the waste rock and tailings cover performance fails to meet expectations. Repairs should be performed on the cover where applicable. Increased monitoring and the evaluation of the monitored results should be conducted as part of a response plan.

A general adaptive management response is described in Section 1.2.6.

6 AMP COMPONENT – WATER COLLECTION AND CONVEYANCE STRUCTURES

6.1 WATER COLLECTION AND CONVEYANCE STRUCTURES – DESCRIPTIONS

The major water diversion and conveyance structures for Phase IV closure and reclamation are shown on Figure 2-1. Detailed descriptions of these structures are provided in thePhase IV RCP. PRCP.

The water collection and conveyance structures consist of the infrastructures that assist in drainage from waste rock and tailings piles and include pipes, ditches, armored channels, bypasses, etc.

Conveyance and collection structures are also used to convey drainage from the major waste infrastructure to treatment systems prior to release.

6.2 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – NARRATIVE TRIGGERS

- Undiverted runoff upstream of waste management facilities leads to run-on water, increased infiltration, and ongoing maintenance costs

- Failure of upstream diversions and/or waste management facilities leads to excessive infiltration into upgradient base of dump, resulting in increased flows and/or metal loads and unacceptable water quality conditions downstream.

6.3 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – MONITORING REQUIREMENTS

In addition to water quality monitoring, other monitoring of the water diversion and conveyance structures will consist of periodic physical and/or geotechnical inspections.

Closure monitoring of the physical stability of the water diversion and conveyance structures is discussed in the Phase IV RCP.

6.4 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – EVALUATION OF MONITORING

- Periodic inspections and maintenance to determine condition of infrastructure

- Water quality monitoring and results evaluation from key downstream locations

6.5 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – SPECIFIC INDICATORS

Water quality and quantity at downgradient monitoring locations

Physical inspections and maintenance to be performed on infrastructure for example: pipes, channels, erosion and stability, etc.

6.6 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – SPECIFIC THRESHOLDS

- Exceedance of acceptable water quality thresholds (refer to Section 2.6)
- Physical condition of infrastructure is deteriorating and requires repair

6.7 WATER COLLECTIONS AND CONVEYANCE STRUCTURES – RESPONSE APPROACHES

Appropriate corrective actions should take place if the water collection and conveyance structures performance fails to meet expectations. Repairs should be performed on the collection and conveyance structures where applicable. Increased monitoring and the evaluation of the monitored results should be conducted as part of a response plan.

A general adaptive management response is described in Section 1.2.6.

7 AMP COMPONENT – ADMINISTRATIVE FAILURES

An "administrative failure" is defined broadly as a failure by Minto or their agents to comply with obligations under environmental acts, conditions of licences, permits, or commitments.

An administrative failure could be the result of a number of factors including, but not limited to: incompetence, lack of due diligence, fraud or deliberate error in the reporting of environmental program evaluations, site abandonment or bankruptcy. As such, possible modes of administrative failures are discussed in this section, and possible adaptive management responses are presented.

7.1 ADMINISTRATIVE FAILURES – DESCRIPTIONS

Administrative failure could occur at a number of levels within the organization including, but not limited to: the site monitoring and field staff, management, and consultants. Administrative failure is seen to be limited to be directly a result of action or lack of action which results in a failure to comply with obligations. An administrative failure could be the result of a deliberate or unintentional action or inaction.

7.2 ADMINISTRATIVE FAILURES – NARRATIVE TRIGGERS

In general, an administrative failure is considered to be a failure to maintain the site requirements and obligations as they have committed to, or agreed upon. Minto, their agents, or other agencies in charge of administering the project fail to competently manage the closure and reclamation process and fulfill their obligations as described under environmental acts, licences and permits, and agreements.

7.3 ADMINISTRATIVE FAILURES – MONITORING REQUIREMENTS

Minto is primarily responsible for the monitoring for administrative failures. Other parties including regulators, first nations, and other groups or individuals may also monitor administrative performance. Specific monitoring consists of:

1. ensuring compliance with, and proper reporting of environmental monitoring requirements under licences and permits, as well as this AMP.

2. ensuring compliance with relevant Canadian or Yukon legislation and licences. Regulatory bodies in charge of enforcing legislation and licences are also responsible to monitor compliance by Minto through regular review of environmental programming results and potentially through independent audit.

3. ensuring compliance with agreements between SFN and any other interest group. SFN and other partners in these agreements also have a responsibility to monitor the performance of the project to ensure compliance.

7.4 ADMINISTRATIVE FAILURES – EVALUATION OF MONITORING

As discussed in Section 9.3, Minto holds the primary responsibility for monitoring and evaluation of the performance of its project under relevant legislation and regulatory and licence requirements and obligations. These types of evaluations are expected to occur routinely as part of reporting requirements for site licences. These regular reports provide an opportunity for Minto to recognize if any administrative failures may be occurring, and take corrective action.

7.5 ADMINISTRATIVE FAILURES – SPECIFIC INDICATORS

Specific indicators of administrative failure will be the lack of compliance with federal and territorial legislation, and the permits, licences, plans and obligations under said legislation which governs site activity. In addition, discrepancies with any agreements with First Nations or other interest groups may also be specific indicators of administrative failure. Specific indicators may be contained in the following specific legislation, regulations, permits, licences and other agreements, which are listed below by category.

1. Federal Legislation, including the following but not limited to:
    - Environmental Violations Administrative Monetary Penalties Act, (2009) and regulations
    - Canadian Environmental Protection Act, *(1999)* and regulations
    - Canadian Environmental Assessment Act, (2012*)* and regulations
    - Fisheries Act (1985) and regulations (especially Metal Mining Effluent Regulations)
    - International River Improvements Act (1985) and regulations
    - Migratory Birds Convention Act (1994)
    - Species at Risk Act (2002)
    - Navigable Waters Protection Act and Regulations
2. Yukon Legislation, including the following but not limited to:
    - The Yukon Quartz Mining Act (2003) and Quartz Mining Land Use regulations
    - Territorial Lands (Yukon) Act (2003)
    - Yukon Waters Act (2003) and regulations
    - Yukon Environmental and Socio-economic Assessment Act (2003) and regulations
    - Yukon Environment Act (2003) and regulations

3. Licences and Permits and all plans and requirements under those licences and permits held by Minto including but not limited to:

    - Quartz mining licence QML-0001
    - Type A water licence QZ96-006

Any other agreements which may exist between Minto and any other interest group, such as SFN and the Selkirk First Nation Cooperation Agreement, may contain specific triggers and thresholds which indicate administrative failure of the project. A failure to meet the obligations under the agreement could also be viewed as a specific trigger.

7.6 ADMINISTRATIVE FAILURES – SPECIFIC THRESHOLDS

Specific thresholds are linked with specific triggers discussed in Section 9.5. A specific threshold for adaptive management is considered to be a failure to comply with obligations.

7.7 ADMINISTRATIVE FAILURES – RESPONSE APPROACHES

As discussed in Section 9.3, Minto bears the primary responsibility for monitoring, identifying and addressing administrative failures, should they occur. However, an administrative failure, by definition, involves failure as the direct result of some action or inaction, of Minto or one of its agents. Thus, responses could vary depending on the level on which the administrative failure has occurred (see Figure 9-1).

Administrative failures are primarily envisioned as initiating at the bottom of the responsibility chain at the level of site operators or contractors. Minto management should have the opportunity to identify administrative failure during regular review of environmental monitoring and performance data and results. If a failure is identified, corrective action could be undertaken. Should no corrective action be undertaken at any given level, the responsibility to bring the project back into compliance and fulfillment of its obligations would belong to the next level above in the hierarchy in Figure 9-1.

As can be seen in Figure 9-1, severe administrative failures (e.g. bankruptcy, site abandonment) could result in Minto no longer being the responsible party for the site. Should such an unlikely event occur, responsibility for the site would revert to the bond holder (i.e. YG EMR). Should the bond holder fail to administrate the site effectively or posted bond be insufficient to administer the site effectively, responsibility for the site could fall to public trust.

Legal action against the responsible parties by regulators or other groups is another avenue by which severe administrative failures (for example, deliberate contravention of Canadian or Yukon law) could result in civil or criminal charges or other penalties. This constitutes a possible response in the case of an extreme administrative failure.

If Minto is still the responsible party for site administration, the same general approach to AMP responses as presented in Section 1.2.6 will be followed for administrative failures.

Figure 7-1: Responsibility hierarchy for the Minto closure process

8 MAJOR CONTINGENCY AMP ELEMENTS

8.1 AMP COMPONENT – BIOREACTOR TREATMENT SYSTEMS

8.1.1 Bioreactor Treatment System – Descriptions

Bioreactors are currently being evaluated in the context of potential incorporation at key locations on the Minto mine site (Figure 2-1), where the potential for contaminant loading may occur at closure. Bioreactors are not proposed as part of the base case closure measures for the Minto Site; however, studies are currently underway to advance conceptual bioreactor designs for the Minto site to the "proof of concept" level such that they could be efficiently incorporated into the closure plan in the event that observed post-closure water quality is significantly worse than predicted and bioreactors are deemed to be an appropriate mitigation. Bioreactors could potentially be installed along the SWD and at the toe of the DSTSF. The bioreactor system is considered to be semi-passive and would require periodic maintenance.

As the water quality within the SWD and DSTSF is still evolving it is suggested that the area should be monitored, and the results evaluated to determine the potential benefits of incorporating bioreactors as part of the long-term water treatment solution.

A description of the proposed bioreactor conceptual systems is found in the PRCP within Section 4.2.2.3. The following section has prepared to address a hypothetical scenario in which bioreactors are incorporated into future water treatment at Minto.

8.1.2 Bioreactor Treatment System – Narrative Triggers

Bioreactors don't perform as designed, for example they become: overwhelmed, freeze, discharge unacceptable water quality, etc.

8.1.3 Bioreactor Treatment System – Monitoring Requirements

The bioreactors are part of the semi-passive water quality treatment train systems on site, which also include the anaerobic and aerobic wetlands. The primary monitoring and key performance indicators for these semi-passive water quality treatment systems will consist of the monitoring (and evaluation of monitored results) at key locations up and down stream of each treatment train. Intermediate monitoring locations within the bioreactors themselves may be used during the construction and set up phase as well as during maintenance or monitoring of the systems.

- Monitoring station W15 will serve as the key monitoring location below the SWD
- Monitoring station W37 will serve as the key monitoring station below the second treatment system which is located below the DSTSF and MVFE

If an AMP trigger is exceeded at a downstream monitoring location, additional detailed upstream monitoring within the passive treatment train would be conducted in order to help determine the root cause of the exceedance. For example, monitoring could take place at the input points, intermediate monitoring points, and discharge points for each bioreactor, and / or above and below each of the wetland systems.

8.1.4 Bioreactor Treatment System – Evaluation of Monitoring

A performance evaluation is to be conducted on the effectiveness of the bioreactors. Periodic inspections and maintenance are to be performed on the bioreactors.

The performance evaluation will consist of (in part):

- The surface water quality results from stations W3, W37, W35, and W15
- Periodic physical inspection and maintenance

8.1.5 Bioreactor Treatment System – Specific Indicators

Specific indicators will be established from the surface water quality parameters at monitoring stations W15, W37, W35, and W15.

Additional specific indicators directly related to the condition and performance of the bioreactors to be developed if required.

8.1.6 Bioreactor Treatment System – Specific Thresholds

Specific thresholds will be related to, or triggered by, unacceptable water quality measurements at key downstream monitoring stations.

8.1.7 Bioreactor Treatment System – Response Approaches

Specific bioreactor response approaches are to be developed by someone within the bioreactor field, and / or develop over time as this AMP evolves.

A general adaptive management response is described in Section 1.2.6.

8.2 AMP COMPONENT – WETLANDS

8.2.1 Wetlands – Descriptions

Wetlands, specifically Constructed Wetland Treatment Systems (CWTS) are currently being evaluated in the context of potential incorporation at key locations on the Minto mine site (Figure 2-1). CWTS are not proposed as part of the base case closure measures for the Minto Site; however, studies are currently underway to advance conceptual (and small scale field trial) CWTS designs to the "proof of concept" level such that CWTS could be efficiently incorporated into closure planning in the event that observed post-closure water quality is significantly worse than predicted and CWTS is deemed to be an appropriate mitigation. These locations include to the east of the Southwest Dump (after the bioreactors), within the main pit, and before the water storage pond (WSP dam). The wetlands are considered to be a passive to semi-passive treatment system, and as a result would require periodical maintenance and service.

High flow events may lead to blowouts within the wetland, causing damage and maintenance requirements. It is assumed that during high flows events the wetlands are designed to allow for a discharge bypass.

A description of wetlands and their processes can be found within the PRCP. The following section has prepared to address a hypothetical scenario in which bioreactors are incorporated into future water treatment at Minto.

8.2.2 Wetlands – Narrative Triggers

Wetlands don't perform as designed, for example they become: overwhelmed, freeze, resulting in unacceptable water quality conditions downstream, etc.

8.2.3 Wetlands – Monitoring Requirements

The wetlands are part of the passive water quality treatment train systems, which included the bioreactors, and both the anaerobic and aerobic wetlands. The primary monitoring and key performance indicator of the passive water quality treatment systems will be the routine monitoring at key locations directly below each treatment train. Station W15 will serve as the key monitoring location below the SWD, and station W37 will serve as the key monitoring station below the second treatment system below the DSTSF and MVFE (Figure 2-1).

If an AMP trigger is exceeded at a key downstream monitoring location, additional upstream monitoring will be conducted above and below the passive treatment train components to help determine the root cause and/or source of the exceedance. Intermediate monitoring may occur within the wetlands if monitoring station(s) have been established there. For example, sampling could be conducted at the input points, intermediate monitoring point(s), and discharge points for each bioreactor and/or above and below each of the wetland systems.

It is assumed that during peak flow or flooding events that the wetlands will not treat the surface water. During these periods or events, a discharge bypass will convey water away from the wetland in an effort to preserve them. An understanding of this assumption and its implications are needed during freshets, flooding events, and also during peak flow events as the wetlands are neither designed nor capable of treating these peak flows conditions. Downstream water quality measurements will be evaluated at monitoring stations, for example station W3, and these results will be used to determine if any AMP thresholds have been exceeded and if adaptive management is required.

8.2.4 Wetlands – Evaluation of Monitoring

A performance evaluation is to be conducted on the effectiveness of the anaerobic and aerobic wetlands. Periodical inspections and maintenance are also to be performed on the wetlands.

The performance evaluation will consist of (in part):

- The surface water quality results from stations W3, W37, W35, and W15
- Periodic physical inspection and maintenance

8.2.5 Wetlands – Specific Indicators

Specific indicators will be established from the surface water quality parameters at monitoring stations W15, W37, W35, and W15.

Additional specific indicators directly related to the condition and performance of the wetlands to be developed if required.

8.2.6 Wetlands – Specific Thresholds

Specific thresholds will be related to, or triggered by, unacceptable water quality measurements at key downstream monitoring stations.

8.2.7 Wetlands – Response Approaches

Specific wetland response approaches are to be developed by Contango Strategies Ltd., and / or develop over time as this AMP evolves.

A general adaptive management response is described in Section 1.2.6.

9 AMP COMPONENT – GENERAL RECLAMATION MEASURES

Section 6.13 of the previous Decommissioning and Reclamation Plan (Revision 3.2) included discussion and commitments towards developing and refining AMP measures around issues relating to general reclamation. Specifically, two issues are discussed including:

- **Reclamation Cover Material** – uncertainty around whether the quantity of reclamation cover material (overburden or other materials) will be adequate for closure and reclamation requirements.
- **Contaminated Soil** – the permitted Land Treatment Facility (LTF) removes hydrocarbon contamination but residual metal contamination in soil may result in its designation as special waste.

AMP protocols for these issues are presented in Section 11.1 and Section 11.2, respectively.

9.1 RECLAMATION COVER MATERIAL – DESCRIPTIONS

A significant volume of reclamation cover material will be required for development of cover systems (see Section 7). Overburden stockpiles are created during pre-development and stripping. The major overburden stockpile at the site is the Reclamation Overburden Dump (see Figure 2-1). Overburden will also be used for progressive reclamation and bulk-disposed in waste dumps with waste rock.

The final design of these covers are not complete and may depend on the results of cover trials and other design and performance testing, but may vary in thickness (and thus required volume) depending on the desired performance specifications.

9.1.1 Reclamation Cover Material – Narrative Triggers

Insufficient quantities of cover material are available to construct closure cover systems or other planned uses for overburden.

9.1.2 Reclamation Cover Material – Monitoring Requirements

Evaluation and accounting of available and anticipated reclamation overburden volumes, and reconciling this against anticipated reclamation cover material requirements will occur regularly during the operations and closure periods.

9.1.3 Reclamation Cover Material – Evaluation of Monitoring

Calculations of available reclamation overburden volumes will be conducted using standard industry practices and will be performed by qualified persons. This volume will be compared with the predicted volumes required for closure and reclamation uses, as indicated by the most current version of the RCP. Factors such as

compaction and placed density will be taken into account to ensure accurate accounting. The reclamation research programs will provide insight into:

- The quality and quantity of growth medium required to achieve the objectives of the revegetation/reclamation plan
- The thickness and material properties required to achieve cover performance objectives (e.g. organic content, nutrient composition).

9.1.4 Reclamation Cover Material – Specific Indicators

- Available quantity and quality of overburden material
- Predicted requirements for reclamation cover material and or other material

9.1.5 Reclamation Cover Material – Specific Thresholds

- If at any time in the closure process the overburden requirements exceed the stockpiled inventory by more than 100,000 cubic metres, this will be considered as a specific threshold for adaptive management
- If available overburden is determined to be of insufficient quality in order to achieve objectives of revegetation/reclamation planning or cover performance objectives

9.1.6 Reclamation Cover Material – Response Approaches

1. Internal notification to management, followed by notification to SFN and the closure liability holder that a trigger has been exceeded within a timely period
2. Company will add the cost of mining overburden to the closure liability estimate.
3. Identify a source of overburden or suitable cover material for reclamation use.

9.2 CONTAMINATED SOILS – DESCRIPTIONS

The LTF is permitted for the treatment of soils and allows for the removal of hydrocarbon contamination. This process does not alter the concentrations of metal present in the soil. Given the present condition and the confirmed geochemical signature of area surficial soils, it is likely that some of the materials treated will have metal contamination that would designate it as special waste.

9.2.1 Contaminated Soils – Narrative Triggers

Contaminated soils treated in the LTF require additional remediation or adaptive management

9.2.2 Contaminated Soils – Monitoring Requirements

After the hydrocarbon remediation is complete in the LTF, a complete suite of testing to ensure that LTF soil is compliant with relevant standards with respect to both hydrocarbon content, and metals, will be undertaken. This testing will be undertaken using appropriate methods and sufficient sample numbers that ensure that results are representative of the treated LTF soil.

Preliminary testing of materials in the LTF has indicated that this material may contain levels of metals that could result in its designation as special waste and/or require other special handling.

9.2.3 Contaminated Soils – Evaluation of Monitoring

The results of testing of the LTF soils will be compared with relevant standards to determine what handling and/or disposal methods are most appropriate. Relevant standards for this comparison and reference may include:

- Yukon Contaminated Sites Regulation (CSR) Soil Standards
- Canadian Council of Ministers of the Environment (CCME) Soil Quality Guidelines

9.2.4 Contaminated Soils – Specific Indicators

Parameters listed in soil guidelines and standards listed in Section 11.2.3 are considered to contain the specific indicators to determine appropriate disposal methods for LTF soil.

9.2.5 Contaminated Soils – Specific Thresholds

Specific thresholds are the levels specified in the guidelines and standards listed in Section 11.2.3. Exceedance of the thresholds and guidelines could result in designation of the material as special waste, which may require special handling and disposal.

9.2.6 Contaminated Soils – Response Approaches

1. Should testing of LTF soil indicate that soil exceeds specific thresholds, internal notification to management, followed by notification to SFN and the closure liability holder that a trigger has been exceeded within a timely period.
2. This material, once successfully treated for hydrocarbons, could be placed in one of the waste storage areas (tailings, waste rock or IROD storage areas) and reclaimed in keeping with the implemented measures at that location.

3. Adaptive management and monitoring for mitigation success (i.e. cover systems and geotechnical integrity, downgradient water quality) for this material would be implemented as per these components of the AMP

10 REFERENCES

De Beers Mining Inc., (2004). *Snap Lake Diamond Project Adaptive Management Plan*. De Beers.

Environment Canada, (2009). *Environmental Code of Practice for Metal Mines*. 1/MM/17 Mining Section, Mining and Processing Division, Public and Resources Sectors Directorate, Environmental Stewardship Branch, Environment Canada.

Hudson Bay Mining and Smelting Co. Ltd., (2010). *Tom Valley Final Adaptive Management Plan.* Whitehorse, YT: AECOM.

Minto Explorations Ltd., (2009). *Appendix G Adaptive Management and Monitoring Plan*. Vancouver, BC: Minto Explorations Ltd.

SRK Consulting, (2013). *Minto Mine Phase V/VI Expansion: Hydrogeological Characterization Report.* Report prepared for Minto Explorations Ltd.

APPENDIX E

SCOPING LEVEL COVER ASSESSMENT FOR MINTO CLOSURE COVERS

Scoping Level Cover Assessment for Minto Closure Covers

Prepared for

Minto Explorations Ltd.

Prepared by

SRK Consulting (Canada) Inc.
1CM002.007
August 2013

Scoping Level Cover Assessment for Minto Closure Covers

August 2013

Prepared for

Minto Explorations Ltd.
Suite 900 – 999 West Hastings Street
Vancouver, BC V6C 2W2

Tel: +1 604 684 8894
Web: www.capstonemining.com

Prepared by

SRK Consulting (Canada) Inc.
2200 –1066 West Hastings Street
Vancouver, BC V6E 3X2
Canada

Tel: +1 604 681 4196
Web: www.srk.com

Project No: 1CM002.007

File Name: Minto_Final_Scoping Level Cover Assessment_1CM002 007_20130822_EMR_DBM_CCS

Copyright © SRK Consulting (Canada) Inc., 2013

srk consulting

Executive Summary

Minto Explorations Ltd. (Minto) is considering the use of covers as one of the remedial strategies for mine waste at their Minto Mine site in Yukon Territory, Canada. Mine waste at Minto site includes both waste rock and tailings (dry stack and in-pit tailings). At the end of Phase IV (the current phase of mining), there will be six distinct waste rock and overburden piles on site, and these will be expanded as future mine development takes place.

Geochemical characterization of the mine waste has confirmed that acid generation potential is low; however, neutral metal leaching will be a long-term concern. This scoping level cover assessment provides a comprehensive evaluation of appropriate cover design concepts that should be considered for the Minto site, taking into account site specific conditions and overall site wide closure objectives.

Mine waste covers are one remedial technology that can be used to manage drainage. Successful closure covers over mine waste facilities depend on many factors; however, two factors dominate decisions on what may be appropriate at any specific site, i.e., climatic conditions and locally available material (i.e., soils).

The evaluation demonstrates that the hydrologic and climatic regime at the Minto site is best suited to the use of water covers or infiltration reducing covers (i.e., barrier covers). In contrast, store-and-release and thermal covers are not likely to be successful. The available overburden soils at Minto are however not well suited for construction of low or very low infiltration barrier covers.

These soils are best used as isolation and vegetation supporting covers, and are expected to result in overall infiltration typically between 10 and 20% of mean annual precipitation. Periodic higher breakthrough events will occur. Soil amendments or use of synthetic products are therefore required to construct low to very low infiltration covers at the site. Conceptual designs of each of these different cover variants are proposed.

Table of Contents

1 Introduction 1
1.1 Background 1
1.2 Scope of Work 1
1.3 Report Layout 2
2 General Cover Design Elements 2
2.1 Cover Design Life 2
2.2 Site Climate 2
2.3 Potential Cover Materials 4
2.4 Waste Settlement 6
2.5 Seismicity 6
2.6 Trafficability/Constructability 7
2.7 Physical Exposure of Mine Waste 7
2.8 Oxygen Reduction 8
2.9 Infiltration Reduction 8
2.10 Slope Stability 8
2.11 Wind Erosion 8
2.12 Overland Surface Runoff 9
2.13 Evapo-Concentration 10
2.14 Root Uptake 10
2.15 Animal Activity 11
2.16 Human Activity 11
3 Generalized Cover Types 12
3.1 Water Covers 12
3.2 Saturated Soil Cover 12
3.3 Barrier Covers 13
3.3.1 Concept 13
3.3.2 Natural Low Permeability Soil Cover 13
3.3.3 Synthetic Cover (HDPE, LDPE, Bituminous Liner) 15
3.3.4 Synthetic Cover (Geosynthetic Clay Liner) 15
3.3.5 Bentonite Amended Mine Waste/Cover Soils 16
3.4 Store-and-Release Cover 17
3.5 Reactive Cover 18
3.6 Capillary Break Cover 19
3.7 Frozen/Thermal Cover 19
4 Conceptual Cover Designs 20

4.1 Site Wide Closure Objectives 20
4.2 Possible Cover Functions 21
4.3 Cover Design Criteria 21
4.4 Conceptual Designs 23
4.4.1 Isolating Cover 23
4.4.2 Low Infiltration Cover 23
4.4.3 Very Low Infiltration Cover 24
5 Conclusions 26
6 References 27

List of Figures

Figure 1: General Site Layout
Figure 2: Climatic Water Balance
Figure 3: Thornthwaite & Mather (1995) Moisture Index
Figure 4: Typical Cover Types
Figure 5: Climate Wheel
Figure 6: Grain Size Distribution Curves for All Candidate Cover Materials
Figure 7: Atterberg Limits for All Candidate Cover Materials
Figure 8: Representative Cover Materials
Figure 9: Measured Soil Water Characteristic Curves
Figure 10: Estimated Soil Water Characteristic Curves
Figure 11: Comparison of Measured & Estimated SWCC's (MWD Material)
Figure 12: Comparison of Measured & Estimated SWCC's (ROD and IROD Material)
Figure 13: Calibrated SWCC Estimates Compared to Measured Data
Figure 14: Calibrated Soil Water Characteristic Curves
Figure 15: Conceptual Isolation Cover
Figure 16: Conceptual Low Infiltration Cover
Figure 17: Conceptual Very Low Infiltration Cover

List of Tables

Table 1: Hydraulic properties of overburden material from MWD, ROD, and IROD 5
Table 2. Proposed Minto mine cover design criteria 22

1 Introduction

1.1 Background

Minto Explorations Ltd. (Minto) is considering the use of covers as a remedial strategy at their Minto Mine site in Yukon Territory, Canada. The general concepts of this plan are documented in Minto's current Decommissioning and Reclamation Plan (D&RP) (Minto 2011). A rigorous assessment of the proposed cover concepts taking into account site specific conditions has not been carried out and therefore the cover design concepts are not optimized. This work is intended to provide a rationale for how covers can best be utilized at Minto.

Mine waste at Minto includes both waste rock and tailings. At the end of Phase IV (the current phase of mining) there will be six distinct waste rock and overburden piles on site as illustrated on Figure 1, and these will be expanded as future mine development takes place.

Historic tailings deposition consisted of dry-stacked compacted filtered tailings. This deposition strategy was discontinued in October 2012, in favour of conventional low solids content (50 to 60% by mass) slurry tailings deposited sub-aqueously into Main Pit. Future tailings deposition will continue as hydraulically deposited tailings in Main and Area 2 Pits.

Geochemical characterization carried out on both waste rock and tailings confirms that, for the most part, the mine waste is not highly reactive, and has very low potential to generate acid; however, there is potential for neutral metal leaching (SRK 2013a). Mitigation strategies are therefore required to manage this leachate, including water treatment, waste relocation and waste encapsulation (i.e., closure covers).

1.2 Scope of Work

While it is understood that covers are one of many possible mitigation strategies that can be used to achieve site wide closure objectives, the scope of this study was to specifically determine what cover concepts are most likely to be successful at Minto, and how best to implement them. This was done by carefully evaluating site specific conditions that affect cover design, construction and ultimately long-term performance, including but not limited to design life, climate, material availability, waste characterization, seismicity, slope stability, erosion resistance, etc.

Once the cover concepts that are most likely to be successful at Minto were identified, appropriate cover functions were defined to specifically ensure overall site wide closure objectives would be met. Finally conceptual cover designs are presented that demonstrate actual implementation plans for all of the concepts.

1.3 Report Layout

Specific design elements that need to be considered in cover design are described in Section 2. Section 3 of this report describes the different cover types and whether they should be given consideration at Minto. Section 4 provides a generalized overview of the currently stated site wide closure objectives, complete with preliminary suggestions for cover functionality. Finally, different conceptual cover designs suitable for application at Minto, complete with expected performance criteria, are presented.

2 General Cover Design Elements

2.1 Cover Design Life

SRK does not believe that engineered soil covers can be expected to continue to perform in accordance with their original design intent for an infinite lifetime after construction (i.e., in perpetuity), especially if there is no monitoring and maintenance plan in effect. Therefore, it is appropriate to design soil covers and associated monitoring and maintenance plans with a finite lifespan in mind. The length of that time period should dictate to what standard the cover must be designed and constructed, and also what level of monitoring and maintenance would be required.

There are no specific guidelines or standards in Canada that specify a lifespan for covers, leaving the design decision to the discretion of the mine operator. Internationally, there are also no fixed criteria for cover lifespan; however, some mining companies explicitly adopt life spans of 100, 200 or even 500 year periods during which the cover is expected to perform in accordance with the original design intent (Rykaart *et al*. 2006).

The design life of a cover is complicated by the fact that some cover failure modes require inherently different approaches. For example, if Minto was to adopt a design life for the conceptual cover designs presented in this report of say 200 years, then it would be assumed that these covers would continue to perform the functions listed in Section 4 for this lifespan. However, portions of the cover design may have different design criteria, for example surface water conveyance channels may be designed to withstand 1:100 year storm events with an understanding that the necessary maintenance and repair would be carried out for the 200 year design life of the cover.

It would be premature for SRK to recommend a design life for the Minto covers in isolation of the overall closure design, as well as input from stakeholders. A risk assessment approach can be used during detailed design to evaluate the consequences of the different cover failure modes and what the optimal cover design life should be.

2.2 Site Climate

Site specific climate is one of the primary drivers that define what the most appropriate and sustainable cover may be for any given project area. The three dominating climatic parameters include the climatic water balance, air temperature, and radiation energy.

Site specific climate data is available with records from two onsite weather stations. Both stations have data from 2005 to 2011; however, the datasets are incomplete and generally too short to be useable or representative for a scoping level cover assessment. Regional climate data is available from the Pelly Ranch station, managed by Environment Canada. This station is located about 25 km north of Minto and has data dating back to 1955.

Based on the Pelly Ranch data, the mean annual total precipitation (MAP) for Minto is estimated to be about 335 mm. Roughly 50% of this precipitation falls as rain, with the remainder being the snow water equivalent of the annual snowpack. The maximum annual precipitation on record is 466 mm.

Monthly lake evaporation (aka potential evaporation) has been recorded at the Pelly Ranch station from 1965 to 2005 and the mean annual lake evaporation is 452 mm. Site specific data suggest that the mean annual evaporation is closer to 430 mm (Clearwater 2008) and 438 mm (Clearwater 2010). EBA (2010) applied an elevation correction to the Pelly Ranch data (1971-1990) to reduce the mean annual evaporation to 400 mm. SRK calculated the mean annual evaporation from first principles using the FAO method (FAO 1998) which computes to 410 mm evaporation per year. For the purpose of this study, the mean annual evaporation was selected based on the elevation correction presented by EBA (2010) to the Pelly Ranch evaporation data to yield a mean annual evaporation of 400 mm. The mean monthly climatic water balance based on this data is presented in Figure 2 and it demonstrates that between March and September, the climatic water balance is net negative, i.e., evaporation exceeds precipitation. This highly seasonal water balance deficit on a near neutral annual water balance makes it challenging to determine the most suitable cover type and a more in depth analysis of the climate is required.

Using the elevation corrected annual lake evaporation and precipitation data from Pelly Ranch from 1965 to 1995, the Thornthwaite and Mather (1955) Moisture Index was calculated to provide an indication of the site climate classification taking into consideration both water and temperature influences. This is presented in Figure 3 and confirms, generally, the site can be classified as Dry Subhumid; however, over the years the site spans both the Moist Subhumid and Semi-Arid climate zones.

The climatic water balance and climate classification are good indicators for what the most appropriate cover type would be at any given site and this is illustrated for Minto on Figure 4. This graph has been adapted from the Holdridge *et al*. (1971) life zone classification, as presented in the Global Acid Rock Drainage (GARD) Guide (INAP 2012). The data confirms that the site is best suited towards either water covers or infiltration controlling (i.e., barrier type) covers. Store-and-release and thermal covers on the other hand are not recommended for the site based on climatic conditions.

The mean monthly ambient air temperature for the site is also plotted on Figure 2. The annual average ambient air temperature is -4°C. This leads to seasonal ground freezing, and site specific measurements suggest that the annual depth of frost penetration is less than 4 m. The site is also located in the discontinuous permafrost region of Canada and where permafrost is present, it is generally relative warm at about -1°C.

Empirical methods were used to determine the annual depth of frost penetration at Minto, which amounts to between 2 and 3.5 m depending on soil porosity, water content and bulk density. Therefore, any low permeability barrier cover that could be damaged through freeze-thaw action would have to be constructed with a protection cover of at least 3 m.

Freezing temperatures also lead to a unique moisture distribution profile which is important when considering possible covers. During spring, significant surface runoff is present in the form of snowmelt; however, during this time the ground is still frozen and therefore water is less likely to infiltrate. When considering the climatic water balance illustrated in Figure 2, it appears that during spring (freshet) and early summer, when the most runoff is expected, the highest evaporation potential exists.

Figure 5 provides an overall climate wheel for the Minto site which summarizes key dates and timelines which will affect cover performance from both a hydrologic and physical perspective.

2.3 Potential Cover Materials

Locally available candidate cover soils consist of the overburden soils which can generally be classified as silty sands. Numerous geotechnical characterization programs have been carried out over the years including a dedicated cover soil characterization program in 2012 (SRK 2013b).

Three primary candidate cover soil sources have been identified as illustrated in Figure 1; (1) overburden stockpiled on the Main Waste Dump (MWD); (2) the Reclamation Overburden Dump (ROD); and (3) the Ice-Rich Reclamation Overburden Dump (IROD). Additional material is currently being developed from Area 2, Stage 2 Pit development and is being stockpiled on the Dry Stack Tailings Storage Facility and the Reclamation Overburden Dump. In total, it is estimated that there is about 2.8 Mt of these soils available for use as cover material.

Indicator property characterization testing has been completed on these soils (i.e., particle size distribution and Atterberg Limits) and the summarised results are presented in Figures 6 and 7. Their results demonstrate that there is minimal variability in the available material when considering its use a candidate cover source. Based on the overall grain size distribution envelope for all of the candidate cover soils (Figure 6), nine curves were initially selected to represent the possible range in cover performance (Figure 8).

Hydraulic testing (i.e., porosity, saturated hydraulic conductivity and Soil Water Characteristic Curves (SWCC)) was carried out on select samples and the results are summarized in Table 1 and Figure 9. Prior to the completion of the SWCC testing, six of the nine samples in Figure 8 were chosen and SWCCs were estimated using empirical methods. These resultant curves are illustrated in Figure 10. Comparisons of these estimated curves with the measured curves are presented in Figures 11 through 13. The final six calibrated SWCCs that were used in the cover analysis presented in this report are presented in Figure 14.

The MWD overburden material is sandy, lean clay (CL, in accordance with the Unified Soil Classification System). The porosity is estimated at about 36% and saturated hydraulic conductivity is about 1.38 x 10^{-7} m/sec. The air entry value is estimated to be between 23.1 and 71.9 kPa.

Materials from the ROD and IROD range from silty sands to clayey sands (SM-SC). Porosity is estimated at 29% to 31%, and saturated hydraulic conductivity ranges between 7.72 x 10^{-8} and 9.24 x 10^{-8} m/sec. The air entry value is estimated to range between 1.5 and 12.1 kPa.

Table 1: Hydraulic properties of overburden material from MWD, ROD, and IROD

Material Type	Porosity	Saturated Hydraulic Conducticity (m/s)	Field Capacity (VWC)	Wilting Point (VWC)	Storage Capacity (VWC)	Air Entry Value (kPa)
MWD1	36.0%	1.38 x 10^{-7}	0.339	0.223	0.116	71.9
MWD2	36.0%	1.38 x 10^{-7}	0.304	0.192	0.112	23.1
ROD2	31.0%	9.16 x 10^{-8}	0.260	0.160	0.100	12.1
ROD3	29.0%	7.72 x 10^{-8}	0.176	0.112	0.065	1.5
IROD1	31.0%	9.24 x 10^{-8}	0.243	0.127	0.116	4.8
IROD2	30.5%	8.79 x 10^{-8}	0.202	0.122	0.080	1.7

Three properties dominate the suitability of material as it relates to its use as a candidate cover material. First, for barrier covers intended to reduce infiltration, the saturated hydraulic conductivity is the most important. As a general rule of thumb, a soil should have a saturated hydraulic conductivity of at least 1 x 10^{-8} m/s (315 mm/year) to be considered an infiltration barrier.

Secondly, the property that dominates the suitability of a store-and-release type cover is how well graded it is, which translates into its moisture holding capacity (i.e., difference between its air entry value and residual suction). The moisture holding capacity is often simplified in terms of the Storage Capacity as listed in Table 1. This is calculated as the difference between the soil's Field Capacity and Wilting Point. Field Capacity correlates closely to the air entry value but is generally considered to be the volumetric moisture content of a soil at a soil suction of 33 kPa. Likewise, the Wilting Point correlates closely with the residual suction, but is generally considered to occur at a suction of about 1,500 kPa. The Field Capacity is the point where a soil starts to de-saturate, and the Wilting Point is the point where plants are no longer able to extract moisture from the soil pore space. Generally the greater the storage capacity of a soil, the greater the potential for being an efficient store-and-release cover, provided the climate is suitable.

Lastly, a soil cover must resist surface erosion and therefore silty soils, which are highly prone to erosion, are normally considered less desirable.

It can therefore be concluded that the available soils at Minto are not ideal store-and-release materials (although certainly workable) and are definitely not suitable for construction of low

infiltration (barrier) covers. Construction of such covers will require intervention such as adding bentonite.

2.4 Waste Settlement

Mine waste settlement, specifically differential settlement can affect cover integrity. The waste rock dumps and dry-stack tailings at Minto are not expected to undergo significant settlement; however, the tailings in Main Pit will undergo settlement as a result of self-weight consolidation, as well as the surcharge from cover placement.

Consolidation testing has not been done on the Main Pit tailings; however, based on general experience with similar tailings it is conceivable that tailings consolidation, and associated cover settlement could be around 30 cm on the exposed beaches, and up to 1 m on the slimes regions near the central pond area (not accounting for entrained ice). Such settlement could affect cover integrity, and therefore the cover design should either compensate for potential settlement, or construction should only be done once settlement is complete.

Complete tailings settlement will require tailings dewatering, and even then it could take years or even decades. Therefore, it is recommended that the Main Pit tailings impoundment cover design be such that up to 1 m of settlement would still result in the cover performing as designed.

2.5 Seismicity

According to the 2010 National Building Code of Canada seismic hazard calculator, the corresponding peak ground acceleration (PGA) for the Minto site is 0.057 g for a 2% probability of exceeding in 50 years (1 in 2,500). This means that this site is not particularly seismically active.

Assuming the cover is constructed from a non-liquefiable material, seismic action will affect cover integrity in two ways:

First, a cover placed on steep side slopes not subject to liquefaction, would be subject to classic failure mechanisms such as increased pore water pressures induced by ground shaking. At the Minto site this failure mechanism would only apply to covers constructed on the waste rock pile and dry-stack tailings impoundment.

Second, a cover constructed on potentially liquefiable material such as the Main Pit tailings could cause surface manifestations of liquefaction in the cover in the form of cracks and boils.

The occurrence of such surface manifestations, assuming liquefiable tailings at depth, is a function of the thickness of the non-liquefiable cap (cover plus the unsaturated tailings layer). For a cap thickness greater than 3 m, case histories (Ishihara 1985, as reported by Ritchie (1999)) suggest that there will not be a surface manifestation for ground surface accelerations up to 0.2 g. Since this is an order of magnitude greater than the design earthquake this is not considered to be a concern.

2.6 Trafficability/Constructability

The construction of any cover over saturated tailings is challenging, due to the fact that construction equipment cannot travel over the surface that needs to be covered. This means that the cover has to be constructed in one of five possible ways:

1. Construction of the tailings cover is delayed until the tailings have had enough time to naturally dewater such that equipment can safely travel on it. The problem with this approach is that this process can take very long, i.e. many years, if ever.
2. The tailings are actively dewatered through installation of wick drains or other similar dewatering devices. This can be cost prohibitive, and still must address the issue of access onto the tailings for the installation of these dewatering devices.
3. A platform is developed from the perimeter of the saturated zone by dumping cover material and dozing it over the saturated tailings. This platform becomes the working base for the construction equipment as it advances. The problem with this method is the amount of cover material that is required is significantly greater due to the requirement for a trafficable surface, and often a tailings bow wave forms immediately ahead of the working face. This results in an uneven tailings surface which may add to the need for increased cover material.
4. Cover construction can sometimes be done with specially modified low ground pressure equipment. This still requires a de-saturated surface layer, and the equipment is highly specialized and expensive.
5. Construct the cover in winter, after the frost has penetrated to a depth sufficient to support construction equipment.

Cover construction at Minto over the slimes zones of the Main Pit tailings impoundment will definitely be subject to trafficability challenges. Therefore, any cover design does need to mitigate these challenges, for example by doing winter construction to take advantage of a frozen tailings surface.

For the dry-stack tailings impoundment and the waste rock piles cover constructability should not be too much of a concern, provided that where possible the side slopes be kept flatter than 33% (3H:1V). Cover placement on steeper slopes becomes less efficient. Should geosynthetics be used, slopes may have to be flattened to as low as 20% (5H:1V).

2.7 Physical Exposure of Mine Waste

Physical exposure of mine waste is a human and terrestrial health and safety concern at mine sites (including Minto). Exposure pathways include direct physical contact, as well as indirect contact via dust and overland surface runoff. In order to mitigate this, any physical separation cover over the mine waste areas would suffice. There may however be other cover design criteria that could dominate such as infiltration control, and therefore a cover for the sole purpose of separation may not be appropriate at Minto.

2.8 Oxygen Reduction

As previously documented, geochemical characterization of the tailings and waste rock suggest that rapid oxidation is not a concern. Therefore construction of oxygen limiting/reducing covers at Minto is not warranted.

2.9 Infiltration Reduction

It has already been documented that the available cover materials are not good candidate materials to construct effective barrier covers, even if well compacted. Furthermore, in most cases, the saturated hydraulic conductivity of the mine waste is less than or equal to the available cover material, further negating the possible usefulness of constructing barrier covers with these candidate cover materials. Although data is not available it is estimated that the saturated hydraulic conductivity of the dry-stack tailings is about 1×10^{-7} m/sec (3,154 mm/year), and the Main Pit tailings (beach tailings) would be similar. The slimes would be at least an order of magnitude less (i.e., 1×10^{-8} m/sec or 315 mm/year). Data for the waste rock is not available but it is likely to be about 1×10^{-4} m/sec (3,153,600 mm/year).

Site specific water balance calculations suggest that about 30% (Clearwater 2010) of precipitation gets discharged as overland runoff at the Minto site. Very little overland runoff is however observed and, in reality, the bulk of this volume is actually shallow infiltration which emerges as stream flow downstream of the Minto site at the flow gauging station. Therefore it is not unreasonable to assume, in the absence of specific infiltration analysis, that although the available soils would allow for construction of store-and-release covers, they would likely not be able to consistently perform to a standard better than reducing infiltration to about 20% of mean annual precipitation.

As a result, in all likelihood, the only viable method to reduce infiltration further would be to make use of a synthetic cover, or alternately a bentonite-amended barrier layer.

2.10 Slope Stability

For the most part, the cover designs at Minto will be on relatively flat surfaces. The waste rock piles and dry-stack tailings impoundment have been designed with final slopes of either 2.5H:1V or 3H:1V which would support efficient cover construction, provided the slopes are not too long. Should geosynthetic covers be required, these slopes may be considered too steep.

2.11 Wind Erosion

The fines content of the candidate cover material suggest that, under prolonged dry periods, wind erosion could be a concern with respect to cover integrity. Appropriate mitigation strategies could include sacrificial increase of the cover thickness to compensate for material loss over time, or providing a physical barrier against wind erosion.

Wind erosion is a complex phenomenon and is a function of the soil properties, climate and the vegetation characteristics. Wind erosion simulation models can be used to evaluate what the potential soil loss would be; however, the lack of data precludes the use of such models at this time.

A number of physical wind erosion studies provide some useful indicative data to use as a first order estimate of wind erosion rates in this conceptual design. Forward *et al*. (2004) reported that the annual soil loss through wind erosion from agricultural land in Southern Australia ranges between 0.01 and 0.06 mm/year. Basher and Webb (1997) reported wind erosion rates in bare soil in New Zealand of 0.90 mm/year. Based on this data, a sacrificial increase in soil thickness for a 200 year cover design life would be between 3 and 180 mm. However, considering the uncertainty associated with these estimates, the difficulty in transposing the data to a site specific condition, combined with the risk of exposed mine waste, mitigation against wind erosion through sacrificial increase of the cover should be considered a potential optimization strategy at this time.

An alternative method of preventing wind erosion would be to construct a physical barrier (i.e., some form of armouring such as fine gravel) on the erosion susceptible soil cover. Since there is no readily available source of such a material at Minto, this mitigation measure is likely not viable.

Cover stabilization using vegetation is commonly acknowledged and is likely the preferred method of wind erosion stabilization for the site.

2.12 Overland Surface Runoff

The high silt content of the cover soils suggest that surface erosion will be a problem. Just as with wind erosion, overland surface water erosion rates are difficult to estimate, and can be managed by adding sacrificial cover material, or providing a suitable physical barrier. The thickness of a sacrificial cover layer cannot be estimated at this time; and further optimization in this area is recommended.

Similar to wind erosion, a definite method of ensuring that erosion protection is provided in the long-term would be to clad the erosion susceptible cover with erosion resistant soil or rip-rap. Since there is no readily available material of this nature at Minto (other than waste rock), this alternative is not recommended.

Vegetation is a proven erosion stabilization technique and is therefore the preferred mitigation strategy against overland surface runoff. To further reduce the risk of developing erosion gullies, appropriate landform engineering must be carried out to promote the development erosion resistant landforms.

It is important to remember that water shed by runoff has to be safely conveyed over the cover to its receiving environment. Therefore, the cover design must account for the volume, frequency and intensity of runoff that is anticipated and the seamless integrated designs of the cover and conveyance channel contact zones are integral to the overall success of the cover.

Naturally, more runoff implies that less water is available for infiltration. This presents potential opportunities that are of relevance in selecting a suitable cover design for the Minto site. Firstly, if a significant portion of the freshet season infiltration is shed as runoff, then the amount of infiltration that has to be accounted for in a store-and-release cover becomes less, and the likelihood of reaching a workable ratio of infiltration versus potential evaporation increases (although it may still not be enough), making this type of cover more viable.

2.13 Evapo-Concentration

Chemical constituents present in the mine waste pore water, specifically salts, can be transported up ("wicked") towards the waste surface, and continue up through the cover soil due to capillarity associated with upward fluxes caused by evaporation. This problem, also termed evapo-concentration, is common in net negative climates where the predominant flux is upward. If evapo-concentration occurs, it leads to contamination of surface water, which would constitute as non-compliance with the site closure objectives. During the wet season, there would be a constant variability of the flux within the cover, but evapo-concentration is not likely to be a major concern. However, during prolonged dry periods, the predominant flux would be upwards, especially if the underlying waste has a high moisture content. As a result evapo-concentration is not expected to be much of a concern at Minto.

This can however be mitigated by making the cover thick enough that all the meteoric action occurs within the cover with no contribution from the underlying waste, or by including a physical barrier in the cover that prevents this pore water from migrating up through the cover. The most common physical barrier is a capillary break. Since evapo-concentration is not expected to be a concern at Minto, the cover design will not take this into consideration.

2.14 Root Uptake

Allowing vegetation to establish on the final Minto closure covers is probably the most sustainable long-term solution, notwithstanding the limited growing season. A vegetative cover offers benefits in terms of reducing meteoric infiltration through increased evapotranspiration, whilst also providing erosional stability from wind and surface runoff. Disadvantages of a vegetative cover include creation of preferential flow paths through root penetration, and potential contaminant uptake from the underlying waste by the plant root systems to the surficial plant biomass, which in turn could pose a terrestrial exposure risk.

Mitigation against root uptake could include limiting plant growth outright, or constructing a chemical or physical root barrier as part of the cover. Outright prevention of vegetation can only be done through active site management, since even if coarse rock is used as a cover, dust and seed will be transported to the cover over time through wind from neighbouring undisturbed land and, ultimately, some vegetation will establish. Since active site management is not acceptable, a chemical or physical root barrier should be included as part of the cover.

Chemical root barriers, although expensive, work well in cold climates and are likely to have a significant lifespan. A more common root barrier would be a physical barrier, consisting of a layer of gravel and cobbles filled with fines such as the candidate cover soils. The fines will prevent the

layer acting as a capillary break. This root barrier should be at least 20 cm thick and should be above the barrier layer or, alternatively, below the store-and-release cover layer.

The root barrier will serve a secondary purpose of acting as a bio-intrusion layer preventing burrowing animals from penetrating the underlying waste. A root barrier needs to be constructed at Minto if low infiltration covers are required and active vegetation management is not being proposed.

2.15 Animal Activity

Minto is in a wilderness area and, therefore, after closure terrestrial animals are expected to move across the site. Burrowing activity by animals could compromise the cover, and to prevent such an occurrence, a gravelly layer can be designed into the cover. The likelihood of large scale damage due to animal burrowing action is very small and, therefore, such measures are not recommended at Minto.

2.16 Human Activity

Following closure, the site is likely to be infrequently used by seasonal hunters. Hunters typically use snowmobiles and all-terrain vehicles to get around and these machines can erode away the vegetation layer of a cover and subsequently result in damage to a geosynthetic liner. This can be mitigated by limiting access to the covered areas or, alternatively, adding in a coarse rock protection layer to the cover. The site is, however, sufficiently remote that concentrated access routes from these off-road vehicles are not expected and therefore no specific design elements will be included to protect against such damage.

3 Generalized Cover Types

3.1 Water Covers

Water covers involve permanently submerging mine waste. A water cover effectively shuts down oxygen ingress to the underlying waste, preventing oxidation. The water cover provides a constant hydraulic head that promotes seepage which may provide a pathway for mobilizing soluble oxidation products present in the waste. Therefore, water covers work best if oxidation of the waste is prevented from starting in the first place. If the waste has already undergone significant oxidation, exclusion of oxygen through a water cover to prevent further oxidation may not be warranted, or even desirable, given the inventory of oxidation products already present in the waste.

Water covers are best suited to net positive climatic water balance areas (i.e., annual precipitation exceeds evaporation), since that implies a surplus supply of water to the cover. Water covers are less favourable when permanent large engineered water retaining structures are required, such as dams that may be subject to long-term integrity concerns.

Based on the diffusion coefficient of oxygen through water, it is accepted that under ideal conditions only 30 cm of water cover would be sufficient to prevent oxidation. In reality, waste disposal facilities are typically large, and are subject to wind induced wave action, counter-current flows, seiching, lake/pond turnover (and lake/pond ice formation in cold climates) etc. These physical actions result in water turbulence, which in turn, may result in re-suspension of particles. Re-suspended particles may undergo oxidation rendering the water cover ineffective. Rules-of-thumb state that a 1 m thick water cover would mitigate against these concerns; however, a review of current practice shows that typical water cover depths are between 2 and 5 m thick.

As described in Section 2.2, the climate at Minto is conducive to the use of water covers. The mine waste at Minto is however not highly oxidizing and therefore maintaining a permanent water cover is not necessary for long-term geochemical stability. More importantly however is the fact that, with the exception of tailings deposited in Main Pit (and possible future pits), the mine waste rock and dry-stack tailings facility cannot readily be flooded unless large containment structures are constructed, and/or waste is relocated. For the tailings in Main Pit, a water cover could likely easily be engineered; but a perpetual water retaining dam would be required. Water covers were, therefore, not given further consideration at this time.

3.2 Saturated Soil Cover

Saturated soil covers are an alternative method of ensuring isolation of wastes from exposure to oxygen, but by eliminating the need for large stretches of open water, the issues associated with re-suspension are eliminated. The concept entails using a coarse (ideally gravelly) material with significant void space as the primary cover material and placing it in a perpetually saturated state. This saturated layer can be at surface or at depth, i.e., providing opportunity for an upper cover layer that may, for example, sustain vegetation. This type of cover works best if the climatic water balance is positive, and just as with the water cover, may be problematic if significant oxidation products are already present.

At Minto this type of cover may have merit for in-pit tailings although, given the fact that neutral metal leaching is a concern, the constant hydraulic head and subsequent risk of seepage may be problematic. Therefore this cover type was not explored further at this time.

3.3 Barrier Covers

3.3.1 Concept

Barrier covers (also known as water shedding or infiltration controlling covers) work on the principle of physically limiting and/or preventing meteoric infiltration and/or oxygen ingress. As described above, if the waste has been significantly oxidized, an oxygen barrier may be of limited benefit; however, a cover controlling infiltration may be of benefit.

Physical barriers can come in many different forms, including impermeable synthetic barriers such as high density polyethylene (HDPE) liners, low density polyethylene (LDPE) liners, bituminous liners, geosynthetic clay liners (GCL), or natural low permeability soil. A barrier cover can also be constructed by amending the surface layer of mine waste to achieve a low permeability layer. A brief summary of these different barrier cover types is provided below.

3.3.2 Natural Low Permeability Soil Cover

The effectiveness of a natural low permeability soil cover is determined by the following criteria:

- The cover should have a sufficiently low saturated hydraulic conductivity in order to restrict meteoric infiltration rates to the underlying waste;
- The cover should have a significantly lower saturated hydraulic conductivity than the underlying waste; and
- The cover should maintain a high degree of water saturation in order to limit the entry of atmospheric oxygen to the waste (a rule of thumb is at least 85% saturation).

A natural low permeability soil cover that is intended to act as both a water and oxygen reducing cover should adhere to all criteria above, whilst if the cover is only required to act as an infiltration barrier it needs to only adhere to the first and second criteria. If the intent of the cover is to act as only an oxygen barrier, it needs only to adhere to the third criterion.

Natural low permeability soil covers work best in net positive water balance climates which are not subject to freeze-thaw cycles. Under such conditions, there is sufficient moisture to keep the level of cover saturation high, and cover degradation due to frequent wetting and drying cycles (i.e., shrinkage and cracking) is limited. The annualized climatic water balance at Minto is largely net positive; however, three months of the year it is net negative, and more importantly, the site is subject to annual ground freezing. Therefore, if the barrier layer can be constructed below the annual depth of freezing, a barrier cover would likely work well at the site.

Generally, natural low permeability soil covers consist of clays and silts, with plasticity ranging from moderate to high. These materials are generally placed in a compacted state. Theoretically, a low permeability cover does not have a minimum thickness, i.e., the performance of a 1 m thick layer with a specific saturated hydraulic conductivity value would have exactly the same net effect as a geosynthetic clay liner (GCL) of the same saturated hydraulic conductivity given the same hydraulic gradient (i.e., unity). In practice, however, low permeability layer thickness is governed by constructability and allowance for desiccation cracking. Therefore, if the low permeability cover: (a) has limited desiccation cracking risk due to a well-graded texture and low plasticity, (b) is not subject to extreme wetting and drying cycles; (c) is below the depth of ground frost penetration; and, (d) is protected against surface runoff erosion, then the cover could be relatively thin, and constructability issues would be the primary concern (i.e., it is difficult to place a consistent thin compacted layer of low permeability soil over an undulating waste pile surface, and it is almost impossible to do so on soft saturated ground).

It is generally considered poor practice to allow vegetation to establish directly on a compacted low permeability layer because the design hydraulic conductivity and performance will be compromised. If a single-layer cover is adopted, using only the compacted low permeability cover material, then the thickness must be appropriately increased to allow at least a 60 cm thick layer of compacted low permeability soil that will not be penetrated by roots. As an added safeguard, consideration can be given to placing a root barrier. At Minto, use of a single layer at surface is not recommended due to ground freezing.

In order to get a general sense of what type of cover material would be required to perform as an effective natural low permeability soil cover at the Minto site, some general calculations can be carried out. Infiltration due to precipitation will be reduced if the hydraulic conductivity of the soil cover profile is less than the intensity of precipitation. For example, if the annual precipitation at Minto is about 335 mm, or 1.06×10^{-8} m/sec, water infiltration will be limited should the hydraulic conductivity of the cover be less than this value. Therefore, if it is intended to reduce infiltration through the cover to less than 20% of mean annual precipitation (i.e., less than 67 mm), the cover material should have a saturated hydraulic conductivity of at least 2.12×10^{-9} m/sec. From a water infiltration perspective, this a conservative assessment, since in reality the cover would not be completely saturated all the time, and based on unsaturated soil property theory, the hydraulic conductivity of an unsaturated soil profile is significantly less than in its saturated state. However, if the profile is significantly de-saturated to benefit from a low unsaturated hydraulic conductivity, the soil air entry value will be exceeded, and significant oxygen ingress will occur, i.e., the cover cannot be an oxygen barrier.

Current soil characterization data suggest that the saturated hydraulic conductivities of the available candidate cover materials range from 1.99×10^{-7} to 1.12×10^{-7} m/sec (6,275 to 3,532 mm/year), which is clearly not suitable for use as a barrier cover. Experience has shown that in practice, it is not realistic to expect natural soil barrier covers to have saturated hydraulic conductivities of less than 10^{-7} m/sec (about 3,154 mm/year), even though laboratory tests would often suggest otherwise. This is especially true if the barrier layer is located within the soil active zone (i.e., it is within the zone of cyclic wetting and drying, or freezing and thawing). Furthermore, Wilson *et al*. (2003) demonstrate that world wide experience with natural soil barrier covers,

especially in seasonally wet/dry climates almost always yield greater than expected or predicted infiltration numbers. Given the site climatic conditions, SRK would not recommend the use of natural soil barrier covers at Minto using the locally available soils.

3.3.3 Synthetic Cover (HDPE, LDPE, Bituminous Liner)

Low permeability soils, if available, are almost always more economical than synthetic products; however, when natural soils are not readily available, or if the environmental risk is high, synthetic products such as capping materials can be appropriate. HDPE, LDPE, and bituminous liners are essentially impermeable; however, due to manufacturing and installation errors, even under the best quality control procedures, small pin holes can develop in the liner, such that generally for design purposes these liners are assumed to have saturated hydraulic conductivity values in the order of 10^{-15} m/sec (0.00003 mm/year). The difference between HDPE, LDPE, and bituminous products is generally the chemical resistance and workability of the material, with HDPE and bituminous liners being more robust products.

Synthetic liners must be installed according to manufacturer installation procedures that call for seaming of joints between liner sections, as well as placing the liner on an appropriately prepared surface. An appropriately prepared surface implies a clean, stable, smooth surface with limited undulations and few surface protrusions. If the waste surface is sufficiently coarse, the liner may be damaged, and an appropriate bedding material consisting of either a layer of clean sand or a non-woven geotextile are required.

Finally, the liner would have to be covered with a suitable cover depending on the final adopted land use. Again, if the cover soil contains a significant coarse fraction, then a protective sand or geotextile layer must first be placed over the liner.

An HDPE, LDPE, or bituminous liner would effectively eliminate oxygen and water ingress and provide a reclamation alternative with the least risk of impacting the environment in the long-term. Synthetic liners do, however, have a finite lifetime (manufacturer's guarantee is normally limited to about 20 to 40 years), and there is a possibility that the closure plan would have to allow for complete liner replacement every 100 to 200 years. Finally, synthetic liners cannot be constructed on steep slopes, with the general rule of thumb being slopes flatter than 3H:1V for short slopes, and as flat as 5H:1V for longer slopes. If low infiltration covers are required at Minto, these types of covers should be considered.

3.3.4 Synthetic Cover (Geosynthetic Clay Liner)

A GCL consists of a thin layer (generally less than 1 cm thick) of bentonite clay sandwiched between two non-woven geotextile layers. Under ideal conditions, a GCL is generally assumed to have a hydraulic conductivity of approximately 10^{-11} m/sec (0.3 mm/year); however, in practice a value of 10^{-9} m/sec (31.5 mm/year) is often adopted for design calculations. GCLs are considered to be less susceptible to installation damage than HDPE, LDPE, or bituminous liners; however, they must be installed according to manufacturer's installation procedures. Since GCLs are generally used with liquid containment in mind, and the use of a GCL as a cover (infiltration barrier) is somewhat different, the sub-grade specification can be relaxed. Depending on the

surface preparation, it is conceivable that the GCL may be placed directly onto the mine waste and similarly the protective cover could be placed directly onto the GCL. The built-in geotextile, if appropriately specified, may provide sufficient protection.

A cover which includes a GCL may prove to be an extremely effective infiltration and oxygen barrier, provided the bentonite can remain hydrated and confined at all times. At the Minto site, this hydration should not be a problem during the wet season, but during the dry season, the bentonite may de-hydrate if the protective layer does not have sufficient moisture retaining capability. In addition, if the GCL is subject to freeze-thaw cycles, the physical integrity of the liner may be impacted. A GCL can be penetrated by roots, and therefore, as with a natural low permeability soil cover, it is desirable to ensure the vegetative substrate is thick enough to ensure roots do not reach the GCL, or alternatively, introduce a root barrier into the cover design.

It is also important to carefully consider the calcium content of meteoric water that will permeate through the GCL. As water passes through the GCL, calcium will cause ion exchange with sodium in the bentonite, which leads to permanent aggregation of the GCL. This results in an increased hydraulic conductivity, and subsequently increased infiltration rates (Lin and Benson 2000).

GCL covers are worth considering at Minto if low infiltration covers are required.

3.3.5 Bentonite Amended Mine Waste/Cover Soils

It is possible to reduce the surface hydraulic conductivity of the mine waste or a candidate cover material by mixing in bentonite clay and compacting the mixed layer, thereby creating an in-situ low permeability layer. This type of amendment is often done as a more cost effective solution than a synthetic cover to reduce surface permeability due to the fact that limited importing of soils and/or synthetic products is required. The hydraulic conductivity is reduced by mixing in bentonite clay which has a high affinity for moisture and hydrates to more than twice its volume, thereby taking up void space in the host material, which would otherwise have a high hydraulic conductivity. Naturally the same restrictions apply to bentonite amended soils with respect to possible aggregation of the bentonite as a result of ion exchange as has been previously discussed for GCLs.

There are two primary methods to mix the bentonite and host soil (or mine waste): (a) off-site mixing using a pug mill, and (b) in-situ mixing. Off-site mixing requires stockpiles of host material and bentonite, which is fed into a pug mill, and the mixed product is trucked to the deposition location for application and compaction. This method allows for excellent control over the mix, including moisture control which is important to ensure proper hydration of the bentonite (the mix is normally placed at above optimum moisture content). In-situ mixing requires the upper layer of the location to be ripped before spreading the bentonite at the desired application rate.
The bentonite is then mixed into the host soil using agricultural equipment. This method allows for less control over application rate and moisture, and therefore requires more bentonite product. However, if the host material is not pre-stockpiled then this method is usually more cost-effective.

The thickness of the bentonite amended layer will be site specific; however, a realistic thickness for use as a low permeability cover would be between 15 cm and 30 cm thick, with an application rate of 4 to 6% bentonite by weight (of the host soil). The bentonite-amended layer will perform as an effective low permeability layer, reducing infiltration and oxygen ingress as long as the bentonite remains hydrated. Should the layer be allowed to dry out, the volume change will result in cracks, which will increase the hydraulic conductivity. Bentonite does however have self-healing characteristics which will help cracks to reseal if the bentonite becomes re-hydrated. Normally, to minimize chances of drying of the bentonite amended layer, it would be overlain with 50 cm of compacted, but non-modified material that would remain at high saturation due to the low permeability of the bentonite amended layer. Should vegetation be a requirement, a suitably designed vegetation substrate layer would have to be placed on the amended and compacted layers, to limit root penetration of the amended layer. Bentonite amended covers would be a worthwhile alternative to consider at Minto should low infiltration covers be required.

3.4 Store-and-Release Cover

An alternative method of reducing infiltration is to make use of the inherent soil moisture storage capacity of the soil. Meteoric infiltration is not prevented as with a barrier cover, but rather promoted, such that the moisture is stored in the cover soil. This moisture is returned to the atmosphere via evapotranspiration before is has the opportunity to drain through the cover and enter the underlying waste. These covers are referred to as “store-and-release” covers (also called “water retention” or “alternative” covers), and work most effectively in dominantly net negative climates, i.e., the potential evaporation greatly exceeds the mean annual precipitation (typically at least two or three times greater).

As discussed in Section 2.2, the site climate is not particularly well suited towards use of store-and-release covers; however, during the summer months, they certainly can be effective provided that the wet (frozen) season precipitation is shed as runoff, such that the amount of infiltration for which storage would have to be created, would be manageable. It may also be beneficial to provide a barrier layer beneath the store-and-release layer to prevent breakthrough during the prolonged wet season.

Ideal store-and-release cover soils are well-graded soils that have sufficient fines to allow capillarity to be high whilst not compromising too much on the material porosity. Store-and-release covers are less susceptible to site preparation and quality control since compaction of the soil cover is generally not required (or in fact not recommended) and the cover is of sufficient thickness to mask minor undulations on the waste surface. Settlement of the waste will also not affect the cover as much. Direct re-vegetation of the store-and-release cover is generally undertaken, unless the soil has a nutrient deficiency. The successful establishment of vegetation on a store-and-release cover is crucial towards its success, since the enhanced evapotranspiration will ensure long-term cover performance.

Notwithstanding the reservations about the applicability of using store-and-release covers at Minto, we can use the estimated hydraulic properties of the available cover soils at Minto, and use empirical methods (Chen 1999) to estimate the likely range of store-and-release cover thicknesses that would be required at Minto. Assuming 20% mean annual precipitation as the

infiltration target, the store-and-release layer thickness would have to be between 384 and 740 mm. This increases to between 676 and 1,225 mm if the infiltration target was lowered to 2%. It is important to note that due to the relatively low air entry value of these soils, their capillarity is limited and, therefore, increasing the thickness of the store-and-release layer provides very little added benefit. Although the available storage space is increased, the moisture cannot be moved upward more than about 1 m at most, but more importantly, there is not enough radiating energy available to extract the excess moisture.

At Minto, considering the available soils and climate, an infiltration target of about 20% on average for a store-and-release type cover is probably as good as would be consistently attainable. Under specific conditions this cover is likely to yield much better performance; however, significant breakthrough events will frequently occur.

3.5 Reactive Cover

Reactive covers normally refer to covers that include chemically active components. Broadly speaking, two types of such reactive covers are referred to: (1) covers where the reaction leads to consumption of oxygen, and (2) covers where the reaction leads to formation of low permeability layers and/or barriers to oxygen diffusion.

Oxygen consuming covers can be either organic or inorganic. Organic covers, for example wood waste over an acid generating tailings impoundment have been shown to have good success, however the main complication with these kinds of covers is that they are not sustainable. The organic cover loses its ability to consume oxygen over time, and as a result become ineffective. Organic oxygen consuming covers can be in the form of materials that have high neutralizing potential, and as a result, balance out the overall seepage waste load as a result of the buffering capacity.

The concept of deliberately placing reactive materials to create low-permeability covers rests on the principal that two layers are placed in contact, each one being a reagent. Where these layers contact each other, the reactants will meet and combine to form a precipitate that fills the pores.

Although in theory reactive covers show potential, to date they have not been used in full scale mine closure applications. Some long-term and medium scale pilot scale covers have been constructed; however, the principle of using reactive covers as final closure covers has not been adopted by the industry to date.

There does not appear to be any potential cover materials that would make for good reactive cover construction at the Minto site, and therefore this type of cover was not given further consideration in this evaluation.

3.6 Capillary Break Cover

A capillary break cover can be used to limit infiltration and to prevent contaminants from a waste deposit from being wicked up into the cover soil. It works by placing a fine grained soil over a coarse soil (typically a gravely soil containing little or no fines). The upper fine soil can come close to saturation, before it allows flow to pass through the underlying gravel. Generally, if a capillary break is used to limit infiltration, it can be used to reduce the thickness of an overlying store-and-release cover layer.

A capillary break may also be useful to maintain a high degree of saturation in a cover such that it would act as an oxygen barrier. Therefore, a capillary barrier may be constructed under a low permeability cover layer to ensure that the degree of saturation remains high, and limit oxygen ingress.

Capillary barriers also work in the reverse, i.e., if there is an upward flux through the cover due to evaporative action through which contaminants in the waste body may be wicked to the surface, the capillary break will prevent this from happening. Such wicking could result in surface water contamination in runoff from the cover, and it could also lead to metal uptake of vegetation established on the cover. Wicking is generally more of a concern in a net negative climate, where the upward flux often dominates. This may only be a concern during the three dry months at Minto.

Assuming the capillary barrier has been correctly designed with the appropriate hydraulic properties (it must have a residual suction which is lower than the air entry value of the overlying fine soil), a capillary break layer has no minimum thickness. In reality, the rule of thumb is to design these layers at least 30 cm thick. Depending on the difference between the gradations of the capillary break and the overlying fine soil, a filter media or geotextile may be required at the upper and lower interfaces.

In many cases, the waste material to be covered is sufficiently coarse that, if a low permeability cover is applied, the gradation difference is sufficiently large enough that the waste itself would act as a capillary break. Capillary break covers are quite complex to design and construct, but are best used to either keep an upper or lower layer at a higher degree of saturation, or to specifically prevent upwards wicking. Neither of these conditions appears to be specifically required at Minto and therefore this cover variant was not considered further at this time.

3.7 Frozen/Thermal Cover

In cold regions, mine waste may freeze, or measures can be implemented to promote freezing. This effectively eliminates any risk of contamination from these wastes. Covers can therefore be designed to preserve the frozen waste mass. This concept, generally, only works in areas where cold continuous permafrost is already present and the covers are normally very thick (i.e., in excess of 2 m).

Minto is located in the discontinuous permafrost region of Canada and the permafrost present is relatively warm (i.e., about -1°C near surface). Considering climate change predictions which are forecasting warming trends, design of a frozen cover at Minto is not considered a viable option.

4 Conceptual Cover Designs

4.1 Site Wide Closure Objectives

In accordance with the D&RP (Minto 2011), the site wide closure objectives are as follows:

- Have a closure planning process that seeks input from the Selkirk First Nations, understands the input received, and incorporates the input into closure planning decisions;
- Protect the health of people pursuing traditional activities including hunting, fishing, trapping, camping, and collection of plants for food, medicinal or cultural purposes;
- Protect people from safety risks when they are pursuing traditional activities including hunting, fishing, trapping, camping and collection of plants for food, medicinal or cultural purposes;
- Protect the environment (including land, air, water, plants, animals fish and other environmental components and their interrelationships) from long-term effects caused by the mine activities and facilities;
- Return the mine site and affected areas to a state similar to surrounding lands so that people can pursue traditional activities the same as they did before mining, including hunting, fishing, trapping, camping, and the collection of plants for food, medicinal or cultural purposes;
- Protect the environment from long-term effects caused by post-closure access to the mine area;
- Protect the environment from effects of earthquakes, floods, climate change, and other natural events on related mine structures;
- Have effective management and control structures in place during operation, closure and post-closure to provide;
  - Adequate financial resources to carry out all closure activities including plan implementation and long-term activities;
  - Adequate flexibility during closure and post-closure to allow adaptation of activities in order to address unexpected performance and events; and
  - Consideration of the Company's long-term desire to "walk away" from the site under conditions acceptable to Selkirk First Nations and with adequate resources provided to address long-term requirements.
- Minimize long-term activities by ensuring long-term chemical and physical stability of mining components and disturbed areas;

- Confirm the effectiveness of closure measures by monitoring the site after closure;
- Undertake mine planning incorporating progressive reclamation;
- Provide short and long-term slope stabilization and erosion control on linear and non-linear disturbances;
- Ensure the long-term chemical stability of residual mining components and minimize their effects on water quality draining the property;
- Ensure the long-term physical stability of key structures such as the waste dumps and the diversion and drainage ditches; and
- Work towards a passive closure scenario for most or all mine components.

4.2 Possible Cover Functions

Covers are one of many possible mitigation strategies that can be used to achieve site wide closure objectives. Other two common strategies include waste relocation and water treatment. If conditions are such that covers are a suitable mitigation strategy, then the specific function that the cover needs to perform in order to meet the closure objective must be explicitly stated. The following cover functions are recommended for Minto based on the current understanding of site conditions:

- Reduce infiltration to a specific target that would ensure site wide water quality objectives can be met;
- Isolate the mine waste to avoid direct contact by human or other terrestrial animals; and
- Provide a stable landform that is aesthetically pleasing.

4.3 Cover Design Criteria

The cover functions in Section 4.2 above could be considered ambiguous if they are considered in isolation and therefore these functions needs to be explicitly defined in terms of measurable design criteria. A set of example design criteria is provided in Table 4.1.

Table 2. Proposed Minto mine cover design criteria

Component	Criteria
Design Life	100 years (while it is recognized that the cover will remain in place for a longer period, design performance will be measured against this criteria)
Oxygen Reduction	Not required
Infiltration Reduction	Isolating Cover: no more than the uncovered waste; Low Infiltration Cover: no more than 10% of mean annual precipitation with no significant breakthrough events, and; Very Low Infiltration Cover: no more than 2% of mean annual precipitation with no breakthrough events
Waste Settlement	Waste Rock Piles and Dry-Stack tailings: no criteria; Main Pit Tailings: up to 30 cm on beach areas and up to 100 cm on slimes areas (cover is not expected to perform without maintenance and repair when subject to these settlements)
Seismicity	1 in 2,500 year recurrence interval (10% probability of exceeding in 50 years)
Trafficability	Concern for the Main Pit tailings area only. Mixing zone acceptable; but minimum cover design thickness to be measured from above the mixing zone
Physical Exposure	As far as practicable keep mine waste covered. In no areas may more than 1 m^2 of mine waste be exposed as a contiguous area for the life of the structure
Slope Stability	Overall factor of safety of at least 1.3 under static conditions and 1.1 under seismic loading
Wind Erosion	No visible dust up to and including wind speeds with a recurrence interval of 1:10 years, for any given duration. In no areas may overall cover thickness be less than 75% of original design thickness for the life of the structure
Overland Surface Runoff	Capable of withstanding 1:100 year, 24 hour duration storm during peak freshet with no damage. In no areas may overall cover thickness be less than 75% of original design thickness for the life of the structure
Evapo-Concentration	Not required
Root-Uptake	Not required
Vegetation	Self-sustaining vegetation cover endemic to the region within 20 years after cover construction (foreign species and fertilizers during early years acceptable if it supports the final objective)
Land Use	General wilderness area. Large terrestrial animals, birds and aquatic life will be present. Humans will travel through the area infrequently (mostly hunters and trappers). Specific measures to preclude damage to the covers due to human and/or animal use not required
Landform	Promote use of landforms consistent with the current landscape. Provide for variability on cover thicknesses and landscaping to promote establishment of microclimates and variability

4.4 Conceptual Designs

4.4.1 Isolating Cover

Figure 15 illustrates a conceptual isolating cover for the Minto site. The bottom trafficking layer of run-of-mine waste rock is only required for the Main Pit tailings. For beach areas, the trafficking layer thickness of about 0.5 m is probably sufficient, but in the slimes areas, this layer may have to be up to 1 m thick. It is recommended that these trafficking layers be constructed during the winter season when the tailings surface is frozen as the added strength will facilitate in minimizing the mixing zone which would reduce the total volume of material required. Note that tailings may migrate through the trafficking layer as traffic passes over the cover and therefore placement of this layer alone does not constitute an isolating layer.

The isolating layer will be a minimum 0.5 m thick compacted layer of local overburden soil. No specific measures need to be taken to specifically preclude compacting through trafficking across the covered surface; however, to the extent practical, to facilitate vegetation establishment, care must be taken to prevent excessive vehicle compaction. The soil cover will then be re-vegetated.

Detailed numerical analysis has not been carried out; however it is SRK's opinion based on the material characterization and site climate that this cover would consistently result in infiltration values of between 10 and 20% of mean annual precipitation. Significant breakthrough events can, however, occur based on large individual rainfall events. The cover will be susceptible to surface erosion and, therefore, it would be of paramount importance to establish stabilizing vegetation soon after cover placement. Where surface runoff concentrates, dedicated surface water conveyance channels will have to be constructed.

The performance of this cover will not be affected by freeze-thaw and wetting/drying cycles and is not significantly affected by waste settlement. Some maintenance in the form of regrading will be required if significant differential settlement is experienced to ensure that water is not trapped in ponds on the covered surface.

4.4.2 Low Infiltration Cover

A conceptual low infiltration cover for the Minto site is presented in Figure 16. The locally available soils are not suited to constructing low infiltration covers and therefore soil amendment will be required. Although no specific testing has been carried out, it is expected that a 4% bentonite mix with the locally available soils will yield an appropriate infiltration barrier to ensure infiltration remains consistently below 10% of mean annual precipitation. The amended layer should be about 0.3 m thick, be compacted and covered with a 0.5 m loosely compacted isolating layer as described in Section 4.4.1.

The trafficking layer requirements are also consistent with those described in Section 4.4.1.

The infiltration performance of this cover will be affected by freeze/thaw and wetting/drying cycles; however the self-healing properties of the bentonite should compensate against total failure. It is, however, conceivable that small breakthrough events could occur unless the upper isolating cover is increased in thickness to about 3 m to ensure the amended barrier layer is below the annual frost penetration depth.

The cover performance is sensitive to waste settlement, as large displacements of the bentonite amended layer may result in significant discontinuities in the layer which would increase infiltration. Frequent inspections of the cover will have to be undertaken over the Main Pit tailings and where large depressions are observed, the bentonite amended layer must be exposed and possibly in-filled to compensate for potential loss of performance.

On the dry-stack and possibly the Main Pit beach areas, consideration can be given to amending the upper tailings surface with bentonite as opposed to the dedicated 0.3 m thick imported overburden layer.

Appropriate trade-off studies will have to be carried out to determine the most cost effective method of mixing the amended layer.

4.4.3 Very Low Infiltration Cover

Suitable natural soils to construct a very low infiltration cover at Minto are not available and, therefore, a geosynthetic liner is recommended if this level of cover performance is required. An appropriate trade-off study will have to be carried out to determine the most economical geosynthetic product; however, for the purpose of this study, a 60 mil textured HDPE liner has been assumed. The overall conceptual cover design is illustrated in Figure 17. As described before, the trafficking layer only applies to the Main Pit tailings impoundment.

A levelling and protective layer of compacted tailings (borrowed from Main Pit beach tailings or the dry-stack tailings impoundment) at least 10 cm thick must be placed between the mine waste and the liner. Note this is not required on the dry-stack, but will be required on the Main Pit tailings since the trafficking layer will be the surface on which the liner is placed.

A similar protection layer must be placed over the liner prior to constructing the overliner soil cover. Given the relatively benign geochemical composition of the tailings, it is recommended that this layer be tailings. Should focussed characterization prove this is unacceptable, suitable clean sand would have to be imported, or alternaticely a robust (e.g., 16 oz) non-woven geotextile can be substituted.

The overliner soil cover should consist of a 0.3 m thick compacted layer (at least 98% Standard Proctor) of local overburden soils, overlain by a 0.5 m thick, loosely compacted layer similar to that recommended for the isolating cover. The lower compacted layer serves to better anchor the liner, and to provide a root barrier to resist deep penetration which may damage the liner.

Although detailed numerical analysis has not been carried out, the liner, if installed with due care, will ensure infiltration to less than 2% of mean annual precipitation with no chance of

breakthrough events due to extreme events. The upper isolating cover will be susceptible to surface erosion and would require the same treatment as described in Section 4.4.1.

The infiltration performance of this cover will not be affected by freeze/thaw and wetting/drying cycles; however the compacted layer will become less dense overtime, thereby reducing its functionality as described. A complete loss of functionality over the design life of the cover is, however, not expected.

The liner performance is very sensitive to waste settlement, and may tear or rupture under severe conditions. Frequent inspections of the cover will have to be undertaken over the Main Pit tailings impoundment in the first 5 to 20 years following cover construction. If trampolining (i.e., unsupported liner) is observed, the liner would have to be exposed, and remedial works initiated.

5 Conclusions

The hydrologic and climatic regime at the Minto site is best suited to the use of water covers or infiltration reducing covers (i.e., barrier covers). Store-and-release and thermal covers are not likely to be successful. The available overburden soils at Minto are not well suited for construction of low or very low infiltration covers.

These soils can however be used as effective isolation and vegetation supporting covers, and are expected to result in overall infiltration of between 10 and 20% of mean annual precipitation, typically. Periodic higher breakthrough events will, however, occur. Soil amendments or use of synthetic products would be required to construct low to very low infiltration covers at the site. Conceptual designs of each of these different cover variants have been proposed.

This report ***"Scoping Level Cover Assessment for Minto Closure Covers"*** has been prepared by:

ORIGINAL SIGNED BY

Bill Chen
Staff Consultant

ORIGINAL SIGNED BY

Maritz Rykaart, PhD, PEng
Principal Consultant

Reviewed By:

ORIGINAL SIGNED BY

Cam Scott , PEng
Principal Consultant

Disclaimer—SRK Consulting (Canada) Inc. has prepared this document for Minto Explorations Ltd.. Any use or decisions by which a third party makes of this document are the responsibility of such third parties. In no circumstance does SRK accept any consequential liability arising from commercial decisions or actions resulting from the use of this report by a third party.

The opinions expressed in this report have been based on the information available to SRK at the time of preparation. SRK has exercised all due care in reviewing information supplied by others for use on this project. Whilst SRK has compared key supplied data with expected values, the accuracy of the results and conclusions from the review are entirely reliant on the accuracy and completeness of the supplied data. SRK does not accept responsibility for any errors or omissions in the supplied information, except to the extent that SRK was hired to verify the data.

6 References

Basher, L.R., Webb, T.H. (1997). Wind erosion rates on terraces in the Mackenzie Basin. Journal of the Royal Society of New Zealand 27: 499-512.

Chen, C. (1999). Meteorological Conditions for Design of Monolithic Alternative Earthen Final Covers (AEFCs). Master of Science thesis submitted to the Department of Civil and Environmental Engineering, University of Wisconsin-Madison.

Clearwater Consultants Ltd. (2008). Minto Copper Project – Water Balanace Model. Memorandum CCL-MC3 by Peter S. McCreath to Dan Cornett, Access Consulting Group, File 087.01, March 28.

Clearwater Consultants Ltd. (2010). Minto Copper Project – Surface Water Hydrology Conditions – FINAL. Memorandum CCL-MC6 by Peter S. McCreath to Randall Thompson, General Manager Minto Mine, File 087.04, August 12.

EBA Engineering Consultants Ltd. (2010). Minto Mine 2010 Climate Baseline Report. Report prepared for Minto Explorations Ltd., Project W14101068.025, August 2010.

FAO (1998). Crop evapotranspiration – Guidelines for computing crop water requirements – FAO Irrigation and drainage paper 56. ISBN 92-5-104219-5.

Forward, G., Payne, R., Bright, M. (2004). The Estimated Cost of Wind Erosion in South Australia's Agricultural Lands. Source unknown, 6 pp.

Holdridge L.R., Grenke, W.C., Hatheway, W.H., Liang, T, Tosi, J.A. (1971). Forest Environments in Tropical Life Zones. Pergamon Press, Oxford.

INAP (2012). Global Acid Rock Draingae (GARD) Guide. http://www.gardguide.com., May.

Ritchie, D.G. (1999). Discussion of Sesimic Design Considerations for Soil Covers on Tailings. Proceedings of the Sudbury '99, Mining and Environment II, Volume 1. Sudbury, Ontario, Canada, September 13-17, pp. 49-58.

Lin, L.C., Benson, C.H. (2000). Effect of wet-dry cycling of swelling and hydraulic conductivity of GCLs. J. Geotech. Geoenviron. Engrg., 130(12), 1236 – 1249.

Minto Explorations Ltd. 2011. Decommissioning and Reclamation Plan, Minto Mine, Yukon Territory. Revision 3.2, prepared June 2011.

Rykaart, M., Hockley, D., Noel, M., Paul, M. (2006). Findings of international review of soil covers design and construction practices for mine waste closure. International Conference on Acid Rock Drainage (ICARD). St. Louis MO.

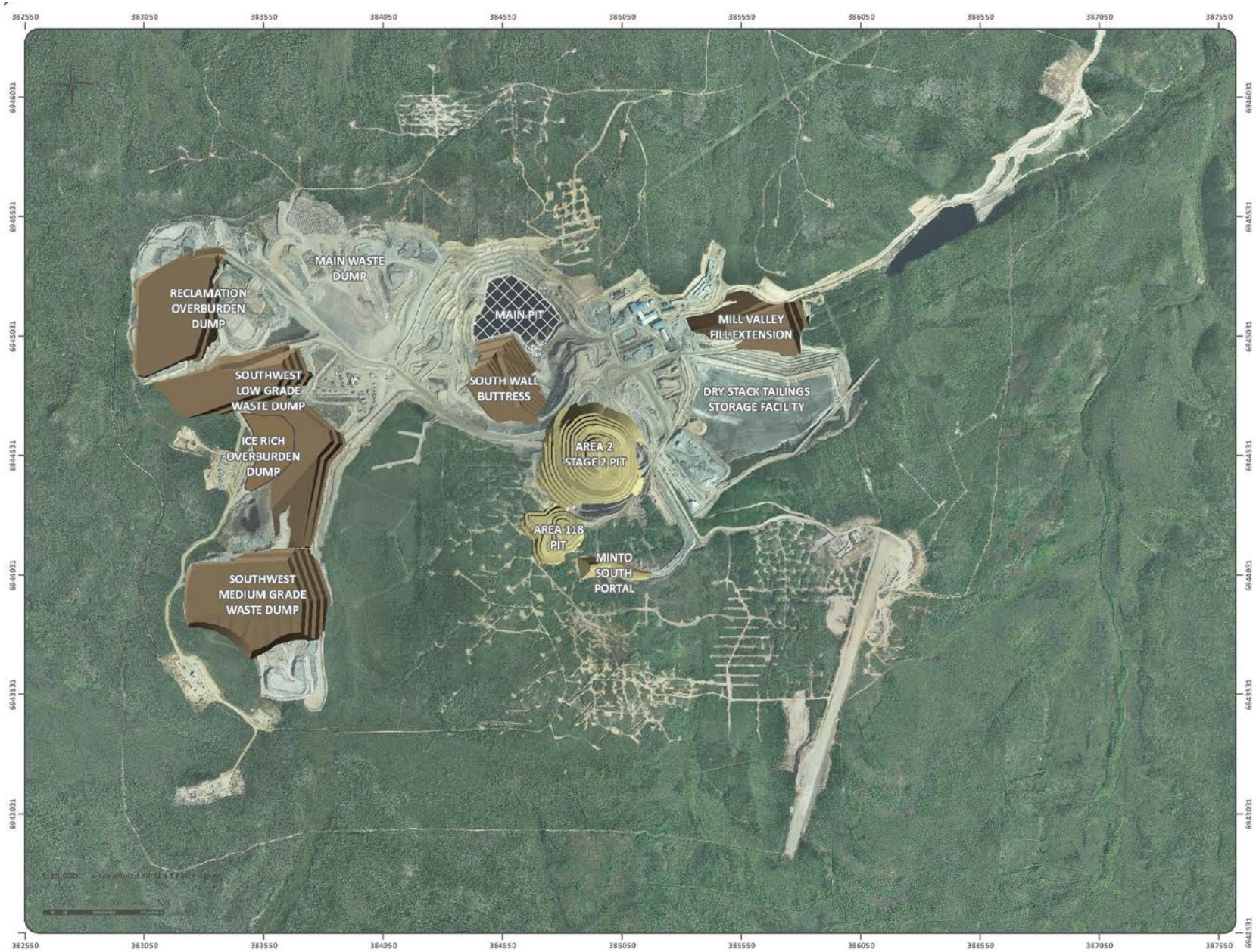
SRK Consulting (2013a). Minto Mine Phase V/VI Expansion: ML/ARD Assessment and Inputs to Water Quality Predictions. Report prepared for Minto Explorations Ltd. July 2013.

SRK Consulting (2013b). Overburden Characterization Factual Data Report. Report prepared for Minto Explorations Ltd. To be completed Summer 2013.

Thornthwaite, C.W., Mather, J.R. (1955). The Water Balance. Publications in Climatology VIII(1): 1-104, Drexel Institute of Climatology, Centerton, NJ.

Wilson, G.W., Williams, D.J., Rykaart, E.M. (2003). The Integrity of Cover Systems – An Update. The AusIMM Bulletin. Journal of the Australasian Institute if Mining and Metallurgy, No. 6, November/December, pp. 63-69.

Figures



Note: Drawing as supplied by Minto Explorations Ltd. (subsidiary of Capstone Mining Corp.)

srk consulting

CAPSTONE MINING CORP.
MINTO MINE

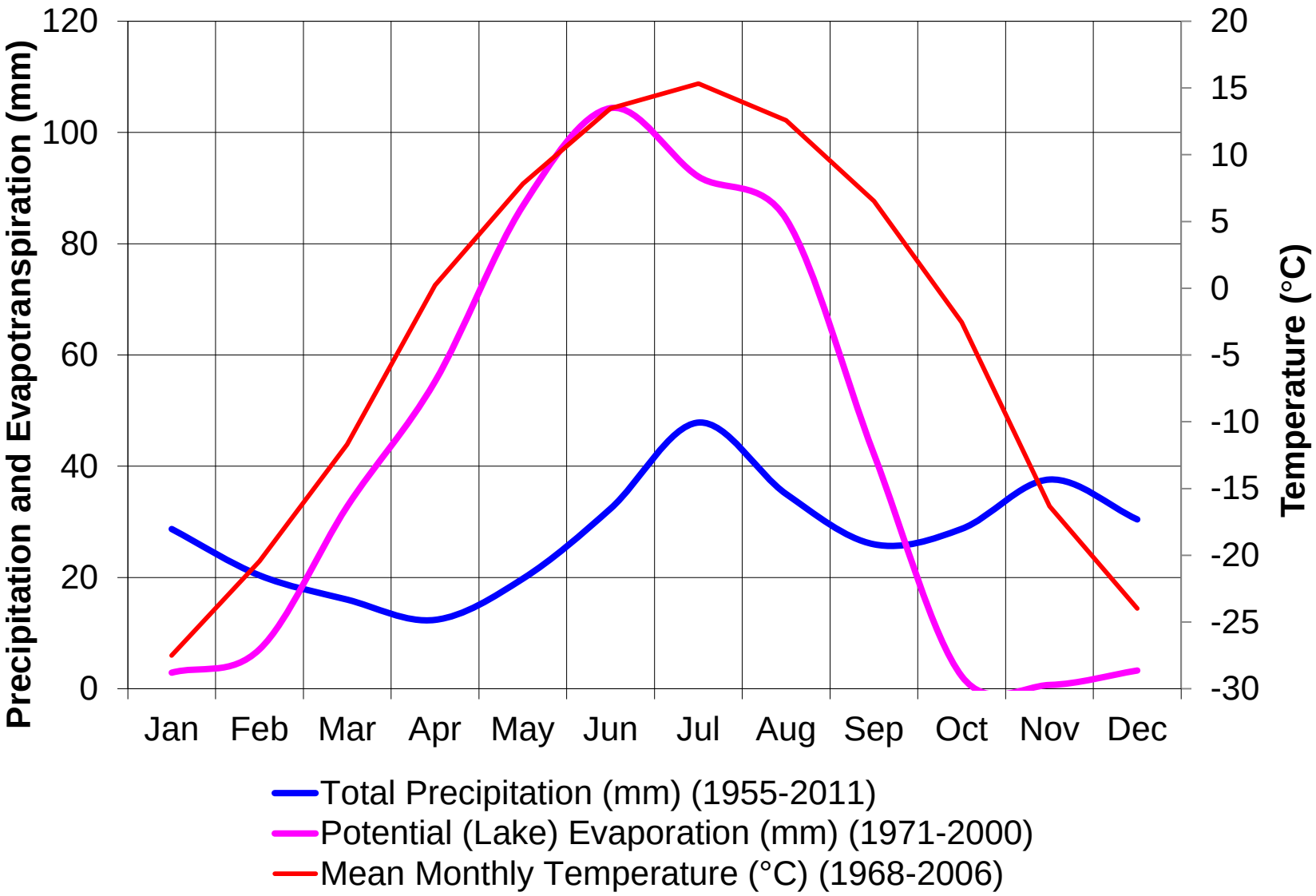
Scoping Level Cover Assessment

General Site Layout

Job No:	1CM002.007
Filename:	Figure 1_1CM002.007_Gen Layout_Rev01.pptx

Minto Mine

Date:	Approved:	Figure:
July 2013	EMR	1



srk consulting

CAPSTONE MINING CORP.
MINTO MINE

Scoping Level Cover Assessment

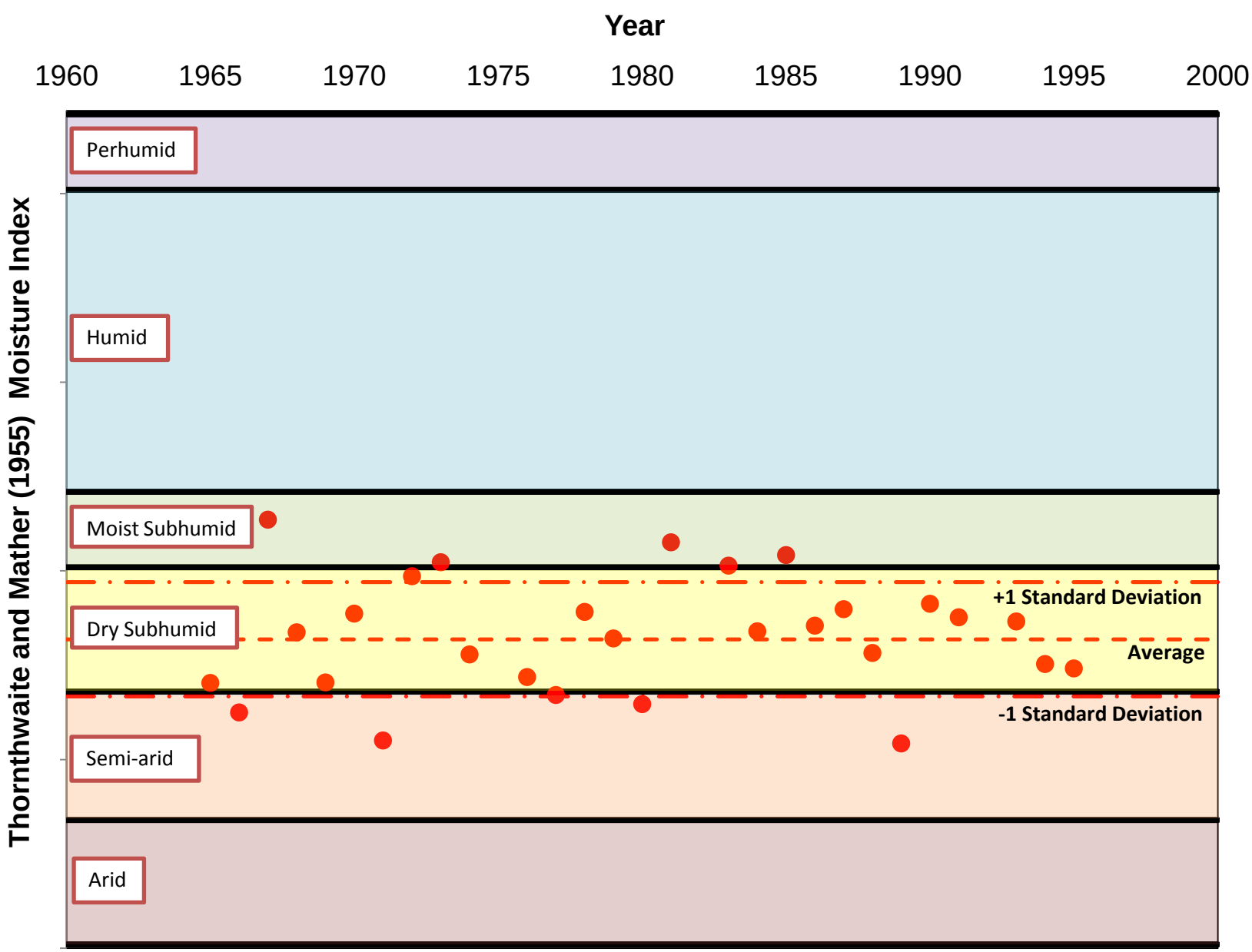
Climatic Water Balance

Job No: 1CM002.007
Filename: Figure 2-14_1CM002.007_Rev05.pptx

Minto Mine

Date:	Approved:	Figure:
July 2013	EMR	2

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\GENERAL - Soil Cover Thickness Calculation Spreadsheet (Chen 1999).xls



srk consulting

CAPSTONE MINING CORP.
MINTO MINE

Scoping Level Cover Assessment

Thornthwaite & Mather (1995) Moisture Index

Job No: 1CM002.007	Minto Mine	Date: July 2013	Approved: EMR	Figure: 3
Filename: Figure 2-14_1CM002.007_Rev05.pptx				

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Thornthwaite classification model_1cm002.007_bc_rev01

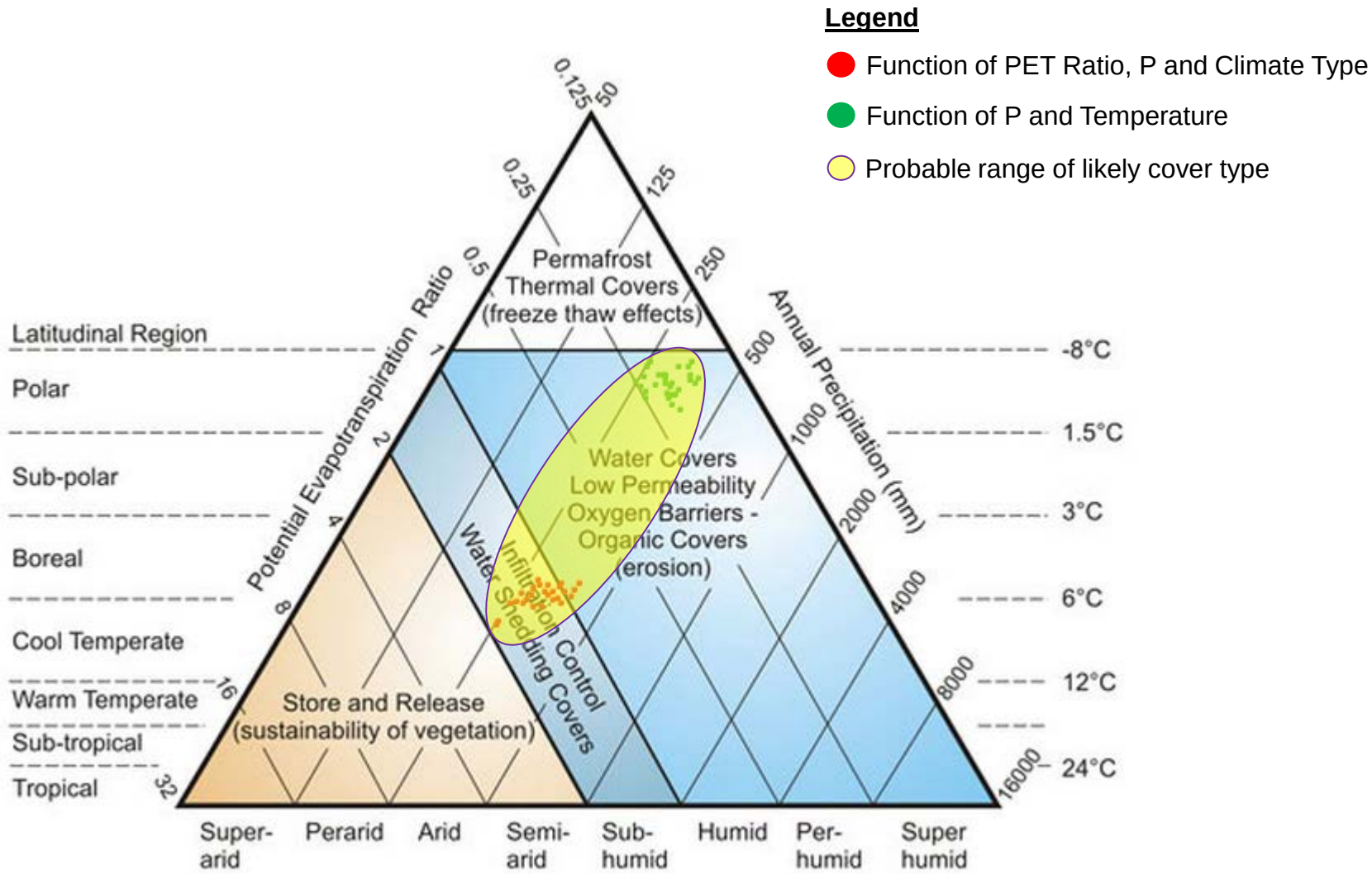
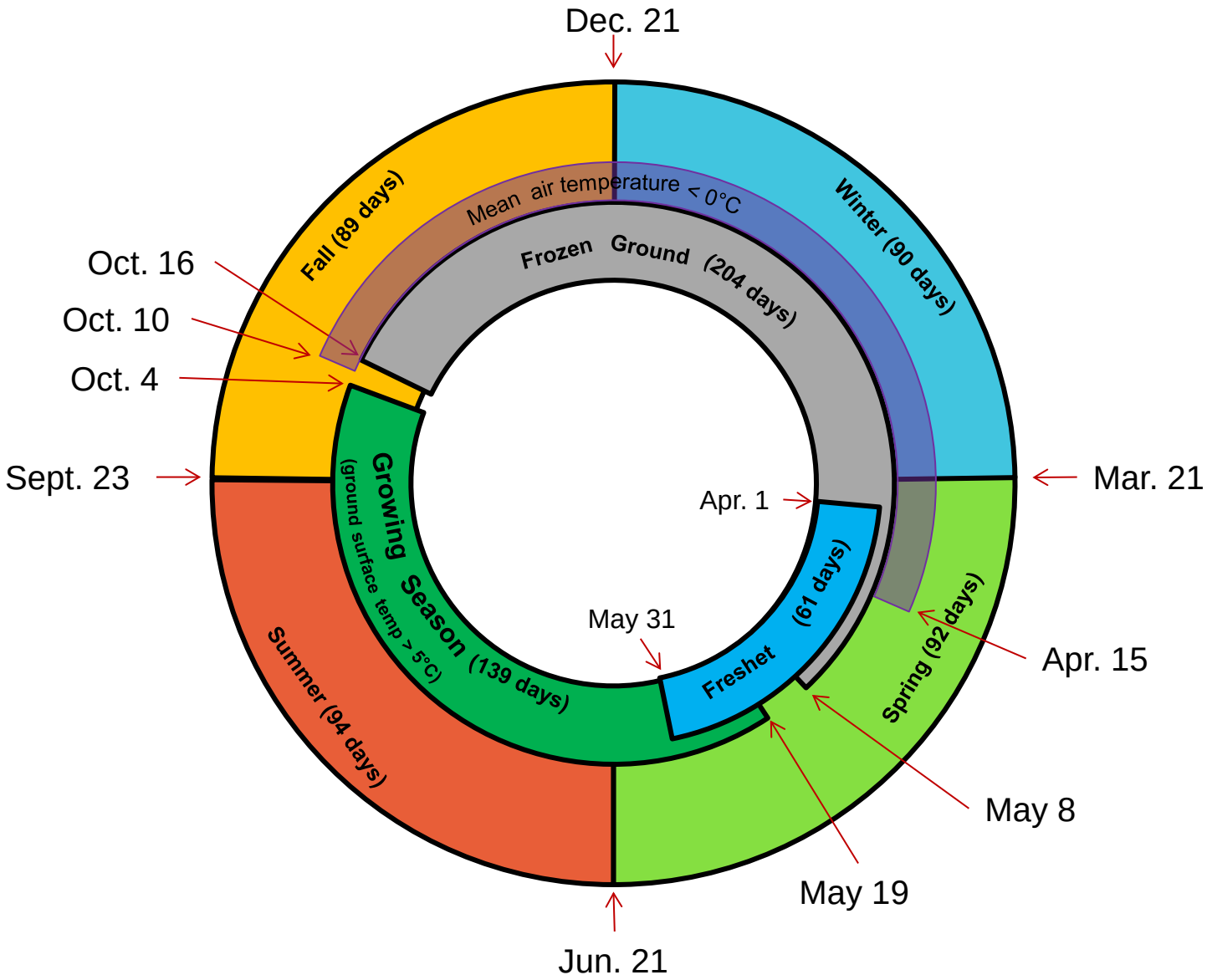


Chart obtained from:
Chapter 6 - GARDGuide. 2013. *Chapter 6 - GARDGuide*. [ONLINE] Available at: http://www.gardguide.com/index.php/Chapter_6. [Accessed 04 April 2013]. (Wickland and Wilson, 2006)

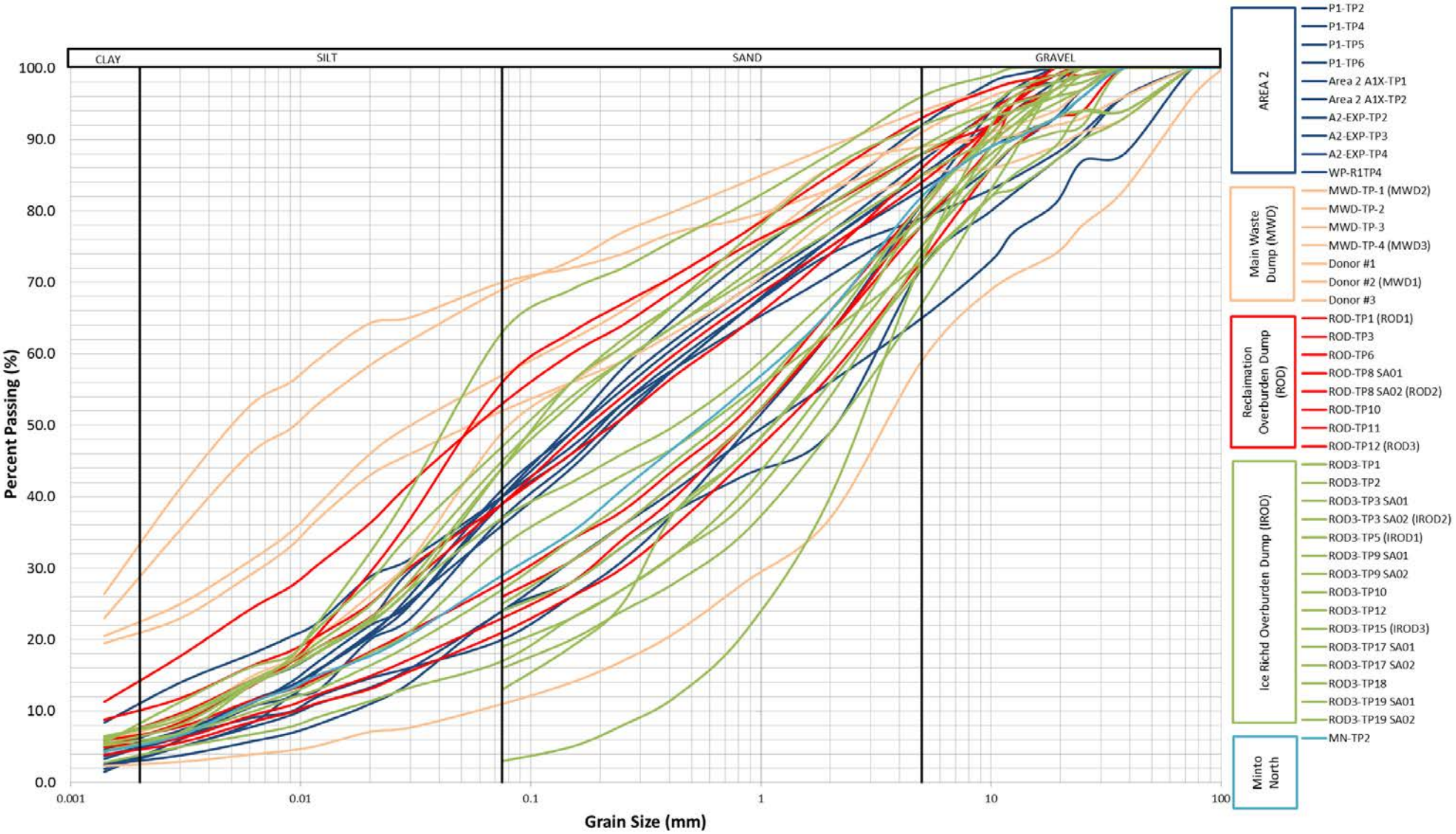
srk consulting	CAPSTONE MINING CORP. MINTO MINE	Scoping Level Cover Assessment			
		Typical Cover Types			
Job No: 1CM002.007 Filename: Figure 2-14_1CM002.007_Rev05.pptx	Minto Mine	Date: July 2013	Approved: EMR	Figure: 4	

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Minto Climate Figures&Charts_1cm002.007_bc_rev01



srk consulting	CAPSTONE MINING CORP. MINTO MINE	Scoping Level Cover Assessment	
		Climate Wheel	
Job No: 1CM002.007 Filename: Figure 2-14_1CM002.007_Rev05.pptx	Minto Mine	Date: July 2013	Approved: EMR	Figure: **5**

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Minto Climate Figures&Charts_1cm002.007_bc_rev01



srk consulting

CAPSTONE MINING CORP.
MINTO MINE

Scoping Level Cover Assessment

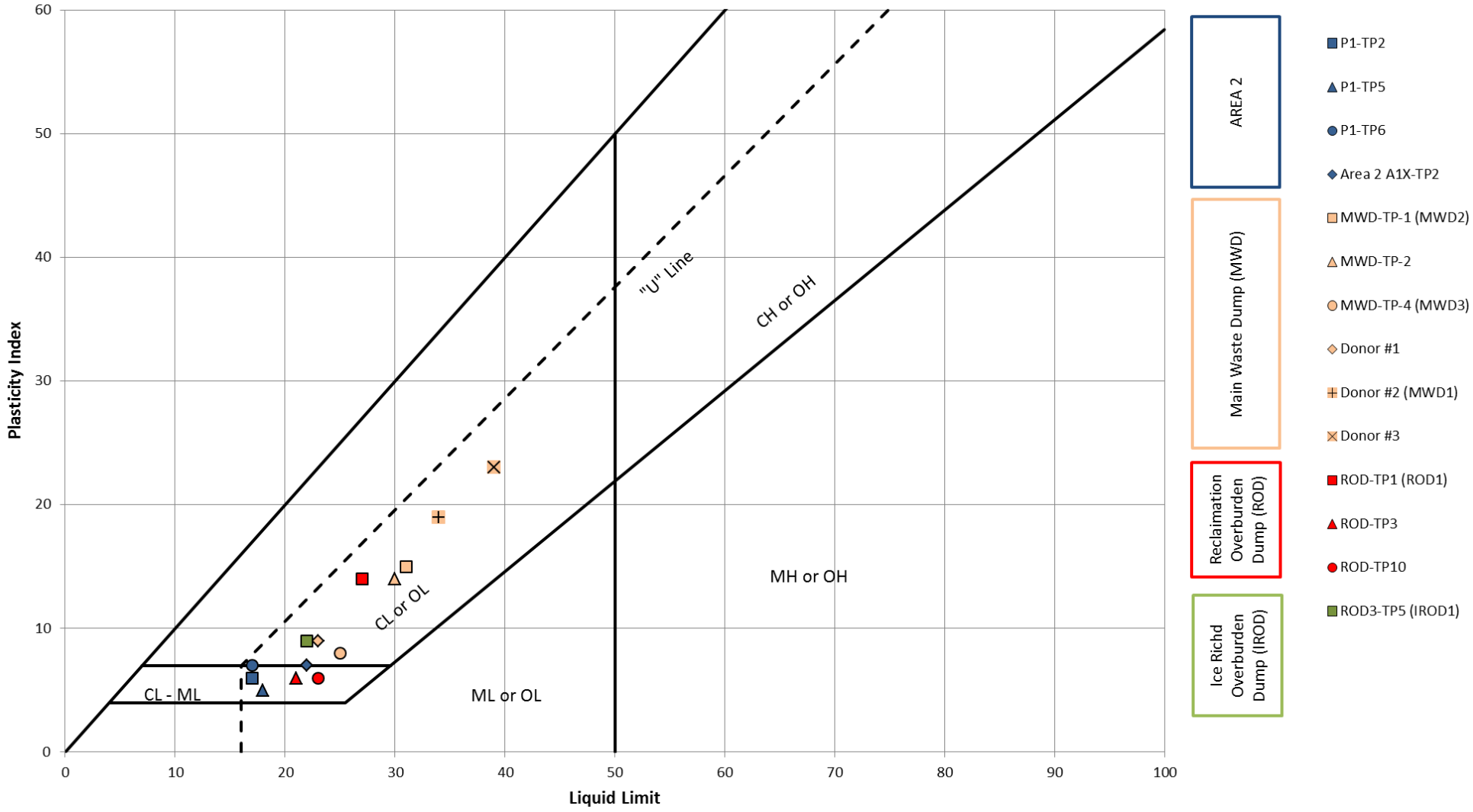
Grain Size Distribution Curves for All Candidate Cover Materials

Job No: 1CM002.007
Filename: Figure 2-14_1CM002.007_Rev05.pptx

Minto Mine

Date: July 2013
Approved: EMR
Figure: 6

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Material Data\Cover material geotech data_1cm002.007_bc_rev01



srk consulting

CAPSTONE MINING CORP. MINTO MINE

Scoping Level Cover Assessment

Atterberg Limits for All Candidate Cover Materials

Job No: 1CM002.007

Filename: Figure 2-14_1CM002.007_Rev05.pptx

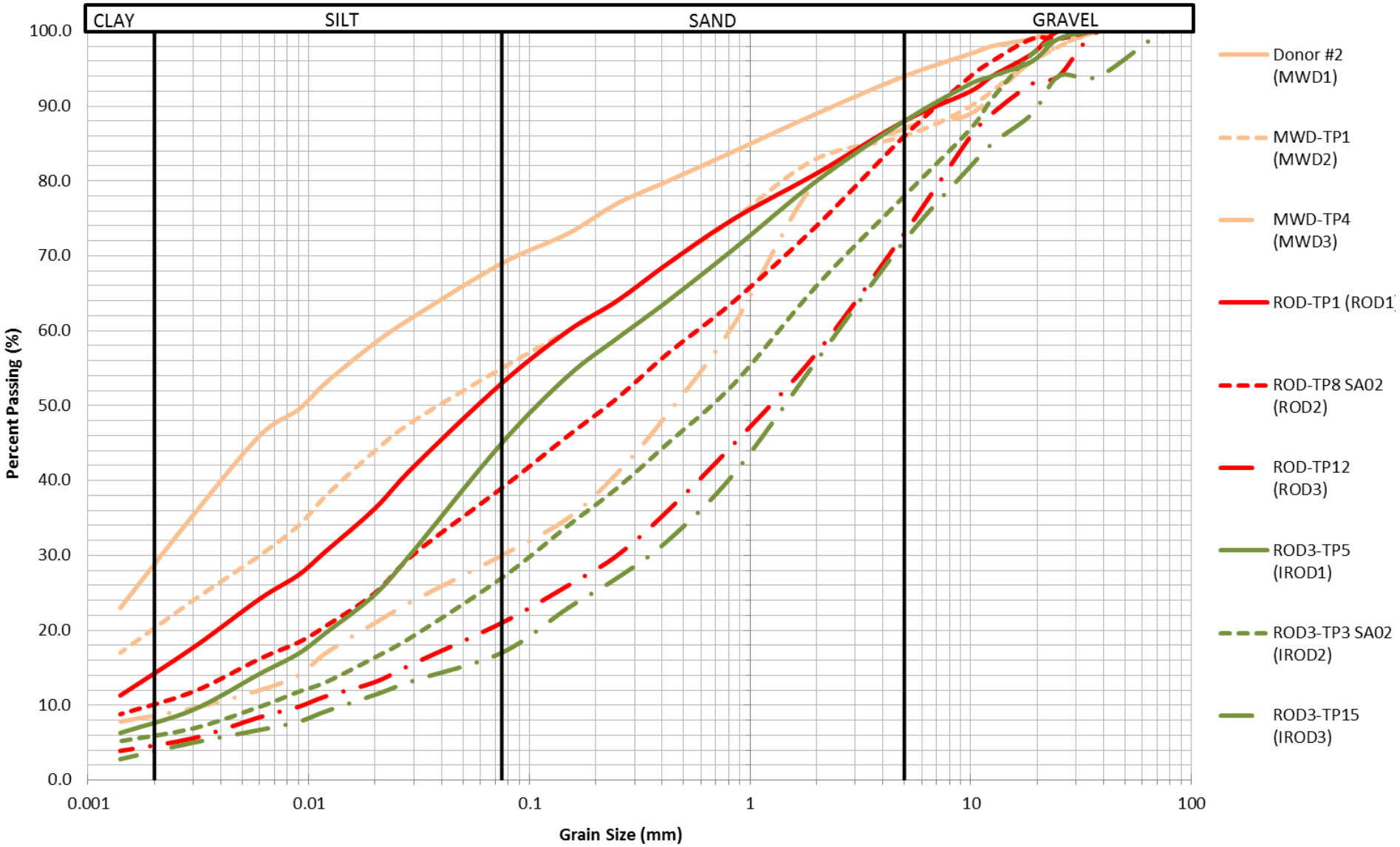
Minto Mine

Date: July 2013

Approved: EMR

Figure: 7

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Material Data\Cover material geotech data_1cm002.007_bc_rev01



srk consulting

CAPSTONE MINING CORP. MINTO MINE

Scoping Level Cover Assessment

Representative Cover Materials

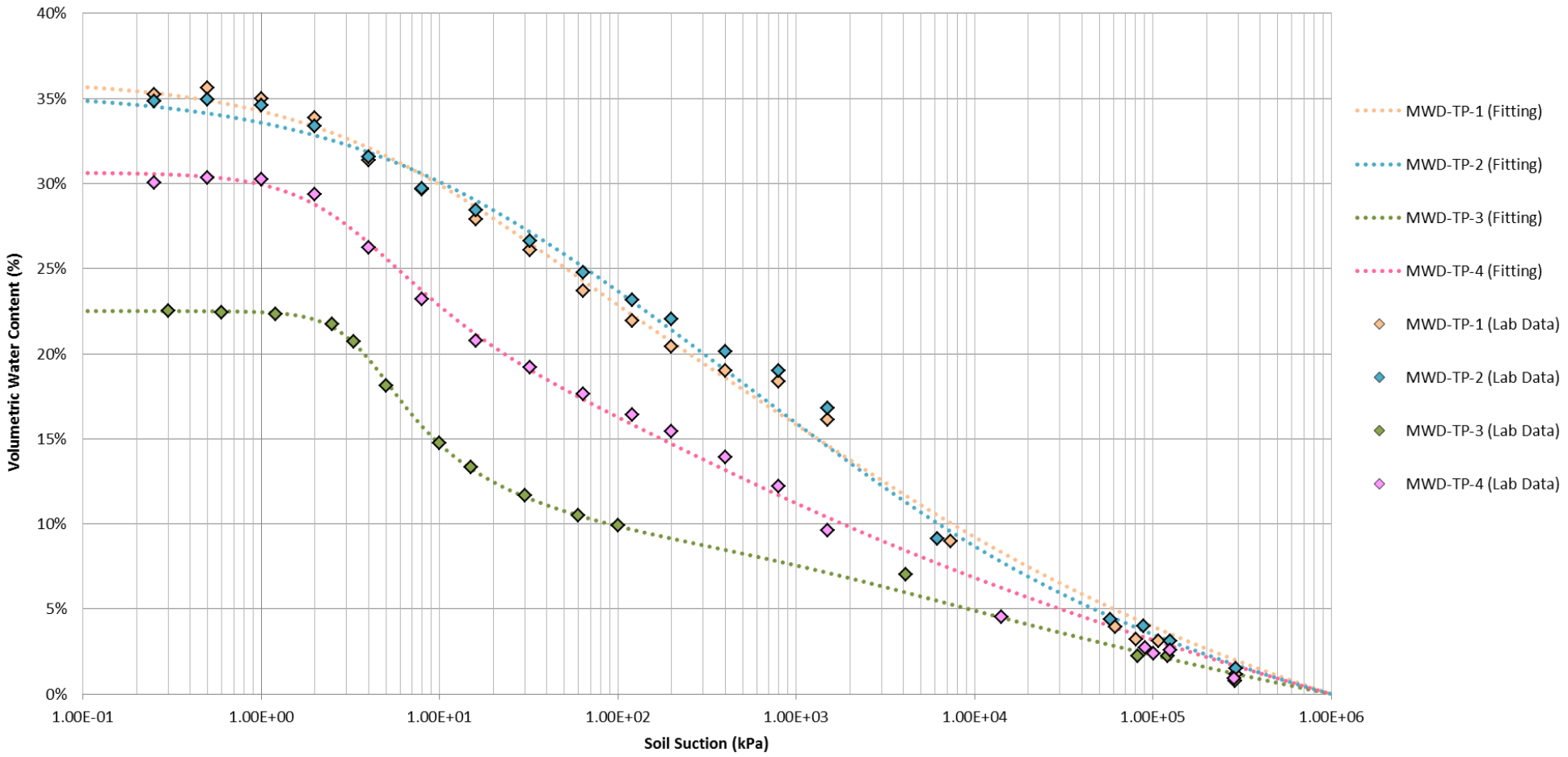
Job No: 1CM002.007

Filename: Figure 2-14_1CM002.007_Rev05.pptx

Minto Mine

Date:	Approved:	Figure:
July 2013	EMR	8

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Material Data\Cover material geotech data_1cm002.007_bc_rev01



srk consulting

CAPSTONE MINING CORP.
MINTO MINE

Scoping Level Cover Assessment

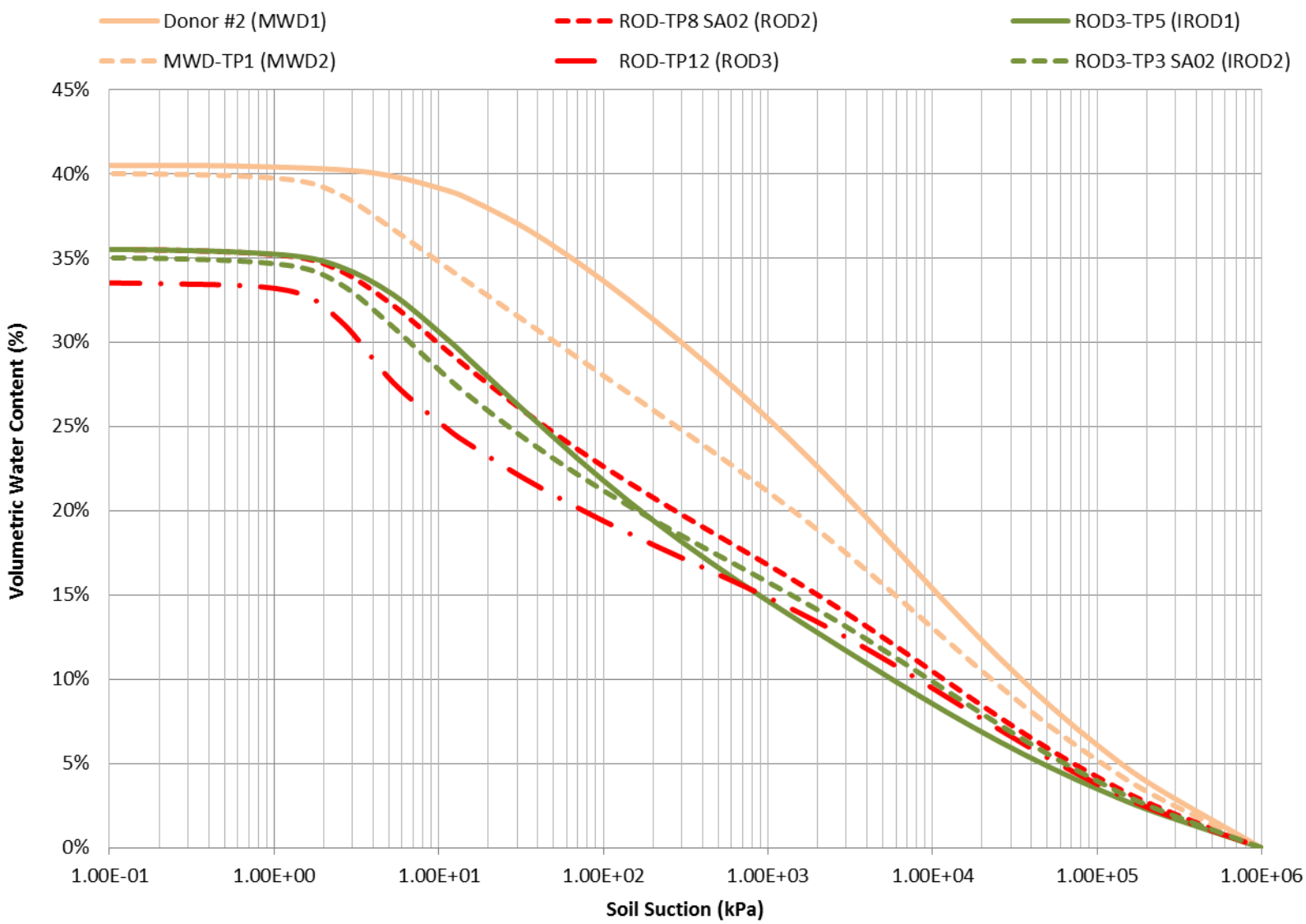
Measured Soil Water Characteristic Curves

Job No: 1CM002.007
Filename: Figure 2-14_1CM002.007_Rev05.pptx

Minto Mine

Date: July 2013
Approved: EMR
Figure: 9

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Material Data\Cover material geotech data_1cm002.007_bc_rev01



srk consulting

CAPSTONE MINING CORP.
MINTO MINE

Scoping Level Cover Assessment

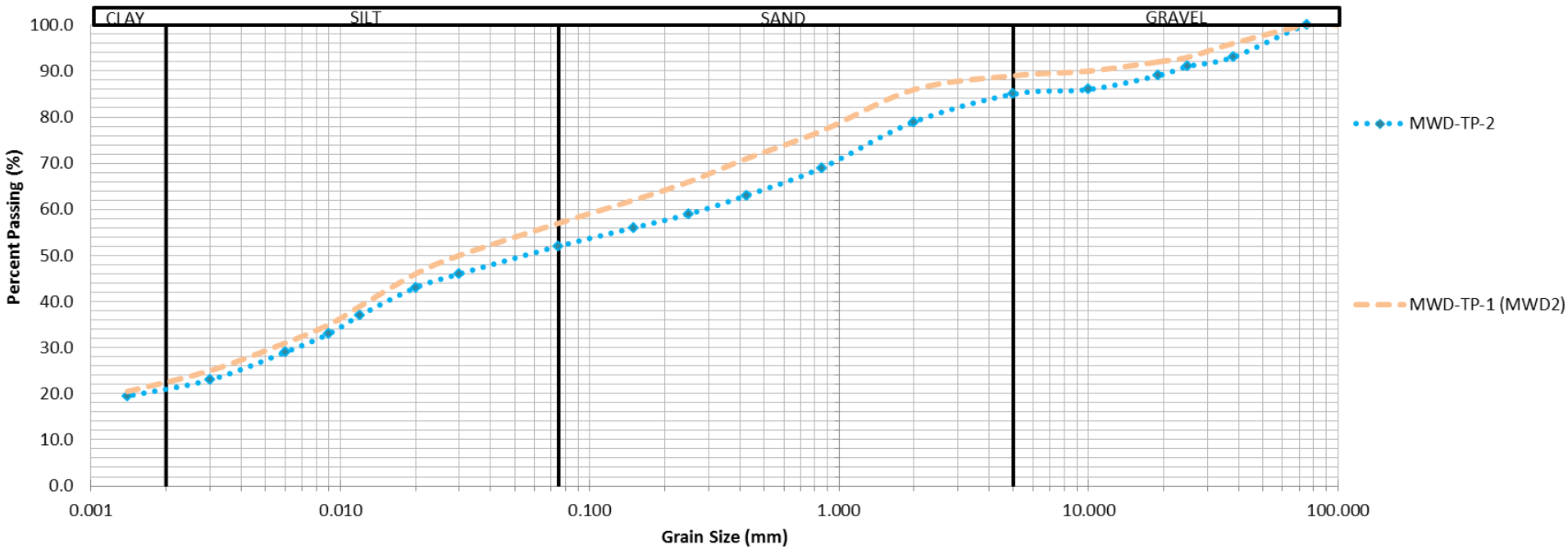
Estimated Soil Water Characteristic Curves

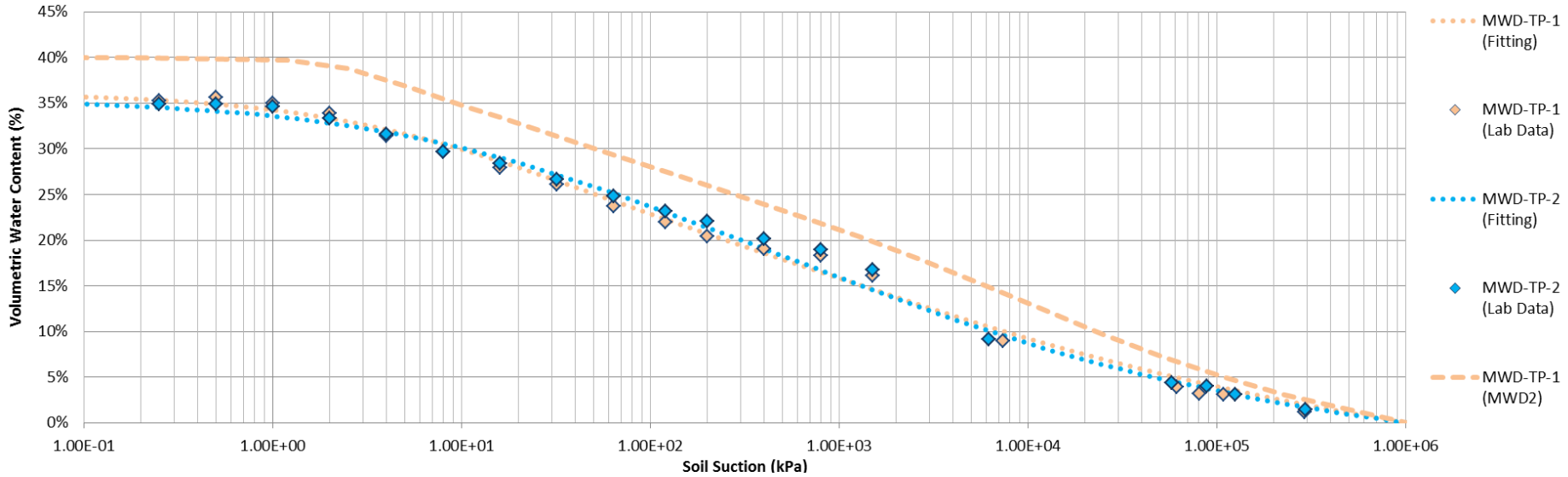
Job No: 1CM002.007
Filename: Figure 2-14_1CM002.007_Rev05.pptx

Minto Mine

Date: July 2013
Approved: EMR
Figure: **10**

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Material Data\SWCC graphs_1cm002.007_bc_rev01





srk consulting

CAPSTONE MINING CORP.
MINTO MINE

Scoping Level Cover Assessment

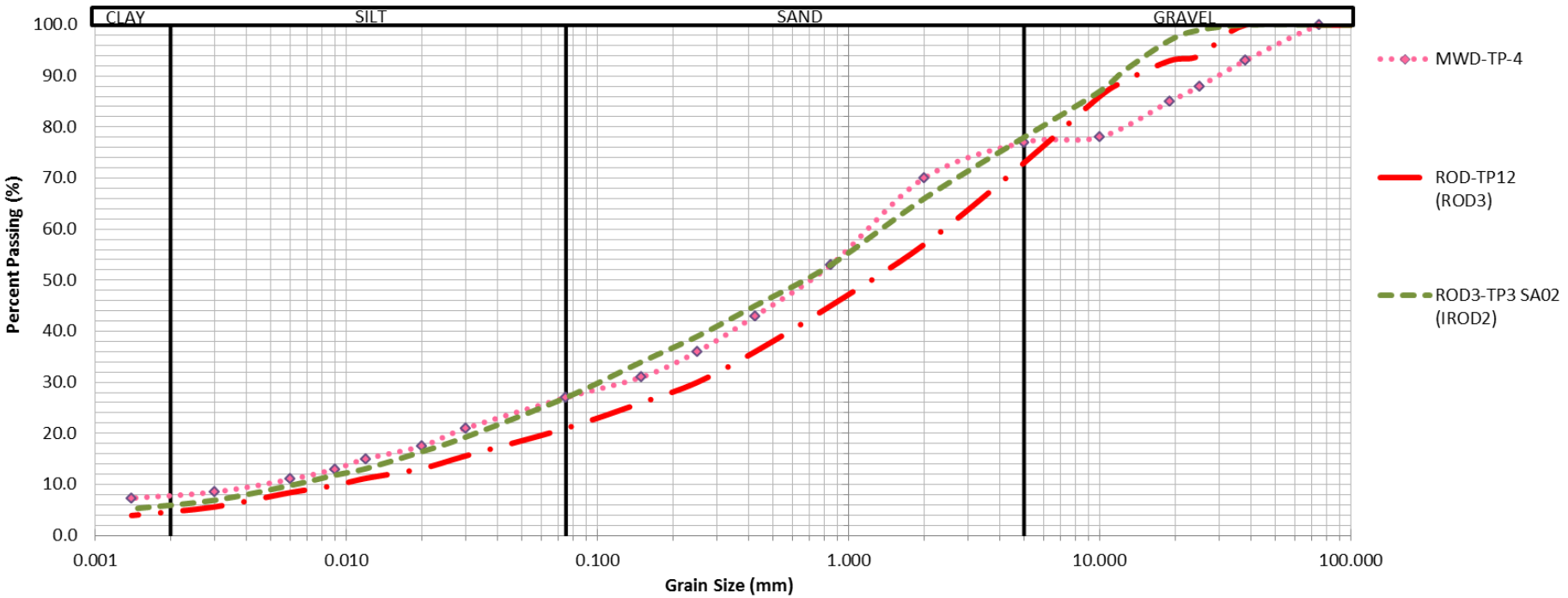
Comparison of Measured and Estimated SWCC's (MWD Material)

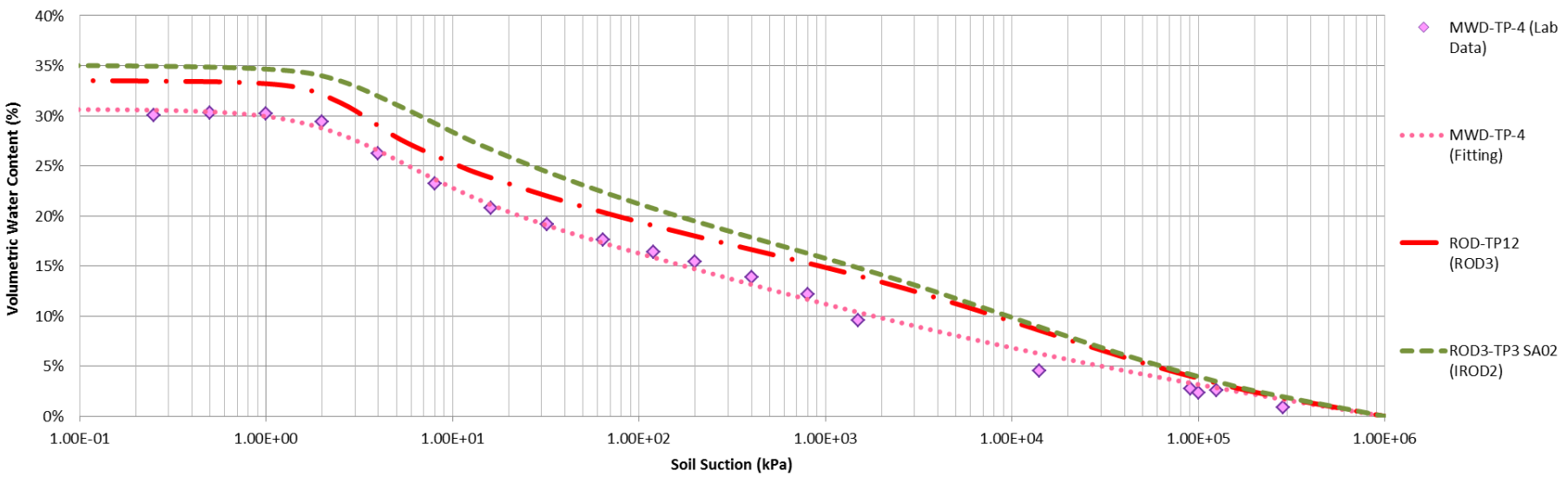
Job No: 1CM002.007
Filename: Figure 2-14_1CM002.007_Rev05.pptx

Minto Mine

Date:	Approved:	Figure:
July 2013	EMR	11

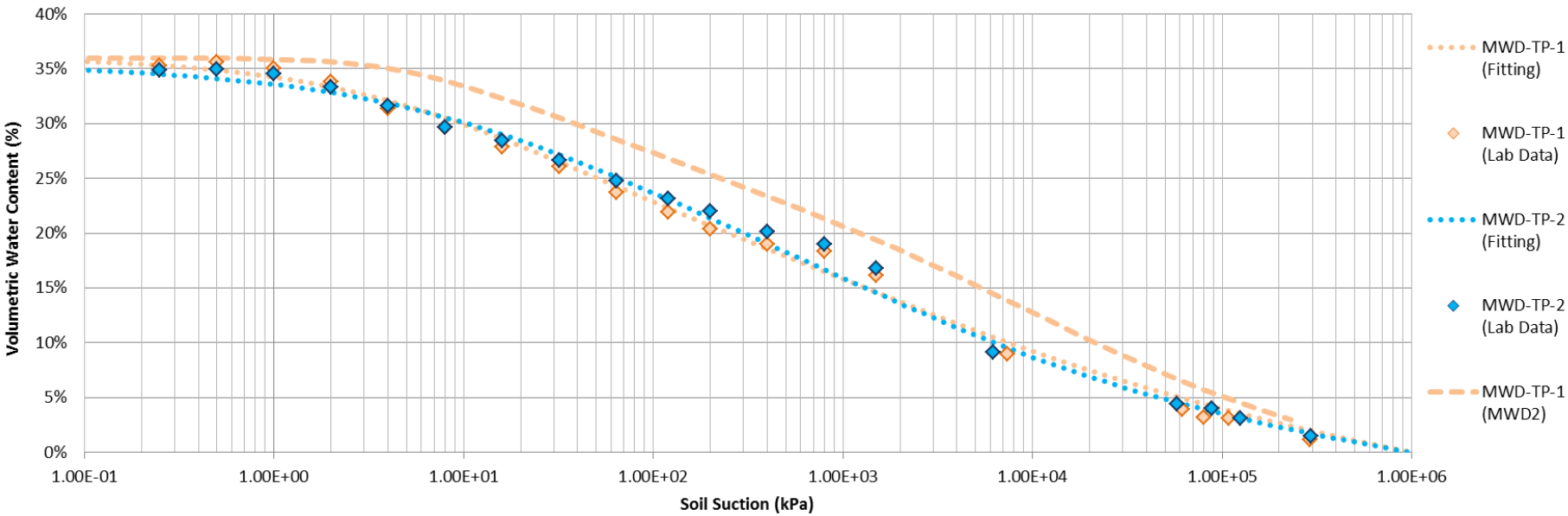
\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Material Data\SWCC graphs_1cm002.007_bc_rev01

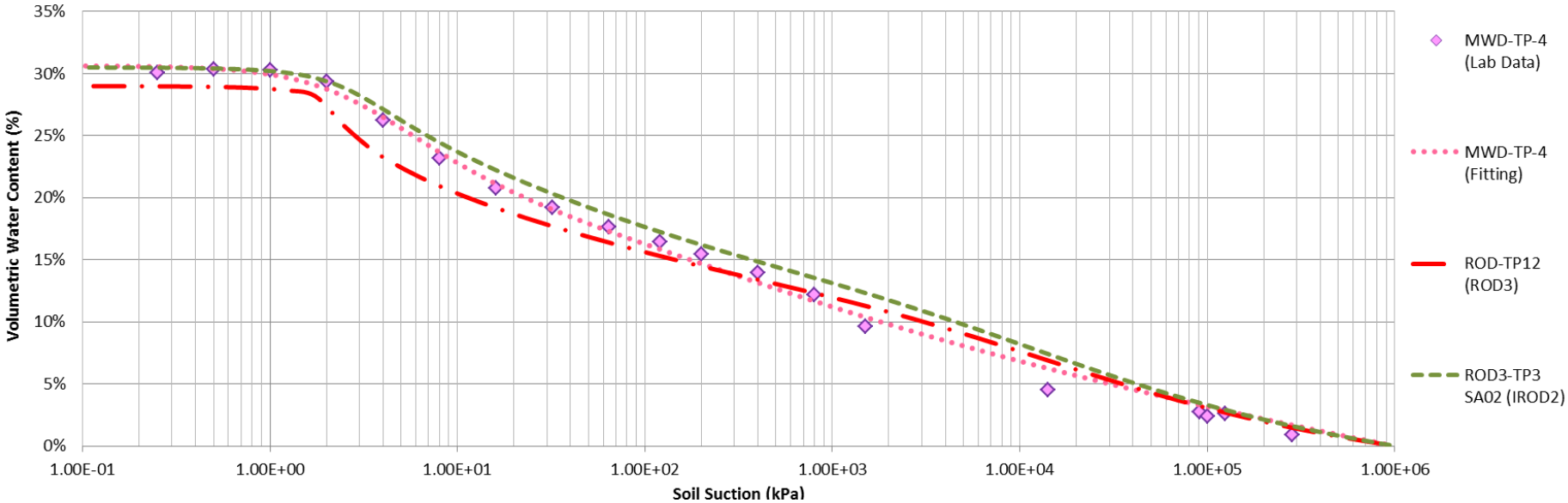




srk consulting	CAPSTONE MINING CORP. MINTO MINE	Scoping Level Cover Assessment
Job No: 1CM002.007 Filename: Figure 2-14_1CM002.007_Rev05.pptx	Minto Mine	**Comparison of Measured and Estimated SWCC's (ROD & IROD Material)**
		Date: July 2013 / Approved: EMR / Figure: **12**

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Material Data\SWCC graphs_1cm002.007_bc_rev01





srk consulting

CAPSTONE MINING CORP. MINTO MINE

Scoping Level Cover Assessment

Calibrated SWCC Estimates Compared to Measured Data

Job No: 1CM002.007

Filename: Figure 2-14_1CM002.007_Rev05.pptx

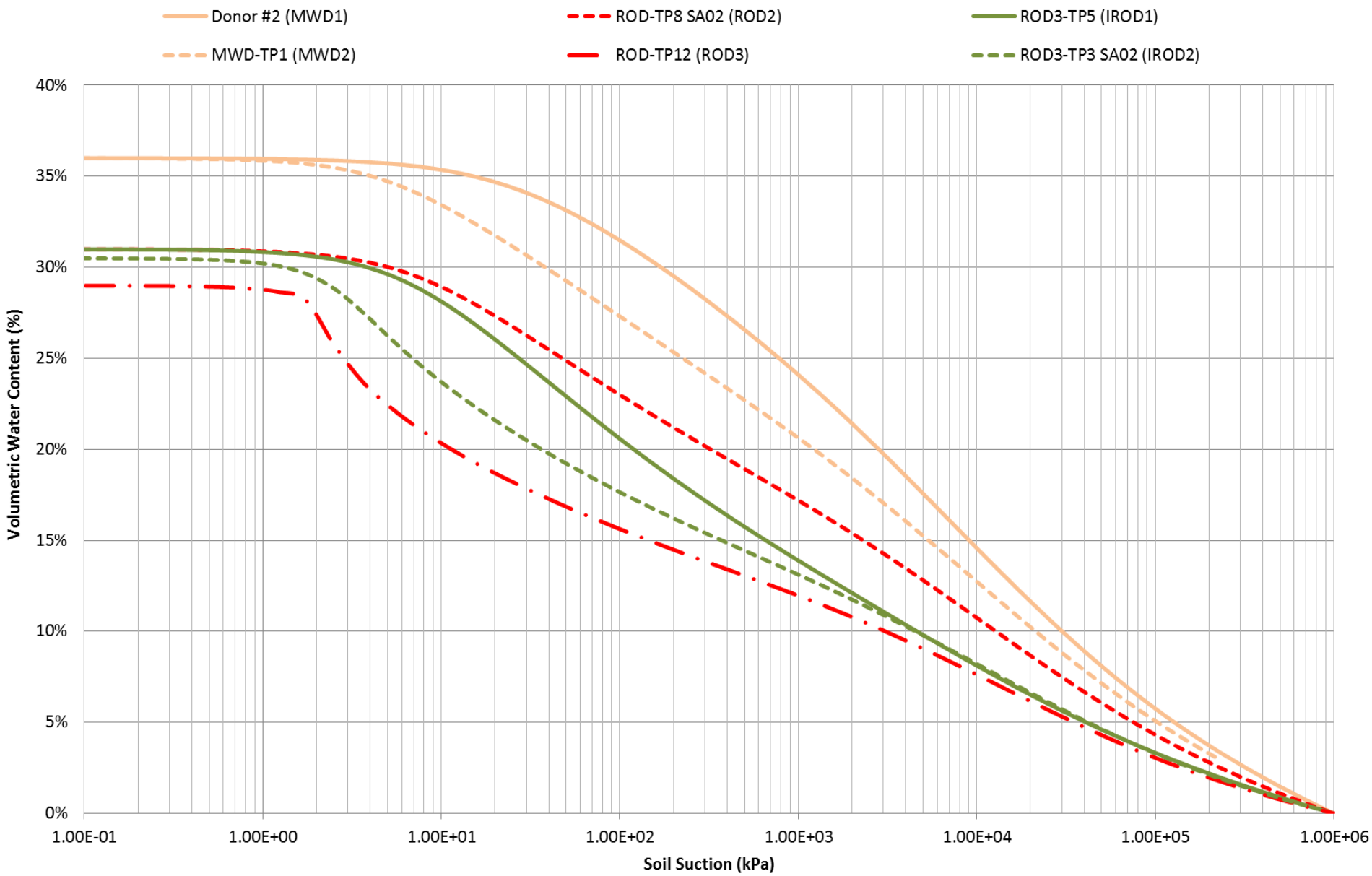
Minto Mine

Date: July 2013

Approved: EMR

Figure: 13

\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Material Data\SWCC graphs_1cm002.007_bc_rev01



srk consulting

CAPSTONE MINING CORP.
MINTO MINE

Scoping Level Cover Assessment

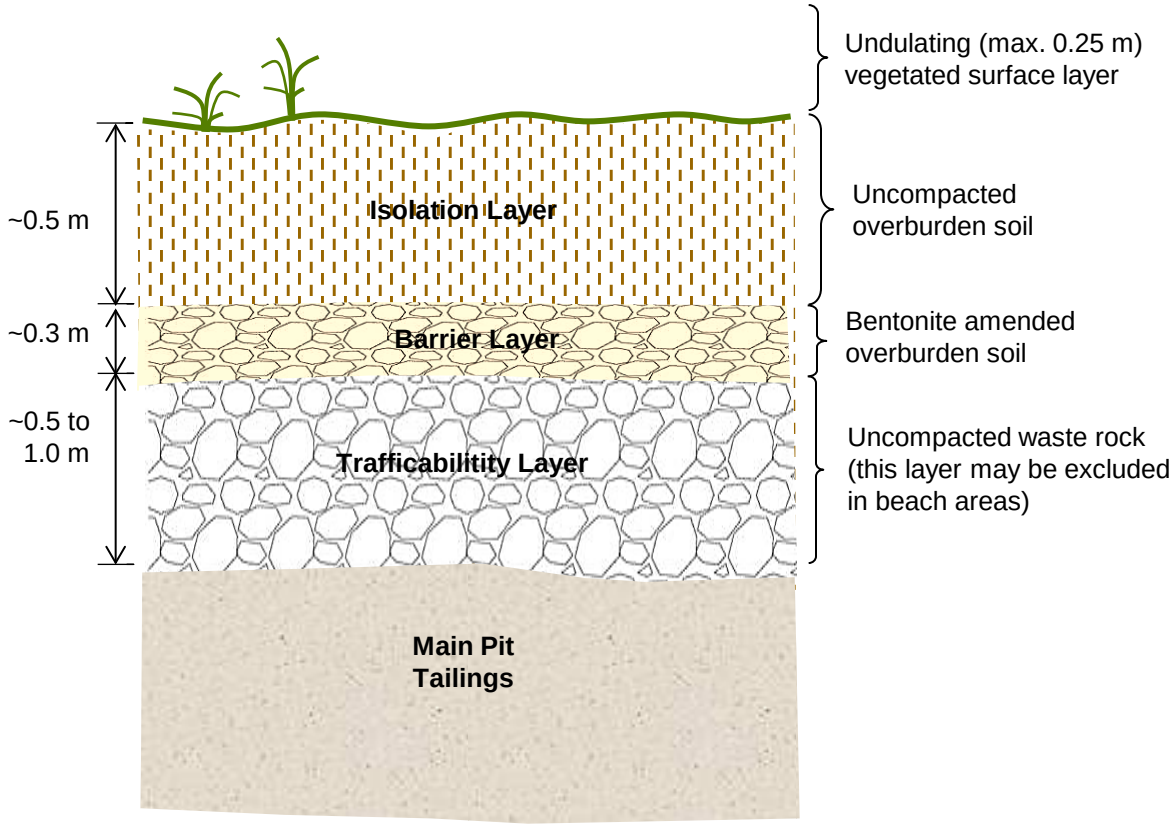
Calibrated Soil Water Characteristic Curves

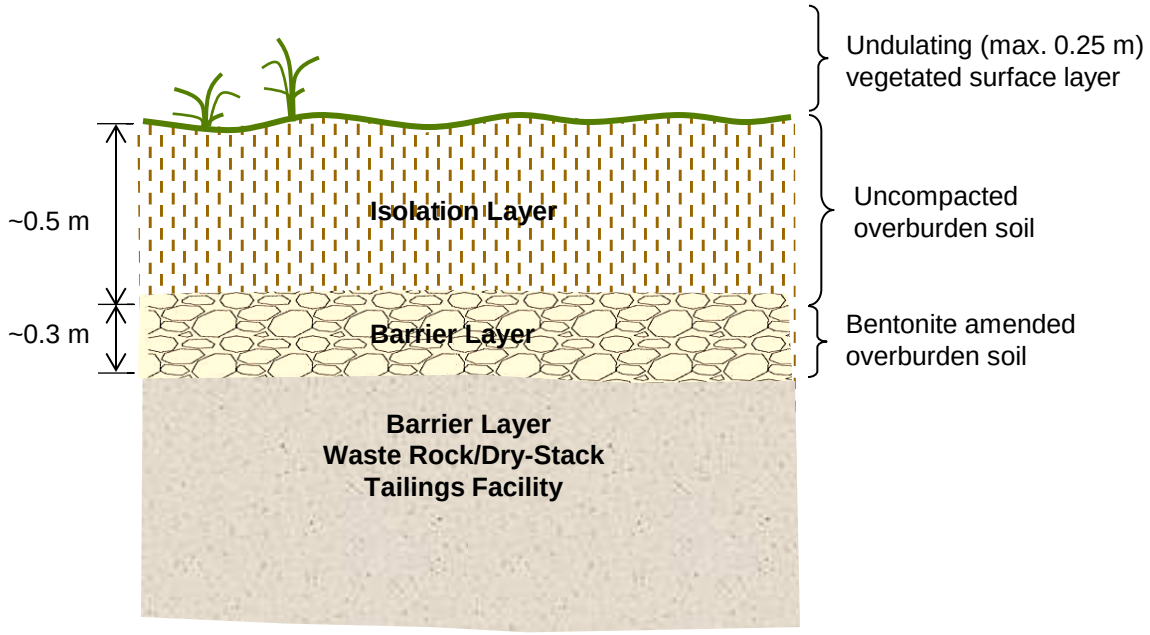
Job No: 1CM002.007
Filename: Figure 2-14_1CM002.007_Rev05.pptx

Minto Mine

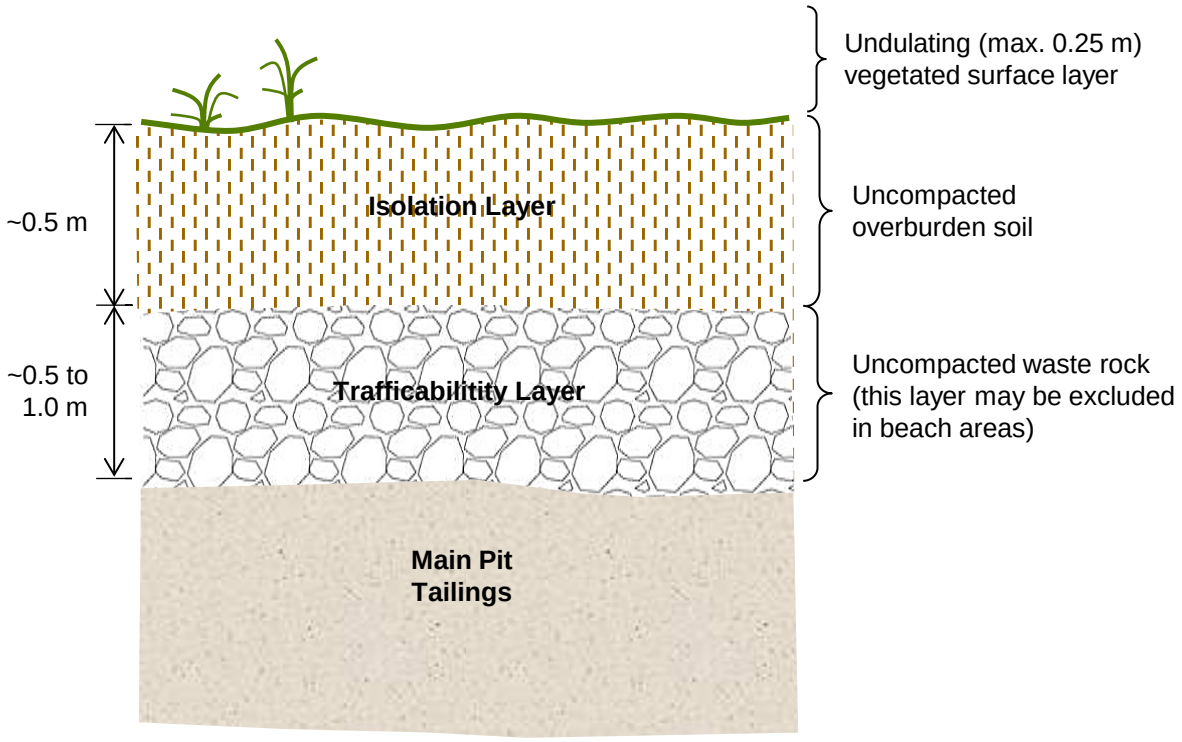
Date: July 2013
Approved: EMR
Figure: 14

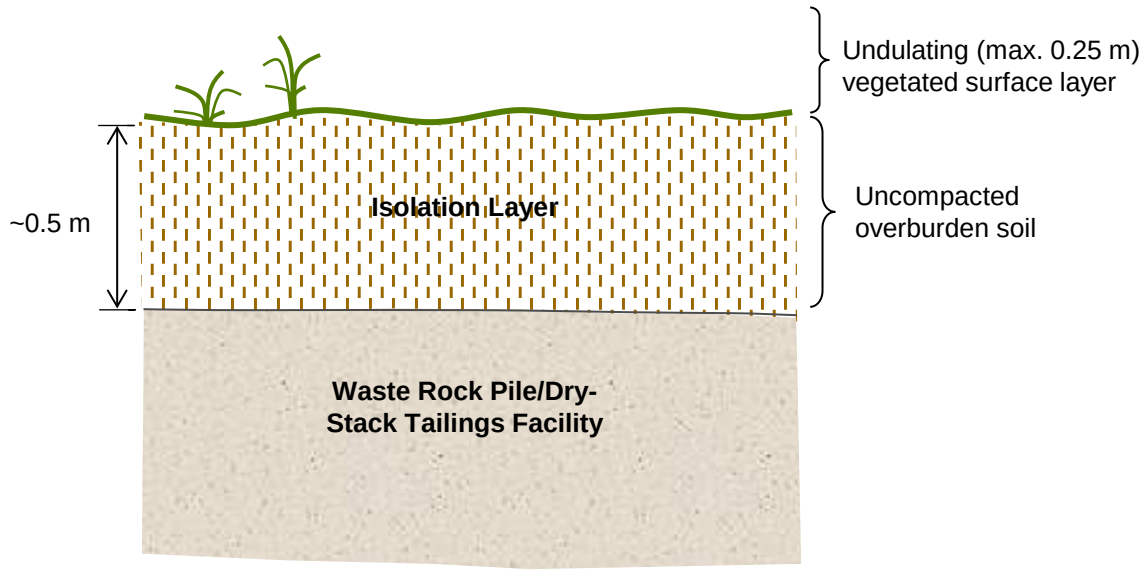
\\Van-svr0\Projects\01_SITES\Minto\1CM002.007_ClosureCovers\!020_Project Data\010_SRK\Material Data\SWCC graphs_1cm002.007_bc_rev01



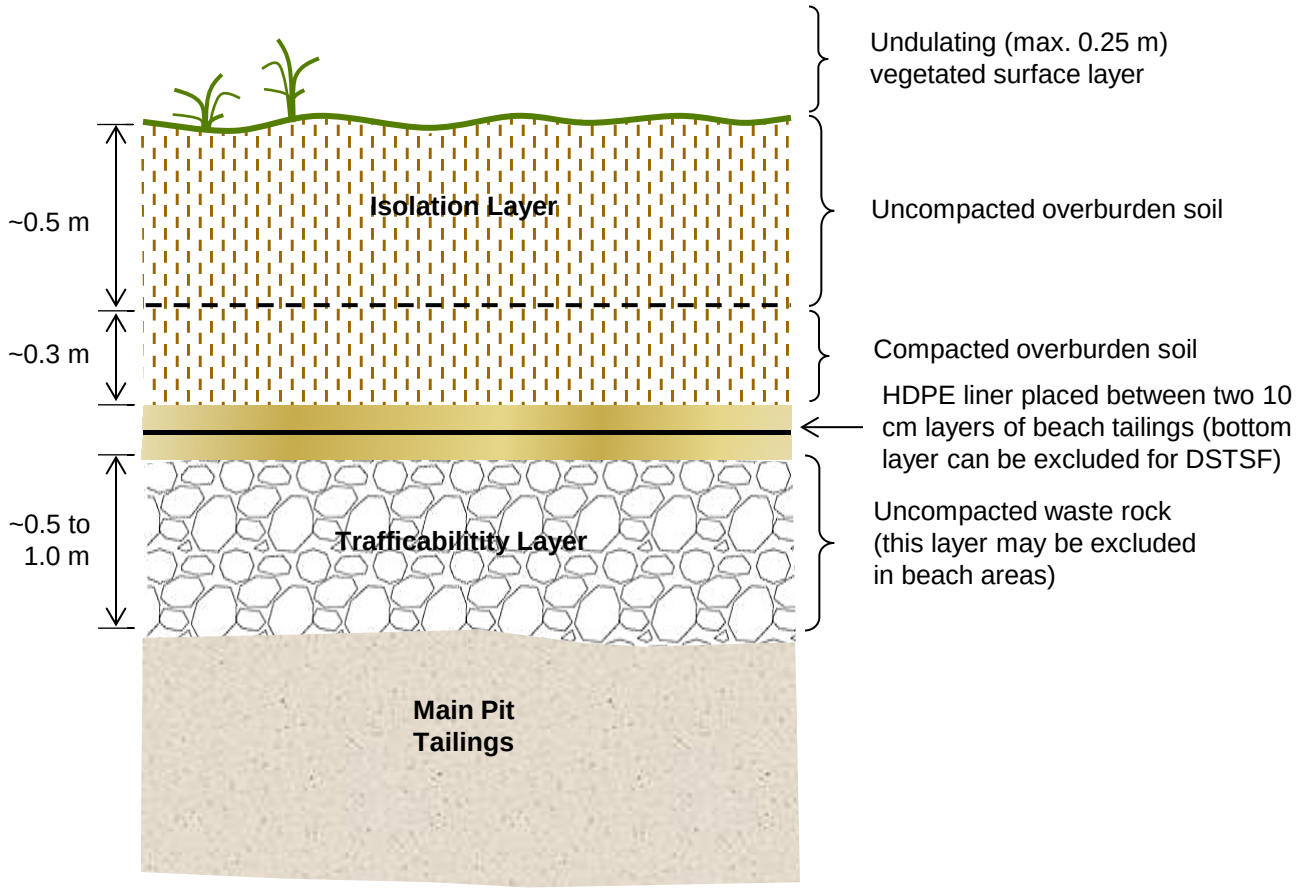


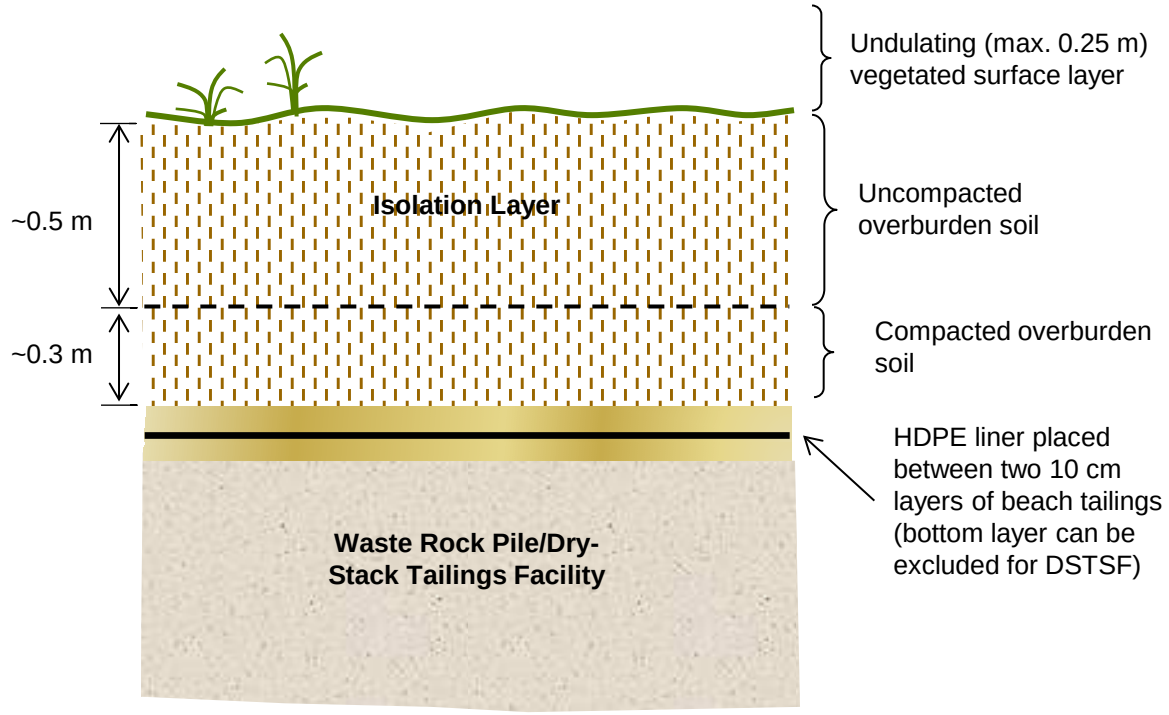
srk consulting	CAPSTONE MINING CORP. MINTO MINE	Scoping Level Cover Assessment **Conceptual Low Infiltration Cover**
Job No: 1CM002.007 Filename: Figure 15-17_1CM002.0007_Conceptual Covers	Minto Mine	Date: July 2013 / Approved: EMR / Figure: **16**





srk consulting	CAPSTONE MINING CORP. MINTO MINE	Scoping Level Cover Assessment		
		Conceptual Isolation Cover		
Job No: 1CM002.007 Filename: Figure 15-17_1CM002.0007_Conceptual Covers	Minto Mine	Date: July 2013	Approved: EMR	Figure: **15**

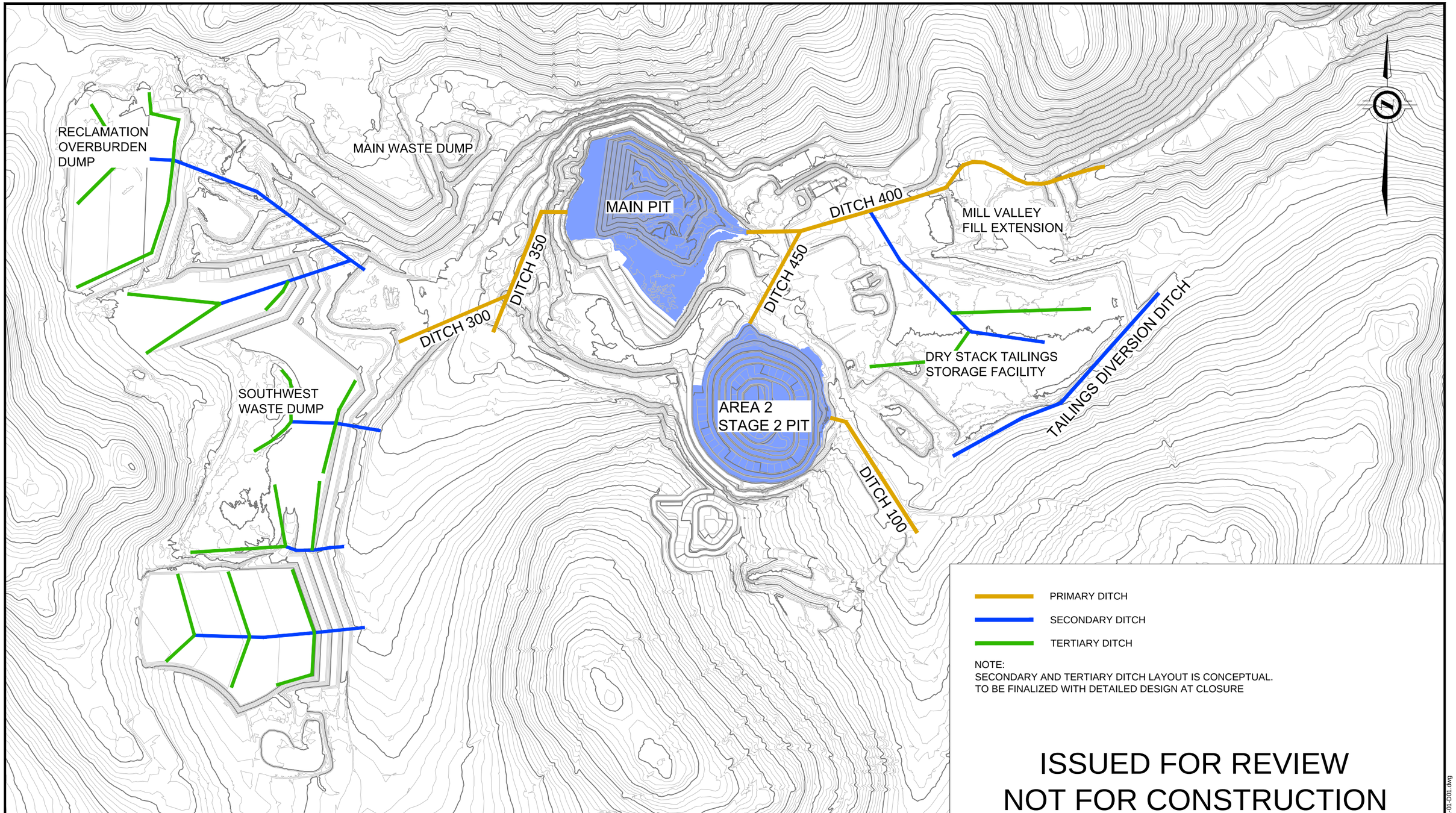




srk consulting	CAPSTONE MINING CORP. MINTO MINE	Scoping Level Cover Assessment **Conceptual Very Low Infiltration Cover**
Job No: 1CM002.007 Filename: Figure 15-17_1CM002.0007_Conceptual Covers	Minto Mine	Date: July 2013 / Approved: EMR / Figure: **17**

APPENDIX F

DESIGN DRAWINGS



NOTE:
SECONDARY AND TERTIARY DITCH LAYOUT IS CONCEPTUAL.
TO BE FINALIZED WITH DETAILED DESIGN AT CLOSURE

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2013-09-13	ISSUED FOR REVIEW	00	KB	JT

ACCESS

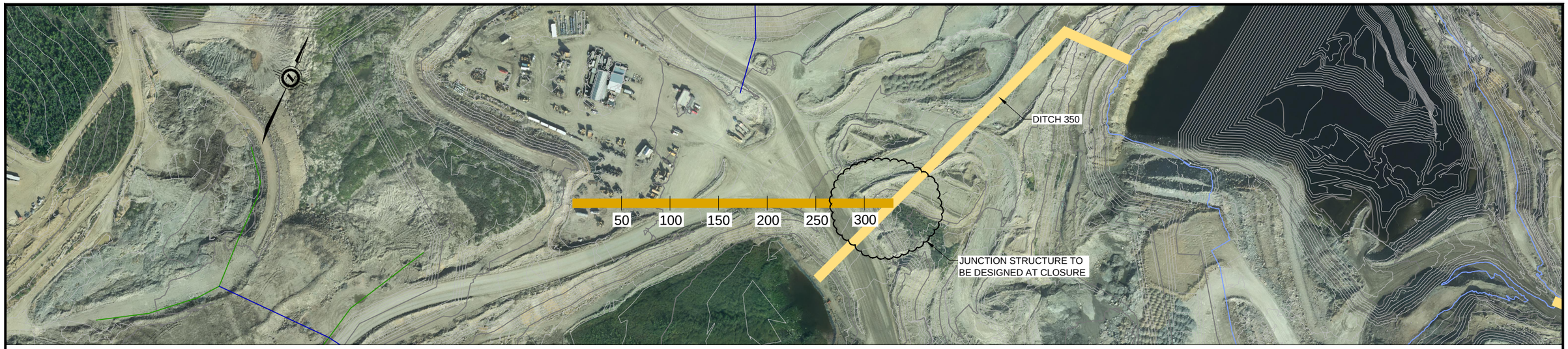
capstone MINTO MINE

PROJECT NAME:
Minto Mine Phase IV
Reclamation and Closure Plan
Revision 4.0

DRAWING NAME:
SITE PLAN

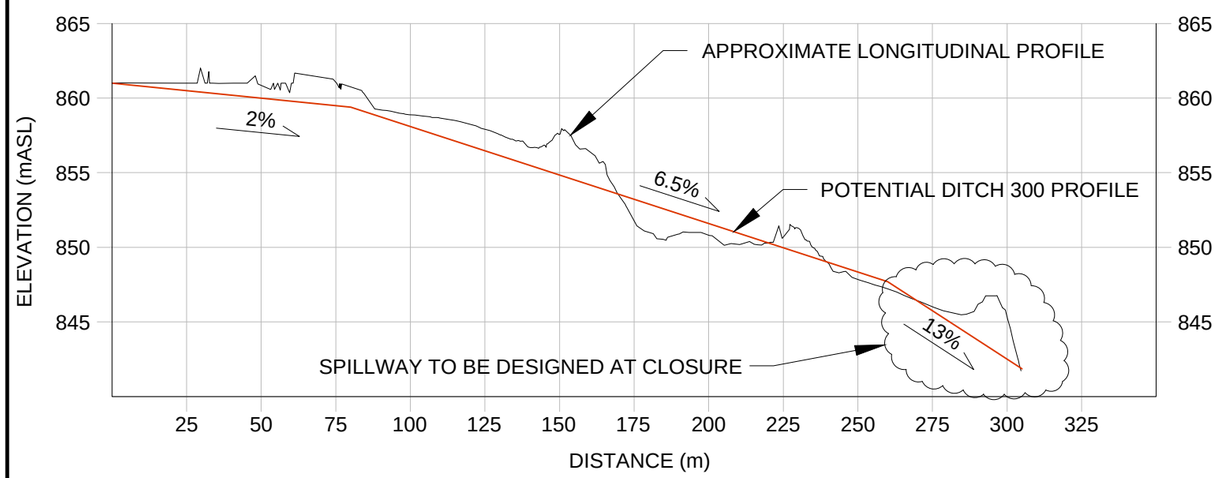
DESIGNED BY:	ACCESS PROJECT NO:	CLIENT REF.:
D. Morissette	MIN-11-01	
DRAWN BY: K. Boldt	DRAWING SCALE: 1:10000	
CHECKED BY: J. Theriault	DRAWING NO: 01	REV.: 00

C:\Users\kboldt\Projects\Minto\CAD\Drawings\MIN-11-01-D01.dwg



DITCH 300 PLAN VIEW

1:4000 SCALE



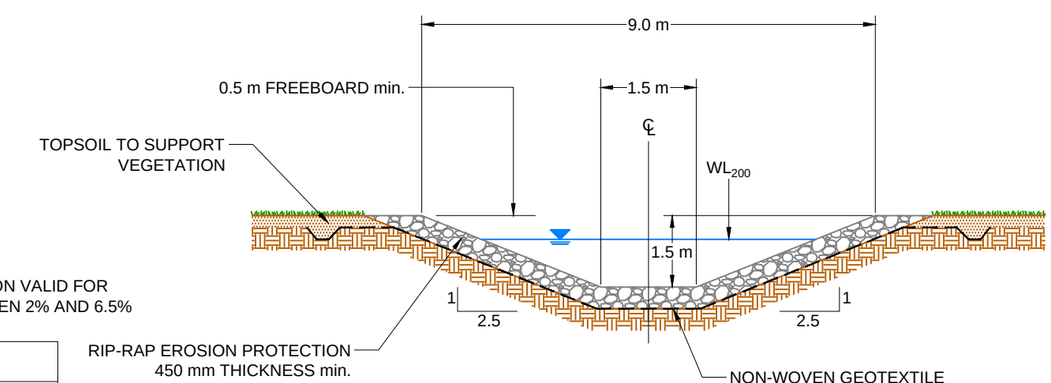
DITCH 300 PROFILE VIEW

5X VERTICAL EXAGGERATION
1:2000 SCALE

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

NOTE:
TYPICAL SECTION VALID FOR
SLOPES BETWEEN 2% AND 6.5%

RIP-RAP	
MIN SIZE	200 mm
D_{50}	300 mm
MAX SIZE	500 mm



DITCH 300 TYPICAL SECTION

NOT TO SCALE

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2013-09-13	ISSUED FOR REVIEW	00	KB	JT

ACCESS

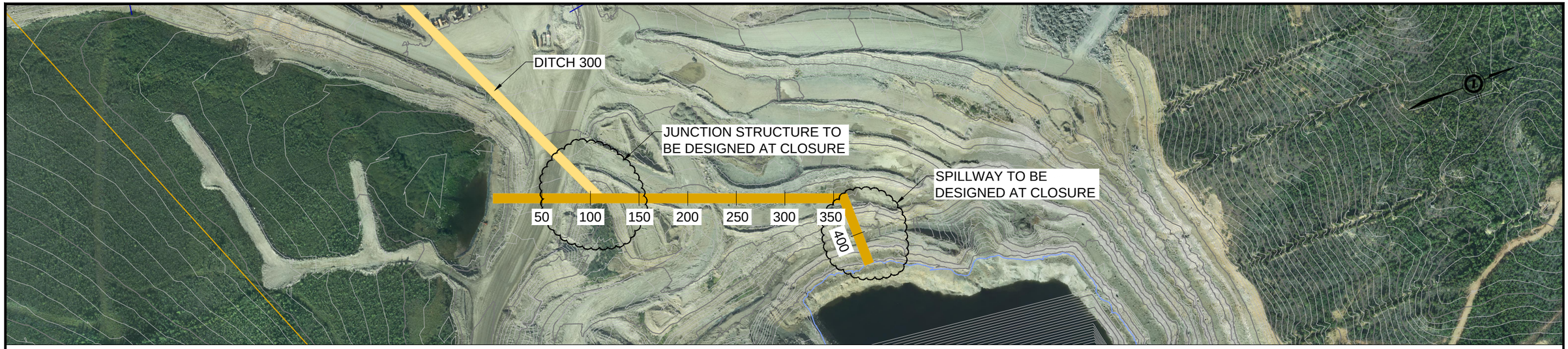
capstone MINTO MINE

PROJECT NAME:
Minto Mine Phase IV
Reclamation and Closure Plan
Revision 4.0

DRAWING NAME:
DITCH 300
PLAN AND PROFILE

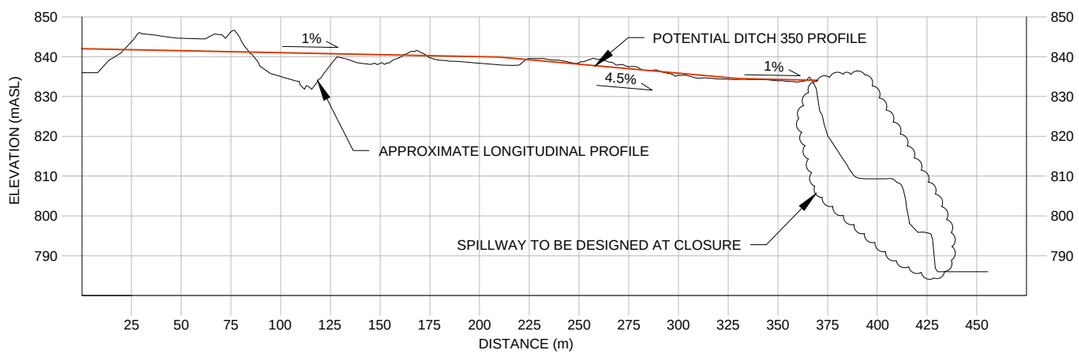
DESIGNED BY:	ACCESS PROJECT NO:	CLIENT REF.:
D. Morissette	MIN-11-01	
DRAWN BY: K. Boldt	DRAWING SCALE:	
CHECKED BY: J. Theriault	DRAWING NO: 02	REV.: 00

C:\Users\kboldt\Projects\Minto\CAD\Drawings\MIN-11-01-D02.dwg



DITCH 350 PLAN VIEW

1:4000 SCALE



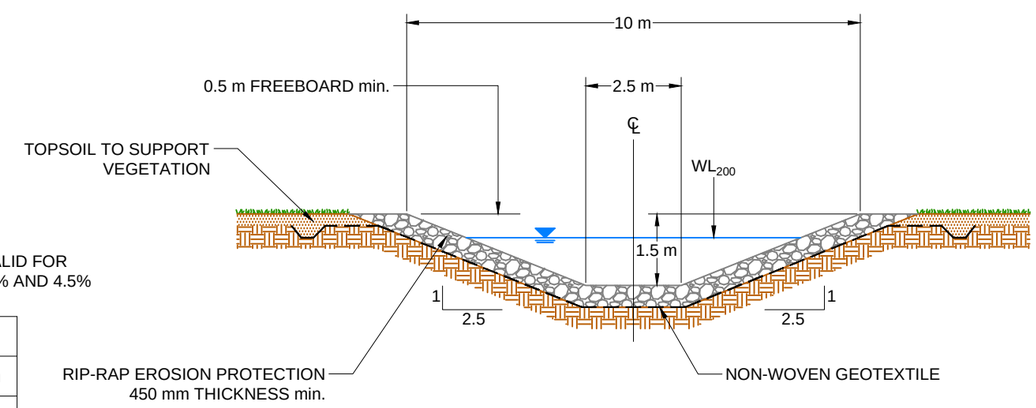
DITCH 350 PROFILE VIEW

2X VERTICAL EXAGGERATION
1:3000 SCALE

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

NOTE:
TYPICAL SECTION VALID FOR
SLOPES BETWEEN 1% AND 4.5%

RIP-RAP	
MIN SIZE	200 mm
D_{50}	300 mm
MAX SIZE	500 mm



DITCH 350 TYPICAL SECTION

NOT TO SCALE

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2013-09-13	ISSUED FOR REVIEW	00	KB	JT

ACCESS

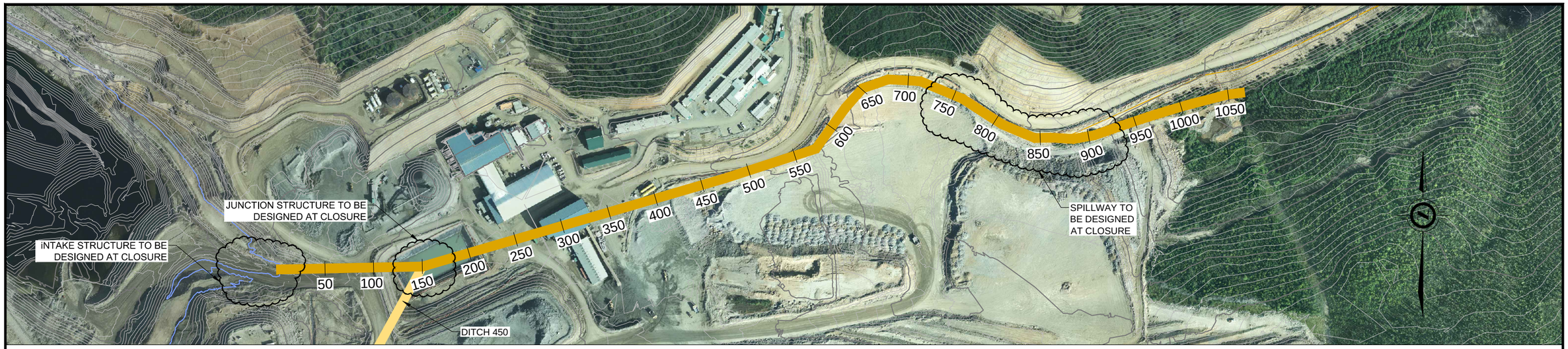
capstone MINTO MINE

PROJECT NAME:
Minto Mine Phase IV
Reclamation and Closure Plan
Revision 4.0

DRAWING NAME:
DITCH 350
PLAN AND PROFILE

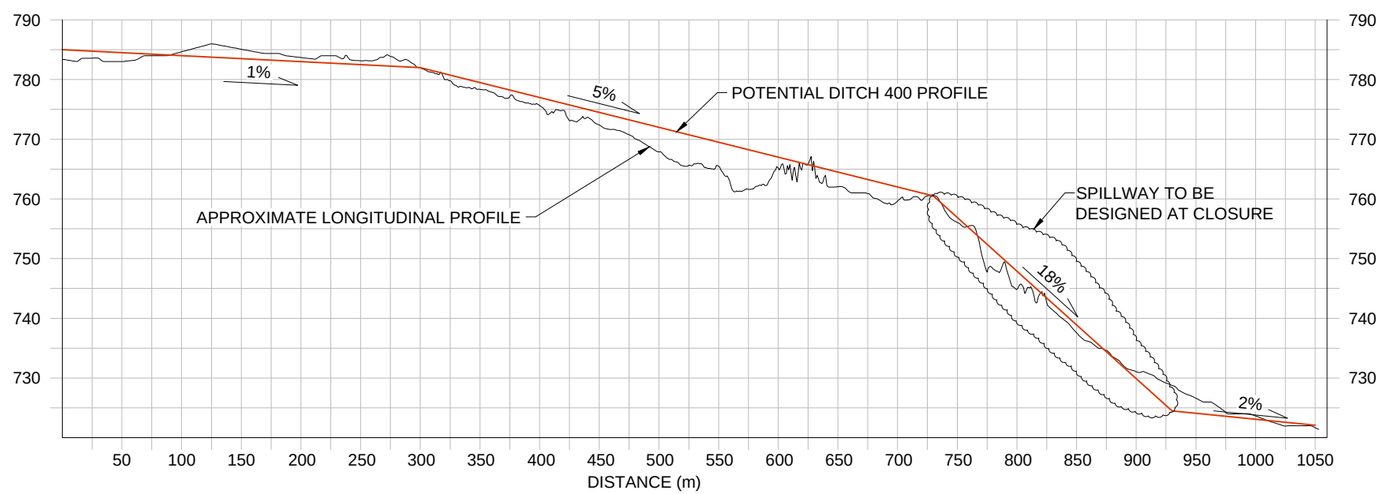
DESIGNED BY:	ACCESS PROJECT NO:	CLIENT REF.:
D. Morissette	MIN-11-01	
DRAWN BY: K. Boldt	DRAWING SCALE:	
CHECKED BY: J. Theriault	DRAWING NO: 03	REV.: 00

C:\Users\kboldt\Projects\Minto\CAD\Drawings\MIN-11-01-D03.dwg



DITCH 400 PLAN VIEW

1:4000 SCALE



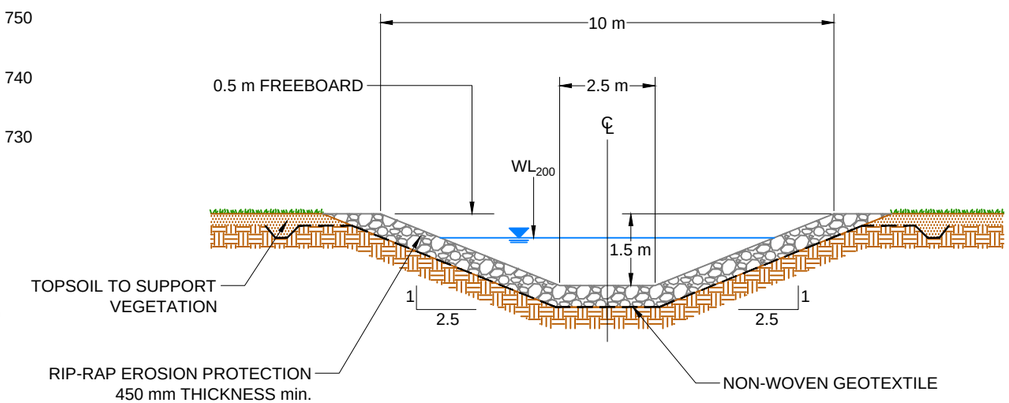
DITCH 400 PROFILE VIEW

5X VERTICAL EXAGGERATION
1:5000 SCALE

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

NOTE:
TYPICAL SECTION VALID FOR SLOPES BETWEEN 1% AND 5%

RIP-RAP	
MIN SIZE	200 mm
D_{50}	300 mm
MAX SIZE	500 mm



DITCH 400 TYPICAL SECTION

NOT TO SCALE

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2013-09-13	ISSUED FOR REVIEW	00	KB	JT

ACCESS

capstone MINTO MINE

PROJECT NAME:
Minto Mine Phase IV
Reclamation and Closure Plan
Revision 4.0

DRAWING NAME:
DITCH 400
PLAN AND PROFILE

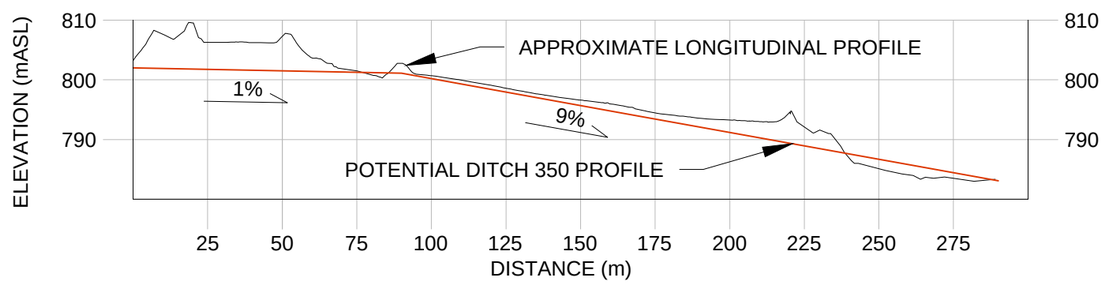
DESIGNED BY:	ACCESS PROJECT NO:	CLIENT REF.:
D. Morissette	MIN-11-01	
DRAWN BY: K. Boldt	DRAWING SCALE:	
CHECKED BY: J. Theriault	DRAWING NO: 04	REV.: 00

C:\Users\kboldt\Projects\Minto\CAD\Drawings\MIN-11-01-D04.dwg

DITCH 450 PLAN VIEW

1:4000 SCALE

ISSUED FOR REVIEW
NOT FOR CONSTRUCTION

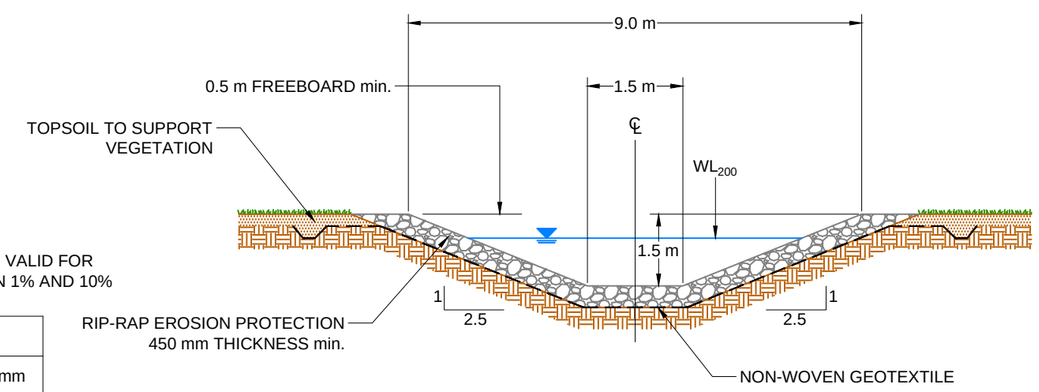


DITCH 450 PROFILE VIEW

2X VERTICAL EXAGGERATION
1:2000 SCALE

NOTE:
TYPICAL SECTION VALID FOR SLOPES BETWEEN 1% AND 10%

RIP-RAP	
MIN SIZE	200 mm
D_{50}	300 mm
MAX SIZE	500 mm



DITCH 450 TYPICAL SECTION

NOT TO SCALE

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2013-09-13	ISSUED FOR REVIEW	00	KB	JT

ACCESS

capstone MINTO MINE

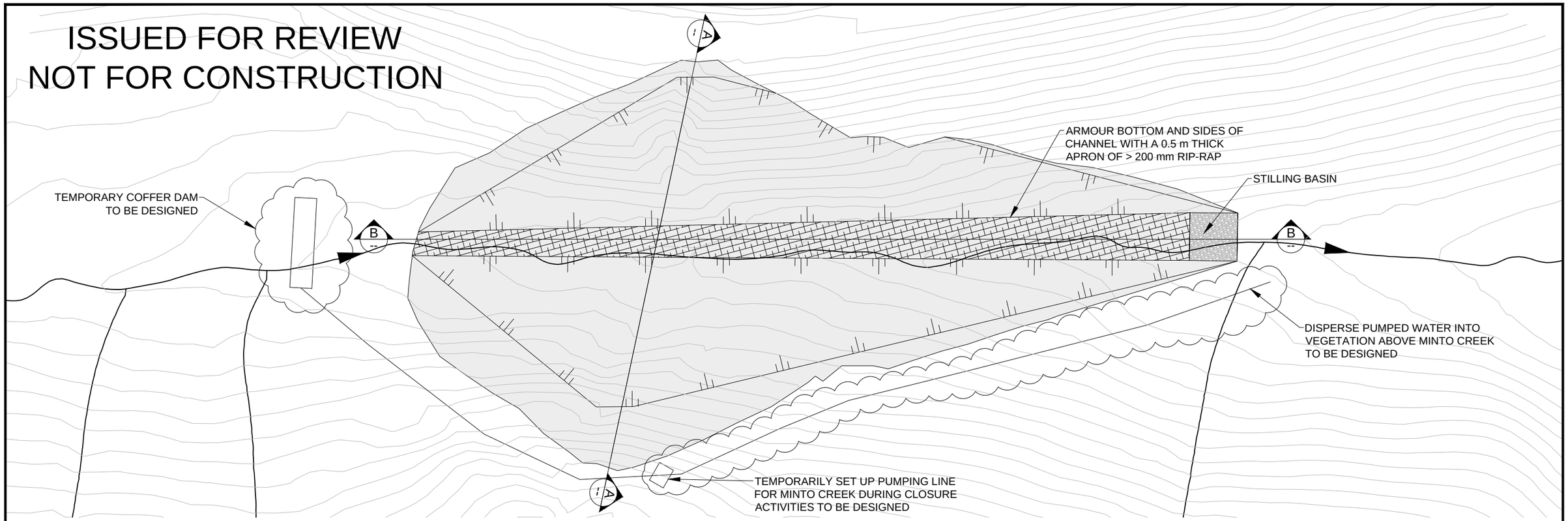
PROJECT NAME:
Minto Mine Phase IV
Reclamation and Closure Plan
Revision 4.0

DRAWING NAME:
DITCH 450
PLAN AND PROFILE

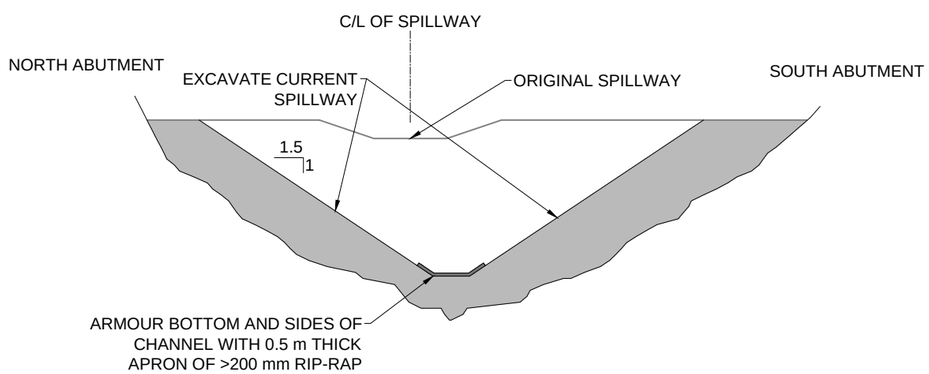
DESIGNED BY:	ACCESS PROJECT NO:	CLIENT REF.:
D. Morissette	MIN-11-01	
DRAWN BY: K. Boldt	DRAWING SCALE:	
CHECKED BY: J. Theriault	DRAWING NO: 05	REV.: 00

C:\Users\kboldt\Projects\Minto\CAD\Drawings\MIN-11-01-005.dwg

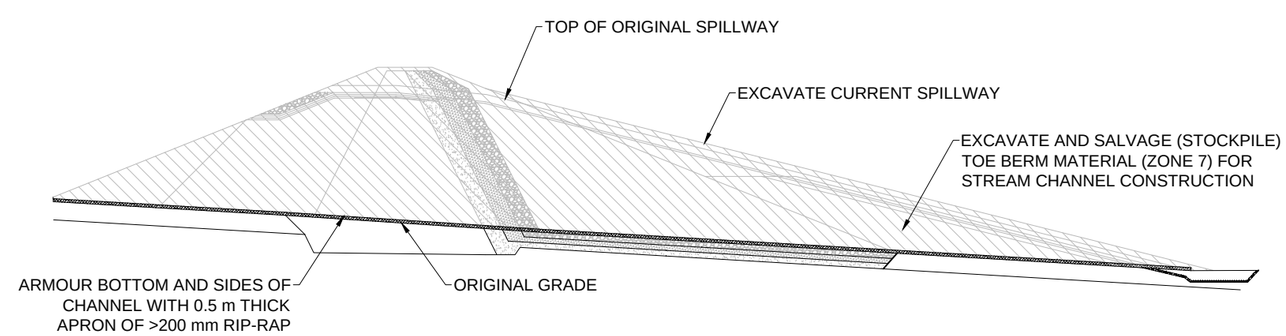
ISSUED FOR REVIEW
NOT FOR CONSTRUCTION



PLAN VIEW - WATER STORAGE POND DAM - TO BE REMOVED



A
--
SECTION - CENTRELINE OF DAM CREST



B
-
WATER STORAGE POND DAM - TO BE REMOVED

NOTE:
DRAWING REPRODUCED IN PART FROM FIGURE 6-19 OF MINTO MINE DECOMMISSIONING AND RECLAMATION PLAN ver. 3.2

This drawing has been prepared for the use of Access Mining Consultants Ltd.'s client and may not be used, reproduced or relied upon by third parties, except as agreed by Access Mining Consultants Ltd. and its client, as required by law for use of governmental reviewing agencies. Access Mining Consultants Ltd. accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without Access Mining Consultants Ltd.'s express written consent.

DATE	ISSUE/REVISION	REV No.	DRW.	APP.
2013-09-13	ISSUED FOR REVIEW	00	KB	JT

ACCESS

capstone MINTO MINE

PROJECT NAME:
Minto Mine Phase IV Reclamation and Closure Plan
Revision 4.0

DRAWING NAME:
REMOVAL OF WATER STORAGE POND DAM AT CLOSURE

DESIGNED BY:	ACCESS PROJECT NO:	CLIENT REF.:
EBA	MIN-11-01	
DRAWN BY: K. Boldt	DRAWING SCALE: 1:1000	
CHECKED BY: J. Theriault	DRAWING NO: 06	REV.: 00

C:\Users\kboldt\Projects\Minto\CAD\Drawings\MIN-11-01-D06.dwg