SÄ DENA HES OPERATING CORPORATION

SÄ DENA HES MINE

DETAILED DECOMMISSIONING & RECLAMATION PLAN

JANUARY 2010 UPDATE

Submitted for Review

January 28, 2010

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Prepared by

TECK Metals Ltd.

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1.0 INTRODUCTION

This document contains updates to the Detailed Decommissioning and Reclamation Plan ("DDRP", or the "Plan") for the Sä Dena Hes Mine, Yukon that was originally submitted in February of 2000 and updated in January 2006.

The Sä Dena Hes Mine is owned by a joint venture between Teck Metals Limited (25% ownership), Teck Resources Limited (25% ownership) and Pan Pacific Metal Mining Corp. (50% ownership, a wholly owned subsidiary of Korea Zinc). The Joint Venture purchased the Sä Dena Hes lead/zinc property in March 1994. Teck is the operator under the joint venture agreement.

Teck Metals Ltd. ("Teck" or the "Company"), formally known as Teck Cominco, is a diversified resource company committed to responsible mining and mineral exploration development with major business units focused on copper, metallurgical coal, zinc and energy. The Company is headquartered in Vancouver, BC. Historical references to Teck Cominco and Cominco in this report remain accurate. Teck is the operator of record for the Sä Dena Hes property, and any of the tasks, activities and commitments made in the DDRP in this update are made on behalf of the Sä Dena Hes Operating Corporation by Teck.

The Sä Dena Hes Operating Corporation has a Type A Water Use License (QZ99-045, formerly QZ97-025) issued pursuant to the Yukon Waters Act and Regulations for the mine and milling operations. Teck continues to ensure that all water license obligations are fulfilled on behalf of the Sä Dena Hes Operating Corporation. The Company also has a Yukon Quartz Mining Production Licence QML-0004 issued pursuant to the Yukon Quartz Mining Act and Regulations.

The original DDRP for the Sä Dena Hes Mine was submitted in February 2000 towards fulfillment of the requirements of Section 67 of Water License QZ97-025. This update to the DDRP is built upon the original submission from February 2000 and the 2006 update and is submitted as a requirement of Section 86 of Water License QZ99-045, and Section 15 of QML-0004.

This Plan addresses closure issues related to the decommissioning of operations at Sä Dena Hes and reclamation of the site. Since the mineable reserves at the property have not yet been fully extracted, the plan has been developed to address two possible scenarios:

1) The mine site in its current state is permanently decommissioned, or
2) The mine is permanently decommissioned after production resumes and ore reserves are exhausted.

Most decommissioning and reclamation measures however, are not dependent on eventual reopening of the mine. The current status of the mine and reopening plans are presented later in this report.

A thorough plan, complete with detailed designs, is presented for all activities that need to be undertaken for an environmentally safe and responsible closure of the Sä Dena Hes Mine. The plan recognizes that a reserve base exists on the property and that the mine will reopen when metal prices are favorable. The plan addresses both 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. The plan is based on the best information available at the present time. As additional planning, information, and/or experience at the site becomes available, the details of the plan will be updated and/or altered as necessary. Decommissioning and reclamation cost estimates are provided and financial security requirements reviewed.

1.1 CLOSURE PHILOSOPHY

In keeping with its worldwide high standards for environmental and social responsibility, Teck will implement an environmentally sound and technically feasible decommissioning and reclamation plan for the Sä Dena Hes mine. Closure planning and the implementation of the DDRP at a minesite must be undertaken with appropriate environmental care, while respecting local laws, public interest and ensuring that the company's high environmental standards are achieved. The approach to mining and reclamation to be followed at the Sä Dena Hes operation will be to undertake progressive reclamation as appropriate. Assuming the Jewelbox Hill ore zone is depleted first, this would be a candidate site for carrying out reclamation (recontouring, establishing proper pit drainage, etc.) using mine personnel and equipment available at that time. This approach is consistent with Teck's Corporate Code of Sustainable Conduct (see Appendix A).

A principal philosophy followed during the development of this plan was to work towards an eventual closure that requires minimal long term monitoring and maintenance. This involved an assessment of the key mine components that could potentially place the public or the environment at risk following closure. Mitigation measures have been designed 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 the mitigation measures are assured the management of the site can be safely reduced to a level that is consistent with final closure. Post-closure monitoring has been designed to ensure that performance objectives are closely monitored and inspected during the initial years following implementation of closure measures. It is anticipated that final determination of the effectiveness of closure measures will be the subject of review and concurrence with regulatory agencies and the public.

Performance-based criteria were adopted for the decommissioning and reclamation plan where deemed possible. The Water Licence decommissioning and reclamation plan performance criteria for physical structures has been reviewed and criteria selected to conform to the closure philosophy. Licensed effluent discharge standards were used as criteria for waters emanating from the tailings management facility while CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life criteria (CCME, 2007) were used to assess effectiveness of closure measures to local downstream receiving waters. These same performance based criteria will be used to determine the effectiveness of closure measures during post-closure monitoring. It is expected that post-closure monitoring and inspection results would be reviewed to ensure that closure objectives continue to be met well after decommissioning. If these objectives are not met, maintenance or contingency plans would be developed as necessary to address potential areas requiring further remediation.

To ensure that the 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 minimize adverse environmental impact;
- Ensuring land use commensurate with surrounding lands;
- Recognize mine reopening in the short term and 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
- Passive post closure monitoring and management of the site until the former mine presents evidence of long term compliance of closure criteria.

1.2 Scope of Plan

The scope of the original Sä Dena Hes Mine Decommissioning & Reclamation Plan was the subject of a Yukon Water Board (YWB) public hearing held in Whitehorse on November 19, 1997. Following this public hearing and deliberations by the YWB, requirements for the Detailed Decommissioning & Reclamation Plan were set out as outlined in Water Licence QZ97-025, section 66. The plan includes the following components*:*

- *"Detailed designs to address long-term physical stability of all closure structures, including designs for upgrading the permanent tailings impoundment structures to withstand natural events with a probability of occurrence similar to their expected service life (1:1000 year to PMF/MCE);*
- *Plans for addressing any short-term or long-term chemical stability or water quality problems;*
- *Plans for mitigating effects of access and surface disturbance;*
- *Plans for post closure monitoring and maintenance;*
- *Consideration of the need for, and as necessary, the establishment of, water balance and water quality models; and*
- *An updated cost estimate for decommissioning and post closure monitoring and maintenance."*

To achieve these goals, a complete review of all pertinent historical information regarding the Sä Dena Hes operation was undertaken. Table 1-1 Global Information List, presents a complete listing of reports and other information sources that were reviewed in the writing of this plan. Cominco felt that this review was necessary since the original mine ownership had changed and the mine has not been operational since the property was purchased.

The scope of the Sä Dena Hes Mine Decommissioning & Reclamation Plan remains essentially the same as outlined in the 2000 Plan document to include requirements in section 66 of Water License QZ97-025, and subsequently the renewal of this license, QZ99-045 and the QML-0004 sections 15 and 16.

Section 86 of the current Water License also stipulates that an update to the Decommissioning Plan be submitted within four years of the effective date of the Water License. To be addressed in this Update Document are the following:

1. relevant changes in technology;
2. changes to the Canadian Environmental Quality Guidelines (CCME, 2007);
3. any relevant additional information that has been acquired through site monitoring or studies; and
4. a review of the estimated costs of decommissioning.

Table 1-1 Global Information List

Report Title / Topic	Author	Date
Reclamation Guidelines for Northern Canada	Land Resources, DIAND	1987
Mt. Hundere Project - Project Overview and Plan for IEE	SRK	Aug-89
Mt. Hundere Joint Venture IN90-002, Volume I - Report, Volume II - Appendices and Interventions	SRK	Jul-90
Mt. Hundere Joint Venture IN90-002, Transcript of Hearing; Additional Exhibits Entered at Hearing (Oct. 10&11/90)	Yukon Water Board	12-Oct-90
Mt. Hundere Joint Venture IN90-002 - Geotechnical Investigations and final Design for Mill and Tailing Disposal Facilities	SRK	Dec-90
Mt. Hundere Development, Initial Environmental Evaluation of the Mt. Hundere Development on the Watson Lake Area & Yukon (in drawer B210-B240 Vancouver) ** see note*	SRK	*1990*
Screening Report under the Environmental Assessment & Review Process Guidelines Order - Mt. Hundere Development	DIAND	16-Dec-90
EARP Decision Report - Mt. Hundere Development Proposal	DIAND	Jan-91
Water Use Licence IN90-002	Yukon Water Board	31-Jan-91
Sä Dena Hes Joint Mine (Overview)	Curragh	1991 or 19992
Sä Dena Hes Articles (Northern Miner, etc.)	Various	1991 to 1993
Sä Dena Hes Mine IN90-002 - As Built Construction Report for Reclaim Dam Toe Buttress	James B. Edward	3-Jan-92
Mt. Hundere Joint Venture IN90-002 - *Sä Dena* Hes Mine - As Built Report - North, South & Reclaim Dams & Instrumentation SRK Project 1203	SRK	24-Jan-92
Sä Dena Hes Mine Spill Contingency Plan	Curragh Inc.	Mar-92
1991 Annual Report to the Water Board	Curragh Resources	10-Mar-92
Sä Dena Hes Mine IN90-002 - Inspection of Facilities at the Tailings Impoundment and Reclaim Pond	SRK	20-Jul-92
Mt. Hundere Joint Venture IN90-002 - *Sä Dena* Hes Mine, Inspection Report Reclaim Dam Spillway & Camp Creek Diversion Reconstruction SRK S101104	SRK	19-Nov-92
Sä Dena Hes Mine IN90-002 - South Dam Extension Design Report SRK Project 101204	SRK	25-Nov-92
Water Licence and Temporary Closure Plan	G.B. Acott, Environmental Affairs Curragh Inc.	Dec. 1992
Sä Dena Hes Temporary Closure Plan Report #WH9209	Curragh	Dec-92
Sä Dena Hes Joint Venture Concentrator Operation	Curragh	Jan-93
WGM Due diligence report	Curragh	25-Jan-93
Sä Dena Hes Joint Venture 1992 Annual Report	Ewald Pengal	Feb-93

Report Title / Topic	Author	Date
Environmental Assessment of False Creek Canyon - 1992 Study	P.A. Harder & Associates Ltd.	Mar-93
Assessment of Environmental Liabilities *Sä Dena* Hes Mine near Watson Lake	Norecol, Dames & Moore	12-Oct-93
Application for Temporary Amendment to Water Licence IN90-002, *Sä Dena* Hes	Coopers & Lybrand	19-Nov-93
Sä Dena Hes 1993 Annual Report to the YT Water Board Licence IN90-002	Coopers & Lybrand & Cominco	Feb-94
1994 Annual Inspection of Tailings Management Facility, July 27 & 28, 1994 - *Sä Dena* Hes Mine	SRK	7-Oct-94
Construction Report Remedial Work, *Sä Dena* Hes Mine, Yukon Territory	SRK	Nov-94
Environmental Monitoring at False Canyon Creek 1994	LES & White Mountain	Jan-95
Sä Dena Hes 1994 Annual Report - Yukon Water Licence IN90-002	Cominco	Feb-95
North Creek Dyke, *Sä Dena* Hes Mine, Yukon Territory, C104105	SRK	Feb-95
1995 Annual Inspection - Tailing Management Facility - *Sä Dena* Hes	SRK	Oct-95
Sä Dena Hes Preliminary Decommissioning and Reclamation Plan	Cominco	Nov-95
Sä Dena Hes Preliminary Decommissioning and Reclamation Plan	Cominco	Jan-96
Water Use Licence IN90-002 - Amendment	Water Resources	25-Jan-96
Sä Dena Hes 1995 Annual Report Yukon Water Licence IN90-002	Cominco	Feb-96
Environmental Monitoring at False Canyon Creek 1996	LES	Dec-96
Sä Dena Hes 1996 Annual Report Yukon Water Licence IN90-002	Cominco	Feb-97
Submission in Support of the Amendment of Water Licence IN90-002	Cominco	Aug-97
QZ97-025 Sä Dena Hes Operating Corporation Amendment to IN90-002	YT Water Board	26-Sep-97
Review of Reclamation Cost Estimates	DIAND	Oct-97
1997 Annual Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	15-Oct-97
The Sä Dena Hes Socio-Economic Participation Agreement	Cominco	21-Oct-97

Report Title / Topic	Author	Date
Construction Report South Dam extension Toe Buttress	SRK	Nov-97
Review of Application for Water Licence amendment	Gartner Lee	Nov-97
Sä Dena Hes Amendment	Conservation Society	7-Nov-97
Amendment to IN90-002 (Sä Dena Hes)	YT Water Board	19-Nov-97
QZ97-025 Sä Dena Hes Register Public Hearing Amend to IN90-002	YT Water Board	19-Nov-97
Sä Dena Hes 1997 Annual Report - Yukon Water Licence IN90-002	Cominco	Feb-98
Application for a Type B Licence - Reconstruction of a run-off catchment berm	Access Mining Consultants Ltd.	Feb. 1998
Water Use Application MS97-091, response to Water resources comments	Cominco	Mar. 1998
Water Licence QZ97-025	Yukon Water Board	May 1998
QZ97-025 - Amendment to Water Licence IN90-002	YTG Renewable	Nov. 1998
Site Review of October 18, 1993 Tailings Dams & Diversion Channel – Remedial works, Sä Dena Hes Mine, Yukon Territory	SRK	Oct. 1993
Final Report - Assessment of Environmental Liabilities, Sä Dena Hes Mine, Near Watson Lake, Yukon Territory	Norecol, Dames & Moore	Oct. 1993
Addendum to 1997 Construction Report, South Dam Toe Buttress, Sä Dena Hes, Yukon Territory	SRK	Nov. 1997
Aquamin Case Studies - Sä Dena Hes	Working Group 6 (BC & YT)	N/A
1998 Annual Report	Cominco	Feb. 1999
1998 Annual Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Dec. 1998
Water Licence MS97-091	Yukon Water Board	May 1998
Sä Dena Hes Water Licence Security	Yukon Water Board	Mar. 1998
Sä Dena Hes Water Licence Amendments	Yukon Water Board	Mar. 1998
Reason for Decision - Water Licence QZ97-025 amendment to IN90-002 Sä Dena Hes	Yukon Water Board	Mar. 1998
Environmental Priorities – Sä Dena Hes	Norecol, Dames & Moore	N/A
Environmental Permits/Licenses/ Approvals Needed to Mine in Yukon	DIAND	1999
Environmental Monitoring at False Canyon Creek 1998	LES & Can-Nic-A-Nick	Dec. 1998
1999 Annual Report	Cominco	Feb. 2000

Report Title / Topic	Author	Date
1999 Annual Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Dec. 1999
2000 Annual Report	Cominco	Feb. 2001
2000 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Feb. 2001
2000 Geochemical Studies, Sä Dena Hes Mine	SRK	Nov. 2000
Environmental Monitoring at False Canyon Creek 2000	LES & Can-Nic-A-Nick	Dec. 2000
Land Reclamation and Revegetation Plan. Preliminary Test Program Summary Report, Sä Dena Hes,	Access Mining Consultants Ltd.	Nov. 2000
2001 Annual Report	Teck Cominco	Feb. 2002
2001 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Dec. 2001
Results Summary of Phase II Revegetation Test Program -2001, Sä Dena Hes. ,	Access Consulting Group	Feb. 2002
2002 Annual Report	Teck Cominco	Feb. 2003
2002 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Mar. 2003
2002 Geochemical Projects Sä Dena Hes,	SRK	Mar. 2003
Results Summary of Phase II Revegetation Test Program -2002, Sä Dena Hes. ,	Access Consulting Group	Jan. 2003
2003 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Dec. 2003
Sä Dena Hes – 2003 Dam Safety Review	Klohn Crippen	Nov. 2003
2003 Annual Report	Teck Cominco	Feb. 2004
Results Summary of Phase II Revegetation Test Program - 2003, Sä Dena Hes. ,	Access Consulting Group	Mar. 2004
Environmental Monitoring at False Canyon Creek 2004	LES & Can-Nic-A-Nick	Nov. 2004
Operating, Maintenance and Surveillance Manual, Tailings Management Facility – December 2004	SRK Consulting	Dec, 2004
2004 Geotechnical Inspection Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK	Feb 2005
2004 Annual Report	Teck Cominco	Mar. 2005
Results Summary of Phase II Revegetation Test Program - 2004, Sä Dena Hes. ,	Access Consulting Group	Mar. 2005

Report Title / Topic	Author	Date
Sä Dena Hes Mine Temporary Closure Site Status Report as of January 2005	Teck Cominco	Jan. 2005
Results Summary of Phase II Revegetation Test Program - 2004, Sä Dena Hes. ,	Access Consulting Group	Mar. 2005
Results Summary of Phase II Revegetation Test Program - 2005, Sä Dena Hes. ,	Access Consulting Group	Jan. 2006
Results Summary of Phase II Revegetation Test Program - 2006, Sä Dena Hes. ,	Access Consulting Group	Jan. 2007
Detailed Decommissioning & Reclamation Plan January 2006 Update	Access Consulting Group, SRK & Teck Cominco	January 2006
Sä Dena Hes Mine 2005 Annual Report, Yukon Water Licence QZ99-045	Teck Cominco	March 2006
Sa Dena Hes Mine 2005 Annual Report, Yukon Production Licence QML-0004	Teck Cominco	April 2006
2005 Geotechnical Inspection, Tailings Management Facility, Sa Dena Hes, Yukon Territory	SRK Consulting Engineers and Scientists	March 2006
Sä Dena Hes Mine 2006 Annual Report, Yukon Water Licence QZ99-045	Teck Cominco	March 2007
Sä Dena Hes Mine 2006 Annual Report, Yukon Production Licence QML-0004	Teck Cominco	March 2007
2006 Geotechnical Inspection, Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK Consulting Engineers and Scientists	March 2007
Sä Dena Hes Mine 2007 Annual Report, Yukon Water Licence QZ99-045	Teck Cominco	March 2008
Sä Dena Hes Mine 2007 Annual Report, Yukon Production Licence QML-0004	Teck Cominco	March 2008
2007 Geotechnical Inspection, Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK Consulting Engineers and Scientists	March 2008
Environmental Monitoring at False Canyon Creek, 2008	Laberge Environmental Services & Can-Nic-Nick Environmental Services	November 2008
Sä Dena Hes Mine 2008 Annual Report, Yukon Water Licence QZ99-045	Teck Cominco	March 2009
Sä Dena Hes Mine 2008 Annual Report, Yukon Production Licence QML-0004	Teck Cominco	March 2009
2008 Geotechnical Inspection, Tailings Management Facility, Sä Dena Hes, Yukon Territory	SRK Consulting Engineers and Scientists	March 2009

* Note: The IEE consists of 6 volumes as follows:
- Volume I - Project Description
- Volume II - Mine Access Road Evaluation
- Volume III - Socio-Economic Evaluation
- Volume IV - Biophysical Evaluation for the Project Site
- Volume V - Appendices
- Volume VI - Overview & Summary

Various closure options were assessed to ensure that closure objectives were met for each mine component.

The approach taken to this plan is to present a brief description of each mine component and the closure issues related to that component. Closure measures are then presented for the mine, tailings management facility, and infrastructure components. A summary of the environmental setting for the project, complete with results from all ongoing licensed monitoring programs are presented in Appendix B ("*Environmental Baseline Update and Technical Basis for Closure Assumptions*"). This approach ensures that the reader is given a picture of the existing facilities at the site and the local environmental conditions without having to review previous historical information. Previous work or reports on the project have been referenced without repeating details so that this document is focused on decommissioning and reclamation.

1.3 CORPORATE BACKGROUND

Teck is an integrated natural resource company whose principal activities are mineral exploration, mining, smelting and refining. The Vancouver-based company was incorporated in 1906 and is Canada's oldest continually operating mining company. Its active operations include twelve mines and one metallurgical smelting complex.

Teck is one of the world's largest producers of zinc and lead concentrate. It is also a major producer of refined zinc and lead metals. Other products produced by Teck include copper, molybdenum, silver, gold, germanium, ferronickel, cadmium, bismuth and indium. Several other by-products are produced at Teck's Trail Metallurgical Operations, one of the world's largest lead smelting and zinc refining complexes.

The company owns or is a significant partner in the following active operations including:

- Highland Valley Copper Mine (British Columbia) – copper / molybdenum
- Antamina Mine (Peru) – copper
- Quebrada Blanca – (Chile) - copper
- Carmen de Andacollo – (Chile) - copper
- Duck Pond Mine – (Newfoundland) – copper - zinc
- Red Dog Mine (Alaska) – zinc / lead
- Teck Coal which operates the following six open pit coal mines:

  - Elkview Operation (British Columbia)
  - Fording River Operation (British Columbia)
  - Coal Mountain Operation (British Columbia)
  - Greenhills Operation (British Columbia)
  - Line Creek Operation (British Columbia)
  - Cardinal River Operation (Alberta)
- Trail Smelter and Refinery – zinc / lead and other associated metals

In recent years the company has received numerous awards and recognition for their reclamation efforts (see www.teck.com/Generic.aspx?PAGE=Teck+Sustainability+Pages%2fAwards+and+Recognition&portalName=tc)

The Company has significant experience in exploration and mining, particularly in the north, in Canada, Alaska and Greenland. Exploration crews have been working in the north since the 1920's with successful results.

Teck's northern mines past and present include:

- *Con*, Yellowknife, NWT – Con was the first gold mine in the NWT, beginning production in 1937. It is still producing, although under different ownership since 1986.

- *Pine Point*, Pine Point, NWT – This open pit lead-zinc mine operated between 1965 and 1988. It is located near the south shore of Great Slave Lake. Forty-eight deposits containing approximately 64 million tonnes of ore were mined. The Pine Point Minesite has been successfully decommissioned in accordance with the Northwest Territories Waters Act.

- *Black Angel*, Greenland – The Black Angel lead-zinc underground mine operated between 1973 and 1990, although not under Cominco ownership from 1986 onwards. It was located at 73°N in extremely rugged terrain, approximately 500 kilometres north of the Arctic Circle on Greenland's west coast.

- *Polaris*, NWT – The Polaris zinc-lead underground mine began production in 1981 and ceased production in 2002 producing 1 million tonnes of ore per year. It was the world's most northerly base metal mine, located at 75°N on Little Cornwallis Island approximately 100 kilometres northwest of Resolute, NWT. Post closure reclamation is completed and all monitoring is scheduled to be completed in 2011.

- *Red Dog*, Alaska – The Red Dog zinc-lead open pit mine began producing in 1990 and has a projected mine life of at least another 40 years. It is currently the largest zinc concentrate producer in the world at about 8,000 tonnes of ore per day (2.8 million t/yr). The mine is located 145 kilometres north of Kotzebue. The North Alaska Native Association (NANA) Regional Corporation Inc. owns the land and leases it to Teck, which operates the mine and owns the facilities. NANA shareholders work at the mine and NANA receives annual royalty payments. It is a model for cooperation between First Nations people and mining companies.

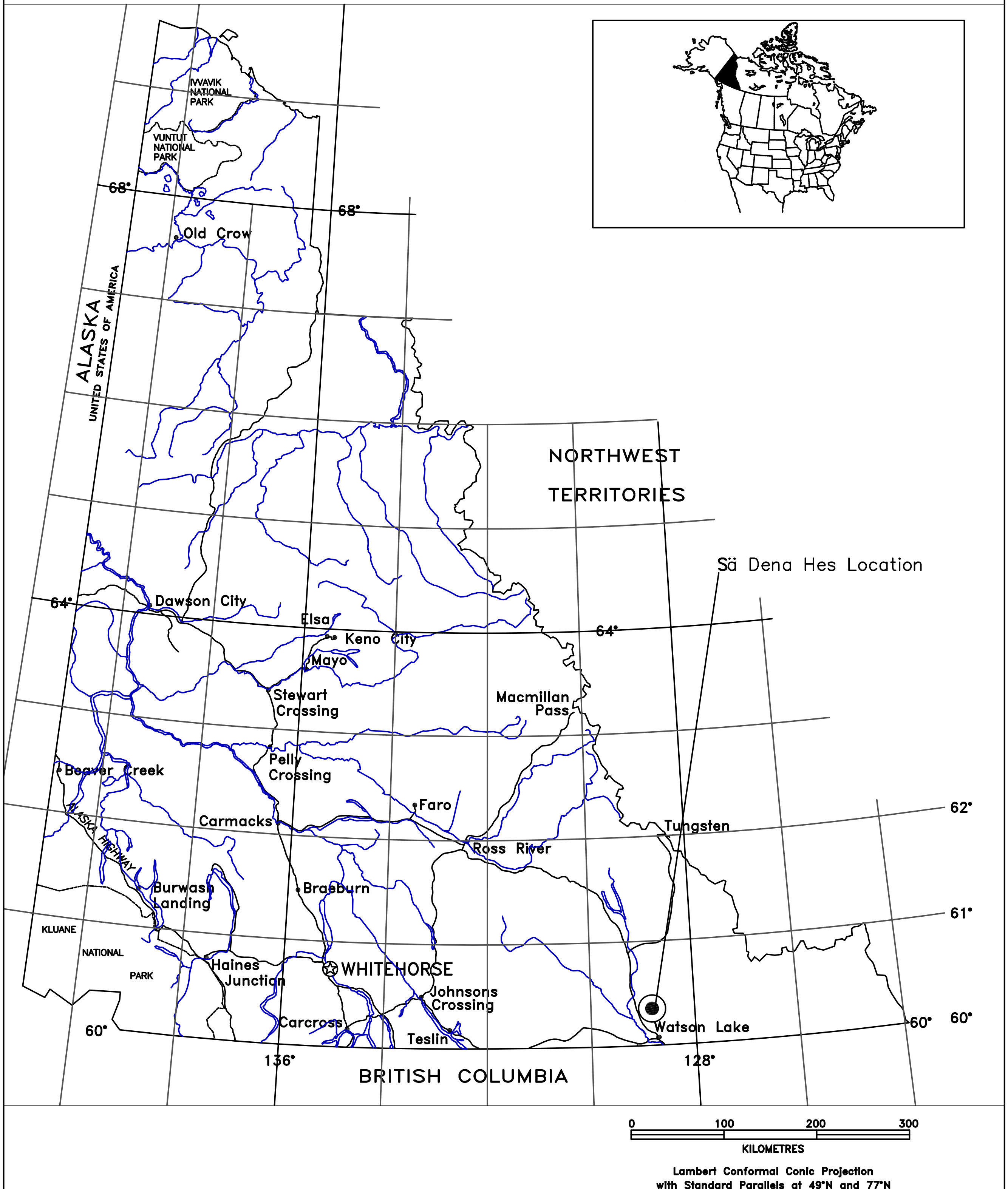
1.4 PROPERTY LOCATION

The Sä Dena Hes property is located close to Yukon's southern boundary with British Columbia, approximately 70 kilometres by road from the Town of Watson Lake. The minesite (see Figure 1-1) is reached via the Robert Campbell Highway, north of Watson Lake. At approximately kilometer 47 of the Robert Campbell Highway, a 25 kilometer access road designed to accommodate the safe and efficient haulage of concentrate extends to the property.

Most of the mineral occurrences are situated above the treeline ranging in elevation from 1,200 meters to 1,500 meters above sea level. The plant site is below the mine workings and lies in boreal woodlands. Snowfall is relatively light (approximately 230 cm/year) and temperatures vary from an average of –26.3 °C in January, to an average of 14 °C in July.

The Sä Dena Hes mine comprises the Jewelbox and Burnick underground mines, and two undeveloped mineralized zones – Gribbler Ridge and Attila, and a number of other identified exploration targets within the claims group (see Figure 1-2).

Yukon Territory



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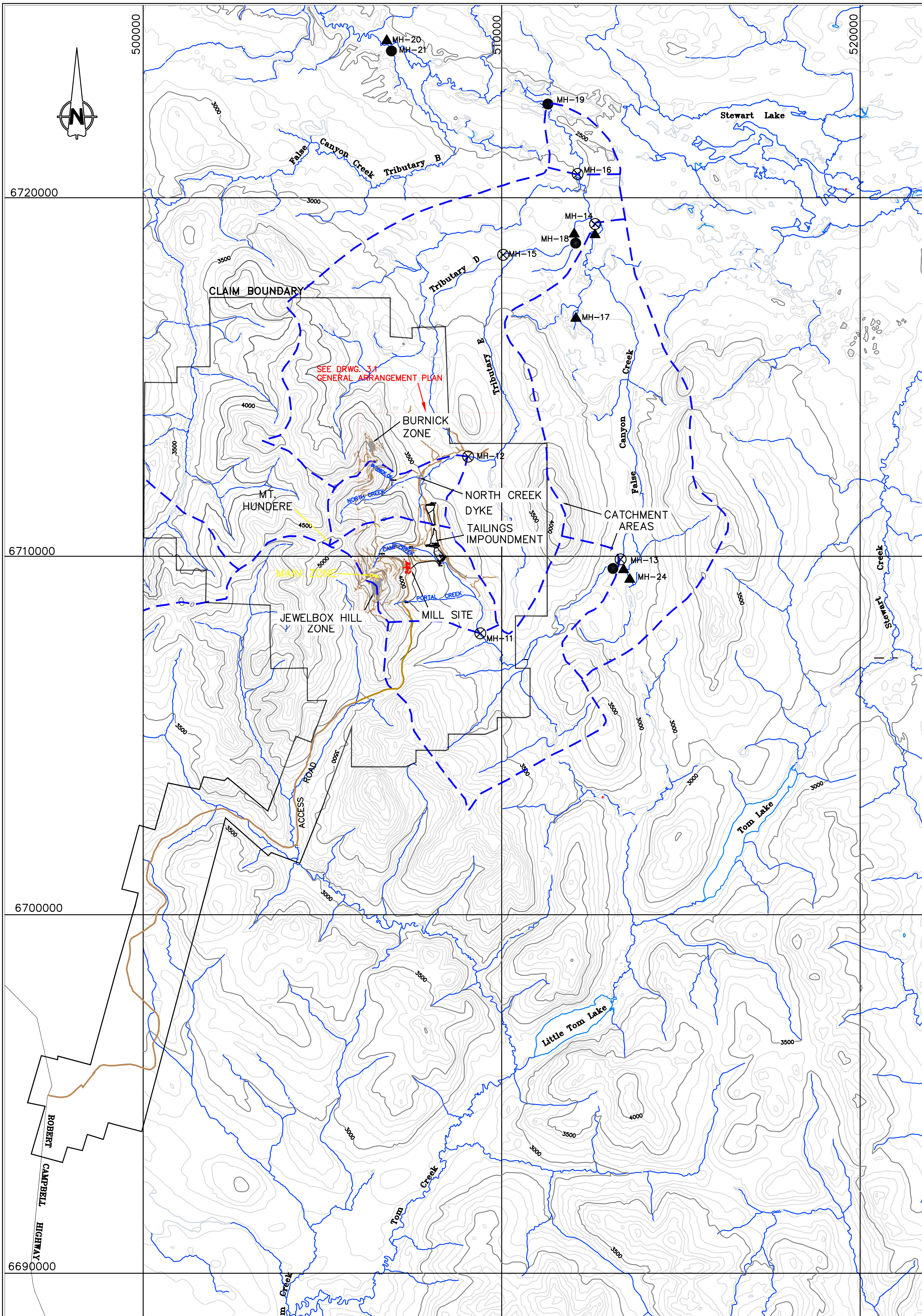
Legend

- Populated Settlements
- ✪ Territorial Capital

Să Dena Hes Draft Detailed Decommissioning and Reclamation Plan

General Location Map (Map of Yukon)

DRAWN BY: ASH	CHECKED BY:	Fig No. 1-1
January 2010	Scale 1: 6, 000, 000	



NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

CONTOUR INTERVAL 100 FEET

0 1000 2000 3000 4000 5000 metres

1:100,000

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

FILE REF.:CATCHMENT.DWG

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LEGEND
- ⊗ WATER MONITORING STATION
- ▲ FISH MONITORING STATION
- ● BENTHIC MONITORING STATION

Sä DENA HES DRAFT DETAILED DECOMMISSIONING AND RECLAMATION PLAN

SITE LOCATION PLAN

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	REV.
DATE: January 2010	PROJ. NO. 1CC005.05	1–2	

1.5 STATUTORY AND REGULATORY RESPONSIBILITIES

1.5.1. *Regulatory Agencies*

The Sä Dena Hes mine was constructed in 1991 and operated for a 16-month period between August, 1991 and December, 1992 under Water Use Licence IN90-002. The Sä Dena Hes Operating Corporation purchased the property from Curragh Resources Inc. in March 1994 and the Water Use Licence was subsequently assigned in April 1994. Teck presently manages the property on behalf of the Sä Dena Hes Operating Corporation.

Water Use Licence IN90-002 was amended by the Sä Dena Hes Operating Corporation in August 1997 to address submission of a decommissioning plan for the site. Amended Water Use Licence (QZ97-025) was issued in March 1998 and required the licensee to submit a DDRP for the site. The licence expiry date remained September 15, 2000.

The company submitted a final DDRP in February 2000 after extensive consultation with various interested parties. A Water Use Licence renewal application was also filed (QZ99-045) in February 2000 to renew and extend the existing licence and this application triggered an environmental assessment (EA) pursuant to the Canadian Environmental Assessment Act (CEAA). Two further amendment requests (QZ00-047) and (QZ00-048) were made to the Yukon Water Board to request an extension to the licence expiry date to ensure completion of the CEAA review. In addition, the company also submitted an application for a Quartz Mine Production Licence pursuant to the *Yukon Quartz Mining Act* that also required a CEAA review.

An extensive CEAA screening was completed in June 2001 while the property was still under Temporary Closure and included an assessment of the DDRP. The CEAA screening enabled the issuance of both the Water Use Licence (QZ99-045) and Quartz Mine Production Licence (QML-0004) with specific terms and conditions relating to temporary closure and maintenance of the site.

The 2001 CEAA screening remains current with respect to the existing property and care and maintenance activities. No new development activities have been undertaken since the screening and all required care and maintenance activities are being implemented by the

Company. Required licence studies and monitoring programs have been either completed or continue to be ongoing as mandated and are submitted on a regular basis to the Yukon Water Board and other regulatory authorities. The results of various studies and monitoring programs have been reviewed and an assessment completed regarding the site's effects on the surrounding environment. The Company submitted their most recent temporary site closure status report to the Water Board in March 2005 as part of the Annual Report.

1.5.2. *Approvals and Licenses*

The Company currently holds a Type A Water License QZ99-045, and Quartz Mine Production Licence (QML-0004) for quartz mining, which expires on December 15, 2015. Table 1-2 has been updated to reflect changes since 2006 to the approvals and licenses that have been issued for this project and the associated permitting bodies.

The company is required to comply with the terms and conditions of the licenses and of the Yukon Waters Act and Regulations. Compliance with licence terms and conditions is monitored by Yukon Government (YG), Dept. of Environment, Water Resources Division.

Various other agencies grant the permits necessary to develop, operate, and close a project of this nature. A detailed summary of the approvals and licenses that may be issued for this project and the associated permitting bodies are presented in Table 1-2.

As part of implementing the Decommissioning & Reclamation Plan, the Company will ensure that the various other licenses and/or permits that are required for undertaking various closure measures are secured and followed.

Table 1-2 Summary of Permits and Licences Since 2006

Purpose	Permit/Application Name, and/or Act, and/or Program	Responsible Authority/Agency	Contact
Permission to operate a dump for the disposal of solid waste generated by commercial activities	Commercial Dump Permit issued pursuant to the Environment Act	Environmental Programs Branch Environment Yukon	Shannon Jensen (867) 667-8787
Special Waste Permit for one time removal of special wastes	Provincial/Territorial ID Number for Special Waste: 44-166	Yukon Environment	Jules Farkas (867) 667-5683

1.6 DOCUMENT ORGANIZATION

Section 1 of this document introduces the philosophy and scope for the decommissioning and reclamation plan as well as Teck's corporate background. Information is provided on the property and its history and includes a discussion of regulatory responsibilities regarding closure.

Section 2 provides a brief overview of the current status of the Sä Dena Hes mine and the Company's plans for eventual mine reopening.

Section 3 provides a detailed description of the decommissioning and reclamation plan for the various components including mine workings, tailings management facility, infrastructure and reagents, and site access and haul roads. This section presents a description of each of the project components and outlines potential closures issues. The plan for decommissioning and reclamation activities for each of these areas is then presented.

Section 4 presents the implementation schedule for the plan, in the format of a Gantt chart.

Section 5 deals with post closure site management plans and activities. This section presents the environmental management measures proposed for the decommissioning and post closure period.

Section 6 provides an updated cost estimate for implementing the decommissioning and reclamation plan.

Section 7 presents a discussion of the licensed financial security requirements and arrangements.

Section 8 provides report references.

1.7 ACKNOWLEDGEMENTS

This report benefited from input by the following companies:

Teck – Senior staff provided overall direction for the Project as well as the corporate policy framework and senior technical review of the proposed closure measures.

Access Consulting Group – Responsible for assisting with preparation/updating of sections on Introduction, Mining Activities, Implementation Schedule, Post Closure Site Management, and Costing and Financial Security as well as developing closure measures for the infrastructure and industrial reagents. Also prepared and/or coordinated the environmental baseline update, and had responsibility for overall project management, document preparation and coordination.

SRK Consultants Ltd. – Responsible for sections on closure measures and costing for mine workings and the tailings management facility, and geochemistry, climate, and hydrology components of the environmental baseline update. Updates to water quality trends subsequent to the 2006 DDRP update were done without review or comment by SRK.

Laberge Environmental Consultants – Responsible for environmental baseline update for aquatic resources and helped develop the land reclamation closure measures.

2.0 MINING ACTIVITIES

2.1 MINE HISTORY

The original surface showings were discovered in 1962 by prospectors working for the Francis River Syndicate, and for the next few years geochemical and geophysical surveys were conducted, together with some diamond drilling. Between 1979 and 1982, Cima Resources Ltd. and Canadian Natural Resources Ltd. carried out diamond drill programs totaling almost 3,000 metres in 72 holes, and outlined an estimated 250,000 tonnes of zinc and lead mineralization.

In 1984, Canamax purchased the property and began systematic geological and geochemical prospecting, including airborne geophysical surveys, with follow-up ground geophysics. By the end of 1988, Canamax had completed 23,333 metres of drilling in 193 holes and estimated a zinc-lead-silver mineral inventory of over 5 million tonnes in a number of zones.

In 1989, the Mount Hundere Joint Venture (Curragh Resources Ltd. - 80%, and Hillsborough Resources Ltd. - 20%) purchased the property from Canamax and completed 29,000 metres of diamond drilling in 150 holes in order to upgrade reserves in the Jewelbox Hill and North Hill areas. This program resulted in an assessment of proven plus probable mineable reserves of 3.9 million tonnes at 11.5% Zn, 3.8% Pb, and 53 grams/tonne Ag.

In 1990, Kilborn Ltd. prepared a development plan, the project secured financing from the Bank of Nova Scotia, and the property was put into production in August 1991.

The first zinc and lead concentrate shipment to the port of Skagway, Alaska occurred in September, 1991. Mine production rates and mill processing exceeded design capacity of 1,500 tonnes per day during the production period. The maximum mill throughput was over 1,800 tonnes per day. During the 16 months of production, some 700,000 tonnes of ore were mined and processed. Approximately 120,000 tonnes of zinc concentrates were produced with a grade of 59% Zinc and 54,000 tonnes of lead concentrates at a grade of 77% Lead. The concentrates were trucked in covered containers to Skagway for shipment to European and

Asian smelters. A sharp downturn in metal prices forced the mine to shut down in December 1992, at which time the property was put on a care and maintenance basis.

Curragh Resources sought and received Court protection under the *Corporations and Creditors Arrangement Act* in 1993. On September 20, 1993, Coopers & Lybrand Ltd. was appointed by the court as Receiver and Manager of the Sä Dena Hes property. In March 1994, the current owners purchased the property through the Receiver according to a Court Order. The property has been kept on care and maintenance except for a brief period in the winter of 1998 when Cominco began preparations for reopening. A downturn in metal prices forced a re-evaluation, and subsequent suspension of work.

2.2 CURRENT STATUS

The Sä Dena Hes Mine is currently idle, awaiting the return of more favorable metals prices. The entire site is clean, inventoried, and kept in a ‘standby’ mode for the resumption of production. The site continues under the care of a full time, onsite caretaker. The caretaker provides security for the site, conducts daily checks of the mill and the general area, daily checks of the Tailings Management Facility, as well as conducting monthly and quarterly environmental sampling. Preparations (such as placing the ball mill on blocks, and draining and cleaning the reagent cells, draining fluids, and covering and sealing the electrical generators, etc.) have been made for the mill and related facilities to be brought on-stream in a timely and cost-effective manner. Details of the current state of all facilities are provided in later sections of this report.

Geotechnical inspections of the tailings management facility, as required by Water Licence QZ99-045, are conducted on an annual basis. This ensures that any potential geotechnical problems are identified early to enable remedial measures to be undertaken if required. The Company has implemented recommendations that have resulted from these inspections. Currently there is one outstanding item from the 2008 inspection that still requires additional work. This work will involve the raising of a short length of the South Dam crest and is scheduled for completion in 2010.

2.3 REOPENING PLANS & PROJECTIONS

In 1999, Teck Cominco attempted to restart the mine as a result of higher metal prices. A management team was assembled, a mining contractor engaged, and work underground at the mine was initiated to prepare the Jewelbox deposit for production. However the increase in metal prices was short lived and dropped before the mine could resume production.

In 2005, the Company conducted a review of the economics of the mine as metal prices were starting to strengthen. At the time the review was completed, it was concluded that metal prices were insufficient to re-commence operations.

Prior to reopening the mine, investments of both capital funds and management resources will be required. Once metal prices are sufficient to consider re-opening, there must be confidence that the markets will remain strong for the projected 4-year mine life before a decision to re-open will be made.

2.4 PERMANENT AND TEMPORARY CLOSURE STATUS

The Company recognizes the legitimate concern that government and the public have surrounding mines continuing for lengthy periods of time in a state of 'temporary' closure. At the same time, it must be recognized that world commodity prices are difficult to predict and are not under the control of the Company, and, consequently, it cannot be definitively stated when the Sä Dena Hes mine will reopen.

During 'temporary' closure, the Company intends to be a responsible steward of the site and demonstrate its commitment to reopening the site by:

- Continuing to have the site be under the care of a full time on-site caretaker;
- Continuing to maintain the main access road in a manner that heavy equipment can be brought on site on short notice to deal with any environmental emergency;
- Adequately monitor and maintain buildings and facilities (i.e. tailings facilities) on the site; and
- Ensuring that major fixed equipment and buildings remain essentially intact onsite.

The issues surrounding permanent and temporary closure have been addressed most recently in Teck Cominco's document *Temporary Site Closure Status Report as of January 2005*, included in the 2004 Annual Water License Report. Annual reports also provide updated information on closure issues and conditions. Essentially, responsible closure conditions and strategies have been implemented at the site and have been successful in achieving the objectives of temporary closure set forth in Water Licenses QZ99-045. These include activities, studies or monitoring programs in the following areas:

- maintenance of site facilities;
- geotechnical stability;
- geochemistry of surface and ground waters;
- hydrology and climatology; and
- environmental conditions.

These initiatives are discussed in greater depth throughout this update document.

2.5 DECOMMISSIONING AND RECLAMATION PLAN REVIEW

As Teck continues to manage the site, additional information about the site and its operational plans will be improved. Over time, both regulations and technology change. It is important that this plan is reviewed periodically and updated.

This update represents the third review of the Decommissioning and Reclamation plan as required in Water License QZ99-045 and QML0004. The first update to the plan was submitted in January 2006. The recent 2010 amendment to QML-0004 requires that this closure plan be updated again in two years.

It cannot be predicted when metal prices will stabilize at a level that will make the Sä Dena Hes Mine economically viable. Indicated reserves are estimated at 2,190,000 tonnes @ 10.4% Zn, 2.6% Pb and 45 grams/tonne Ag. The remaining mine life is projected to be 3.8 years. At this point, the property is considered relatively well explored. However, as in all mines, the potential does exist to contribute new reserves as mining progresses. While the mill is capable of higher throughput rates, production is severely limited by mining and hauling constraints. At this time, the other potential ore zones, such as Gribbler, are considered exploration targets at best and are considered unlikely to provide any significant additional tonnage.

3.0 DETAILED DECOMMISSIONING & RECLAMATION PLAN

3.1 OVERVIEW

This section presents a detailed discussion of the planned decommissioning and reclamation measures for the various facilities located on the Sä Dena Hes property.

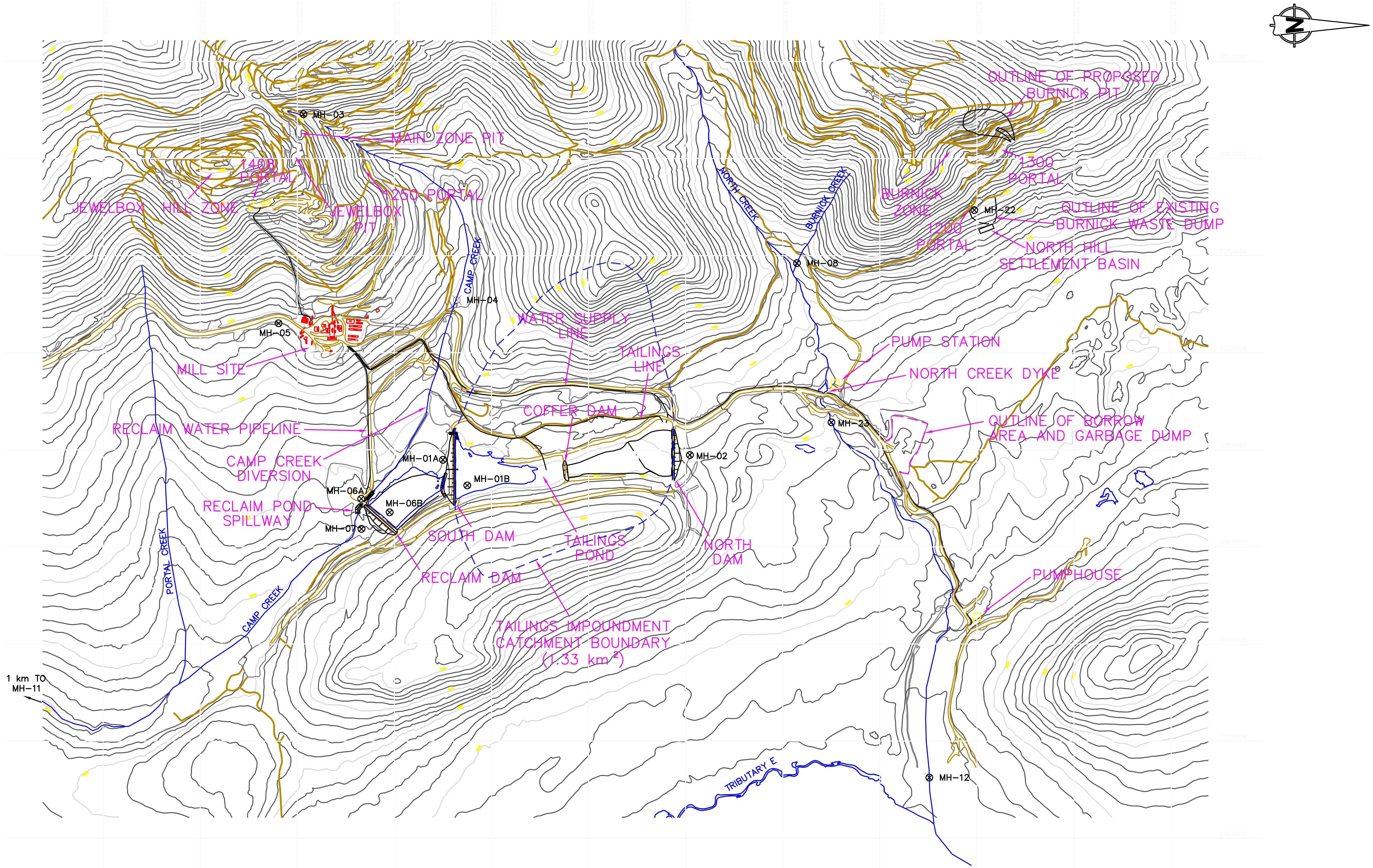
The approach to each subsection is to present a description of each area so readers are familiar with the existing facility and do not have to refer back to previous reports or information. Next, specific closure issues are discussed as they relate to each closure activity.

Finally, planned closure measures are presented. Each section is supported with detailed figures and tables as required. Where needed, references are made to previous reports or supporting documentation. Figure 3-1 provides a general arrangement plan for current conditions at the site. Figure 3-2 presents a summary of the various closure measures for features on the general arrangement plan.

3.2 MINE WORKINGS

This section discusses the mine features that require action upon closure of the operation. This section limits its discussions to the physical safety and stability of these features. Surface facilities such as buildings, electrical services, air/water services, fuels storage tanks and access roads will be discussed in other sections of this report. Reclamation issues related to these features are discussed in Section 3.6.

Potential water chemistry issues are discussed at length as part of the geochemistry discussions in Section 4 of Appendix B Volume II.



FILE REF.: NEW-BASE-TOPO.DWG

Teck

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SRK Consulting
Engineers and Scientists

LEGEND

⊗ WATER MONITORING STATION

0 200 400 600 800 1000 metres

1:20,000

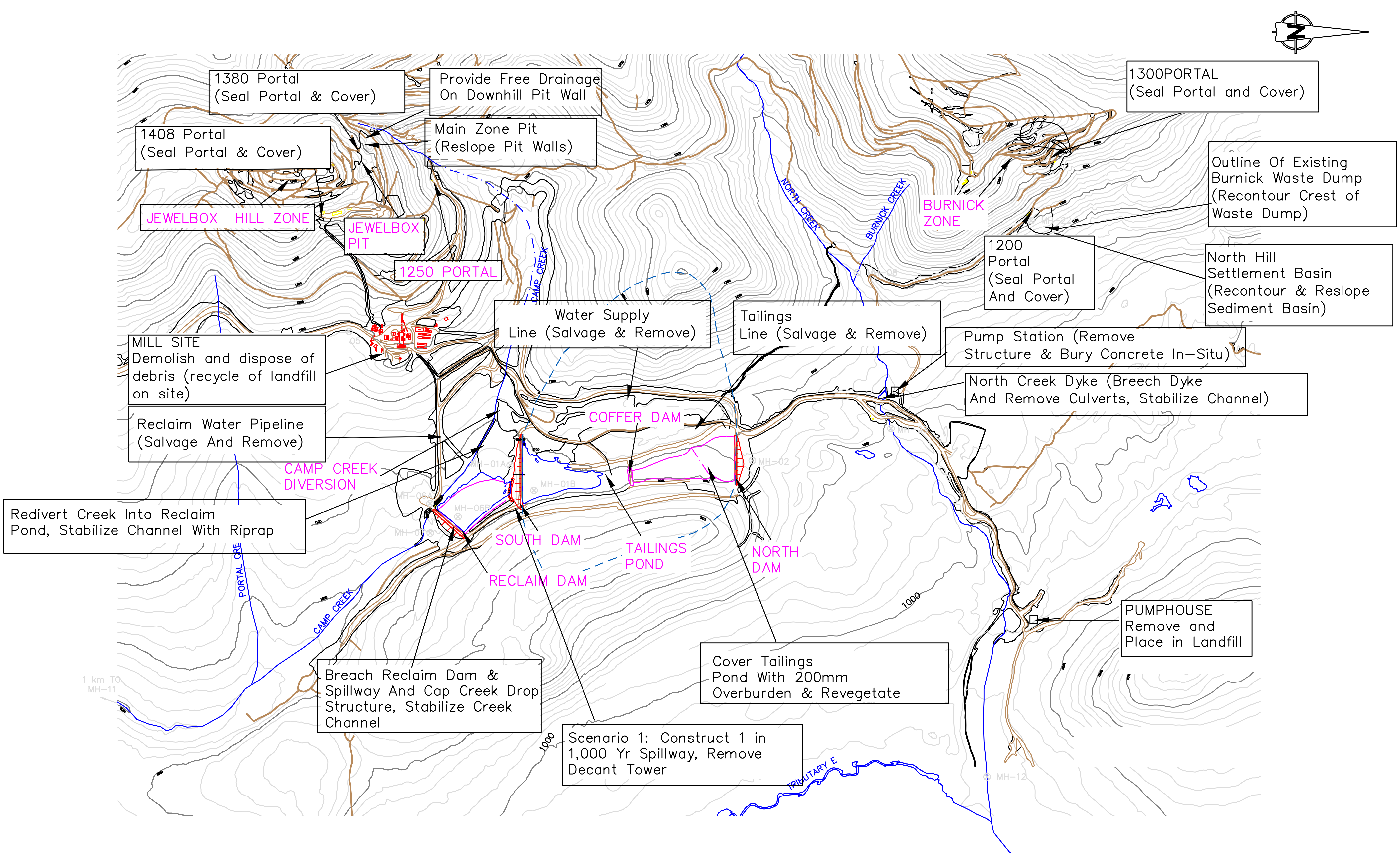
CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

SA DENA HES DRAFT DETAILED DECOMMISSIONING AND RECLAMATION PLAN

GENERAL ARRANGEMENT PLAN
CURRENT CONDITIONS

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO. 3.1	REV.
DATE: January 2010	PROJ. NO. 1CC005.05		



NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

Teck

ACCESS CONSULTING GROUP

SRK Consulting
Engineers and Scientists

Sä DENA HES DRAFT DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

GENERAL ARRANGEMENT PLAN
CLOSURE MEASURES

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO. 3-2	REV.
DATE: JANUARY 2010	PROJ. NO. 1CC005.05		

FILE REF.: NEW-BASE-TOPO.DWG

3.2.1. *Jewelbox Ore Body*

The Jewelbox ore body is located near the top of Jewelbox Hill (Figure 3-1) immediately west of the mill complex. Curragh Resources started development of this ore body in 1990 and produced ore using several different underground mining methods. These methods included room and pillar, mechanized cut and fill, and long hole stoping.

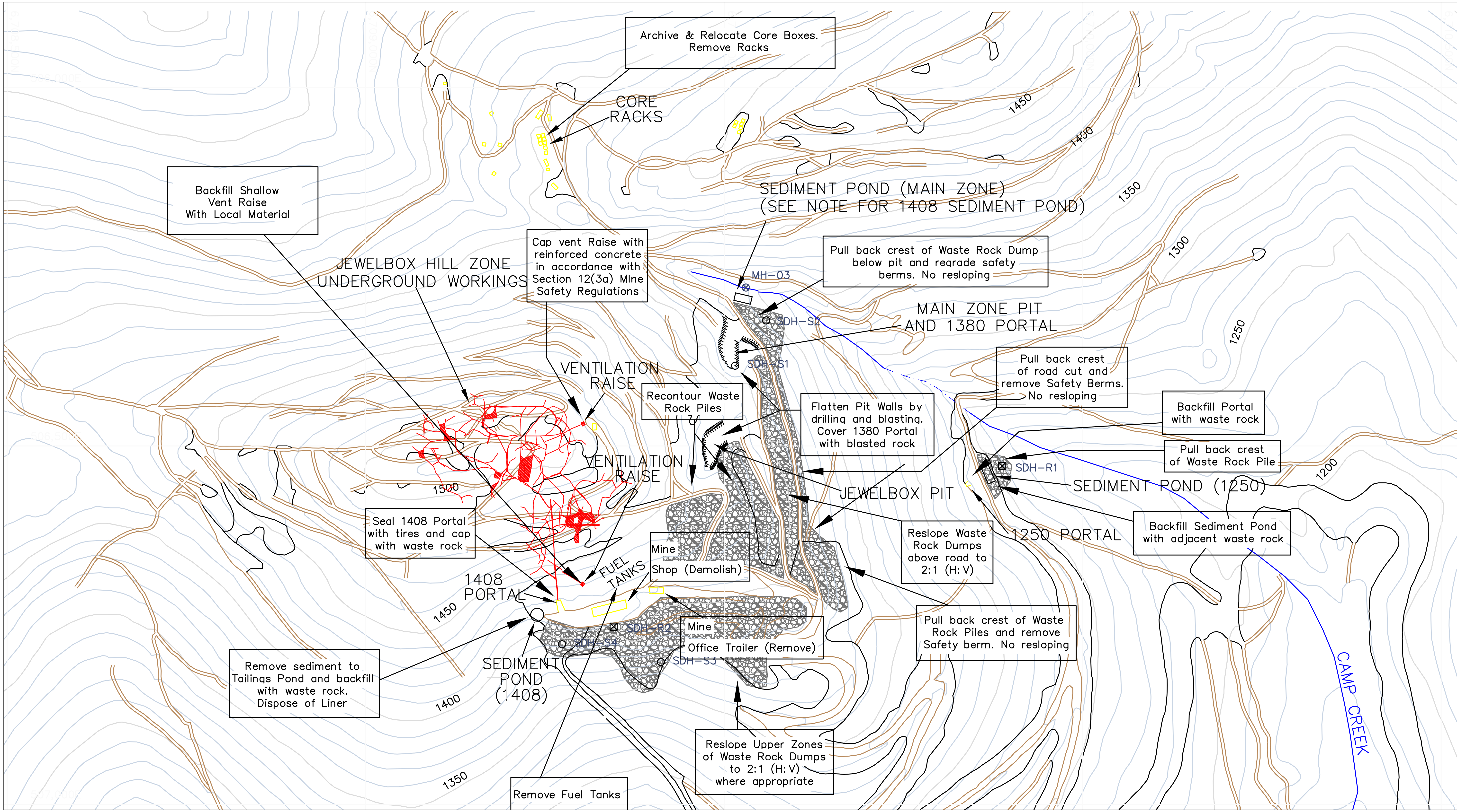
Jewelbox has a number of features that will require work upon closure. They include the 1408 Portal, the 1250 Portal, two ventilation raises, a small open pit and the associated waste rock dumps. These features along with a plan view of the extent of the underground workings are shown in Figure 3-3.

3.2.1.1. Jewelbox 1408 Portal

(i) Description

The 1408 portal is located immediately above the mill site, as shown on Figures 3-1 and 3-3. A haul road from the mill provides access to the main ramp of the underground workings at the Jewelbox zone. The portal is roughly 4.5 m by 4.5 m and is set back into the hillside about 8 m. This portal is one of only 3 openings that intersect the underground mine workings at the Jewelbox ore zone.

At the last inspection in the mine in 2005, the water level in the workings was at the 1,344 metre elevation and was slowly increasing. Prior to the dewatering of the workings by Cominco in December 1998, the water level had been recorded at the 1,350 metre elevation after the mine had been closed for approximately four years. The source(s) of the water is from fractures in the rock below the 1,350 metre elevation. There are no signs of water flowing down the decline from the portal elevation.



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LEGEND
⊙ SDH-S4 – SEEP SAMPLE
⊗ MH-03 – WATER MONITORING STATION
⊠ SDH-R1 – WASTE ROCK SAMPLE
EXPLORATION TRAILS
WASTE ROCK DUMPS
HAUL ROADS
CLEARED AREA

0 50 100 150 200 250 metres
1:5,000
CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

Sä DENA HES DRAFT DETAILED DECOMMISSIONING AND RECLAMATION PLAN

JEWELBOX HILL AND MAIN ZONE CLOSURE MEASURES

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO.	3-3	REV.
DATE: JANUARY 2010	PROJ. NO. 1CC005.05			

FILE REF.: GRIBBLER-JEWEL.DWG

(ii) Closure Issues

The Jewelbox ore zone has several openings to surface. The lowest opening is the 1408 Portal, which is the main entrance to the Jewelbox mine. It has two ventilation raises that exit at a higher elevation. All other mine workings are lower than the 1408 Portal. Water from the mine workings does not flow out of this opening. After the mine was closed for many years, only the lower portion of the mine had flooded. Even if the mine were to completely flood, the vast majority of the water would be below the elevation of the 1408 Portal, so there is no risk of major quantities of water being build up above the 1408 Portal.

The primary concern is to prevent access into the mine by either the public or by wildlife. It is not expected that ice plug formation will occur at this site.

(iii) Closure Measures

At closure the 1408 Portal will be sealed off in a manner agreed on by Yukon regulators and the Company. Several options for sealing are available including backfilling, tires, foam and concrete and a possible combination of any of these.

A cap of coarse waste rock will be placed over the sealed portal to eliminate public access and to provide a permeable barrier. This barrier is designed to prevent water from being sealed into the mine, which could gradually pressurize and become a potential safety hazard. The cap of waste rock over the portal will be contoured to restore the natural slope of the surrounding terrain. The detailed plans for the seals will be submitted to the mine safety branch for review and approval prior to starting work.

A rock lined channel will be constructed from the base of the portal to direct any potential mine drainage water around the waste rock dump. The ground at the base of the portal entrance will be sloped to ensure precipitation drains away from the portal. Similar methods will be used at the other mine portals that access underground workings.

3.2.1.2. Jewelbox Ventilation Raises

(i) Description

The mine workings at Jewelbox are ventilated by two ventilation raises that extend up from the underground workings to 'daylight' on the hillside above the 1408 Portal. One of the ventilation raises is located near the summit of Jewelbox Hill, while the other is located immediately up slope behind the shop building at the 1408 Portal.

(ii) Closure Issues

Both raises must be permanently sealed to prevent access into the mine by the public and by wildlife. The openings will be sealed in a manner that prevents water from entering the mine workings as these tunnels are steeply dipping down into the mine.

(iii) Closure Measures

Both ventilation raises will be sealed in a manner in accordance with Mine Safety Regulations. The seals will provide the physical barrier to eliminate the potential for the public or wildlife to access the mine through ventilation raises. In addition, the seals will prevent water from entering the mine workings through these openings. Because the exact nature of the seal is not known at this time, costs have been included that reflect the most expensive option – a concrete seal.

3.2.1.3. Jewelbox - 1250 Portal

(i) Description

The 1250 Portal is located on the north side of Jewelbox Hill, in the Camp Creek catchment as shown on Figures 3-1 and 3-3. Original mine plans called for production to come from this portal, but subsequent diamond drilling and increased knowledge of orebody geometry forced a relocation of the production portal to the current 1408 Portal. Construction of the mine workings had been started by mining the portal, but the tunnel extends only 3 metres (approximately) into the hillside. The tunnel has not exposed any ore and has no water flowing from it. The sediment pond contains only benign material.

(ii) Closure Issues

The loose rock at the entrance to this short tunnel could be a potential safety hazard to the public. A small quantity of waste rock produced from starting this short tunnel requires contouring. There are no other issues related to this minor item.

(iii) Closure Measures

The opening will be capped with waste rock borrowed locally and the cap will be shaped to form a 2:1 (H:V) slope to ensure stability. The minor amount of waste rock, at the portal entrance, will be regarded and revegetated.

3.2.1.4. Jewelbox Pit

(i) Description

The Jewelbox pit is located above the Main zone pit as shown on Figure 3-3. The pit bottom is at an elevation of 1,400m and rises steeply to 1,430m. The pit is not free draining but seepage through the fractures in the rock causes the ponded water levels in the bottom of the pit to fluctuate. Weathering of the pit walls results in rock gradually loosening and falling into the pit.

(ii) Closure Issues

The loose rock and steep slope of the pit walls are a safety concern. During the spring freshet water collects in the bottom of this pit and may drain through fractures in the ground and waste rock. Actual routing of the water is difficult to determine.

(iii) Closure Measures

The pit walls will be stabilized by resloping them by drilling and blasting. The blasted rock material will partially fill the pit. A channel filled with coarse rock (French drain) will be made to ensure that if water levels within the pit were to increase, that it would have a safe route to discharge out of the pit. Water quality from this discharge is expected to meet acceptable levels. This will ensure that there is no free standing pool of water within the pit and reduces the potential for this water to flow into the 1380 Portal through fractures in the rock.

3.2.1.5. Jewelbox Waste Rock Dumps

(i) Description

The waste dumps associated with the development of Jewelbox and Main Zone make up the bulk of the current waste rock at the Sä Dena Hes minesite. Waste rock from the Jewelbox underground was placed immediately below the 1408 Portal as shown on Figure 3-3 and covers an area of 2.6 hectares. In the upper section of this dump (1.3 ha), the material was placed in two to three lifts with berms providing an overall slope of about 2:1 (H:V). However, the lower sections were end-dumped on relatively steep slopes leaving slopes at the angle of repose (1.3:1). Since the shut down of the mine in 1992, there has been no evidence of any instability of the dump. No tension cracks, toe bulges or subsidence have been noted.

Waste rock mined from the Jewelbox Pit is located on a ridge immediately east of the pit as shown in Figure 3-3. The dump was built in two phases and covers an area of approximately 1.9ha. The ultimate crest is at El. 1442m and the side slopes of the dump are generally 2:1 (H:V).

Waste rock was also deposited on relatively steep ground immediately below the upper Jewelbox pit dump as shown on Figure 3-3. The face of this dump is about 1.3:1 (H:V) and the crest has been over-steepened. The dump covers an area of about 0.4 ha.

Waste rock from the Jewelbox pit can also be found above and below the access road to the Main Zone Pit. This material sits on relatively steep ground with the dump faces at slopes of 1.3:1 and covers an area of about 0.9 ha. Safety berms are located along the crest of the access road and stand about 1 metre high.

(ii) Closure Issues

All of the waste rock dumps at Jewelbox and the main zone pit are in the alpine zone (above the tree line), and, as such, is slowly being revegetated naturally. Therefore, the closure issues at these sites are restricted to recontouring the areas in order to conform to natural surrounding slopes and to avoid the ponding of water. Long term physical stability is the issue for these waste rock dumps. Recontoured portions will be seeded in an effort to initiate revegetation.

(iii) Closure Measures

At closure the upper section of the waste dump below the 1408 Portal will be resloped to about 2:1 (H:V) and seeded to provide a more stable configuration. No specific action will be carried out on the lower slopes of this dump.

The waste rock in the Jewelbox pit dump on the ridge above the 1408 Portal will be recontoured as much as possible to provide a continuous slope of 2:1(H:V).

As the sidehill dump below the Jewelbox pit dump is built on very steep ground, resloping of this dump is not feasible; however, it may be possible to reslope the upper portions of the dump by stepping back on the dump platform. This will also expected to spread fines further down the dump face thus facilitating revegetation.

All safety berms along the access roads will be removed either with an excavator or by dozer and drainage patterns re-established.

3.2.2. *Main Zone Ore Body*

The Main Zone is located on the south flank of the Camp Creek catchment. It is on Jewelbox Hill just north of the Jewelbox Zone. Locations of these mine features are shown in Figures 3-1 and 3-3. The Main Zone workings consist of a pit, an adit and waste dumps. There are no significant underground workings associated with this ore zone.

3.2.2.1. Main Zone - Open Pits

(i) Description

The main zone pit is the lower of the two open pits located on the south flank of the Camp Creek catchment. The pit is a sidehill excavation with the pit floor at 1,370 m elevation rising to an elevation of about 1,400 m with relatively steep slopes. Raveling of the highwalls is a dynamic process and will likely continue. With the low concentrations of iron sulphides in association with abundant carbonates, acid generation will not occur and therefore no additional measures to provide chemical stability of the pit walls are required. As discussed in Section 3.2.2.2, the drainage from the 1380 Portal flows into fractures within the pit floor and through the waste dump into Camp Creek.

(ii) Closure Measures

The pit walls will be stabilized by drilling and blasting the high wall to reduce the wall slope, and where possible, resloped using a dozer. The blasted rock and resloped material will be used to the fill the pit and cover the 1380 portal. The coarser rock fragments will be placed at the base of the fill to allow free drainage from the pit. It is expected that when the mine does reopen, this work will be carried out while the mine is operating.

3.2.2.2. Main Zone – 1380 Portal

(i) Description

The 1380 Portal is located within the Main Zone Pit as shown on Figure 3-3. The portal is approximately 4.5 m by 4.5 m in section and is collared in limestone and skarn. This portal does not connect with any other underground workings. The mining of this tunnel (adit) was apparently stopped due to very poor ground conditions. Water drains from this portal through the snow free period. It likely flows for at least part of the winter but it is not safe during Temporary Closure periods to access this area during winter due to avalanche hazards in the area. Water discharges from a fault in within the adit. The ground water flows onto the adit floor where it comes into contact with weathered mineral rich skarns which creates neutral mine drainage containing high zinc concentrations (>30 mg/L). The water from the portal flows down through the adjacent waste dump and joins a surface water flow in the gulley. Currently the zinc concentrations are being amended by contact with the water rock. Attenuation continues as the drainage water mixes with the alkaline surface water. The surface water goes into the ground approximately 500 m before Camp Creek. Steven Day of SRK prepared a letter report dated March 12, 2007 titled "*Sä Dena Hes Mine – 1380 Portal*". This report is included in Appendix E.

(ii) Closure Issues

Closure issues related to this site include stability of the opening and prevention of inadvertent access by the public or by wildlife. The discharge of water flow from this portal has elevated zinc levels that is currently attenuated but may in the long-term exhaust however, geochemical predictions are that is will not have an unacceptable affect on the receiving environment.

(iii) Closure Measures

As discussed in the geochemistry commentary in Section 4.3.3.2 Main Zone - 1380 Portal Drainage is not forecast to have a significant impact on the receiving waters in Camp Creek. It is assumed that this portal can be sealed using a typical seal that is designed to prevent access by the public or wildlife was not be designed to seal the water flow.

Material to bury the portal will come from the resloping of the Main Zone pit walls as discussed in Section 3.2.2. As the cover material is expected to be very coarse, the water that flows out of the portal will not be obstructed by the rock. The use of alternative closure methods (i.e. concrete, tires) to provide a secure physical barrier is not required here due to the volume of rock fill that will bury the entrance to this tunnel.

Closure measures for this pit include blasting out a channel in the downhill lip of the pit to provide positive drainage.

3.2.2.3. Main Zone – Waste Dump

(i) Description

Waste from the Main Zone pit was end-dumped on hillside slopes below the pit floor and above the headwaters of Camp Creek (Figure 3-3). The slope of the dump is about 1.3:1 and consists of very coarse, broken rock. The dump covers an area of about 0.3 ha. The waste rock is composed primarily of limestone with some ore-type skarn material. Some of the skarn has weathered resulting in the release of coarse sphalerite and galena-rich sand. Water was seen flowing inside the dump presumably originating from the Main Zone pit or the Jewelbox pit.

Phyllite waste rock was also end-dumped on the hillside above Camp Creek and adjacent to the 1250 Portal. This dump is relatively small (< 0.2 ha) with a slope of about 1.3:1 and contains no mineralized material.

(ii) Closure Measures

As the dump below the Main Zone Pit is on relatively steep ground, full resloping is not possible. However the crest will be pulled back to remove the over steepened sections and the safety berms will be removed.

3.2.3. *Burnick Ore Body*

The Burnick ore body is located on the North Hill which is approximately 4 km north of the mill site as shown in Figure 3-2. There are 3 portals and a waste dump related to this area of the mine. Very little development has been done to date but future mining is planned. The mining plan for Burnick includes development of the Attilla ore zone, and access provided by a ramp from Burnick underground. Because of this, closure measures and the resultant costing for the Attilla zone have been included in the discussions about the Burnick waste dumps.

3.2.3.1. Burnick Zone – 1200 Portals

(i) Description

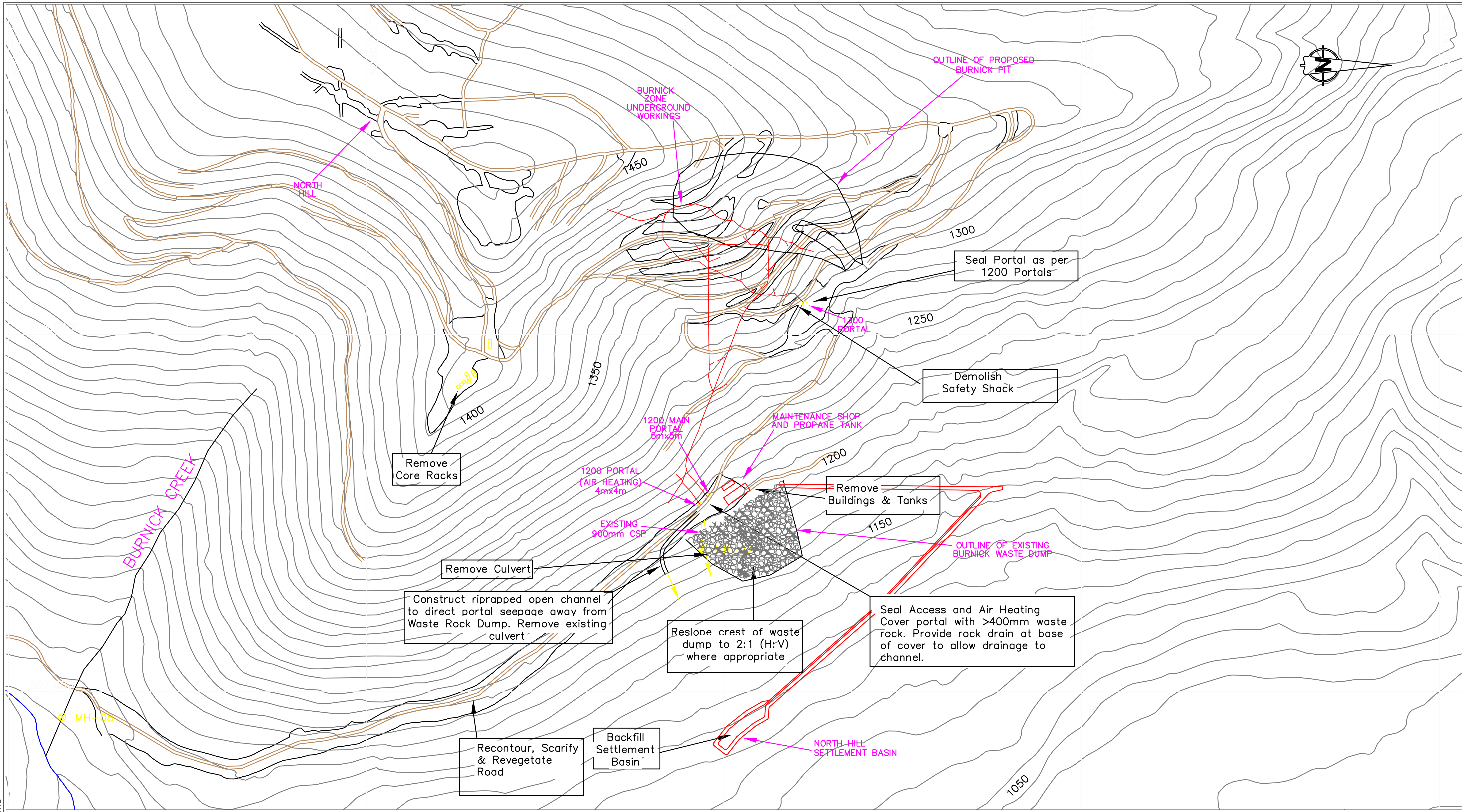
At the 1200 Level of Burnick, there are two portals separated by several metres (see Figure 3-4). One of the portals is the main access to the Burnick ore body and the second portal provides propane heating for the ventilation air. Water from the mine drains the ventilation portal. In 1998, a temporary shotcrete dam was instructed inside the ventilation portal to create a settling sump to contain any sediment in the discharge. The flow rate of this water ranges from approximately 800 L/min during spring to 15 L/min during winter low flows. The water flows into a culvert beneath the portal pad which directs it over the existing waste rock dump.

The source of most of this water appears to be fractures and drill holes located near the entrance of the 1300 Portal. It flows down hill from this portal, exiting the mine from the 1200 Level. Because there has only been preliminary development completed at Burnick the underground workings are not extensive. A plan view of the present workings at Burnick is shown in Figure 3-5.

(ii) Closure Issues

The two portals at the 1200 Level must be sealed to prevent public and wildlife from accessing the mine workings. The portals will be sealed in a manner that allows the max flow of 800 L/min to be free draining in order to prevent water from backing up into the mine workings and creating a safety hazard. Water from the portals will be redirected around the waste dump.

In the Yukon, there have been instances of ice plugs forming in open portals of mines after closure. The ice plugs have resulted in water being stored behind the plugs and being released in an uncontrolled fashion when the ice plugs break. Ice forming in tunnels are often the result of unrestricted air flow through the tunnel during winter months causing any water in the mine to freeze. Sealing of all portals will all but eliminate the flow of air through the workings and formation of ice in the workings is not expected to be an issue.



FILE REF.: BURNICK-ATTILA.DWG

Teck

ACCESS CONSULTING GROUP

SRK Consulting
Engineers and Scientists

LEGEND

⊗ WATER MONITORING STATION

WASTE ROCK DUMPS AND ROAD CUT

CLEARED AREA

0 50 100 150 200 250 metres

1:5,000

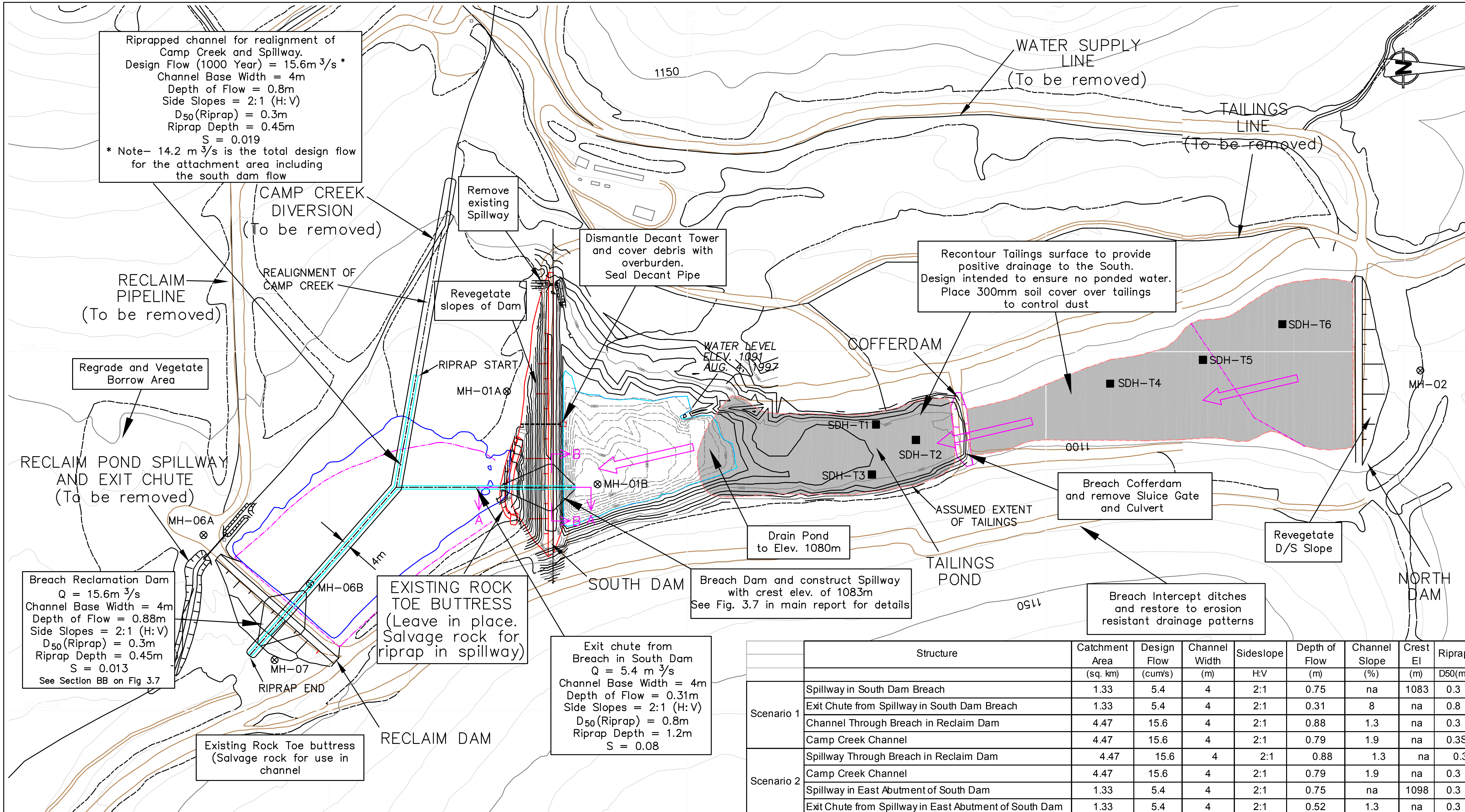
CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

Sä DENA HES DRAFT DETAILED DECOMMISSIONING AND RECLAMATION PLAN

BURNICK ZONE CLOSURE MEASURES

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO. 3-4	REV.
DATE: JANUARY 2010	PROJ. NO. 1CC005.05		



	Structure	Catchment Area	Design Flow	Channel Width	Sideslope	Depth of Flow	Channel Slope	Crest El	Riprap
		(sq. km)	(cum/s)	(m)	H:V	(m)	(%)	(m)	D50(m)
Scenario 1	Spillway in South Dam Breach	1.33	5.4	4	2:1	0.75	na	1083	0.3
	Exit Chute from Spillway in South Dam Breach	1.33	5.4	4	2:1	0.31	8	na	0.8
	Channel Through Breach in Reclaim Dam	4.47	15.6	4	2:1	0.88	1.3	na	0.3
	Camp Creek Channel	4.47	15.6	4	2:1	0.79	1.9	na	0.3S
Scenario 2	Spillway Through Breach in Reclaim Dam	4.47	15.6	4	2:1	0.88	1.3	na	0.3
	Camp Creek Channel	4.47	15.6	4	2:1	0.79	1.9	na	0.3
	Spillway in East Abutment of South Dam	1.33	5.4	4	2:1	0.75	na	1098	0.3
	Exit Chute from Spillway in East Abutment of South Dam	1.33	5.4	4	2:1	0.52	1.3	na	0.3

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⊗ WATER MONITORING STATION

■ TAILINGS SAMPLE

SURFACE DRAINAGE

0 50 100 150 200 250

1: 5, 000

CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

TMF CLOSURE MEASURES
SCENARIO 1

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO. 3-5	REV.
DATE: January 2010	PROJ. NO. 1CC005.05		

(iii) Closures measures

Any sediment collected in the sump behind the shotcrete dam will be removed to the tailings pond. Both portals will be securely sealed and covered with coarse waste (in the same manner described for the Jewelbox 1208 Portal in Section 3.2.1.1). The waste rock will be taken from the Burnick waste dump. An engineered rock drain will be placed at the base of the waste rock fill to provide free drainage from the portal.

The rock fill drain at the base of the portal seal will be designed to accommodate a peak flow that will be determined during final design. The closure measures presented are conceptual in nature and are not to be considered as final engineering designs.

The channel will be constructed several metres back and parallel with the crest of the resloped rock dump. The outlet of the channel would be located at the south end of the dump to ensure no discharge over the rock fill.

When Cominco took over management of the mine, inspections revealed that the Burnick workings had ice building up within the main access tunnel near the 1200 Portals. It has been determined that this buildup of ice is the result of cold air moving through the mine. Previous attempts to stop this flow with fabric seals has proven ineffective because of the need for continual maintenance. In 2009, compacted waste rock seals were installed at both the upper and lower portals to minimize air flow. Inspection of any ice buildup at the lower portal is still possible through the ventilation access and will be conducted to assess the effectiveness of the seals at reducing ice buildup. Upon permanent closure of the mine, permanent seals will be built to prevent access to the mine and to prevent air from flowing within the mine. This will eliminate the potential for ice plugs to form.

3.2.3.2. Burnick Zone – 1300 Portal

(i) Description

The 1300 Portal is accessible via an old exploration road and has been sealed (2009) to restrict movement of air through the workings (Figure 3-5). There is no drainage from the portal as it is the highest point of the mine and any water occurring in the mine flows down to the 1200 Portal.

(ii) Closure Issues

The entrance must be sealed and contoured in a manner to prevent water from entering the mine workings and to prevent access by wildlife and the public. The seal will prevent air movement through the mine and prevent buildup of ice plugs within the mine workings.

(iii) Closure Measures

The portal will be permanently sealed and covered with waste rock. The platform in front of the portal will be contoured to ensure water drains away from the portal.

3.2.3.3. Burnick Zone - Proposed Pit

(i) Description

An open pit development is planned for the mine at the Burnick Zone. The outline in plan view of this pit is shown on Figure 3-5. Planning is at the conceptual stage and will likely be revised as more detailed planning is done. It is currently planned to have three portals entering the mine from the wall of the pit. The pit would have an ultimate floor elevation of 1,300 m, and is scheduled to be developed in the third year of operation.

The majority of the waste rock produced from this pit is currently planned to be used as underground backfill.

(ii) Closure Issues

It is premature to detail the closure issues here. It would be typical of open pits to have public safety issues related to the slope of the pit walls. There are not expected to be significant quantities of waste placed in dumps so any issues related to this will be minor.

(iii) Closure Measures

The pit walls will be stabilized by drilling and blasting to address the physical stability and public safety concerns.

3.2.3.4. Burnick Zone – Waste Dump

(i) Description

The waste rock from the underground workings at the Burnick Zone covers an area of about 1.4 ha and is located in a sidehill dump immediately below the portal. There were several tension cracks identified along the crest of the dump. Since the closure plan was issued in 2000, the top of the dump has been re-graded to reduce the load off the crest and the dump has been monitored annually with no further settlement or slumping being observed. Monitoring of this dump will continue through to final closure.

(ii) Closure Issues

The main closure issue is physical stability and recontouring to ensure positive drainage. There has been evidence of some instability at the north end of the dump.

(iii) Closure Measures

At closure, the Burnick dump will be resloped to as low an angle as the surrounding terrain will accommodate and revegetated.

With regards to long-term integrity of the dump, the area of current instability is concentrated at the north end of the dump. The 1300 Portal drainage channel, as discussed in Section 3.2.3.1 above, would be constructed at the south end of the dump. In 2007, flows from the portal resulted in toe materials becoming supersaturated leading to a washout downslope of the toe. Drainage was restored to the proper channel and no further erosion has occurred and the washout area is naturally revegetating. Improved sealing of the portal will be effective in reducing the flows from the portal by minimizing the air flows within the mine.

3.3 TAILINGS MANAGEMENT FACILITY

3.3.1. *General*

Two scenarios for the closure of the Tailings Management Facility ("TMF") at the Sä Dena Hes mine are presented in this closure plan. The first scenario considers the option that if the operation does not reopen the mine, closure of the TMF would focus on the current conditions (see Figure 3-6).

The second scenario assumes that the mine will reopen and tailings will be deposited into the existing facility over a period of 4 years (see Figure 3-8). It is estimated that an additional 1.8 million tonnes of dry tailings would be deposited into the facility. To achieve this, the North Dam would need to be raised to an ultimate elevation of 1,102 m and the South Dam to 1,100 m. No changes would be made to the Reclaim Dam.

Only upon a decision to close the mine would efforts begin to decommission and reclaim the TMF. Timelines may differ slightly between the scenarios, due to the increase in areal extent of the TMF in Scenario 2.

The following section presents a description of the existing TMF, followed by a discussion of the closure measures for each option. Many of the measures are common to both and will not be repeated for the second scenario.

3.3.2. *Description*

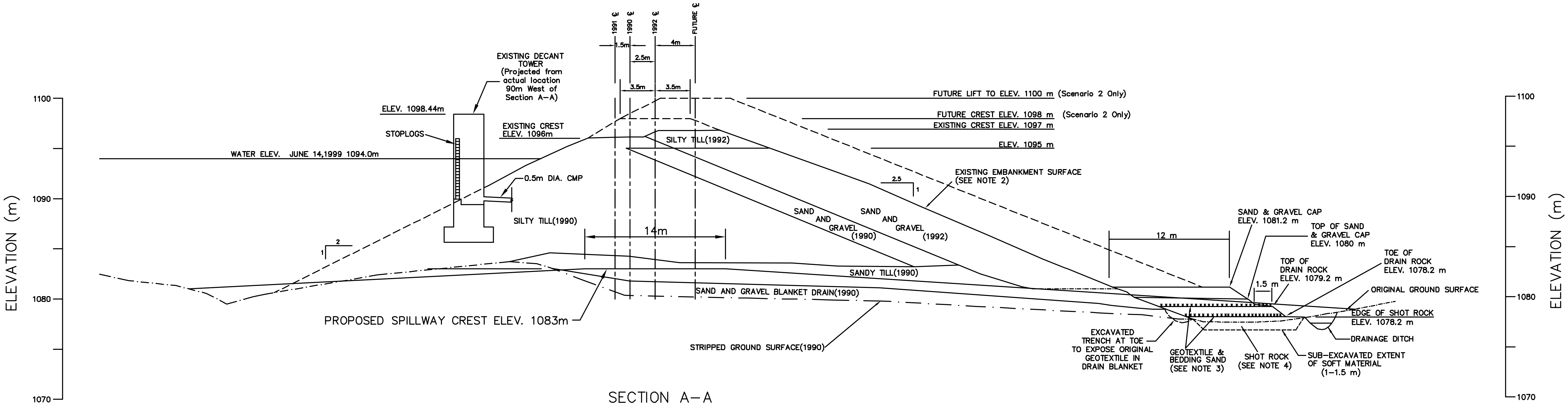
The TMF consists of three earth structures, which are referred to as the North Dam, the South Dam and the Reclaim Dam as shown on Figure 3-6. The North and South Dams, which impound the tailings, were constructed between July 1990 and October 1991. The starter dams for both structures were built to a height of about 13 metres. A small, two metre high cofferdam was also constructed halfway between the two dams to control flow of water and tailings from the north end of the impoundment.

In addition to the North and South Dams, a Reclaim Dam was built to retain supernatant water decanted from the tailings pond for reuse in the mill. The Reclaim Dam is about 15 metres high at the maximum section. The mine plan involved recycling of the reclaimed water to the mill with a controlled discharge into Camp Creek from April to October each year. During operations and when the pond water level becomes too high, water is decanted from the tailings pond to the Reclaim Pond through a concrete decant tower located adjacent to the upstream crest of the South Dam as shown Figure 3-6. Details of the decant tower are shown on Figure 3-7.

A 0.5m dia. corrugated steel pipe ("CSP") decant culvert discharges the water from the tower, beneath the dam and into the Reclaim Pond. Water is discharged from the Reclaim pond to Camp Creek during the licensed allowable discharge period, April through to October.

During operations, when the pond water level becomes too high, water is decanted from the Tailings pond to the Reclaim pond through a concrete decant tower located adjacent to the upstream crest of the South Dam. During temporary closure the decant system is not being used. Instead a siphon arrangement is used to control water levels retained by the South Dam Pond. Prior to the onset of winter, the water level in the tailings pond is drawn down as far as practical to provide extra storage during the spring runoff.

An emergency spillway, consisting of two 900 mm dia. CSP culverts, is located at the west abutment of the South Dam as shown on Figure 3-6. The spillway has the capacity to discharge flow from a 200-year flood event into the Reclaim pond. An emergency spillway is also located on the west flank of the Reclaim pond which would discharge into the Camp Creek Diversion.



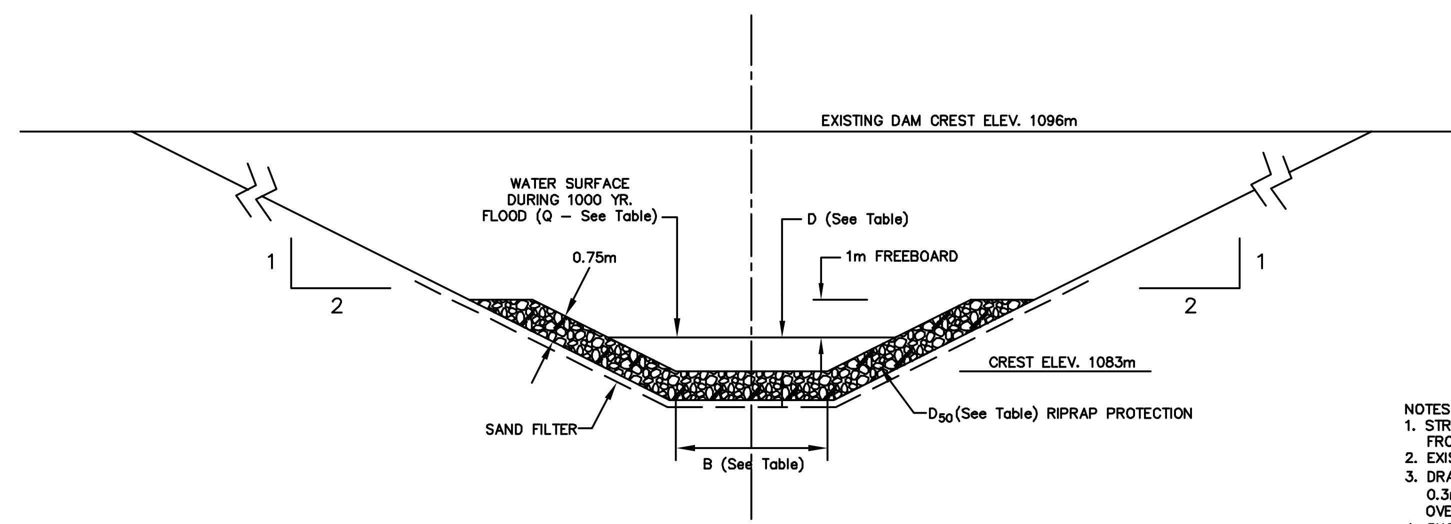
SECTION A–A

0 4 8 12 16 20 metres

1:400

	RECLAIM DAM BREACH CHANNEL	SOUTH DAM SPILLWAY
Q (m^3/s)	15.6	5.4
B (Crest width)	4m	4m
D (Depth of flow)	0.88m ?	0.75m
D_{50} (Riprap)	0.3m	0.3m
Sideslopes	2:1	2:1
Depth of Riprap	0.45m	0.45m
Crest Elevation	N/A	1083m
Channel Slope	0.013	N/A

N/A = Not Applicable



SECTION B–B

0 2 4 6 8 10 metres

1:200

NOTES
1. STRIPPED GROUND SURFACE AND EXISTING DAM ZONES FROM Y.E.S. AS–BUILT DRAWINGS, JULY 1991.
2. EXISTING DAM SURFACE FROM SURVEY COMPLETED AUGUST 1997.
3. DRAIN ROCK FILTER CRITERIA – 5mm ≤ D_{15} ≤ 25mm
   0.3m THICK BEDDING LAYER OF PIT RUN SAND AND GRAVEL OVER SHOT ROCK PLATFORM.
4. SHOT ROCK CONSISTS OF BLASTED LIMESTONE FROM JEWELBOX PIT.

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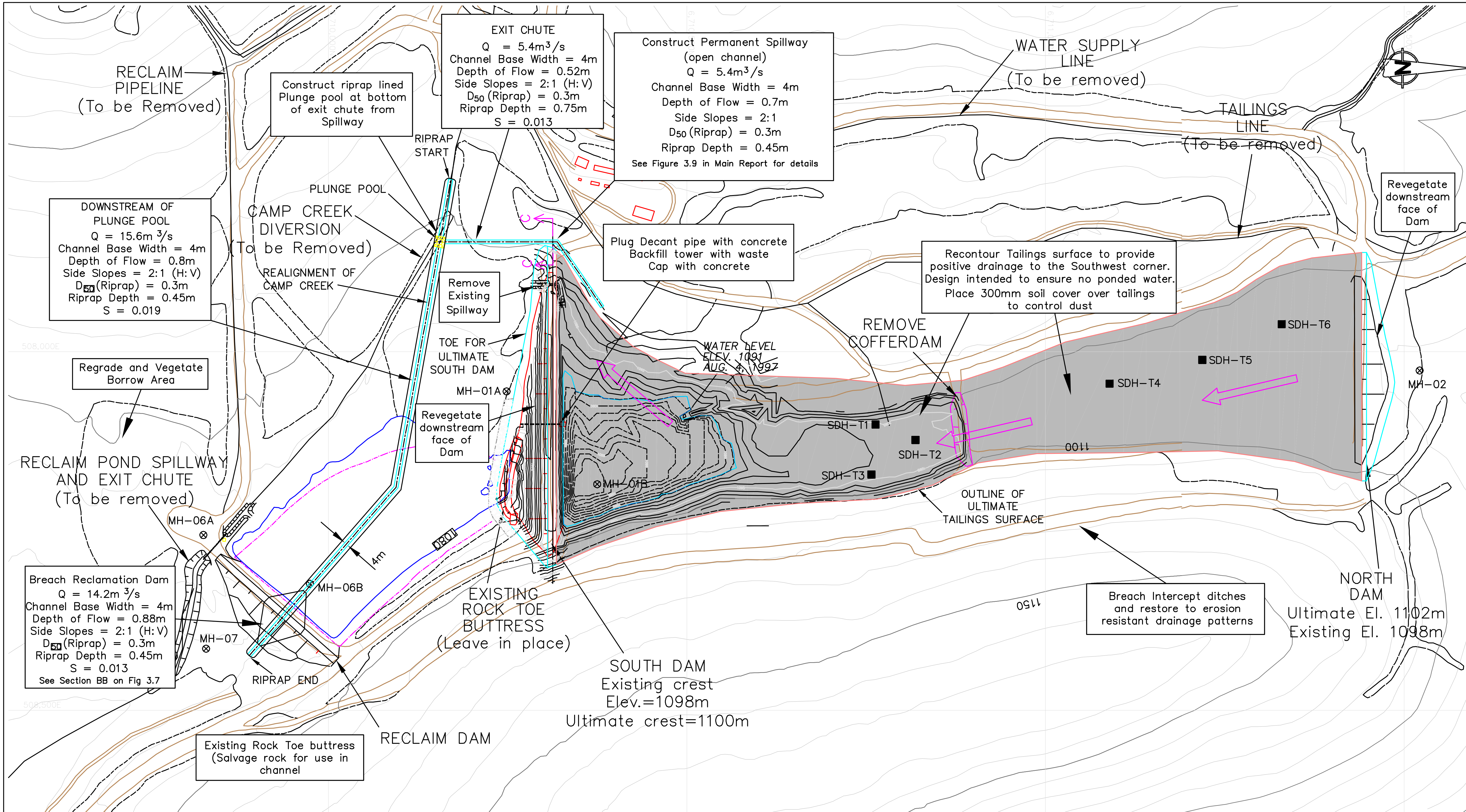
SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

TMF CLOSURE MEASURES – SCENARIO 1
SECTIONS A–A AND B–B

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO. 3-6	REV.
DATE: January 2010	PROJ. NO. 1CC005.05		



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LEGEND

⊗ WATER MONITORING STATION

■ TAILINGS SAMPLE

⇐ SURFACE DRAINAGE

0 50 100 150 200 250

1: 5, 000

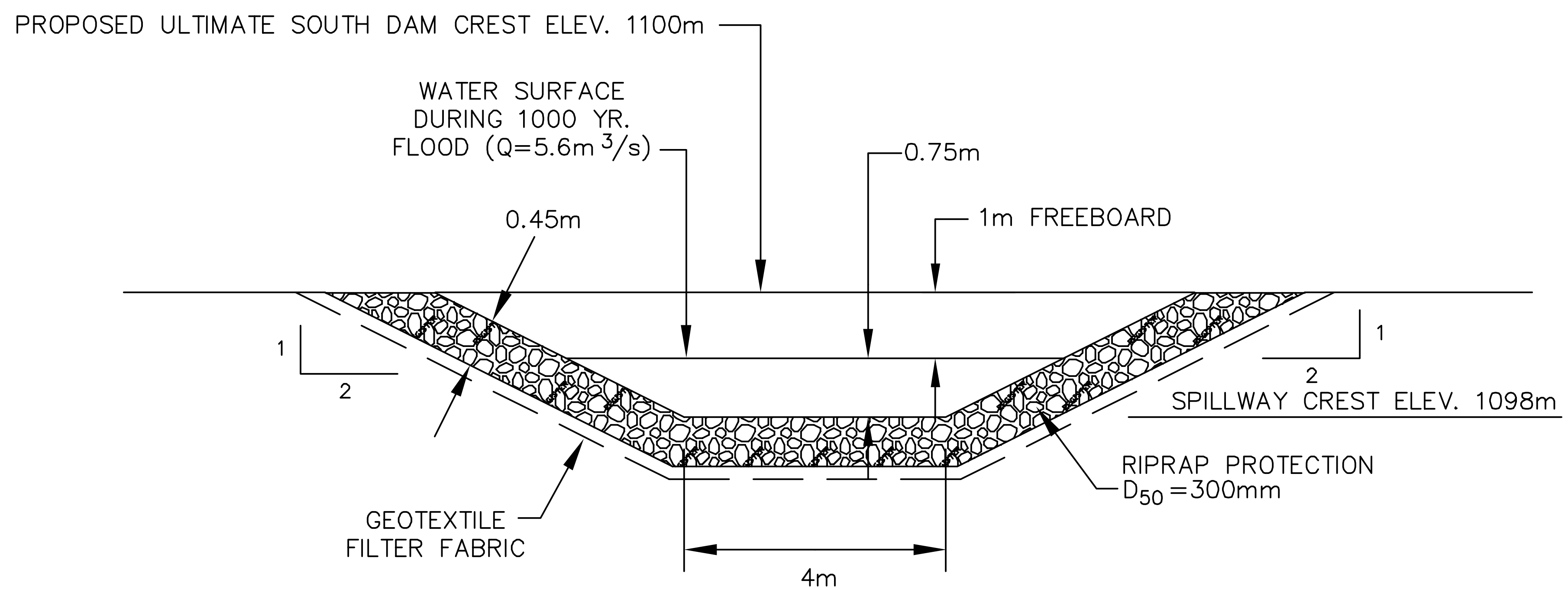
CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

TMF CLOSURE MEASURES SCENARIO 2

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	January 2010	PROJ. NO.	1CC005.05	3-7	



0 1 2 3 4 5 metres
1:100

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SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

TMF SPILLWAY DETAIL
SECTION C–C – SCENARIO 2

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO. 3-8	REV.
DATE:	January 2010	PROJ. NO.	1CC005.05		

In the 2003 Dam Safety Review, the consequence category of this dam was revised and as a result the design flood was verified that the dam would meet the 1000-year event under operations, care and maintenance as well as at closure. A detailed discussion on the revised flood hydrology for the site, including the referenced Figures 1 to 9, is provided in Section 3.1.5 of Appendix B – Flood Estimates.

An extract of this discussion is provided as follows:

To examine the effects of storage on flood magnitude it was necessary to use a rainfall/runoff model that simulates the full flood hydrograph and that provides flood routing capabilities. The model selected for this purpose was developed by the U.S. Corps of Engineers and is known as HEC-HMS.

Figure 5 [Appendix B] *shows the results of applying the HEC-HMS model to the Tailings Management Facility (TMF). The instantaneous peak of the incoming flood hydrograph was estimated to be 5.4 m^3/s. The combined outflow through the two culverts would peak at 1.6 m^3/s, or 30% of the incoming flood peak. During passage of the flood, a volume of 53,000 m_3 of water would be temporarily stored within the TMF. The water level in the TMF would peak at an elevation of 1,094.9 m, which is roughly at the crown level of the two culverts.*

The reclaim pipeline (≅ 300 mm dia.) is located along the west side of the access road to the mill as shown on Figure 3-6. A short section of the pipe near the reclaim pumphouse is buried. The tailings pipeline (≅ 250 mm dia. HDPE) lies, above ground, along the side of the road as shown on Figure 3-6.

Camp Creek is currently diverted into a channel along the west side of the Reclaim Pond and discharges through a twin culvert spillway (two 1.2m dia CSP's) into a riprap lined channel. The channel is designed to accommodate the 200-year flood event. Although there is no requirement to upgrade the design flood from the current 200-year event for these culverts, the impact of the 1000-year flood on the culverts was reviewed. A detailed discussion of the hydrological assessment is provided in Section 3.1.5 of Appendix B - Flood Estimates. An extract is provided below.

***Figure 6 [Appendix B]** shows the simulated flood hydrology for the two culverts at the road crossing of the Camp Creek Diversion. The instantaneous peak of the hydrograph generated by the Camp Creek catchment would be 12.7 m^3/s, including outflows from the TMF. The combined outflow through the two culverts at the road crossing would be an estimated 6.0 m^3/s, or roughly half the peak of the incoming flood. In passing this flood, some 66,000 m^3 of water would be temporarily stored in the Reclaim Pond. Another 36,000 m^3 would be stored in the TMF. The water level would rise to 1081.1 m behind the Reclaim Dam, leaving a freeboard of about 0.9 m below the dam's crest.*

In March of 1992, the previous operators, Curragh Resources, built a rockfill buttress along the toe of the Reclaim dam to provide extra protection against sloughing and erosion of the toe. Annual inspections of this buttress show that it is performing as designed.

In September 1992, work commenced on a 2-metre raise in the elevation of the South Dam with the intention of bringing it up to 1,098 m elevation. Work on the extension was shutdown on October 14, 1992 because of the construction difficulties experienced due to sub-zero temperatures. In 2008 it was identified that a short section of the crest of the dam was below the design elevation. Work completed in 2009 added approximately 0.5 meters to the crest elevation in the low spot under the supervision of a Geotechnical Engineer. The remaining work will be completed in 2010 under the direct supervision of a Geotechnical Engineer.

In 1997 work was initiated on a toe buttress at the South Dam in advance of the planned reopening of the mine in 1998. Although the decision to re-open the mine was postponed, the buttress was completed in the fall of 1998.

Interceptor ditches are located above the TMF on the east side of the catchment. These ditches direct runoff away from the TMF both to the north and the south. Drainage ditches associated with the access roads on the west side of the TMF direct runoff away from the TMF on the west side.

3.3.3. *Closure Issues*

The long-term physical stability of the tailings embankments and the chemical stability of the tailings are the key items that have been addressed in this closure plan. The key physical stability issues are related to the design flood and seismic events. The only chemical stability issue, as discussed in Section 4 of Appendix B, is related to the zinc loading from the tailings.

(i) Physical Stability Issues

As the Reclaim Dam will be breached after closure in both of the two scenarios being considered, the physical stability of this structure is not addressed in the plan. Furthermore, as the South Dam will also be breached in Scenario 1, the physical stability of the current configuration of the South Dam will not be discussed.

The stability analyses of the tailings embankments, which is presented in Section 10 of Appendix B, concluded that both dams for both closure scenarios will have an adequate factor of safety under both static and seismic loading.

However, physical stability of the South Dam requires that a spillway be constructed to pass the mean annual runoff and peak flood events. The spillway has been designed for the 1000-year return event.

The selection of the 1,000 year design event for the emergency spillway at the South Dam for scenario 2, is based on the guidelines presented in Table 8 of the report entitled "*Mine Reclamation in the Northwest Territories and The Yukon*", Indian and Northern Affairs Canada (INAC), 1992. The size of the embankment is classified as large (>7.5m), but the potential impact or hazard associated with the failure of the spillway is considered to be moderate. In the event of a spillway failure, limited tailings and embankment material would be released and transported downstream into False Canyon Creek. The tailings are not acid generating, but once the flood levels have subsided, there is potential for a moderate increase in metal concentrations such as zinc in the stream due to oxidation of sphalerite in the exposed tailings. There would be no loss of life expected, no damage to buildings or agricultural land, and no loss to roads.

This spillway design is considered conservative. There is a freeboard of 1.1 m above the 1,000 year, which would easily accommodate the PMF of 14.8 m^3/s without overtopping. Furthermore, the spillway design ignores the attenuation effect of the impoundment. If the flood is routed through the spillway allowing for this attenuation effect, the current design is expected to accommodate the PMF with freeboard. Analyses using the rainfall model and routing the 1000-year storm through two 900 mm culverts indicated that the freeboard below the current 1097 m crest elevation under current conditions would be 2.1 m. A review of the PMF under Scenario 2 closure condition for the Tailings Management facility concluded that the peak outflow would be 14.2 m^3/s (based on the Rational Method). Given the configuration of the final spillway (see Figure 3-9), the PMF would be accommodated without overtopping of the dam.

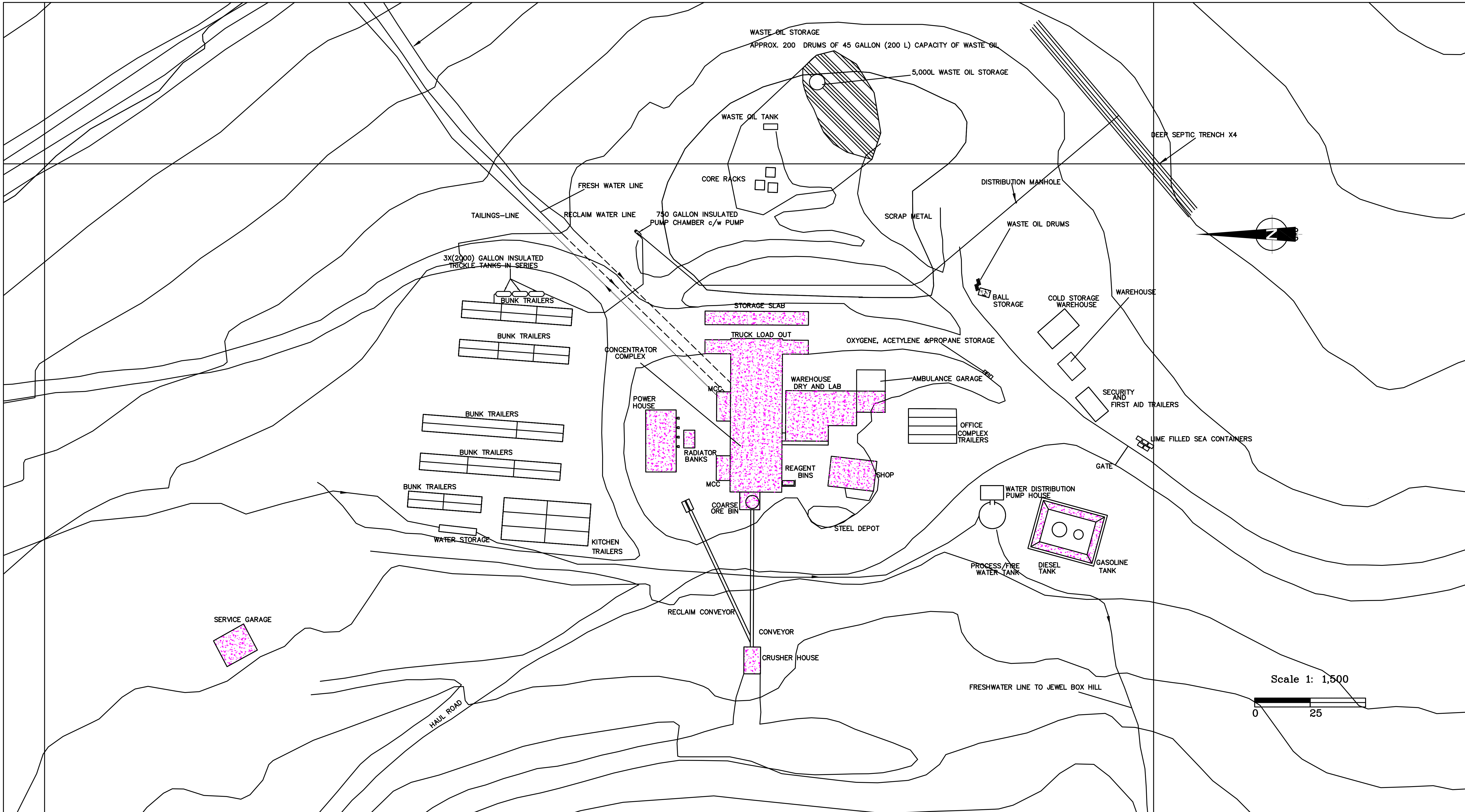
With the present spillway design, it is expected that minimal maintenance would be required following a 1,000 year event. In the event of a 1000 year flood event, an inspection of the site will be conducted to determine if any maintenance work is required.

(ii) Chemical Stability

As discussed in detail in Section 4.4 in Appendix B under Scenario 1, the zinc load from the tailings is not expected to have a significant impact on the receiving water quality at MH–11 or MH–16, and consequently no additional engineered measures to control leaching are required for closure. Furthermore, since temporary shut down of the mine in 1992, effluent water quality levels have been in compliance with the water licence.

Based on the most recent water quality monitoring data collected at MH-02 for 2009 (Appendix B, Section 3.3.1.3), total metals concentrations for zinc have increased over the past year but remain well under permit levels. The reason for this increase is currently not known, and as a result further work will be initiated in 2010 to investigate possible reasons.

Although more tailings will be deposited into the TMF for the scenario 2, the actual zinc load in the long-term would not increase because the tailings surface area exposed to oxidation will not change significantly. Similarly, no additional control measures for chemical stability of the tailings are required for Scenario 2.



Legend

CONCRETE SLAB

OIL WASTE DRUM STORAGE AREA

UNDERGROUND WATER LINE

UNDERGROUND TAILINGS LINE

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SÄ DENA HES DRAFT DETAILED DECOMMISSIONING AND RECLAMATION PLAN

Infrastructure- Mill and Office Complex Detail
Current Conditions

DRAWN BY: ASH	CHECKED BY: RLM	Fig No. 3-9
Jnaurary 2010	SCALE 1:1,500	

3.3.4. *Closure Measures (Scenario 1)*

General closure measures for the Tailings Management Facility are presented in Figure 3-6.

3.3.4.1. Tailings Embankments

At closure, the majority of the ponded water above the South Dam will be siphoned into the reclaim pond. Final draining will be by pumping down to a level that will enable construction and demolition work to proceed at the toe of the dam. As discharge from the TMF is limited under the current water licence, careful management of the drawdown and discharge will be required to ensure compliance with the licence. The South Dam will be breached at the low point in the dam and a permanent spillway constructed within the breach at a crest elevation of 1,083 m. Breaching of the dam will be done by removing the material by excavator and rock trucks.

The design of the spillway will result in a small pond of water forming upstream of the dam that will fluctuate seasonally. Details of the spillway are discussed in Section 3.3.4.6. The sideslopes of the South Dam will be revegetated to provide erosion control. The existing CSP spillway will be removed. The cofferdam will be cut down flush with the tailings and the sluice gate and pipe beneath the dyke will be removed.

As the stability analyses concluded that the North Dam has adequate factors of safety against failure under both static and seismic conditions, no specific action to stabilize the dam is required. However the downstream slope will be vegetated to provide erosion control.

3.3.4.2. Dust Control

To prevent ponding of water on the surface of the tailings, the latter will be recontoured to provide positive drainage towards the south end of the impoundment. A nominal 300 mm cover of soil will be placed over the contoured tailings to control dust and provide a growth medium for revegetation. Where required (i.e. where there is significant moisture), mine waste rock will be placed on the tailings to provide a suitable sub-base so that heavy equipment are able to work on the tailings surface without becoming stuck. The soil will consist of locally available till with sufficient fines for seeding and planting.

As the southern extent of the existing tailings deposit is currently covered with water, the proximity of the tailings to the upstream toe of the dam and the depth of the tailings is unknown. However, an estimate of the extent of the tailings was made and is shown on Figure 3-6.

3.3.4.3. Interceptor Ditches

The interceptor ditches on the east hillside above the TMF will be breached and regraded to restore the ground to erosion resistant drainage patterns.

3.3.4.4. Tailings Pond Decant Tower

The decant tower will be dismantled to ground level and the resulting debris buried on site. All exposed rebar will be cut off. The decant pipe will be completely filled with concrete to eliminate the possibility of corrosion resulting in settling of the dam or tailings escaping through a hole in the pipe. This practice is consistent with current requirements of the Ministry of Energy and Mines in British Columbia.

3.3.4.5. Tailings Pipelines

The high density polyethylene (HDPE) tailings pipelines will be salvaged, and all drop boxes will be removed.

3.3.4.6. South Dam Spillway

The tailings impoundment spillway located within the breach of the South Dam is shown in Figure 3-6. It has been designed to pass the 1000-year flood event. Details of the hydrology and flood estimate for this event are presented in Section 3.1 of Appendix B. The design flow was estimated to be 5.6 m^3/s. Sections of the proposed spillway are shown in Figure 3-7. Once the South Dam is breached in Scenario 1, the flow through the breach will be related to the drainage area upstream. However, seepage flow through the tailings, which is anticipated to be a small component of the overall flow, will be influenced by the permeability, the depth, and the areal extent of the tailings impoundment (1.33 km).

The spillway crest and sideslopes will be riprapped with suitably sized material. Below the spillway, a riprapped channel will convey the flow to the restored Camp Creek as shown on Figure 3-6. Details of the channel geometry are presented in the table on Figure 3-6.

As discussed above and in Appendix B Section 3.1.5 – Flood Estimates, the 1,000-year design flood would have a peak flow of 5.4 m^3/s. The configuration of the breach (Scenario 1) has not changed and is shown as Figure 3-7.

3.3.4.7. Reclaim Pond

(i) Reclaim Dam

At closure, the water ponded behind the dam will be siphoned down as far as practical and the remainder then pumped down to a workable level. During the final pumping process sediment control measures may be required. As discussed above, discharge of the water to Camp Creek will be planned to ensure compliance with licence requirements. Once the water is removed, an assessment will be completed of the sediment that has accumulated over time in the bottom of the pond. The sediments will be analyzed for metals levels. If significant elevated metals are discovered, then the pond will either be capped, or the sediments will be hauled to the main tailings pond area for capping and reclamation. A riprapped channel will need to be constructed from the outlet of the South Dam spillway to the confluence with the restored Camp Creek. A similar riprapped channel will also be required to convey the flow in Camp Creek through the Reclaim Dam breach. Both channels will be designed for the 1,000-year flood event. Details of the channel are provided on Figure 3-6.

(ii) Channel in Breach

The location of the channel through the breach in the Reclaim Dam (not a spillway) is shown in Figure 3-6. It has been designed to pass the 1,000-year flood event. Details of the hydrology and flood estimate for this event are presented in Section 3.1 of Appendix B. The design flow is estimated to be 15.6 m^3/s. A section through the channel in the breach is similar to the spillway section at the South Dam and is shown on Figure 3-7. The breach flow would include the contribution from the entire catchment of Camp Creek (4.47km^2). The channel will be riprapped to provide erosion protection. Below the reclaim dam breach, the channel will be riprapped for a distance of about 70 metres.

(iii) Camp Creek Diversion

At closure the Camp Creek diversion will be breached and contoured to provide natural drainage patterns. Camp Creek will be restored to its original alignment within a riprapped channel designed to accommodate the 1000-year event. Details sections of the channel are presented on Figure 3-6.

(iv) Reclaim Lines

The existing HDPE reclaim lines on surface will be salvaged and all culverts used to convey the line to the mill will be removed. The pumphouse will be removed, and the buried sections of the reclaim line and the discharge pipe to the existing Camp Creek spillway channel will be left in place.

3.3.5. *Closure Measures (Scenario 2)*

3.3.5.1. Tailings Embankments

At closure, assuming Scenario 2, both the North and South dams will remain in place. The downstream slope of the North Dam will be revegetated and the crest of the dam will be cut down flush with the tailings surface. The cut material will be pushed out over the tailings surface as part of the overall tailings cover.

The crest of the South Dam will also be cut down flush with the final surface of tailings. However, as a permanent spillway will be constructed at the west abutment of the South Dam (see Section 3.3.5.6 for details), a 1m freeboard will be left above the contoured tailings in this area to provide an approach apron for the spillway.

The downstream slope of the South Dam will be revegetated to provide erosion control. The stability analyses concluded that the stability is adequate without any modifications or upgrading of the dam.

3.3.5.2. Dust Control

The surface of the tailings will be recontoured to provide positive drainage towards the southwest corner of the impoundment. A 300 mm cover of soil will be placed over the contoured tailings to control dust and provide a suitable growth medium for revegetation. The soil cover will be re-vegetated as discussed in Section 3.6.

3.3.5.3. Interceptor Ditches

As for Scenario 1.

3.3.5.4. Tailings Pond Decant Tower

As the pond is raised, the decant tower will be raised accordingly. Any section of the tower remaining above the tailings surface will be cut down flush with the tailings and covered with available material. At closure, the decant pipe would be plugged with concrete through its entire length, and the tower filled with waste rock. The surface of the pond will be contoured to provide drainage away from the backfilled tower, therefore no ponding of the water will occur. This practice is consistent with the current requirement of the Ministry of Energy and Mines in B.C.

3.3.5.5. Tailings Pipelines

As for Scenario 1.

3.3.5.6. South Dam Spillway

The tailings impoundment spillway will be located in native soil at the west abutment of the South dam as shown in Figure 3-8. It has been designed to pass the 1000-year flood event. Details of the hydrology and flood estimate for this event are presented in Section 3.1 of Appendix B. The design flow is 5.4 m^3/s. A section through the proposed spillway is shown in Figure 3-9. The flow would include the contribution from the entire catchment of the Tailings impoundment (1.33 km^2). The spillway crest and adjacent slopes will be riprapped. Below the spillway, a riprapped channel will convey the flow to the restored Camp Creek as shown Figure 3-8. As the flow during the 1000-year event will be supercritical, a plunge pool to dissipate the energy will be required at the confluence with the Camp Creek Channel as shown on Figures 3-6 and 3-8.

3.3.5.7. Reclaim Pond

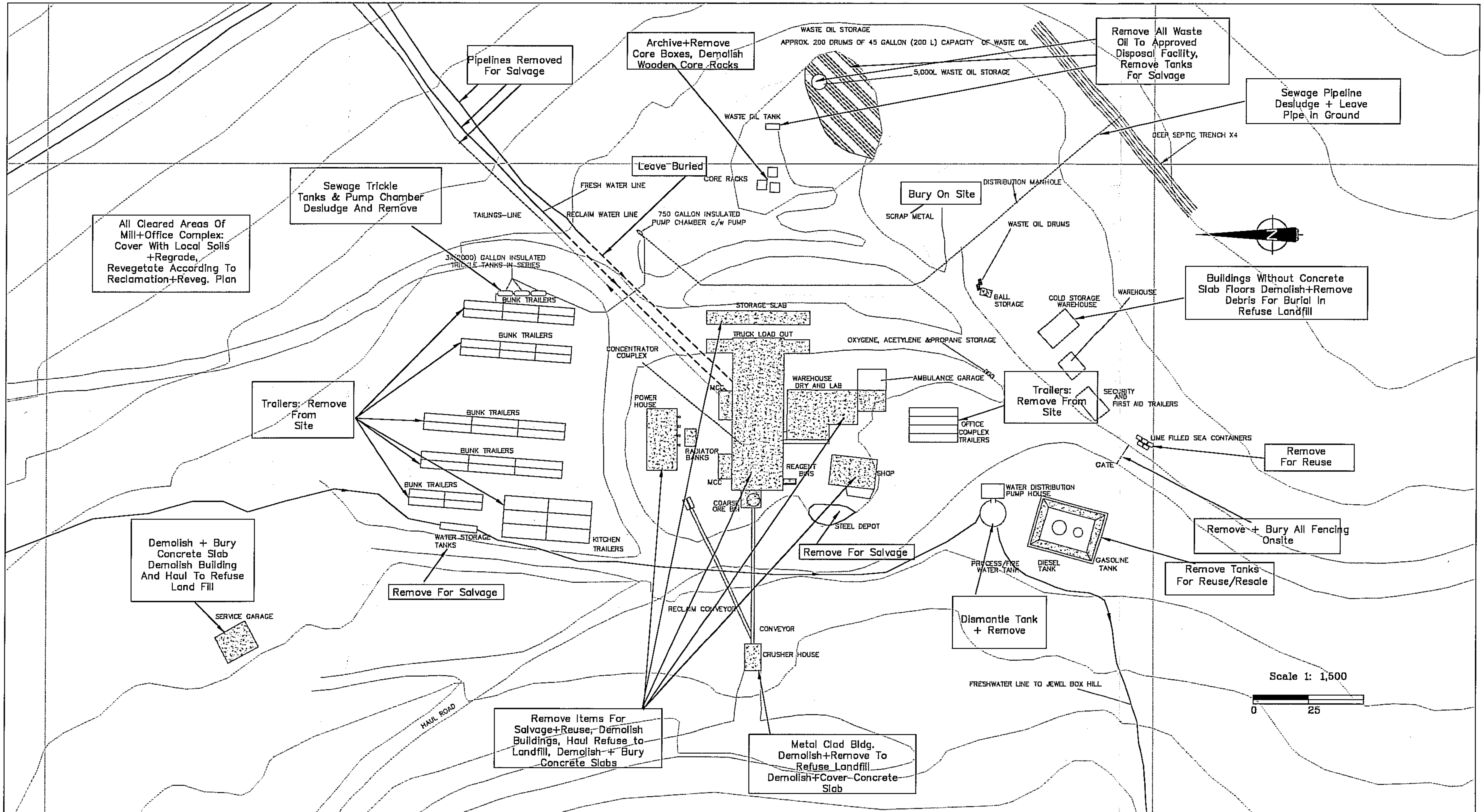
As for Scenario 1

3.4 INFRASTRUCTURE: BUILDINGS, STRUCTURES AND SERVICES

The approach to the decommissioning of the constructed infrastructure is to completely remove all materials with the exception of concrete foundations, which will be demolished and buried *in situ*. This will be accomplished by contracting the work out to a company experienced in demolition. It is expected that there will be a salvage value for much of the materials (particularly structural steel and other crushing, grinding and processing equipment from the mill). However, salvage values have not been used to offset closure costs.

In all cases, concrete foundations and other concrete structures will be broken up to ground level and buried.

The reader is referred to Figure 3-10, Mill Site Plan, for the location of the infrastructure components that are dealt with in this section.



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Legend

OIL WASTE DRUM STORAGE AREA

CONCRETE SLAB

----- UNDERGROUND WATER LINE

.... UNDERGROUND TAILINGS LINE

SÄ DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

Infrastructure- Mill and Office Complex Detail

Closure Measures

DRAWN BY: ASH	CHECKED BY: RLM	Fig No. 3-10
January 2010	SCALE 1:1,500	

Closure issues related to infrastructure include public health and safety, site stabilization aesthetics, and restoration of disturbed lands.

The approach to closure for the infrastructure components of Sä Dena Hes is to first salvage any equipment that may be used at other mining operations that are within a feasible hauling distance, and then assess the remaining facilities and equipment for disposal through demolition and salvage contracts. It is impossible at this time to accurately predict freight haulage costs and supply and demand economics for salvage at the time of closure; however, closure measures assumptions have been made based upon current market conditions. If it is not economical to remove material from the site, it will be buried in an approved landfill.

Table 3-1 provides a brief dimensional description of the various infrastructure components, and Figure 3-10 depicts the general arrangement of the central office, accommodation and mill site buildings and services. Figure 3-11 depicts the generalized closure measures for this area.

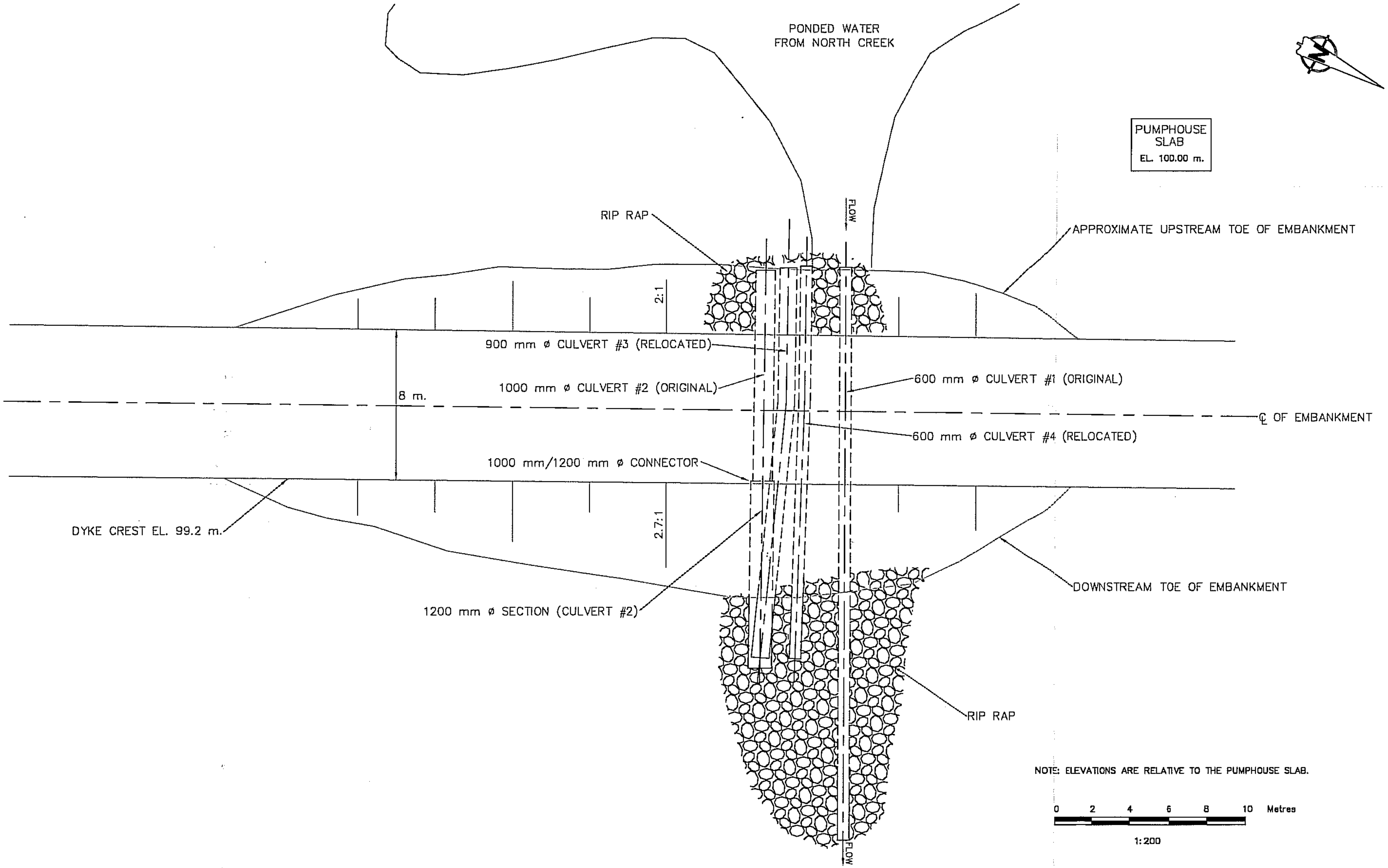
Other infrastructure and facilities associated with outlying mine components are listed in Table 3-1, and are depicted on the drawing particular to each component (Figures 3-3 and 3-5).

An engineered landfill facility will be constructed for the disposal of non-putrescible waste with no salvage value generated during closure activities. The reader is referred to Section 3.5.5 for a discussion of this facility.

3.4.1. *Concentrator Buildings*

The ore concentrator (the “mill”) is comprised of the mill building itself, the crusher house, conveyors, and truck load out facility. All buildings are steel frame construction on concrete slab flooring. A list of equipment currently located in the mill is found in Table 3-2.

The mill building itself houses what is expected to be the most attractive components from a salvage perspective; in particular, the ball and sag mills and structural steel, as well as other scaffolding and processing equipment.



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SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

PLAN OF NORTH CREEK DYKE

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO. 3-11	REV.
DATE: January 2010	PROJ. NO. 1CC005.05		

Table 3-1 Infrastructure Description

Component	**Description (see Figure 3-9 for layout)**
	(Note all concrete slabs 0.20 m thick)
Concentrator Buildings	
Concentrator Complex	Area of 1,761 m^2, 352 m^3 concrete slab
Crusher House	8 m x 12 m, Metal Building, 91 m^3 concrete slab
MCC	6 m x 11 m metal building, 14 m^3 concrete slab
MCC	6 m x 13 m, 16 m^3 concrete slab
Reagent Bins	2 m x 5 m , 2 m^3 concrete slab
Coarse Ore Bin	9 m x 8 m , 14 m^3 concrete slab
Power House	13 m x 27 m, Metal Building, 77 m^3 concrete slab
Service Garage	13 m x 15 m, Metal Clad Building, 41 m^3 concrete slab
Accommodation Buildings	
Bunk Trailer x 10	7 m x 33 m, Metal Trailer
Bunk Trailer x 10	8 m x 64 m, Metal Trailers
Bunk Trailer x 10	8 m x 50 m, Metal Trailers
Kitchen Trailers x4	19 m x 39 m, Metal Trailer
Office Trailers Complex	22 m x 23 m, 98 m^3 concrete slab
Miscellaneous Buildings/ Structures	
Ambulance Garage	13 m x 10 m, Metal Building
Water Distribution + Pump House	Area= 182 m^2, Metal Clad Building
Warehouse	10 m x 8 m, Metal Clad Building
Security and First Aid Building	8 m x 14 m, Metal Trailer
Cold Storage Warehouse	10 m x 16 m, Metal building
1480 Portal Shop	20 m x 10 m metal clad building, earth floor, concrete footings
1480 Portal Office	4 m x 10 m Atco trailer
1480 Portal Fuel Tanks	2 tanks 2,000 l, in bermed enclosure
Burnick 1200 Portal Shop	40 x 20 m metal clad building, earth floor, concrete footing
Burnick 1200 Portal Fuel Tank	
Miscellaneous Core Racks, Gribbler Ridge	Wooden structures
Water Storage	17 m x 3 m, storage tank
Radiator Banks	5 m x 8 m, 8 m^3 concrete slab
Storage Slab	6 m x 47 m, 57 m^3 concrete slab
Warehouse and Dry Lab	Area of 760 m^2, 152 m^3 concrete slab
Ball Storage	3 m x 5 m, 3 m^3 concrete slab
Diesel – 5,000 l; Gasoline – 2,000 l	Area of 729 m^2, 56 m^3 concrete slab
Decant Tower	50 m^3 reinforced concrete structure
North Creek Dyke	
1480 Portal Electrical Transformer	Power poles, chain link fence
Water Intake Pumphouse/Shop	2 m x 3 m wooden sheds (x3); 1.2 m^3 concrete pad

Table 3-2 Mill Equipment List

EQUIPMENT	MANUFACTURER	QUANT.	SIZE	REMARKS
Grizzly		1	760mm x 760mm	
Rock Breaker	Teledyne	1	30 kW	Hydraulic
Reciprocating Feeder	Universal engineering	1	1525mm x 4267mm	
Jaw Crusher	Allis Chalmers	1	1220mm x 1067mm	Used
Ore Conveyor	Trans-Continental	1	900mm	500 t/p
Belt Magnet	J.F. Comer	1	3 H.P.	
Reclaim Conveyor	Trans-Continental	1	900mm	250 t/h
Reclaim Vibrating Feeder	AISCO	1	1067mm x 2240mm, 5 H.P.	
Ore Bin	GEM Steel	1	200t	
SAG Vibrating Feeder	AISCO	1	1067mm x 2240mm, 5 H.P.	
SAG Feed Conveyor	Trans-Continental	1	900mm	100 t/h
SAG Mill	MPSI	1	5500mm DIA. x 2134mm, 970 H.P., Var.Sp.	
Liner Handler	McLellan Industries	1		
SAG Discharge Pumps	G.I.W.	2	150mm x 100mm, 60 H.P.	
Vibrating Screens	Simplicity	1	1525mm W x 3600mm L, 10 Mesh, 25 H.P.	
Ball Mill	Allis Chalmers	1	3050mm DIA. x 3680mm, 900 H.P.	Used
B.M. Disch. Pumps	I.T.T.	2	250mm x 200mm, 60 H.P.	
B.M. Cyclones	Technequip/Krebs	2	D20B	
Lead Unit Flotation Cells	Outokumpu	4	$5.1m^3$, 25 H.P./Cell	
Lead Unit Cell Blower	Roots	1	$297m^3$/hr, 24.8 kPa	
Flotation Cells, Lead Rgh and zinc Rgh	Denver	2 sets, 15/set	$5.7m^3$, 25 H.P./Cell	Used
Lead and Zinc CLNR Flotation Cells	Denver	2 sets, 14/set	$1.4m^3$, 7.5 H.P./Cell	
Lead Regrind Mill	Taylor	1	1830mm x 2140mm, 150 H.P.	
Lead Rgr Cyclones	Techniquip/Krebs	3	D6B	
High Rate Thickener	Outokumpu/ Supaflo	2	4600mm DIA.	
Lamella Clarifier	Lamella	2	570mm x 55°	
Slurry Storage Tank	GEM Steel	3	5500mm DIA. x 14000mm	
Pressure Filters	Filtra Systems	2	Lead-$28m^2$, Zinc-$32m^2$	100 psi
Concentrate Bin	GEM Steel	2	3500mm DIA. x 9000mm	

EQUIPMENT	MANUFACTURER	QUANT.	SIZE	REMARKS
Minifab Flocculant Mixer	Allied Colloids	1	1m^3	Flocculant Mixing
Lime Grinding Mill	SALA	1	900mm DIA. x 1525, 10 H.P.	
Fresh Water Tank	GEM Steel	1	200,000 USG	
Flotation Air Blower	Spencer	1	21240 Im^3/hr, 14.5 kPa	Used
Air Compressor	Ingersol Rand	2	2550m^3/hr, 750 kPa, 350 H.P.	
Air Dryer	Xebic	1	170 Im^3/hr, 758 kPag	
Pressure Filter air Receiver Tank	Ingersol Rand	1	1830mm DIA. x 4000mm	
Courrier 30 OSA	Outokumpu	1	10 streams, Lead Zinc, Iron, % solids	
DCS	Fisher Controls	1		
PLC	Allen Bradley	1		
Truck Scale	Canadian Weigh Scale	1	100 t	Computerized loading system
Diesel Generator	Midwest	2	2 MW	
Diesel Generator	Midwest	2	1 MW	

Note: Unless otherwise stated, dimensions are in millimetres

Buildings and equipment that are not salvaged will be demolished and the debris will be hauled for burial in the main permitted refuse landfill, or landfilled on site under YG Environment permitting requirements. The concrete foundations will be demolished to ground level, and the rubble will be buried on site and covered with till material.

3.4.2. *Power House and Power Lines*

The power house contains three diesel generators which supply power for the entire mining operation. It is expected that these generators will have an appreciable salvage value, which would be realized upon closure. The power is distributed via approximately 6 km of three phase, overhead power lines. There is also approximately 600 metres of 60 mm dia. "TEC" cable leading from Jewelbox 1440 portal to the Main Zone pit. The distribution lines would be respooled for salvage or buried. The power poles (approx. 120) will be removed and either sold for salvage if in good condition, or sawn and buried in the refuse landfill if in poor condition.

It is not known if the power poles that were installed by the previous operator were treated with a preservative such as creosote. If it turns out that they are creosote-treated, the contaminated portion of the poles will be disposed of in conformity with the *Special Waste Regulations* of the Yukon Environment Act.

3.4.3. *Water Supply*

The water supply system consists of a series of three electrical 100 hp water pumps housed in 2.5 m x 2 m wooden shacks. These pumphouses are located in the lower North Creek drainage (Figure 3-1). The pumps will be removed for salvage and the shacks removed. The approximately 2 km of water line (300 mm dia.) will be removed for salvage. The entire disturbed area around the pumphouses at False Canyon Creek was previously reclaimed (see Section 3.6 *Land Reclamation and Revegetation* for a discussion of this activity).

3.4.4. *North Creek Dyke*

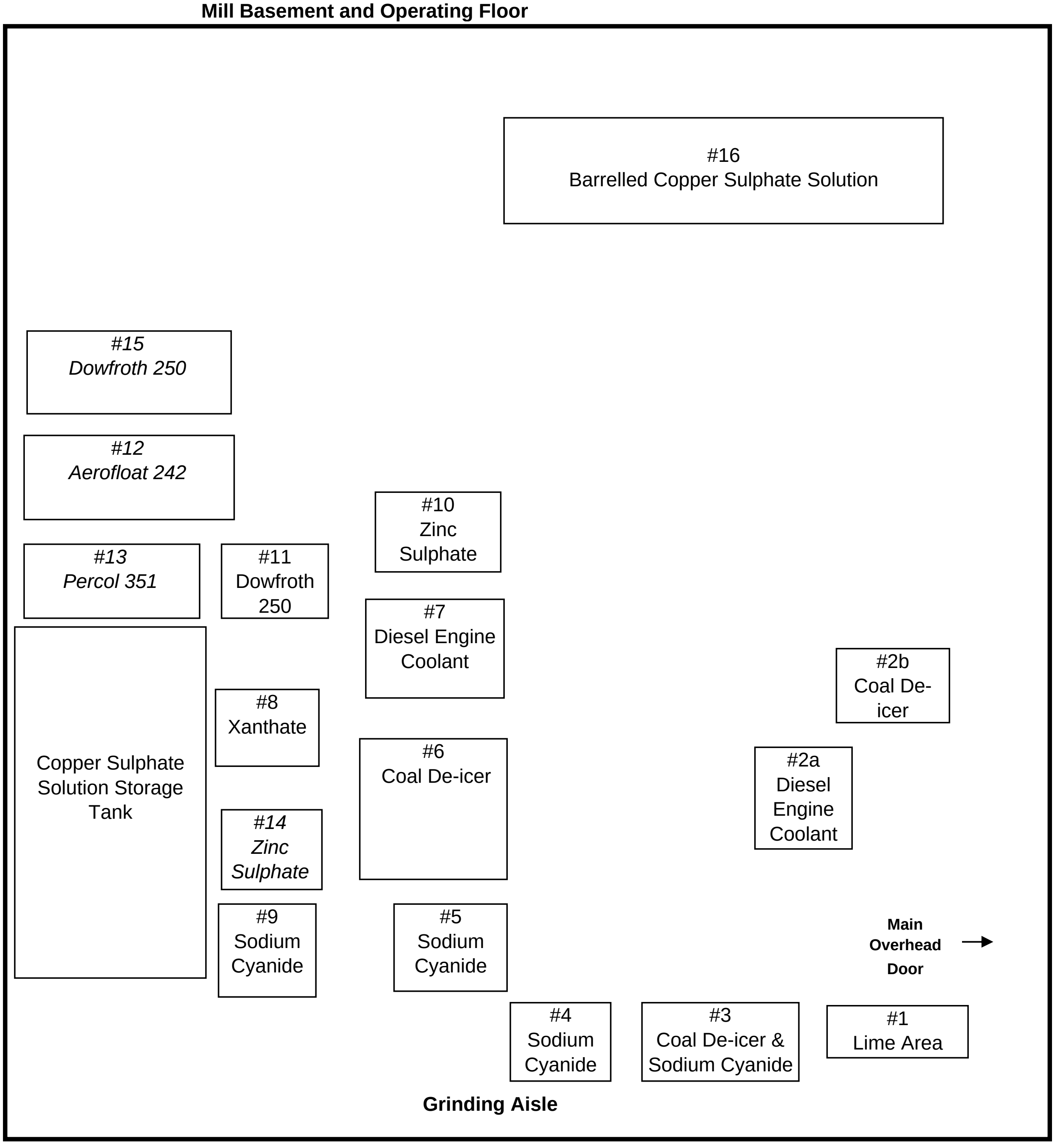
(i) Description

The North Creek dyke is located about 1 km north of the existing tailings impoundment, as shown in Figure 3-12. The dyke was constructed in the summer of 1991 by Golden Hill Ventures (GHV). The dyke was constructed to provide a reservoir from which water was pumped to the northern end of the tailings impoundment in preparation for the start-up of the mill.

The dyke has a maximum height above original ground of about 5 m and is about 50 m in length. Fill used to construct the dyke is a silty sandy till and it is estimated that about 2000 m^3 of this material was placed.

A 600 mm dia. pipe at the base of the dyke allows flow in the North Creek to pass through the dyke. Three other culverts varying in size from 600 to 1000mm in dia. provide capacity to pass the 200-year event. A plan of the dyke showing the current location of the culverts and layout of the dyke is shown on Figure 3-12.

Figure 3-12 **Plan View - Current Locations of Chemicals and Reagents at the Sa Dena Hes Mine Site - Mill Basement and Operating Floor**



NB: Storage Locations (12, 13, 14, 15) are on Operating Floor, in Reagent Mix Area

(ii) Closure Measures

At closure the dyke will be breached and the culverts will be removed. Riprap will be placed across the breach to provide erosion protection. The size of the breach will be based on the 1000-year event.

3.4.5. *Accommodation/Camp Buildings*

The campsite accommodation was provided by approximately 30 sleeping/wash Atco trailers and 6 kitchen/recreation Atco trailers. The trailers will be demolished, and all piping and cable connections cut at ground level. These trailers are no longer functional and would need to be replaced as part of startup activities

3.4.6. *Explosive Magazine*

Assuming the mine reopens prior to the implementation of this closure plan, additional explosives magazine(s) would be brought to site and used. The closure measure for explosives magazines would be to either return these to the supplier for credit, or to sell for salvage. Unused explosives will be checked for condition and either returned to the supplier for credit where in safe condition or destroyed through appropriate procedures. Detonation devices will be returned to the supplier for credit.

3.4.7. *Miscellaneous Buildings & Structures*

- The office complex consists of six Atco trailer units set up on wood block footings and joined under a common roof. Useable office furniture and equipment will be sold where appropriate, offered to local service organizations or shipped to other Company facilities where economically feasible. The skirting and roofing materials will be destroyed, the trailers hauled away from the site or destroyed, and the ground surface regraded, recontoured, and revegetated.

- At the Jewelbox 1480 Portal, there was a 13 m x 40 m metal shop building with earthen floor and concrete footings. The building collapsed under snow load in 2007 and has been demolished and refuse buried nearby in an approved landfill site. Concrete footings will be demolished and buried at site under 400 mm of till cover. Fuel tanks will be hauled away for salvage. Fuel berms are to be recontoured, the liner removed and hauled to refuse landfill. There is also a mine office trailer at this location. It will be hauled away from the site. The power transformer and power line will be removed for salvage, power poles destroyed or hauled out for salvage depending on conditions; chain link fencing enclosure demolished and buried on site. Any hydrocarbon contaminated soils will be treated in an appropriate manner.

- At the Burnick 1200 Portal, there is a 13 m x 40 m metal shop with an earthen floor and concrete footings. This building will be sold for salvage. Any soil contamination will be removed for treatment and the site decompacted and revegetated.

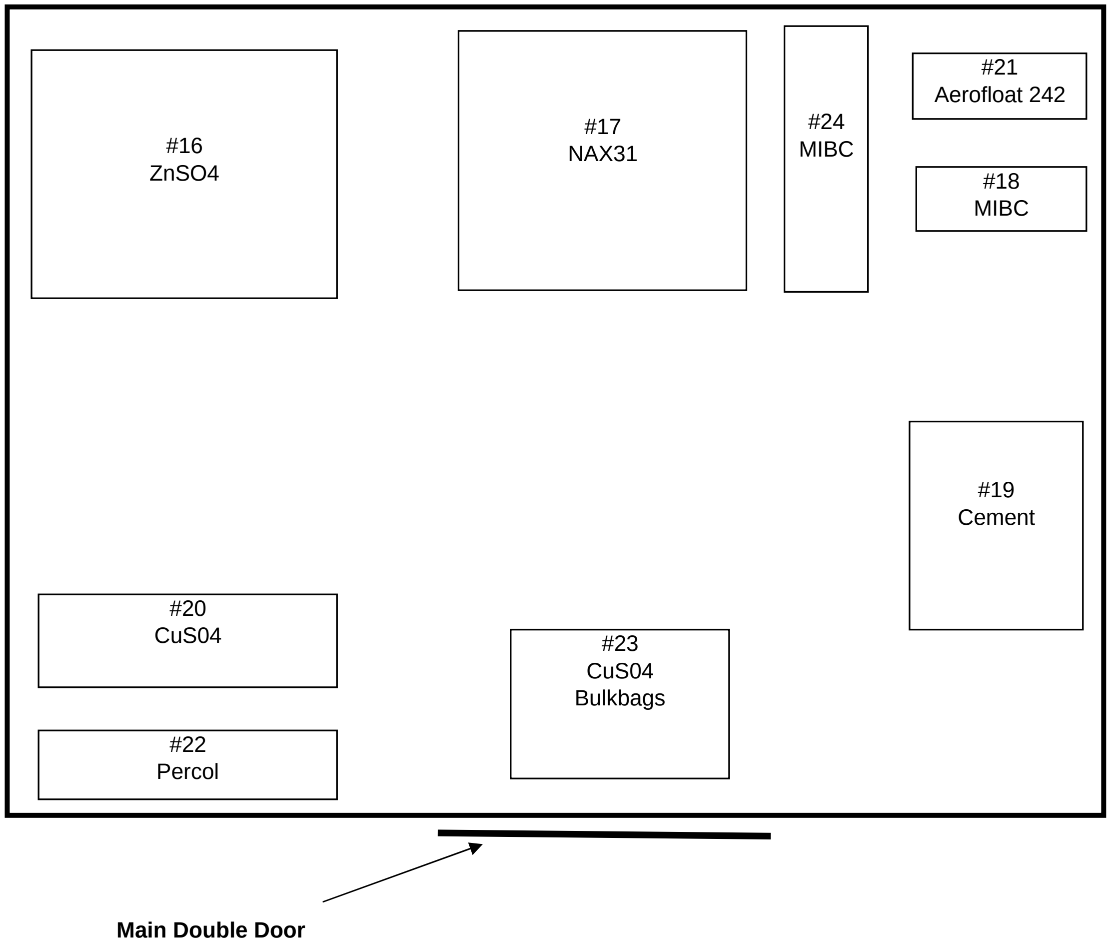
- At the Burnick 1300 Portal, there is a 2 m x 4 m safety shack which will be demolished and the debris removed to the landfill for burial. The site is to be regraded.

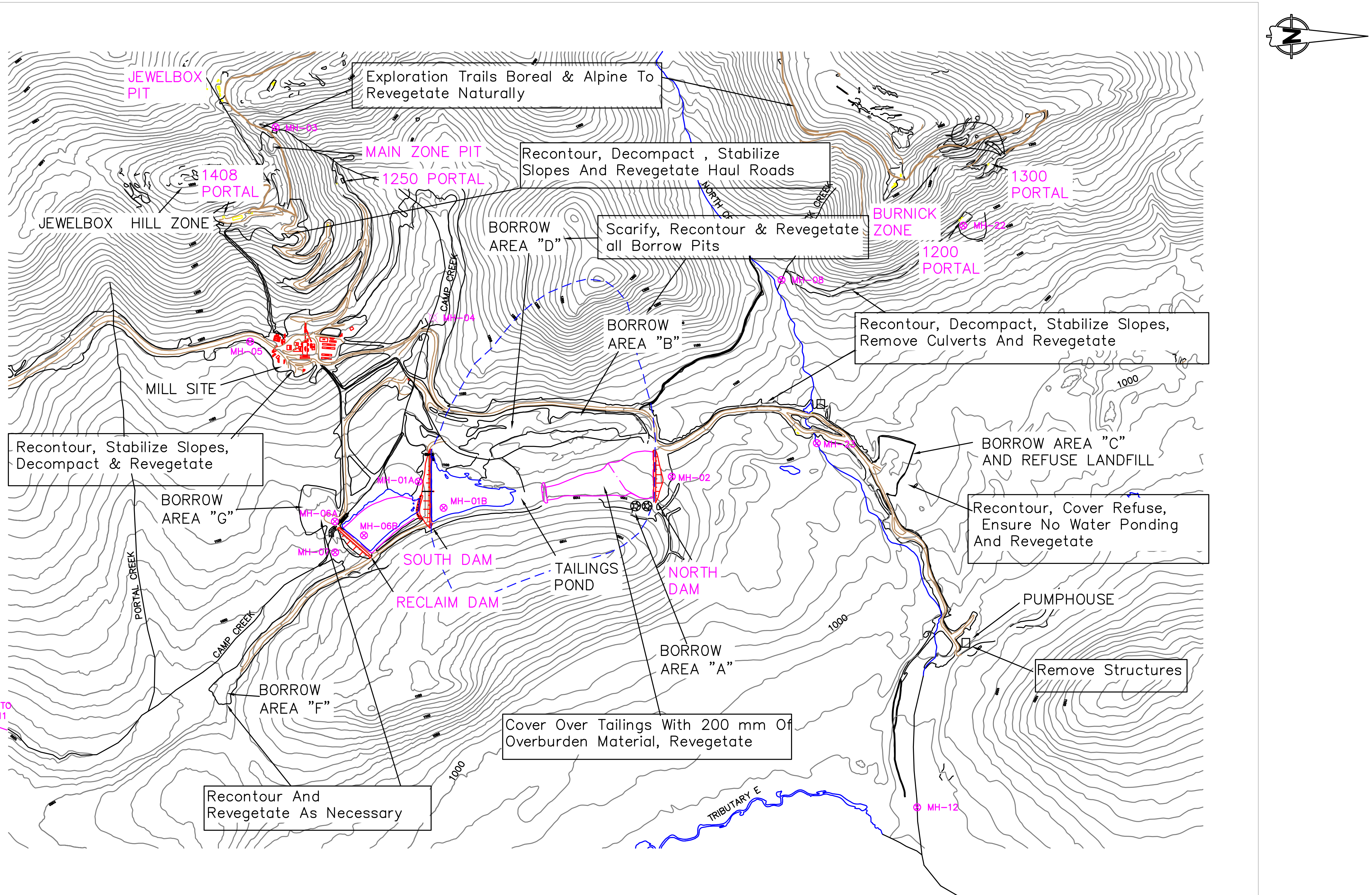
- Core racks and core are all that remain from previous exploration at the property. The core will be removed from the racks, and the racks will be demolished.

3.5 INDUSTRIAL REAGENTS AND WASTES

For details of closure measures and disposal methods discussed in the following sections the reader is referred to Table 3-3 *Industrial Reagents: Inventory, Storage Location and Closure Methods*. Figures 3-13 and 3-14 remain accurate as to the locations of the industrial reagents.

Figure 3-13 **Plan View - Current Locations of Chemicals and Reagents at the Sa Dena Hes Mine Site - Outside Storage Shed**





LEGEND

SOIL SAMPLES

CLEARED AREA

0 200 400 600 800 1000 metres

1: 20,000

CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

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Sä DENA HES DRAFT DETAILED DECOMMISSIONING AND RECLAMATION PLAN

RECLAMATION & REVEGETATION PLAN

DRAWN BY: ASH	CHECKED BY: Someone	FIGURE NO. 3-14	REV.
DATE: January 2010	PROJ. NO. 1CC005.05		

FILE REF.: REVEGRECLAM.DWG

3.5.1. *Mill Reagents*

A variety of mill reagents have been utilized in the grinding/floatation process. For a more thorough discussion of mill reagents, the reader may review the Sä Dena Hes Mine, *Spill Contingency Plan* that was originally submitted in accordance with Water Licence IN90-002. This Plan has been updated in 1998. Product utilization forms for each of the reagents including information on historical rates of consumption, tank size, normal warehouse inventory levels and other pertinent information can be found in Appendix A of the aforementioned *Spill Contingency Plan*. The information contained in the plan will be utilized during closure.

Some of the reagents used at the mine have included Quicklime (CaO), Soda Ash (Na_2CO_3), Copper Sulphate ($CuSO_4$), Sodium Cyanide (NaCN), Aerofloat R242, Percol 351, Methyl Isobutyl Carbinol, Stanfroth 250, Zinc Sulphate, and Sodium Isopropyl Xanthate.

In August of 1998 a review of inventory, storage practices, and of potential environmental concerns was conducted on site. An additional inspection was conducted on June 16, 1999 to confirm current status. Table 3-3 provides a summary of current reagents on-site, their quantities, storage locations, and their disposition upon closure of the mine. Storage of reagents in the mill provides containment within a concrete foundation in the event of leakage.

For a more thorough and updated discussion of mill reagents, the reader may review the Sä Dena Hes Mine, *Environmental Emergency Response & Procedures Plan*. Product utilization forms for each of the reagents including information on historical rates of consumption, tank size, normal warehouse inventory levels and other pertinent information can be found in Appendix A of the aforementioned *Environmental Emergency Response & Procedures Plan*.

Table 3-3 Industrial Reagents: Inventory, Storage Location, and Closure Measures

Substance	Total Quantity Stored on Site	Storage Location	Closure Measure (refer to note)	Plan View Location #
Lime	50 - 1,000kg bags	Mill basement, lime-mixing area, left from main overhead door.	1	1
	5 – Containers (8x8x20ft.), 4x100% Full, 1x33% Full	In the Conex containers by the main gate.		n/a
Diesel Engine Coolant (Glycol)	5 - 45 IG barrels	Mill basement, right from main overhead door, near entrance.	1	2
		Mill basement, right from main overhead door, near middle of room.		7
Antifreeze / Engine Coolant / Coal De-icer	69 - 45 IG barrels	Mill basement, right from main overhead door, near entrance.	1	2b
		Mill basement, left from main overhead door, at pump boxes.		3
		Mill basement, right from main overhead door, midway along copper sulphate tank.		6
Sodium Cyanide	85 - 100 kg barrels	Mill basement, left from main overhead door, at pump boxes.	1	3
		Mill basement, left from main overhead door midway along grinding aisle.		4
		Mill basement, first reagent encountered in front of main door.		5
		Mill basement, under reagent mixing.		9
Sodium Isopropyl Xanthate (NAX31)	49 - 130 kg barrels	Mill basement, under reagent mixing.	1	8
		Storage shed, opposite main doors at back.		17
Zinc Sulphate	433 - 25 kg barrels	Mill basement, right from main overhead door, near middle of room.	1	10
		Reagent mixing floor, at zinc sulphate mix tank hopper.		14
		Storage shed, back left corner from main doors.		16
Dowfroth 250	4 full and 1 partial 45 IG barrels	Mill basement, under stairway.	1	11
		Reagent mixing floor, by reagent addition pumps.		15
Aerofloat 242	13 - 45 IG barrels	Reagent mixing floor, near reagent mixing pumps.	1	12
		Storage shed, in very back right corner from main doors.		21
Percol 351	13 - 25 kg bags	Reagent mixing floor, opposite stairway access.	1	13
		Storage shed, left front corner from main doors.		22
Copper Sulphate	52 - 45 IG barrels, 100 - 25 kg bags, and 5 - 1 tonne IBC's	Mill basement, tank located on opposite side of basement from main overhead door.	1	Storage Tank
		Mill basement, far right from main overhead door, under dewatering.		16
		Storage shed, left front from main doors.		20
		Storage shed, directly in front of main doors.		23
Methyl Isobutyl Carbinol (MIBC)	37 - 165 kg barrels	Storage shed, back right corner from main doors.	1	18
		Storage shed, back right corner from main doors.		24
Cement	2 - 1tonne pallets	Storage shed, right side from main doors, midway back.	2	19

Note: ***1*** Use in closure and/or determine economic viability of re-sale and expedite, otherwise ship to other Teck properties or have removed to appropriate hazardous waste disposal facility (approved under Yukon Environment Act)
2 Sell or donate to a local group.

Closure issues and measures for these items are highlighted in Table 3-3 and the current storage locations within the mill are presented in Figures 3-13 and 3-14.

Some chemicals and reagents on-site are more likely than others to be sold. Primarily on the basis of material condition, demand, and value. These chemicals and reagents include, but are not restricted to:

- **Sodium Cyanide**: There are 85 @ 100 kg barrels. The barrels are stored at several locations within the concentrator and are in good condition and are marketable. Other operations using such material could be approached in order to sell the material.

- **Methyl Isobutyl Carbinol (MIBC)**: There are 37 @ 165 kg. barrels of MIBC stored in the outside sheds. The material may be usable by other mine operations. Storage of reagents in the mill provide containment within a concrete foundation in the event of leakage or fire.

3.5.2. *Other Chemicals*

These materials may include, but are not limited to: solvents, paints, cleansers, and battery acid. They will be removed from the minesite by one of the following procedures:

- given to a third party user; or

- removed from the minesite and disposed of through a licensed hazardous waste disposal firm. In such an event, the disposal will only take place following consultation with and approval from the appropriate regulatory authorities.

Waste vehicle batteries have been segregated, with periodic shipments to a licensed battery disposal facility – the most recent of which was in September 2008. This procedure will continue through the end of mine closure operations.

The mine maintains a sewage system designed to service a 160 person camp with a water consumption of approximately 40 gal/person/day. The current system was installed in 1997 and is comprised of three sewage tanks and a pump-out chamber which then drains to the soil absorption area (septic field) (see Figure 3-10).

Upon closure the three septic tanks would be pumped out, desludged, with sludges deposited in the tailings pond. The pump out chamber would also be removed. The remaining infrastructure (i.e. piping and related materials, including the septic field) would remain buried.

3.5.3. *Fuels and Lubricants*

It is expected that the inventory of hydrocarbon products at the Sä Dena Hes site will be consumed as mine operations are brought to a close. Fuels and lubricants will be required during the three year period for implementation of the closure measures after mine shutdown (as discussed in Section 5). 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 the diesel fired electrical generators used on site will provide the Company with a method of reducing remaining inventory of diesel fuel as the mining operations cease. Gasoline will be similarly removed, and it is predicted that any remaining inventories of diesel and gasoline will be successfully returned to suppliers or sold based on its wide spread local use.

The bulk diesel fuel storage tanks will be emptied of their contents in accordance with one of the above mentioned procedures. The tanks will then be drained and where feasible removed from the site and sold for their salvage value. For tanks too large to be removed, the tanks will be cleaned out utilizing a licensed tank cleaning contractor with any sludge being treated or removed in accordance with procedures approved by the Yukon regulatory authorities. The cleaned out tanks will then be dismantled and either be salvaged or disposed of as scrap metal and buried in the site landfill area.

Rental propane tanks will be removed by the propane supplier. Associated fuel delivery lines at any portals and at the camp will be removed and disposed of in a manner similar to that of the gasoline and diesel fuels.

Other hydrocarbon products used at the minesite are primarily hydraulic fluids, lubricating oils, greases, antifreeze and solvents packaged in either 1,000 litre bulk cubes, 200 litre drums or smaller packaging. It is predicted that in most cases the remaining inventory of these materials will be successfully 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 licensed waste disposal firm. It is anticipated that such material will be small in volume. Most recently, 2,000 L of waste oil was removed from the site and disposed of through the Yukon Government Special Waste Collection Program.

Petrochemical contaminated soils will be identified and processed for remediation. Any fuel storage areas and refueling stations, once decommissioned, will then be assessed for hydrocarbon contamination. The affected soils may be removed from the minesite and disposed of through a licensed hazardous waste disposal firm. The second, and more probable method of disposal will be to have the soils landfarmed where bioremediation will work to remediate the soils. In either event, the disposal will only take place following consultation with and approval from appropriate regulatory authorities. Originally proposed to be assessed and implemented during the final site assessment, recent identification of hydrocarbon contaminated soils at various locations on the site have expedited the planning for the establishment of a permitted Land Treatment Facility on the site for treatment of these materials prior to final closure.

3.5.4. *Scrap Metal*

Scrap equipment has been stored in various lay down areas (known as "bone yards") located on site and along the access road. This is primarily scrapped equipment that was stored so that it could be utilized on the minesite as a source of spare parts or good recyclable scrap material. At mine closure, salvageable material from these sites will be sold as scrap and removed from the site. Material that has no scrap value will be disposed of in an approved landfill area. Prior to disposal in the landfill all of this material will be examined to ensure that all hazardous materials have been removed. Hazardous materials so removed will be shipped off site to a licensed waste disposal site.

3.5.5. *Site Landfill*

The 2000 report proposed the use of the existing landfill for the disposal of non-putrescible wastes that have no salvage value, such as lumber and scrap steel. Schedule A – Solid Waste Management of Sä Dena Hes Operating Corporation's Production License QML-0004 requires such a facility to be an "approved engineered landfill area." As such, the Company is proposing to construct an approved landfill on site to provide for disposal of materials in accordance with the Production License requirements and YG Solid Waste Regulations.

Specifically, the engineered landfill facility will:

- be approved by an inspector prior to any waste disposal;
- be compacted and covered with rock or overburden on a regular basis;
- be maintained to minimize attraction of wildlife and water infiltration; and
- be compacted and capped with a minimum of one meter of low-permeability overburden or soils (domed and re-vegetated) to retard the infiltration of water on the completion of landfill activities.

In 2008, in response to the collapse of the Jewelbox shop, the Company applied for and received approval through YG Environmental Programs for a Solid Waste (Commercial Dump) permit #81-020 to landfill the refuse from the shop on site near the Jewelbox portal. This work was completed in late 2009. A similar permit will be applied for in 2010 to locally bury the refuse of the Golden Hills shop.

3.6 LAND RECLAMATION & REVEGETATION

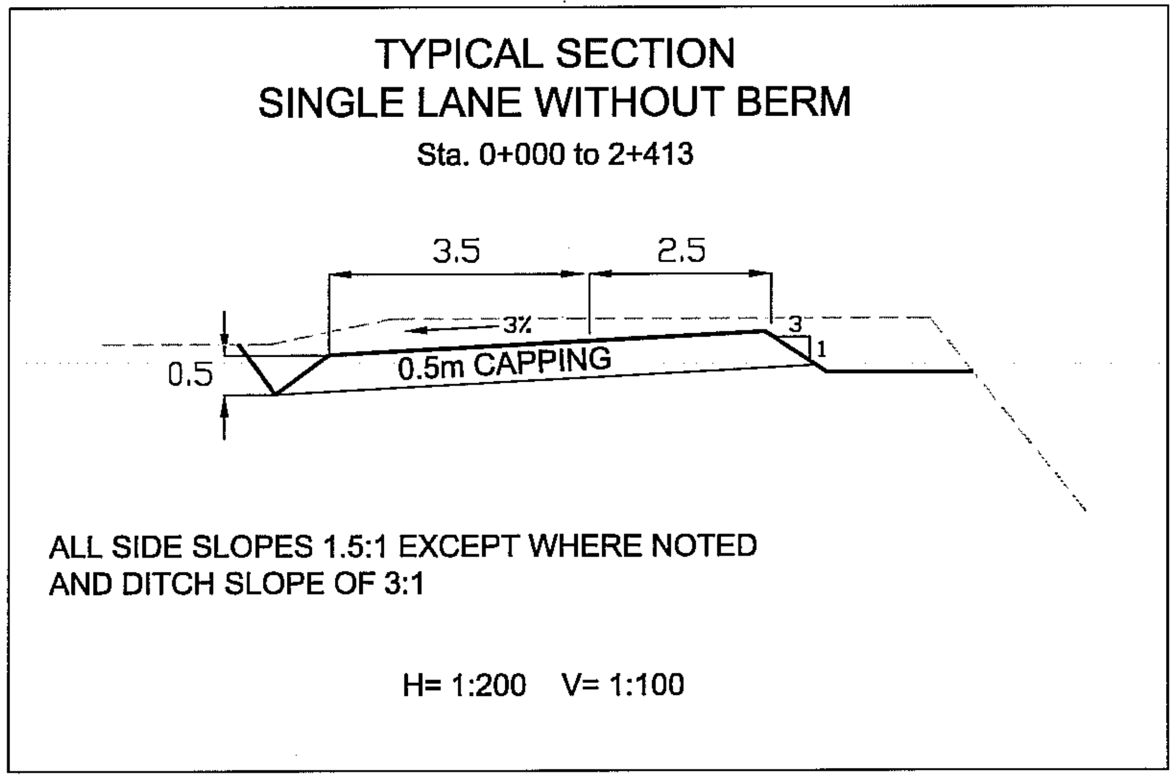
The primary objectives of land reclamation and revegetation activities at the Sä Dena Hes minesite are to provide short and long term erosion control, to ensure a final land use compatible with the surrounding lands, and to leave the area as a self-sustaining ecosystem.

The overall goal is to prepare the site so that the vegetation returns to a state as near as possible to that in existence prior to mining activities.

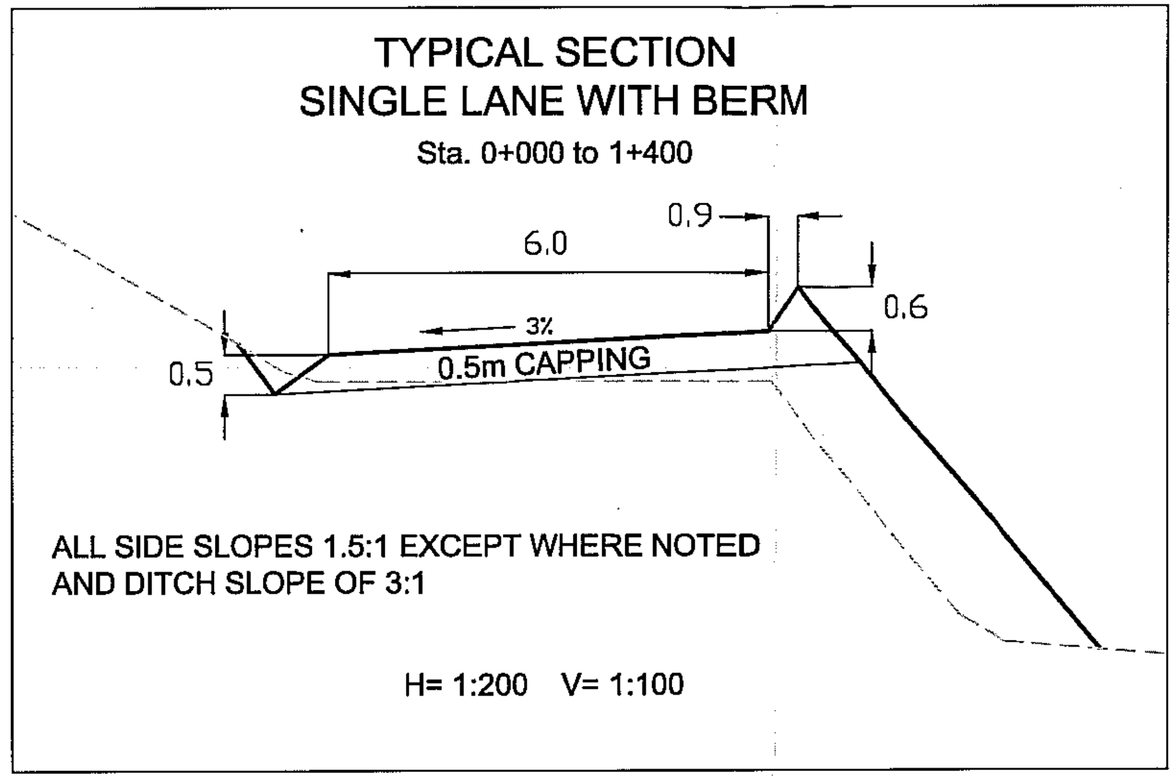
This section describes the current areas slated for reclamation, and the closure issues and measures proposed. Previous reclamation activities that have occurred on the property are observed as part of annual site inspections by Teck personnel. The extent of natural revegetation on previously disturbed areas is also observed. These observations will be used in part to develop the final overall reclamation and revegetation strategy for the site. Reclamation options for various types of disturbed lands were developed and are discussed below. Figure 3-15 provides a summary of the reclamation and revegetation plan for the Sä Dena Hes property.

Previous Revegetation Initiatives

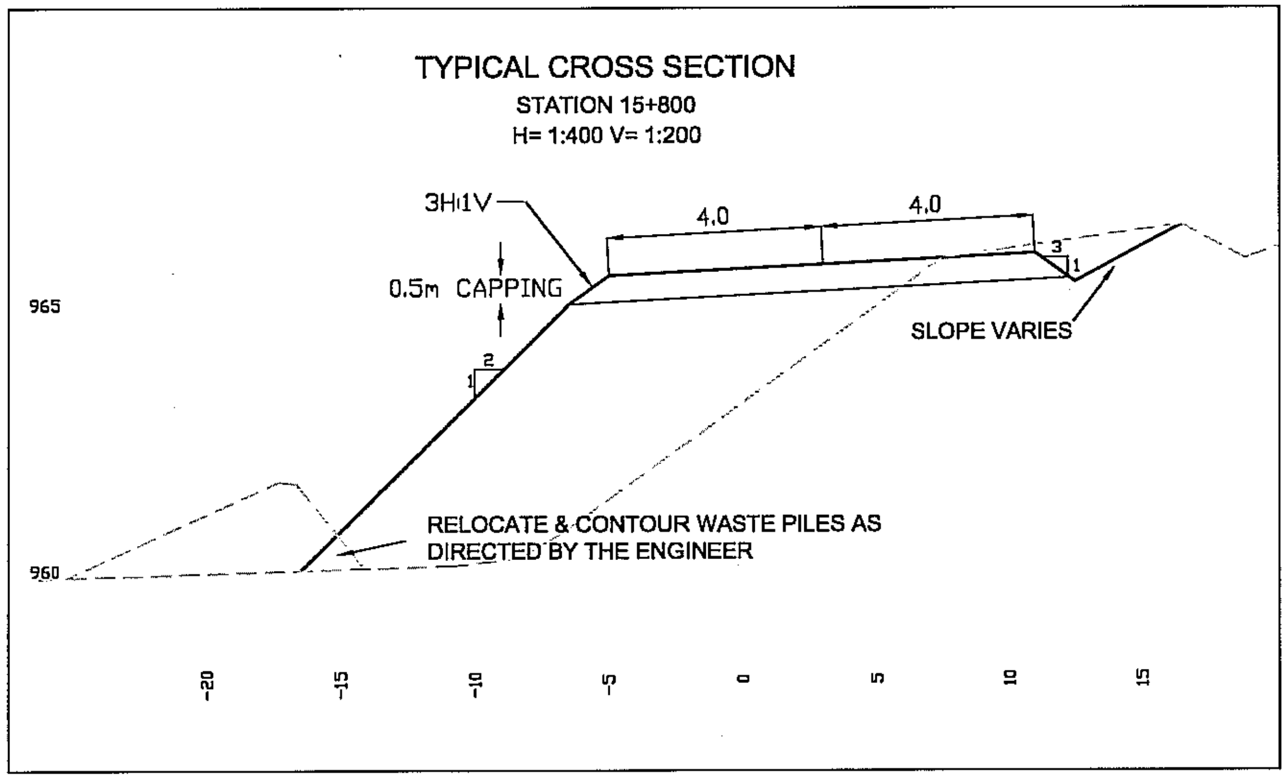
The disturbed land around the freshwater pumphouse and access route to this location was revegetated in 1992. It is understood that the area was cleared of debris, decompacted and seeded with a fertilizer mixture (R. Flanigan, pers. com.); however, no records are available on this reclamation work.



HAUL ROAD - TYPICAL



HAUL ROAD - TYPICAL



ACCESS ROAD - TYPICAL

Teck	ACCESS CONSULTING GROUP / SRK Consulting Engineers and Scientists	Sä Dena Hes Detailed Decommissioning and Reclamation Plan
		Typical Road Sections
		DRAWN BY: ASH · CHECKED BY: RLM · DATE: January 2010 · Fig No. 3-15

The site was inspected in July 1999 and it was observed that a robust growth of graminoids and legumes now cover this area. The most prevalent graminoids here now are creeping red fescue (*Festuca rubra*), reed fescue (*Festuca arundinaceae*), polar grass (*Agrostis latifolia*), small-flowered wood-rush (*Luzula parviflora*) and sedges (*Carex* spp). Legumes include alsike clover (*Trifolium hybridum*). Other colonizing plant species in this area are little-tree willow (*Salix rbusculoides*) and annual hawk's-beard (*Crepis tectorum*).

Natural Revegetation

Areas that are revegetating naturally on the site include disturbed lands adjacent to the tailings management facility, old borrow sources, exploration trails, and the old site access road. Although an extensive survey was not conducted to document the extent of natural revegetation, the following observations were noted:

- The primary colonizing plant species now found around the minesite are willows, alder and graminoids. The most prevalent willows are little-tree willow (*Salix arbusculoides*), Alaska willow (*Salix alaxensis*), blue-green willow (*Salix glauca*), diamond-leaf willow (*Salix planifolia*) and Barclay's willow (*Salix barclayi*). Arctic willow (*Salix arctica*) occurs above treeline in the Jewelbox adit area. The colonizing graminoid species in the mine area include small-flowered wood-rush (*Luzula parviflora*), spike tristeum (*Tristeum spicatum*), and blue grass (*Poa* spp.). Other herbaceous pioneering species include annual hawk's-beard (*Crepis tectorum*) and arrowleaf senecio (*Senecio triangularis*). Alfalfa (*Medicago savita*), orchard grass (*Dactylis glomerata*), timothy (*Phleum pratense*) and smooth brome (*Bromus inermis*) also occur and have presumably been introduced.

- 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. Most of the exploration trails are completely recolonized with native species. There is also significant evidence of native shrub recolonization of all disturbed areas in particular access roads and corridors as well as sporadic invasion occurring throughout the Tailings Pond.

Revegetation Options

The establishment of an initial ground cover of graminoids has historically been viewed as a desirable initial objective on most disturbed areas to stabilize slopes and control soil erosion. Reclamation and revegetation efforts on site will ensure that this objective is achieved; however, the establishment of natural vegetative communities and species is the primary objective. Based on recent reclamation research and observations, it is noted that there is an abundance of natural seed or reproductive seed material sources available from local surroundings and that these naturally occurring seed sources will be considered as part of the reclamation program (Craig, et al., 1998).

The natural vegetation found on undisturbed sites around the mine generally indicate the underlying soil properties, including texture, drainage, pH, and the level of available nutrients. Revegetation seed mixtures will be formulated for the Sä Dena Hes minesite using knowledge of the naturally occurring vegetation and soil conditions. Additional soil sampling on disturbed sites may be required in order to determine areas of localized nutrient deficiencies.

Evidence indicates that revegetation by the seeding of sod-forming grass species will inhibit the invasion of the area's natural colonizing species by competing for space, light, nutrients, sunlight and moisture (Craig, et al., 1998). Experimentation with seeding and fertilizer rates continue to be carried out at the Sä Dena Hes minesite in order to determine the optimum mixes for preventing seeded species from becoming too firmly established. Seed mixtures will be designed for site specific areas based on the results of research and local conditions.

The nutrient uptake by northern native seed varieties on nutrient deficient soil is usually more effective than nutrient uptake by southern agronomic species. Every effort will be made to utilize native species while recognizing that there will be some use of agronomics in site specific applications in particular any areas identified as having a high erosion potential.

Currently there is some use by wildlife of the tailings impoundment areas, it is expected that this will increase over time as revegetation of this area occurs. As part of the ongoing vegetation test plot program, the Company will test various plant species for metals uptake to assess if there are any potential concerns of ingestion of the plants by grazing and/or browsing animals.

In order to establish a successful revegetation program, the Company will initiate a methodical program to confirm:

a) An inventory of available soils around the site - Soil was stripped from the tailings pond area as part of the site preparation process. The original thickness of the cover is not known at this time. Preliminary plans are to place a 300 mm soil cover over the tailings facility. While this is more than adequate to support long term healthy plant growth, it is not known whether there is a sufficient quantity of soils available at the mine site. If there is a shortage of soil cover material, then testing of thinner covers would be necessary to establish the minimum thickness that would permit successful long term plant growth.
b) The nutrients in the available soils - Initial testing indicates some nutrient deficiencies in the surrounding soils. While fertilizers will likely be necessary to encourage initial establishment of healthy growth, the plant species selected will be capable of sustaining long term growth without the aid of additional fertilizer treatments.
c) 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 assessments will confirm the appropriate seed mixes that should be used.
d) The potential for metals uptake by the plants - Different plant varieties and species, tailings characteristics, cover designs and other environmental conditions are all factors influencing uptake of metals by plant tissues. Sampling of plant tissues from the test plots will be conducted to assist in designing the revegetation program.

Reclamation research plots were established on a number of sites in 2001 and annual assessments were carried out annually until 2008. The annual summary reports have been included in the annual production reports. Because the changes that were occurring in the plots over the past several years were determined to be insignificant, the decision was made to step out the assessment period from annual to every 5 years. This will allow for a better assessment of changes.

In the larger, more open disturbed areas at the minesite (borrow areas, mill and camp site area), where natural seed sources are less available, the seeding/planting of indigenous shrub species (primarily willows, birch and alder) may be required to encourage the later seral stages of plant succession on these sites. Shrub species would be planted concurrently with the revegetation program.

3.6.1. *Roads and Trails*

3.6.1.1. Exploration Trails

The exploration trails outside of the immediate minesite have not actively been used for a number of years. These trails have for the most part been completely invaded by native species and will probably not require further treatments. Additional stabilization may be required in a few locations if erosion concerns are identified. These exploration trails include 6.0 ha of boreal and 1.5 ha of alpine area (see Table 3-4).

Table 3-4 Summary of Spatial Disturbance for Sä Dena Hes Property

Component		Approach	Approximate Area of Disturbance (ha.)	Subtotals
Exploration Trails	Boreal	Natural Revegetation	6.0	
	Alpine	Natural Revegetation	1.5	**7.5**
Access Road (including pullouts and borrows 0.5 ha.)		Scarify, recontour, pull culverts, active revegetation	65.0	**65.0**
Site Haul Roads		Scarify, recontour, pull culverts, active revegetation	16.0	**16.0**
Non-Linear Disturbances	Tailings Management Facility Scenario #1	Cover and Revegetate	11.8	
	Reclaim Pond Scenario #1	Cover and Revegetate	4.0	
		Subtotal Scenario #1:		**15.8**
	Tailings Management Facility Scenario #2	Cover and Revegetate	22.0	
	Reclaim Pond Scenario #2	Cover and Revegetate	4.0	
		Subtotal Scenario #2:		**26.0**
	Borrow Pits & Refuse areas, Mill & Camp	Scarify, Recontour and Revegetate	7.0	**7.0**

Total Area in Hectares Scenario #1:	**111.3**
Total Area in Hectares Scenario #2:	**121.5**

3.6.1.2. Main Access Road

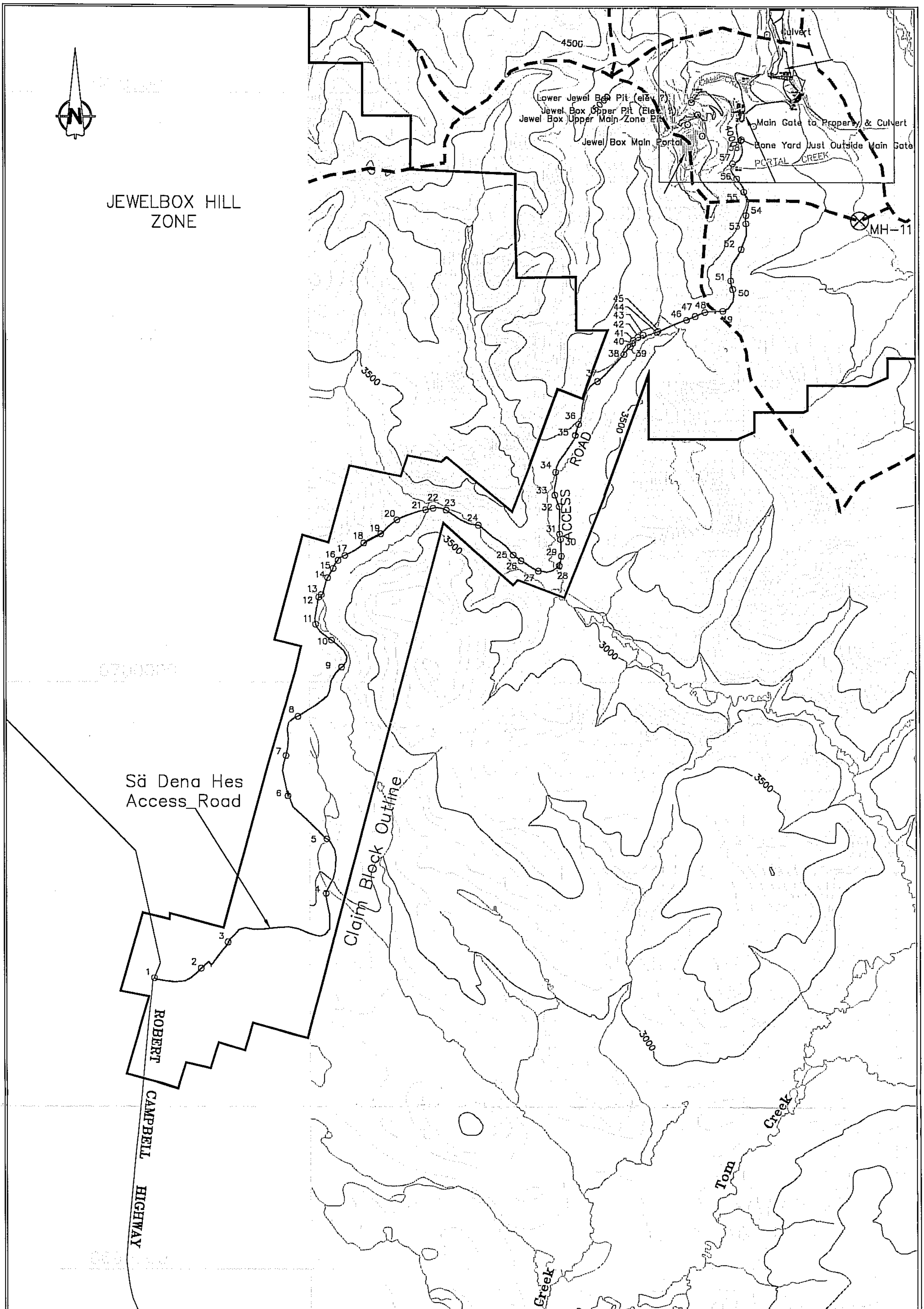
Although the main access road is not covered as part of Water Licence QZ97-025, consideration of the access road has been included in order to ensure the reclamation plan is complete.

The main access road to the property was constructed in 1990. Figure 1-2 illustrates the overall routing for this road. This road was constructed to facilitate traffic from 26 ton ore concentrate trucks. The road was constructed by cut and fill methods with a road width of 8 m and associated ditch drainage and culvert installations. A typical cross section for the main site access road appears in Figure 3-16 (Typical Road Cross Section).

The plan proposes to reclaim the road after it is no longer required for access to the site. The Company will continue to maintain the road until it is established that the reclamation program has been successful and that the physical structures at the site are stable and if frequent future monitoring is no longer required. While the Company would be willing to consider a responsible party taking over the responsibility for the road (rather than it being closed), the Yukon Territorial Government has previously indicated that it would not be willing to do so.

Closure measures related to road decommissioning include final timeframe for road closure, stabilization of slopes and prevention of erosion, and stabilization of stream crossings.

Decommissioning of this road will include recontouring including berm removal, decompaction, and removal of stream culverts. On steeper slopes, erosion control structures may be required at suitable intervals to ensure stability. Original drainage patterns will be reestablished.



NTS: 105 A/06, 105 A/07, 105 A/10, 105 A/11

CONTOUR INTERVAL 100 FEET

0 600 1200 1800 2400 3000

1: 60, 000

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

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LEGEND
○ Culvert Location

Sä DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

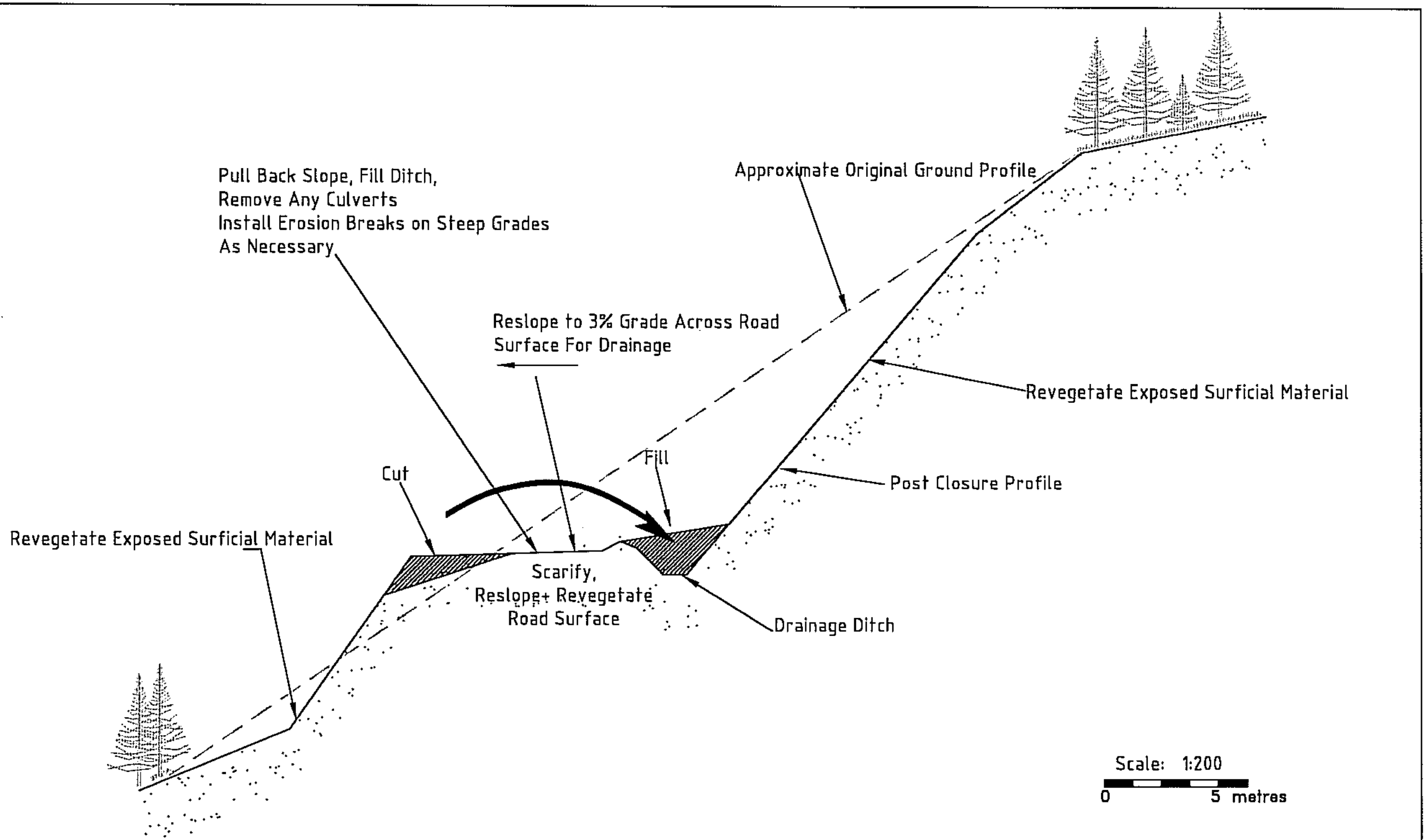
Access Road Culvert Locations

DRAWN BY:	MH	CHECKED BY:	PMH	FIGURE NO.	REV.
DATE:	January 2010	PROJ. NO.	1CC005.05	3-16	

A number of culverts will be removed upon final closure of the road. Figure 3-17 shows the location of the culvert crossings along the access road, with a listing of culvert sizes. Of key importance is the removal of culverts at stream crossings which are fish bearing. At these stream crossings, the road bed would be cut down to the culvert and original stream bed elevation with side slopes brought back to 2:1. Till material removed during culvert removal will be utilized to promote revegetation. No specific design criteria has been selected for the stream channel reconstruction after culvert removal. The intention is to restore the stream channel to the original grade, width and channel configuration so that historic flood events are accommodated as they were prior to road construction. Stream banks will be stabilized and slopes revegetated. A typical section outlining closure measures at stream crossings appears in Figure 3-18.

The preferred methodology is to encourage natural revegetation to occur after first preparing the road surface by scarifying and fertilizing. Visual assessments of existing roads and trails in the area is showing that natural invasion by woody species is rapid. For the purposes of budgeting, the decommissioning and reclamation plan assumes that the access road will be seeded.

The road surface (approximately 65 hectares) will be revegetated with graminoids and legumes at an application rate low enough not to hinder native shrub and tree invasion. Stream crossings will be treated appropriately so as not to allow sedimentation of the waterway. The seed mixes used for revegetating this road will include either the agronomic selections recommended for linear development in the greater Watson Lake region by Kennedy (1993) or the alternative native selections if economically available. For costing purposes, it is assumed that these seed mixtures include:



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Sand & Gravel

Existing Vegetation

Sä Dena Hes Detailed Decommissioning and Reclamation Plan

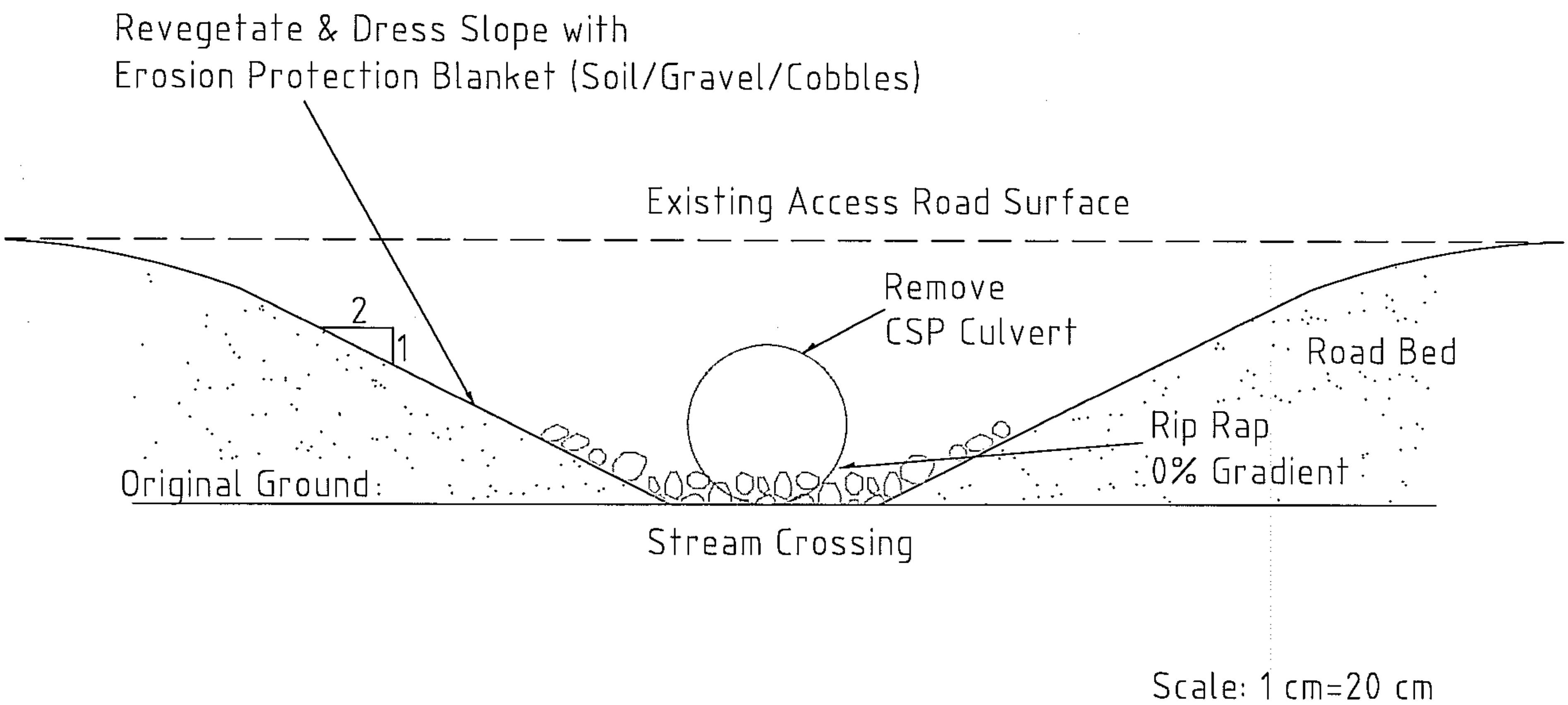
Typical Haul Road Closure Cross-section

DRAWN BY: ASH

CHECKED BY: RLM

January 2010

Fig No. 3-18



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Sä Dena Hes Detailed Decommissioning and Reclamation Plan

Typical Access Road Culvert Removal

DRAWN BY: ASH | CHECKED BY: RLM

January 2010

Fig No. 3-17

Agronomic Selections		Native Alternatives	
Red top *Agrostis gigantea*	4 kg/ha	Red top *Agrostis gigantea*	2 kg/ha
Meadow foxtail *Alopecurus pratensis*	6 kg/ha	Meadow foxtail *Alopecurus pratensis*	3kg/ha
Smooth brome *Bromus inermis*	8 kg/ha	Violet wheatgrass *Agropyron violaceum*	5 kg/ha
Sheep fescue *Festuca ovina*	4 kg/ha	Sheep fescue *Festuca ovina*	2 kg/ha
Creeping red fescue *Festuca rubra*	3 kg/ha	Tufted hairgrass *Deschampsia caespitosa*	2 kg/ha
Fowl bluegrass *Poa palustris*	6 kg/ha	Glaucous bluegrass *Poa glauca*	3 kg ha
Alfalfa *Medicago* sp.	3 kg/ha	Mackenzie's hedysarum *Hedysarum mackenzii*	2 kg/ha
Alsike clover *Trifolium hybridum*	3 kg/ha	Arctic lupine *Lupinus arcticus*	2 kg/ha
Total	**37 kg/ha**		**21 kg/ha**

The nutrient requirements for this seed mix are nitrogen (100 kg N/ha) and phosphorus (120 kg P_2O_5/ha).

Access to the road entrance will be blocked by installing ditches and berms or boulders near the highway entrance. The entrance will be recontoured to make it less apparent from the Robert Campbell Highway. Shrubs, such as willows, aspens and poplars, will be planted near the entrance to further reduce the visibility of the entrance to the deactivated road.

3.6.1.3. Service and Haul Roads within the Minesite

A network of service and haul roads exist on the property (Figure 3-1). These roads provide access to the mine workings, tailings management facilities, and site infrastructure. Figure 3-16 (Typical Section Haul Road) provides a typical section through a haul road, with and without safety berms.

Closure objectives for the site access roads include slope and drainage stabilization, erosion prevention and revegetation.

Figure 3-18 depicts the typical treatment of haul road and service road closure measures.

All of the service and haul roads within the minesite will be decommissioned. All culverts will be removed and the roadbeds will be recontoured to restore original drainage patterns and to provide stability and long term erosion control. On the steeper slopes, erosion control structures will be placed at suitable intervals to reduce erosion potential. These access roads cover an area of approximately 16.0 ha (Table 3-4).

The road surfaces will be decompacted and revegetated with graminoids and legumes. Most of these service roads are located within the subalpine fir vegetation community. In these areas, including subalpine sites such as the haul roads leading to the Jewelbox and Burnick deposits, the seed mixes recommended by Kennedy (1993) for subalpine fir community soils are being considered for use. Every effort will be made to utilize native seed mixes for these higher elevation locations. Potential seed mixes being considered are:

Agronomic Selections		Native Alternatives	
Meadow foxtail *Alopecurus pratensis*	8 kg/ha	Meadow foxtail *Alopecurus pratensis*	3 kg/ha
Tufted hairgrass *Deschampsia caespitosa*	4 kg/ha	Tufted hairgrass *Deschampsia caespitosa*	2 kg/ha
Timothy *Phleum pratense*	8 kg/ha	Violet wheatgrass *Agropyron violaceae*	5 kg/ha
Sheep fescue *Festuca ovina*	6 kg/ha	Sheep fescue *Festuca ovina*	3 kg/ha
Creeping red fescue *Festuca rubra*	8 kg/ha	Alpine bluegrass *Poa alpina*	2 kg/ha
		Glaucous bluegrass *Poa glauca*	3 kg/ha
Alsike clover *Trifolium hybridum*	4 kg/ha	Mackenzie's hedysarum *Hedysarum alpinum*	2 kg/ha
Total	**38 kg/ha**		**20 kg/ha**

The nutrient requirements for this seed mix are nitrogen (150 kg N/ha) and phosphorus (150 kg P_2O_5/ha) and potash (50 kg K2O/ha).

3.6.2. *Non-Linear Disturbances (Mill Site, Camp, Tailings Management Facility, and Mine Workings)*

Non-linear disturbances include the areas around the mill and camp, tailings management facility, mine workings including open pits and waste rock dumps, and the refuse landfill site and borrow pit areas. They bear special treatment in this revegetation plan because they are not as conducive to natural revegetation as are roads, etc., because of the distance from seed sources. The locations of these non-linear disturbances appear in Figure 3-15. The TMF covers an area ranging from 11.8 ha to 22.0 ha, depending on the closure scenario, and the remaining non-linear disturbances include an area of about 11.0 ha (Table 3-4).

A complete description of the facilities associated with these non-linear disturbances was presented in the previous sections. Closure objectives include slope and drainage stabilization, erosion control, and revegetation.

3.6.2.1. Tailings Management Facility

The tailings will be covered with a nominal 300 mm soil cover from the overburden originally stripped from the pond area. Teck's experience at its other operations indicates that a 200 mm soil cover would be more than adequate for plant growth. However, based on experience gained at the Kimberley Sullivan operation, it is felt that it would be more practical from a constructability perspective to place a nominally 300 mm thick cover. Additional soil material would be removed from the northeast slope beside the North Dam. The soil will eliminate tailings dusting concerns and provide a growth medium for revegetation. Prior to placing the 300 mm soil cover, it is assumed that approximately 25% of the tailings area (the assumed wet area) will be covered with a 1.0 m thick layer of coarse rock. The purpose of the rock is to provide a solid base for equipment to operate on. Revegetation of the tailings area will occur after placement of the soil cover.

Analyses of soil samples collected from the north end of the overburden stock pile (near the north tailings impoundment dam) in June 1999 show that this soil is deficient in available phosphorous (3.2 mg/kg phosphate) and available potassium (30 mg/kg potassium) (Table 3-5). Although this soil sample has lower levels of available sulphur (19 mg/kg sulfate) and available nitrogen (11.2 mg/kg nitrate) than the sample collected from the south end of the stockpile, the seed and fertilizer requirements are the same as that prescribed for the reclaim pond revegetation.

Test plots have been established on the tailings impoundment area in order to determine the optimum soil treatments and seed mixtures. These test plots will include applications of topsoils, fertilizers, as well as different agronomic seed mixes. A control plot with no treatment will be used to measure the success of the test plots and to monitor any natural revegetation that occurs.

In 2009 an alder planting trial was established on the tailings pond. This was initiated following observations that native alder and willow species were volunteering in a number of areas on and adjacent to the Tailings Pond. Seed from local plants was collected in the fall of 2008 and sent to a nursery for growing. A total of 1,200 plants were planted in August of 2009. Planting sites varied from approximately 300 mm of till material to directly on tailings at the pond edge. Future assessments will include success, optimal depth of till material and metal uptake.

Until further information is gained from the test plots planned, it is assumed that the agronomic seed mixture recommended by Kennedy (1993) for white spruce/black spruce vegetation communities will be used to revegetate the TMF. Native seed mixture will be substituted where suitable species are available. Care will be taken to ensure that areas seeded with native seed are not integrated with areas seeded with agronomics. It has been shown in many other areas that native seed cannot, over the long term, compete with agronomic species.

Table 3-5 Soil Analysis for Overburden Pile – Near North Dam

	Sample Identification			
	45523-1 - SDH-SS-001 North Dam Waste Overburden Pile (South End)	**45523-2 - SDH-SS-002 North Dam Waste Overburden Pile (North End)**		
Depth	Near Surface	Near Surface		
Date/Time Sampled	June 18/1999	June 18/1999		
Matrix	Soil	Soil		
Sampling Method	Grab	Grab		
Number of Containers	One (1)	One (1)		
Available N,P,K,S			**Detection Limits**	**Units**
Nitrate-N	41	11.2	0.1	mg/kg
Phosphate-P	3.2	3.2	1	mg/kg
Potassium K	40	30	10	mg/kg
Sulfate-S	150	19	0.1	mg/kg
C/N Ratio	13.8	20.8		
Electrical Conductivity	0.4	0.29	0.01	mS/cm
Organic Matter	2.2	6.3	0.05	%
pH in Soil (1:2 water)	7.13	7.43	0.01	pH
Total Nitrogen in Soil	0.09	0.17	0.01	%
Total Organic Carbon in Soil	1.24	3.54	0.05	%

Note: See Figure 3-15 for a location of soil sample sites.

The seed mixture includes:

Agronomic Selections		Native Alternatives	
Red top *Agrostis gigantea*	2 kg/ha	Ticklegrass *Agrostis gigantea*	1 kg/ha
Meadow foxtail *Alopecurus pratensis*	8 kg/ha	Meadow foxtail *Alopecurus pratensis*	4 kg/ha
Fowl bluegrass *Poa palustris*	6 kg/ha	Fowl bluegrass *Poa palustris*	4 kg ha
Reed canarygrass *Phalaris arundinaceae*	5 kg/ha	Altai fescue *Festuca altaica*	1 kg/ha
Timothy *Phleum pratense*	9 kg/ha	Violet wheatgrass *Agropyron violaceae*	5 kg/ha
Alsike clover *Trifolium hybridum*	3 kg/ha	Bear root *Hedysarum alpinum*	3 kg/ha
Total	**33 kg/ha**		**18 kg/ha**

The nutrient requirements for this seed mix are nitrogen (50 kg N/ha) and phosphorus (100 kg P_2O_5/ha) and potash (50 kg K2O/ha).

The sides of the pond areas will be revegetated with this same seed and fertilizer mixture.

3.6.2.2. Reclaim Pond

After the reclaim pond has been drained and the original drainage channel of Camp Creek has been restored, the sediments will be covered with overburden and revegetated. The area required for cover and revegetation is approximately 4.0 ha. Overburden that was originally stripped from the pond area (a nominal cover of 300 mm) will be used as the growth medium. Analyses of soil samples taken from the south end of the overburden stock pile (the end closest to the reclaim pond) show that this overburden is deficient in available phosphorous (3.2 mg/kg phosphate) and available potassium (40 mg/kg potassium), but has marginally adequate available nitrogen (41 mg/kg nitrate) and available sulphur (150 mg/kg sulphate) (see Table 3-5). The seed and fertilizer mix used for the reclaim pond will be the same as that recommended for the TMF (see Section 3.6.2.1).

3.6.2.3. Pits and Waste Dumps

As pits and waste dumps are primarily in the alpine zones with little original vegetation, they will not be actively revegetated. The exception is the Burnick 1200 waste rock dump which is located below treeline in the Boreal Zone. This waste rock area will be planted with locally available herbaceous shrub seedlings.

3.6.2.4. Sediment Ponds

There are four sediment ponds corresponding to the Jewelbox 1408, Main Zone Pit, Burnick 1200 Portal, and the Jewelbox 1250 Portal (see Figures 3-3 and 3-5). They are all approximately 4 m x 3 m, constructed of unlined locally available materials, except the Jewelbox 1408 portal sediment pump which is lined. They were used to provide retention time to mitigate suspended solids levels in the water draining from the mine workings. While confirmatory soil testing has not been conducted, it is expected that three of the sediment ponds (all but Jewelbox 1250, which saw virtually no production and does not have a flow), will contain elevated metals levels. The metal contaminated soils will be removed to the TMF, and the sites will be regraded. Only the Burnick 1200 sediment pond occurs in the Boreal Zone, therefore, this site alone will be actively revegetated by the application of seed mix developed as per this plan.

3.6.2.5. Refuse Areas and Borrow Pits

The site presently has one main refuse area and a number of smaller waste metal sites. A number of borrow areas also exist on the property. The location of these areas is shown in Figure 3-15.

Closure issues associated with these areas are similar with other disturbed lands discussed previously; however, contouring of refuse areas to eliminate water ponding and seepage is also a concern that will be addressed. All landfill, refuse and borrow pit areas will be graded to prevent ponding of water and revegetated with a similar seed and fertilizer mix as recommended for white spruce-willow vegetation communities. This seed mix includes:

Agronomic Selections		Native Alternatives	
Sheep fescue *Festuca ovina*	6 kg/ha	Sheep fescue *Festuca ovina*	3 kg/ha
Creeping red fescue *Festuca rubra*	4 kg/ha	Glaucous bluegrass *Poa glauca*	2 kg/ha
Fowl bluegrass *Poa palustris*	6 kg/ha	Fowl bluegrass *Poa palustris*	5 kg ha
Streambank wheatgrass *Agropyron riparian*	8 kg/ha	Yukon wheatgrass *Agropyron yukonense*	4 kg/ha
Slender wheatgrass *Agropyron trachycaulum*	8 kg/ha	Violet wheatgrass *Agropyron violaceum*	4 kg/ha
Kentucky bluegrass *Poa pratensis*	2 kg/ha	Kentucky bluegrass *Poa pratensis*	1 kg/ha
Alfalfa *Medicago* sp.	2 kg/ha	Showy locoweed *Oxytropis splendens*	1 kg/ha
Alsike clover *Trifolium hybridum*	2 kg/ha	Arctic lupine *Lupinus arcticus*	1 kg/ha
Total	**38 kg/ha**		**21 kg/ha**

The nutrient requirements for this seed mix are nitrogen (75 kg N/ha) and phosphorus (75 kg P_2O_5/ha).

3.7 Adaptive Management Planning

The closure measures in the previous sections have been developed and proposed based on the relevant current information collected at the site, and the best interpretations of these data with respect to the projected conditions on the site at final closure. As these conditions are not likely to change significantly prior to closure – and as the periodic revisions to this DDRP document as per the QML schedule will address any changing conditions leading up to final closure – it is not expected that closure methods and activities will be significantly different from those proposed.

As most of the work proposed in this plan is relatively straight forward, there are limited areas where changes to the approved closure plan are likely. 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. The Company is committed to AMP in the context of closure of some of the higher risk features on the site. The Company sees the application of AMP for the following mine component/conditions:

- **Tailings Storage Facility**
    - The most likely difficulty in reclaiming the tailings facility area is due to low load bearing capacity of saturated tailings. This could result in very thick layers of rock being required to be place on the tailings in order to support equipment trying to place a till cover on the tailings. If this were to occur, then the tailings cover could be placed in the winter months when the tailings surface is frozen. Due to working conditions, this would increase the costs of excavation of cover material but would be partially offset by reducing or eliminated the need for placing rock as a stable working base.
    - Update of metals into the vegetative cover will occur. What is not currently known is what long term concentrations of heavy metals will occur in the vegetation. While some testing has been done, additional testing needs to occur. Given our knowledge that mammals such as moose use the area periodically (but not for significant time periods), the actual risk to of toxicity is expected to be low. If longer term sampling of the vegetations suggest that this could be an issue, the conduct a formal ecological risk assessment based on predicted exposures to wildlife expected to use the area. If the risk assessment (which are very conservative), suggest that there are unacceptable risks, then controls such as selecting vegetation types that are no desired food sources for mammals can be used for revegetation or at a worst case either have the area fenced or do not re-vegetate the area. The costs for doing the associated studies and changes to vegetation would be less than $200,000.

- **1380 Portal**
    - The primary risk is that SRK's prediction that zinc loading discharging from the portal ultimately has an unacceptable effect on the water quality in Camp Creek.

The most practical ways of limiting release of contaminated water from the portal would be through either grouting the ground fractures that provide a conduit of ground water into the adit to prevent the water from entering the adit, or to provide a water tight seal to block the water from discharging out of the adit portal. Before attempting either of these methods, drilling to determine whether these methods would simply result in water being diverted through other mineralized and weathered rock would need to be done. It was proposed by Energy Mines and Resources' consultant that cost for providing a permanent water tight seal would be in the order of $250,000. This amount is well below the amount of contingency allowances provided for in the cost estimates.

- **Contaminated Soils** – the Land Treatment process for treatment of hydrocarbon contamination is not effective for the removal of metal contamination, and the nature of the site and the confirmed geochemical signature of area surficial soils make it likely that some of the materials treated will have metal contamination that would designate it as special waste. This has been confirmed by recent testing of contaminated soils around the site. This material, once successfully treated for hydrocarbons, could be placed in the tailings facility and reclaimed in keeping with the implemented measures at that location, as metal concentrations in materials at these locations will likely be similar or higher. This approach has been approved in principle by YG Environmental Programs at the site. This adaptive management plan will refine these measures based on remediation success and discussion and agreement with the Ministry of Environment.

These adaptive management plans will be developed if and when the needs arise. During ongoing maintenance and monitoring of the site during Temporary Closure and during the anticipated 4 years of mine operations which will reduce the uncertainty by the time that this DDRP is implemented. Where adaptive management plans need to be implemented, they will be modelled 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.

4.0 IMPLEMENTATION SCHEDULE

For this decommissioning and reclamation plan it has been assumed that active mining at the Sä Dena Hes mine will cease once ore reserves at Jewell Box and the Burnick zones are depleted and ore is processed through the concentrator. The timing for completion of active mining is not known at this time and would be dependent on the decision to reopen the mine. This decision is largely dependent on metal prices, which cannot be predicted with any certainty. Mine reopening remains a function of future economics and ore reserves. Based on the present property ore reserves, it is anticipated that the mine would run for a further 3.8 years.

It is anticipated that 3 years will be required to fully implement and complete all aspects of the decommissioning and reclamation works. The work would be conducted seasonally during the ice-free period (May-September). During the first year of closure, the majority of site decommissioning works would be initiated. Some concurrent reclamation works will be initiated with the commencement of mine reopening. For example, the Main Zone open pits and associated waste rock dumps on Jewelbox hill will be progressively reclaimed during operations.

As one of the first steps in decommissioning the site, a comprehensive environmental site assessment will be done to identify any closure issues not addressed at the time of writing this plan.

Once the concentrator facility has been cleaned and flushed of tailings residue, the tailings management facility will be decommissioned. Decommissioning and final closure of the main property access road off the Robert Campbell Highway will be the last closure measure to be completed. A program of post closure monitoring and inspection will be carried out during the implementation of closure measures and for a five year period following closure. The details of the post closure monitoring program are discussed in Section 5. The program would continue until it is demonstrated that closure objectives have been met and the physical and chemical performance of remaining site structures in the long term is assured, through periodic monitoring and possibly some minor maintenance.

The general schedule for closure of the mine is summarized in Table 4-1. A more detailed schedule for closure measure implementation is presented in Table 4-2 in Gantt chart format.

The Gantt chart displays closure issues that follow directly with the discussion in the body of the text. The associated section numbers are shown where appropriate.

Table 4-1 General Closure Schedule for the Sä Dena Hes Mine

Phase of Operation	Key Triggering Event or Timeline	General Reclamation Activity
Temporary Closure/ Current Conditions	Continued through ongoing care and Maintenance	- Continued environmental monitoring programs - Implement vegetation test plots and monitor - Tailings Management Facility (pond water) geochemical test work
Production Mining	Production Mining will cease once the existing ore reserves in the Jewell Box and Burnick Zones are depleted (current reserves estimated at 1,300,000 tonnes).	Once the mine reopens, a program of progressive reclamation will be initiated to the cessation of production mining. It is expected that reclaiming of the Main zone and Jewelbox open pits, 1380 and 1250 portals and associated waste rock storage areas would be conducted concurrently with ongoing mining activities
Closure Implementation	It is anticipated that a 3-year period is required to implement the various site closure measures. Work to be done seasonally (May-September)	Dismantling of site infrastructure and implementation of the tailings management facility closure measures will commence in year 1. Work will then begin on the reclamation of the open pits, waste rock storage areas and haul roads that have not been previously reclaimed. Reclamation and revegetation of disturbed lands will occur throughout the 3-year period.
Main Access Road Closure	Main property access road will be maintained during closure implementation and for a period following post closure. Decision to permanently close the main access road made in consultation with regulatory agencies and Liard First Nation.	Main access road will be blocked, recontoured and sloped, decompacted, culverts removed and revegetated
Post Closure Monitoring	Post closure environmental monitoring will continue during closure implementation. Once environmental monitoring results are reviewed and performance of reclamation objectives demonstrated a final certificate of closure will be sought.	Environmental monitoring and inspection frequency will reduce with time, assuming sampling results are satisfactory. Data review to determine that reclamation objectives have been achieved.
Temporary Closure/ Current Conditions	Continued/ongoing care & maintenance	- Continued environmental monitoring programs - Implement vegetation test plots and monitor - Tailings Management Facility (pond water) Geochemical test work

Teck

Sa Dena Hes Mine
Detailed Decommissioning and Reclamation Plan
Closure Measures Implementation Plan

ID	Report Section #	Task Name
1	-	Closure Notification
2	-	Closure Drawing Submission
3	-	Initiate Closure Plan Execution
4	-	Closure Environmental Site Assessment
5	3.2	Mine Workings
6	3.2.1	Underground
7	3.2.1.1	Jewelbox Zone Portal 1408
8	3.2.1.2	Jewelbox Zone Portal 1250
9	3.2.1.3	Main Zone Portal 1380
10	3.2.1.4	Burnick Zone 1200 Portals
11	3.2.1.5	Burnick Zone Portal 1300
12	3.2.1.6	Ventilation Raises
13	3.2.2	Open Pits
14	3.2.2.1	Main Zone (Upper and Lower)
15	3.2.2.2	Jewelbox Pit
16	3.2.2.3	Proposed Burnick Pit
17	3.2.3	Waste Rock Dumps
19	3.3	Tailings Management Facility
20	3.3.1	Tailings Embankments
21	3.3.3	Seepage Collection Ponds
22	3.3.4	Interceptor Ditches
23	3.3.5	Decant Tower
24	3.3.6	Tailings Pipelines
25	3.3.7	Spillways
26	3.3.8	Reclaim Pond
27	3.3.8.1	Reclaim Dam
28	3.3.8.2	Spillway
29	3.3.8.3	Camp Creek Diversion
30	3.4	Infrastructure: Buildings, Structures and Services
31	3.4.1	Concentrator Buildings
32	3.4.2	Power House and Power Lines
33	3.4.3	Water Supply
34	3.4.4	North Creek Dyke
35	3.4.6	Accommodation/Camp Buildings
36	3.4.8	Miscellaneous Buildings & Structures
37	3.5	Industrial Reagents and Wastes
42	3.6	Land Reclamation & Revegetation
43	3.6.1.2	Main Access Road
44	3.6.1.3	Site Haul Roads
47	3.6.2	Non-Linear Disturbances
48	3.6.2.1	Tailings Management Facility
49	3.6.2.3	Pits and Waste Dumps
50	3.6.2.5	Refuse Areas and Borrow Pits
51	-	Environmental Monitoring
52	-	Closure Implementation Monitoring
53	-	Post Closure Monitoring (Quarterly)
66	-	Post Closure Monitoring (one/year calendar years 7 & 8)
67	-	Certificate of Closure

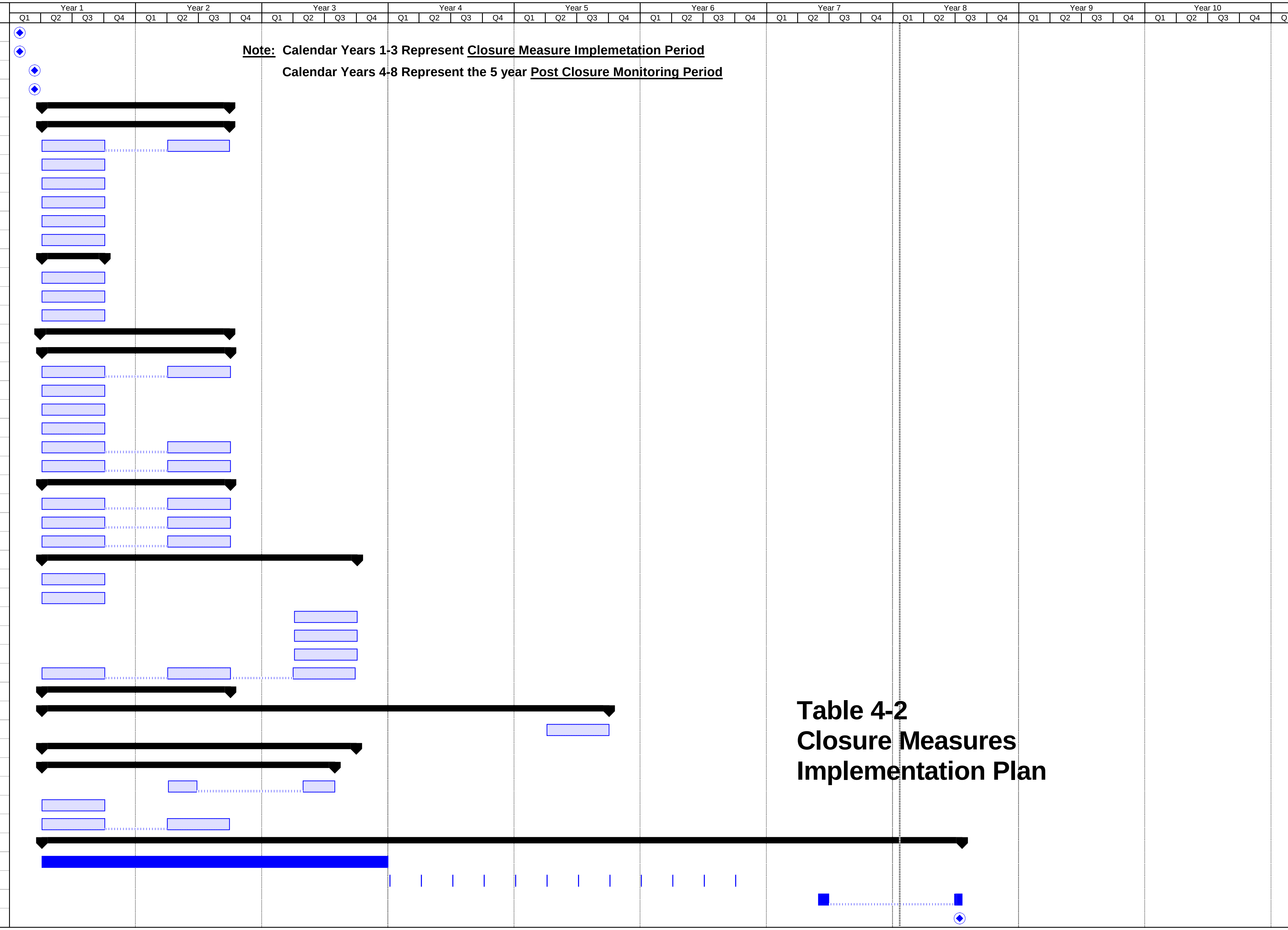

Table 4-2 Closure Measures Implementation Plan

Task | Progress | Summary | Rolled Up Task | Rolled Up Milestone | Rolled Up Progress | Split | External Tasks | Project Summary

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5.0 POST CLOSURE SITE MANAGEMENT

The closure phase of the Sä Dena Hes mine will commence with the cessation of open pit and underground production mining at both Jewelbox Hill and Burnick and the milling of ores and stockpiles from these ore zones. Once all mineable ore reserves have been processed, the mill and concentrator will be flushed and the tailings management facility 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 the major decommissioning and reclamation tasks are completed the number of site personnel required will decline.

It is expected that a Water Use Licence 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 tailings management facility in a controlled fashion. The 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 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 licenses or permits would be re-examined. The following section provides a general outline of the site management approach that will be taken at the Sä Dena Hes operations during the closure phase.

5.1 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 piles, decommissioning of the tailings management facility, salvage and removal of infrastructure, equipment and reagents, decommissioning of access roads and reclamation 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 Sä Dena Hes mine.

At present, a caretaker remains on site year round to provide site security, maintenance, monitoring and inspection requirements. It is anticipated that during the initial post closure phase, site security requirements will continue with the caretaker remaining on site following seasonal closure of the site. Security personnel will no longer be required once decommissioning and reclamation activities are completed on the property. Table 5-1 provides a summary of the personnel requirements by year for decommissioning and reclamation works.

Prior to undertaking closure activities as part of a comprehensive environmental site assessment, areas of suspected oil, chemical, or other contaminant spills will be tested to confirm locations and quantities requiring clean-up.

During the first two years of closure, the majority of site decommissioning works would be initiated and completed. During this period the mine workings, open pits and waste rock storage area would be decommissioned. Closure measures on the tailings management facility will have commenced and the dismantling of mine and mill site infrastructure completed. The number of personnel required on site will be reduced once these activities have been completed.

The main access road and property security gate will be maintained during implementation of the post closure phase. Site access along the main road will be required for personnel and truck haulage requirements to and from the site. The present security gate and fencing would be maintained while the main access road is in use. Decommissioning and reclamation of various property 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 on site and following a period of post closure monitoring a determination will be made to permanently close the main site access road and security gate. Closure of the main access road is expected to be consistent with the plan's closure philosophy; however, it is recognized that the performance of physical reclamation and the chemical stability of water drainage from the site must be assured before a final determination of the main access road closure is made.

Table 5-1 Site Decommissioning and Reclamation Seasonal Personnel Requirements

Personnel	Post Closure Year 1	Post Closure Year 2	Post Closure Year 3
Project Manager	1	1	1
Mine Engineer	1	-	-
Construction Supervisor	1	1	1
Environmental Monitoring	1	1	1
Equipment Operators	15	3	3
Equipment Mechanics/Welders/ Fabricators/Electricians	5	5	1
General Labourers	5	3	2
Catering Staff	2	1	1
Total Seasonal Personnel	17	11	10
Off Season Site Security/Caretaker	1	1	-
TOTAL	**49**	**27**	**20**

Note: Although some of the above personnel will be Company staff, the closure costing presented in Section 6 of this report reflects costs for 3rd party contractors.

5.2 SUPERVISION AND DOCUMENTATION OF WORK

All decommissioning and reclamation works will be properly supervised to ensure that works are constructed according to their design and that this work is properly carried out and documented. The project manager or the construction supervisor would supervise 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 followed as necessary.

For the tailings management facility, construction plans for all earthen works would be prepared and submitted to the Yukon Water Board for reviews and approval 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 also inspect and document this construction work. As built plans and drawings would be completed and the results of the closure work completed on the tailings management facility documented in a final as built report. This report would be submitted to the Yukon Water Board 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 which would 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.

5.3 MINE RECORDS

As noted in the previous section, all decommissioning and reclamation works will be documented. Mine records comprising the extent of underground and open pit workings would be retained by Teck. Other site records, files and plans would be archived. 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 and submitted to government agencies and boards.

5.4 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 Sä Dena Hes 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 tailings management facility 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 decant structure at the tailings management facility;
- Annual summer inspections by a qualified geotechnical engineer of tailings management facility, storage dikes, diversion channel and waste rock storage areas for structural stability; and,
- Scheduled environmental tours and audits of the property by Teck staff to look for environmental hazards and site stability. The Company will endeavor to invite various Government agencies' representatives as part of the environmental inspections.

At present, the site caretaker undertakes the scheduled environmental monitoring and inspection programs with the exception of the annual geotechnical inspection and the benthic invertebrates, stream sediment and fish monitoring programs, which are conducted by qualified professionals. All results from the licensed compliance monitoring programs are reported to the Yukon Water Board.

During the closure phase environmental compliance monitoring and inspections will continue according to the current water use licence utilizing site based personnel. A summary of the present environmental compliance and inspection program as outlined in Water Use Licence QZ97-025 is shown in Table 5-2, with monitoring station locations described in Table 5-3. Figures 1-2 and 3-1 provide the station locations for the environmental monitoring programs.

It is expected that the amount of environmental monitoring and inspection (frequency and quantity) will decline once all closures measures have been implemented. The approach to post closure monitoring is 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 licence requirements will require approval upon closure. The plan specifies the details of the monitoring planned for the 5 years immediately following completion of reclamation work (Table 5-4). The purpose of these periodic inspections, ranging from monthly to every 3 years, would be to ensure that waste discharges remain compliant, downstream receiving waters meet 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.

It is important to note that it is not proposed that all monitoring would completely cease after the 5 year monitoring plan. Based on the results from this monitoring and in discussion with the appropriate regulators during this period, the need for and the frequency of additional site monitoring will be determined at that time. If the results from monitoring indicate that the site is stable with acceptable geotechnical and environmental performance, then the Company would propose continue decreasing to the monitoring frequency. If the results from monitoring indicate there are concerns with either geotechnical conditions at the site or with environmental issues, then the site would continue to require more frequent monitoring than otherwise proposed and possibly additional remedial work would be required.

Table 5-2 Licensed Surveillance Program During Temporary Cessation of Operations

		Stations																				
		MH-1	**MH-2**	**MH-3**	**MH-4***	**MH-5**	**MH-6a**	**MH-6b****	**MH-7**	**MH-8**	**MH-9**	**MH-10**	**MH-11**	**MH-13**	**MH-14**	**MH-16**	**MH-18**	**MH-19**	**MH-20**	**MH-22**	**MH-24**	**MH-25**
	Water Quality Monitoring																					
WATER QUALITY PARAMETERS	pH (Field)	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Flow Rate	Q	M	M	Q	M	M	Q	M	M	M	M	M/C***	Q	Q	Q	--	--	--	M	--	M
	Temperature	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Conductivity	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Alkalinity	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	pH(Lab)	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Tot. Sus. Solids	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Dissolved Solids	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	ICP Scan - Total	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Ammonia - Total	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Sulphate	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Hardness	Q	M	M	Q	M	M	Q	M	M	M	M	M	Q	Q	Q	--	--	--	M	--	M
	Cyanide - Total	Q	M	--	--	--	M	Q	M	--	--	--	M	Q	Q	Q	--	--	--	--	--	--
	Bioassay - LC50	--	--	--	--	--	Q	Q	--	--	--	--	--	--	--	--	--	--	--	--	--	--
MONITORING PROGRAMS	**Environmental Monitoring**																					
	Benthic Invertebrates	--	--	--	--	--	--	--	--	--	--	--	--	2Y	2Y	--	2Y	2Y	--	--	2Y	--
	Stream Sediments	--	--	--	--	--	--	--	--	--	--	--	--	2Y	2Y	--	2Y	2Y	--	--	2Y	--
	Fish Monitoring	--	--	--	--	--	--	--	--	--	--	--	--	2Y	--	--	2Y	--	2Y	--	2Y	--
	Physical Monitoring																					
	Internal Monitoring (Earthworks)	Monthly internal inspection of all earthworks on site																				
	Annual Geotechnical Inspection	Annual Geotechnical Inspection of all earthworks																				
	Piezometers Monitoring	Monthly piezometric readings from wells located in tailings management facility																				
	Settlement Marker Monitoring	Annual readings taken during geotechnical inspection																				
	Seepage Monitoring	Monthly seepage readings from seepage weirs located in tailings management facility																				

LEGEND: **Q = Quarterly** **M = Monthly** **2Y = every second year during September** **C = Continuous**

NOTES:

--	Monitoring for this parameter at this station is not required as per water use licence schedule
*	To be monitored as an alternative site to MH-3 only when there is no discharge from the Camp Creek Sediment Pond.
**	To be monitored as an alternative site to MH-6a only when there is no discharge from the reclaim pond.
***	Monitor a minimum of monthly or continuous flow recording year round.

Table 5-3 Licensed Surveillance Network - Water Quality Monitoring Site

MH-1:	Tailings Pond Outflow – discharge from the tailings pond, through the decant tower, to the reclaim pond or if no discharge, the pond water.
MH-2:	Tailings North Dam Seepage – seepage water collected immediately below the downstream face of the north tailings dam.
MH-3:	Camp Creek Pond Outflow – discharge from a sedimentation pond located in upper Camp Creek which drains the Jewelbox Hill 1250 Portal and Main Zone Waste Dump.
MH-4:	Alternate Site – Lower Camp Creek – on Camp Creek located immediately above the West Interceptor Ditch; this is an alternative site to be sample only when there is no discharge from MH-3.
MH-5:	Portal Creek – a small intermittent stream which drains the East face of Jewelbox Hill, immediately below the 1408 portal, to False Canyon Creek; releases discharge from the portal sedimentation pond and water from the Jewelbox Waste Dump.
MH-6a:	Reclaim Pond Outflow – discharge from the reclaim pond through the overflow spillway.
MH-6b:	Reclaim Pond – To be monitored as an alternative to MH-6a only when there is no discharge from the reclaim pond.
MH-7:	Reclaim Pond Seepage – water accumulating within the seepage collection system located immediately below the downstream face of the reclaim dam.
MH-8:	Burnick Creek – a small intermittent drainage south of the Burnick pit and portal sites which will consolidate drainage within a sediment pond from those sites as well as Burnick pit access road runoff; the drainage contributes to the upper end of Tributary E, east fork, of False Canyon Creek.
MH-9:	Burnick West Pond Outflow – discharge from a small sediment pond, which collects drainage from the west and north faces of the Burnick Dump and drains to the upper end of Tributary E, west fork, of False Canyon Creek.
MH-10:	Burnick East Pond Outflow – discharge from a small sediment pond, which collects drainage from the east face of the Burnick Dump, to a branch of Tributary E, west fork, of False Canyon Creek.
MH-11:	Upper False Canyon Creek located one kilometre downstream of the tailing management facility.
MH-12:	Tributary E, east fork – of False Canyon Creek, approximately 2 kilometres downstream of the north tailings dam.
MH-13:	The main channel of False Canyon Creek, approximately 10 kilometres downstream of the reclaim pond.
MH-14:	The main channel of False Canyon Creek, approximately 20 kilometres downstream of the reclaim pond just upstream of the confluence with Tributary E.
MH-15:	Tributary E, west fork, upstream of the confluence with Tributary E, east fork, approximately six kilometres downstream of the North Hill development.
MH-16:	The main channel of False Canyon Creek, downstream of the confluence of Tributary D, approximately 22 kilometres downstream of the reclaim pond.
MH-18:	Lower reaches of Tributary E, approximately one kilometre above the confluence with False Canyon Creek.
MH-19:	The main channel of False Canyon Creek, approximately four kilometres downstream of the Tributary D confluence.
MH-20:	The main channel of False Canyon Creek, approximately 13 kilometres upstream of the mouth and immediately above the Tributary B confluence.
MH-22:	Burnick portal discharge, the end of pipe discharge point into the North Hill Settlement Basin.
MH-23:	North Creek immediately downstream of the impoundment.
MH-24:	The east tributary that joins False Canyon Creek just downstream of MH-13.
MH-25:	The Min Zone 1380 Portal discharge.

Table 5-4 Environmental Monitoring and Inspection Program - Post Closure

		Post Closure Implementation Year			Post Closure Monitoring Year					
		1	**2**	**3**	**1**	**2**	**3**	**4**	**5**	**>6**
	Calendar Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**>9**
WATER QUALITY MONITORING	**Water Quality Monitoring Stations ***									
	MH-1	Q	Q	Q	Q	Q	Q	A	A	P
	MH-2	M	M	M	Q	Q	Q	A	A	P
	MH-3	M	M	M	--	--	--	--	--	--
	MH-4	Q	Q	Q	Q	Q	Q	A	A	P
	MH-5	M	M	M	Q	Q	Q	A	A	P
	MH-6	M	M	M	--	--	--	--	--	--
	MH-7	M	M	M	--	--	--	--	--	--
	MH-8	M	M	M	--	--	--	--	--	--
	MH-9	M	M	M	--	--	--	--	--	--
	MH-10	M	M	M	--	--	--	--	--	--
	MH-11	M	M	M	Q	Q	Q	A	A	P
	MH-13	Q	Q	Q	Q	Q	Q	A	A	P
	MH-14	Q	Q	Q	Q	Q	Q	A	A	P
	MH-16	Q	Q	Q	--	--	--	--	--	--
	MH-18	--	--	--	A***	--	A***	--	A***	P
	MH-19	--	--	--	A***	--	A***	--	A***	P
	MH-22	M	M	M	Q	Q	Q	A	A	P
	MH-24	--	--	--	A***	--	A***	--	A***	P
	MH-25	M	M	M	--	--	--	--	--	--
MONITORING PROGRAMS										
	Environmental Monitoring **									
	Benthic Invertebrates		2Y		2Y	--	2Y	--	2Y	--
	Stream Sediments		2Y		2Y	--	2Y	--	2Y	--
	Fish Monitoring		2Y		2Y	--	2Y	--	2Y	--
	Physical Monitoring									
	Internal Monitoring (Earthworks)	M	M	M	--	--	--	--	--	--
	Annual Geotechnical Inspection	A	A	A	A	A	A	A	A	P
	Piezometers Monitoring	M	M	M	Q	Q	Q	A	A	P
	Settlement Marker Monitoring	A	A	A	A	A	A	A	A	P
	Seepage Monitoring	M	M	M	Q	Q	Q	A	A	P

LEGEND:

Q = Quarterly; M = Monthly; A = Annually; 2Y = every second year during September; P = Periodic Inspectior

NOTES: Post Closure starts after all mining & milling is completed. Post Closure phases include reclamation implementation and long term monitoring.

***** Water quality parameters include pH, Flow, Temperature, Conductivity, Alkalinity, Suspended solids, Dissolved solids, ICP scan - Total and Dissolved metals, Ammonia, Sulphate, Hardness and Total cyanide

** Monitoring stations for this program includes MH-13, MH-14, MH-18, MH-19 & MH-24

*** Water Quality monitored annually in conjunction with Environmental Monitoring Programs

Access to the property for post closure monitoring would continue via the main access road until it is eventually fully decommissioned. Following this, site access would be via helicopter. A summary of the post closure monitoring and inspection program is outlined in Table 5-4.

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 Yukon Water Board and the Yukon Government according to requirements contained in the Water Use Licence, Mine Production Licence and other operating permits and approvals.

Company personnel responsible for the management of the Sä Dena Hes property would continue to meet with regulatory agencies, the Liard First Nation, and the community on an as-needed basis to apprise interested parties 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 Yukon regulators and or other interested parties. Once this review is completed, the Company would apply for a Certificate of Closure for the Sä Dena Hes mine under the Yukon Quartz Mining Act Mine Production Regulations. The Certificate of Closure will confirm that all closure obligations for the site have been met.

6.0 CLOSURE COSTS

The updated estimated costs to implement the Detailed Decommissioning and Reclamation Plan described in this report are presented in updated Tables 6-1 through to 6-10. Table 6-1 presents the summary of cost estimates for various mine components including mine workings, tailings management facility, infrastructure, land reclamation and revegetation, and post closure monitoring and maintenance.

As shown in Table 6-1, a closure cost of *$7,691,770* is estimated for current conditions with no mine reopening (Scenario 1). Closure costs for Scenario 2, wherein the mine resumes operation to exhaust the known ore reserves (additional 3.8 years mining), is estimated at *$8,347,355.* Where there is a different cost for closure measures for Scenario 1 or 2, they are presented separately. All costs are in 2009 dollars.

Where available, the equipment costs have been updated using current unit rates for equipment providers from Yukon Government's *Third Party Equipment Rental Rates Summary* for the fiscal year 2005/06. Contractor Unit Rates have been updated to reflect current pricing for these activities. Contingency costing allowance has been increased from 15% to 20%. All costing has been applied to levels of effort in sufficient detail to allow thorough scrutiny by the reader.

- Table 6-1 provides a summary of all cost estimates;
- Table 6-2 sets out unit rates used in the calculations;
- Table 6-3 provides closure cost estimates for the existing mine workings (Scenario 1);
- Table 6-4 outlines the additional mine workings closure costs associated with mine reopening (Scenario 2);
- Table 6-5 presents cost estimates for the tailings management facility Scenario 1;
- Table 6-6 estimates costs for the tailings management facility for reopening (Scenario 2);
- Table 6-7 presents the decommissioning cost estimates for site infrastructure. These costs are common to both Scenario 1 and 2;
- Table 6-8 presents cost estimates for land reclamation and revegetation for Scenario 1;
- Tables 6-9 presents cost estimates for land reclamation and revegetation for Scenario 2;
- Table 6-10 outlines costs associated with the site management during closure implementation and presents post closure costs for compliance monitoring and maintenance

for the entire projected 8 year post closure monitoring life (These costs are common to both Scenario 1 and 2).

All of the individual mine component cost estimate tables provide the detailed breakdown of the costs to implement each of the main elements of the works as described in the Decommissioning & Reclamation Plan.

Table 6 - 1

Estimated Decommissioning Costs Summary Table - Temporary Closure Conditions

December 2009 Update

Table	Description	Cost
3	Mine Workings	$337,940
4	Tailings Management Facility	$859,585
5	Infrastructure	$1,255,875
6	Land Reclamation and Revegetation	$1,621,338
7	Post Closure Site Management (Including Monitoring & Maintenance)	$2,335,070
	Sub-total	**$6,409,808**
	Contingency Allowance @ 20%	$1,281,962
	Total Estimated Closure Cost	**$7,691,770**

Table	Description	Cost
3	Mine Workings	$353,610
4	Tailings Management Facility	$1,045,750
5	Infrastructure	$1,255,875
6	Land Reclamation and Revegetation	$1,965,824
7	Post Closure Site Management (Including Monitoring & Maintenance)	$2,335,070
	Sub-total	**$6,956,129**
	Contingency Allowance @ 20%	$1,391,226
	Total Estimated Closure Cost	**$8,347,355**

Table 6-2
Unit Costs

EQUIPMENT RATES		
Bulldozer-small (Cat D6)	$130	per hr
Bulldozer-large (D9H)	$260	per hr
D250E Haul Truck	$220	per hr
235 Excavator	$240	per hr
235 Excavator w Hammer	$275	per hr
16H grader	$220	per hr
Loader-large (Cat 988B)	$250	per hr
Loader-small (Cat 950)	$125	per hr
Drill Rig	$186	per hr
Compactor (Walk behind)	$75	per day
Tractor Trailer (lowbed)	$130	per hr
30 ton Crane	$160	per hr
Hiab Flatdeck truck	$125	per hr
Pickup Truck	$2,500	per month

PERSONNEL RATES		
Blaster	$60	per hr
General Labourer	$45	per hr
Trades Labourer	$80	per hr
Site Supervisor	$95	per hr
Design Engineer	$130	per hr
Environmental Scientist	$95	per hr
Project Manager	$9,700	per month
Camp Labourer	$4,000	per month
Site Caretaker	$6,100	per month
Environmental Monitor	$5,000	per month
Analytical Costs	$500	Unit cost

REVEGETATION RATES		
Revegetation Seed Mix	$13	per kg
Fertilizer	$1	per kg
Seed/Fertilizer Application	$1,500	per ha

CONTRACTOR UNIT RATES & CAMP COST		
Excavation of Soil	$5	cu.m
Supply and place Geotextile	$7	sq m
Load, haul and place soil cover	$8	cu.m
Haul & Place rock cover	$8	cu.m
Drill, Blast and Screen Rip Rap	$22	cu.m
Load, Haul and Place Soil/Rip Rap	$13	cu.m
Erosion barriers	$3	sq m
Camp Cost	$110	per day per person
Power and Heat	$5,500	per month
Sundry equipment maintenance	$5,000	yearly
General Administrative expenses	$2,000	per month

Table 6-3
Estimated Decommissioning Costs For Current Site Status - Mine Workings (Scenario 1)

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
1.0	**MINE WORKINGS**						
1.1	**JEWELBOX ZONE**						
1.1.1	**Jewelbox Zone - 1408 Portal (4.5m x 4.5m)**						
	Plug portal with tires	235 Excavator	hrs	20	$240	$4,800	
	Supply of used large truck tires	Misc.	ea	30	$100	$3,000	
	Place waste rock cap over tires	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	10	$220	$2,200	
	Supply broken rock for drain at base of plug and discharge channel riprap	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	20	$220	$4,400	
	Construct rock drain at base of plug	235 Excavator	hrs	5	$240	$1,200	
	Supply till to seal discharge channel	235 Excavator	hrs	4	$240	$960	
		D250E Haul Truck	hrs	4	$220	$880	
	Construct lined open channel for discharge from portal	235 Excavator	hrs	15	$240	$3,600	
	Load, haul & place sand for liner bedding	Load, haul and place soil cover	cu m	100	$8	$800	
		Compactor (Walk behind)	days	1	$75	$75	
	Supply & install liner material	Misc.	l.s.		$5,000	$5,000	
	Misc. Supplies & Shipping	Misc.	l.s.			$5,000	
	Labour to assist with placing tires & cap	General Labourer	hrs	40	$45	$1,800	
	Supervision to design & install tires & cap	Site Supervisor	hrs	40	$95	$3,800	
	Sub-Total						**$42,315**
1.1.2	**Jewelbox Zone - 1250 Portal**						
	Place waste rock cap in opening	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	20	$220	$4,400	
	Supervision of work	Site Supervisor	hrs.	10	$95	$950	
	Sub-Total						**$7,750**
1.1.3	**Jewelbox Zone - Ventilation Raises**						
	Construct Concrete cap over upper vent openings (both upper & lower)	235 Excavator	hrs	40	$240	$9,600	
		General Labourer	hrs	40	$45	$1,800	
		Misc.	l.s.		$7,500	$7,500	
	Contour Slope around opening	235 Excavator	hrs	10	$240	$2,400	
	Design and Site Supervision of Cap	Design Engineer	hrs	75	$130	$9,750	
	Sub-Total						**$31,050**
1.1.4	**Jewelbox Zone - Open Pit**						
	Drill and blast highwall	Drill Rig	hrs	20	$186	$3,720	
		Blaster	hrs	20	$60	$1,200	
		General Labourer	hrs	20	$45	$900	
		Misc.	l.s.		$2,500	$2,500	
		Bulldozer-large (D9H)	hrs	20	$260	$5,200	
	Construct rock filled Spillway	235 Excavator	hrs	40	$240	$9,600	
		Drill Rig	hrs	20	$186	$3,720	
		Blaster	hrs	20	$60	$1,200	
		General Labourer	hrs	**40**	$45	$1,800	
		Bulldozer-large (D9H)	hrs	10	$260	$2,600	
		D250E Haul Truck	hrs	10	$220	$2,200	
	Layout and Site Supervision of Spillway	Site Supervisor	hrs	80	$95	$7,600	
	Sub-Total						**$42,240**
1.1.5	**Jewelbox Zone - Waste Dumps**						
	Reslope Upper Zone of Dump below Portal (1.3ha)	Bulldozer-large (D9H)	hrs	30	$260	$7,800	
	Reslope Jewelbox pit waste on ridge (1.9 ha)	Bulldozer-large (D9H)	hrs	**30**	$260	$7,800	
	Pull Back crest of waste dump and road cut below access road to Main Pit (0.5ha)	235 Excavator	hrs	30	$240	$7,200	
	Reslope Jewelbox pit waste dump above road (0.8ha)	Bulldozer-large (D9H)	hrs	30	$260	$7,800	
	Supervision	Site Supervisor	hrs	55	$95	$5,225	
	Sub-Total						**$35,825**
1.2	**MAIN ZONE**						
1.2.1	**Main Zone - 1380 Portal (see also Main Zone Pit) (4.5m X 4.5m)**						
	Plug 1380 Portal with concrete plug	Misc.	l.s.			$50,000	
	Sub-Total						**$50,000**
1.2.2	**Main Zone - Open Pit**						
	Drill and blast highwall and cover Portal 1380	Drill Rig	hrs	20	$186	$3,720	
		Blaster	hrs	20	$60	$1,200	
		General Labourer	hrs	20	$45	$900	
		Supplies			$2,500	$2,500	
		Bulldozer-large (D9H)	hrs	20	$260	$5,200	
	Sub-Total						**$13,520**
1.2.3	**Main Zone - Waste Dump**						
	Pull Back crest of waste dump below pit (0.3ha)	235 Excavator	hrs	20	$240	$4,800	
	Pull Back crest of waste dump below 1250 portal	235 Excavator	hrs	5	$240	$1,200	
	Supervision	Site Supervisor	hrs	12	$95	$1,140	
	Sub-Total						**$7,140**
1.3	**BURNICK ZONE**						
1.3.1	**Burnick Zone - 1200 Portal (2 portals?) (sizes?)**						
	Plug portals with tires	235 Excavator	hrs	30	$240	$7,200	
	Supply of used large truck tires	Misc.	ea	45	$100	$4,500	
	Supply & Place waste rock cap over tires	235 Excavator	hrs	20	$240	$4,800	
		D250E Haul Truck	hrs	40	$220	$8,800	
	Supply broken rock for drain at base of plug and discharge channel riprap	235 Excavator	hrs	20	$240	$4,800	
		D250E Haul Truck	hrs	40	$220	$8,800	
	Construct rock drain at base of portal plugs	235 Excavator	hrs	10	$240	$2,400	
	Supply till to line discharge channel	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	20	$220	$4,400	
	Construct lined open channel for discharge from portal	235 Excavator	hrs	20	$240	$4,800	
	Load, haul & place sand for liner bedding	Load, haul and place soil cover	cu m	100	$8	$800	
		Compactor (Walk behind)	days	1	$75	$75	
	Supply & install liner material	Misc.	l.s.		$5,000	$5,000	
	Misc. Supplies	Misc.	l.s.			$4,500	
	Labour to assist with placing tires & cap	General Labourer	hrs	80	$45	$3,600	
	Design of rock drain and channel	Design Engineer	hrs	40	$130	$5,200	
	Supervision installation of tire plug & rock drain	Site Supervisor	hrs	50	$95	$4,750	
	Sub-Total						**$76,825**
1.3.2	**Burnick Zone - 1300 Portal**						
	Plug portals with tires	235 Excavator	hrs	30	$240	$7,200	
	Supply of used large truck tires	Misc.	ea	45	$100	$4,500	
	Supply & Place waste rock cap over tires	235 Excavator	hrs	20	$240	$4,800	
		D250E Haul Truck	hrs	20	$220	$4,400	
	Misc. Supplies	Misc.	l.s.			$5,000	
	Labour to assist with tire installation	General Labourer	hrs	40	$45	$1,800	
	Supervision to design & install tires & cap	Site Supervisor	hrs	20	$95	$1,900	
	Adjustment for to balance with agreed cost review					-$13,700	
	Sub-Total						**$15,900**
1.3.3	**Burnick Zone - Open Pit**						
	Does not exist under current conditions					$0	
	Sub-Total						**$0**
1.3.4	**Burnick Zone - Waste Dump**						
	Reslope Dump below Portal (1.4ha)	Bulldozer-large (D9H)	hrs	50	$260	$13,000	
	Supervision	Site Supervisor	hrs	25	$95	$2,375	
	Sub-Total						**$15,375**
Total Estimated Cost in Reclaiming Mine Workings							**$337,940**

Table 6-4
Estimated Decommissioning Costs For Current Site Status - Mine Workings (Scenario 2)

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
1.0	**MINE WORKINGS**						
1.1	**JEWELBOX ZONE**						
1.1.1	**Jewelbox Zone - 1408 Portal (4.5m x 4.5m)**						
	Plug portal with tires	235 Excavator	hrs	20	$240	$4,800	
	Supply of used large truck tires	Misc.	ea	30	$100	$3,000	
	Place waste rock cap over tires	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	10	$220	$2,200	
	Supply broken rock for drain at base of plug and discharge channel riprap	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	20	$220	$4,400	
	Construct rock drain at base of plug	235 Excavator	hrs	5	$240	$1,200	
	Supply till to seal discharge channel	235 Excavator	hrs	4	$240	$960	
		D250E Haul Truck	hrs	4	$220	$880	
	Construct lined open channel for discharge from portal	235 Excavator	hrs	15	$240	$3,600	
	Load, haul & place sand for liner bedding	Load, haul and place soil cover	cu m	100	$8	$800	
		Compactor (Walk behind)	days	1	$75	$75	
	Supply & install liner material	Misc.	l.s.		$5,000	$5,000	
	Misc. Supplies & Shipping	Misc.	l.s.			$5,000	
	Labour to assist with placing tires & cap	General Labourer	hrs	40	$45	$1,800	
	Supervision to design & install tires & cap	Site Supervisor	hrs	40	$95	$3,800	
	Sub-Total						**$42,315**
1.1.2	**Jewelbox Zone - 1250 Portal**						
	Place waste rock cap in opening	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	20	$220	$4,400	
	Supervision of work	Site Supervisor	hrs.	10	$95	$950	
	Sub-Total						**$7,750**
1.1.3	**Jewelbox Zone - Ventilation Raises**						
	Construct Concrete cap over upper vent openings (both upper & lower)	235 Excavator	hrs	40	$240	$9,600	
		General Labourer	hrs	40	$45	$1,800	
		Misc.	l.s.		$7,500	$7,500	
	Contour Slope around opening	235 Excavator	hrs	10	$240	$2,400	
	Design and Site Supervision of Cap	Design Engineer	hrs	75	$130	$9,750	
	Sub-Total						**$31,050**
1.1.4	**Jewelbox Zone - Open Pit**						
	Drill and blast highwall	Drill Rig	hrs	20	$186	$3,720	
		Blaster	hrs	20	$60	$1,200	
		General Labourer	hrs	20	$45	$900	
		Misc.	l.s.		$2,500	$2,500	
		Bulldozer-large (D9H)	hrs	20	$260	$5,200	
	Construct rock filled Spillway	235 Excavator	hrs	40	$240	$9,600	
		Drill Rig	hrs	20	$186	$3,720	
		Blaster	hrs	20	$60	$1,200	
		General Labourer	hrs	**40**	$45	$1,800	
		Bulldozer-large (D9H)	hrs	10	$260	$2,600	
		D250E Haul Truck	hrs	10	$220	$2,200	
	Layout and Site Supervision of Spillway	Site Supervisor	hrs	80	$95	$7,600	
	Sub-Total						**$42,240**
1.1.5	**Jewelbox Zone - Waste Dumps**						
	Reslope Upper Zone of Dump below Portal (1.3ha)	Bulldozer-large (D9H)	hrs	30	$260	$7,800	
	Reslope Jewelbox pit waste on ridge (1.9 ha)	Bulldozer-large (D9H)	hrs	**30**	$260	$7,800	
	Pull Back crest of waste dump and road cut below access road to Main Pit (0.5ha)	235 Excavator	hrs	30	$240	$7,200	
	Reslope Jewelbox pit waste dump above road (0.8ha)	Bulldozer-large (D9H)	hrs	30	$260	$7,800	
	Supervision	Site Supervisor	hrs	55	$95	$5,225	
	Sub-Total						**$35,825**
1.2	**MAIN ZONE**						
1.2.1	**Main Zone - 1380 Portal (see also Main Zone Pit) (4.5m X 4.5m)**						
	Plug 1380 Portal with concrete plug	Misc.	l.s.			$50,000	
	Sub-Total						**$50,000**
1.2.2	**Main Zone - Open Pit**						
	Drill and blast highwall and cover Portal 1380	Drill Rig	hrs	20	$186	$3,720	
		Blaster	hrs	20	$60	$1,200	
		General Labourer	hrs	20	$45	$900	
		Supplies			$2,500	$2,500	
		Bulldozer-large (D9H)	hrs	20	$260	$5,200	
	Sub-Total						**$13,520**
1.2.3	**Main Zone - Waste Dump**						
	Pull Back crest of waste dump below pit (0.3ha)	235 Excavator	hrs	20	$240	$4,800	
	Pull Back crest of waste dump below 1250 portal	235 Excavator	hrs	5	$240	$1,200	
	Supervision	Site Supervisor	hrs	12	$95	$1,140	
	Sub-Total						**$7,140**
1.3	**BURNICK ZONE**						
1.3.1	**Burnick Zone - 1200 Portal (2 portals?) (sizes?)**						
	Plug portals with tires	235 Excavator	hrs	30	$240	$7,200	
	Supply of used large truck tires	Misc.	ea	45	$100	$4,500	
	Supply & Place waste rock cap over tires	235 Excavator	hrs	20	$240	$4,800	
		D250E Haul Truck	hrs	40	$220	$8,800	
	Supply broken rock for drain at base of plug and discharge channel riprap	235 Excavator	hrs	20	$240	$4,800	
		D250E Haul Truck	hrs	40	$220	$8,800	
	Construct rock drain at base of portal plugs	235 Excavator	hrs	10	$240	$2,400	
	Supply till to line discharge channel	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	20	$220	$4,400	
	Construct lined open channel for discharge from portal	235 Excavator	hrs	20	$240	$4,800	
	Load, haul & place sand for liner bedding	Load, haul and place soil cover	cu m	100	$8	$800	
		Compactor (Walk behind)	days	1	$75	$75	
	Supply & install liner material	Misc.	l.s.		$5,000	$5,000	
	Misc. Supplies	Misc.	l.s.			$4,500	
	Labour to assist with placing tires & cap	General Labourer	hrs	80	$45	$3,600	
	Design of rock drain and channel	Design Engineer	hrs	40	$130	$5,200	
	Supervision installation of tire plug & rock drain	Site Supervisor	hrs	50	$95	$4,750	
	Sub-Total						**$76,825**
1.3.2	**Burnick Zone - 1300 Portal**						
	Plug portals with tires	235 Excavator	hrs	30	$240	$7,200	
	Supply of used large truck tires	Misc.	ea	45	$100	$4,500	
	Supply & Place waste rock cap over tires	235 Excavator	hrs	20	$240	$4,800	
		D250E Haul Truck	hrs	20	$220	$4,400	
	Misc. Supplies	Misc.	l.s.			$5,000	
	Labour to assist with tire installation	General Labourer	hrs	40	$45	$1,800	
	Supervision to design & install tires & cap	Site Supervisor	hrs	20	$95	$1,900	
	Adjustment for to balance with agreed cost review					-$13,700	
	Sub-Total						**$15,900**
1.3.3	**Burnick Zone - Open Pit**						
	Drill and blast highwall and cover portals	Drill Rig	hrs	20	$186	$3,720	
		Blaster	hrs	20	$60	$1,200	
		General Labourer	hrs	20	$45	$900	
		Supplies	l.s.			$2,750	
		Bulldozer-large (D9H)	hrs	20	$260	$5,200	
		Site Supervisor	hrs	20	$95	$1,900	
						$0	
	Sub-Total						**$15,670**
1.3.4	**Burnick Zone - Waste Dump**						
	Reslope Dump below Portal (1.4ha)	Bulldozer-large (D9H)	hrs	50	$260	$13,000	
	Supervision	Site Supervisor	hrs	25	$95	$2,375	
	Sub-Total						**$15,375**
Total Estimated Cost in Reclaiming Mine Workings							**$353,610**

Table 6-5
Estimated Decommissioning Costs For Current Site Status - Tailings Management Facilities (Scenario 1)

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Costs
2.0	**TAILINGS MANAGEMENT FACILITY - CURRENT CONDITIONS**						
2.1	**South Dam**						
2.1.1	Pump down Pond	Pump & minor pre-treatment	cu.m	220,000	$0.10	$22,000	
2.1.2	Remove Existing Spillway	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	20	$220	$4,400	
2.1.3	Breach Dam	Excavation of Soil	cu.m	16,300	$5	$81,500	
2.1.4	Construct Spillway and Exit Channel						
	Excavate Channel	Excavation of Soil	cu.m	4,125	$5	$20,625	
	Geotextile Spillway and Channel	Supply and place Geotextile	sq.m	4,250	$7	$29,750	
	Rip Rap Spillway and Channel	Drill, Blast and Screen Rip Rap	cu.m	2,625	$22	$57,750	
		Load, Haul and Place Soil/Rip Rap	cu.m	2,625	$13	$34,125	
	Design Spillway & Channel	Design Engineer	hrs	50	$130	$6,500	
	Site Supervision Spillway and channel	Site Supervisor	hrs	60	$95	$5,700	
	Sub-Total						**$264,750**
2.2	**Decant Tower**						
2.2.1	Dismantle Decant Tower and Bury debris	235 Excavator w Hammer	hrs	20	$275	$5,500	
		235 Excavator	hrs	10	$240	$2,400	
		General Labourer	hrs	10	$45	$450	
2.2.2	Specifications/Design Plug for Decant Pipe	Design Engineer	hrs	24	$130	$3,120	
2.2.3	Plug Decant Pipe	General Labourer	hrs	80	$45	$3,600	
		Materials	l.s.			$5,500	
2.2.4	Supervision	Site Supervisor	hrs	40	$95	$3,800	
	Sub-Total						**$24,370**
2.3	**Tailings Surface**						
2.3.1	Recontour tailings surface (11ha)	Bulldozer-large (D9H)	hrs	200	$260	$52,000	
2.3.2	Remove Cofferdam and bury culvert	Bulldozer-large (D9H)	hrs	16	$260	$4,160	
2.3.3	Supervision	Site Supervisor	hrs	50	$95	$4,750	
	Sub-Total						**$60,910**
2.4	**Reclaim Dam**						
2.4.1	Pump down pond	Pumping (all-inclusive)	cu.m	340,000	$0.03	$10,200	
2.4.2	Remove Existing Spillway and exit channel. Regrade	235 Excavator	hrs	20	$240	$4,800	
		Bulldozer-large (D9H)	hrs	30	$260	$7,800	
		D250E Haul Truck	hrs	40	$220	$8,800	
2.4.2	Breach Dam	Excavation of Soil	cu.m	21,800	$5	$109,000	
2.4.3	Construct Spillway and Exit Channel						
	Geotextile Spillway and Channel	Supply and place Geotextile	sq.m	1,700	$7	$11,900	
	Rip Rap Spillway and Channel	Drill, Blast and Screen Rip Rap	cu.m	1,050	$22	$23,100	
		Load, Haul and Place Soil/Rip Rap	cu.m	1,050	$13	$13,650	
	Design Spillway & Channel	Design Engineer	hrs	50	$130	$6,500	
	Site Supervision Spillway and channel	Site Supervisor	hrs	60	$95	$5,700	
	Sub-Total						**$201,450**
2.5	**Camp Creek Diversion and Restoration**						
2.5.1	Breach existing diversion, remove culverts, regrade	235 Excavator	hrs	40	$240	$9,600	
		Bulldozer-large (D9H)	hrs	30	$260	$7,800	
		D250E Haul Truck	hrs	20	$220	$4,400	
2.5.2	Realign Camp Creek and riprap						
	Excavate Channel	Excavation of Soil	cu.m	9,250	$5	$46,250	
	Supply and place Geotextile	Supply and place Geotextile	sq.m	6,290	$7	$44,030	
	Supple and place Rip Rap	Drill, Blast and Screen Rip Rap	cu.m	3,885	$22	$85,470	
		Load, Haul and Place Soil/Rip Rap	cu.m	3,885	$13	$50,505	
	Design of Channel Realignment	Design Engineer	hrs	40	$130	$5,200	
	Site Supervision of channel realignment	Site Supervisor	hrs	60	$95	$5,700	
	Sub-Total						**$258,955**
2.6	**Interceptor Ditches**						
2.6.1	Breach ditches and recontour	Bulldozer-large (D9H)	hrs	30	$260	$7,800	
	Sub-Total						**$7,800**
2.7	**Tailings pipeline (1.9km)**						
2.7.1	Remove Pipeline	235 Excavator	hrs	50	$240	$12,000	
		D250E Haul Truck	hrs	50	$220	$11,000	
		General Labourer	hrs	100	$45	$4,500	
		Site Supervisor	hrs	20	$95	$1,900	
	Sub-Total						**$29,400**
2.8	**Reclaim pipeline (0.8km)**						
2.8.1	Remove Pipeline	235 Excavator	hrs	20	$240	$4,800	
		D250E Haul Truck	hrs	20	$220	$4,400	
		General Labourer	hrs	40	$45	$1,800	
		Site Supervisor	hrs	10	$95	$950	
	Sub-Total						**$11,950**
Total Estimated Cost in Reclaiming TMF							**$859,585**

Table 6-6
Estimated Decommissioning Costs For Current Site Status - Tailings Management Facilities (Scenario 2)

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Costs
2.0	**TAILINGS MANAGEMENT FACILITY - CURRENT CONDITIONS**						
2.1	**South Dam**						
2.1.1	Pump down Pond	Pump & minor pre-treatment	cu.m	220,000	$0.10	$22,000	
2.1.2	Remove Existing Spillway	235 Excavator	hrs	10	$240	$2,400	
		D250E Haul Truck	hrs	20	$220	$4,400	
		Excavation of Soil	cu.m	16,300	$5	$81,500	
2.1.3	Construct Spillway and Exit Channel						
	Excavate Channel	Excavation of Soil	cu.m	4,125	$5	$20,625	
	Geotextile Spillway and Channel	Supply and place Geotextile	sq.m	4,250	$7	$29,750	
	Rip Rap Spillway and Channel	Drill, Blast and Screen Rip Rap	cu.m	2,625	$22	$57,750	
		Load, Haul and Place Soil/Rip Rap	cu.m	2,625	$13	$34,125	
	Design Spillway & Channel	Design Engineer	hrs	50	$130	$6,500	
	Site Supervision Spillway and channel	Site Supervisor	hrs	60	$95	$5,700	
2.1.4	Plunge Pool						
	Excavate Channel	Excavation of Soil	cu.m	350	$5	$1,750	
	Supply and place geotextile (spillway and channel)	Supply and place Geotextile	sq.m	300	$7	$2,100	
	Supply and place riprap (spillway and channel)	Drill, Blast and Screen Rip Rap	cu.m	206	$22	$4,532	
		Load, Haul and Place Soil/Rip Rap	cu.m	206	$13	$2,678	
	Design plunge pool and channel	Design Engineer	hrs	32	$130	$4,160	
	Design and site supervisor for spillway and channel	Site Supervisor	hrs	80	$95	$7,600	
	Sub-Total						**$287,570**
2.2	**Decant Tower**						
2.2.1	Dismantle Decant Tower and Bury debris	235 Excavator w Hammer	hrs	20	$275	$5,500	
		235 Excavator	hrs	10	$240	$2,400	
		General Labourer	hrs	10	$45	$450	
2.2.2	Specifications/Design Plug for Decant Pipe	Design Engineer	hrs	24	$130	$3,120	
2.2.3	Plug Decant Pipe	General Labourer	hrs	80	$45	$3,600	
		Materials	l.s.			$5,500	
2.2.4	Supervision	Site Supervisor	hrs	40	$95	$3,800	
	Sub-Total						**$24,370**
2.3	**Tailings Surface**						
2.3.1	Recontour tailings surface (11ha)	Bulldozer-large (D9H)	hrs	200	$260	$52,000	
2.3.2	Remove Cofferdam and bury culvert	Bulldozer-large (D9H)	hrs	16	$260	$4,160	
2.3.3	Supervision	Site Supervisor	hrs	50	$95	$4,750	
	Sub-Total						**$60,910**
2.4	**Reclaim Dam**						
2.4.1	Pump down Pond	Pumping (all-inclusive)	cu.m	340,000	$0.03	$10,200	
2.4.2	Remove Existing Spillway and exit channel. Regrade.	235 Excavator	hrs	20	$240	$4,800	
		Bulldozer-large (D9H)	hrs	30	$260	$7,800	
		D250E Haul Truck	hrs	40	$220	$8,800	
2.4.2	Breach Dam	Excavation of Soil	cu.m	21,800	$5	$109,000	
2.4.3	Construct Spillway and Exit Channel						
	Geotextile Spillway and Channel	Supply and place Geotextile	sq.m	1,700	$7	$11,900	
	Rip Rap Spillway and Channel	Drill, Blast and Screen Rip Rap	cu.m	1,050	$22	$23,100	
		Load, Haul and Place Soil/Rip Rap	cu.m	1,050	$13	$13,650	
	Design Spillway & Channel	Design Engineer	hrs	50	$130	$6,500	
	Site Supervision Spillway and channel	Site Supervisor	hrs	60	$95	$5,700	
	Sub-Total						**$201,450**
2.5	**Camp Creek Diversion and Restoration**						
2.5.1	Breach existing diversion, remove culverts, regrade	235 Excavator	hrs	40	$240	$9,600	
		Bulldozer-large (D9H)	hrs	30	$260	$7,800	
		D250E Haul Truck	hrs	20	$220	$4,400	
2.5.2	Realign Camp Creek and riprap						
	Excavate Channel	Excavation of Soil	cu.m	15,900	$5	$79,500	
	Supply and place Geotextile (Spillway & Channel)	Supply and place Geotextile	sq.m	10,800	$7	$75,600	
	Supply and place Rip Rap (Spillway and Channel)	Drill, Blast and Screen Rip Rap	cu.m	6,700	$22	$147,400	
		Load, Haul and Place Soil/Rip Rap	cu.m	6,700	$13	$87,100	
	Design of Channel Realignment	Design Engineer	hrs	40	$130	$5,200	
	Site Supervision of channel realignment	Site Supervisor	hrs	60	$95	$5,700	
	Sub-Total						**$422,300**
2.6	**Interceptor Ditches**						
2.6.1	Breach ditches and recontour	Bulldozer-large (D9H)	hrs	30	$260	$7,800	
	Sub-Total						**$7,800**
2.7	**Tailings pipeline (1.9km)**						
2.7.1	Remove Pipeline	235 Excavator	hrs	50	$240	$12,000	
		D250E Haul Truck	hrs	50	$220	$11,000	
		General Labourer	hrs	100	$45	$4,500	
		Site Supervisor	hrs	20	$95	$1,900	
	Sub-Total						**$29,400**
2.8	**Reclaim pipeline (0.8km)**						
2.8.1	Remove Pipeline	235 Excavator	hrs	20	$240	$4,800	
		D250E Haul Truck	hrs	20	$220	$4,400	
		General Labourer	hrs	40	$45	$1,800	
		Site Supervisor	hrs	10	$95	$950	
	Sub-Total						**$11,950**
Total Estimated Cost in Reclaiming TMF							**$1,045,750**

Table 6-7
Estimated Decommissioning Costs For Current Site Status - Demolition and Reclamation

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
3.0	**INFRASTRUCTURE: BUILDINGS, STRUCTURES AND SERVICES**						
3.1	**Concentrator Buildings (incl. Whse, crusher building, load out)**						
	Remove salvageable equipment	General Labourer	hrs	704	$45	$31,680	
		Trades Labourer	hrs	880	$80	$70,400	
	Dismantle Building - Manpower	General Labourer	hrs	1200	$45	$54,000	
	Dismantle Building - Manpower	Trades Labourer	hrs	720	$80	$57,600	
	Dismantle Building - Equipment	235 Excavator	hrs	120	$240	$28,800	
	Dismantle Building - Equipment	30 ton Crane	hrs	120	$160	$19,200	
	Concrete Demolition	235 Excavator	hrs	80	$240	$19,200	
		235 Excavator w Hammer	hrs	80	$275	$22,000	
	Reslope, contour & bury	Bulldozer-large (D9H)	hrs	48	$260	$12,480	
	Misc. Supplies & Tools	Misc.	l.s.			$11,000	
	Scrap haul to landfill	235 Excavator	hrs	160	$240	$38,400	
		D250E Haul Truck	hrs	240	$220	$52,800	
	Subtotal:						**$417,560**
3.2	**Power House and Power Lines**						
	Remove salvageable equipment	General Labourer	hrs	240	$45	$10,800	
		Trades Labourer	hrs	240	$80	$19,200	
	Salvage and remove powerline and poles		l.s.			$27,500	
	Dismantle Building - Manpower	Trades Labourer	hrs	160	$80	$12,800	
	Dismantle Building - Equipment	235 Excavator	hrs	80	$240	$19,200	
	Concrete Demolition	235 Excavator	hrs	40	$240	$9,600	
		235 Excavator w Hammer	hrs	40	$275	$11,000	
	Reslope, contour & bury	Bulldozer-large (D9H)	hrs	24	$260	$6,240	
	Misc. Supplies & Tools	Misc.	l.s.			$1,650	
	Scrap haul to landfill	235 Excavator	hrs	30	$240	$7,200	
		D250E Haul Truck	hrs	40	$220	$8,800	
	Subtotal:						**$133,990**
3.3	**Water Supply**						
	Remove salvageable equipment - pipeline/pumps	General Labourer	hrs	48	$45	$2,160	
		Trades Labourer	hrs	98	$80	$7,840	
	Remove pipeline	D250E Haul Truck	hrs	100	$220	$22,000	
		235 Excavator	hrs	100	$240	$24,000	
		General Labourer	hrs	200	$45	$9,000	
	Dismantle Building - Manpower	General Labourer	hrs	20	$45	$900	
	Dismantle Building - Equipment	235 Excavator	hrs	16	$240	$3,840	
	Misc. Supplies & Tools	Misc.	l.s.			$550	
	Reslope, contour & bury	Bulldozer-large (D9H)	hrs	16	$260	$4,160	
	Subtotal:						**$74,450**
3.4	**North Creek Dyke**						
	Excavation of Soil	Unit cost basis	cu.m	1600	$5	$8,000	
	Remove culverts	Misc.	l.s.			$4,400	
	Drill, Blast and Screen Rip Rap	Unit cost basis	cu.m	20	$22	$440	
	Load, Haul and Place Soil/Rip Rap	Unit cost basis	cu.m	20	$13	$260	
	Subtotal:						**$13,100**
3.5	**Service Garage**						
	Dismantle Building - Manpower	General Labourer	hrs	48	$45	$2,160	
		Trades Labourer	hrs	24	$80	$1,920	
	Dismantle Building - Equipment	235 Excavator	hrs	10	$240	$2,400	
	Concrete Demolition	235 Excavator w Hammer	hrs	10	$275	$2,750	
	Reslope, contour & bury	Bulldozer-large (D9H)	hrs	8	$260	$2,080	
	Misc. Supplies & Tools	Misc.	l.s.			$550	
	Scrap haul to landfill	235 Excavator	hrs	6	$240	$1,440	
		D250E Haul Truck	hrs	8	$220	$1,760	
	Subtotal:						**$15,060**
3.6	**Accommodation/Camp Trailers Buildings/Office**						
	Remove salvageable equipment	General Labourer	hrs	140	$45	$6,300	
		Trades Labourer	hrs	48	$80	$3,840	
	Dismantle Buildings - Manpower	General Labourer	hrs	380	$45	$17,100	
		Trades Labourer	hrs	32	$80	$2,560	
	Dismantle Building - Equipment	235 Excavator	hrs	20	$240	$4,800	
	Remove septic tanks & clean line	General Labourer	hrs	24	$45	$1,080	
	Reslope, contour & bury	Bulldozer-large (D9H)	hrs	48	$260	$12,480	
	Misc. Supplies & Tools	Misc.	l.s.			$825	
	Scrap haul to landfill	235 Excavator	hrs	12	$240	$2,880	
		D250E Haul Truck	hrs	20	$220	$4,400	
	Subtotal:						**$56,265**
3.7	**Explosive Magazine**						
	Remove from site	Misc.	l.s.			$2,500	
	Subtotal:						**$2,500**
3.8	**Miscellaneous Buildings & Structures**						
	Remove salvageable equipment - Manpower	General Labourer	hrs	280	$45	$12,600	
		Trades Labourer	hrs	280	$80	$22,400	
	Remove salvageable equipment - Equipment	Hiab Flatdeck truck	hrs	280	$125	$35,000	
		Loader-small (Cat 950)	hrs	280	$125	$35,000	
	Dismantle Building - Manpower	General Labourer	hrs	280	$45	$12,600	
		Trades Labourer	hrs	140	$80	$11,200	
	Dismantle Building - Equipment	235 Excavator	hrs	40	$240	$9,600	
	Concrete Demolition	235 Excavator w Hammer	hrs	40	$275	$11,000	
	Reslope, contour & bury	Bulldozer-large (D9H)	hrs	80	$260	$20,800	
	Misc. Supplies & Tools	Misc.	l.s.			$2,750	
	Scrap haul to landfill	235 Excavator	hrs	30	$240	$7,200	
		D250E Haul Truck	hrs	40	$220	$8,800	
	Subtotal:						**$188,950**
3.9	**Industrial Reagents, Fuels & Waste**						
	Industrial Reagents	Misc.	l.s.			$16,500	
	Fuels	Misc.	l.s.			$11,000	
	Wastes	Misc.	l.s.			$11,000	
	Subtotal:						**$38,500**
3.10	**Spill Clean**						
	Concentrator haul out	lump sum	l.s.			$82,500	
	Other Building/Site spill clean up	lump sum	l.s.			$82,500	
	Subtotal:						**$165,000**
3.11	**Demolition Overheads**						
	Supervision	Site Supervisor	hrs	1000	$95	$95,000	
	Mob/Demob	Misc.	l.s.			$0	
	Office/Admin Costs	Misc.	l.s.			$5,500	
	Subtotal:						**$100,500**
3.12	**Landfill**						
	Design/build new landfill facility	Misc.	l.s.			$50,000	
	Subtotal:						**$50,000**
Total Estimated Cost in Infrastructure: Buildings, Structures and Services							**$1,255,875**

Table 6-8
Estimated Decommissioning Costs For Current Site Status - Land Reclamation & Revegetation (Scenario 1)

Item No.		Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
4.0	**LAND RECLAMATION & REVEGETATION**						
4.1	**Roads and Trails**						
4.1.1	**Exploration Trails**						
	stabilize slopes - erosion barriers	Erosion barriers	per linear m	4000	$3	$12,000	
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	10	$2,410	$24,100	
	Subtotal:						**$36,100**
4.1.2	**Main Access Road**						
	road barrier	Misc.	l.s.			$3,300	
	culvert excavation	235 Excavator	hrs	500	$240	$120,000	
	culvert removal	D250E Haul Truck	hrs	500	$220	$110,000	
	scarify	16H grader	hrs	200	$220	$44,000	
	recontour slopes	Bulldozer-large (D9H)	hrs	200	$260	$52,000	
	stabilize slopes - erosion barriers	Erosion barriers	per linear m	5000	$3	$15,000	
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	65	$2,410	$156,650	
	Subtotal:						**$500,950**
4.1.3	**Service and Haul Roads within the Minesite**						
	road barrier	Misc.	l.s.			$3,300	
	culvert excavation	235 Excavator	hrs	200	$240	$48,000	
	culvert removal	D250E Haul Truck	hrs	200	$220	$44,000	
	scarify	16H grader	hrs	48	$220	$10,560	
	recontour slopes	Bulldozer-large (D9H)	hrs	60	$260	$15,600	
	stabilize slopes - erosion barriers	Erosion barriers	per linear m	3500	$3	$10,500	
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	16	$2,410	$38,560	
	Subtotal:						**$170,520**
4.2	**Non-Linear Developments**						
4.2.1	**Tailings Management Facility**						
	Cover installation - rock fill for base in wet areas (**33%** of 11.8 ha, 1 m depth)	Haul & Place rock cover	cu.m	38,940	$8	$311,520	
	Cover installation - haul soil and place (300 mm depth over entire area)	Load, haul and place soil cover	cu.m	35400	$8	$283,200	
	Grading of surface	Bulldozer-large (D9H)	hrs	100	$260	$26,000	
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	11.8	$2,410	$28,438	
	Subtotal:						**$649,158**
4.2.2	**Reclaim Pond**						
	pond clean up	Misc.	l.s.			$11,000	
	Cover installation - rock fill for base in wet areas (25% of 4 ha, 1 m depth)	Haul & Place rock cover	cu.m	10000	$8	$80,000	
	Cover installation - haul soil and place (300mm cover on rock cover area)	Load, haul and place soil cover	cu.m	3000	$8	$24,000	
	Grading of surface	Bulldozer-large (D9H)	hrs	40	$260	$10,400	
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	4	$2,410	$9,640	
	Subtotal:						**$135,040**
4.2.3	**Waste Dumps**						
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	6	$2,410	$14,460	
	Subtotal:						**$14,460**
4.2.4	**Sediment Ponds**						
	Jewel Box sediment pond - recontour and slope	235 Excavator	hrs	12	$240	$2,880	
	Main Zone sediment pond - recontour and slope	235 Excavator	hrs	6	$240	$1,440	
	Sediment Pond solids haul	D250E Haul Truck	hrs	20	$220	$4,400	
	Burnick sediment pond - recontour and slope	235 Excavator	hrs	10	$240	$2,400	
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	1	$2,410	$2,410	
	Subtotal:						**$13,530**
4.2.5	Disturbed Sites (incl. Mill), Landfill Areas and Borrow Pits						
	LTF-prepare detailed closure plan		l.s.			$2,000	
	Characterize final soil hydrocarbon concentrations		l.s.			$3,000	
	Re-grade & compact LTF area (0.5 ha)	Bulldozer-large (D9H)	hrs	5	$260	$1,300	
	Re-grade & compact landfill areas (2 ha)	Bulldozer-large (D9H)	hrs	50	$260	$13,000	
	Cover installation-haul soil & place (250mm cover over compacted landfill & LTF areas)	Load, haul and place soil cover	cu.m	6250	$8	$50,000	
	Compact cover over landfill areas	Bulldozer-large (D9H)	hrs	50	$260	$13,000	
	Revegetation of all misc disturbed sites - use per ha cost including application	Unit Cost	ha	8	$2,410	$19,280	
	Subtotal:						**$101,580**
Total Estimated Cost in Land Reclamation and Revegetation							**$1,621,338**

Table 6-9
Estimated Decommissioning Costs For Current Site Status - Land Reclamation & Revegetation (Scenario 2)

Item No.		Equipment/ Labour	Units	Quantity	Unit Cost	Cost
4.0	**LAND RECLAMATION & REVEGETATION**					
4.1	**Roads and Trails**					
4.1.1	**Exploration Trails**					
	stabilize slopes - erosion barriers	Erosion barriers	per linear m	4000	$3	$12,000
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	10	$2,410	$24,100
	Subtotal:					
4.1.2	**Main Access Road**					
	road barrier	Misc.	l.s.			$3,300
	culvert excavation	235 Excavator	hrs	500	$240	$120,000
	culvert removal	D250E Haul Truck	hrs	500	$220	$110,000
	scarify	16H grader	hrs	200	$220	$44,000
	recontour slopes	Bulldozer-large (D9H)	hrs	200	$260	$52,000
	stabilize slopes - erosion barriers	Erosion barriers	per linear m	5000	$3	$15,000
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	65	$2,410	$156,650
	Subtotal:					
4.1.3	**Service and Haul Roads within the Minesite**					
	road barrier	Misc.	l.s.			$3,300
	culvert excavation	235 Excavator	hrs	200	$240	$48,000
	culvert removal	D250E Haul Truck	hrs	200	$220	$44,000
	scarify	16H grader	hrs	48	$220	$10,560
	recontour slopes	Bulldozer-large (D9H)	hrs	60	$260	$15,600
	stabilize slopes - erosion barriers	Erosion barriers	per linear m	3500	$3	$10,500
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	16	$2,410	$38,560
	Subtotal:					
4.2	**Non-Linear Developments**					
4.2.1	**Tailings Management Facility**					
	Cover installation - rock fill for base in wet areas (**33%** of 11.8 ha, 1 m depth)	Haul & Place rock cover	cu.m	51,401	$8	$411,206
	Cover installation - haul soil and place (300 mm depth over entire area)	Load, haul and place soil cover	cu.m	66000	$8	$528,000
	Grading of surface	Bulldozer-large (D9H)	hrs	100	$260	$26,000
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	11.8	$2,410	$28,438
	Subtotal:					
4.2.2	**Reclaim Pond**					
	pond clean up	Misc.	l.s.			$11,000
	Cover installation - rock fill for base in wet areas (25% of 4 ha, 1 m depth)	Haul & Place rock cover	cu.m	10000	$8	$80,000
	Cover installation - haul soil and place (300mm cover on rock cover area)	Load, haul and place soil cover	cu.m	3000	$8	$24,000
	Grading of surface	Bulldozer-large (D9H)	hrs	40	$260	$10,400
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	4	$2,410	$9,640
	Subtotal:					
4.2.3	**Waste Dumps**					
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	6	$2,410	$14,460
	Subtotal:					
4.2.4	**Sediment Ponds**					
	Jewel Box sediment pond - recontour and slope	235 Excavator	hrs	12	$240	$2,880
	Main Zone sediment pond - recontour and slope	235 Excavator	hrs	6	$240	$1,440
	Sediment Pond solids haul	D250E Haul Truck	hrs	20	$220	$4,400
	Burnick sediment pond - recontour and slope	235 Excavator	hrs	10	$240	$2,400
	Revegetation- use a per ha. cost that includes application	Unit Cost	ha	1	$2,410	$2,410
	Subtotal:					
4.2.5	Disturbed Sites (incl. Mill), Landfill Areas and Borrow Pits					
	LTF-prepare detailed closure plan		l.s.			$2,000
	Characterize final soil hydrocarbon concentrations		l.s.			$3,000
	Re-grade & compact LTF area (0.5 ha)	Bulldozer-large (D9H)	hrs	5	$260	$1,300
	Re-grade & compact landfill areas (2 ha)	Bulldozer-large (D9H)	hrs	50	$260	$13,000
	Cover installation-haul soil & place (250mm cover over compacted landfill & LTF areas)	Load, haul and place soil cover	cu.m	6250	$8	$50,000
	Compact cover over landfill areas	Bulldozer-large (D9H)	hrs	50	$260	$13,000
	Revegetation of all misc disturbed sites - use per ha cost including application	Unit Cost	ha	8	$2,410	$19,280
	Subtotal:					
Total Estimated Cost in Land Reclamation and Revegetation						

Table 6-10
Estimated Decommissioning Costs For Current Site Status - Post Closure Site Management

Item No.	Work Item Description	Equipment/ Labour	Units	Quantity	Unit Cost	Cost	Total Cost
5.0	**POST CLOSURE SITE MANAGEMENT**						
5.1	**Organization, Site Access & Security, Overhead Costs**						
	Pre-Closure Planning/Organizing	Project Manager	monthly	2	$9,700	$19,400	
	Project Manager	Project Manager	monthly	21	$9,700	$203,700	
	New Camp Construction	Misc.	l.s.	1		$300,000	
	Camp Cost	Camp Cost	monthly	4500	$110	$495,000	
	Site Security, Routine Water Sampling Till end to Year 3 of Post Closure	Site Caretaker	monthly	36	$6,100	$219,600	
	Operation of LTF (addn of nutrients, turn-overs, monitoring)	Misc.	years	5	$5,000	$25,000	
	Pre-Closure Site Environmental Assessment	Contract	l.s.	1		$82,500	
	Post-Closure Environmental Cleanup Confirmation Assessment	Contract	l.s.	1		$55,000	
	Main Access Road Maintenance	Misc.	per year	3	$55,000	$165,000	
	Vehicles for Security & Manager	Pickup Truck	months	57	$2,500	$142,500	
	Misc. Office/Supply/Misc. Costs	Misc.	per year	3	$1,650	$4,950	
	Subtotal:						**$1,712,650**
5.2	**Supporting Studies**						
	Water Quality Modelling for Selected Closure Plan	Misc.	l.s.	1		$10,000	
	Preparation of required AMPs	Misc.	l.s.	1		$20,000	
	Subtotal:						**$30,000**
5.3	**Supervision and Documentation of Work**						
	Site environmental monitoring, reporting, documentation (5 yrs of p-c)	Environmental Monitor	quarterly	20	$5,000	$100,000	
	Document Reviews/Storage	Misc.	l.s.	1		$10,000	
	Final as built plan	Design Engineer	hrs	160	$130	$20,800	
	Subtotal:						**$130,800**
5.3	**Compliance Monitoring and Reporting**						
	Water Quality Monitoring - During Closure implementation (3yrs) - analytical	Misc.	l.s.			$64,900	
	Water Quality Monitoring - During Closure implementation (3 yrs)- Heli	Misc.	l.s.			$18,480	
	Water Quality Monitoring - Post Closure - Analytical/Collection	Misc.	l.s.			$76,560	
	Water Quality Monitoring - Post Closure - Heli/Travel	Misc.	l.s.			$77,880	
	Geotechnical Inspection - During Closure implementation (3 yrs)	Misc.	years	3	$13,200	$39,600	
	Geotechnical Inspection - Post closure	Misc.	years	5	$13,200	$66,000	
	Biological Monitoring - Professional fees - Closure implementation	Misc.	per event	1	$11,000	$11,000	
	Biological Monitoring - Helicopter & Lab Analysis - implementation	Misc.	per event	1	$6,050	$6,050	
	Biological Monitoring - Professional fees - Post closure	Misc.	per event	3	$11,000	$33,000	
	Biological Monitoring - Helicopter & Lab Analysis - Post closure	Misc.	per event	3	$6,050	$18,150	
	Subtotal:						**$411,620**
5.4	**Post Closure Maintenance**						
	Misc. Maintenance work related to the site after closure	Misc.	per year	5	$10,000	$ 50,000	
	Subtotal:						**$50,000**
Total Estimated Post Closure Site Management							**$2,335,070**

7.0 FINANCIAL SECURITY

7.1 WATER LICENCE REQUIREMENTS

The current water licence which is currently under review (January 27, 2010) has the following financial security terms:

> *"18. Within 30 days of the effective date of this License, the Licensee shall provide security in addition to that already in place to increase the total amount to five million, thirty-two thousand dollars ($5,032,000). The Licensee shall provide additional security, as follows:*
>
> *(a) sixty-six thousand dollars ($66,000) within thirty (30) days of the start of commercial production;*
> *(b) an additional one hundred and forty-four thousand dollars ($144,000) no less than one year after the start of commercial production;*
> *(c) an additional one hundred and forty-three thousand dollars ($143,000) no less than two years after the start of commercial production; and*
> *(d) an additional one hundred and forty thousand dollars ($140,000) no less than three years after the start of commercial production.*

It is our understanding that the licence security requirements were based upon DIAND's intervention to the Water Board Public Hearing (November, 1997), which in turn was based upon a detailed closure costing review prepared by Mr. Robert Rodger in October, 1997. The closure cost estimate for the Sä Dena Hes mine as reviewed by Mr. R. Rodger was $3,434,000.00 (R. Rodger, October 1997, Table 2.1).

As part of the 2010 update of the DDRP, the cost estimates have been updated. and submitted for review to the Yukon Government Department of Energy, Mines and Resources (EMR). The cost estimates were reviewed by an independent consultant contracted by EMR. After receiving details of this review and discussing them with EMR, Sä Dena Hes Operating Corporation (SDHOC) came to agreement on the specifics of the cost estimates as presented in this document for Scenario 1.

As discussed in Section 6, detailed cost estimates were prepared for each mine component based on whether or not the mine reopened. Closure costs for the present mine site (Scenario 1) are estimated at $7,691,770 (Table 6-1). With eventual mine reopening (Scenario 2), closure costs are estimated at $8,347,355.

7.2 UPDATED FINANCIAL SECURITY

The January 2010 amendment to the site's Quartz Mining Licence, requires reclamation security to be increased to $7,691,770 (as discussed in Section 7.1). It is anticipated that the forthcoming amendment to the Water Licence will be harmonized with this amount, but this can not be confirmed as the amended Water Licence has not been issued at the time of writing this report.

7.3 RETURN OF FINANCIAL SECURITY

It is SDHOC's anticipation that the as decommissioning and reclamation work proceeds that the security will be reduced consistent with the Government of Yukon's Reclamation Policy and Guidelines with respect to the return of financial security.

8.0 REFERENCES

Table 1-1, in Section 1, provides a complete list of documents and reports that were reviewed in updating of the Detailed Decommissioning and Reclamation Plan for Sä Dena Hes Mine. The following references have been added to the 2000 reference list:

Steffen Robertson and Kirsten (Canada) Inc. (SRK), 2000. *" Geochemical Studies Sä Dena Hes Mine, November 2000."* Report 1CC005.06.

Steffen Robertson and Kirsten (Canada) Inc. (SRK), 2002. *" Geochemical Reports Sä Dena Hes Mine, March 2003."* Report 1CT008.000.

Steffen Robertson and Kirsten (Canada) Inc. (SRK), *"Sä Dena Hes Mine Water Quality and Loading Re-Assessment. January 2005."* Report 1CT006.008.

Teck Cominco Ltd. 2001. "*Sä Dena Hes, 2000 Annual Report, Yukon Water Licence QZ97-025."*

Teck Cominco Ltd. 2002. "*Sä Dena Hes, 2001 Annual Report, Yukon Water Licence QZ97-025."*

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Teck Cominco Ltd., 2004. *"Environmental Emergency Response & Procedures Plan."* Sä Dena Hes Mine, Yukon Territory. Prepared by Access Consulting Group.

Teck Cominco Ltd. 2005. *"Temporary Closure Site Status Report as of January 2005."* Sä Dena Hes

Teck Cominco Ltd. 2005. "Sä Dena Hes, 2004 Annual Report, Yukon Water Licence QZ99-045."

Teck Cominco Ltd. 2006. "Sä Dena Hes, 2005 Annual Report, Yukon Water Licence QZ99-045."

Teck Cominco Ltd. 2007. "Sä Dena Hes, 2006 Annual Report, Yukon Water Licence QZ99-045."

Teck Cominco Ltd. 2008. "Sä Dena Hes, 2007 Annual Report, Yukon Water Licence QZ99-045."

Teck Cominco Ltd. 2009. "Sä Dena Hes Mine, 2008 Annual Report, Yukon Water Licence QZ99-045."

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SÄ DENA HES MINE

DETAILED DECOMMISSIONING & RECLAMATION PLAN

JANUARY 2010 UPDATE

APPENDIX A – TECK RESOURCES LIMITED
CODE OF SUSTAINABLE CONDUCT

Prepared by:

ACCESS CONSULTING GROUP

SRK Consulting
Engineers and Scientists

Teck Resources Limited

Code of Sustainable Conduct

To implement our Charter of Corporate Responsibility, we will:

1. Obey the law and conduct business in accordance with our Code of Ethics;
2. Ensure that no discriminatory conduct is permitted in the workplace. Decisions on job selection, advancements and promotions will be unbiased, based on merit and ability, and in keeping with commitments to local communities;
3. Foster open and respectful dialogue with all communities of interest;
4. Respect the rights and recognize the aspirations of people affected by our activities;
5. Support local communities and their sustainability through measures such as development programs, locally sourcing goods and services and employing local people;
6. Continually improve safety, health and environmental policies, management systems and controls and ensure they are fully integrated into each of our activities;
7. Promote a culture of safety and recognize safety as a core value;
8. Continually reinforce company-wide efforts to achieve zero safety or health incidents;
9. Ensure programs that address workplace hazards are applied to monitor and protect worker safety and health;
10. Conduct operations in a sound environmental manner, seeking to continually improve performance;
11. Integrate biodiversity conservation considerations through all stages of business and production activities;
12. Design and operate for closure;
13. Promote the efficient use of energy and material resources in all aspects of our business;
14. Practise product stewardship and promote research to enhance the benefits of our products to society;
15. Conduct regular audits to ensure compliance with this Code.

Donald R. Lindsay
President and CEO

July 2009

Teck

Metals LTD.

SÄ DENA HES MINE

DETAILED DECOMMISSIONING & RECLAMATION PLAN

JANUARY 2010 UPDATE

APPENDIX B – EVIRONMENTAL BASELINE UPDATE & TECHNICAL BASIS FOR CLOSURE ASSUMPTIONS

Prepared by:

ACCESS
CONSULTING GROUP

SRK Consulting
Engineers and Scientists

SÄ DENA HES OPERATING CORPORATION

SÄ DENA HES MINE

DETAILED DECOMMISSIONING & RECLAMATION PLAN
JANUARY 2010 UPDATE

Teck

TECK Metals Ltd.

APPENDIX B

ENVIRONMENTAL BASELINE UPDATE AND TECHNICAL BASIS FOR CLOSURE ASSUMPTIONS

Prepared by:

ACCESS
CONSULTING GROUP

Laberge Environmental Services

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INTRODUCTION

This report, prepared in support of the Decommissioning & Reclamation Plan, presents a summary of the environmental conditions at the Sä Dena Hes mine site. Data from the initial environmental baseline surveys, and results from ongoing environmental monitoring programs, have been incorporated to provide an update on the current environmental conditions.

Key findings or pertinent information is summarized with references made to the individual reports where the data was originally presented. The reader is referred to those reports for a complete discussion.

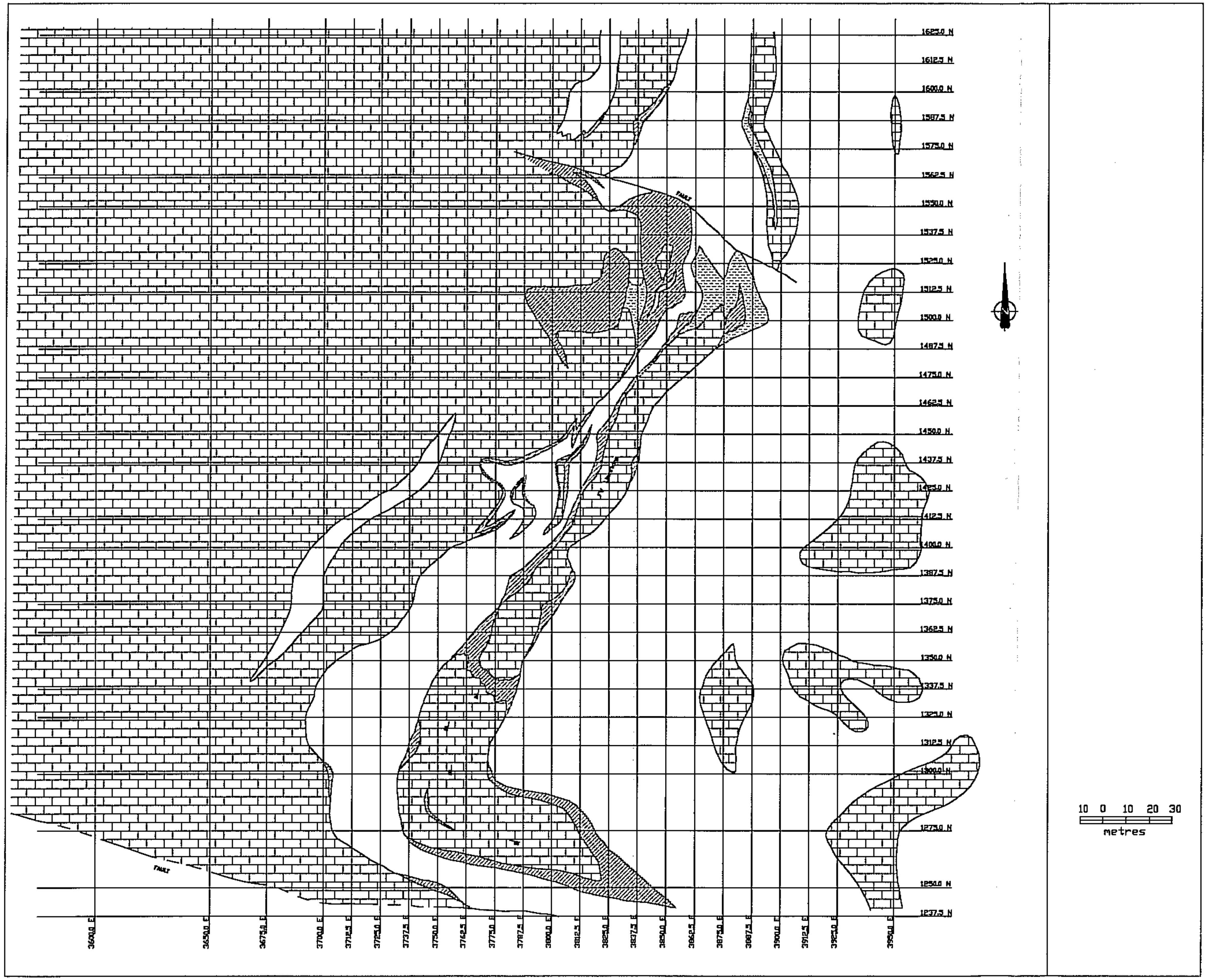
1.0 GEOLOGY AND ORE RESERVES

The following discussion is generally from the Sä Dena Hes Reopening Study, November 1995.

1.1 GEOLOGY

The Sä Dena Hes Property is underlain chiefly by lower Palaeozoic metasedimentary rocks, including both calcareous and non-calcareous pelitic phyllite and limestone. (Refer to Figure 1-1 “Typical Geology, Jewelbox Deposit”, and Figure 1-2 “Typical Geological Section, Burnick Deposit”, for a depiction of the typical geometry of the ore deposits and the associated rock types). Limestone comprises about five percent of the stratigraphic sequence and consists of discontinuous units which are up to 100 metres thick, and which typically pinch and swell over short distances. The thicker limestone units can be traced along strike for hundreds of metres. There is evidence locally that the limestone grades laterally into calcareous phyllite.

Intrusive igneous rocks on the property include three suites: mafic to intermediate, intermediate, and quartz porphyry. These intrusives are of limited size, and their age has been estimated at 50 million years. Although larger igneous bodies are not found on the property, it has been speculated that the area is underlain by a granitic pluton of the mid-Cretaceous Selwyn Plutonic Suite.



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Legend

ROCK TYPES

- Marble / limestone
- Phyllite
- Lowgrade Skarn (< 8% Pb+Zn)
- Highgrade Skarn (>= 8% Pb+Zn)
- Oxide Skarn

Structural Symbols

- overturned syncline axis
- overturned anticline axis
- anticline axis
- syncline axis
- dip and strike of bedding

Cross and Long Section Lines

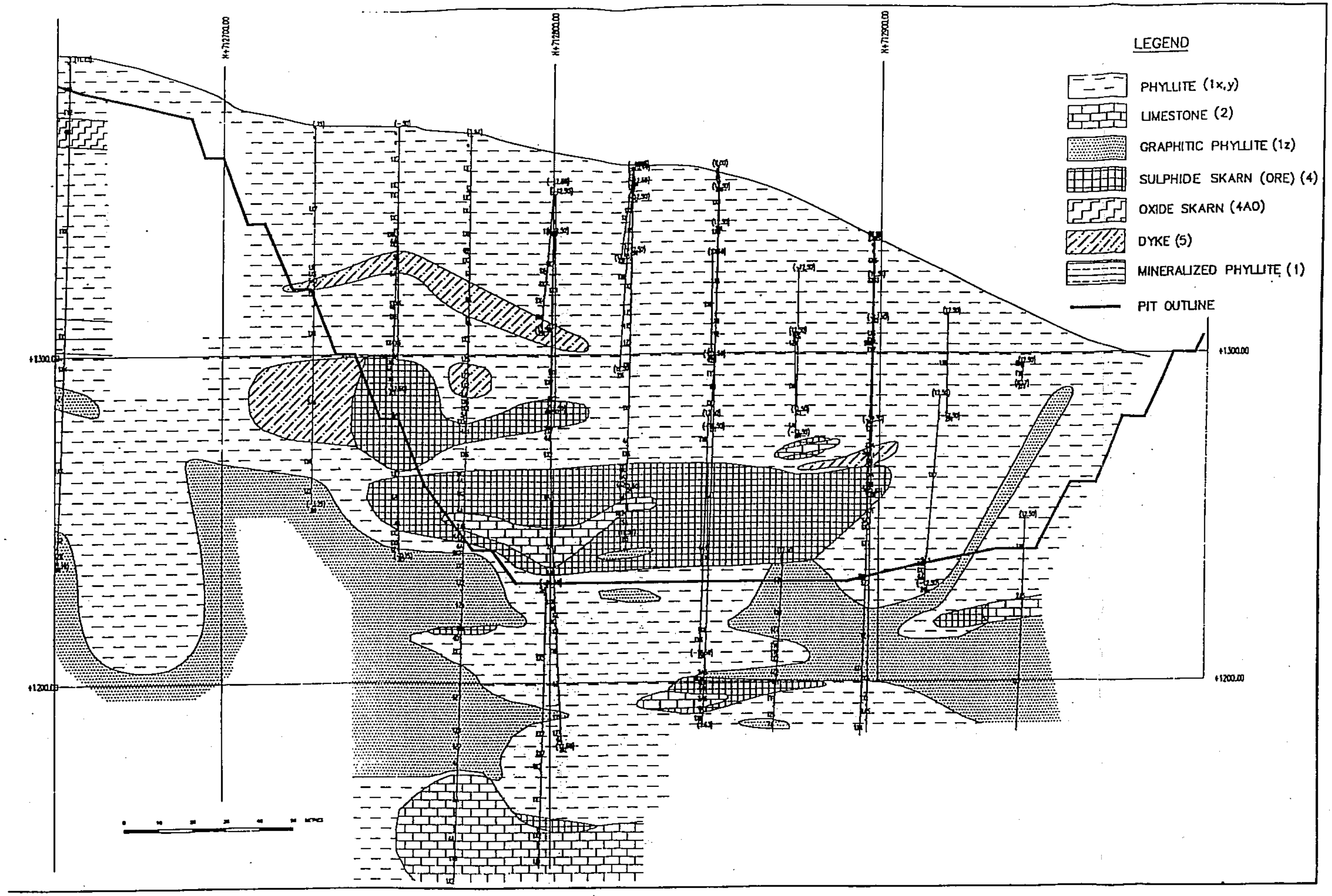
Geology corresponds to 1380.0 m elevation

SÄ DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

Typical Geology - Jewelbox Deposit

DRAWN BY: ASH*	CHECKED BY: RLM	Fig No. 1-1
DATE: 29/07/99	SCALE 1 : 2,000	

* Taken From a Drawing by L. Pigage



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STEFFEN ROBERTSON AND KIRSTEN
Consulting Engineers

Sä Dena Hes Mine
Detailed Decommissioning and Reclamation Plan

Typical Geological Section- Burnick Deposit

DRAWN BY: ASH	CHECKED BY:
DATE: 05/08/99	

Fig No. 1-2

The sedimentary strata are complexly folded and metamorphosed muscovite-chlorite phyllites of the greenschist facies. Several sets of steeply dipping faults occur on the property which post-date the folding. Most of these faults are thought to have normal displacement; however, some may be strike-slip. On Jewelbox Hill, a shallow-dipping shear zone follows the upper contact of the main limestone/marble body. A prominent conjugate fracture set trending approximately 100 degrees and dipping steeply north and south is considered to be an important control of mineralization.

Mineralization on the property is hosted by skarns which are commonly developed along the contact of limestone or phyllite with marble. Most of the important skarns are formed from a limestone protolith; however, there are good examples of skarn development from phyllite and locally from intrusive rocks. The grades of the latter skarns are generally on the low side.

Sulphide mineralization consists mainly of medium to coarse grained sphalerite and galena which are heavily disseminated in skarn layers. Iron sulphide is present in only minor quantities, or is absent altogether. Close to the peripheries of areas of lead-bearing skarn, there is local development of magnetite skarns. These peripheral skarns occasionally contain pyrrhotite and pyrite, and traces of chalcopyrite in some areas.

The mineralized horizons are commonly heavily oxidized to soft incompetent masses of clay, quartz, smithsonite, anglesite and cerussite to a depth of 130 metres, and some oxides have been encountered at depths of 300 metres and more. Locally, smithsonite has been mobilized from the oxidized skarns and deposited in nearby open fractures.

In some areas the phyllites are modestly to intensely hornfelsed, a feature that is broadly associated with skarn mineralization. Hornfelsing is more readily apparent in the calcareous phyllites than in non-calcareous types; consequently, the contact marking the outer limits of the hornfels suggests that the highly altered phyllites may be closely associated with faults or fractures which form conduits for mineralizing (and hornfelsing) fluids.

1.1.1 Alteration

Prominent alteration zones, up to 2 km long and 1 km wide, occur in four locations: Jewelbox Hill, Gribbler Ridge, North Hill and Porcupine Hill. From current information, the alteration pattern appears to be similar in all four areas. The phyllite is altered to hornfels over a large vertical distance, at least 300 metres. Limestone beds are converted to marble in most cases (the Burnick area is the main exception), and more locally to an actinolite, diopside or garnet skarn. The skarn zones are up to 30 metres thick and have lateral dimensions up to several hundred metres. They usually occur at limestone-phyllite contacts; for example, at the upper and lower contacts of thick limestone units, along phyllite beds within the thicker limestone beds, or in association with thin limestone beds within the phyllites. Zinc-lead-silver (Zn, Pb, Ag) mineralization is directly associated with the skarn zones.

1.1.2 Mineralization

The sulphide mineralization is fairly similar throughout the Sä Dena Hes property, although mineral proportions vary from place to place. It consists of medium to coarse grained sphalerite and galena more or less evenly distributed in skarn layers. There is very little iron sulphide present (Section 4.2). Variable but minor amounts of quartz and calcite are commonly present as blebs. The Pb:Zn ratio is generally in the order to 1:2 to 1:3. The Burnick Zone at North Hill is an exception with a 1:30 ratio.

Silver values are associated with the galena and no separate silver bearing minerals have been identified. The ratio of Ag to Pb is variable.

Parts of some of the mineralized zones show varying degrees of oxidation. At an early stage, smithsonite develops gram sphalerite, and iron and manganese oxides from the skarn silicates. In extreme cases, the sphalerite and calc-silicates are completely converted to smithsonite and iron oxides, and the galena to cerussite. Although most of the oxidized mineralization appears to occur in-site, there are a few cases where downward migration has apparently occurred, resulting in smithsonite healed cracks in unaltered limestone in the footwall of oxidized skarn mineralization.

A few drill holes have intersected steeply dipping faults with a different type of mineralization, consisting of drusy quartz, chalcedony, fluorite and calcite, over widths of up to 10 metres. Fluorite is occasionally present in the skarn Pb-Zn mineralization, but is minor.

1.1.3 Geological Reserves

In most cases, individual zones of mineralization can be correlated with stratigraphy with a high degree of certainty. Normally, the mineralized skarn layers occur at either the borders of relatively thick, easily identified limestone units or form bands that parallel the contacts of the main limestone bands.

In parts of the Jewelbox and Burnick Zones, where there are structural complexities, the correlation is less certain, but the implications regarding tonnage possibilities are probably not too serious because alternative interpretations provide a similar tonnage in blocks of mineable size.

Based on visual estimates, close to 20% of the Jewelbox mineralization has been oxidized to a significant degree, but the oxidation appears to be mostly restricted to well defined areas (mainly the East Zone). Although minor oxidation is present in the Main Zone and the parts of the JB-1 Zone that are close to surface, no problem is anticipated in mining essentially unoxidized material on a selective basis. The oxidized material is not included in the mineable reserves.

1.1.4 Mineral Reserves

As reported in the Teck Cominco. 2007 Annual Report, mineral reserves are as follows:

Indicated Resource - 2,190,000 tonnes @	10.4% Zn
	2.6% Pb
	45 G/T Ag

As no additional reserve estimation work has been done since, there are the most current figures for the reserves.

1.2 PHYSIOGRAPHY

The following is a summary from the Mt. Hundere Development Initial Environmental Evaluation, by SRK Consultants Ltd., April 1990.

> "*The mountainous area around Mount Hundere is part of the Hyland Plateau physiographic unit. To the west, the Hyland Plateau gives way to the Liard Plain, a broad southeasterly trending intermontane basin which contains the Liard and Frances Rivers (Bostock, 1970).*
>
> *Surface drainage flows both north and south from the Mount Hundere area. A number of valley streams, of which Tom Creek is the largest, drain southward to the Frances River. North of Hundere ridge, most creeks flow northward to join False Canyon Creek which eventually flows to the Frances River, northwest of the study area.*
>
> *A broadly rolling, till plain, forms the dominant glacial landform traversed by the Robert Campbell Highway in the Liard Plain. Isolated pockets of fluvial and glaciofluvial sands and gravels, glaciolacustrine silts and shallow organic materials mantle the subdued till in places. Surface till on the Liard Plain is variable in colour, moderately stony and has a silty sandy matrix (Klassen, 1987).*
>
> *The plateau area features broad valleys and rounded ridge crests, Relief is 450 to 600 m within the claim block; Mount Hundere is the highest point at 1576 m. Late Wisconsin ice covered all of the area during glacial maxima. It likely flowed southward to join the southeasterly flowing piedmont glacier in the Liard Plain. As glaciation commenced and the ice sheet retreated and downwasted, glaciers remained in the valleys while ridge crests and upper slopes were ice-free. Till deposits in the valley bottoms and on lower slopes are the result of direct glacial deposition. Tills with a silty sandy matrix reflect the regional glaciation; in the upper valleys a coarser, looser till may be found which reflects deposition from an ablating valley glacier.*

Large volumes of meltwater emanated from the retreating ice. Loose, surficial deposits were eroded from slopes, transported by meltwater streams and deposited as glaciofluvial terraces, outwash plains and ice-contact kames and eskers. These granular sediments infilled much of the valley lowlands. In places they are associated with silt deposits laid down in glacial lakes formed by temporary ponding of meltwater.

In post-glacial time, deposition and erosion continued. Colluvial deposits are gravity-transported materials common to sloping ground. Angular bedrock fragments with interstitial sand and silt are ubiquitous on ridge crests and upper and mid-slope positions. Fluvial sediments and organic materials accumulated on floodplains, fans and adjacent valley lowlands. Fluvial erosion, lateral and vertical cutting through existing surface materials, is an on-going but generally imperceptible process; it is usually most dynamic in steeper-gradient channels and where unstable bank materials exist. Landsliding and snow avalanching are rapid mass movement processes which are modifying some areas of sloping terrain. Periglacial processes (driven by the freeze-thaw cycle) are slowly modifying alpine and subalpine slopes."

2.0 CLIMATE

2.1 CLIMATOLOGICAL SETTING

The Sä Dena Hes property is located in the upper basin of the Liard River, some 40 km north of Watson Lake. The climate is dictated by a number of factors, mainly altitude, latitude and distance to mountain barriers. The property is in the rain shadow of the Coast and St. Elias Mountains. These two mountain ranges form an effective barrier against Pacific influences and allow a continental climate to exist over most of the Yukon. The Cassiar Mountains cause a secondary rain shadow effect.

2.2 CLIMATOLOGICAL DATA SOURCES

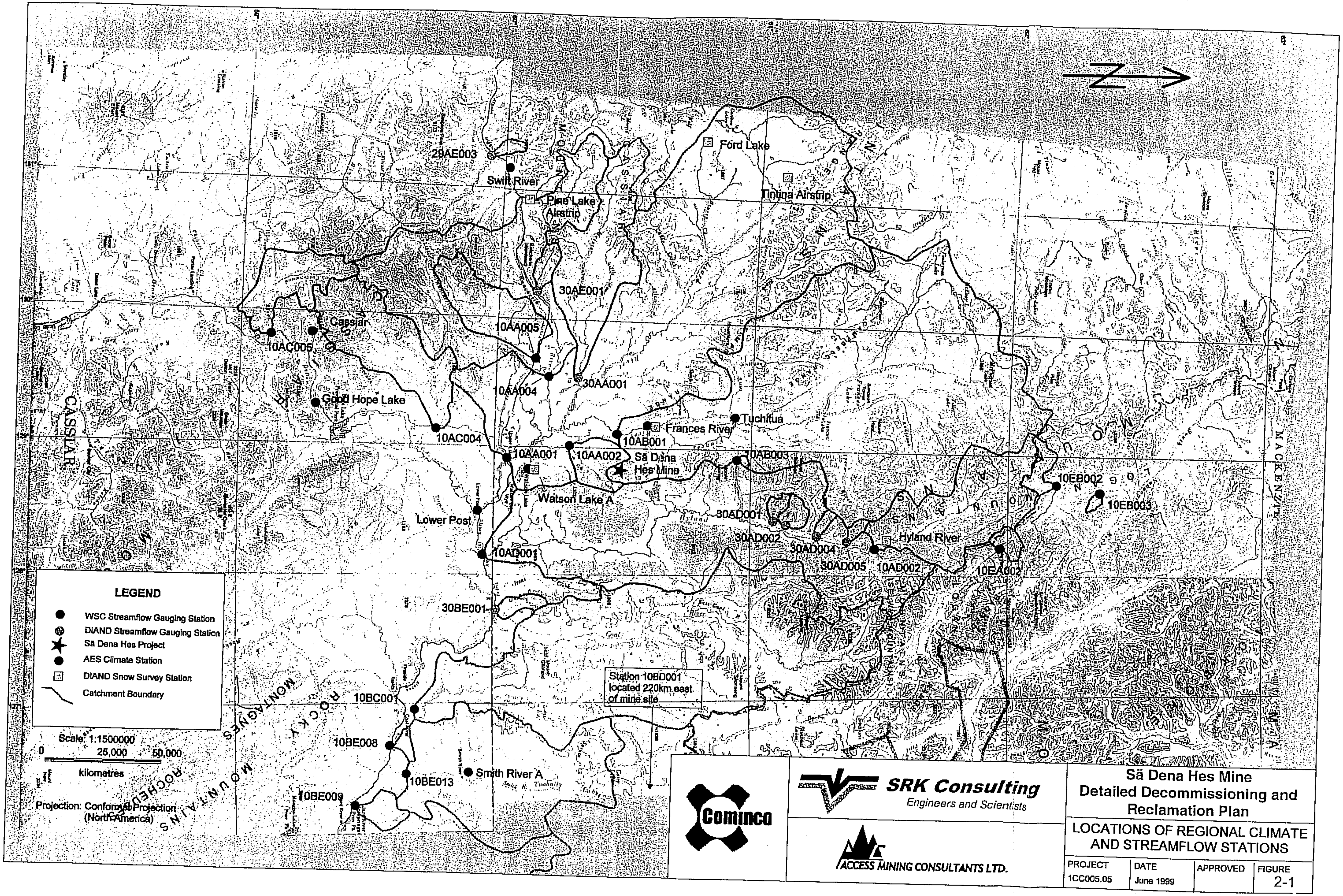
The climate of the minesite was first characterized in 1990 during the permitting stage of the mine development. An update was prepared in 1999 in support of the 2000 DDRP. In both cases, the source of data was exclusively regional climate stations and snow courses. In 2002, Access Mining Consultants established a weather station at the mill site to monitor rainfall intensity, air temperature and humidity. Until a substantial number of years of climate data are collected from the site, the data would not be considered significant for long term climate predictions and so this section of the report has not been revised

Although long-term climatological records are not available at the Sä Dena Hes mine site, the climate of the mine site can be adequately inferred from the data of regional climate stations. The records of nine stations operated by the Atmospheric Environment Service (AES) were used to assist in characterization of the mine site climate. In addition, six snow survey records collected by the Department of Indian Affairs and Northern Development (DIAND) were employed in estimating snowpack levels. Details of these regional stations are provided in Table 2-1. The table also identifies the types of climatological parameters each station provided for the study. The locations of the regional stations except for the single evaporation station, which is located several hundred kilometres from the mine site, are shown on Figure 2-1.

Table 2-1 Details of Regional Climate Stations

Station Name	Latitude		Longitude		Elevation (m)	Authority *	Information Applicable to Study
	Deg	Min	Deg	Min			
Cassiar	59	17	129	50	1077	AES	Precipitation/Temperature
Frances River	60	35	129	11	732	AES	Precipitation
Francis River	60	35	129	11	730	DIAND	Snowpack
Good Hope Lake	59	18	129	17	770	AES	Precipitation/Temperature
Hyland River	61	31	128	16	855	DIAND	Snowpack
Lower Post	59	56	128	30	583	AES	Precipitation
Pine Lake Airstrip	60	6	130	56	995	DIAND	Snowpack
Smith River A	59	54	126	26	673	AES	Precipitation
Swift River	60	0	131	11	891	AES	Precipitation/Temperature
Tintina Airstrip	61	5	131	15	1067	DIAND	Snowpack
Tuchitua	60	56	129	15	724	AES	Precipitation
Watson Lake A	60	7	128	49	689	AES	Precipitation/Temperature
Watson Lake A	60	7	128	50	685	DIAND	Snowpack
Whitehorse A	60	43	135	4	703	AES	Evaporation
Ford Lake	60	47	131	28	1110	DIAND	Snowpack

Note: * AES: Environment Canada, Atmospheric Environment Service
DIAND: Department of Indian Affairs and Northern Development



LEGEND
WSC Streamflow Gauging Station
DIAND Streamflow Gauging Station
Sä Dena Hes Project
AES Climate Station
DIAND Snow Survey Station
Catchment Boundary
Scale: 1:1500000
0 25,000 50,000
kilometres
Projection: Conformal Projection (North America)
29AE003
Swift River
Pine Lake Airstrip
Ford Lake
Tintina Airstrip
30AE001
10AA005
Cassiar
10AC005
10AA004
30AA001
Good Hope Lake
Tuchitua
Frances River
10AB001
10AC004
10AA001
10AA002
Sä Dena Hes Mine
10AB003
Watson Lake A
Lower Post
30AD001
30AD002
30AD004
Hyland River
10EB002
10EB003
10AD001
30AD005
10AD002
10EA002
30BE001
Station 10BD001 located 220km east of mine site
10BC001
10BE008
10BE013
Smith River A
10BE009
CASSIAR
ROCKY MOUNTAINS
MONTAGNES ROCHEUSES
MACKENZIE
N
Cominco
SRK Consulting
Engineers and Scientists
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Sä Dena Hes Mine
Detailed Decommissioning and Reclamation Plan
LOCATIONS OF REGIONAL CLIMATE AND STREAMFLOW STATIONS
PROJECT 1CC005.05
DATE June 1999
APPROVED
FIGURE 2-1

2.3 PRECIPITATION CORRECTION FOR NORTHWEST TERRITORIES AND YUKON

When the climate of the mine was re-assessed in 1999 for the closure plan, the data for the regional stations were available up to about 1997. The company reviewed the more recent data in 2005 and updated the plan where applicable.

Figure 1 shows the annual series for three measurements of precipitation at the Watson Lake Airport. The top plot on this figure shows the annual maximum daily precipitation from 1939 to 2004. The middle plot presents the annual total precipitation for the same period. Finally, the bottom plot presents the water content of the snowpack on April 1 of each year from 1965 to 2005.

Examination of these plots show that no increased trend in precipitation has occurred in the last eight years. Furthermore, the period 1998 to 2005 did not result in any new record highs. The snowpack in 2005 was high but was exceeded by an event in 1967. The maximum daily precipitation in the period January 1998 to September 2005 was 37.2 mm, which is significantly less than the record event of 47 mm that occurred in 1987. In 2009 snowpack water content was 150% above normal.

The climate records for Watson Lake Airport suggest the addition of eight further years of data would not substantively change the assessment made of the minesite climate in 1999, which are presented in the following paragraphs.

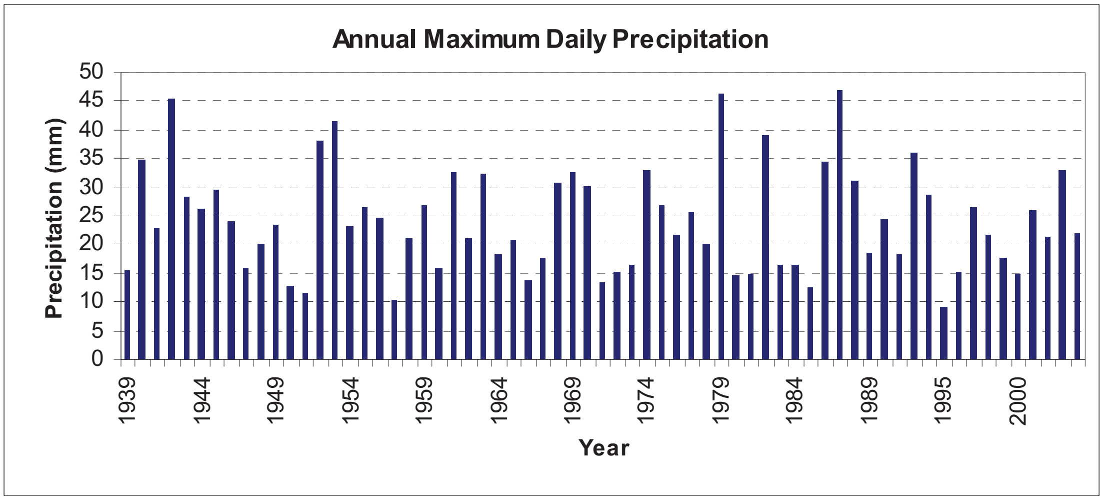
The density of recording stations in the Northwest Territories (“NWT”) and Yukon is sparse compared to the rest of Canada, and the measurement of precipitation is subject to a number of measurement errors (Metcalfe, 1999). Most stations still use non-recording or manual methods of measuring precipitation in the form of rainfall and snowfall. The most significant measurement errors are:

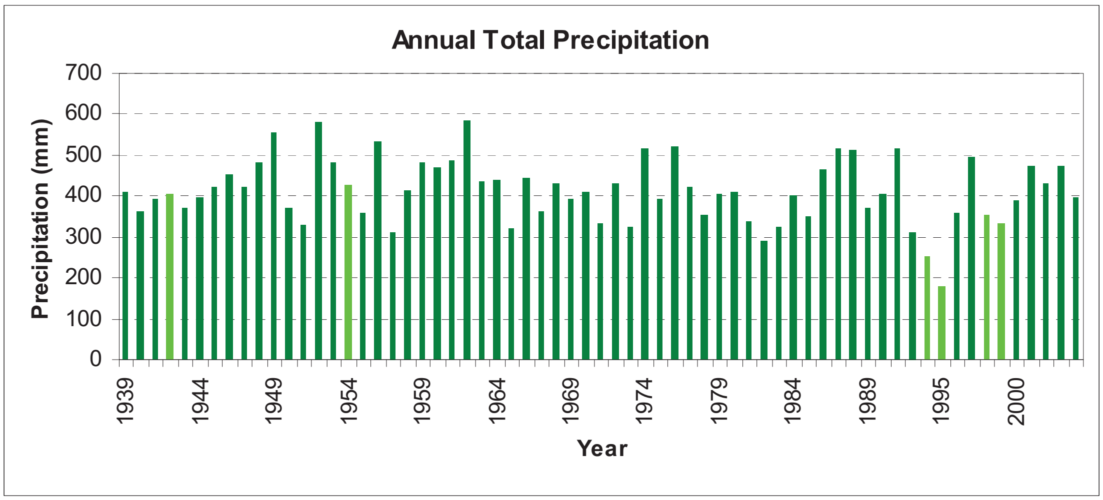
- the standard Type-B rain gauge has been shown to interact with the wind, deflecting a portion of the rainfall away and underestimating the precipitation;

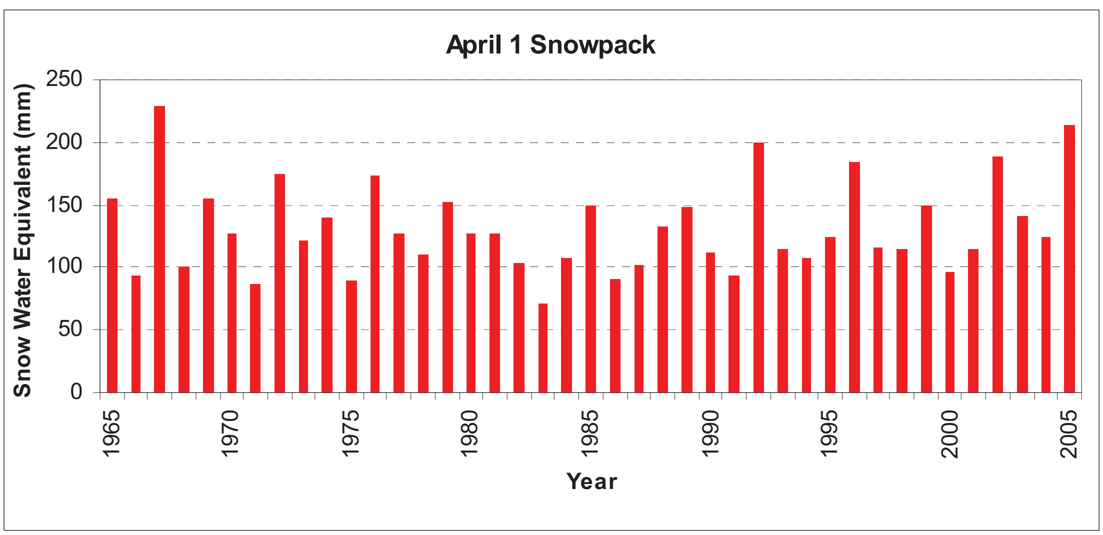
- the standard Nipher snow gauge is used at many of these stations, and these demonstrate a systematic error, underestimating snowfall;
- snowfall is also manually recorded using a ruler at the remaining stations and the depth of snow is converted into a "water equivalent" using an assumed density of 100 kg/m^3. Studies have shown that the average densities of snow in these regions can actually be as much as 20% less than this assumed density, leading to another source of error in the snowfall record; and,
- wind has been shown to be a major cause of error in precipitation gauge measurements.

On balance, the measurements combine to cause an underestimation of precipitation at first-order stations equipped with a Nipher snow gauge. AES have embarked on a program to correct the precipitation archive for such stations. The only first-order station of value to the current study is Watson Lake Airport. The bottom graph on Figure 2-2 shows a comparison of the archived and corrected precipitation record for the Watson Lake Airport. The graph shows the total monthly precipitation, normalized to a percentage of the mean annual precipitation ("MAP"). This demonstrates that the correction process has not significantly changed the shape of the monthly precipitation distribution and therefore precipitation normals can safely be used to characterize the snowfall and rainfall distributions for the minesite.

Therefore, the corrected MAP for Watson Lake of 490mm will be used in the analysis. The previous archived value from the 1961 – 1990 normals was 413 mm. For all other stations, the archived MAP value will be used. The correction of the archived records for these other stations is the focus of on-going research at the AES.







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Annual Precipitation Data for Watson Lake Airport

Job No: 1CT008.004

Filename: Annual Extreme Daily Precipitation_Fig.xls

Sä Dena Hes
Closure Plan Update

Date:

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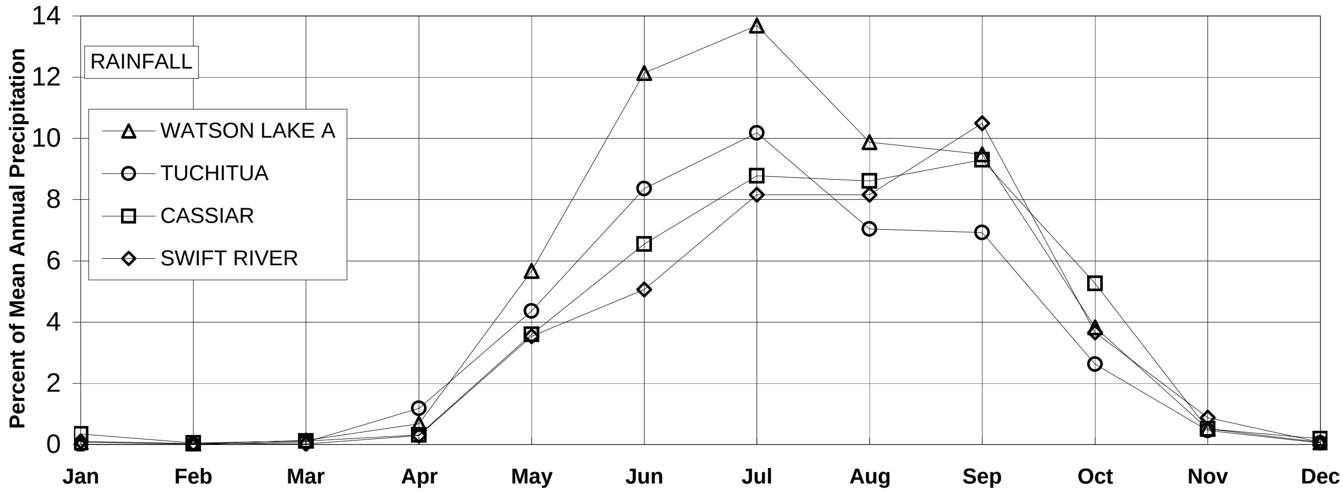
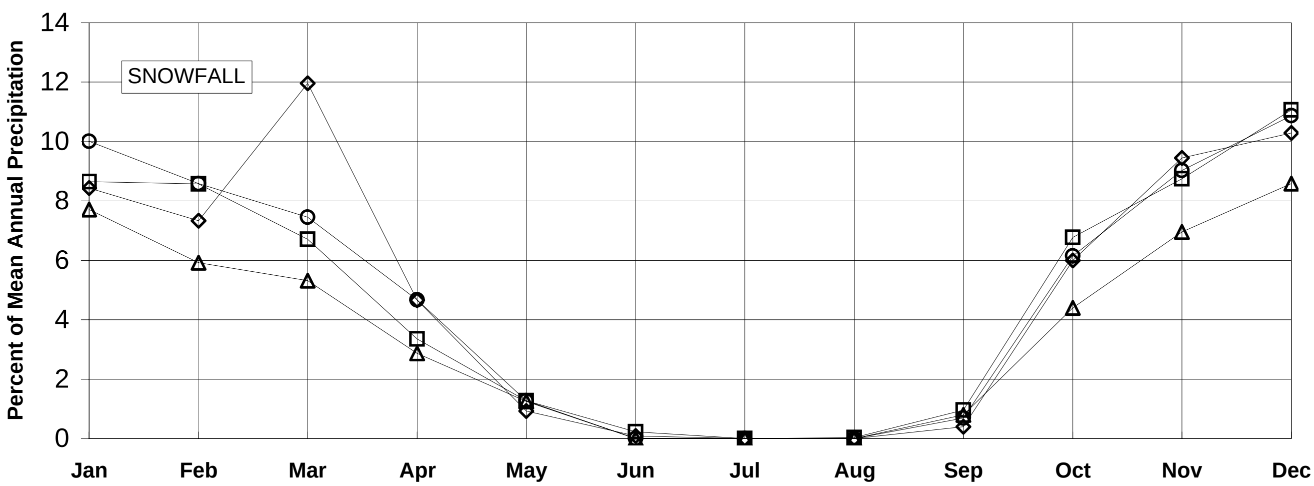
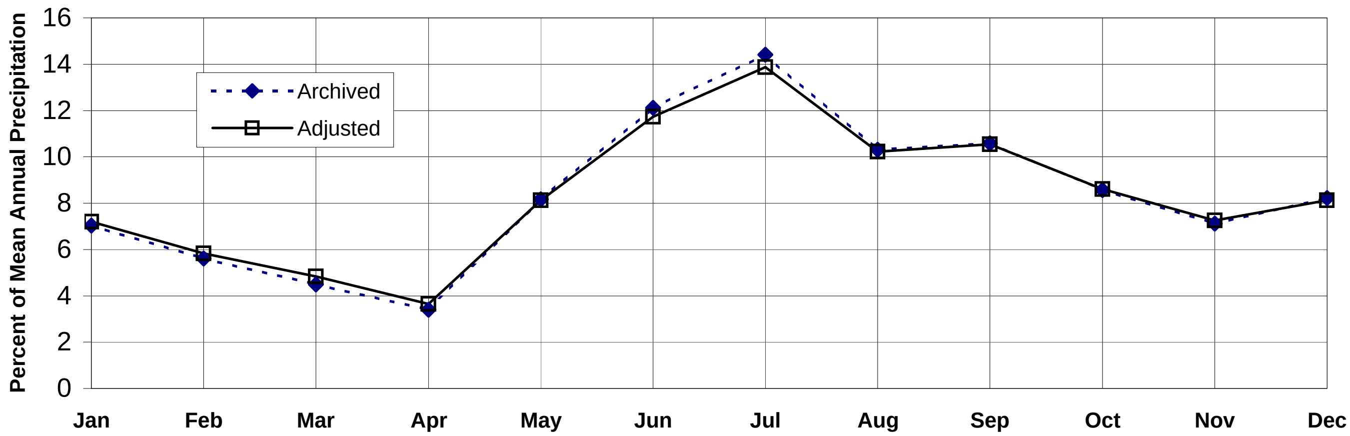
Figure: 1





Comparison of Archived and Corrected Precipitation Records for Watson Lake A. - (1953-1993)



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SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

MEAN MONTHLY PRECIPITATION DISTRIBUTIONS AT REGIONAL CLIMATE STATIONS

PROJECT	DATE	APPROVED	FIGURE
1CC005.05	AUG. 1999		**2-2**

2.4 PRECIPITATION ESTIMATE

Elevation is the principal control on the distribution of precipitation in the region. Figure 2-3 illustrates this control and is a plot of MAP versus elevation as derived from the data of regional AES stations. A best-fit linear regression of these data showed that the average precipitation gradient in the region is about 48 mm per 100 m of ascent. Using Watson Lake Airport as a base (elevation 689 m and MAP 490 mm) and applying the observed regional precipitation gradient, the mean annual precipitation (MAP) at the tailings impoundment is estimated to be 690 mm. This is about 1.67 times as much precipitation as measured at the Watson Lake Airport. Because of local variations in topography which affect precipitation, the actual mean precipitation at the tailings impoundment may differ by as much as 100 mm from the value calculated.

Rainfall data collected at the mine site were also used as a partial validation of the minesite MAP. The tipping bucket was operated in the summers of 2002 and 2005. No data were collected in the intervening years due to an instrumentation malfunction. A summary of the data collected by the tipping bucket is presented in Table 2-2, together with the coincidental data measured at the Watson Lake Airport. These data indicate that the mine receives about 1.14 to 1.19 times more precipitation than Watson Lake during the summer months, which is far less than the 1.67 times expected when the annual totals at the two sites are compared. Rainfall data continues to be collected at site but has not been incorporated into this update.

The small difference between the summer precipitation at the minesite and Watson Lake Airport was expected because orographic effects tend to be less important during warmer weather. To get an indication of the orographic effects in the winter, a comparison was made of snowpack levels between high and low elevation snow courses. Table 2-3 shows the average water contents of the March 1 and April 1 snowpacks at the Pine Lake Airstrip and the Watson Lake Airport. The former station is located at a similar elevation as the minesite and probably provides a reasonable approximation of the snowpack conditions at the minesite. Figure 2-4 provides evidence to suggest that a regional snow course can be used to accurately approximate conditions at the minesite. This figure shows that there are two other snow courses in the region with similar elevations as the minesite, and both experience comparable, but less, snowpacks than the Pine Lake Airstrip. The snowpack at the Pine Lake Airstrip is some 1.6 to 1.7 times larger than what develops at the Watson Lake Airport.

Taken together, the information provided in Tables 1 and 2 suggest that the adopted estimate of MAP for the minesite may be conservative (i.e., overestimate the true MAP). On an annual basis, the ratio between the minesite and Watson Lake MAPs would be expected to lie intermediate to the multiplier for the summer months (1.14 to 1.19) and the one for the winter months (1.6 to 1.7). Such an intermediate value would be less than the multiplier that has been adopted (i.e., 1.67). To retain some conservatism, no change is proposed to the adopted MAP value for the minesite.

Table 2-2 Coincidental Precipitation at Minesite and Watson Lake

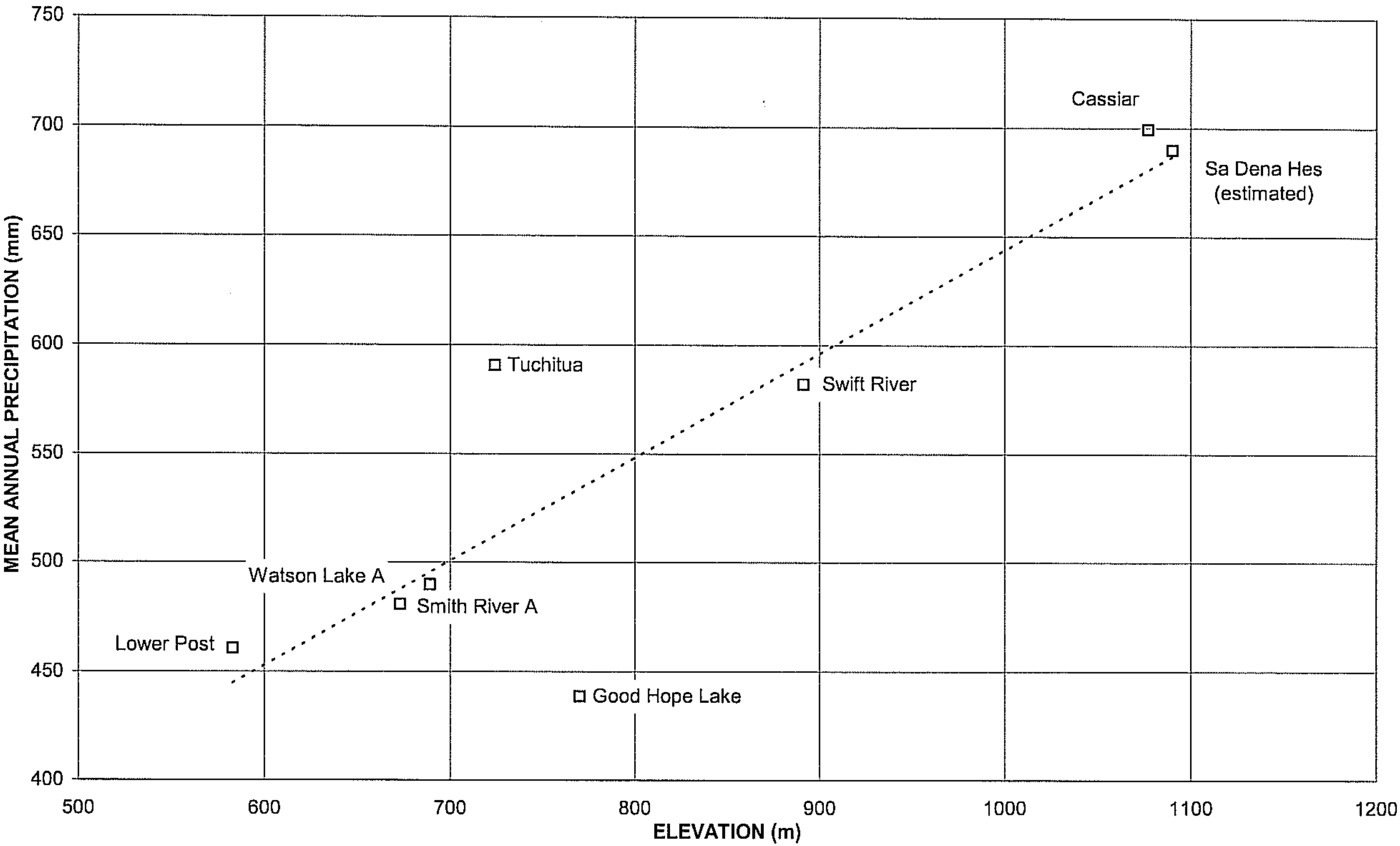
Period of Overlap	Total Precipitation over Period of Overlap (MM)		Ratio: Minesite to Watson Lake Precipitation
	Minesite	Watson Lake	
June 20 to 30, 2002	3.6	7.5	0.48
July 2002	110.8	119.7	0.93
August 1 to 28, 2002	118.8	77.4	1.53
June 20 to August 28, 2002	**233.2**	**204.6**	**1.14**
May 16 to 31, 2005	50.4	57.5	0.88
June 2005	74	61.8	1.2
July 2005	66	61.8	1.07
August 2005	37.6	31.2	1.21
September 2005	53.4	38.4	1.39
October 1 to 24, 2005	24.6	n/a	n/a
May 17 to September 30, 2005	**254.3**	**213.5**	**1.19**

Table 2-3 Comparison of Average Snowpacks at Pine Lake Airstrip and Watson Lake

Date of Measurement	Average Snow Water Equivalent (mm)		Ratio: Pine Lake to Watson Lake Snowpack
	Pine Lake Airstrip	Watson Lake Airport	
March 1	198	125	1.58
April 1	224	131	1.72

Note: Averages are for period 1976 to 2005

The seasonal precipitation distribution at the tailings impoundment was approximated using normalized monthly average distributions of regional AES stations. The two upper graphs in Figure 2-2 graphically present the monthly rainfall and snowfall distributions for two high altitudes (Cassiar and Swift River) and two low altitude (Tuchitua and Watson Lake A) AES stations. The rainfall and snowfall (as water equivalent) distributions are expressed as percentages of the MAP. The high altitude stations exhibit fairly different distribution patterns than the low altitude stations. It is assumed that the difference is primarily a result of an elevation dependency; however, it may also be related to spatial variations. The two low altitude stations are located along the valley floors of the Frances and Liard Rivers in fairly close proximity to the mine site whereas the two high altitude stations are sited further to the west within the Cassiar Mountains. The normalized distributions for the two high altitude stations coincide remarkably well despite the fact that the stations have an elevation difference of about 170 m. The one difference is the anomalously high, and probably erroneous, average snowfall at Swift River during March. Based on the similarities between the distributions at the two high altitude stations, the Cassiar distribution was adopted, without any adjustments, to represent the precipitation pattern at the tailings impoundment. This distribution was used to reflect the fact that a higher proportion of precipitation falls as snow at elevations as high as the proposed tailings impoundment than at the valley floor. It should be noted that the snowfall at Cassiar is converted to a water equivalent by applying a factor of 0.1.



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SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

REGIONAL RELATIONSHIP BETWEEN MEAN ANNUAL PRECIPITATION AND ELEVATION

PROJECT	DATE	APPROVED	FIGURE
1CC005.05	AUG. 1999		2-3

The estimated average monthly snowfall and rainfall amounts for the tailings impoundment are shown in Table 2-4 together with other estimated climatic parameters for the tailings impoundment. The mean annual precipitation can be expected to comprise about 300 mm rainfall and 390 mm snowfall as water equivalent. Precipitation is common throughout the year with the driest month typically being April, and the wettest being October.

Table 2-4 Estimated Mean Monthly Climatic Parameters for Tailings Impoundment Site

Parameter	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	YEAR
Rainfall (mm)	2.4	0.4	0.8	2.2	24.9	45.2	60.6	59.4	64.2	36.3	3.6	1.3	301
Snowfall (cm)	60	59	46	23	9	2	0	0	7	47	60	76	389
Total Precipitation (mm)	62	60	47	25	34	47	61	60	71	83	64	78	690
Daily Maximum Temp (°C)	-20.2	-12.3	-5.3	1.3	8.1	14.2	17.1	14.5	8.4	-0.4	-13.1	-18.0	-0.5
Daily Minimum Temp (°C)	-31.3	-28.2	-22.6	-13.2	-3.2	1.7	5.3	3.7	-2.3	-10.1	-24.4	-27.9	-12.7
Daily Mean Temp (°C)	-25.7	-20.3	-14.0	-6.0	2.5	7.9	11.2	9.1	3.0	-5.3	-18.7	-22.9	-6.6
Evaporation (mm)	0	0	0	0	53	105	130	99	43	0	0	0	430

The Cassiar climatological record can also provide an indication of the extreme daily precipitation events at the mine site. The greatest 24-hour rainfall measured at this station over its 26-year history was 48 mm while the greatest 24-hour snowfall was 53 cm. The average number of days with measurable precipitation at Cassiar was 155.

The extremes in annual precipitation at the tailings impoundment were estimated assuming they exhibit a similar variability as observed at Cassiar. The coefficient of variation (standard deviation divided by mean) was used to quantify the amount of variability and has a value of 0.14 for this AES station. Table 2-5 shows the extreme precipitation values as projected using a normal distribution.

Table 2-5 Estimated Precipitation Extremes: Tailings Impoundment

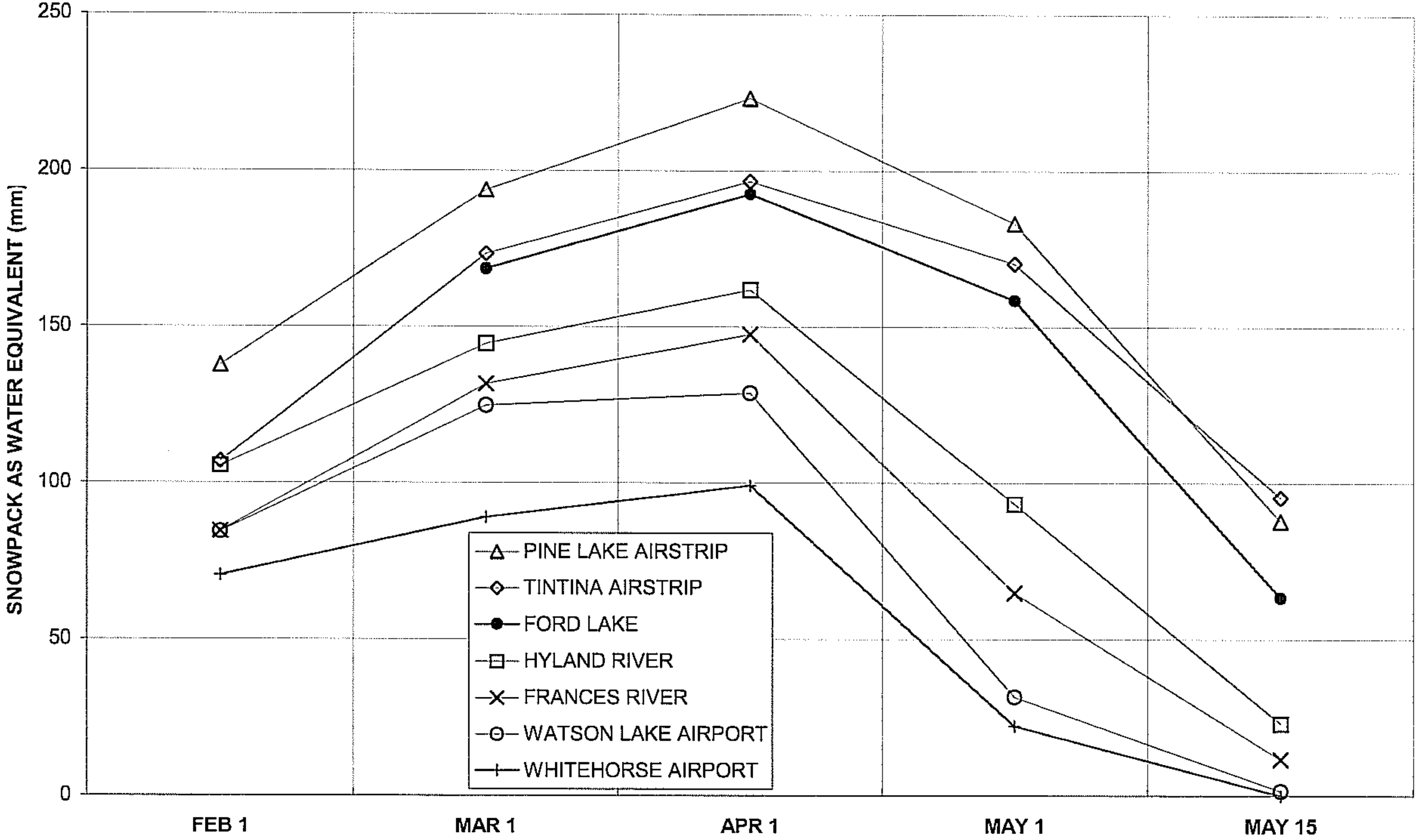
Return Period	Total Precipitation (mm)
100-yr High	920
20-yr High	850
Mean Annual	690
100-yr Low	540
20-yr Low	470

2.5 SNOWPACK ESTIMATE

The DIAND operates a relatively dense network of snow survey stations in the region of the Sä Dena Hes minesite. Figure 2-4 is a graphical presentation of the average snowpack statistics for the five closest long-term (i.e., greater than 10 years) stations for various dates during the winter and spring. Inspection of these data reveals the expected general trend of increasing snowpack with increasing elevation. The three highest elevation stations, Pine Lake Airstrip (elev. 995 m), Tintina Airstrip (elev. 1067 m) and Ford Lake (elev. 1110) have similar elevations as the Sä Dena Hes minesite and are, therefore, judged to be indicative of the snowpack conditions likely experienced at the tailings impoundment. The accumulation of snow at the tailings impoundment site will typically begin in October and snowmelt will usually be complete by early June. At maximum snowpack in April, the density of the snowpack is about 240 kg/m^3.

2.6 TEMPERATURE ESTIMATE

A regional analysis was used to characterize the temperature regime at the tailings impoundment site. Examination of the spatial temperature differences between the AES stations, especially those on the valley floors, revealed that the mean annual temperature followed a decreasing trend in both the northward and eastward direction in the region. This observation was taken into account in extrapolating regional temperature data to the mine site. The temperature data continues to be collected at the mill site weather station so the data is available to help with updating regional data.



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SA DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

MEAN MONTHLY SNOWPACK AT REGIONAL SNOW SURVEY STATIONS

PROJECT	DATE	APPROVED	FIGURE
1CC005.05	AUG. 1999		2-4

The first step in performing the analysis was to evaluate a typical vertical temperature gradient between a valley station and a high altitude station. The stations at Cassiar and Good Hope Lake were judged to be appropriate for this purpose, as they are located fairly close to each other in horizontal distance.

The temperature gradient between this pair of stations, on an annual average basis, was calculated at -0.0084°C/metre. A significant variation around this number is, however, observed on a month to month basis. The second step involved using these monthly temperature gradients in conjunction with the climate record of the Watson Lake Airport to extrapolate the regional temperature data to the tailings impoundment site. The Watson Lake Airport, being the closest AES station to the mine site that measures temperature, was selected as the base for the extrapolation to implicitly account for the observed northward and eastward regional trends in temperature. The elevation difference between Cassiar and Good Hope Lake is similar to that between the tailings impoundment and the Watson Lake Airport (307 m versus 401 m). Therefore, the analysis involved multiplying the incremental temperature differences between the Cassiar and Good Hope Lake stations by the factor 1.3 (401/307) and then adding the resulting numbers to the 1961 – 1990 temperature normals for the Watson Lake Airport. The resulting estimated monthly temperature distribution at the tailings impoundment is listed in Table 2-2. The mean annual temperature at the mine site is predicted to be -6.6°C, which compares to a value of -3.1°C at the Watson Lake Airport.

A rough indication of the temperature extremes at the mine site can be made by referencing the long-term (52 year) and reliable climatological record at the Watson Lake Airport. The extreme minimum temperature experienced at this station was -59°C; the extreme maximum temperature was 34°C.

2.7 EVAPORATION ESTIMATE

The network of evaporation stations is sparse in the Yukon and northern British Columbia. The closest evaporation pan is located at the Whitehorse Airport AES station, some 340 km west of the mine site. This station experiences higher air temperatures than does the mine site and as a result probably experiences higher evaporation rates.

In order to account for this temperature dependency, the evaporation rate at the tailings impoundment was approximated using the Thornthwaite Method (Gray, 1973), an empirical formula that uses average monthly air temperature and latitude to calculate potential evapotranspiration. The temperature regime derived in Section 2.6 provided the input data for the Thornthwaite Method. The calculated monthly average evaporation values are listed in Table 2-2. Using this empirical method, the annual evaporation rate was estimated to be 430 mm.

The accuracy of the Thornthwaite Method was tested by applying it to the same conditions as experienced at the Whitehorse Airport. This empirical relationship predicted an evaporation rate for the period May to September that was only 2% less than the value derived from pan measurements.

3.0 WATER RESOURCES

3.1 SURFACE WATER HYDROLOGY

3.1.1 Hydrological Setting

The Sä Dena Hes mine is located in the drainage basin of False Canyon Creek, a left bank tributary of the Frances River. False Canyon Creek has a total catchment area of 492 km^2 and discharges some 55 km above the Frances River and Liard River confluence. Access to the mine development is from the south across the drainage basin of Tom Creek, a left bank tributary of the Liard River.

Figure 2-1 shows the location of the mine in relation to the major rivers and lakes of the region.

The open pits, underground workings and waste rock dumps associated with the Jewelbox ore zones are located near the drainage divide between Tom and False Canyon Creeks. All drainage from the Jewelbox development is directed to Camp Creek, a steep-gradient tributary of False Canyon Creek that drains the eastern flank of Mount Hundere. The mill site is also located in the catchment of Camp Creek. The Burnick development is entirely confined in the headwaters of another False Canyon Creek tributary, which has been designated Tributary D. The tailings impoundment is constructed in a saddle that lies along the drainage divide between Camp Creek and Tributary E. Figure 3-1 shows the locations of the major mine elements relative to the catchments of False Canyon and Tom Creeks. Figure 3-2 is a larger scale map showing the drainage basin for the Tailings Management Facility.

3.1.2 Available Data

As was done for the climate analysis, the hydrology of the minesite was first characterized in 1990 as part of the mine's permitting studies. The hydrology was then updated in 1999 to support preparation of the 2000 DRP. In both cases, the hydrology was estimated using a mix of site-specific and regional data. At the point of updating the hydrology in 1999, no automated streamflow gauging stations had been operated at the minesite. The site-specific data largely comprised spot measurements made by a current meter.

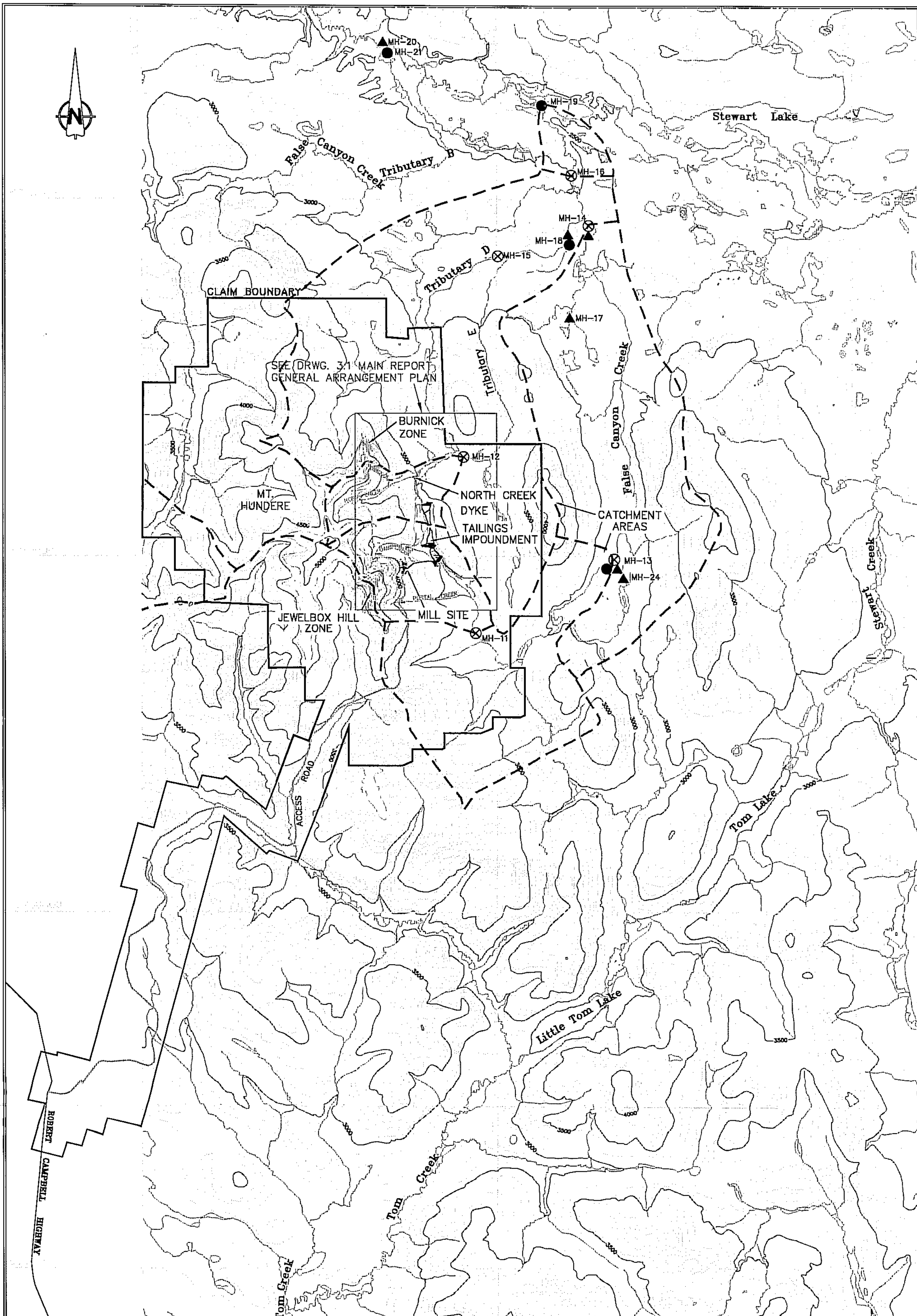
In 2002, Access Mining Consultants established an automated water level recorder in the Camp Creek Diversion upstream of the spillway from the Reclaim Pond. Although automated seasonal streamflow logging continues in Camp Creek, for this analysis, the station had been operated for four open water seasons. A total of 12 direct flow measurements had been made at the station with a current meter.

The flows collected at the Camp Creek Diversion from 2002 to 2005 are presented in Figures 2 to 4. The corresponding daily rainfall records collected at the mill site, where available, are also shown on these figures.

The flow hydrographs for Camp Creek have one distinctive feature: they are very subdued. This suggests that the groundwater contribution to streamflow is very large. Large rainfalls (e.g., see July 9, 2002 event on Figure 2) appear to cause only minor increases in flow in Camp Creek. The groundwater-dominated nature of the hydrology may, at least partly, be a result of the limestone geology within the stream's catchment.

The annual peak was probably missed in the first two years of record and may have also been missed in 2004. However, it is very likely that the 2005 peak was measured, as evidenced by the streamflow record of a regional streamflow gauging station (Big Creek). This regional station experienced its annual peak just days after the peak was observed in Camp Creek (see Figure 4).

The 2005 peak flow for Camp Creek is shown on Figure 4 to be about 0.5 m^3/s. However, it is strongly suspected that the true discharge was less than this value. On the day preceding the occurrence of the peak, the stream was largely covered by ice and snow. This cover probably collapsed into the stream, temporarily causing an artificially high water level. The shape of the water level record exhibits abrupt increases and decreases in stream depth just prior to and following the apparent peak in discharge, which suggests the stream channel was temporarily dammed by ice and snow. Further discussion of the Camp Creek flow data is given in Section 3.1.5.



NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

CONTOUR INTERVAL 100 FEET

0 1000 2000 3000 4000 5000 metres
1:100,000

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

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LEGEND
⊗ WATER MONITORING STATION
▲ FISH MONITORING STATION
● BENTHIC MONITORING STATION

SÄ DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

LOCATION PLAN

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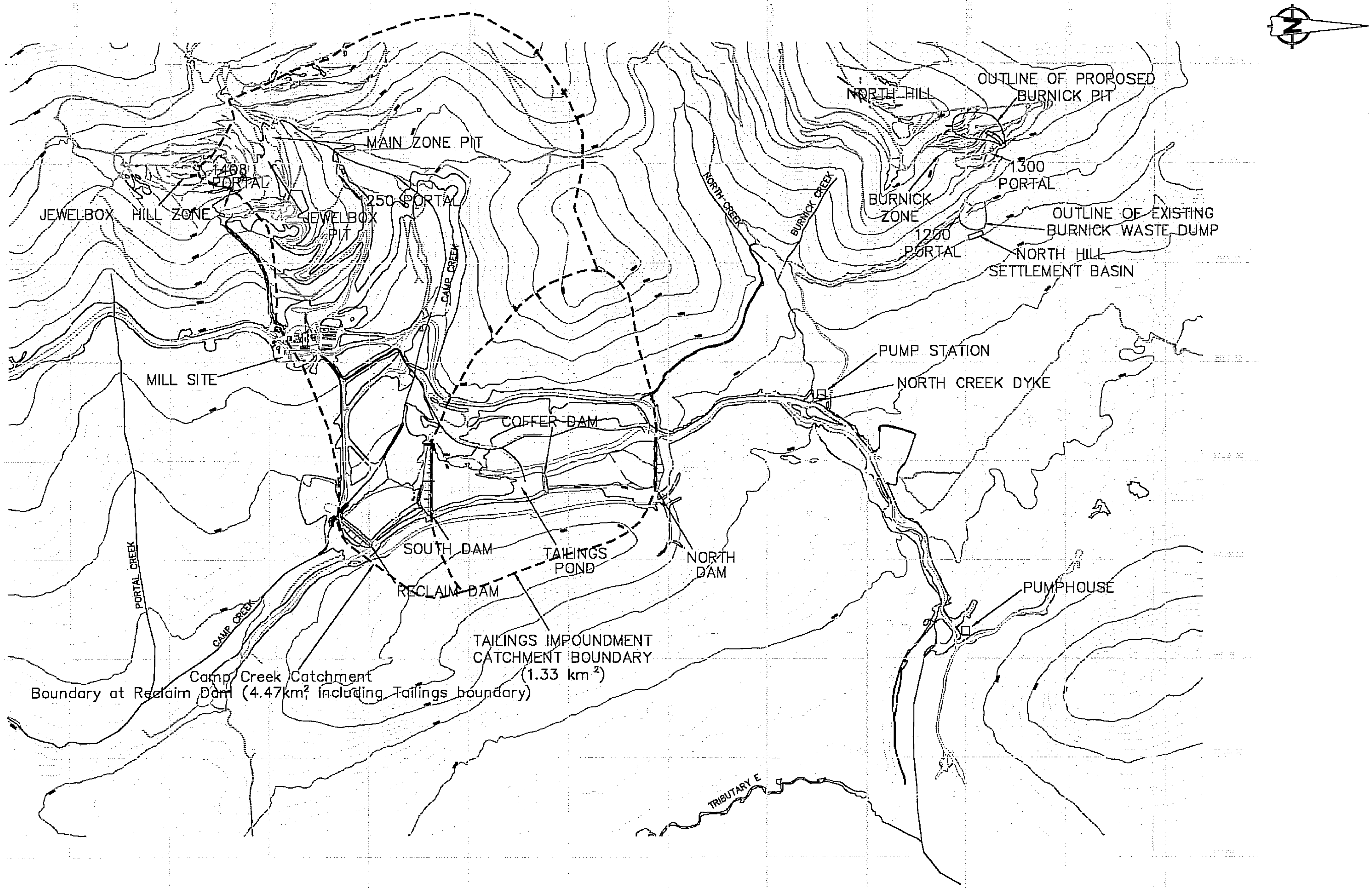
DATE: JULY 29,1999	PROJ. NO. 1CC005.05	3—1	



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LEGEND

WATER MONITORING STATION

0 200 400 600 800 1000 metres

1:20,000

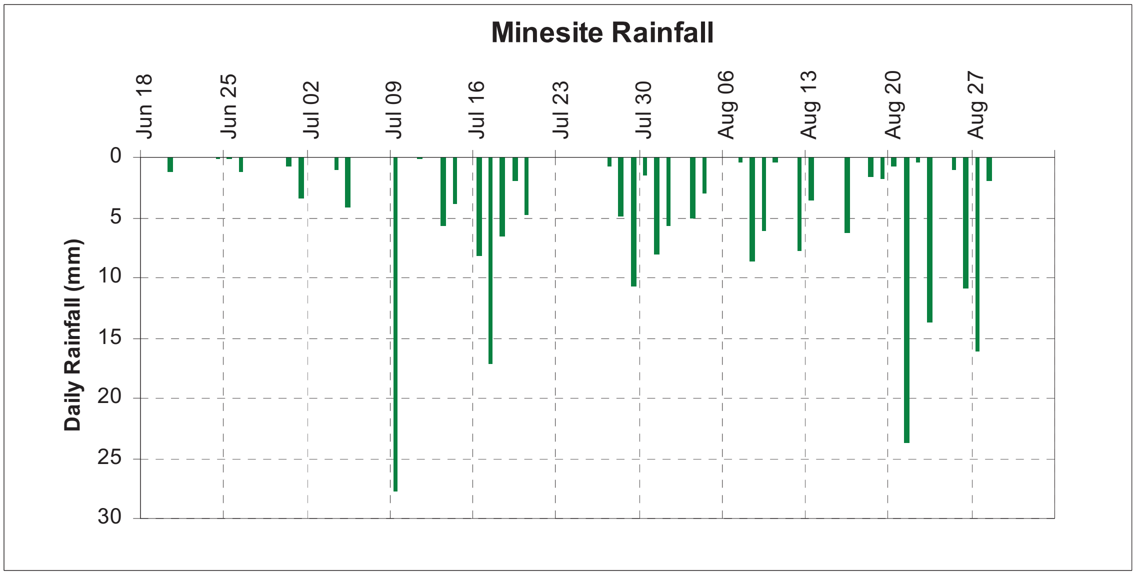
CONTOUR INTERVAL=10m

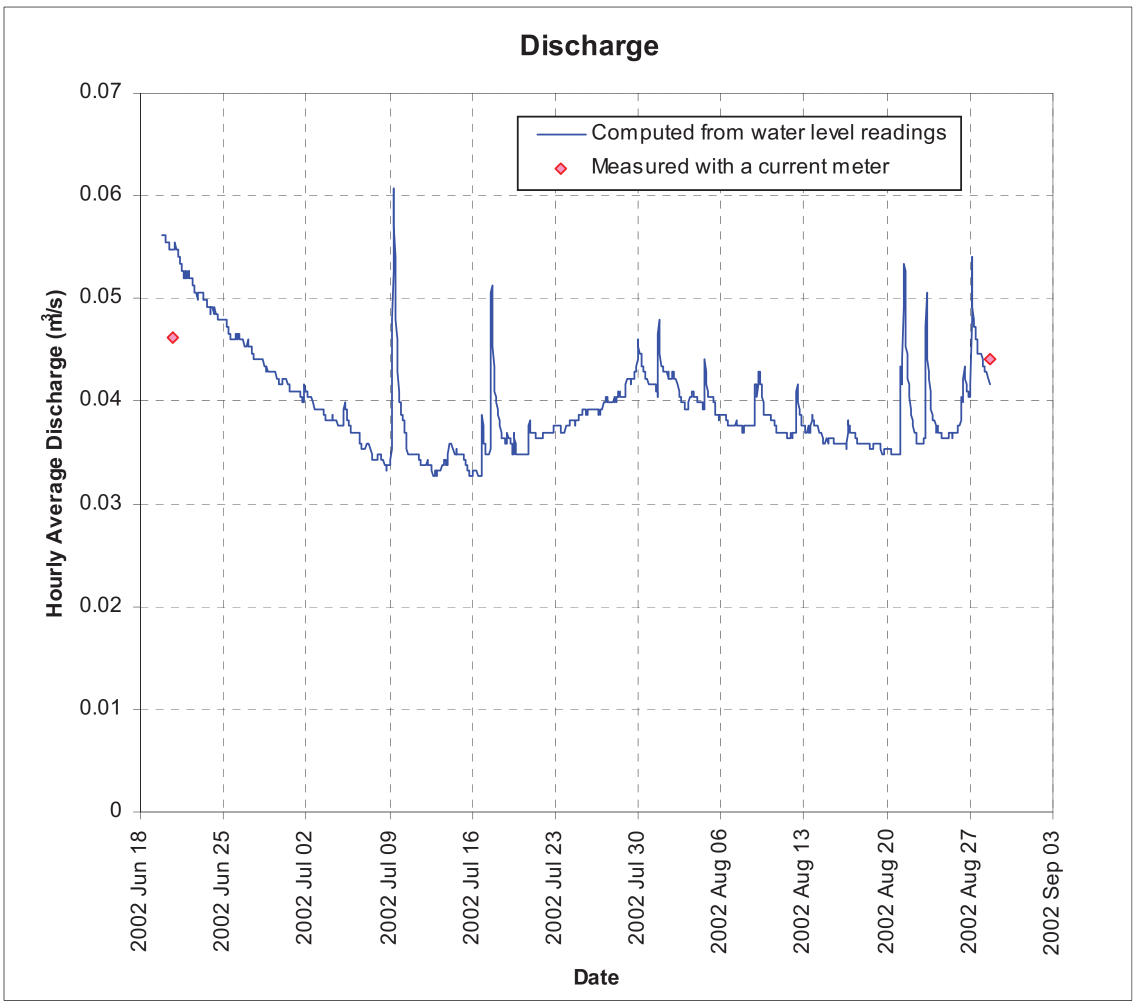
NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

Sä DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

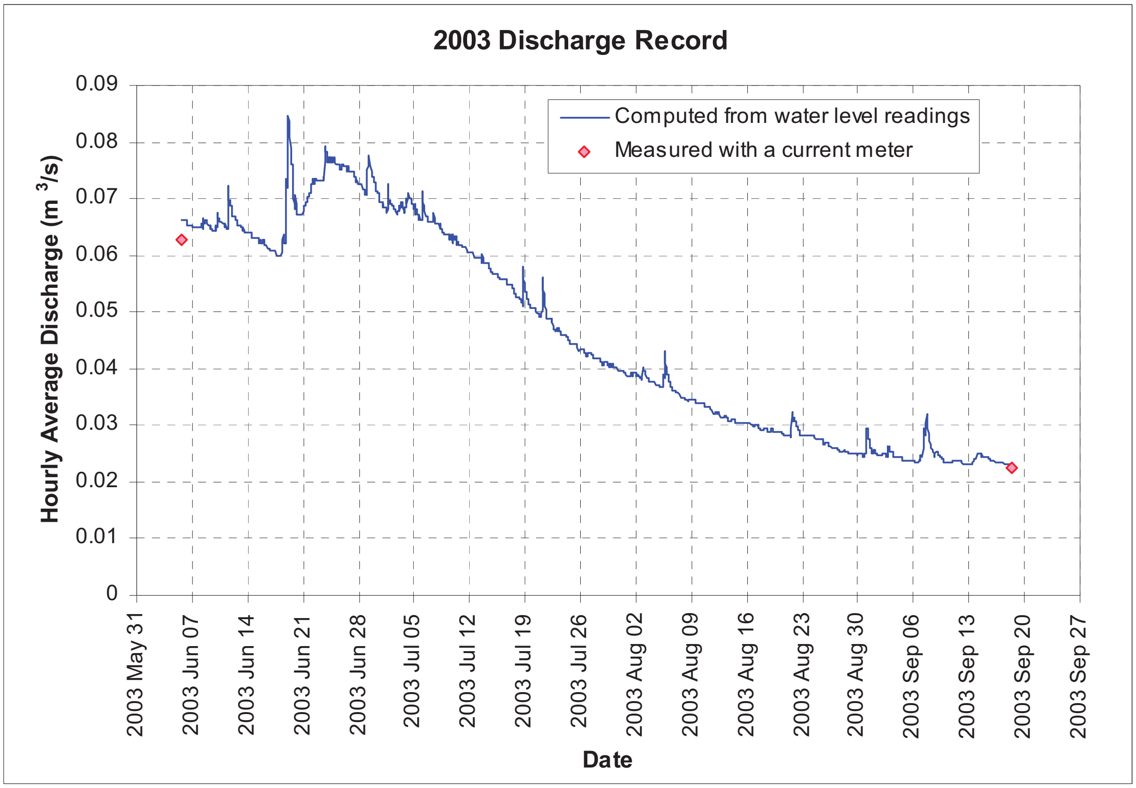
CAMP CREEK AND TMF
CATCHMENT BOUNDARIES

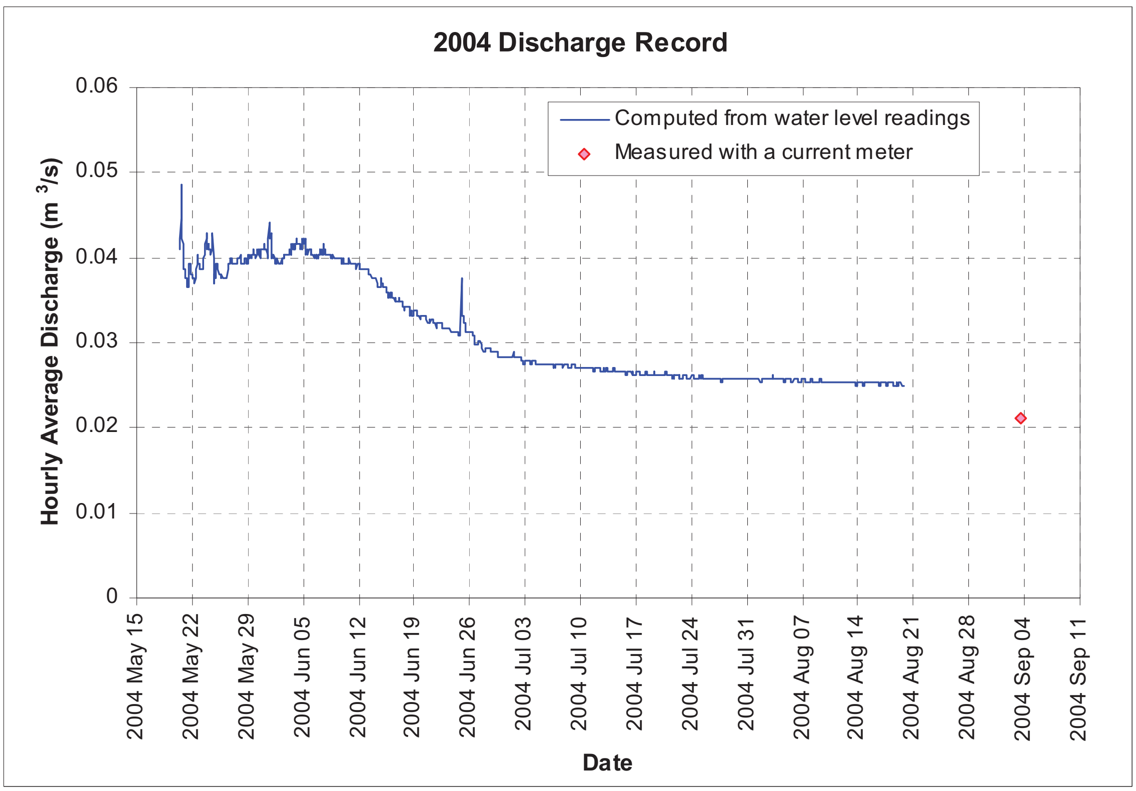
DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO. 3–2	REV.
DATE: JULY 29,1999	PROJ. NO. 1CC005.05		





SRK Consulting Engineers and Scientists VANCOUVER	Teck	**Camp Creek Flow Record and Minesite Rainfall Record - 2002**
Job No: 1CT008.004 Filename: Figure 2_Camp Cr Flow Record_20051213.ppt	Sä Dena Hes Closure Plan Update	January 2010 | Approved: | Figure: 2





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Hourly Flow Record for Camp Creek – 2003 and 2004

Job No: 1CT008.004

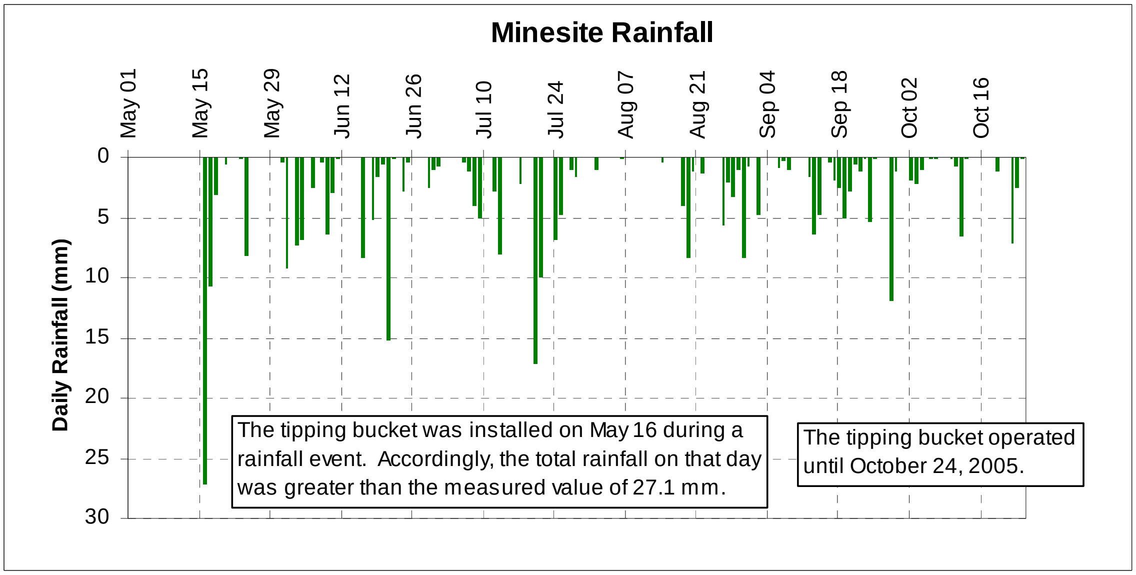
Filename: Figure 3_hr flow Record Camp Cr_20051213.ppt

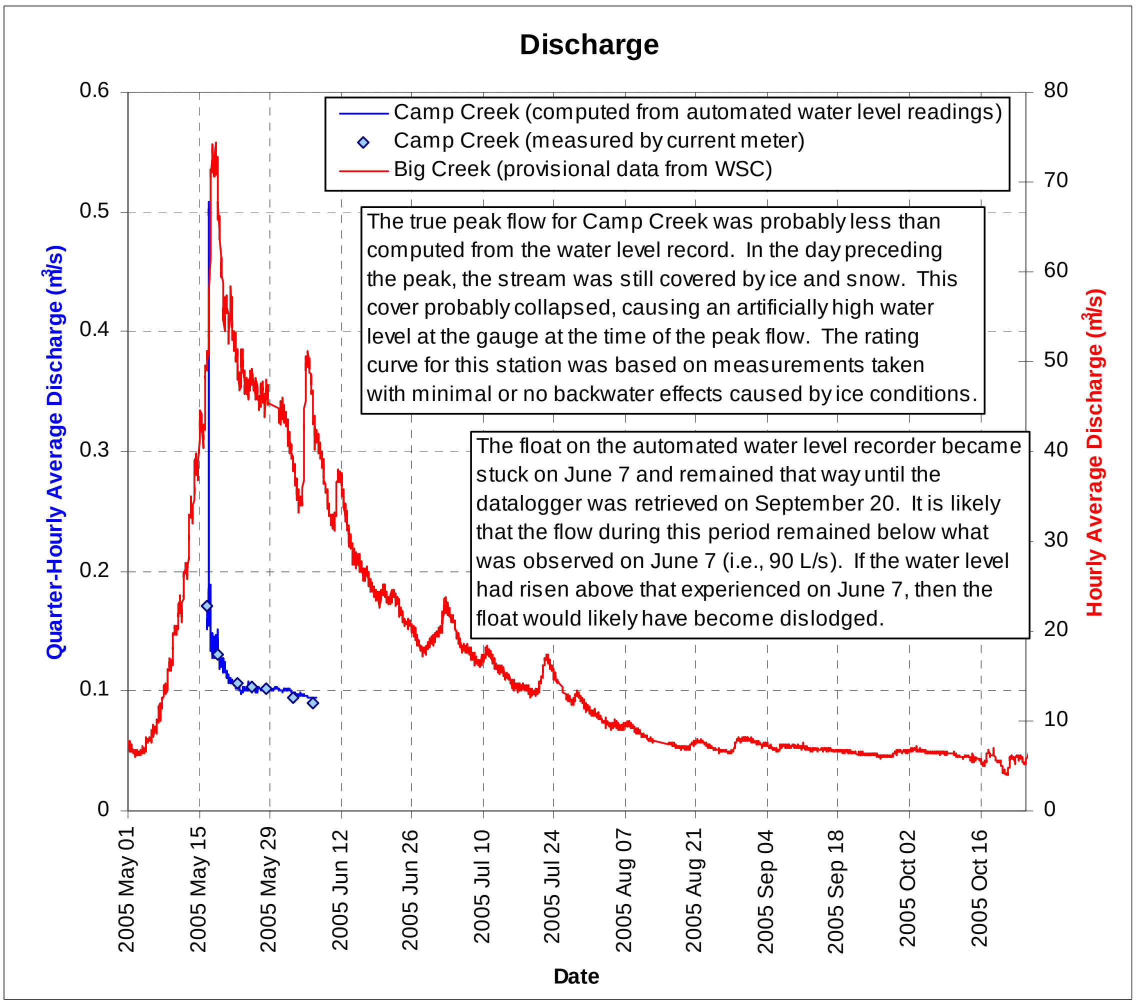
Sä Dena Hes
Closure Plan Update

January 2010

Approved:

Figure: 3





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Camp Creek Flow Record and Minesite Rainfall Record - 2005

Job No: 1CT008.004	Sä Dena Hes	Date: Dec. 2005	Approved:
Filename: Figure 4_Camp Cr Flow Record-05_20051213.ppt	Closure Plan Update		Figure: 4

3.1.3 Average Flow Estimates

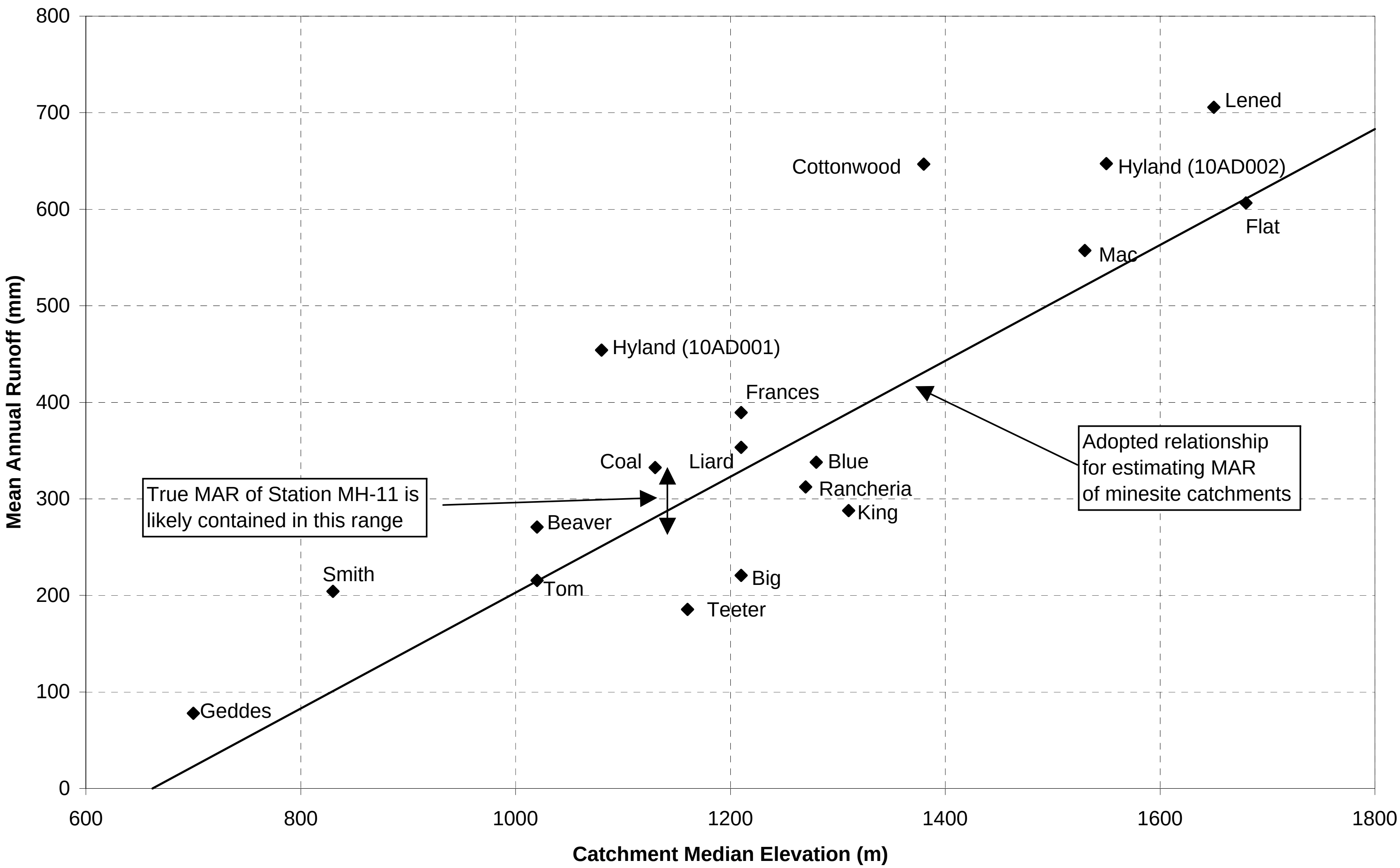
As indicated in Section 2.4 in Appendix B, elevation generally accounts for a large proportion of the variation in mean annual precipitation within a mountainous region. It follows, therefore, that mean annual runoff (MAR) would also be a function of elevation. Figure 3-3 shows how this observation was exploited to estimate the average flows of the minesite streams. The vertical axis of this figure displays values of MAR expressed as equivalent depths of water. The horizontal axis shows values of median elevation, which is the variable adopted to quantify the elevation characteristics of the regional and minesite catchments. The 18 pairs of MAR and median elevation values assembled in Table 3-2 for the WSC stations were plotted on this figure. These data demonstrate a reasonably strong relationship between the two variables.

The data plotted on Figure 3-3 were used to develop a relationship that was believed to represent the conditions at the minesite. Two steps were undertaken to develop the relationship. Firstly, a linear regression was fitted to all 18 data points. This defined a straight line with a slope of 0.60 mm per m. Secondly, the intercept of this straight line was adjusted to force the line through the data point for Tom Creek. This adjustment was based on the premise that, of all the WSC catchments, the one for Tom Creek is probably the most representative of the conditions within the False Canyon Creek catchment. These two catchments share a significant portion of their respective drainage divides and also possess similar elevational characteristics.

Expressed as an equation, the adopted relationship between mean annual runoff (MAR in mm) and catchment median elevation (E in m) is:

$$MAR = 0.60\ E - 397$$

The above relationship was derived exclusively from the regional data. The site-specific data collected at Station MH-11 were reserved for validation purposes. As described in Section 3.2, the streamflow record for this station comprises a series of spot flow measurements made over a 10-year period.



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SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

REGIONAL RELATIONSHIP BETWEEN MEAN ANNUAL RUNOFF AND CATCHMENT MEDIAN ELEVATION

PROJECT	DATE	APPROVED	FIGURE
1CC005.05	AUG. 1999		**3-3**

To provide a greater degree of confidence in the estimate, the observed flows at Station MH-11 were correlated with the coincidental flows of neighbouring WSC Stations. Three stations were selected for this purpose, Station 10AA005 on Big Creek, Station 10AA004 on Rancheria River and Station 10AA002 on Tom Creek. Figure 3-4 is a graphical presentation of the correlations. These correlations were performed on log-log graphs in recognition of the differences between the flow regimes of small and large catchments. Station MH-11 commands a much smaller catchment than the three WSC Stations and, accordingly, is expected to experience a more erratic flow regime (i.e., the ratio between the highest and lowest flow for Station MH-11 should be greater than the corresponding ratios for the other three stations).

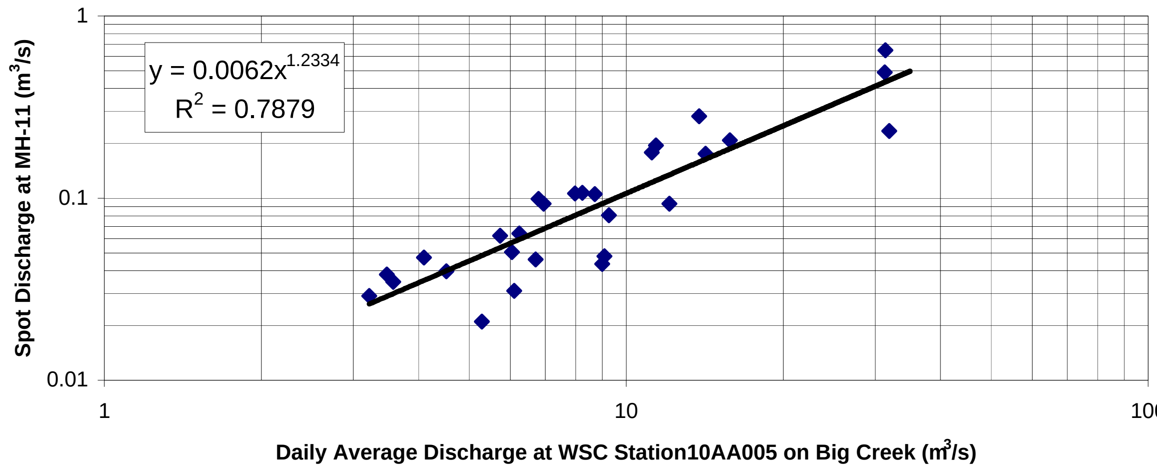
The correlations were used to make estimates of the MAR at Station MH-11. Table 3-1 summarizes the results. These correlations provided estimates that fall in a fairly narrow range from 266 mm to 330 mm. To validate the adopted relationship between MAR and elevation, this range was plotted on Figure 3-3. As can be seen, the adopted relationship passes through the range believed to contain the true MAR of Station MH-11. This suggests that the relationship is reasonably accurate, at least for catchments with similar median elevations as Station MH-11 (1140 m).

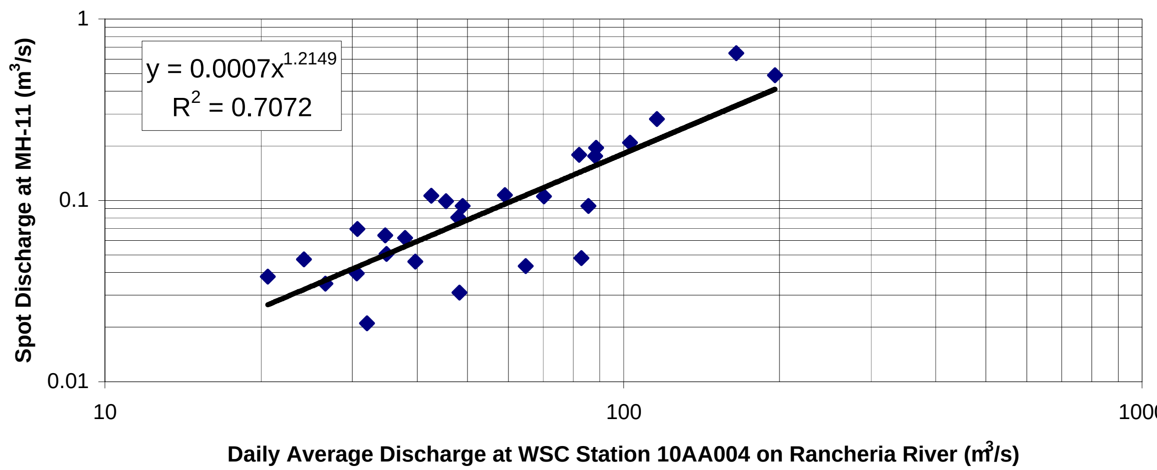
The above discussion centred on finding a means of determining the average annual runoff volume at an ungauged site. The remainder of this section presents a technique for distributing this annual volume amongst the twelve months of the year. To implement this technique, an examination was made of the average monthly hydrographs observed at the regional gauging stations. The top plot on Figure 3-5 graphically presents the distributions for five regional stations. The average monthly flows for these distributions have been expressed as percentages of MAR to facilitate comparisons amongst the distributions. Of all the 18 WSC stations selected for the hydrology study, the five selected ones were judged to be the most representative of the minesite catchments, largely on the basis of a similarity in catchment median elevation. Three of the WSC stations (Geddes Creek, Teeter Creek and Smith River) were rejected because their seasonal runoff patterns are extremely subdued with low spring freshet flows and high winter baseflows. These conditions are not observed on the minesite streams. The subdued distributions are indicative of substantial groundwater storage and suggest that limestone dominates the geology of the catchments of Geddes Creek, Teeter Creek and Smith River.

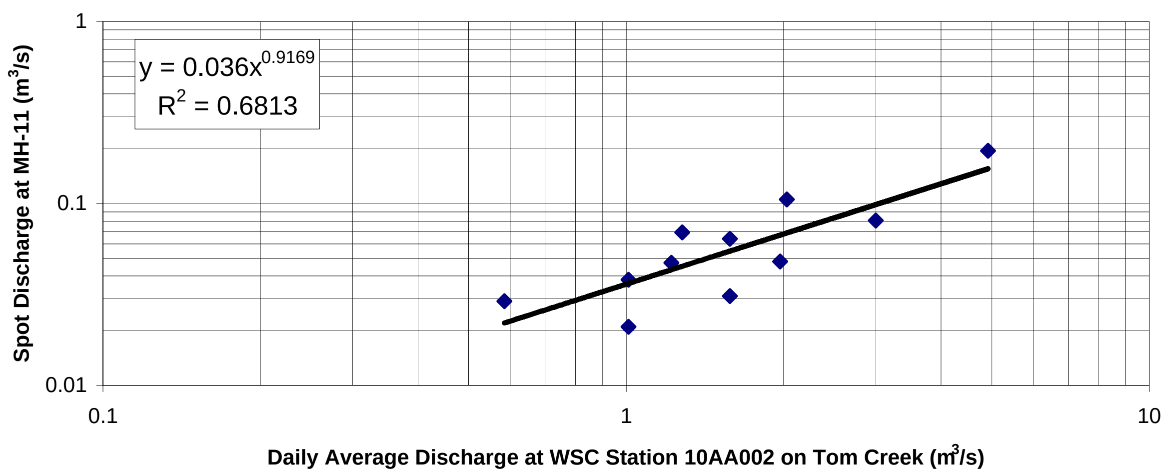
Table 3-1 Estimated Streamflow Characteristics at Station MH-11

Location	Streamflow Characteristic				
	Mean Annual Runoff [a]		7-Day Low Flow for the following Return Periods:		
	As a Flow (m^3/s)	As a Depth (mm)	2-Year (m^3/s)	10-Year (m^3/s)	50-Year (m^3/s)
Big Creek at WSC Station 10AA005	6.93	221	1.97	1.31	0.97
Station MH-11 (estimated using regression between MH-11 and 10AA005)	0.075	266	0.014	0.009	0.006
Rancheria River at Station 10AA004	50.5	312	10.1	5.21	2.79
Station MH-11 (estimated using regression between MH-11 and 10AA004)	0.087	308	0.011	0.005	0.002
Tom Creek at WSC Station 10AA002	2.97	215	0.374	0.182	0.104
Station MH-11 (estimated using regression between MH-11 and 10AA002)	0.093	330	0.015	0.008	0.005
Average estimate for Station MH-11	**0.085**	**301**	**0.013**	**0.007**	**0.004**

Note: a) Based on the complete daily record of the WSC Station, a daily streamflow record was synthesized for Station MH-11. This was done by applying the regression equation to every observed daily flow value in the record of the WSC station. The MAR of Station MH-11 was then taken to equal the average of the synthesized record.







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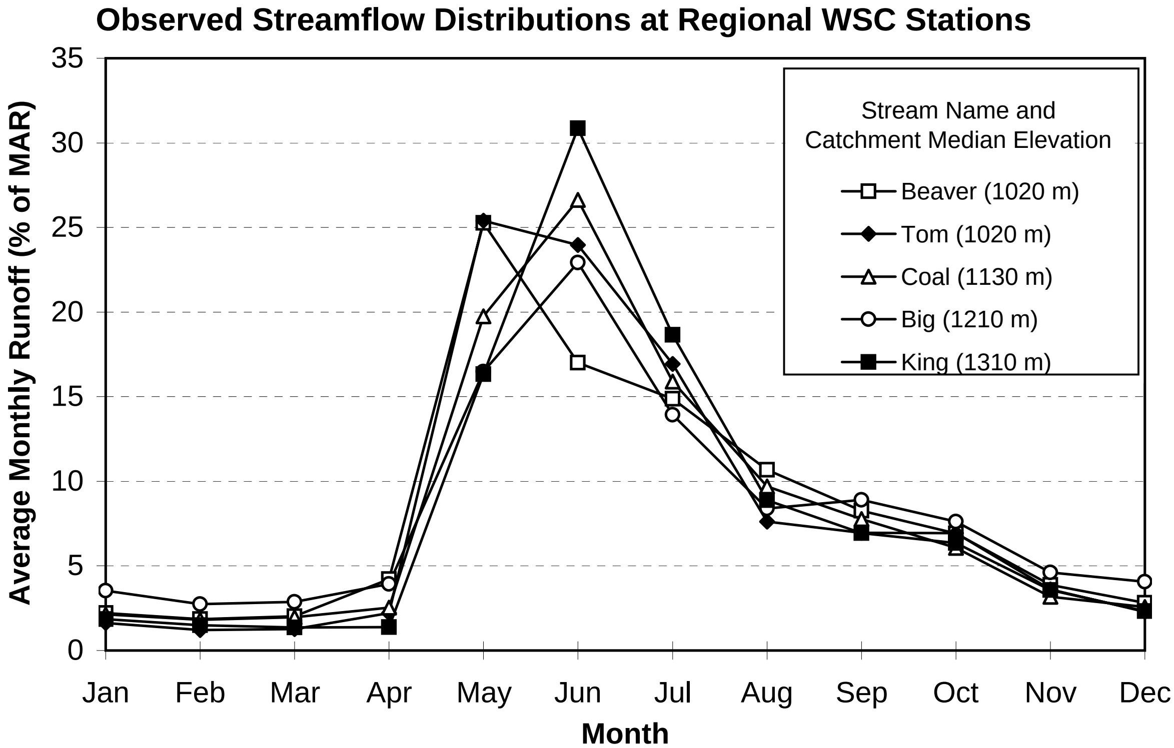
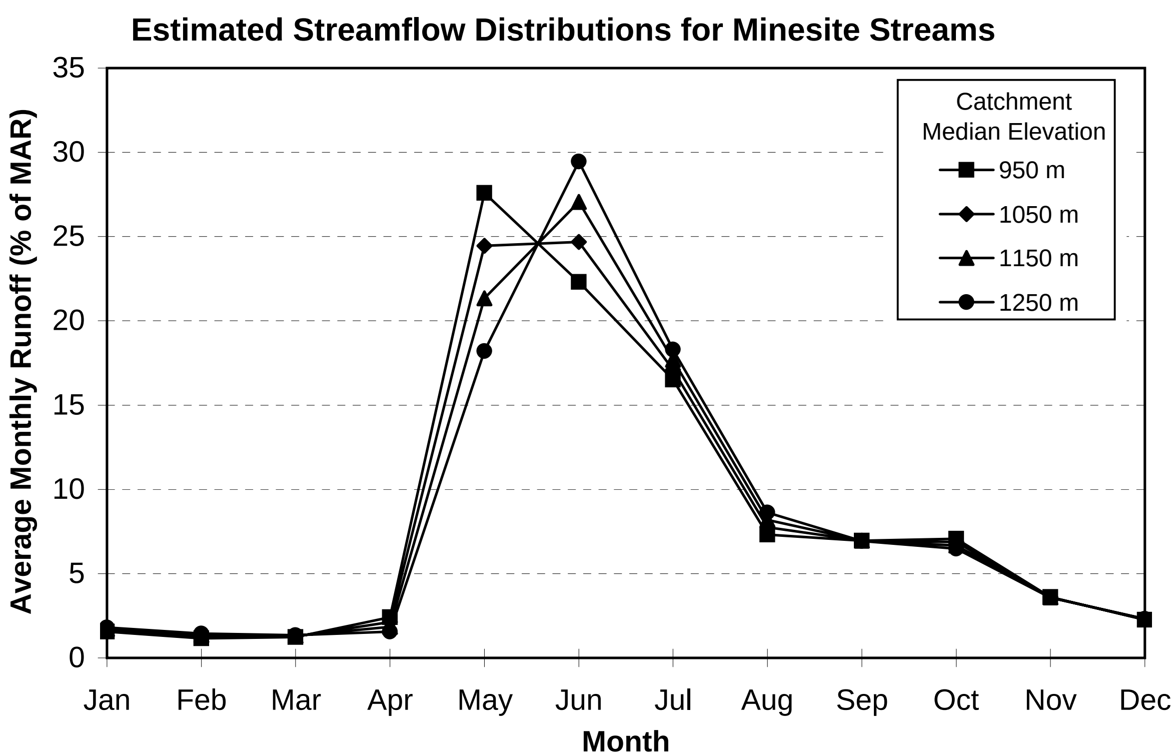
SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

CORRELATION BETWEEN SITE AND REGIONAL STREAMFLOW DATA

PROJECT	DATE	APPROVED	FIGURE
1CC005.05	AUG. 1999		**3-4**





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SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

AVERAGE MONTHLY STREAMFLOW DISTRIBUTIONS

PROJECT	DATE	APPROVED	FIGURE
1CC005.05	AUG. 1999		**3-5**

The distributions for the five selected stations are characterized by high spring flows during snowmelt and low winter flows during prolonged freezing conditions. All five distributions are remarkably similar over the period August to April, especially considering they represent runoff from significantly different catchment areas ranging from 13.7 km^2 to 9190 km^2. The major difference that exists amongst the five distributions is the proportion of runoff that occurs during the months of May, June and July. Examination of these distributions and the characteristics of their associated catchments revealed that median elevation is a reasonably good predictor of the shape of the average monthly hydrograph. As expected, low-elevation catchments generally experience earlier peaks than high-elevation catchments. The median elevations for the catchments of the five stations are shown in the legend of the top plot.

The observed relationship between hydrograph shape and catchment median elevation was used to estimate the shape of the average monthly hydrograph at ungauged locations around the minesite. The bottom plot on Figure 3-5 shows how this was implemented. The normalized distributions for Tom Creek and King Creek were used to establish the hydrograph shape at median elevations of 1020 m and 1310 m, respectively. Interpolation between the shapes of these two hydrographs was used to estimate the distribution for intermediate median elevations. Figure 3-5 shows the estimated shapes of the hydrographs for four distinct elevations.

3.1.4 Low Flow Estimates

Low flows in southeastern Yukon occur in the winter months due to the prolonged freezing conditions. This is a consistent phenomenon, as evidenced by the WSC streamflow records assembled for this study. For 16 of the 18 records, the annual minimum daily flow was observed to always occur in the period November to early May. Even for the other two records, low flows outside this period were infrequent. For the Cottonwood River, the annual minimum was outside the winter period on only one occasion over a total of 35 years of record. In the case of Geddes Creek, the annual minimum was outside the winter period a total of four times in a 17-year record. This latter streamflow record should, however, not be given much credence in assessing the low-flow behaviour of the minesite streams because, as discussed in Section 3.1.3, the streamflow regime of Geddes Creek is substantially attenuated and not representative of the conditions at the minesite.

The magnitude of low flows at the minesite was estimated using Regional Analysis. To apply this technique, three steps were undertaken. Firstly, the annual series of 7-day low flows was extracted from each of the 18 WSC streamflow records assembled for this hydrology study. For the purpose of selecting the annual low-flow values, the year was defined as the period June 1 to May 31. Use of a calendar year was rejected for this purpose to avoid missing any low-flow periods that might span the period from late December to early January. It is interesting to note that the annual low flows for durations of 1, 3, 10 and 30 consecutive days have values very close to the 7-day low flow. This is a consequence of the low flows occurring in the winter rather than the late summer. The winter flows originate from storage releases (lake and groundwater) and, accordingly, vary only slightly over lengthy periods of time.

The second step involved fitting a theoretical frequency distribution (Log-Pearson Type III) to each annual series to estimate the magnitude of extreme low flow events. This step and the previous one were performed using a suite of computer programs developed by the U.S. Geological Survey (Jones and Fahl, 1994) for processing hydrological data (viz., IOWDM2.4, SWSTAT3.2 and ANNIE2.5). Table 3-2 summarizes the results obtained from these programs. Estimates of the 7-day low flow are presented for return periods of 2, 5, 10, 20, 50 and 100 years. Because the 18 WSC stations measure the flow from a wide range of catchment areas, some method was sought to normalize the low flow values so that comparisons amongst the stations could readily be made. The method adopted was to express the values as percentages of the mean annual runoff. For example, the table indicates that the 7-day, 50-year low flow for the Blue River station is 6.3% of MAR. This corresponds to a flow rate of 1.1 m^3/s (i.e., 6.3% of 18.2 m^3/s).

The third and final step entailed finding a way of transposing the low flow values in Table 3-2 to the minesite. To accomplish this, an examination was made of the relationship between low flow and the physical characteristics of the catchments that generated the flow. Two such characteristics were investigated: catchment median elevation and catchment area. Correlation with the former characteristic was poor but catchment area was discovered to help explain at least some of the variation in the low-flow characteristics of the WSC stations. A relationship with catchment area is plausible because channel storage and floodplain area tend to increase as drainage area increases. Increases in these two features of a catchment provide a larger unit storage of water from which to sustain the baseflow.

Table 3-2 Estimated Low Flow Magnitudes at Regional Streamflow Gauging Stations

Streamflow Gauging Station		Catchment Area (km^2)	Mean Annual Runoff (m^3/s)	Annual Minimum 7-Day Discharge as a Percentage of Mean Annual Runoff					
ID No.	Name			2-Year	5-Year	10-Year	20-Year	50-Year	100-Year
10BD001	Beaver River below Whitefish River	7280	62.5	22.3	18.4	16.2	14.3	12.3	10.9
10AA005	Big Creek at km 1084.8 Alaska Highway	991	6.93	28.4	22.1	19.0	16.5	14.0	12.4
10AC004	Blue River near the mouth	1700	18.2	19.3	14.0	11.0	8.7	6.3	5.0
10BC001	Coal River at the mouth	9190	96.8	20.7	18.0	16.7	15.7	14.6	13.9
10AC005	Cottonwood River above Bass Creek	888	18.2	12.5	9.2	7.1	5.4	3.8	2.9
10EA002	Flat River at Cantung Camp	128	2.46	11.4	9.2	8.2	7.4	6.5	6.0
10AB001	Frances River near Watson Lake	12800	158	13.6	11.8	10.9	10.3	9.5	9.1
10BE008	Geddes Creek at the mouth	77.8	0.192	42.7	32.3	27.6	24.0	20.8	18.8
10AD002	Hyland River at km 108.5 Nahanni Range Road	2150	44.1	9.2	8.0	7.4	6.9	6.4	6.0
10AD001	Hyland River near Lower Post	9450	136	13.5	10.9	9.5	8.4	7.1	6.3
10AB003	King Creek at km 20.9 Nahanni Range Road	13.7	0.125	12.0	0.0	0.0	0.0	0.0	0.0
10EB003	Lened Creek above Little Nahanni River	34.3	0.767	8.2	6.1	5.2	4.6	3.8	3.4
10AA001	Liard River at Upper Crossing	33400	374	17.3	15.0	13.9	13.1	12.1	11.6
10EB002	Mac Creek near the mouth	188	3.32	3.4	1.8	1.2	0.8	0.5	0.3
10AA004	Rancheria River near the mouth	5100	50.5	20.0	13.6	10.3	7.9	5.5	4.2
10BE013	Smith River above Smith Falls	3740	24.2	53.4	45.5	42.0	39.3	36.6	34.9
10BE009	Teeter Creek near the mouth	211	1.24	44.9	33.2	27.3	22.6	17.7	14.9
10AA002	Tom Creek at km 34.9 Robert Campbell Highway	435	2.97	12.7	8.1	6.2	4.8	3.5	2.9

Figure 3-6 is a graphical presentation of the analysis involved in the third step. This figure shows three plots, one each for the 2-year, 10-year and 50-year events. The vertical axis of each plot shows values of 7-day low flow expressed as a percentage of MAR. The horizontal axis presents the independent variable, or catchment area. At first glance, the data on these plots appear to exhibit considerable scatter. However, the situation improves when the data points for Geddes Creek, Smith River and Teeter Creek are removed from further consideration (denoted by open diamonds on the plots). As explained earlier, the catchments of these streams probably have a geology that promotes the development of substantial groundwater storage. This storage results in an attenuated hydrograph shape with very high baseflows.

Even with the removal of these three "high-yield" catchments, a significant amount of scatter still remained. Given this scatter, the decision was made to develop a prediction equation that would provide conservative estimates of low flow for the minesite streams. To do this, the remaining 15 WSC stations were separated into two groups. The first group comprised the stations that, in effect, formed a lower-bound envelope on all the data. This group was designated the "low-yield catchments" (solid squares on the plots of Figure 3-6). The second group was named the "moderate-yield catchments" and covered the stations lying just above the first group (open squares on the plots). To provide a convenient means of estimating the low flows at ungauged locations, a set of logarithmic regressions were fitted to the data from the first group.

These logarithmic regressions appear as straight lines on the three plots of Figure 3-6. In equation form, these lines are expressed as:

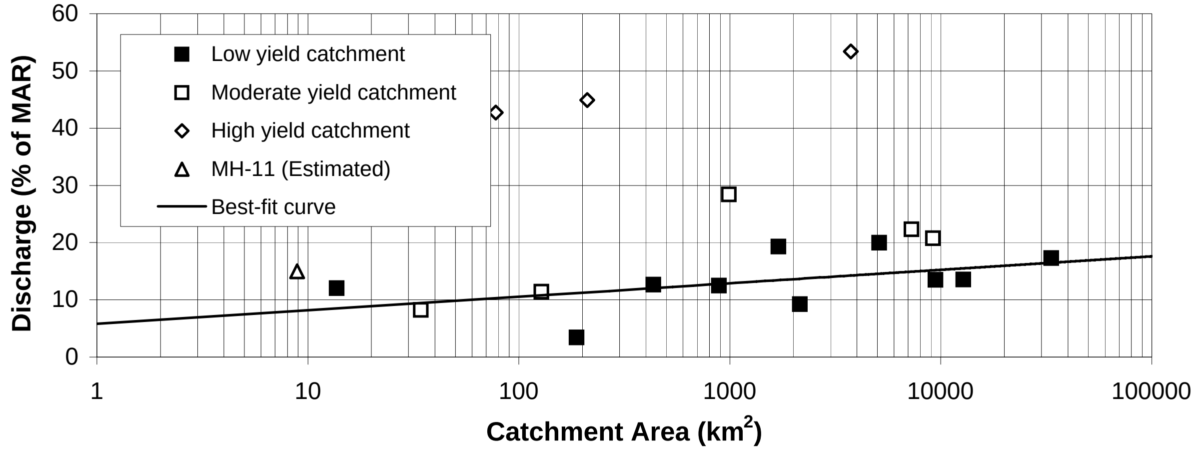
$$Q_{7,\,2} = Q_{MAR}\,(0.0235 \log A + 0.0583)$$

$$Q_{7,\,10} = Q_{MAR}\,(0.0413 \log A - 0.0541)$$

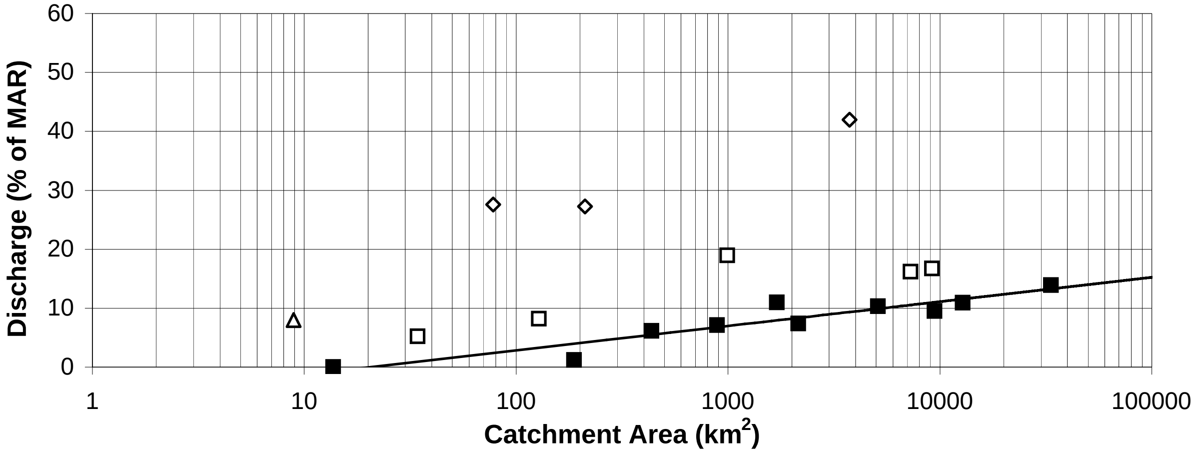
$$Q_{7,\,50} = Q_{MAR}\,(0.0351 \log A - 0.0571)$$

where:
- $Q_{7,\,2}$ = annual minimum 7-day flow with 2-year return period (m^3/s);
- $Q_{7,\,10}$ = annual minimum 7-day flow with 10-year return period (m^3/s);
- $Q_{7,\,50}$ = annual minimum 7-day flow with 50-year return period (m^3/s);
- Q_{MAR} = mean annual runoff (m^3/s); and,
- A = catchment area (km^2).

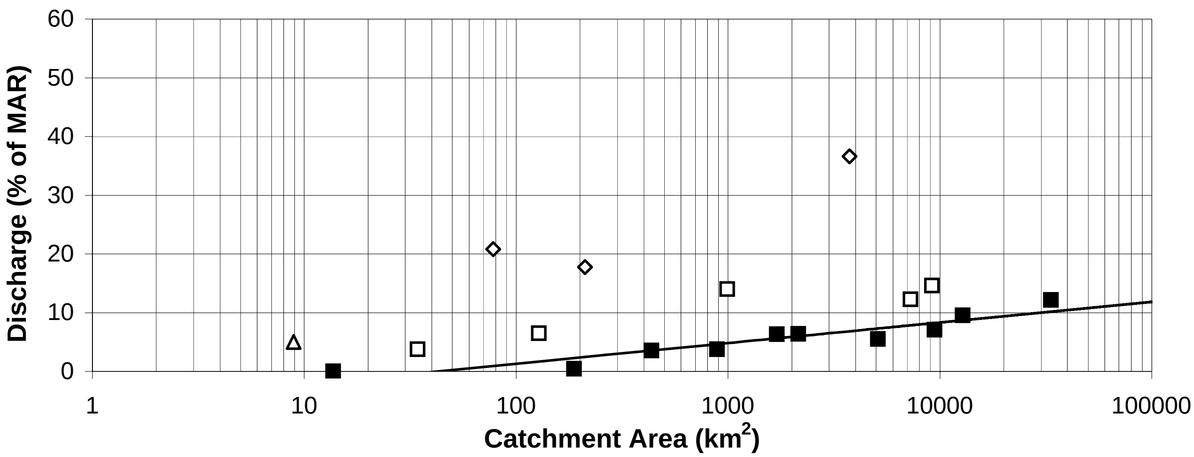
7-Day Low Flow with 2-Year Return Period



7-Day Low Flow with 10-Year Return Period



7-Day Low Flow with 50-Year Return Period



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PROJECT	DATE	APPROVED	FIGURE
1CC005.05	AUG. 1999		**3-6**

These equations suggest that the flow in small catchments (i.e., with areas less than about 10 to 50 km^2) may completely freeze-up at a return period of 10 years.

As was done for average flows, the stream flow record of Station MH-11 was used as a check on the low-flow analysis. Extreme low flow events for this station were estimated using the correlations developed in Section 3.1.3. The mechanics of computing the low flow events are set out in Table 3-3. The estimated 7-day low flows at Station MH-11 for return periods of 2, 10 and 50 years have been plotted on the graphs of Figure 3-6. As can be observed, the MH-11 values suggest that the "moderate-yield" catchments, rather than the "low-yield" catchments, may better represent the Upper False Canyon Creek. However, this observation must be viewed with caution because none of the flow measurements at MH-11 were conducted in the period January to April, or the period most likely to contain the annual minimum flow. Until such measurements become available, the equations based on the "low-yield" catchments should be used to estimate the low-flow characteristics of the minesite streams. Based on the preliminary comparison made with the MH-11 data, these equations will likely provide conservative (i.e., low) estimates for the Upper False Canyon Creek. This is not necessarily the case for locations further downstream in False Canyon Creek. It is noteworthy that the data point for Tom Creek falls within the group of "low-yield" catchments.

3.1.5 Flood Estimates

The flood analysis contained in the 2000 DDRP provided design flood estimates for the permanent closure of the Sa Dena Hes mine. For this scenario, it was only necessary to provide estimates of the instantaneous peak of various flood events. Details on the volumes of water associated with these flood events were unimportant because there was no plan to rely on storages to reduce flood size. For example, under permanent closure status, the Reclaim Dam would be breached, thus eliminating any potential flood-reducing benefit of this structure. In addition, the TFM would be provided with an open channel spillway of large capacity, again reducing the potential for any reduction of flood peaks by storage.

As a consequence of the 2003 Dam Safety Review report, Teck Cominco initiated a study to determine whether the TMF and the Reclaim Dam have the capacity to deal with the 1000-year flood during the temporary closure status. A study was conducted to determine if the current spillway at the TMF (comprising two 900 mm culverts) and the road crossing of the Camp Creek Diversion (comprising two 1200 mm culverts) could accommodate the 1000-year flood. In performing the study, it was recognized that storages within the TMF and the Reclaim Pond would probably have to be relied upon to temporarily store a portion of the incoming flood waters so that the capacities of the culverts would not be exceeded during passage of the extreme flood event. The results of this study are presented below and are still considered valid.

The flood estimation techniques provided in the 2000 DRP only provide estimates of the instantaneous peak of the flood hydrograph. To examine the effects of storage on flood magnitude it was necessary to turn to a rainfall/runoff model that simulates the full flood hydrograph and that provides flood routing capabilities. The model selected for this purpose was developed by the U.S. Corps of Engineers and is known as HEC-HMS.

Figure 5 shows the results of applying the HEC-HMS model to the TMF. Key assumptions of the modeling are:

- The 1000-year flood would be generated by an intense thunderstorm (1000-year, 24-hour total rainfall = 81 mm) falling on a ripe snowpack that, in the days preceding the storm, was melting at a high rate (20 mm/d);
- The spillway would be comprised of the existing two 900 mm culverts;
- All interceptor ditches around the TMF would fail, allowing the full catchment runoff to enter the impoundment; and
- The culverts would be flowing prior to the arrival of the storm, so that storage below the invert level of the culverts would not be available to store a portion of the incoming flood hydrograph.

The instantaneous peak of the incoming flood hydrograph was estimated to be 5.4 m^3/s. The combined outflow through the two culverts would peak at 1.6 m^3/s, or 30% of the incoming flood peak. During passage of the flood, a volume of 53,000 m^3 of water would be temporarily stored within the TMF. The water level in the TMF would peak at an elevation of 1094.9 m, which is roughly at the crown level of the two culverts.

Figure 6 shows the simulated flood hydrology for the two culverts at the road crossing of the Camp Creek Diversion. Key assumptions of the modeling are:

- The 1000-year flood would be generated by the same conditions outlined above for the TMF;
- The interceptor ditches around the TMF would function in such a way as to maximize the peak flow of water to the Camp Creek Diversion (i.e., the West Interceptor Ditch would survive but one of the East Interceptor Ditches would develop a breach and empty into the Reclaim Pond); and
- The TMF spillway and the Reclaim Pond spillway would both be flowing prior to the arrival of the storm so that storage below the crests of these spillways would not be available to store a portion of the incoming floodwaters.

The instantaneous peak of the hydrograph generated by the Camp Creek catchment would be 12.7 m^3/s, including outflows from the TMF. The combined outflow through the two culverts at the road crossing would be an estimated 6.0 m^3/s, or roughly half the peak of the incoming flood. In passing this flood, some 66,000 m^3 of water would be temporarily stored in the Reclaim Pond. Another 36,000 m^3 would be stored in the TMF. The water level would rise to 1081.1 m behind the Reclaim Dam, leaving a freeboard of about 0.9 m below the dam's crest.

In addition to examining the flood hydrology of the mine during the temporary closure status, HEC-HMS was used to provide additional estimates of flood magnitude for the permanent closure status. Figure 7 shows the estimated 1000-year flood that would have to be conveyed by the permanent spillway for the TMF. The situation is identical to the conditions modeled in Figure 5 except it was assumed that no storage attenuation would occur within the TMF. Thus, the peak of the outflow hydrograph is identical to the peak of the inflow hydrograph, or 5.4 m^3/s.

Figure 8 shows the estimated 1000-year flood for the proposed breach in the Reclaim Dam. Without the benefit of storage within either the Reclaim Pond or the TMF, the flood peaks at an estimated 15.6 m^3/s.

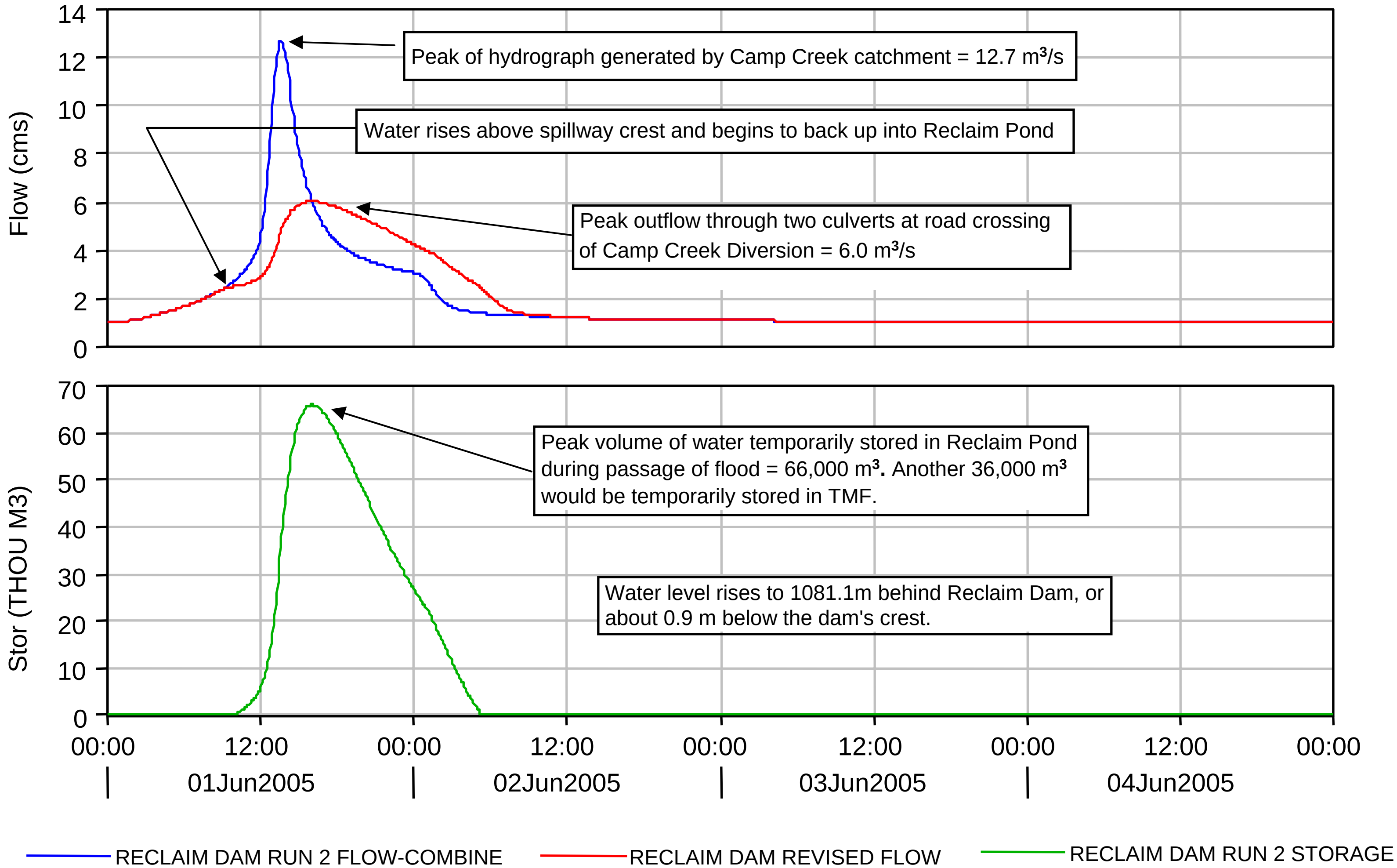
The simulated flood peaks in Figures 5 to 8 were checked for reasonableness by comparing them against maximum observed floods in the Yukon. Figure 9 presents the maximum observed floods at all government-operated streamflow gauging stations within the territory (87 operated by the Water Survey of Canada and 97 by Environment Yukon.) To facilitate comparison of the flood values from the widely different drainage areas, the flood magnitudes have been normalized (i.e., the absolute flood value has been divided by the contributing drainage area). Examination of

Figure 9 reveals that none of the floods in the Yukon have attained a unit discharge greater than 1.0 $m^3/s/km^2$.

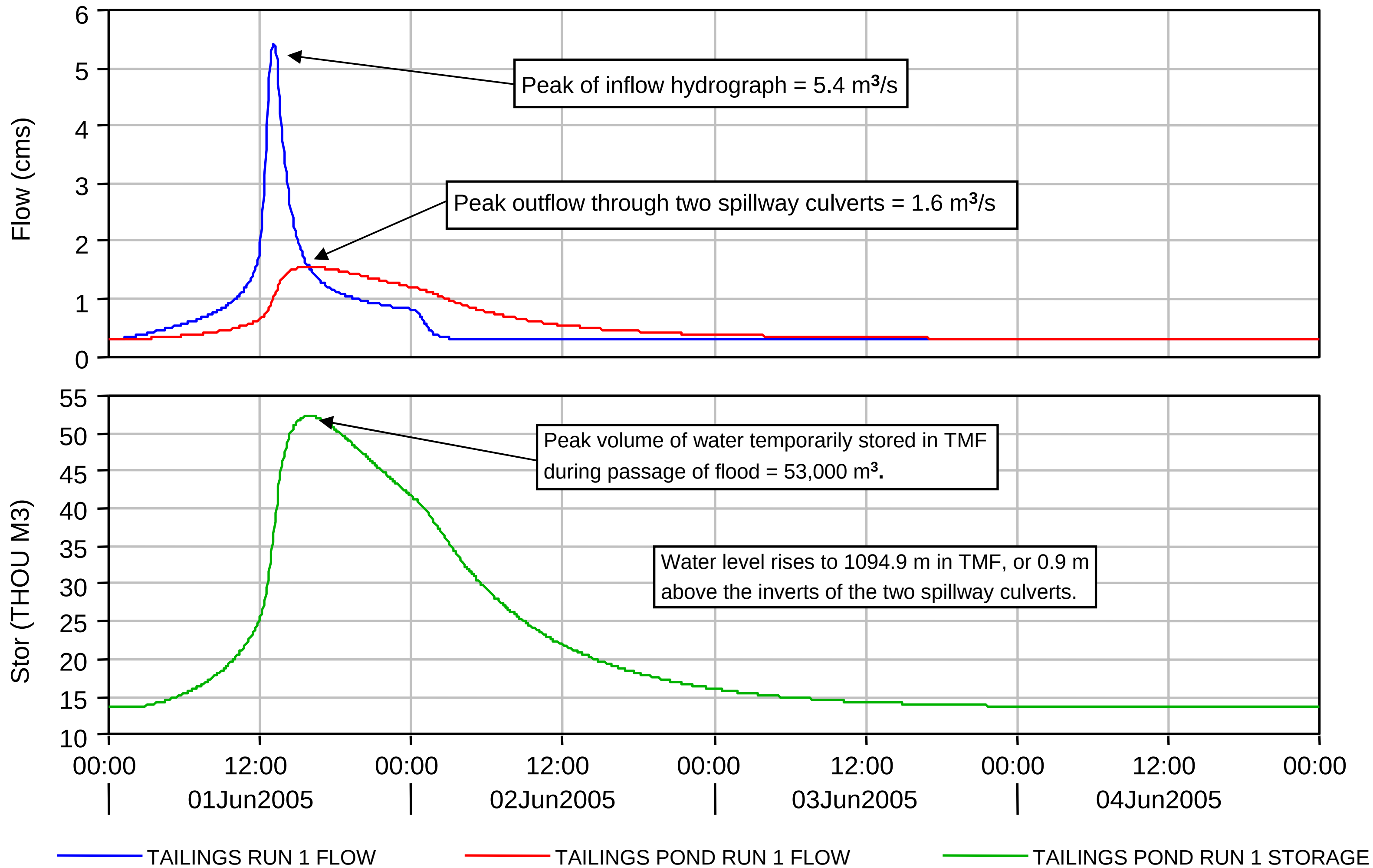
The estimated 1000-year floods for the mine, for both temporary and permanent closure scenarios, all plot above the maximum observed floods in the Yukon. Even the attenuated peaks through the TMF culverts and the Camp Creek culverts are large relative to the floods that have thus far been measured in the territory.

It should be noted that model parameters were selected for HEC-HMS that would generate hydrograph shapes typical of steep, forested catchments. This probably results in an overestimation of the true 1000-year flood peaks that could be generated within the Camp Creek catchment. As discussed in Section 3.5, the flow monitoring station at the minesite has revealed that groundwater contributions to the streamflows of Camp Creek are large. Thus, the 1000-year flood hydrographs for this stream may be substantially more subdued than simulated by the HEC-HMS model. Further monitoring of the flows in Camp Creek may provide enough evidence to allow the estimated flood peaks to eventually be reduced.

In summary, using the conservative 1000-year flood event, the recent hydrological evaluation confirms that both the current facilities as well as the proposed permanent closure designs (as proposed in the 2000 DDRP) are adequate and do not require upgrading.



SRK Consulting Engineers and Scientists VANCOUVER	teckcominco	**Simulated 1000-Year Flood for Camp Creek Diversion - Temporary Closure Status**
Job No: 1CT008.004 Filename: Figure 6_Sim 1000yr_Camp Cr_20051213.ppt	Sä Dena Hes Closure Plan Update	Date: Dec. 2005 / Approved: / Figure: 6



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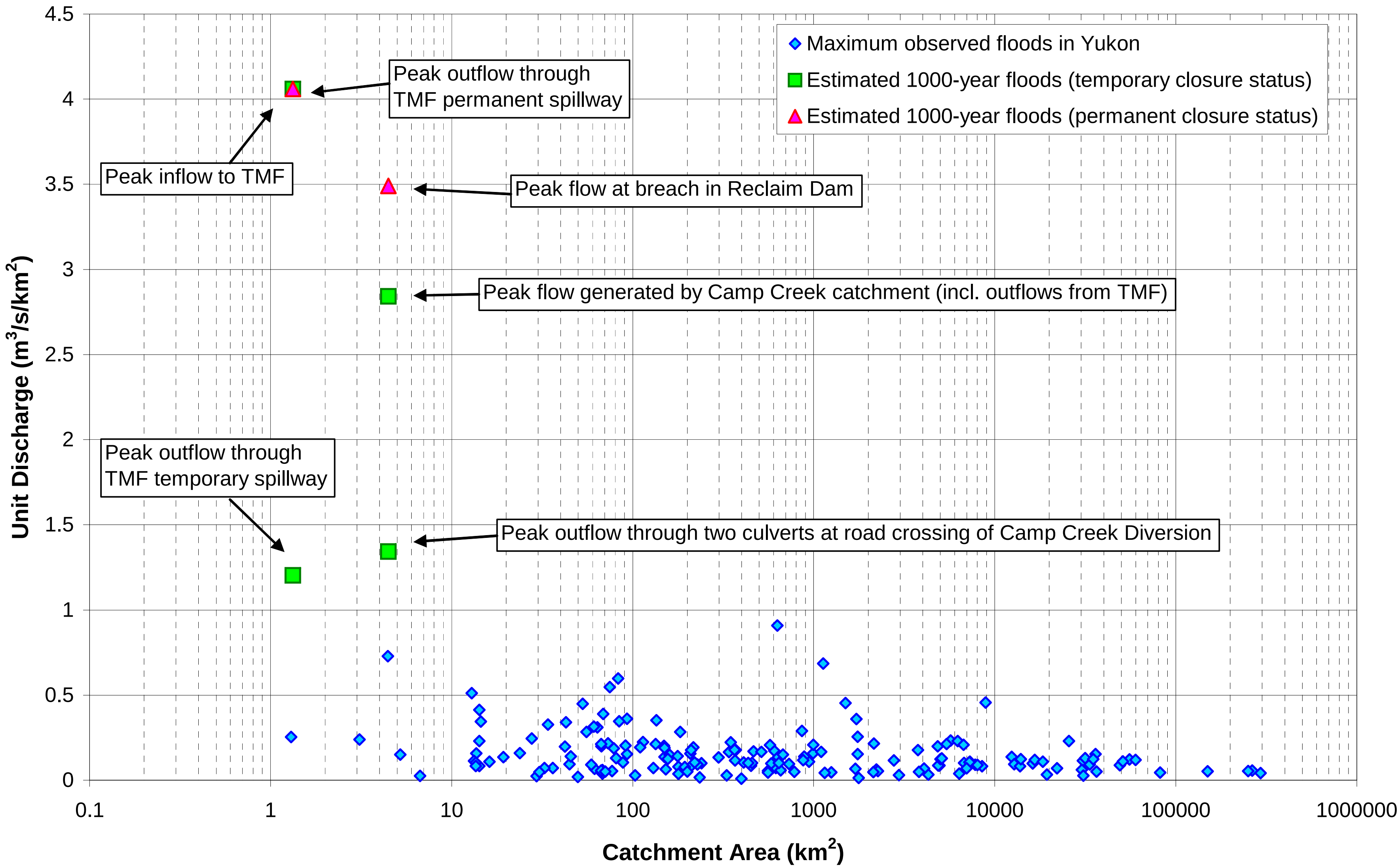
Simulated 1000-Year Flood in Tailings Management Facility-Temporary Closure Status

Job No:	1CT008.004	Sä Dena Hes Closure Plan Update	Date: Dec. 2005	Approved:	Figure: 5
Filename:	Figure 5_Sim 1000yr_Tailings_20051213.ppt				



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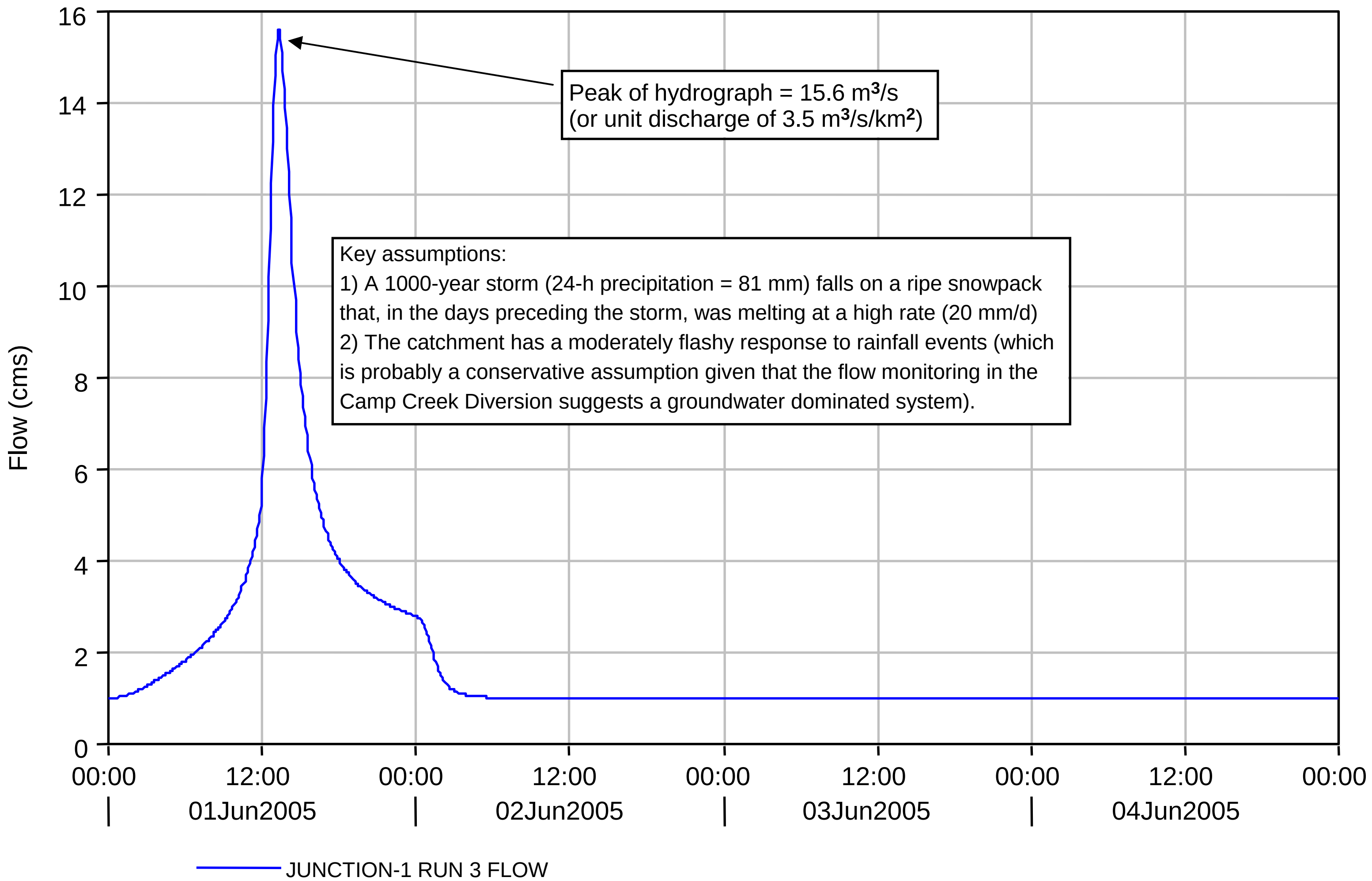
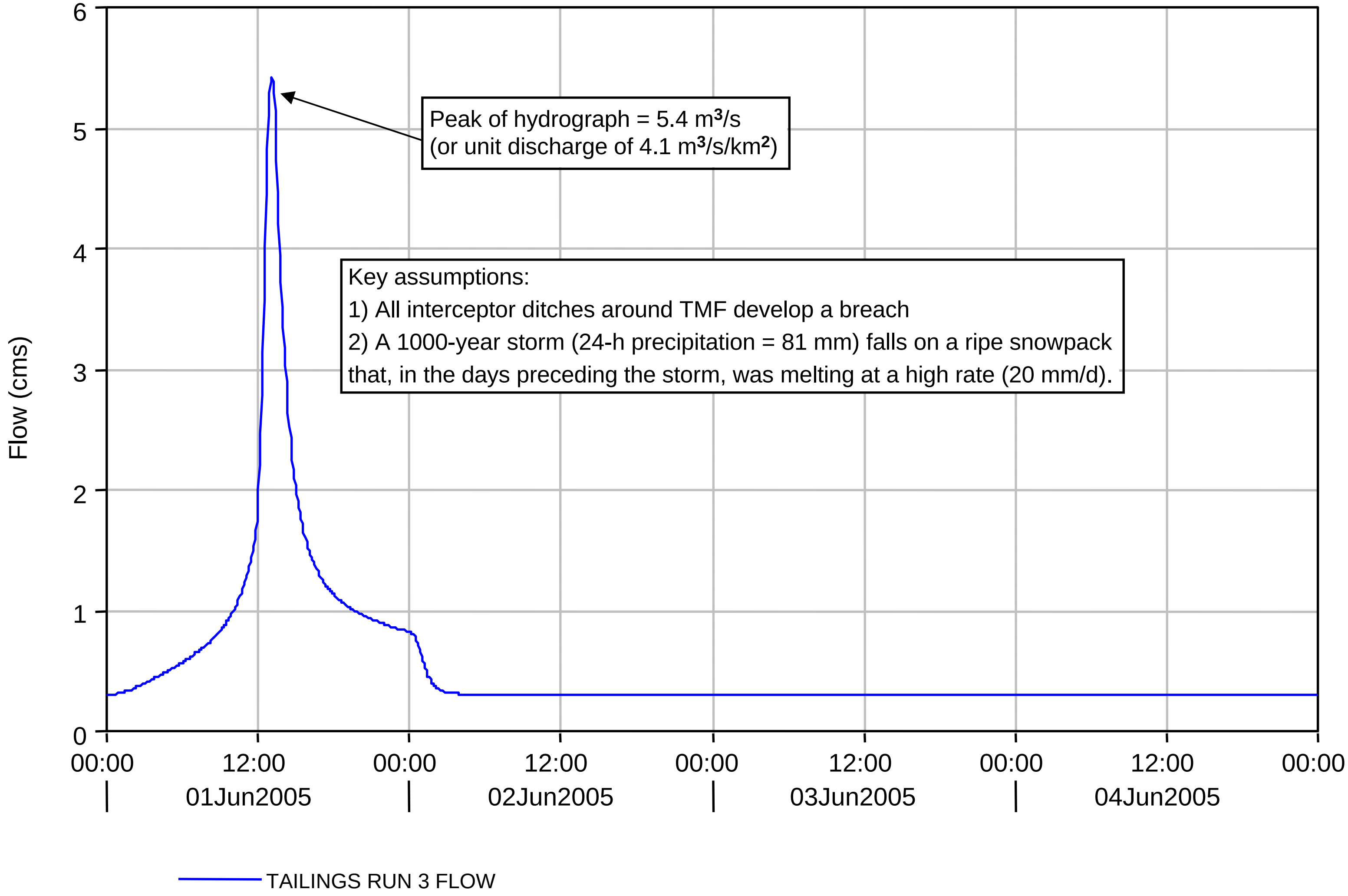
Comparison of Estimated 1000-Year Floods with Maximum Observed Floods in Yukon

Job No:	1CT008.004	Sä Dena Hes Closure Plan Update	Date: Dec. 2005	Approved:	Figure: 9
Filename:	Figure 9_Comparison 1000yr_20051213.ppt				



SRK Consulting Engineers and Scientists VANCOUVER	teckcominco	**Simulated 1000-Year Flood at Breach in Reclaim Dam - Permanent Closure Status**
Job No: 1CT008.004 Filename: Figure 8_Sim 1000yr_Breach_20051213.ppt	Sä Dena Hes Closure Plan Update	Date: Dec. 2005 · Approved: · Figure: 8



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Simulated 1000-Year Flood at Spillway of Tailings Management Facility - Permanent Closure Status

Job No: 1CT008.004	Sä Dena Hes Closure Plan Update	Date: Dec. 2005	Approved:	Figure: 7
Filename: Figure 7_Sim 1000yr_Spillway_20051213.ppt				

3.2 TAILINGS MANAGEMENT FACILITY - SEEPAGE ESTIMATES

3.2.1 Introduction

This section presents a discussion on existing and projected seepage rates from the tailings at the Sä Dena Hes Mine tailings impoundment. This analysis and discussion was originally prepared and reviewed in 2000. In November 2000, SRK submitted to DIAND a review of their seepage estimates from the 2000 DDRP document. They concluded in this memo that:

"On the basis of the above analyses, there is an acceptable margin between the seepage estimate and the threshold levels established using the mass-loading model. We therefore reiterate our opinion that further work to better understand the seepage flows would not be productive."

This discussion has therefore not been revised and is presented in this section.

Direct seepage flows from the toes of the North and South dams, which contain the tailings, have not been consistently measured. However visual estimates of the seepage have been recorded since 1993. In order to better understand the quantities of seepage flow through the dams, available data and simple calculations were used to refine these estimates. These "semi-quantitative" estimates provided a basis for projecting future seepage for the two closure scenarios presented in this closure plan.

Section 3.2.2 discusses the "semi-quantitative" approach used to determine current seepage estimates. Section 3.2.3 discusses the potential for future seepage, for the two closure scenarios.

3.2.2 Seepage under Current Conditions

3.2.2.1 South Dam

Visual observations made at the toe of the South Dam indicated a seepage rate along a 115 m zone at the low point in the dam of approximately 60 L/min. To refine this seepage rate, an estimation of seepage was calculated based on changes in pond water level and evaporation (water balance method). The estimates for seepage losses from the South Dam for existing conditions are based on this water balance method, developed using average annual meteorological data. Seepage loss estimates are relatively insensitive to net evaporation values because of the volume of water in the pond. For example, if evaporation drops to 0 mm, the seepage loss number rises to 238 l/min from 218 l/min. As shown in this example, it is the difference between the values of evaporation and precipitation that are important, not the absolute values for each.

Currently, there is not enough data to estimate groundwater inflow and outflow at the TMF. Therefore, seepage loss estimates do not include the effect of groundwater infiltration/exfiltration.

The method is described below.

The water level in the tailings pond has been monitored since 1993. A record of these levels is shown in Figure 3-7.

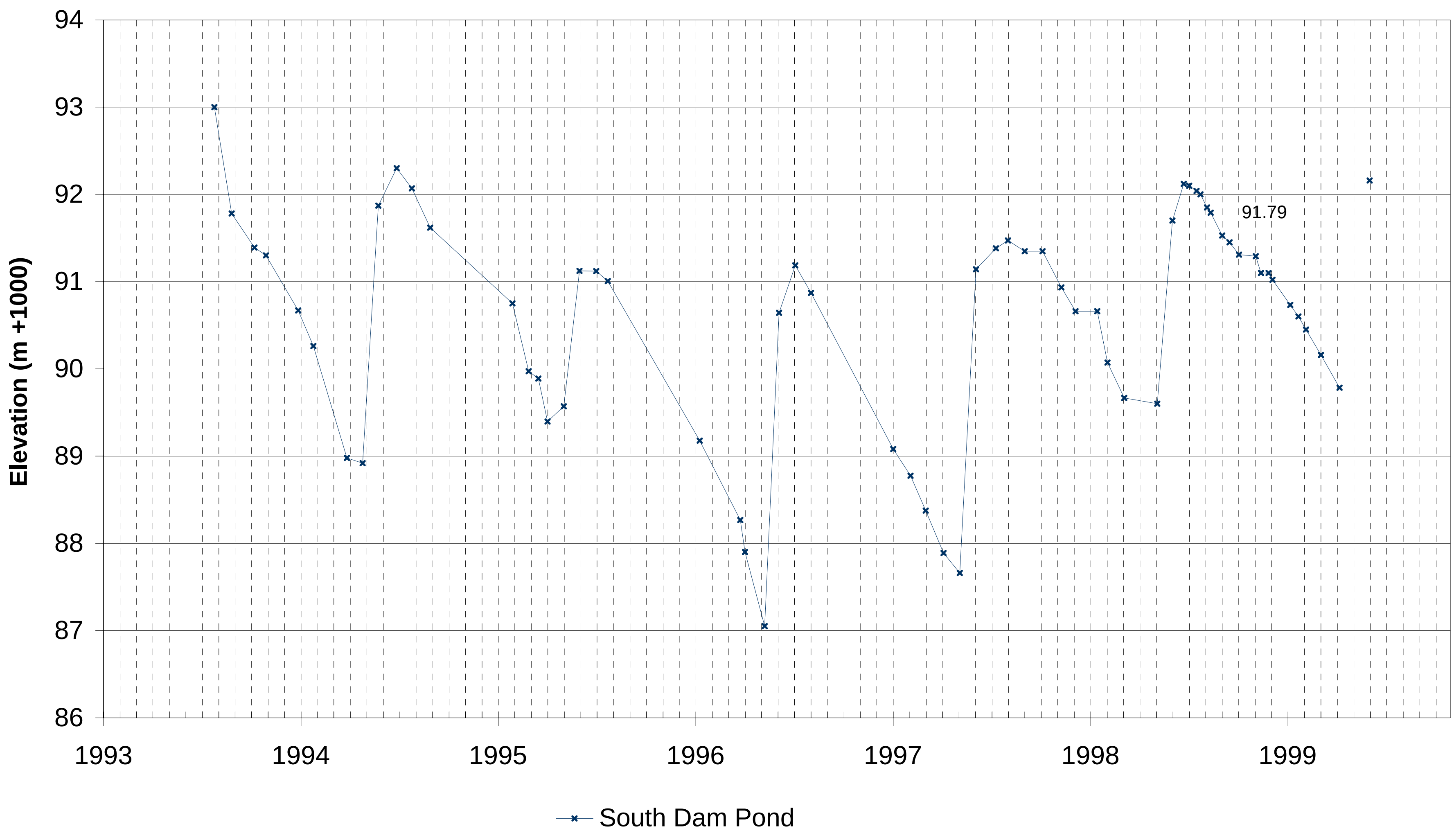
The graph shows a regular seasonal fluctuation in the pond level. The highest levels generally occur in late June or early July, corresponding to the end of the spring snowmelt. These levels steadily decrease to a minimum level in April or May of the following year. There are three possible mechanisms that could cause a drop in the pond level:

1. removal of pond water from the decant tower;
2. net evaporation (precipitation minus pan evaporation) from the ponds surfaces; and,
3. seepage through the dam.

The decant tower was sealed sometime during 1996, therefore the drop in pond levels over the winters of 1997/98 and 1998/1999, and possibly the winter of 1996/1997, would have been due solely to losses from net evaporation and seepage. Table 3-3 shows the estimated losses due to seepage for these three periods based on average evaporation and precipitation values. Since the highest value of 218 L/Min corresponding to the winter of 1996/1997 disregards potential flow that may have occurred from the decant tower, it has been removed from consideration. The average estimated seepage flow through the toe of the south dam for the two succeeding years is 180 L/Min.

Table 3-3 Seepage Estimates Through Toe of South Dam Based on Water Balance

Start Recession			End Recession							Net Evaporative Flux		Seepage
Date	Pond Volume	Pond Area	Date	Pond Volume	Pond Area	Avg Evap over Year	Avg Precip over Year	Change in Dam Volume/Time		(Evap - PPT)		
	(Mm^3)	(m^2)		(Mm^3)	(m^2)	(mm/yr)	(mm/yr)	(Mm^3/day)	(L/Min)	(m^3/yr)	(L/Min)	(L/Min)
07/04/96	130.1	31212.2	05/04/97	39.1	14756.2	450.0	690.0	0.30	207.79	-5516.21	-10.50	218.29
08/01/97	139.8	32756.1	05/04/98	82.2	23187.1	450.0	690.0	0.21	145.06	-6713.19	-12.77	157.83
07/02/98	162.8	36297.1	04/06/99	87.1	24066.2	450.0	690.0	0.27	189.00	-7243.59	-13.78	202.78



SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

South Dam Pond Levels

PROJECT	DATE	APPROVED	FIGURE
1CC005.05	AUG. 1999		3-7

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3.2.2.2 North Dam

Visual observations at the North Dam indicated seepage along an 80 metre zone of the downstream toe. This flow combines with seepage from the surrounding hillside to the west as well as seepage from the east side of the valley to constitute the total flow measured at the downstream pipe weir (MH-02). Visual observations made during the site inspections estimated that approximately 60% of the flow at the pipe weir came from the west side of the valley (tailings pond and surrounding hillside).

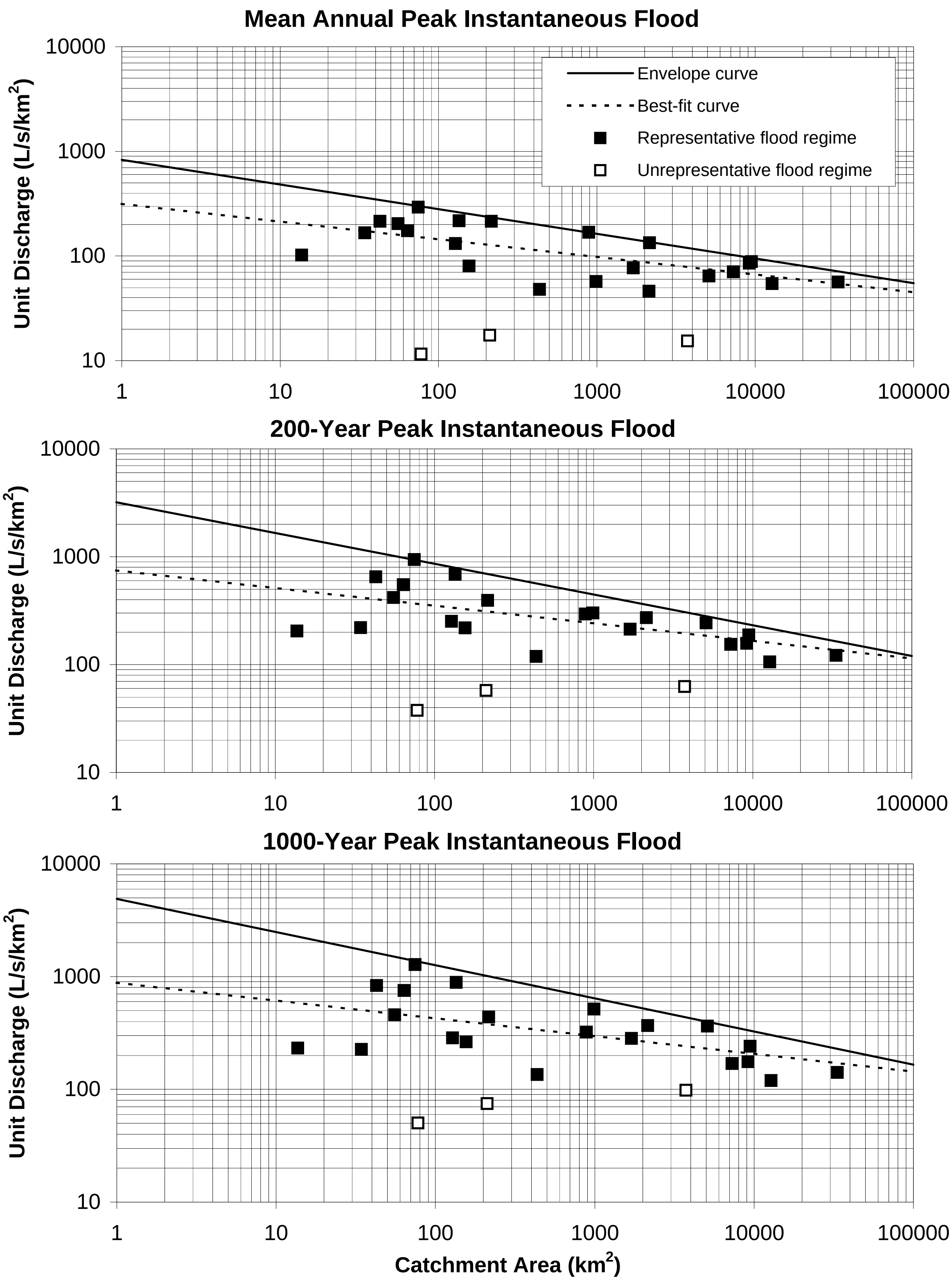
Standing water on the North Dam tailings forms discrete pools of which the occurrence and extent vary seasonally. Therefore a back-calculation of seepage flows could not be performed using a water balance method, as was carried out for the South Dam. Instead, an analysis of the seasonal flow measured at MH-02 was used to estimate seepage from the toe of the North Dam.

The flow measured at MH-02 is comprised of three components:

1. flow from the surrounding hillside to the west;
2. flow from the east side of the valley; and,
3. seepage directly from the toe of the North Dam.

Figure 3-8 shows flows measured at MH-02. The figure shows that the highest flows occur in late May/early June corresponding to the spring snowmelt event. The flows taper off more or less exponentially, reaching an approximate steady-state by early autumn. Generally, the last measurement of flow at the weir prior to the winter freeze showed the lowest flow.

Assuming that the contribution to flow from the surrounding hillside to the west and the east side of the valley is negligible at the end of the season, then the low flow measured at MH-02 is more or less representative of the flow directly from the toe of North Dam. The lowest flows for each season are marked by hollow triangles on the graph, and are fairly consistent from year to year. The average of these low flows is 20 L/Min.



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SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

REGIONAL RELATIONSHIPS BETWEEN FLOOD DISCHARGE AND CATCHMENT AREA

PROJECT	DATE	APPROVED	FIGURE
1CC005.05	AUG. 1999		**3-8**

3.2.3 Tailings Seepage After Closure

The two closure scenarios currently under consideration are:

Scenario 1 Close mine as is, drain pond at south end, breach South Dam and cover tailings; and

Scenario 2 Re-open mine, raise the level of both the North and South Dams to 1102 m and 1100 m respectively and deposit tailings into impoundment over a 4 year period.

Figure 3-9 and Figure 3-10 show the conceptual pathways for flow through and out of the tailings for the two closure options respectively.

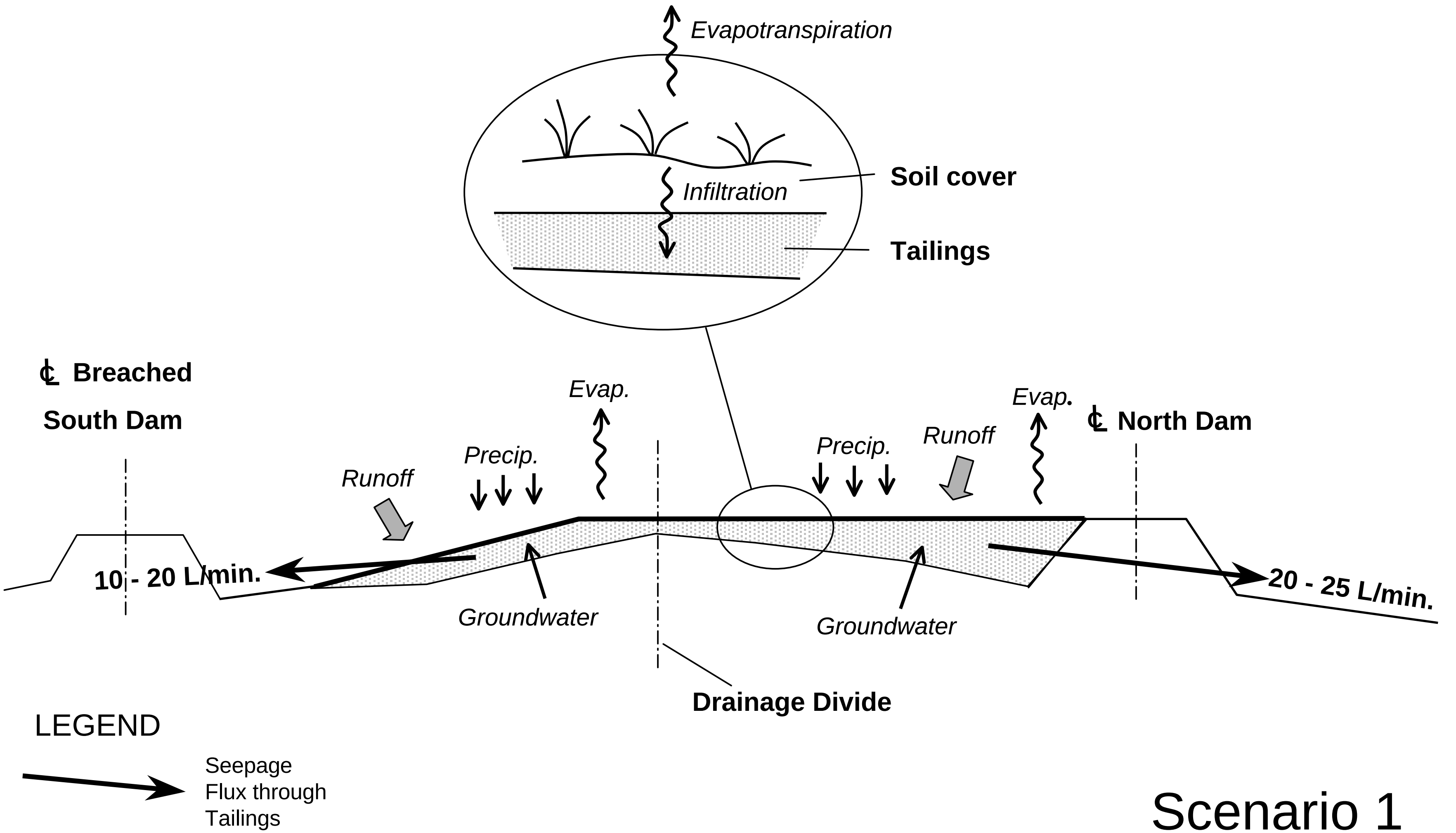
(i) Scenario 1 (see Figure 3-9*)*

This closure options involves breaching the South Dam and applying a soil cover to the existing tailings area.

As shown in Figure 3-8, flow into the tailings will come from groundwater recharge and infiltration through the cover. However, it is also thought that the vegetation cover will reduce the flow.

Tailings at the North end of the impoundment will likely remain saturated after application of the cover, and therefore piezometric levels and hydraulic gradients within the tailings will likely not change. Since seepage through a permeable material is directly related to the hydraulic gradient across that material, the seepage rates through the North Dam will likely not change either and will therefore remain around 20 l/min.

For the South Dam, the current pond of water will be drained and the cover applied for the exposed tailings. Since the tailings are likely to remain saturated, a hydraulic gradient will be established resulting in seepage from the lowest point of the tailings area.



Scenario 1

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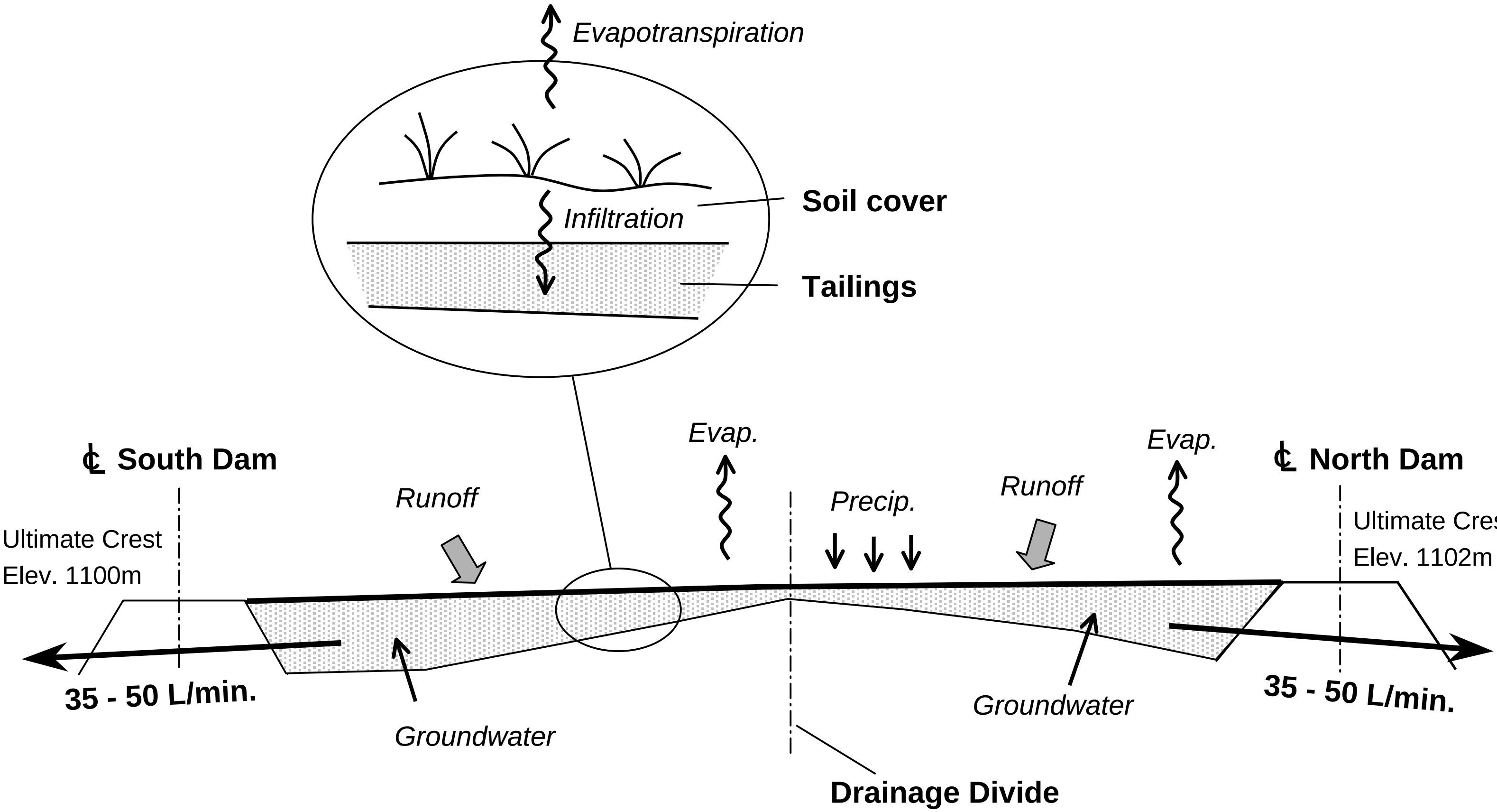
SA DENA HES DRAFT DETAILED DECOMMISSIONING AND RECLAMATION

Conceptual Movement of Water through Tailings - Scenario 1

PROJECT:	DATE:	APPROVED:	FIGURE::
1CC005.05	Aug. 1999		3-9



LEGEND

Seepage Flux through Tailings

Scenario 2

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Conceptual Movement of Water through Tailings - Scenario 2

PROJECT:	DATE:	APPROVED:	FIGURE::
1CC005.05	Aug. 1999		3-10

Given the smaller area and volume of tailings present at the south end, the seepage rate after application of a cover will likely be lower than that of the existing south end. Although the volume and areal extent of tailings at the South end are not known, they are thought to be approximately half that of the North Dam. Therefore a steady seepage rate, in the range of 10 to 20 L/min, is expected from the tailings at the south end after closure.

(ii) Scenario 2 (see Figure 3-10*)*

This closure option results in a final tailings level at the North end of about 1102 and 1100m at the south end.

Under these conditions, seepage from the North Dam would likely increase due to the incremental head of water contributed by the addition of saturated tailings. Assuming the tailings will remain saturated after closure, an incremental increase to 1102 m would result in raising the piezometric surface of the tailings by 25 percent, and increasing the cross sectional area of the tailings dam by approximately 20 percent. This could result in a 50 to 100 percent increase in seepage from the North Dam after closure, which roughly correlates to a flow of 35 to 50 L/Min

Since the volume and surface area of the South Dam tailings area will be very similar to that of the North Dam at closure, it is expected that seepage from the South Dam after closure would be in the same range of 35 to 50 L/min .This reduction in seepage rates from estimates of 180 L/min in 1997 and 1998 can be explained as follows: It is reasonable to conclude that the difference between the seepage from the South end of the impoundment (180 L/min) and the seepage from the North end is due to the tailings buildup behind the North Dam. Scenario 2 intends to involve focused tailings deposition at the upstream face of the South Dam by spigotting tailings from the crest. It is expected that this will significantly reduce seepage at the toe. In addition, the flow of surface run-off will be positively directed to the southwest, around the South Dam in Scenario 2, residence times of surface waters will be substantially reduced. The South Dam will no longer be containing surface run-off and will only experience seepage from saturated tailings, minimal surface water penetration, and any groundwater recharge in the area above the dam. The reduced water head pressure at the South Dam will reduce seepage rates to a level similarly experienced at the North Dam.

3.3 WATER QUALITY

In a report titled *Water Quality and Loading Re-Assessment* issued by SRK in January of 2005, updated water quality monitoring results were reviewed to determine whether significant changes in water chemistry had occurred and how these might affect overall loadings from the site. This assessment has been further updated using the most recent site water quality data and is presented in Appendix E of this DDRP.

Based on previous experience, the review was focused on the following parameters:

- sulfate;
- total suspended solids (TSS); and
- total zinc.

Monitoring results indicated that some changes in water chemistry have occurred since the original loading calculation presented in the February 2000 DDRP. The overall conclusions of the loading calculation, however, remain unchanged. In addition, there have been no changes to the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life with respect to monitored surface water parameters in the surveillance network since 2006.

Significant water quality data has been collected under various monitoring programs at the site, and these are presented in comprehensive tables in Appendix C at the end of this closure plan update. From the data tables, selected graphs of sulphate and zinc concentrations have been developed for reference and are included in Appendix D.

4.0 GEOCHEMISTRY

The geochemistry section of this report was originally written by S. Day of SRK Consulting for the 2000 DDRP. S. Day also prepared the updates to Section 4.0 that were included in the 2006 DDRP. S. Day did not provide input into this current 2010 update to the DDRP. Comments related to data obtained after the 2006 update of the DDRP have been written by B. Donald of Teck and are restricted to comments regarding data trends and not the geochemical interpretations underlying the trends.

4.1 METHODS

The site was visited on June 17 and 18, 1999. Areas of the site inspected included:

- Jewelbox Zone – 1408 portal and waste rock dump; underground mine workings; Jewelbox Pit; 1250 portal; and waste rock dump. The Jewelbox Zone underground workings were entered at the 1408 portal and descended to the elevation that the mine has flooded to.
- Main Zone – 1380 portal, Main Zone Pit and waste rock dumps.
- Burnick Zone – 1200 portal and waste rock dump; mine workings, sealed 1300 portal (from inside mine). The Burnick Zone workings were entered at the 1200 portal and the entire workings inspected up to the 1300 portal.
- Tailings Impoundment.

Each area was described and photographed. Any significant seeps or discharges not currently included in the monitoring program were sampled. Runoff obviously originating from snow melt was not sampled. Water samples were filtered (syringe 0.45 µm filter), preserved (nitric acid) and refrigerated in the field. All samples were from seeps and discharges, therefore, unfiltered samples were not collected. Some samples of rock and tailings were collected.

Water samples were analyzed for pH, electrical conductivity, total suspended solids, alkalinity, sulphate and metals. Rock and tailings samples were submitted for acid-base accounting, total metal analysis and determination of soluble metals using a 24-hour 20:1 deionized-water shake flask test.

4.2 BACKGROUND ROCK GEOCHEMICAL INFORMATION

Rock sampling and testing for the IEE indicated that sulphur content of the rock was variable but the abundance of carbonate in the ore and host rocks offset the acid generation potential. Some ore grade materials with greater than 5% sulphur were identified as potentially acid generating. However, the sulphur may have occurred dominantly as sphalerite and galena which can be sources of dissolved zinc and lead but not acidity. Deionized water shake flask tests on the samples indicated leachable sulphate and zinc in several rock types including ore and oxidized ore. Humidity cells which were conducted for 20 weeks in 1990 indicated ongoing leaching of zinc from ore-type materials.

4.3 RESULTS

4.3.1 Underground Mine Workings

4.3.1.1 Burnick 1200 Portal

Drainage from the 1200 Portal at the Burnick Zone discharges onto the Burnick Waste Rock Dump and infiltrates the waste rock. The mine water is consistently slightly alkaline (Avg. pH = 8.13) and contains zinc concentrations that average 0.416 mg/L. Based on inspection of the slopes below the discharge, SRK (as reported in “2002 Geochemical Projects – Sa Dena Hes” by SRK) was not able to find emergent seepage corresponding to the mine water. There is no evidence that the zinc load in the drainage is detectable in Camp Creek and SRK concluded that zinc was being attenuated by contact with soil.

To evaluate this hypothesis, SRK performed soil column attenuation tests using mine drainage water as the feed. The soil samples were glacial till type materials from near the portal and alluvium composed of carbonaceous phyllite and granite from further downslope. The glacial till would not transmit water so the test was performed in duplicate with the alluvium. The test demonstrated that zinc concentrations decreased from 0.184 mg/L to 0.001 mg/L when in contact with the soils. Using the results of the testwork, it was concluded that downgradient soils have the potential to significantly attenuate zinc concentrations at the levels observed in the discharge for much longer than 200 years.

The studies confirmed that zinc is passively treated to levels below freshwater aquatic life standards by contact with downgradient soils and that zinc removal will effectively occur in perpetuity. A discussion of zinc loadings from this source is presented in section 4.4.2. While there is more current water quality data available for the Burnick discharge, they are not materially different so section 4.42 has not been revised for the 2010 update of the DDRP report.

Main Zone – 1380 Portal

The 1380 portal in the Main Zone Pit is collared in limestone and skarn. The adit was apparently stopped due to very poor ground conditions. Water was observed to be draining through the broken rock, exiting the portal and disappearing into the ground a short distance outside the portal. The flow rate was probably a few litres per second (Table 4-1). The water was pH-neutral (pH 7.2) and contained 183 mg/L sulphate. Dissolved Zn concentrations averaged 42.9 mg/L. Other significant components were Cd (0.4 mg/L) and Pb (0.3 mg/L). While there is more current data, Table 4-1 has not been updated as the changes are not material for the purposes of these discussions.

The flow from the portal was originally believed to be intermittent (2000 DDRP) but subsequently it is now known that this portal discharges from at least freshet throughout summer and until winter. The area is not safe to monitor during winter due to high snow loads in this area and the potential for avalanches on the steep bare slopes so no winter data is collected. The adit does not connect to any other mine workings however, water flowing from faults in the rock race within the adit provide a conduit for ground water to exit onto the floor of the adit and come in contact with weathered skarn materials, and then the flow exits the portal of the adit. The discharge has elevated metals (see above) and the elevated zinc, cadmium and lead concentrations are expected to persist due to the continued weathering of exposed sphalerite-rich skarn in the workings. The presence of abundant limestone associated with the 1380 portal indicates that the drainage will not be acidic.

4.3.1.1 Jewelbox Hill Zone

From the 1408 portal, a declined ramp provides access to the workings below the elevation of the portal. Since the mine was closed in 1992, the lower portion of the mine has been gradually flooding. At the time of the June 1998 inspection, very little water was observed to be flowing underground. The inspection was done in the spring when one would expect the most water to be present. Based on the observations, it is assumed that the flooding of the mine is the result of groundwater. As the mine fills, the head will increase which will reduce the flow and possibly stop the flow. The maximum water elevation recorded was at the 1350 m elevation in 1998. The portal to the mine is at 1408 m. When preparations were made to reopen the mine in 1999, the mine water was pumped down to the 1344 m elevation. In July 2002 the water level was observed to be at the 1349 m elevation (approximately 2 m per year), and in July 2004 when inspected, the level had not changed. Due to the dormant nature of the mine workings, the mine is no longer safe to enter without doing significant scaling and rock bolting and so no further update sampling is planned until the mine reopens. At the time of inspections, the mine pool was sampled and the results are attached below as Table 4-1

Table 4-1 Jewel Box Mine Water Pool Analysis

	Units	Fall 1997	Jun 1999	July 2002	Oct 2004
Sample		**Totals**	**Dissolved**	**Dissolved**	**Totals**
pH	pH	8.6	7.58	7.9	
EC	cS/cm		370	388	
Alk	mg/L		65	65	
SO_4	mg/L		104	84	99.3
Cd	mg/L		0.0154	0.017	0.019
Ca	mg/L		54.7	66.8	48.7
Mg	mg/L		3.81	4.93	3.33
Mn	mg/L		0.247	0.117	0.025
Zn	mg/L	0.69	0.87	1.75	2.18

In 1999, the pool of water in the mine had a pH of 7.6, EC of 370 µS, sulphate of 82 mg/L, and dissolved zinc of 0.87 mg/L (Table 4-2). This compares well to pH of 8.6, sulphate of 104 mg/L and total zinc of 0.69 mg/L (Table 4-3) measured by Cominco during de-watering of the workings in late 1997. As de-watering proceeded in 1999 zinc concentrations decreased to 0.3 mg/L.

It is expected that the chemistry of the pool will change as the water continues to rise (as evidenced by the chemistry changes from the 2002 and 2004 sampling events). Dissolution of weathering products from walls will influence the mine pool chemistry but the lack of significant build-up of soluble salts indicates that this will not be a significant effect.

Table 4-2 Results of Seep Sampling – June 1999

Sample Location		Main Pit Portal (1380)	Main Pit Waste Dump	Jewelbox Underground Pool	Jewelbox Dump Seep	Jewelbox Dump Seep
Sample ID		SDH-S1	SDH-S2		SDH-S3	SDH-S4
Physical Tests	Units	99 06 17	99 06 17	99 06 17	99 06 18	99 06 18
Cond.		421	364	370	200	447
pH		6.9	7.28	7.58	7.29	7.24
Tss.	mg/L	87	115	12	69	325
Diss. Anion.						
Alkalinity-Total	mg/L	23	43	65	33	39
SO_4	mg/L	183	137	82	50	161
Dissolved Metals						
Al	mg/L	<0.005	<0.005	<0.005	0.008	0.014
Sb	mg/L	0.0004	0.0003	0.0027	0.0008	0.0011
As	mg/L	<0.0001	<0.0001	0.0009	0.0015	0.0004
Ba	mg/L	0.012	0.017	0.014	0.019	0.036
Be	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Bi	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Bi	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Cd	mg/L	0.363	0.0989	0.0154	0.0027	0.0074
Ca	mg/L	49	57.3	54.7	28.6	74.8
Cr	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Co	mg/L	0.011	0.002	0.003	<0.001	0.002
Cu	mg/L	0.002	<0.001	<0.001	0.002	<0.001
Pb	mg/L	0.345	0.097	0.04	0.06	0.052
Li	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
Mg	mg/L	1.55	1.76	3.81	1.78	3.39
Mn	mg/L	0.351	0.045	0.247	0.101	0.329
Mo	mg/L	<0.001	0.001	0.003	0.002	0.002
Ni	mg/L	<0.001	<0.001	0.009	<0.001	0.002
K	mg/L	0.75	0.7	1.61	1.63	1.83
Se	mg/L	0.003	0.003	0.02	0.002	0.008
Ag	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sr	mg/L	0.059	0.066	0.143	0.058	0.124
Tl	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Sn	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
U	mg/L	0.00004	0.00019	0.00578	0.00006	0.00053
V	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Zn	mg/L	40.6	10.8	0.87	0.22	0.842

Table 4-3 Jewelbox Zone De-watering - Monitoring Results

Report Date	Sample Date	Time	Sample #	pH	TSS	Zn/T	Pb/T	Pb/D	Zn/D	Ammonia Nitrogen	Sulphate
	25-Nov-97	14:25	UMW@SUMP15&16(?)	8.6	7	0.69	0.1			0.458	
	27-Nov-97	16:32	UMW SUMP 027&28	8.2	7	0.65	0.09				
	4-Dec-97	19:42	UMW@SUMP 054&55&56	8.5	13	0.58	0.12	0.04	0.34		
	7-Dec-97	14:35	UMW@SUMP 064(was mislabelled)	8.6	16	0.51	0.07	0.02	0.24	0.936	104
	11-Dec-97	19:45	UMW@SUMP 072	8.4	<4	0.54	0.1				
	15-Dec-97	6:40	UMW@SUMP 073								
24-Dec-97	15-Dec-97	6:40	UMW@SUMP073	8.5	6	0.49	0.08				92.6
20-Jan-98	15-Jan-98		UMW@SUMP 076	8.56	4	0.432	0.121				
26-Jan-98	22-Jan-98		UMN@SUMP 081	9.11	5	0.392	0.066				
2-Feb-98	29-Jan-98		UMW@SUMP092	9.29	5	0.339					
9-Feb-98	7-Feb-98		UMW@SUMP097	9.34	3	0.341					
17-Feb-98	12-Feb-98		UMW@SUMP100	9.28	3	0.314					
23-Feb-98	19-Feb-98		UMW@SUMP103	8.99	9	0.298					

4.3.2 Pit Walls

Rock exposures in the two small Main Zone and Jewelbox pits are small. The Main Zone Pit has exposures of limestone, phyllite and skarn. The Jewelbox Pit has exposures of limestone and phyllite. The reactive surface area represented by these exposures is much smaller than the associated waste rock.

4.3.3 Waste Rock

4.3.3.1 Burnick Zone

Waste rock was dumped along the slope outside the 1200 portals. On-surface, the waste rock consists primarily of mixed weakly mineralized calcareous and non-calcareous phyllite. This rock was reported to be non-acid generating in the IEE. Visual observation confirmed this finding. A pile (<200 m^3) of oxidized ore-type skarn material was located on top of the dump near the portals. This material consists generally of sphalerite with calcite and actinolite, and minor pyrite. The material was non-acidic. A sample of similar rock from the Jewelbox Zone (SDH-R1) contained 2.5% Zn and 1.27% sulphur (Table 4-4). The molar quantities of Zn and S are very similar indicating that zinc sulphide is the dominant sulphur-containing mineral and that the rock will not be acidic. A deionized water leach test on the sample indicated low zinc concentrations (0.009 mg/L) but elevated sulphate (45 mg/L) (Table 4-5).

No toe seeps were visible during the June 1999 site inspection.

The Burnick Zone waste rock dumps are expected to be chemically stable. The skarn material is currently oxidizing but is not expected to generate acid, and therefore will continue to oxidize at current rates.

Table 4-4 ABA and Metal Analysis Results for Rock and Tailings

Sample ID	Description	Paste pH	CO2 Inorg. (Wt.%)	CaCO3 Equiv.[1]	Total Sulphur (Wt.%)	Sulphate Sulphur (Wt.%)	Sulphide Sulphur (Wt.%)	MPA[2]	NP[3]	NNP[4]	Fizz Rating	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppm	Th ppm	Sr ppm	Cd ppm	Sb ppm
Main Zone 1250 Dump																										
1CC005.05 SD001	SDH-R1	7.6	0.35	7.9	0.31	0.22	0.09	2.8	13.8	11.0	none	190	1612	1294	4.3	95	9	395	4.11	177	43	2	14	121	8.1	20
Jewel Box Zone 1408 Dump Ore																										
1CC005.05 SD004	SDH-R1	7.9	1.58	35.9	1.27	0.04	1.23	38.4	77.5	39.1	moderate	34	36176	25026	18.1	41	18	3910	4.74	< 2	< 8	< 2	< 2	16	161.7	15
South Tailings																										
1CC005.05 SD008	SDH-T1	8.6	10.63	241.3	0.13	<0.01	0.13	4.1	241.3	237.2	moderate	47	4146	3071	4.6	9	4	1857	1.8	17	< 8	< 2	< 2	120	17.7	4
1CC005.05 SD009	SDH-T2	8.6	9.08	206.1	0.20	<0.01	0.20	6.3	208.8	202.6	moderate	20	2892	4129	3.3	8	5	1598	1.6	19	< 8	< 2	2	97	23	3
1CC005.05 SD0010	SDH-T3	8.4	10.91	247.7	0.55	<0.01	0.55	17.2	251.3	234.1	moderate	27	5016	11341	4.3	11	7	1554	1.47	17	< 8	< 2	< 2	119	67.9	4
North Tailings																										
1CC005.05 SD0013	SDH-T4	8.0	7.60	172.5	0.11	0.05	0.06	1.9	181.3	179.4	moderate	70	7607	8241	5.6	21	8	3040	2.83	27	< 8	< 2	2	99	48.2	6
1CC005.05 SD0012	SDH-T5	8.5	10.28	233.4	0.12	0.02	0.10	3.1	233.8	230.7	moderate	45	4769	4208	4.9	51	7	1807	2.02	60	< 8	< 2	2	130	22.4	4
1CC005.05 SD0011	SDH-T6	8.4	10.91	247.7	0.16	<0.01	0.16	5.0	247.5	242.5	moderate	41	4960	7137	3.7	29	7	1713	1.79	41	< 8	< 2	2	117	36.4	4

[1] (Kg CaCO3/Tonne)
[2] Maximum Potential Acidity
[3] Neutralization Potential
[4] Net Neutralization Potential

Table 4-5 Deionized Water (20:1) Leach Extraction Results for Rock and Tailings

Sample	Description	Ag ppb	Al ppm	As ppb	Cd ppb	Cu ppb	Fe ppm	Mo ppb	Pb ppb	Se ppb	Zn ppb	Final pH	SO4 mg/L
1CC005.05 SD001 -2MM	SDH-R1	< 5	< .1	< 30	< 2	6	0.02	16	< 10	< 20	< 5	8.0	19
1CC005.05 SD004 -2MM	SDH-R2	< 5	< .1	< 30	2	2	0.03	< 5	< 10	< 20	9	8.4	45
1CC005.05 SD008	SDH-T1	< 5	< .1	< 30	< 2	4	0.08	13	25	27	13	9.0	3
1CC005.05 SD009	SDH-T2	< 5	< .1	< 30	< 2	3	0.06	11	14	< 20	13	9.1	3
1CC005.05 SD0010	SDH-T3	< 5	< .1	< 30	< 2	5	0.05	9	19	26	13	9.0	3
1CC005.05 SD0011	SDH-T6	< 5	< .1	< 30	< 2	3	0.1	19	22	< 20	39	9.0	2
1CC005.05 SD0011 Dup.	SDH-T6	< 5	< .1	< 30	< 2	4	0.2	23	53	< 20	85	9.0	2
1CC005.05 SD0012	SDH-T5	< 5	< .1	< 30	< 2	4	0.05	31	< 10	< 20	12	9.0	13
1CC005.05 SD0013	SDH-T4	< 5	< .1	< 30	2	5	0.02	18	11	< 20	13	8.5	52
BLANK		< 5	< .1	< 30	< 2	3	0.01	< 5	< 10	< 20	< 5	5.6	<1

4.3.3.2 Main Zone – 1380 Portal Drainage

Water drains from the Main Zone 1380 portal and infiltrates into soils in the dry headwaters of Camp Creek. The drainage was first sampled in 1999 during preparation of the closure plan and found to contain 41 mg/L zinc (dissolved). In 2000, the drainage was monitored to determine the variation in flow and chemistry for two months. While flow decreased following freshet, zinc concentrations were sustained. The zinc load associated with this flow was not detectable in Camp Creek at any time during the summer. Sampling of rock in the portal area showed that zinc is leached from oxidizing exposures and talus containing sphalerite. The source water is probably shallow groundwater but it does not appear to be fed by ponding of water in the small upslope Jewel Box Pit.

SRK concluded that zinc in the drainage is being strongly attenuated by contact with soils between the portal and down gradient springs feeding Camp Creek. To evaluate this hypothesis performed an attenuation test using portal drainage and samples of marble talus. The tests showed very strong attenuation of zinc from 44.9 mg/L to <0.001 mg/L. Cadmium was attenuated to <0.0001 mg/L. Based on measurement of precipitated zinc concentrations in the test, SRK concluded that the attenuation capacity of the soils down gradient of the portal could be exhausted in several years leading to break through of zinc loadings at the Camp Creek springs. Subsequent to this statement, Teck has inspected the surface water flow in the headwaters of Camp Creek and verified that the surface waters go to ground approximately 500 m before arriving at Camp Creek. Using conservative assumptions of <u>no</u> attenuation of zinc loading (i.e. the full loading of zinc is added into Camp Creek), SRK Consultants prepared a technical letter report titled “Sa Dena Hes Mine – 1380 Portal (March 12, 2007) that is attached in Appendix E. This report concludes:

> “Using the conceptual model, and assuming that flow from the gully does report to Camp Creek, it was predicted that in the event of total loss of zinc attenuation capacity of the soils, zinc concentrations in Camp Creek would remain well below MMER standards and by MH11 (the logical “Final Discharge Point”) could almost meet the CCME criterion.”

4.3.3.3 Jewelbox Hill Zone – 1250 Portal

At some times, the portal is not the only source of surface flows. At one annual inspection the portal was observed by SRK and found not to be the source of nearby flowing surface water. Surface water flow in the area originated from the nearby natural slopes. Field measured zinc concentrations were 0.04 mg/L. Therefore, SRK concluded the drainage from slopes was not a significant source of zinc loading to Camp Creek.

SRK recommended no further assessment.

4.3.3.4 Jewel Box Hill Zone – Underground Mine Pool

After mining of the Jewel Box underground mine ceased in the early 1990s, the working began to flood. The concern has been raised that the workings could eventually discharge water containing unacceptable levels of zinc. Investigations have evaluated the likelihood of discharge and the zinc concentrations.

The elevation of the lowest portal is 1408 m. In 1997, the flood level was 1350 m (compared to 1340 m in 1992). Teck Cominco completely drained the workings in 1997 in preparation for re-activation of the mine; however, the mine was allowed to re-flood and rose to 1344 m at the time of the June 1999 inspection. When SRK and Teck Cominco accessed the workings in July 2002, the water level was 1349 m. Based on these observations, SRK concluded that the initial flooding rate exceeded 2 m per year but then decreased to 1.6 m per year. In 2004 the water level was checked again by Teck and was unchanged from 2002. The flooding rate indicates that it is unlikely that a discharge would be observed at the 1408 Portal.

Zinc concentrations in the mine pool were increasing slightly and were 2.18 mg/L in 2004, 1.75 mg/L in 2002 and 0.7 mg/L in 1997. The increase was attributed to the effects of weathering and leaching of residual sphalerite ore. SRK predicted that zinc concentrations might increase further and eventually stabilize and decrease, as the workings become a flow through component of the groundwater system.

4.3.4 Tailings

Tailings are exposed in both the north and south tailings area. The north tailings beach is aerially greater than the south tailings beach. Tailings in both areas are olive-brown with some coarse and fine layering. Partly saturated tailings are grey. The tailings are uniformly calcareous. Salt crusts were not observed on the tailings.

Total sulphur content of six surface samples varied from 0.1 to 0.6% and neutralization potentials were 180 to 250 kg $CaCO_3$/t (Table 4-4). Carbonate content indicated similar levels of neutralization potential. Zinc concentrations varied from 0.4 to 1.1%, and lead from 0.2 to 0.7%. The near molar equivalence of sulphur with lead and zinc content indicates that the residual sulphide content is principally sphalerite and galena with very little iron sulphide. The tailings are therefore not potentially acid generating.

Deionized water leachates of tailings contained low sulphate (2 to 3 mg/L), zinc (0.01 to 0.09 mg/L) and lead (<0.01 to 0.05 mg/L) concentrations. These results indicate oxidation of sphalerite and galena is occurring in the near surface tailings (Table 4-5).

Monitoring of seepage from the North Dam (MH-2) which originates from the tailings in the north end of the impoundment indicates that sulphate, cadmium, and zinc concentrations began increasing in 1992. In 1997, zinc concentrations stabilized (Appendix D, Figure D-10). Since 1999 zinc concentrations have decreased through to 2004 and then increased since back to similar levels in 1999. During winters, with high snow loads, sampling is difficult ant it is apparent that samples are being contaminated with sediments. Frequently, TSS results are abnormally high during winter when they should be low (i.e. no erosion would be occurring). To further examine the impact of this, total zinc concentrations were re-graphed (Appendix D, Figure D-11) deleting winter sample data where TSS was greater than 10 mg/L. Zinc values when TSS was greater than 10 mg/L for spring and summer months were left in as these are not believed to be related to sampling problems. While there is a lot of scatter in the graph, the trend of zinc concentrations appear to be slightly decreasing.

The increase in zinc concentrations up to 1999 may possibly be attributed to oxidation of near surface tailings. It has also been suggested that the increase may be due to leaching of wind-blown tailings. In 2000, a clean up of tailings on the face of the dam and covering of adjacent tailings with a thin layer of gravel was done and has been successful in substantially eliminating the dusting issue.

The increase in sulphate concentrations (Appendix D, Figure D-9), but decrease in zinc concentrations, possibly indicates that a solubility control has been reached for zinc but not for sulfate. The cadmium concentrations and alkalinity of the water are consistent with solubility control by cadmium carbonate, which indicates that cadmium concentrations will not increase. Zinc may also be constrained by zinc carbonate in the tailings surface.

In a report titled "2002 Geochemical Projects, Sa Dena Hes Mine" by SRK Consultants dated March 2003, S. Day concluded:

- Elevated zinc concentrations comparable to those obtained at MH-7 are common in pore water in the tailings beach, and confirmed the conceptual model developed by SRK (2003)
- The composition of seepage at MH-2 appears to be dominated (90%) by natural groundwater originating from valley sides.
- Zinc concentrations' at MH-2 are decreasing but a higher than expected based on conservative element mixing rations. Zinc may partly originate from leaching of wind blown tailings on the dam face.

It should be noted that the South Dam currently impounds much less tailings than the North Dam. Most tailings were deposited near the coffer dam. When these are drained (Scenario 1), the exposed area will be much less than the current exposure at the North Dam, and therefore, less zinc expected.

The monitoring suggests that zinc load is not likely to increase substantially and zinc concentrations will stabilize. Also, subsequent analysis of loading sources, as discussed in Section 4, indicate that this is not a significant source in the False Canyon Creek basin. Substantial increases in the load from this source can occur without a noticeable impact on False Canyon Creek.

4.3.5 Conclusions

The mineralization at Sä Dena Hes is characterized by zinc and lead sulphides with low concentrations of iron sulphides in association with abundant carbonates. Therefore, acid generation will not occur. Zinc, cadmium and lead leaching are controlled by the oxidation of sphalerite (Zn, Cd) and galena under pH-neutral atmospheric conditions. Breakdown of sphalerite is apparent throughout the site. Acceleration of sphalerite oxidation is not expected in the absence of a mechanism to lower pH. Zinc and cadmium leaching will continue but is not expected to accelerate. Most sources will continue to leach zinc and cadmium at the current rates. This is demonstrated by the stable zinc and sulphate concentrations at MH-4 which receives drainage from the Main Zone (Appendix D, Figures D-1 & D-2)

4.4 WATER QUALITY PREDICTION

4.4.1 Methods

Mass loadings in the False Canyon Creek (FCC) basin were calculated to assess the degree to which flows (measured and calculated) combined with measured concentrations account for the various sources of chemical load in the basin.

In general, the load observed in FCC at a location downstream of the mine can be described as:

Total Load = Background
+ Discharge from the Burnick Portal
+ Runoff and groundwater from the Burnick Zone waste rock dumps
+ Runoff and groundwater from the Main Zone Pits
+ Runoff and groundwater from the Main Zone Pits waste rock dumps
+ Runoff and groundwater from the Jewelbox Zone waste rock dumps
+ Runoff and groundwater from the north tailings
+ Runoff and groundwater from the south tailings

The data discussed in the following section is unchanged from the 2000 DDRP. The loading to FCC was assessed using the following methods:

1. Monthly statistics were calculated for water quality for several monitoring stations. The statistics included number of samples, mean, median, maximum and minimum. The above sources of loadings have not been monitored separately but influence various downstream monitoring locations.

   MH-22 captures the Burnick Portal. MH-2 is the seepage from the North end of the tailings impoundment. MH-12 reflects the effect of the Burnick Portal, the Burnick Zone dumps and the North Dam on the East Fork of Tributary E. A substantial background component is included.
   MH-4 represents the effect of the Main and Jewelbox Zone Pits, waste rock dumps and background from North Hill. MH-5 is located by the gate house at the mill site and receives intermittent surface water flow from the Jewelbox Hill Zone waste rock dumps. MH-7 is seepage from the south end of the TMF. MH-11 represents the total of these sources with background from the same catchment area. MH-13 is the same basin with additional background effect.

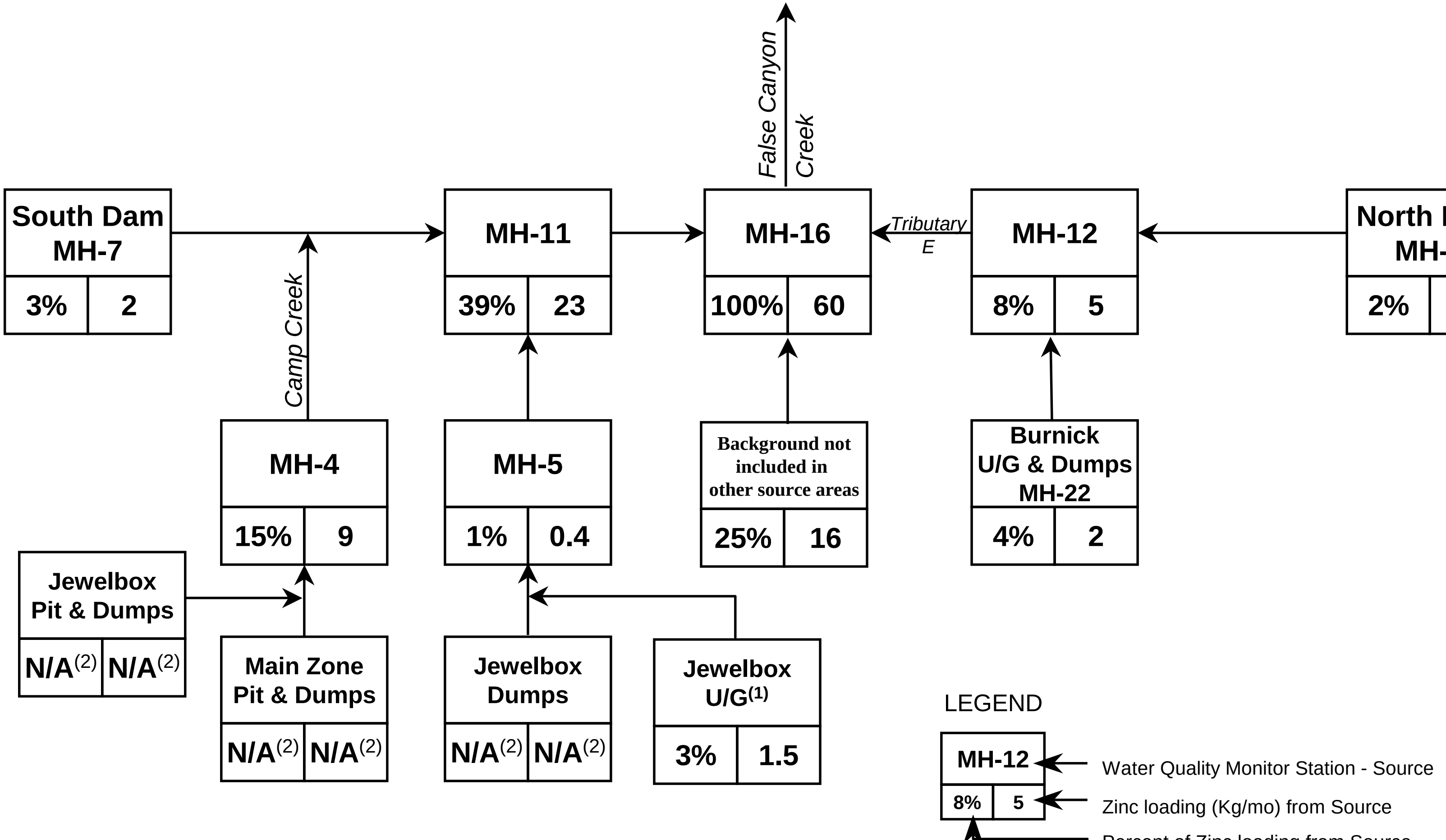
   MH-16 was selected as a downstream monitoring location reflecting the effect of both Tributary E and FCC.

2. Median concentrations for selected months formed the basis for the subsequent loading analysis (Table 4-6). The months were January (winter low flow), June (freshet), August (summer low flow), and October (fall and early winter). Where data was not available, other months in the same quarter were substituted.

3. Flows for loading calculations were estimated from field measurements (seeps and portal discharge) and regional mean annual runoff analysis (creeks).

4. Median loads for routinely analyzed parameters (sulphate, hardness, ammonia, nitrate, barium, cadmium, iron, manganese, lead and zinc) at each location were calculated in kg/month (Table 4-7).

5. The proportion of load at each point as a proportion of the load in the basin (MH-16) was calculated to evaluate the contribution of each source to the total load in FCC (Table 4-8). This is graphically shown in Figure 4-1.



Notes: 1) Based on current flooding rate and U/G pool chemistry

2) No information is available to predict loading from this source

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Estimated Zinc Loading Distribution for June

PROJECT:	DATE:	APPROVED:	FIGURE::
1CC005.05	Aug. 1999		4-1

Background concentrations for sampling locations influenced by non-mined areas were calculated by subtracting the loads and flows attributable to all upstream locations (Table 4-9). For example, the background concentration for the MH-12 catchment was calculated from:

$$\frac{M_{MH12} - (M_{MH2} + M_{MH22})}{Q_{MH12} - (Q_{MH2} + Q_{MH22})}$$

where: Ms are the mass loadings and Qs are the associated flows.

These concentrations also assist with identifying sources of unaccounted for load at the monitoring locations. If the calculated background concentration is higher than the expected background, the unaccounted for load may include the effect of an unmonitored source.

Table 4-6 Summary of Concentrations in False Creek (FCC)

		Tributary E			False Canyon Creek						FCC
		North Dam	Burnick Portal	D/S	Jewelbox Pits and Dumps	Jewelbox Portal	1408 Dump	South Dam Seepage	D/S	D/S	Main
Parameter	**Units**	**MH-2**	**MH-22**	**MH-12**	**MH-4**		**MH-5**	**MH-7**	**MH-11**	**MH-13**	**MH-16**
January											
Flow	m3/mo	2187	3393	30525	14850	#N/A	#N/A	10736	42759	137835	413117
pH		8	8	8	8	#N/A	#N/A	8	8	8	8
Conductivity	us/cm	1070.00	353	360	314	#N/A	#N/A	531	473	435	395
Susp Solids	mg/L	6.00	2	2	6	#N/A	#N/A	2.25	3	6	2
Alkalinity (CaCO3)	mg/L	425.00	118	184	154.5	#N/A	#N/A	240	210	214	213
Sulphate	mg/L	188.00	47.4	9.4	12.45	#N/A	#N/A	66.6	40.45	16	8.9
Hardness (Total)	mg/L	526.00	168	194	173.5	#N/A	#N/A	309	256	234	220
Ammonia (Nitrogen)	mg/L	0.17	0.038	0.0025	0.0055	#N/A	#N/A	0.182	0.019	0.016	0.007
Nitrate (Nitrogen)	mg/L	0.05	0.43	0	1.14	#N/A	#N/A	0.5	0.425	0	0
Barium (Total)	mg/L	0.15	0.0201	0.103	0.0275	#N/A	#N/A	0.07975	0.092	0.166	0.173
Barium (Dissolved)	mg/L	0.00	0.019	0	0.0295	#N/A	#N/A	0.1	0.1325	0	0
Cadmium (Total)	mg/L	0.00	0.0009	0.00005	0.0002	#N/A	#N/A	0.0005	0.000225	0.00005	0.00005
Cadmium (Dissolved)	mg/L	0.00	0.0005	0	0.0002	#N/A	#N/A	0.0007	0.00015	0	0
Iron (Total	mg/L	0.57	0.06	0.238	0.0385	#N/A	#N/A	0.075	0.142	0.33	0.14
Iron (Dissolved)	mg/L	0.00	0.003	0	0.006	#N/A	#N/A	0.001	0.031	0	0
Manganese (Total)	mg/L	3.64	0.028	0.024	0.007	#N/A	#N/A	0.299	0.077	0.02635	0.0107
Lead (Total)	mg/L	0.00	0.004	0.0015	0.00325	#N/A	#N/A	0.0245	0.006	0.0015	0.0015
Lead (Dissolved)	mg/L	0.00	0.002	0	0.002	#N/A	#N/A	0.0185	0.0035	0	0
Zinc (Total)	mg/L	0.21	0.31	0.005	0.0126	#N/A	#N/A	0.1705	0.047	0.02	0.005
June											
Flow	m3/mo	3750	10914	488501	248570	#N/A	17856	10736	667269	2093002	5993369
pH		8.1	8.05	7.9	8.05	#N/A	7.9	8.1	8.1	8.1	8.4
Conductivity	us/cm	1030	250	257	274.5	#N/A	384	531	324	220	354
Susp Solids	mg/L	2	9	2	38.5	#N/A	2	2.25	6.5	13	2
Alkalinity (CaCO3)	mg/L	366	86.4	130	135	#N/A	101	240	160	109	183
Sulphate	mg/L	249	38.15	7.1	12.25	#N/A	63.4	66.6	17.2	26.8	11.9
Hardness (Total)	mg/L	539	130	141	154.5	#N/A	191	309	182	125	208
Ammonia (Nitrogen)	mg/L	0.162	0.134	0.005	0.0225	#N/A	0.006	0.182	0.00425	0.05	0.034
Nitrate (Nitrogen)	mg/L	0.03	0.37	0.06	0.6	#N/A	#N/A	0.5	0.705	0.185	0.04
Barium (Total)	mg/L	0.152	0.01735	0.075	0.03695	#N/A	0.011	0.07975	0.0625	0.08	0.14
Barium (Dissolved)	mg/L	0	0.015	0.066	0.019	#N/A	#N/A	0.1	0.044	0.0935	0.138
Cadmium (Total)	mg/L	0.0013	0.0008	0.0002	0.000275	#N/A	0.0002	0.0005	0.000275	0.00015	0.0042
Cadmium (Dissolved)	mg/L	0	0.0005	0.00005	0.0002	#N/A	#N/A	0.0007	0.000125	0.0001	0.00005
Iron (Total	mg/L	0.46	0.32	0.62	0.856	#N/A	0.025	0.075	0.305	0.42	0.12
Iron (Dissolved)	mg/L	0	0.0015	0.016	0.00825	#N/A	#N/A	0.001	0.04	0.0295	0.026
Manganese (Total)	mg/L	3.16	0.0515	0.012	0.028	#N/A	0.0010	0.299	0.046	0.045	0
Lead (Total)	mg/L	0.005	0.0065	0.003	0.008	#N/A	0.002	0.0245	0.01	0.007	0.004
Lead (Dissolved)	mg/L	0	0.001	0.0005	0.002	#N/A	#N/A	0.0185	0.0085	0.012	0.004
Zinc (Total)	mg/L	0.24	0.195	0.01	0.037	#N/A	0.0200	0.1705	0.035	0.031	0.01
August											
Flow	m3/mo	893	3437	145727	71502	#N/A	#N/A	4464	203186	651751	1937863
pH		8	8.2	8.1	8.2	#N/A	#N/A	8.2	8.3	8.45	8.2
Conductivity	us/cm	991	292	316	309	#N/A	#N/A	523	397	0	396.5
Susp Solids	mg/L	4	2	2	2.5	#N/A	#N/A	2	2	2	2
Alkalinity (CaCO3)	mg/L	395	103	168	147	#N/A	#N/A	243	196	190.5	206.5
Sulphate	mg/L	221	39.7	7.25	16.55	#N/A	#N/A	38.7	19.1	11.8	9.25
Hardness (Total)	mg/L	525	157	192.5	169	#N/A	#N/A	290	225	205	215
Ammonia (Nitrogen)	mg/L	0.046	0.005	0.00375	0.0025	#N/A	#N/A	0.153	0.0025	0.013	0.00375
Nitrate (Nitrogen)	mg/L	0.01	0.38	0	0.83	#N/A	#N/A	0.12	0.32	0	0.07
Barium (Total)	mg/L	0.155	0.018	0.085	0.02655	#N/A	#N/A	0.086	0.075	0.1355	0.1515
Barium (Dissolved)	mg/L	0	0.019	0	0.027	#N/A	#N/A	0.079	0.079	0.125	0.075
Cadmium (Total)	mg/L	0.0008	0.00085	0.000075	0.0002	#N/A	#N/A	0.0007	0.0002	0.000625	0.00015
Cadmium (Dissolved)	mg/L	0	0.0003	0	0.0002	#N/A	#N/A	0.0002	0.0002	0.00025	0.00005
Iron (Total	mg/L	0.9	0.025	0.224	0.025	#N/A	#N/A	0.025	0.13	0.1805	0.15
Iron (Dissolved)	mg/L	0	0.004	0	0.01	#N/A	#N/A	0.032	0.032	0.043	0.057
Manganese (Total)	mg/L	2.94	0.0165	0.0164	0.007	#N/A	#N/A	0.3195	0.055	0.013	0.01
Lead (Total)	mg/L	0.01	0.0015	0.0015	0.0045	#N/A	#N/A	0.01	0.005	0.0085	0.0015
Lead (Dissolved)	mg/L	0	0.002	0	0.004	#N/A	#N/A	0.007	0.007	0.0005	0.0005
Zinc (Total)	mg/L	0.2	0.25	0.005	0.01	#N/A	#N/A	0.16	0.02	0.0045	0.0075
October											
Flow	m3/mo	937	1049	114935	51151	#N/A	#N/A	3928	168422	568190	1825002
pH		8	8.095	8.1	8.3	#N/A	#N/A	8.2	8.3	8.2	8.2
Conductivity	us/cm	1020	299	316	307	#N/A	#N/A	503	397	392	396.5
Susp Solids	mg/L	2	2	2	2	#N/A	#N/A	2	4	2	2
Alkalinity (CaCO3)	mg/L	383	103.5	165	149	#N/A	#N/A	236	194	190.5	206.5
Sulphate	mg/L	235	45.6	8.5	20.5	#N/A	#N/A	37.5	21.8	11.1	9.25
Hardness (Total)	mg/L	536	157	180	174	#N/A	#N/A	284.5	221.5	207	215
Ammonia (Nitrogen)	mg/L	0.023	0.00375	0.0025	0.0025	#N/A	#N/A	0.208	0.0025	0.0175	0.00375
Nitrate (Nitrogen)	mg/L	0.7975	0.86	0.18	1.57	#N/A	#N/A	0.12	0.3	0.26	0.07
Barium (Total)	mg/L	0.15	0.0175	0.075	0.026	#N/A	#N/A	0.086	0.074	0.123	0.1515
Barium (Dissolved)	mg/L	0	0.017	0.072	0.025	#N/A	#N/A	0.101	0.072	0.111	0.075
Cadmium (Total)	mg/L	0.0008	0.0011	0.00005	0.0002	#N/A	#N/A	0.0008	0.0002	0.00015	0.00015
Cadmium (Dissolved)	mg/L	0	0.0013	0	0.0003	#N/A	#N/A	0.0009	0.00005	0.0001	0.00005
Iron (Total	mg/L	0.89	0.025	0.21	0.025	#N/A	#N/A	0.025	0.13	0.26	0.15
Iron (Dissolved)	mg/L	0	0.0015	0.052	0.008	#N/A	#N/A	0.012	0.03	0.031	0.057
Manganese (Total)	mg/L	3.22	0.011	0.01645	0.0085	#N/A	#N/A	0.366	0.06665	0.0184	0.01
Lead (Total)	mg/L	0.0015	0.002	0.0015	0.004	#N/A	#N/A	0.008	0.004	0.003	0.0015
Lead (Dissolved)	mg/L	0	0.003	0	0.003	#N/A	#N/A	0.01	0.003	0.002	0.0005
Zinc (Total)	mg/L	0.28	0.3235	0.005	0.02	#N/A	#N/A	0.22	0.03	0.005	0.0075

Table 4-7 - Summary of Load Proportions in False Creek Basin at MH-16

		Tributary E			False Canyon Creek						FCC
		North Dam	**Burnick Portal**	**D/S**	**Jewelbox Pits and Dumps**	**Jewelbox Portal**	**1408 Dump**	**South Dam Seepage**	**D/S**	**D/S**	**Main**
Parameter	Units	MH-2	MH-22	MH-12	MH-4		MH-5	MH-7	MH-11	MH-13	MH-16
January											
Flow	m3/mo	2187	3393	30525	14850	#N/A	#N/A	10736	42759	137835	413117
January - Loads											
Sulphate	kg/mo	411	161	287	185	#N/A	#N/A	715	1730	2205	3677
Hardness (Total)	kg/mo	1151	570	5922	2577	#N/A	#N/A	3317	10946	32254	90886
Ammonia (Nitrogen)	kg/mo	0.38	0.13	0.08	0.08	#N/A	#N/A	1.95	0.81	2.21	2.89
Barium (Total)	kg/mo	0.32	0.07	3.14	0.41	#N/A	#N/A	0.86	3.93	22.88	71.47
Cadmium (Total)	kg/mo	0.002	0.003	0.002	0.003	#N/A	#N/A	0.005	0.010	0.007	0.021
Iron (Total	kg/mo	1.25	0.20	7.27	0.57	#N/A	#N/A	0.81	6.07	45.49	57.84
Manganese (Total)	kg/mo	7.96	0.09	0.73	0.10	#N/A	#N/A	3.21	3.29	3.63	4.42
Lead (Total)	kg/mo	0.00	0.01	0.05	0.05	#N/A	#N/A	0.26	0.26	0.21	0.62
Lead (Dissolved)	kg/mo	0.00	0.01	0.00	0.03	#N/A	#N/A	0.20	0.15	0.00	0.00
Zinc (Total)	kg/mo	0.46	1.05	0.15	0.19	#N/A	#N/A	1.83	2.01	2.76	2.07
June											
Flow	m3/mo	3750	10914	488501	248570	#N/A	17856	10736	667269	2093002	5993369
June - Loads											
Sulphate	kg/mo	934	416	3468	3045	#N/A	1132	715	11477	56092	71321
Hardness (Total)	kg/mo	2021	1419	68879	38404	#N/A	3410	3317	121443	261625	1246621
Ammonia (Nitrogen)	kg/mo	0.61	1.46	2.44	5.59	#N/A	0.11	1.95	2.84	104.65	203.77
Nitrate (Nitrogen)	kg/mo	0.11	4.04	29.31	149.14	#N/A	#N/A	5.37	470.42	387.21	239.73
Barium (Total)	kg/mo	0.57	0.19	36.64	9.18	#N/A	0.20	0.86	41.70	167.44	839.07
Barium (Dissolved)	kg/mo	0.00	0.16	32.24	4.72	#N/A	#N/A	1.07	29.36	195.70	827.08
Cadmium (Total)	kg/mo	0.005	0.009	0.098	0.068	#N/A	0.004	0.005	0.183	0.314	25.172
Iron (Total	kg/mo	1.72	3.49	302.87	212.78	#N/A	0.45	0.81	203.52	879.06	719.20
Iron (Dissolved)	kg/mo	0.00	0.02	7.82	2.05	#N/A	#N/A	0.01	26.69	61.74	155.83
Lead (Total)	kg/mo	0.02	0.07	1.47	1.99	#N/A	0.03	0.26	6.67	14.65	23.97
Lead (Dissolved)	kg/mo	0.00	0.01	0.24	0.50	#N/A	#N/A	0.20	5.67	25.12	23.97
Zinc (Total)	kg/mo	0.90	2.13	4.89	9.20	#N/A	0.36	1.83	23.35	64.88	59.93
August											
Flow	m3/mo	893	3437	145727	71502	#N/A	#N/A	4464	203186	651751	1937863
August - Loads											
Sulphate	kg/mo	197	136	1057	1183	#N/A	#N/A	173	3881	7691	17925
Hardness (Total)	kg/mo	469	540	28052	12084	#N/A	#N/A	1295	45717	133609	416641
Ammonia (Nitrogen)	kg/mo	0.04	0.02	0.55	0.18	#N/A	#N/A	0.68	0.51	8.47	7.27
Nitrate (Nitrogen)	kg/mo	0.01	1.31	0.00	59.35	#N/A	#N/A	0.54	65.02	0.00	135.65
Barium (Total)	kg/mo	0.14	0.06	12.39	1.90	#N/A	#N/A	0.38	15.24	88.31	293.59
Barium (Dissolved)	kg/mo	0.00	0.07	0.00	1.93	#N/A	#N/A	0.35	16.05	81.47	145.34
Cadmium (Total)	kg/mo	0.001	0.003	0.011	0.014	#N/A	#N/A	0.003	0.041	0.407	0.291
Iron (Total	kg/mo	0.80	0.09	32.64	1.79	#N/A	#N/A	0.11	26.41	117.64	290.68
Iron (Dissolved)	kg/mo	0.00	0.01	0.00	0.72	#N/A	#N/A	0.14	6.50	28.03	110.46
Manganese (Total)	kg/mo	2.62	0.06	2.39	0.50	#N/A	#N/A	1.43	11.18	8.47	19.38
Lead (Total)	kg/mo	0.01	0.01	0.22	0.32	#N/A	#N/A	0.04	1.02	5.54	2.91
Lead (Dissolved)	kg/mo	0.00	0.01	0.00	0.29	#N/A	#N/A	0.03	1.42	0.33	0.97
Zinc (Total)	kg/mo	0.18	0.86	0.73	0.72	#N/A	#N/A	0.71	4.06	2.93	14.53
October											
Flow	m3/mo	937	1049	114935	51151	#N/A	#N/A	3928	168422	568190	1825002
October - Loads											
Sulphate	kg/mo	220	48	977	1049	#N/A	#N/A	147	3672	6307	16881
Hardness (Total)	kg/mo	502	165	20688	8900	#N/A	#N/A	1118	37305	117615	392375
Ammonia (Nitrogen)	kg/mo	0.02	0.00	0.29	0.13	#N/A	#N/A	0.82	0.42	9.94	6.84
Nitrate (Nitrogen)	kg/mo	0.75	0.90	20.69	80.31	#N/A	#N/A	0.47	50.53	147.73	127.75
Barium (Total)	kg/mo	0.14	0.02	8.62	1.33	#N/A	#N/A	0.34	12.46	69.89	276.49
Barium (Dissolved)	kg/mo	0.00	0.02	8.28	1.28	#N/A	#N/A	0.40	12.13	63.07	136.88
Cadmium (Total)	kg/mo	0.001	0.001	0.006	0.010	#N/A	#N/A	0.003	0.034	0.085	0.274
Iron (Total	kg/mo	0.83	0.03	24.14	1.28	#N/A	#N/A	0.10	21.89	147.73	273.75
Iron (Dissolved)	kg/mo	0.00	0.00	5.98	0.41	#N/A	#N/A	0.05	5.05	17.61	104.03
Manganese (Total)	kg/mo	3.02	0.01	1.89	0.43	#N/A	#N/A	1.44	11.23	10.45	18.25
Lead (Total)	kg/mo	0.00	0.00	0.17	0.20	#N/A	#N/A	0.03	0.67	1.70	2.74
Lead (Dissolved)	kg/mo	0.00	0.00	0.00	0.15	#N/A	#N/A	0.04	0.51	1.14	0.91
Zinc (Total)	kg/mo	0.26	0.34	0.57	1.02	#N/A	#N/A	0.86	5.05	2.84	13.69

Table 4-8 - Summary of Inferred Background Concentrations in False Canyon Creek Basin

		Tributary E				False Canyon Creek							FCC
		North Dam	Burnick Portal	Downstream		Jewel Box Pits and Dumps	Jewel Box Portal	1408 Dump	South Dam Seepage	D/S	D/S		Main
Parameter	Units	MH-2	MH-22	MH-12		MH-4		MH-5	MH-7	MH-11	MH-13		MH-16
January - Load Proportions of MH-16													
Sulphate	%	11%	4%	8%		5%	#N/A	#N/A	19%	47%	60%		100%
Hardness (Total)	%	1%	1%	7%		3%	#N/A	#N/A	4%	12%	35%		100%
Ammonia (Nitrogen)	%	13%	4%	3%		3%	#N/A	#N/A	68%	28%	76%		100%
Barium (Total)	%	0%	0%	4%		1%	#N/A	#N/A	1%	6%	32%		100%
Cadmium (Total)	%	7%	15%	7%		14%	#N/A	#N/A	26%	47%	33%		100%
Iron (Total	%	2%	0%	13%		1%	#N/A	#N/A	1%	10%	79%		100%
Manganese (Total)	%	180%	2%	17%		2%	#N/A	#N/A	73%	74%	82%		100%
Zinc (Total)	%	22%	51%	7%		9%	#N/A	#N/A	89%	97%	133%		100%
June - Load Proportions of MH-16													
Sulphate	%	1%	1%	5%		4%	#N/A	2%	1%	16%	79%		100%
Hardness (Total)	%	0%	0%	6%		3%	#N/A	0%	0%	10%	21%		100%
Ammonia (Nitrogen)	%	0%	1%	1%		3%	#N/A	0%	1%	1%	51%		100%
Nitrate (Nitrogen)	%	0%	2%	12%		62%	#N/A	#N/A	2%	196%	162%		100%
Barium (Total)	%	0%	0%	4%		1%	#N/A	0%	0%	5%	20%		100%
Barium (Dissolved)	%	0%	0%	4%		1%	#N/A	#N/A	0%	4%	24%		100%
Cadmium (Total)	%	0%	0%	0%		0%	#N/A	0%	0%	1%	1%		100%
Cadmium (Dissolved)	%	0%	2%	8%		17%	#N/A	#N/A	3%	28%	70%		100%
Iron (Total	%	0%	0%	42%		30%	#N/A	0%	0%	28%	122%		100%
Iron (Dissolved)	%	0%	0%	5%		1%	#N/A	#N/A	0%	17%	40%		100%
Lead (Total)	%	0%	0%	6%		8%	#N/A	0%	1%	28%	61%		100%
Lead (Dissolved)	%	0%	0%	1%		2%	#N/A	#N/A	1%	24%	105%		100%
Zinc (Total)	%	2%	4%	8%		15%	#N/A	1%	3%	39%	108%		100%
August - Load Proportions of MH-16													
Sulphate	%	1%	1%	6%		7%	#N/A	#N/A	1%	22%	43%		100%
Hardness (Total)	%	0%	0%	7%		3%	#N/A	#N/A	0%	11%	32%		100%
Ammonia (Nitrogen)	%	1%	0%	8%		2%	#N/A	#N/A	9%	7%	117%		100%
Nitrate (Nitrogen)	%	0%	1%	0%		44%	#N/A	#N/A	0%	48%	0%		100%
Barium (Total)	%	0%	0%	4%		1%	#N/A	#N/A	0%	5%	30%		100%
Barium (Dissolved)	%	0%	0%	0%		1%	#N/A	#N/A	0%	11%	56%		100%
Cadmium (Total)	%	0%	1%	4%		5%	#N/A	#N/A	1%	14%	140%		100%
Cadmium (Dissolved)	%	0%	1%	0%		15%	#N/A	#N/A	1%	42%	168%		100%
Iron (Total	%	0%	0%	11%		1%	#N/A	#N/A	0%	9%	40%		100%
Iron (Dissolved)	%	0%	0%	0%		1%	#N/A	#N/A	0%	6%	25%		100%
Manganese (Total)	%	14%	0%	12%		3%	#N/A	#N/A	7%	58%	44%		100%
Lead (Total)	%	0%	0%	8%		11%	#N/A	#N/A	2%	35%	191%		100%
Lead (Dissolved)	%	0%	1%	0%		30%	#N/A	#N/A	3%	147%	34%		100%
Zinc (Total)	%	1%	6%	5%		5%	#N/A	#N/A	5%	28%	20%		100%
October - Load Proportions of MH-16													
Sulphate	%	1%	0%	6%		6%	#N/A	#N/A	1%	22%	37%		100%
Hardness (Total)	%	0%	0%	5%		2%	#N/A	#N/A	0%	10%	30%		100%
Ammonia (Nitrogen)	%	0%	0%	4%		2%	#N/A	#N/A	12%	6%	145%		100%
Nitrate (Nitrogen)	%	1%	1%	16%		63%	#N/A	#N/A	0%	40%	116%		100%
Barium (Total)	%	0%	0%	3%		0%	#N/A	#N/A	0%	5%	25%		100%
Barium (Dissolved)	%	0%	0%	6%		1%	#N/A	#N/A	0%	9%	46%		100%
Cadmium (Total)	%	0%	0%	2%		4%	#N/A	#N/A	1%	12%	31%		100%
Cadmium (Dissolved)	%	0%	1%	0%		17%	#N/A	#N/A	4%	9%	62%		100%
Iron (Total	%	0%	0%	9%		0%	#N/A	#N/A	0%	8%	54%		100%
Iron (Dissolved)	%	0%	0%	6%		0%	#N/A	#N/A	0%	5%	17%		100%
Manganese (Total)	%	17%	0%	10%		2%	#N/A	#N/A	8%	62%	57%		100%
Lead (Total)	%	0%	0%	6%		7%	#N/A	#N/A	1%	25%	62%		100%
Lead (Dissolved)	%	0%	0%	0%		17%	#N/A	#N/A	4%	55%	125%		100%
Zinc (Total)	%	2%	2%	4%		7%	#N/A	#N/A	6%	37%	21%		100%

Table 4-9 – Summary of Inferred Background Concentrations in False Canyon Creek Basin

		Trib. E. East Fork		**Jewel Box Pits and**	**FCC**	**FCC**		**FCC**
Parameter	Units	MH-12		MH-4	MH-11	MH-13		MH-16
January								
Sulphate	mg/L	-11		185	35	5		5
Hardness (Total)	mg/L	168		2577	230	224		215
Ammonia (Nitrogen)	mg/L	-0.017		0.08	0.080	0.015		0.002
Barium (Total)	mg/L	0.111		0.41	0.049	0.199		0.186
Cadmium (Total)	mg/L	0.000		0.003	0.000	0.000		0.000
Iron (Total	mg/L	0.233		0.57	0.054	0.415		0.021
Manganese (Total)	mg/L	-0.294		0.10	0.130	0.004		0.000
Lead (Total)	mg/L	0.001		0.05	0.012	-0.001		0.002
Lead (Dissolved)	mg/L	0.000		0.03	0.009	-0.002		0.000
Zinc (Total)	mg/L	-0.054		0.19	0.079	0.008		-0.003
June								
Sulphate	mg/L	4.470		3045	15	31.293		3.447
Hardness (Total)	mg/L	138.104		38404	161	98.323		268.509
Ammonia (Nitrogen)	mg/L	0.001		5.59	0.029	0.071		0.028
Nitrate (Nitrogen)	mg/L	0.053		149.14	0.596	-0.058		-0.052
Barium (Total)	mg/L	0.076		9.18	0.039	0.088		0.186
Barium (Dissolved)	mg/L	0.068		4.72	0.022	0.117		0.176
Cadmium (Total)	mg/L	0.000		0.068	0.000	0.000		0.007
Iron (Total	mg/L	0.628		212.78	0.824	0.474		-0.136
Iron (Dissolved)	mg/L	0.016		2.05	0.008	0.025		0.025
Lead (Total)	mg/L	0.003		1.99	0.009	0.006		0.002
Lead (Dissolved)	mg/L	0.000		0.50	0.003	0.014		0.000
Zinc (Total)	mg/L	0.004		9.20	0.043	0.029		-0.003
August								
Sulphate	mg/L	5.112		1183	17.852	8.493		8.048
Hardness (Total)	mg/L	191.264		12084	176.110	195.941		223.590
Ammonia (Nitrogen)	mg/L	0.003		0.18	0.011	0.018		-0.002
Nitrate (Nitrogen)	mg/L	-0.009		59.35	0.788	-0.145		0.119
Barium (Total)	mg/L	0.086		1.90	0.030	0.163		0.169
Barium (Dissolved)	mg/L	0.000		1.93	0.030	0.146		0.056
Cadmium (Total)	mg/L	0.000		0.014	0.000	0.001		0.000
Iron (Total	mg/L	0.225		1.79	0.025	0.203		0.123
Iron (Dissolved)	mg/L	0.000		0.72	0.011	0.048		0.072
Manganese (Total)	mg/L	-0.002		0.50	0.025	-0.006		0.007
Lead (Total)	mg/L	0.001		0.32	0.005	0.010		-0.003
Lead (Dissolved)	mg/L	0.000		0.29	0.004	-0.002		0.001
Zinc (Total)	mg/L	-0.002		0.72	0.019	-0.003		0.010
October								
Sulphate	mg/L	6.276		1049	21.712	6.592		8.405
Hardness (Total)	mg/L	177.259		8900	181.881	200.891		222.504
Ammonia (Nitrogen)	mg/L	0.002		0.13	0.017	0.024		-0.003
Nitrate (Nitrogen)	mg/L	0.169		80.31	1.467	0.243		-0.036
Barium (Total)	mg/L	0.075		1.33	0.030	0.144		0.173
Barium (Dissolved)	mg/L	0.073		1.28	0.030	0.127		0.057
Cadmium (Total)	mg/L	0.000		0.010	0.000	0.000		0.000
Iron (Total	mg/L	0.206		1.28	0.025	0.315		0.089
Iron (Dissolved)	mg/L	0.053		0.41	0.008	0.031		0.070
Manganese (Total)	mg/L	-0.010		0.43	0.034	-0.002		0.005
Lead (Total)	mg/L	0.001		0.20	0.004	0.003		0.001
Lead (Dissolved)	mg/L	0.000		0.15	0.003	0.002		0.000
Zinc (Total)	mg/L	0.000		1.02	0.034	-0.006		0.009

7. The effect of increasing zinc and cadmium in seepage from the North end of the TMF and discharge of mine water from the Jewelbox Hill Zone 1408 Portal were assessed. The loading from the Jewelbox Hill Portal was estimated by assuming that the mine will discharge at the rate which it is currently flooding and the discharge quality will be comparable to the current underground pool chemistry. The former assumption at least is conservative because flooding tends to be more rapid initially as the water table recovers.

8. The effect of the proposed TMF closure scenarios 1 and 2 were assessed qualitatively.

The model is generally conservative. It is assumed that chemical loads originating at the mine site are responsible for loads observed at downstream locations in the receiving environment. This assumes that there is no attenuation of loads in the streams below the mine. In reality, attenuation of heavy metals does occur, and the contribution from background will be greater than indicated. The current analysis generally ignores downstream attenuation by assuming that loads are conserved. It is possible that attenuation is occurring within the mine site, and that capacity for attenuation could be reduced at some time in the future. Attenuation over short distances is likely to occur as water flows through fine grained materials, for example, the North Dam seepage, South Dam seepage and flow in talus below the Burnick Portal. Both the dam seepage flow paths are very short, therefore, attenuation capacity was likely initially limited and is probably not a significant effect. The current analysis assumes that the entire load from the Burnick Portal enters the receiving environment because the load is based on the discharge from the portal, not the flow after it emerges from the talus. This analysis therefore assumes that no attenuation is occurring. Additional geochemical studies were done 2000 to investigate these effects. (Note – refer to the letter from SRK consulting to Bruce Donald dated March 12, 2007 that discusses the impact of 1380 Portal discharge on Camp Creek, included in Appendix E).

The model used is considered conservative for the following reasons. The increase in loadings at MH-02 is acknowledged. The conclusion that the load from MH-02 is insignificant is based on the loading analysis. This loading at MH-02 is 1 or 2% of the total load to False Canyon Creek.

Less conservative assumptions that were used in the modeling include:

- Additional exposure of tailings will likely result in higher Zn loadings, but the increase in area will only possibly result in an additional 1 or 2%. This was not modeled because the effect was considered small.

- It is probable that submergence of tailings in the South Dam is having a beneficial effect, however the volume submerged currently is negligible.

4.4.2 Results – As Reported in the 2000 DDRP

Comparison of loads for the Tributary E and False Canyon Creek ("FCC") indicate that Tributary E contributes a relatively small load to the FCC basin (and Figure 4-1). Sulphate and zinc are probably the best indicators of the effect of mining and weathering of mineralized rock. Total sulphate load in Tributary E varies from 300 to 3000 kg/month whereas FCC at MH-11 varies from 2000 to 11,000 kg/month. Zinc load varies from 0.2 to 5 kg/month and 2 to 20 kg/month, respectively.

Tributary E indicates relatively complete accounting of load observed from the measured sources. The loads observed at MH-2 and MH-22 account for most load at MH-12. The weakest accounting occurs in January when the load at the sources exceeds the load at MH-12. This may reflect loss of load due to formation of ice in the creek. Back-calculation of background concentrations at MH-12 indicates low concentrations which are reasonable values for the region (Table 4-8). For example, sulphate is 5 to 6 mg/L and zinc is less than 0.004 mg/L. Sulphate and zinc at MH-21 have been 10 and 0.006 mg/L, respectively, and the concentrations are less than the whole basin inferred background at MH-16 (Table 4-8). Several negative concentrations were predicted for January due to the loss of load at MH-12.

Attenuation of metals in soils from the flow path between the Burnick underground and waste dumps (MH-22 and MH-12) is not expected to contribute significantly to downstream zinc concentration, if attenuation is lost at some point in time The extra load added at MH-16 is 4 – 6% (see Figure 4-1) if attenuation capacity is used up. This conservative assumption demonstrates that the load for Burnick is not large, and would therefore not impact downstream receiving waters.

The North Dam (MH-2) is the only source of increasing zinc concentrations in the mine area. Zinc loads appear to have stabilized. It is, nonetheless, a small source (<1 kg Zn/month) of metals in the FCC basin, typically representing 2% or less of the load observed MH-16. In January, the load is 22% of the load at MH-16, however, due to freezing, most of the load probably does not actually report to MH-16. Since this seepage is a small load, any increase of zinc concentrations or loads in the seepage will not have a significant effect on downstream water quality, even if zinc concentrations increase by a factor of 100%.

Loadings to FCC from the Main and Jewelbox Zones indicate that MH-4 is the largest single source of the load observed at MH-11 in June (3000 kg SO_4/month, 9 kg Zn/month). In other months, loads are lower and comparable to South Dam Seepage (MH-7), the only consistently flowing source. MH-5 flows intermittently and appears to account for a small proportion of surface water load in June (2% and 1% of sulphate and zinc, respectively). The calculations indicate that the bulk of zinc and sulphate load observed at MH-11 is not accounted for by the monitored sources (see Figure 4-1). Back-calculation of the concentrations applicable to the unaccounted for load indicates elevated sulphate and zinc concentrations (up to 20 mg SO_4/L and 0.079 mgZn/L). These concentrations are greater than the concentrations at MH-21 and the whole basin background values (Table 4-8). They are slightly greater than concentrations in MH-4. The unaccounted for load may reflect locally elevated background in the vicinity of Mt. Hundere or emergence of water originating in the Main and Jewelbox Zones. Pre-mining baseline monitoring was not specifically designed to separate sources of elevated background metal concentrations, hence, the actual source of the load cannot be evaluated. As noted previously, leaching is not expected to accelerate in any part of the Jewelbox or Main Zones. The current water chemistry is expected to persist indefinitely.

Attenuation of metals in the flow path down-gradient of MH-04 is not anticipated to be a significant factor in removal of zinc loads. Based on a comparison of the Main Pit load (105 kg/month at assumed 1 litre/second flow) with MH-04 (9.2 kg/month) it is considered unlikely that 90% of the load could be lost in the reach above MH-04. Camp Creek is fast flowing in coarse materials, providing little surface area for attenuation. A more likely explanation is that the flow from the Main Pit is short-lived (i.e. Not a continuous load addition) and is therefore not reflected at MH-04. Additional water quality sampling in Camp Creek at several locations when the Main Pit is discharging could confirm this.

Calculated sulphate and zinc loads potentially discharged from the Jewelbox 1408 Portal are 150 kg/month and 1.5 kg/month (annual average based on 30 day month). Lower loads might be expected during low flows in winter. The loads are comparable to current loads from the Burnick Portal and consequently represent a small probably stable load to FCC.

4.4.2.1 Tailings Management Facility (TMF) Closure Issues

Two closure scenarios are proposed for the TMF. Scenario 1 assumes the mine will not reopen, the south dam would be breached, and the pond at the south end of the impoundment would be drained. Scenario 2 assumes SDHOC will reopen the mine and continue to place tailings into the TMF to an elevation of about 1102 metres.

Once the South Dam is breached in Scenario 1, the flow through the breach will be related to the drainage area upstream. The seepage flow through the tailings will be a small component of the overall flow, and will be influenced by the permeability, the depth and the areal extent of the tailings.

The effect in Scenario 1 would be to lower seepage rates through the South Dams (due to the reduced head), maintain the current seepage rate through the North Dam and expose additional tailings. The latter effect is expected to be insignificant because very little tailings are currently underwater. Seepage out of the covered tailings at the south end of the impoundment is expected to be between 10 to 20 L/min after closure. Assuming that zinc concentrations are not solubility limited (due to the high solubility of zinc sulphate under pH neutral conditions), and that zinc possibly originates by slow oxidation of residual zinc sulphide, Scenario 1 would not result in a significant increase in the zinc loads from the tailings. Zinc concentrations in seepage might increase due to the lower seepage flow.

Scenario 2 is expected to increase seepage flow from the north end tailings to between 30 to 50 mg/L. The seepage rate from the south end is expected to be very similar. For the same reasons noted above, the actual zinc load in the long term would probably not increase because the tailings area exposed to oxidation will not change substantially. However, even if loads did increase by the same factor as the seepage flow rates, the additional proportion contributed to downstream load at

MH-16 would be less than 2 percent. A higher calculated contribution would be expected in winter but, as noted previously, the actual load contributed by the mine area is much lower than calculated due to stream flow loss by freezing. The change in loads has an insignificant impact on MH-11 and MH-16 and does not warrant additional engineered measures to address leaching.

4.4.3 2005 Sä Dena Hes Mine Water Quality and Loading Reassessment

In March 2005, SRK updated the water quality and loading assessment provided in the original 2000 DDRP. This update is provided in Appendix F and is titled "*Sä Dena Hes Mine Water Quality and Loading Re-Assessment* ".

The downstream loading re-assessment used a dilution model to back-calculate loading and concentrations in background (natural undisturbed) sources using known sources of loadings in the mine-disturbed area. This approach indicates the presence of any unknown sources (shown by high calculated background) and attenuation effects (shown by low or negative calculated background).

The assessment focused on zinc as the main potential contaminant of concern and sulphate as an indicator of mine-related impacts that is not significantly affected by attenuation processes in surface waters. Generally, input data for years 2001, 2002 and 2003 were used. For the previous assessment included in the 2000 DDRP, input data were from 1996, 1997 and 1998.

The re-assessment resulted in reasonable background concentrations for zinc and sulphate comparable to the previous assessment, which indicated that all significant sources are known. Some changes in concentrations and loadings were apparent but these did not result in significant downstream effects in False Canyon Creek because the mine area occupies a relatively small part of the total catchment area.

The conclusions from this study were as follows:
Monitoring results indicate that some changes in water chemistry have occurred since the previous loading calculation presented in the Detailed D&R Plan, including:

- Negligible zinc loading effect from Main Zone 1380 Portal (MH-25) in MH-4 due to attenuation by contact with rock and soil along the subsurface flow path.

- Decreasing zinc concentrations in Camp Creek (MH-4).

- Increasing zinc concentrations and decreasing sulphate concentrations in the South Dam seepage (MH-7) which has apparently translated into decreasing sulphate concentrations at downstream stations in False Canyon Creek (MH-11 and MH-13). The increase in zinc concentrations at MH-7 is not apparent at MH-11 or MH-13.

- Significant decreasing zinc and increasing sulphate concentrations in seepage from the North Dam (MH-2). Flow rates appear to have increased resulting in no net decrease in zinc load and further increase in sulphate load.

- Negligible effect from zinc concentrations at MH-22 (North Hill Settlement Basin) due to attenuation in soils downslope from the monitoring location indicated by laboratory tests in 2002. Field inspections indicate that this flow does not connect by surface to Tributary E.

The loading analysis reflects these changes but does not indicate a significant effect on overall loadings in the False Canyon Creek catchment area because the contributions from mine site sources are relatively small in the context of the whole basin. The dominant source of sulphate and zinc loading in the catchment area is natural weathering of rocks and soil unrelated to mining activity.

The overall conclusions of the loading calculation are the same as those presented previously in the Detailed D&R Plan.

4.4.4 2009 Update of Water Quality Trends

Utilizing water quality data collected up to 2009, this section discusses the changes in water quality and the long term water quality trends. The data tables containing the monitoring data collected are contained in Appendix C. The associated water quality graphs discussed below are contained with Appendix D.

4.4.4.1 South Fork False Canyon Creek

The main known sources in this catchment area are Camp Creek (MH-04) and seepage from the Reclaim Dam (MH-07). The east slope of Jewelbox Hill also contributes to the catchment area but not through visible surface flow. Intermittent flow is observed near the site gatehouse.

Camp Creek (MH-04) receives flow from the natural mineralized exposure on the north side of Jewelbox Hill as well as from the Main Zone Pit and 1380 Portal via subsurface flow. The 1380 Portal continues to be a source of elevated zinc loads far exceeding loads observed at MH-04. Investigations subsequent to the 2000 DDRP (SRK Consulting 2003) indicated that this load reduction is probably occurring as a result of attenuation in waste rock and talus below the portal. Further investigations by Teck identified that the surface flow in the gulley below the rock dump goes to ground approximately 500m before reaching Camp Creek. Additional attenuation of zinc loading may be occurring in this area as well. Regardless, in 2007 SRK Consulting prepared a technical memorandum that predicts that in the long term, even if there is no attenuation between the 1380 Portal and MH-04, there would still not be an unacceptable impact on the receiving environment (see Appendix E).

Current monitoring results for MH-04 indicate that the zinc concentrations are continuing low and are largely unchanged since 1999 (Appendix D, Figure D-1). Similarly, Sulphate concentrations have also been variable on a month to month basis but trending around 15 mg/L for over ten years (Appendix D Figure D-2).

Monitoring data for the Reclaim Dam seepage (MH-7) is scattered due to sampling difficulties during the winters. Due to low flow and deep snow, samples are often contaminated by sediment during collection. Despite this, the long term trends for sulphate concentrations (Appendix D, Figure- D-3) show an initial steeply decreasing trend which began when operations ceased, and over the past 5 years the trend has been flattening. Total zinc concentrations for MH-7 (Appendix D, Figure D-4) have been variable since 1991 largely associated with suspended solids in the water. The long term trend of zinc concentrations from the mid 1990's has been level or slightly lower. In recent years, higher zinc concentrations are primarily associated with higher TSS levels measured in the winter months caused by sampling difficulties and do not suggest that there is an increase in zinc loading occurring.

MH-11 is roughly 3 km downstream of the Reclaim Dam. This site has shown a steady decrease in sulphate concentrations (Appendix D, Figure D-5) similar to the decrease at MH-07. Zinc at MH-11 has also shown a lowering trend (Appendix D, Figure D-6) since the early 1990's with a slight increase in 2008 and returning to the longer term trend of low concentrations in 2009.

MH-13 is several kilometres downstream from MH-11 in False Canyon Creek. This site has also shown a steady decrease in sulphate concentrations (Appendix D, Figure D-7). Zinc concentrations have remained low (Appendix D, Figure D-8).

4.4.4.2 Tributary E Catchment

Seepage from the North Dam (MH-02) and the Burnick 1200 Portal Discharge (MH-22) are monitored in the Tributary E Catchment. The latter site receives the Burnick Portal discharge and runoff from the 1200 Portal area but it does not have a surface water connection to Tributary E.

MH-2 has shown significant trends since the DDRP was prepared. Sulphate concentrations continued to increase reaching 413 mg/L in 2003 (Appendix D, Figure D-9) and while there is scatter in the data, trends have leveled off since 2003. The increase in sulphate concentrations is probably due to increase in the influence of oxidation of tailings relative to drain down of residual dilute process water. In contrast, zinc concentrations reached peak levels near 0.41 mg/L in 1996 and then in 2003 through 2005 concentrations were sharply decreased (Appendix D, Figure D-10). As interpreted by SRK Consulting (2003), the decrease in zinc concentrations probably reflects the removal of wind blown tailings from the dam face by SDMOC. While the problem of windblown tailings has been apparently solved by the placement of a thin gravel cover on the dry tailings near the North Dam, zinc concentrations have recent increase.

A closer examination of the data between 1999 and 2009 shows that difficulty sampling in the winter months due to snow is resulting is some samples being contaminated with sediment which results in abnormally high zinc concentrations. During the winter, flow rates are low, there are no erosional processes occurring and so the suspension of sediments in the water column is being created by the sampling process. Examination of data from samples where TSS concentrations in the winter are less than or equal to 10 mg/L (did not remove sample data from spring / summer /

fall sampling where TSS concentrations were higher as these are reflective of actual conditions). Appendix D, Figure D-11 indicates that while there are fluctuations, that a linear trend line for total zinc concentrations are trending slightly lower and are below 0.15 mg/L.

Monitoring results for the Burnick Portal Discharge (MH-22) indicate gradual slightly decreasing sulphate concentrations recently below 40 mg/L. Despite significant variations in maximum and minimum total zinc concentrations yearly, there was a clear upwards trend from 1995 though until 2003. The trend peaked in 2003 and now has been decreasing back to about 1995 levels.

4.4.4.3 MH-16 (Combination of False Canyon Creek and Tributary E)

MH-16 is in False Canyon Creek downstream of the confluence with Tributary E. Like MH-11 and MH-13, sulphate concentrations since closure, initially decreased rapidly and have remained stable since with possibly a very slight decreasing trend since 2003 (Appendix D, Figure D-14). Likewise, zinc concentrations have remained very low since 2001 (Appendix D, Figure D-15).

4.4.5 2010 Update of Loading Assessment

The 2009 update of water quality trends in Section 4.4.4 did not identify and significant increasing trends of sulphate loading or zinc loading that would result in significantly changing the result in adding loads from the mine site to the False Canyon Creek catchment basin.

The 2005 SRK report "*Sä Dena Hes Mine Water Quality and Loading Re-Assessment* " concluded that:

> "the loading analysis reflects these changes but does not indicate a significant effect on overall loadings in the False Canyon Creek catchment area because the contributions from mine site sources are relatively small in the context of the whole basin. The dominant source of sulphate and zinc loading in the catchment area is natural weathering of rocks and soil unrelated to mining activity."

As the contribution to the False Canyon Creek are primarily natural in origin (i.e. non-mining activity related) and as mine related contributions are continuing to be stable, the loading assessment model was not updated. If water quality reviews at the next update to the DDRP indicate that the mine is discharging increasing sulphate or zinc loading to the basin, the loading assessment model will be updated and the results examined.

5.0 TERRESTRIAL RESOURCES

5.1 VEGETATION

The Sä Dena Hes mine site is located in the Liard Basin Ecoregion (ESWG, 1995). The site includes boreal forest, subalpine and alpine vegetation zones with treeline at an approximate elevation of 1400 masl. A terrain mapping program consisting of aerial photographic interpretation augmented with field reconnaissance was completed for the IEE. The reader is referred to the IEE, Volume IV, Section 2.1.2 (SRK, 1990) for a discussion of the terrain mapping that was conducted to document generalized terrain features and geomorphic hazards that might affect project facilities. A preliminary vegetation inspection was conducted in July 1999 and forms the basis for the following vegetative description of the site.

Climax vegetation in the boreal forest zone is; white spruce (*Picea glauca*), black spruce (*Picea mariana*), subalpine fir (*Abies lasiocarpa*) or a combination of these species. Black spruce and alpine fir are the most common boreal vegetation communities in the area. Black spruce forest is prevalent on poorly drained bogs and fens such as those in the tailings impoundment area. Open stands of black and white spruce are found on upland slopes. The area around the mill and camp upwards to the treeline is primarily subalpine fir.

Paper birch (*Betula papyrifera*) occurs on moist sites throughout the area. Trembling aspen (*Populus tremuloides*) is found on well-drained south-facing slopes, and balsam poplar (*Populus balsamifera*) colonizes alluvial gravel bars and other moderately well-drained disturbed sites. Lodgepole pine (*Pinus contorta*) forms pure even-age stands in some upland areas on the mine site, presumably following fire. Larch (*Larix laricina*) is found in lowland bogs along the main access road.

Willow (*Salix* spp.), alder (*Alnus crispa*), rose (*Rosa acicularis*) and Labrador tea (*Ledum groenlandicum*) are the common understorey shrubs. Mountain ash (*Sorbus scopulina*) is found in the tailings impoundment area. Ground cover is dominated primarily by kinnikinnick *(Arctostaphylos uva-ursi*), bearberry (*Arctostaphylos rubra*), crowberry (*Empetrum nigrum*), ligonberry (*Vaccinium vitis-idaea*), bunchberry (*Cornus canadensis*) and toadflax (*Geocaulon lividum*).

Shrub birch (*Betula glandulosa*), along with alpine fir and willows dominate the subalpine zone. Low ericaceous shrubs are common in alpine areas, along with a groundcover of mosses and lichens.

Bluejoint reedgrass (*Calamagrostis canadensis*) is a prominent graminoid in the area, particularly in moist semi-shaded areas. Altai fescue (*Festuca altaica*) is dominant on drier slopes. Fowl bluegrass (*Poa palustris*) prevails in moist open areas. Slender wheatgrass (*Agropyron pauciflorum*), violet wheatgrass (*Agropyron violaceum*) and bearded wheatgrass (*Agropyron subsecundum*) are the primary invaders of disturbed areas.

Legumes are not prominent in the native flora. Elegant milk vetch (*Astragalus eucosmus*) and arctic lupine (*Lupinus arcticus*) are the most common indigenous legumes in the Sä Dena Hes area.

Soils

Genetic materials throughout the mine site area are primarily morainal, fluvial or glacofluvial. Organics overlying morainal or fluvial material occur in wetlands such as the tailings impoundment areas. Upper alpine zones are bedrock while zones of colluvium occur on the steeper upland slopes.

A layer of silty loam or gravely sandy loam supports white spruce and mixed deciduous forests. These moderately well drained soils are slightly acidic to neutral (pH 6.1 to 7.3) with low to moderate organic matter and with a low level of available nutrients. Wetlands supporting black spruce vegetation have soils of mesic, fibric peat or silty loam. These poorly drained soils are slightly to strongly acidic, have high organic matter and have very little nutrients available. Alpine and subalpine vegetation is found on moderately well drained silty loam or loamy sand. These soils are slightly acid to neutral with low organic matter and with a low level of available nutrients.

5.2 WILDLIFE

The Sä Dena Hes mine site is located within the False Canyon Creek watershed and the mine access road traverses the headwaters of various tributaries of the Tom Creek watershed. The area encompasses several mature mountains with a predominance of boreal forest and limited alpine and sub-alpine terrain. This habitat is capable of supporting various ungulates, large carnivores, other fur-bearers and many bird species. However, species that generally exploit alpine zones are rare due to the limited availability of this habitat in the area.

Wildlife utilization and habitat potential investigation within the Sä Dena Hes Mine project area was undertaken in 1989 to complement similar studies conducted in the area by other agencies. This investigation involved a review of published and unpublished reports on wildlife in the Southeast Yukon, wildlife surveys and trapline catch information, interviews with personnel knowledgeable about the area, and field reconnaissance. Refer to Section 2.4 within the "Mt. Hundere Development Initial Environmental Evaluation, Supporting Document IV, Biophysical Evaluation" (SRK, 1990).

As noted within the IEE, moose are the most prevalent ungulate in the study area, with sightings from the timberline to the valley bottoms. Currently, moose are very infrequent visitors to the project area, and the Company is not aware of any moose mortalities. The Sä Dena Hes project area also provides good black bear habitat, although only occasionally seen within the vicinity of the mine site itself. Beaver sign has been noted along virtually all watercourses and at all lakes in the study area. An assessment of beaver activity in the area was completed in 1998 (LES, 1998). Cycles of flooding and abandonment attributable to beavers result in ponded wetlands used by many species including waterfowl.

No further wildlife investigations have been completed in the project study area since those reported in the IEE.

6.0 AQUATIC RESOURCES

6.1 FISHERIES

Fisheries monitoring programs have continued to be conducted concurrently with the biological monitoring program. The current water license requires fish monitoring every two years during periods when the mine is not active. The mine has not been active since the mid 1990s. Fisheries monitoring began in 1994 (LES 1995).

Baseline fisheries investigations of drainages within the Sä Dena Hes study area were completed by Environmental Sciences Ltd. (ESL) on the False Canyon Creek drainage in June and September of 1989 as a component of the Initial Environmental Evaluation for the Mt. Hundere Development. ESL also conducted fish surveys on the Tom Creek drainage as well as on a tributary to Francis River, where grayling and slimy sculpin were captured. A summary of the results from this investigation are provided in Chapter 2.5 of the report entitled "*Mt. Hundere Development Initial Environmental Evaluation*, Volume IV Biophysical Evaluation of Project Site, (SRK, 1990).

Updated results from the water use license fisheries monitoring are summarized below. The reader is referred to the following reports for a detailed discussion of the fisheries investigations since the Detailed Reclamation Plan was initially submitted in 2000.

- *Environmental Monitoring at False Canyon Creek, 2000.* Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2000).
- *Environmental Monitoring at False Canyon Creek, 2002.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2002).
- *Environmental Monitoring at False Canyon Creek, 2004.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2004).

- *Environmental Monitoring at False Canyon Creek, 2006.* Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2006).
- *Environmental Monitoring at False Canyon Creek, 2008.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2008).

All of the existing fisheries data on the False Canyon Creek drainage have been summarized and are presented in Table 6-1. Locations of fish monitoring stations are provided in Figure 6-1.

During the study conducted in 1992, fish tissues were analyzed for metals, although this was not a requirement of the licence. The concentrations found in the liver and muscle of Arctic Grayling and Whitefish, and in the whole bodies of sculpins, were similar to concentrations in fish captured in an unaffected watershed (Blind Creek), indicating that there was no effect from the Sä Dena Hes Mine. In 1998, habitat and utilization assessments were also conducted on North Creek upstream and downstream of the North Creek dike and no fish were captured.

A variety of techniques were used during the investigations; electro-shocker (gas and battery operated), minnow trapping, seine netting, gill netting, angling and visual observations. All of the existing fisheries data on the False Canyon Creek drainage have been summarized and are presented in Table 6-1. Locations of fish monitoring stations are provided in Figure 6-1.

Pre- and post-development fish sampling indicate that fish production capabilities in the upper False Canyon Creek drainage are relatively low. The most productive area within the system appears to be the lower reaches of False Canyon Creek near the confluence with the Frances River.

Four species of fish were found within the False Canyon Creek drainage since 2000: Slimy sculpin (Cottus cognatus), Arctic grayling (Thymallus arcticus), round whitefish (Prosopium cylindraceum), and burbot (Lota lota). Slimy sculpin continue to be the most abundant species captured representing 74% of the total catch, followed by Arctic grayling at 23%.

The sites MH-13 and MH-20 were monitored during each of the eight surveys. Only slimy sculpin were captured at MH-13 although several fishing methods were employed. This site is a beaver/wetland complex with low velocity flow. The slimy sculpin population however, continued to be stable and the habitat supports all life history stages of this species.

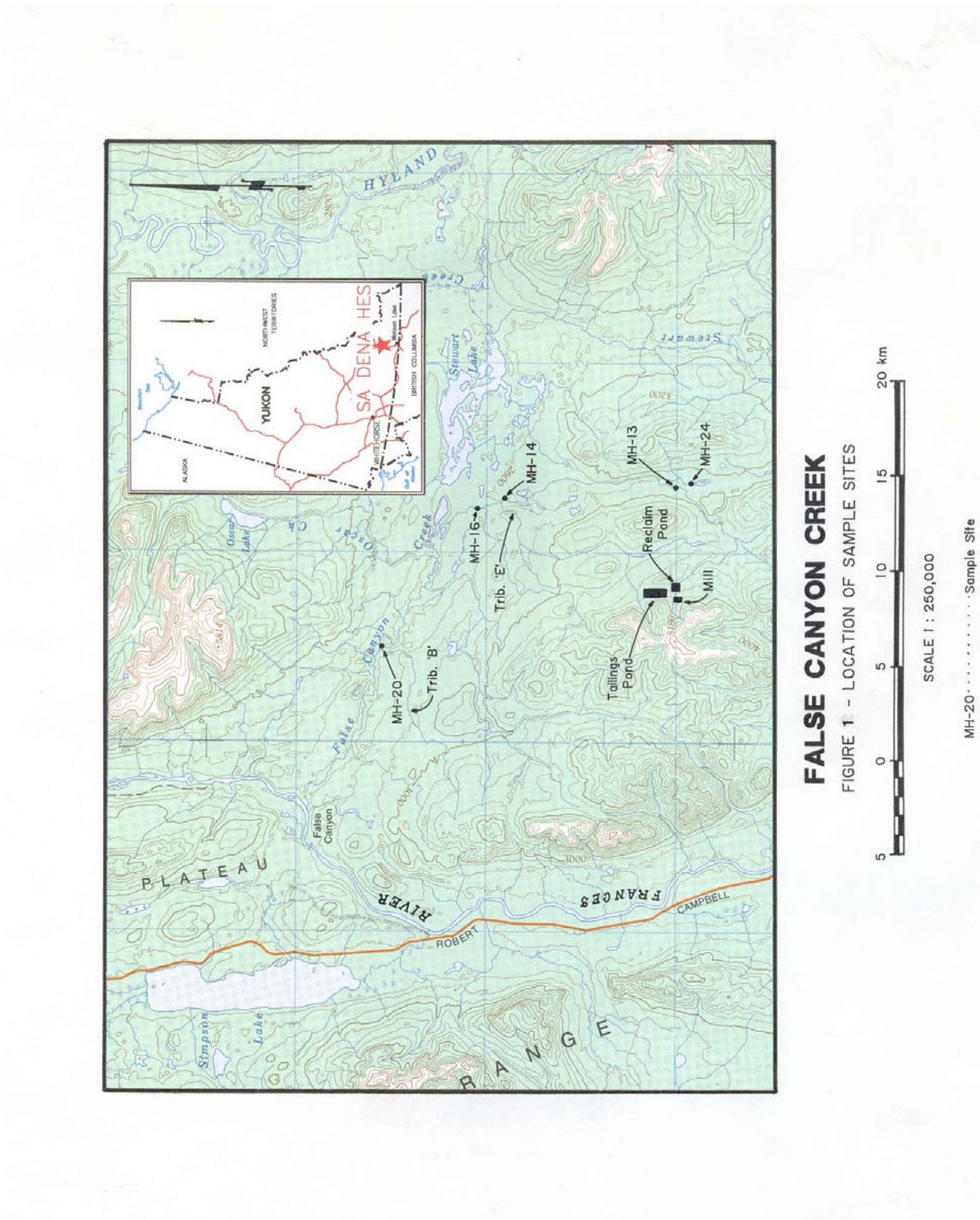
Arctic grayling and slimy sculpin dominated the catch at MH-20 with incidental occurrences of whitefish and char. This site displays suitable fish habitat with stable banks and gravel substrate, and good riffle/pool ratio.

The fisheries data was generally consistent with the past studies. While the absolute number of fish captured varies from year to year, the fish assemblage in the catch is consistent and is itself an indication of stability in the fish community. Slimy sculpins continued to be the dominant species captured throughout the drainage, and the only species present at MH13. The presence of Arctic grayling and whitefish were again confirmed in the False Canyon Creek drainage however no burbot were captured or observed in 2008.

Table 6-1 Summary of Fish Species Captured In the False Canyon Creek Drainage

COMPARISON OF TOTAL FISH CATCH AT THREE SAMPLING SITES OVER A 16 YEAR PERIOD				
SPECIES	**YEAR**	**SAMPLE SITE**		
		MH13	MH16	MH20
Slimy sculpin	1992	9	-	1
	1994	19	-	8
	1996	18	-	33
	1998	15	0	19
	2000	6	6	4
	2002	8	5	4
	2004	25	27	18
	2006	21	17	9
	2008	78	15	23
Arctic grayling	1992	0	-	1
	1994	0	-	7
	1996	0	-	5
	1998	0	0	3
	2000	0	1	6
	2002	0	4	12
	2004	0	6	9
	2006	0	3	1
	2008	0	3	2
Whitefish sp.	1992	0	-	0
	1994	0	-	1
	1996	0	-	0
	1998	0	0	2
	2000	0	0	1
	2002	0	0	2
	2004	0	0	1
	2006	0	0	0
	2008	0	0	1
Other fish species	1992	0	-	0
	1994	0	-	1 char
	1996	0	-	0
	1998	0	2 burbot	0
	2000	0	0	1 burbot
	2002	0	1 burbot	1 burbot
	2004	0	0	0
	2006	0	1 burbot	2 burbot
	2008	0	0	0

Figure 6-1 Regional Water Quality Fish, Benthic & Stream Sediment Monitoring Stations



6.2 BENTHIC INVERTEBRATES

Two baseline benthic invertebrate investigations were conducted within the Sä Dena Hes study area prior to mine development. In September 1989, ESL collected baseline benthic invertebrates from 23 sites. Samples from only three of these sites were identified and analyzed, and the remaining 20 were archived. A discussion of this study was provided in the report entitled "*Mt. Hundere Development Initial Environmental Evaluation*, Volume IV Biophysical Evaluation of Project Site, (SRK, 1990). In July 1990, Environmental Protection Services (EP) of Whitehorse, Yukon, conducted baseline biological monitoring at ten sites, four of which lie within the False Canyon Creek drainage. Details of this study are reported in the "*Mount Hundere Baseline Study, June 1988 and June 1990*. Data Report No. 94-02. Environmental Protection Branch. 1994

Biological monitoring programs have continued according to water license specifications, every two years since 1992. The reader is referred to the following reports for a detailed discussion of the benthic invertebrate investigations since 2000:

- *Environmental Monitoring at False Canyon Creek, 2000.* Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2000).
- *Environmental Monitoring at False Canyon Creek, 2002.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2002).
- *Environmental Monitoring at False Canyon Creek, 2004.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2004).
- *Environmental Monitoring at False Canyon Creek, 2006.* Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2006).
- *Environmental Monitoring at False Canyon Creek, 2008.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2008).

Biological monitoring station locations are shown in Figure 6-1. The licence states that sampling should also be undertaken at MH14 and MH18 for the benthos, fish and sediment surveys. MH14 was submerged from 1996 to 2006, and the alternate site MH16, located two kilometers downstream, had been used for those studies. The present sampling location at MH14 is now no longer flooded, however in the pursuit of consistency, MH16 was again used as the sample site rather than MH14. Regular water samples are collected quarterly at MH14 however. MH16 is also a quarterly water quality station and is located on the main stem of False Canyon Creek. This area is presently unaffected by beaver activity and is representative of a more stable environment than MH14.

Invertebrates were sampled at three similar locations per site. The samples were collected from an undisturbed, fast flowing, gravel strewn riffle habitat at each of the sites. Collections were made with a Surber sampler (area = 0.0929 m^2) which had a 300 micron mesh net. The bed material within the frame was cleaned and washed by hand, with the fast flowing current carrying the disturbed bottom fauna and detritus into the collection bag. The level of effort for each sample and at each site was comparable. The captured invertebrates and detritus were placed in one-litre Nalgene bottles, preserved in 10% formalin, and shipped to Charles Low, PhD, an entomologist in Victoria, B.C., for sorting, identification and enumeration.

At the lab, all samples were washed through two screens with mesh sizes 1 millimetre and 180 microns. All of the organisms retained by the coarse screen were counted and identified, whereas the organisms on the 180 micron screen were subsampled as necessary. A Folsom plankton splitter was used for the subsampling. The majority of the benthos was identified to the genus level.

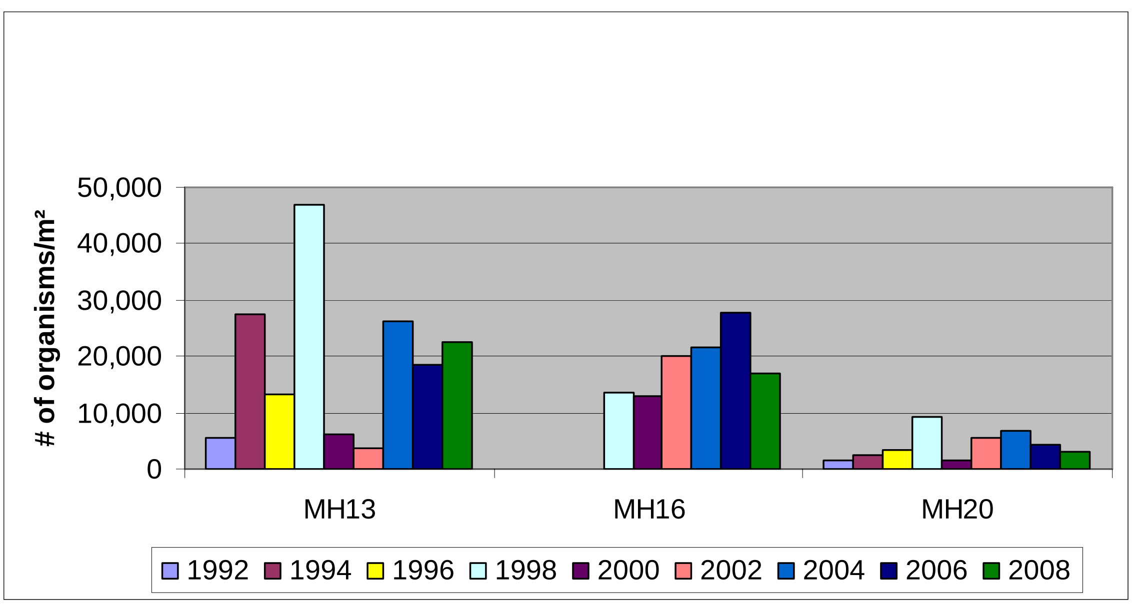
Data collected from False Canyon Creek since 1992 have been summarized and compiled in Table 6-2. Population densities were greatest in 1998 at MH13 and MH20, and in 2006 at MH16 (Figure 6-2). The population at MH13 has fluctuated considerably over time which probably reflects the instability of this site. Populations at MH16 and MH20 in 2008 decreased to their lowest levels since 2000.

Taxonomic richness has continued to fluctuate over time at MH13 and MH20, but has been relatively stable at MH16. The community at MH13 was at its most diverse in 2004. The most diverse communities at MH16 and MH20 occurred in 2006 with an overall record number of 76 different organisms identified at MH16. The number of sensitive taxa increased significantly at MH13 in 2008. This was likely due to an improvement in habitat quality. With lower water levels, gravel/cobble substrate was available for benthic invertebrate sampling. This type of habitat provides preferred conditions to support EPT organisms.

Table 6-2 Summary of Benthic Invertebrate Data in the False Canyon Creek Drainage

Site	Year	Total Abundance	Taxonomic Richness	Density (# of organisms/m²)	Dominant Taxa	Total # of Sensitive Taxa
MH13	1992	1,562	25	5,605	Diptera	7
	1994	7,631	37	27,380	Ephemeroptera & Diptera	9
	1996	3,682	57	13,211	Diptera	8
	1998	13,033	30	46,764	Diptera	2
	2000	1,704	50	6,114	Plecoptera & Diptera	4
	2002	1,020	43	3,660	Diptera	3
	2004	7,289	72	26,153	Diptera	9
	2006	5,168	46	18,543	Diptera	4
	2008	6,319	50	22,673	Diptera & Plecoptera	8
MH16	1998	3,754	60	13,470	Diptera & Ephemeroptera	10
	2000	3,578	65	12,838	Diptera & Ephemeroptera	9
	2002	5,588	67	20,050	Diptera & Ephemeroptera	8
	2004	5,995	63	21,510	Diptera & Ephemeroptera	10
	2006	7,445	76	27,713	Diptera	10
	2008	4,769	58	17,112	Diptera & Ephemeroptera	8
MH20	1992	394	22	1,414	Ephemeroptera	6
	1994	720	31	2,583	Ephemeroptera & Diptera	8
	1996	936	54	3,358	Ephemeroptera & Diptera	12
	1998	2,564	59	9,200	Ephemeroptera & Diptera	10
	2000	412	28	1,478	Diptera & Ephemeroptera	6
	2002	1,591	43	5,709	Diptera	6
	2004	1,853	56	6,648	Diptera & Ephemeroptera	11
	2006	1,196	64	4,291	Ephemeroptera & Diptera	11
	2008	826	49	2,964	Ephemeroptera & Diptera	7

Figure 6-2 Community Density by Site Over Time



The dominance of the respective communities has remained virtually unchanged over the study period. Diptera has been the dominant or co-dominant order at MH13 during every sampling period. Ephemeroptera and/or Diptera have been the dominant orders at MH16 and MH20 over time.

The temporal data generally indicates that the community at MH13 fluctuates depending on the changing habitat characteristics during the particular sampling period. The community at MH16 is stable in terms of numbers and composition, and the community at MH20 experiences some slight changes in numbers and composition.

Overall, the benthic invertebrate communities within the False Canyon Creek drainage have remained relatively diverse and have had good representation from the major groups of organisms that are usually present in lotic waters. The dominance of the respective communities has remained virtually unchanged over the study period, with Diptera the dominant of co-dominant order at MH13 during every sampling event. Ephemeroptera and/or Diptera have bee the dominant orders at MH16 and MH20 over the course of the study period.

6.3 STREAM SEDIMENTS

Stream sediment monitoring has continued according to water license specifications, every two years since 1992. The reader is referred to the following reports for a detailed discussion of the stream sediment investigations since 2000:

- *Environmental Monitoring at False Canyon Creek, 2000.* Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2000).
- *Environmental Monitoring at False Canyon Creek, 2002.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2002).
- *Environmental Monitoring at False Canyon Creek, 2004.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2004).

- *Environmental Monitoring at False Canyon Creek, 2006.* Prepared for Sä Dena Hes Operating Corporation. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2006).
- *Environmental Monitoring at False Canyon Creek, 2008.* Prepared for Sä Dena Hes Operating Corporation, Teck Cominco Ltd. (Laberge Environmental Services and Can-Nic-A-Nick Environmental. 2008).

Updated results from the stream sediment monitoring studies are summarized below.

Baseline stream sediment samples were collected by Environmental Protection Services (EP) in 1988 and 1990 (EPS, 1994). Stream sediment samples have been collected concurrently during the biological monitoring program as described in the water licence, every two years since 1992. In 1998 assessments were also conducted on North Creek upstream and downstream of the North Creek dike. Sediment data have been summarized and are presented in Table 6-3. Stream sediment sample locations are shown in Figure 6-1.

High levels of lead and zinc were found in the 1988 samples collected by EP from a site identified as "headwaters of False Canyon Creek" at 60°32'N by 128°57'W. This site may lie within the vicinity of the ore body. No corresponding licence station exists at this location and samples were only collected in 1988.

Table 6-3 Summary of Metals in Stream Sediments at Sä Dena Hes

Comparison of Metals (ug/g) in Sediments over the Study Period						
Site	**Year**	**Arsenic**	**Copper**	**Cadmium**	**Lead**	**Zinc**
MH - 13	1992	**17.0**	21.7	**1.2**	**65**	**256**
	1994	**11.5**	22.8	**1.5**	**47**	**216**
	1996	**12.0**	19.2	**1.7**	27	**160**
	1998	**14.0**	20.7	**1.2**	**37**	**174**
	2000	**17.3**	24.1	**2.1**	**71**	**266**
	2002	**8.1**	17.8	**1.2**	24	**148**
	2004	**9.6**	23.5	**1.3**	30	**185**
	2006	**18.2**	23.9	**2.4**	**38**	**224**
	2008	**12.8**	22.0	**1.9**	**48**	**226**
MH - 16	1998	<8	9.2	0.4	8	72
	2000	**11.3**	9.8	0.4	8	80
	2002	**6.0**	13.0	**0.8**	11	90
	2004	**7.8**	17.5	**1.0**	13	118
	2006	**8.4**	14.6	**0.8**	11	96
	2008	5.9	13.8	**0.8**	11	95
MH - 20	1992	**13.0**	22.1	<0.1	15	78
	1994	<10	20.6	0.5	9	70
	1996	**9.0**	16.6	**1.5**	9	69
	1998	**10.0**	18.7	0.3	11	74
	2000	**7.3**	23.0	0.3	13	88
	2002	4.6	16.9	0.3	8	57
	2004	**6.1**	22.9	0.4	10	78
	2006	**6.0**	18.0	0.3	8	66
	2008	5.8	21.2	0.4	10	75

Note: Values in bold indicate that the ISQG has been exceeded.
Values that have been shaded indicate that the PEL has been exceeded.

Sediment results were compared to data collected in previous studies in the previously mentioned annual reports. Arsenic concentrations have consistently surpassed the Interim Sediment Quality Guideline (ISQG) and have approached or exceeded the Probable Effects Level (PEL) at MH13. Concentrations at MH13 have ranged between 17.3 mg/L to 8.1 mg/L since 1990 with the lowest concentrations being measured in the last two monitoring events. The concentrations do not appear to have impacted the aquatic communities.

Copper levels remain well below the ISQG, which has been changed since 2000. As the copper ISQG was raised from 22.7 to 35.9, this is not a significant issue with respect to sediment copper concentrations. Concentrations were very similar at MH13 and downstream at MH20. Levels at MH16, located between these two sites, were significantly lower, but appear to be increasing over time.

Cadmium, lead and zinc concentrations were significantly higher in the sediments at MH13 than downstream at MH16 and MH20. The ISQG for these metals was usually exceeded at MH13, but concentrations were near or below the ISQLG at MH16 and MH20. There appears to be a slight increase in the concentrations of these three metals in the sediments at MH16 over recent years.

In general, the concentrations of the various metals have remained relatively consistent in the sediments at MH20. Concentrations tended to fluctuate more widely in the sediments at MH13 and show signs of gradually increasing in the sediments at MH16.

7.0 CURRENT LAND USE AND TENURE

This section addresses other projects or activities within the general Sä Dena Hes Mine project area both currently and from recent history. Land use in the area surrounding the Sä Dena Hes Mine property was addressed in the IEE for the project (SRK, 1990). The IEE should be referred to for a detailed discussion of the results of those investigations. Table 7-1 provides a summary of current and historical projects/activities within this area. The information was obtained from a number of government agencies and boards responsible for the issuance of various permit authorizations. Mineral and land tenure resource maps were also obtained from the DIAND Mining Recorder and DIAND Land Resources.

There have been several activities in the area, most of which have been focused around the Robert Campbell Highway. Yukon Territorial Government and Federal Government departments have also historically conducted various activities within the highway right-of-way, such as right of clearing, maintenance, and geotechnical investigations. There are a few privately held lots along the highway and various First Nation site specific and settlement land claims within the general vicinity of the property area. In addition to the mineral claims held by the Sä Dena Hes Operating Corporation, there are a number of mineral claims held within the area by various parties. Various trapping concessions are held in the project area and actively trapped. Currently trapping and hunting are the primary activities in the project area. Much of the hunting is conducted from the roadways. Various trapping concessions are held in the project area and are summarized in Table 7-1.

The importance of cultural resources such as recreational, traditional, and special uses of land, including hunting and trapping are addressed in the following section. Implementation of closure measures are not expected to interfere with other current land uses in the area.

Table 7-1 List of Previous and Current Activities in the Project Area

Activity Type	Permit Licence Holder	Comments
MAP SHEET 105 A/6		
MINERAL TENURE		
MC Lots. 1-21	Glimmer Resources	Mineral claims designated GMS (expire 01/08/11)
MC Lots. 1-21	Minfocus International Inc.	Mineral claims designated BOMB (expire 99/10/10)
MC Lots 1-32	Pacific Bay Minerals	Mineral claims designated CAM (expire 02/02/26)
MC Lots 13-1583 (various)	Cominco	Mineral claims designated HOLMES (expire 01/12/15)
MC Lots 1-144	McCrory Holdings Ltd.	Mineral claims designated EAGLE (expire 05/08/24)
WATER USE		
LAND USE/Mineral LAND USE		
YA3W436 (expired 96/04/30)	Kaska Forest Resources	Activities related to forestry THA Liard Block
YA5Q925 (closed 97/09/13)	YTG - CTS	Blanket maintenance km 10-50.5 Robert Campbell Hwy.
YA6S187	YTG - CTS - Transportation and Engineering	Geotechnical investigations at various locations between km 55-232 Robert Campbell Hwy.
YA6E255 (closed 98/04/21)	YTG - CTS	Right of Way clearing km 55-232 Robert Campbell Hwy.
YA6S260 (expired 99/01/31)	YTG - CTS - Transportation and Engineering	Geotechnical investigations at various locations between km 34-222 Robert Campbell Hwy.
YA7N301 (closed 98/04/30)	Geological Survey of Canada - Dr. Isa Asudeh	Seismic geological investigations
YA7X296 (closed)	Ivan Johnson	Establish a portable sawmill on the site within a timber operating unit, in the vicinity of km 43 Robert Campbell Hwy.
OTHER		
S-67, S-68, S-168, S-265, S-79	Liard First Nation	Site Specific Lands
Various Trapping Concessions continued from other map sheets (see below)		

Activity Type	Permit Licence Holder	Comments
MAP SHEET 105 A/10		
MINERAL TENURE		
MC Lots 42-46	Sä Dena Hes Operating Corp.	Mineral claims designated JEWEL (expire 99/08/24)
MC Lots 120-308	Sä Dena Hes Operating Corp.	Mineral claims designated HUN (expire 09/03/01)
MC Lots 329-422	Sä Dena Hes Operating Corp.	Mineral claims designated HUN (expire 02/09/06)
MC Lots 1-8	Sä Dena Hes Operating Corp.	Mineral claims designated HAWK (expire 03/08/24)
MC Lots 1-78	Sä Dena Hes Operating Corp.	Mineral claims designated CIMA (expire 09/03/01)
MC Lots 1-12, 40, 41	Sä Dena Hes Operating Corp.	Mineral claims designated MICA (expire 09/03/01)
MC Lots 1-22	Sä Dena Hes Operating Corp.	Mineral claims designated THUNDER (expire 03/08/24)
MC Lots 1-10, 19, 20	Alex Black	Mineral claims designated ECHO (expire 99/10/05)
WATER USE		
IN90-002	Mount Hundere Joint Venture	Original water licence for project was to expire 00/09/15. Licence was amended QZ97-025 by new owner Sä Dena Hes Operating Corp.
QZ97-025	Sä Dena Hes Operating Corp.	
MS97-091 (expires 04/12/31)	Sä Dena Hes Operating Corp.	Type B Water Licence To construct a runoff catchment berm, at km 15.5 of main mine access road
Other		
S-219	Liard First Nation	Site Specific Land
R-15	Liard First Nation	Settlement Land
Registered Trapping Concession #356	Jim Stewart/Andy Szabo	Trapping Concession
MAP SHEET 105 A/07		
MINERAL TENURE		
MC Lots 1-144 (various active)	Sä Dena Hes Operating Corp.	Mineral claims designated GMN (expire 05/10/26)
LAND USE/Mineral LAND USE		
Tom Creek Lookout Site	DIAND - Fire Management	Lookout tower and cabin designated YFS 001
OTHER		
R-15	Liard First Nation	Settlement Lands
Registered Trapping Concession #358	Leo Stewart	Trapping concession
Registered Trapping Concession #359	Alice Brodhagen	Trapping concession

8.0 CULTURAL RESOURCES

The cultural resources of the study area have been previously examined as part of the IEE (SRK, 1990). The results of the Heritage Resource Overview found that the archaeological potential of the study area is low and no zones of high or even moderate potential are encroached by the development. However it is noted in the study recommendations that the area is relatively unknown in terms of heritage resource site distribution and recommends an awareness of the potential for discovery. The reader is referred to Appendix B of Volume III (Socio-economic Evaluation) of the IEE (SRK, 1990) which provides a more complete description of the heritage resource value of the region.

An evaluation in 1990 of current use of the Mount Hundere area by Liard First Nation residents found that primary use of the area was for hunting, fishing, and trapping. No spiritual or special places were identified. The study hypothesized that the impact of the project would not necessarily come from the mine itself, but rather the increased pressure of hunting from both natives and non-natives along the access road. For a more comprehensive description the reader is referred to the aforementioned IEE Volume III Appendix C (SRK, 1990).

Trapping and hunting continue to be the primary activities in the project area. There are several active trapping concessions in the area and the opportunity for hunting access via the Robert Campbell Highway is readily available. The project area is generally part of the Liard First Nation's traditional territory and continues to provide for First Nation's and other subsistence users. Resource usage is expected to continue at existing levels for trapping, hunting, recreational, and subsistence use.

9.0 AIR QUALITY

Past and current air quality for the project area is good. A small fleet of diesel equipment will be in use at the mine and exhaust emissions from the combustion of fossil fuels are mitigated following standard industrial procedures for emission control. Experience operating an underground mine fosters an acute awareness of exhaust emissions. Appropriate control measures are employed to control fugitive dust at the mill site, load-out, mining operations, and from road use.

10.0 STABILITY ANALYSIS

Since the submission of the 2000 DDRP, a Dam Safety Review has been conducted. This review did not identify any stability concerns, however it did recommend that detailed stability calculations be conducted for the Reclaim Dam in its current configuration and piezometric condition. The details of these calculations are presented in the 2005 Geotechnical Inspection Report.

10.1 INTRODUCTION

The following Tailings Management Facility closure scenarios are presented in the Sä Dena Hes closure plan:

Scenario 1: Close the tailings impoundment based on the current volume and distribution of tailings within the facility (Figure 10-1); or

Scenario 2: Deposit an additional 1.8 million tonnes of tailings into the impoundment over a period of 4 years (Figure 10-2).

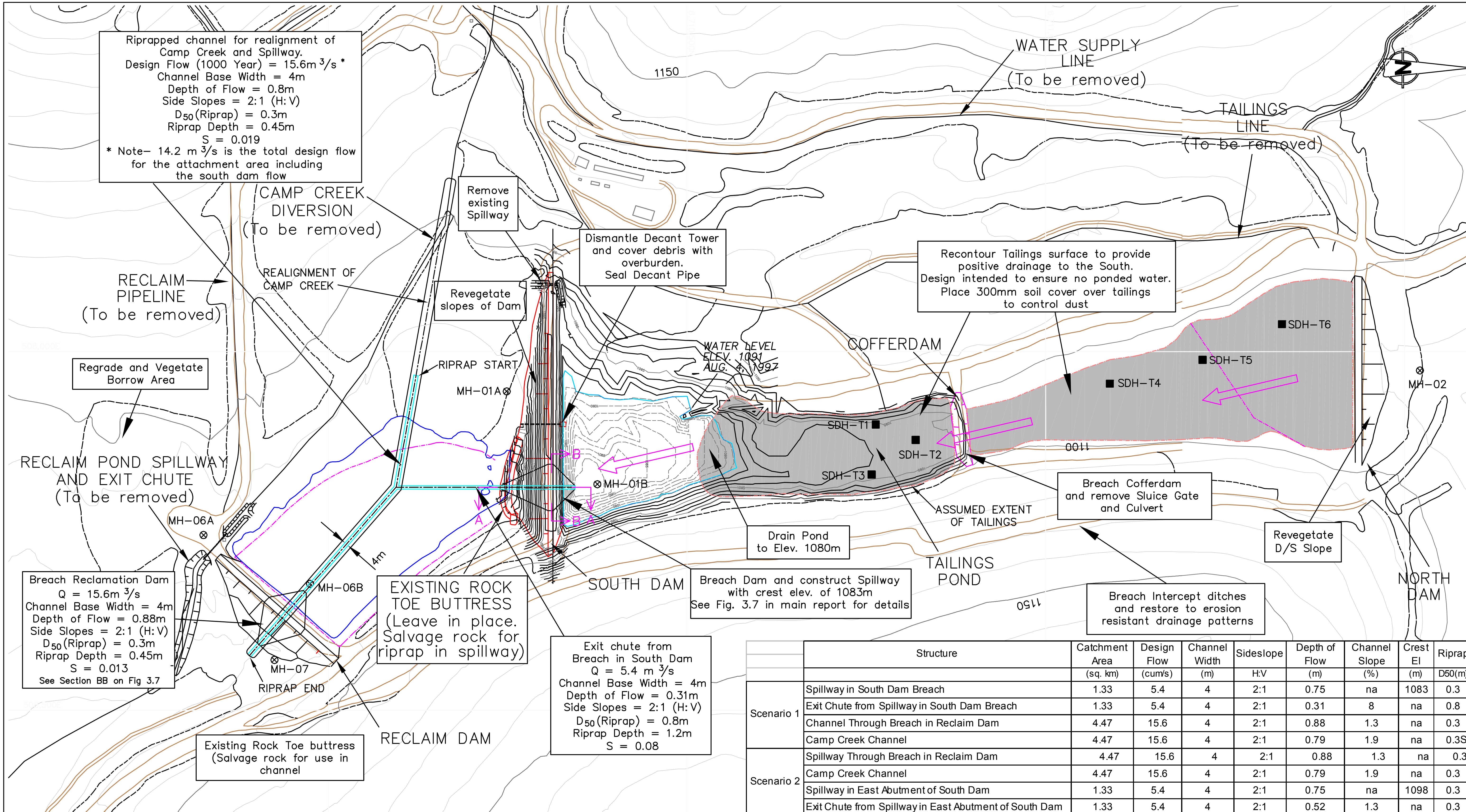
This section discusses the physical stability of the dams at the tailings impoundment in the context of these two closure scenarios.

10.2 GENERAL DESCRIPTION OF THE TAILINGS IMPOUNDMENT

The tailings impoundment occupies a north-south valley segment with an earthfill dam at either end (the North and South Dams, as shown in Figure 10-1). The area between the North and South Dams is about 1100 m long and up to 350 m wide. The small earthfill cofferdam approximately midway between the two dams coincides with the catchment line that separates drainage to the north and south of the impoundment.

The North Dam has a current crest elevation of 1098 m and is about 12 m high. The South Dam currently has a crest elevation of 1096 m and is about 16 m high.

The area of the impoundment is approximately 21 hectares. The total impoundment catchment is 134 hectares.



	Structure	Catchment Area	Design Flow	Channel Width	Sideslope	Depth of Flow	Channel Slope	Crest El	Riprap
		(sq. km)	(cum/s)	(m)	H:V	(m)	(%)	(m)	D50(m)
Scenario 1	Spillway in South Dam Breach	1.33	5.4	4	2:1	0.75	na	1083	0.3
	Exit Chute from Spillway in South Dam Breach	1.33	5.4	4	2:1	0.31	8	na	0.8
	Channel Through Breach in Reclaim Dam	4.47	15.6	4	2:1	0.88	1.3	na	0.3
	Camp Creek Channel	4.47	15.6	4	2:1	0.79	1.9	na	0.3S
Scenario 2	Spillway Through Breach in Reclaim Dam	4.47	15.6	4	2:1	0.88	1.3	na	0.3
	Camp Creek Channel	4.47	15.6	4	2:1	0.79	1.9	na	0.3
	Spillway in East Abutment of South Dam	1.33	5.4	4	2:1	0.75	na	1098	0.3
	Exit Chute from Spillway in East Abutment of South Dam	1.33	5.4	4	2:1	0.52	1.3	na	0.3

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LEGEND

⊗ WATER MONITORING STATION

■ TAILINGS SAMPLE

SURFACE DRAINAGE

0 50 100 150 200 250

1: 5, 000

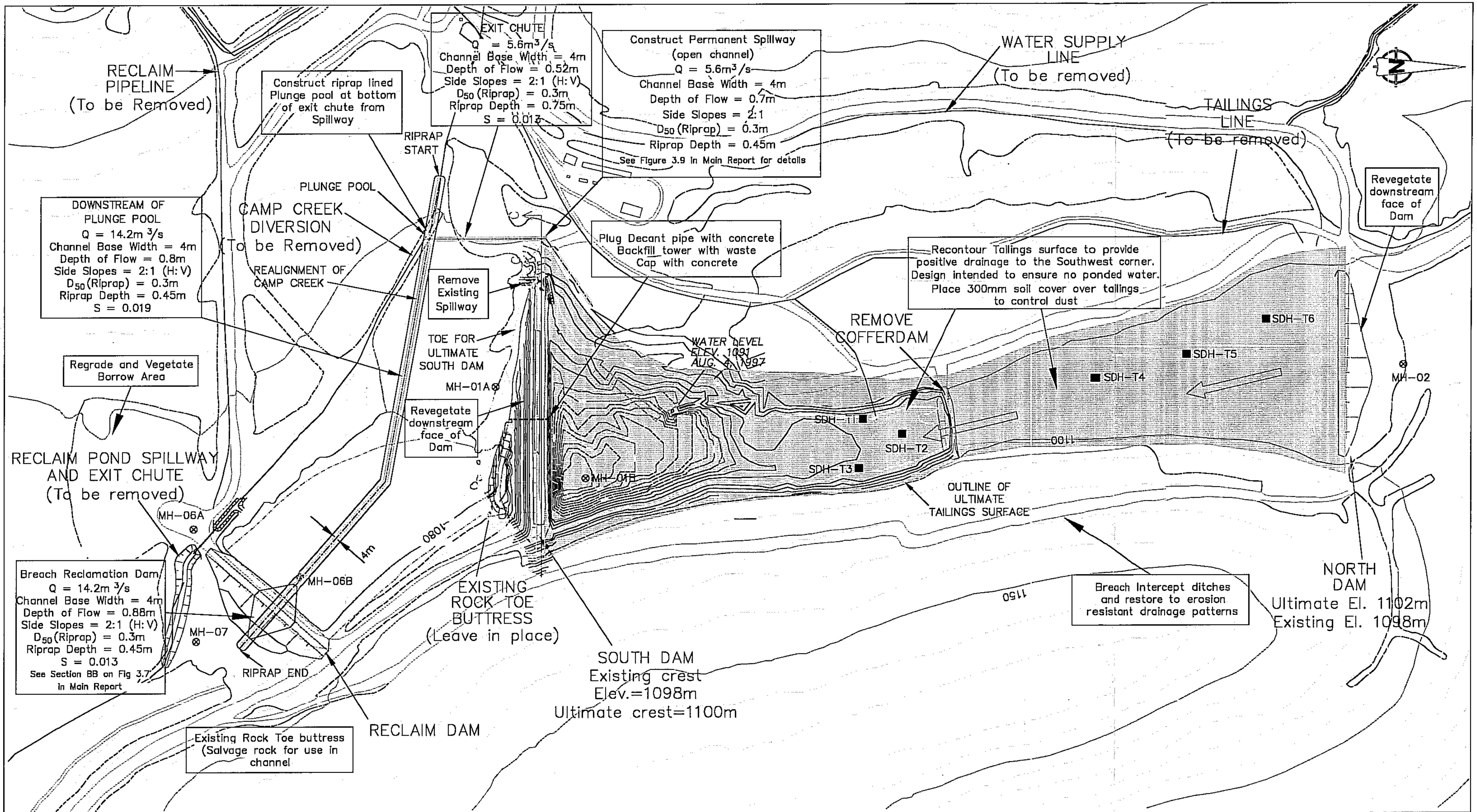
CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

TMF CLOSURE MEASURES SCENARIO 1

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO. 10-1	REV.
DATE: January 2010	PROJ. NO. 1CC005.05		



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LEGEND

⊗ WATER MONITORING STATION
■ TAILINGS SAMPLE
⇦ SURFACE DRAINAGE

0 50 100 150 200 250 metres
1:5,000
CONTOUR INTERVAL=10m

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN ADJUSTED FROM NAD 1927

SA DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

TMF CLOSURE MEASURES SCENARIO 2

DRAWN BY: MH	CHECKED BY: PMH	FIGURE NO. 10.2	REV.
DATE: AUGUST 4,1999	PROJ. NO. 1CC005.05		

10.3 CLOSURE SCENARIO 1

10.3.1 General

With Scenario 1, the North Dam will remain at its current elevation and the South Dam will be breached (Figure 10-1). The invert elevation of the breach will be established so as to prevent the escape of tailings and to eliminate or, at least, minimize the impoundment of water.

For Scenario 1, the stability of the North Dam requires evaluation as a closure issue, while that of the South Dam does not.

10.3.2 North Dam Configuration

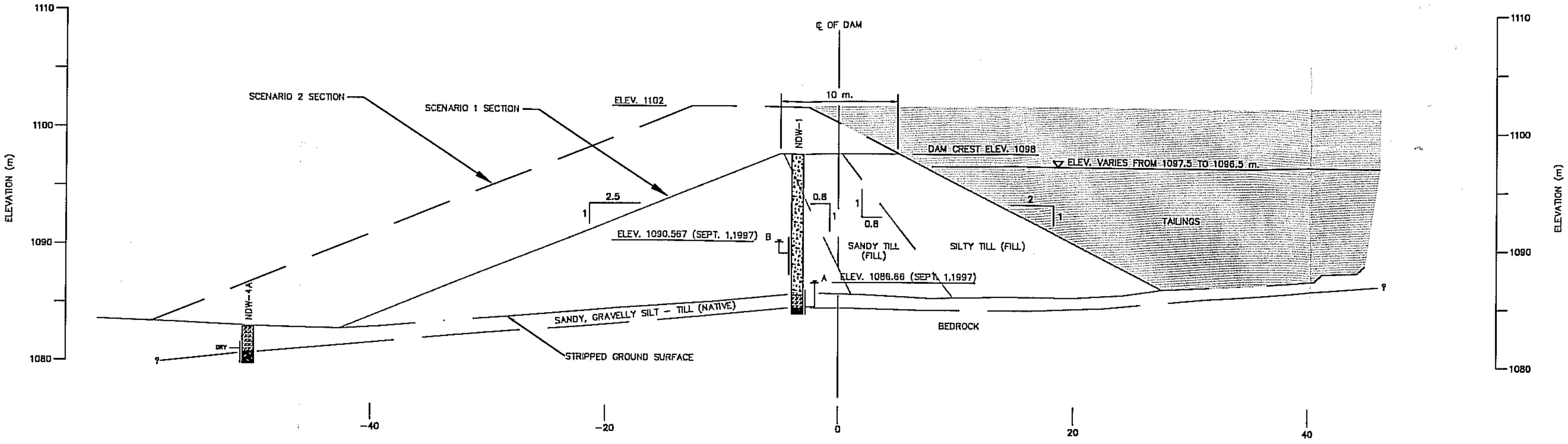
The current crest elevation of the North Dam is 1098 m, which corresponds to a dam height of 12 m relative to the downstream toe (Figure 10-3 and Figure 10-4). It has an upstream slope of 2H:1V (horizontal:vertical) and a downstream slope of 2.5H:1V. In cross-section, the dam consists of three zones: an upstream silty till zone, a central sandy till filter zone and a sand/gravel downstream zone.

10.3.3 Foundation Conditions at the North Dam

The thin cover of organic soils present at the site of the North Dam was removed during initial construction. Foundation conditions, therefore, consist of about 1 to 4 m of till, which grades from a gravelly, silty sand to a sandy, gravelly silt overlying shale bedrock (Figure 10-4).

10.3.4 North Dam Performance

The North Dam was constructed during October and November 1990. Sand boils were observed emanating from the area immediately downstream of the dam in 1991, as water was stored behind the dam in preparation for plant startup. However, tailings were subsequently deposited against the North Dam and the sand boil activity gradually diminished, with no recent evidence of any fines in the seepage.



NDW-1B			
DATE	T.O.P.	READING	ELEV.
SEPT. 1, 1997	1098.572	8.005	1090.567

KEY

- SANDY TILL (FILL)
- SILTY TILL (FILL)
- SAND & GRAVEL (FILL)
- SILTY SAND (TILL)
- GRAVELLY SILTY SAND (TILL)
- SAND & GRAVEL (NATIVE)
- BEDROCK
- PIEZOMETERIC HEAD FOR FILTER ZONE INDICATED

0 4 8 12 16 20 Metres

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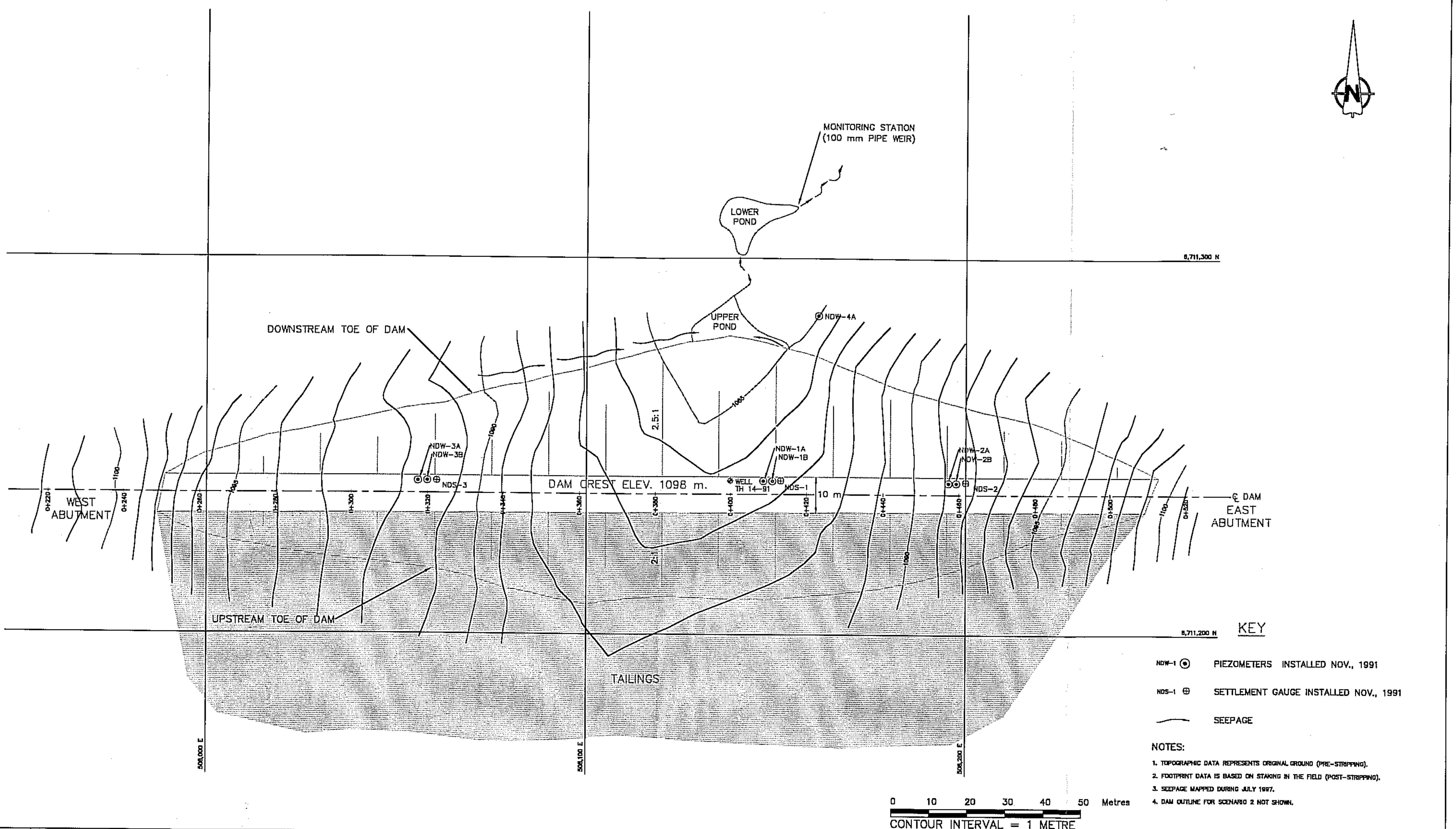
Sä DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

NORTH DAM – SECTION 0+400

DRAWN BY: MH	CHECKED BY: CCS	FIGURE NO. 10-4	REV.
DATE: AUG. 6,1999	PROJ. NO. 1CC005.05		



NOTES:

1. TOPOGRAPHIC DATA REPRESENTS ORIGINAL GROUND (PRE-STRIPPING).
2. FOOTPRINT DATA IS BASED ON STAKING IN THE FIELD (POST-STRIPPING).
3. SEEPAGE MAPPED DURING JULY 1997.
4. DAM OUTLINE FOR SCENARIO 2 NOT SHOWN.

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Sä DENA HES DETAILED DECOMMISSIONING AND RECLAMATION PLAN

NORTH DAM
PLAN VIEW OF EXISTING STRUCTURE

DRAWN BY: MH	CHECKED BY: CCS	FIGURE NO.	REV.
DATE: AUG. 6,1999	PROJ. NO. 1CC005.05	10–3	

Since shutdown, seepage has been observed along the toe of the dam (see Appendix B, Section 3.2). However, most of this seepage originates from groundwater discharge from the hillsides on either side of the valley.

Aside from relatively minor concerns with previous foundation seepage and sand boil activity, the North Dam has experienced no physical stability problems.

10.3.5 North Dam Stability Analysis

As part of the original dam design studies completed in 1990 for the Initial Environmental Evaluation (SRK, 1990), stability analyses were completed using a limit equilibrium slope stability program, PC-SLOPE. The original analyses were done for the South Dam only because it was higher than the North Dam and had a thicker sequence of foundation soils than the North Dam. Therefore, the safety factors computed for the South Dam were expected to be equal to or lower than for the North Dam. The 1990 results are shown in Table 10-1.

Table 10-1 Factor of Safety Results from Original 1990 Design Analyses

Conditions at the South Dam*	**Computed Factor of Safety**	
	Static Loading	**Pseudo-static Loading (a_{max} =0.069g)**
Starter dam, end-of-construction	1.4	
Final dam, long term	1.7	1.4

*Factor of safety at the North Dam will be greater than or equal to that of the South Dam.

The pseudo-static method was used to evaluate dam stability during an earthquake. This method is considered appropriate where neither liquefaction nor major pore pressure buildup is anticipated, which is the case for the dams at Sä Dena Hes. The horizontal acceleration used in the pseudo-static analyses was 0.069g. This value was based on the peak horizontal acceleration for the 1:475 year seismic event, 0.055g, multiplied by an amplification factor, 1.25, that accounts for possible amplification of the seismic wave through the foundation soils. A value of 1.25 is conservative for the conditions at the tailings impoundment.

The current factor of safety for the North Dam has been determined using the computer program, SLOPE/W, recent piezometric data and the 1:1000-year seismic event. The results are summarized in Table 10-2 and in Figure 10-5.

Table 10-2 Current Factors of Safety, Scenario 1, North Dam

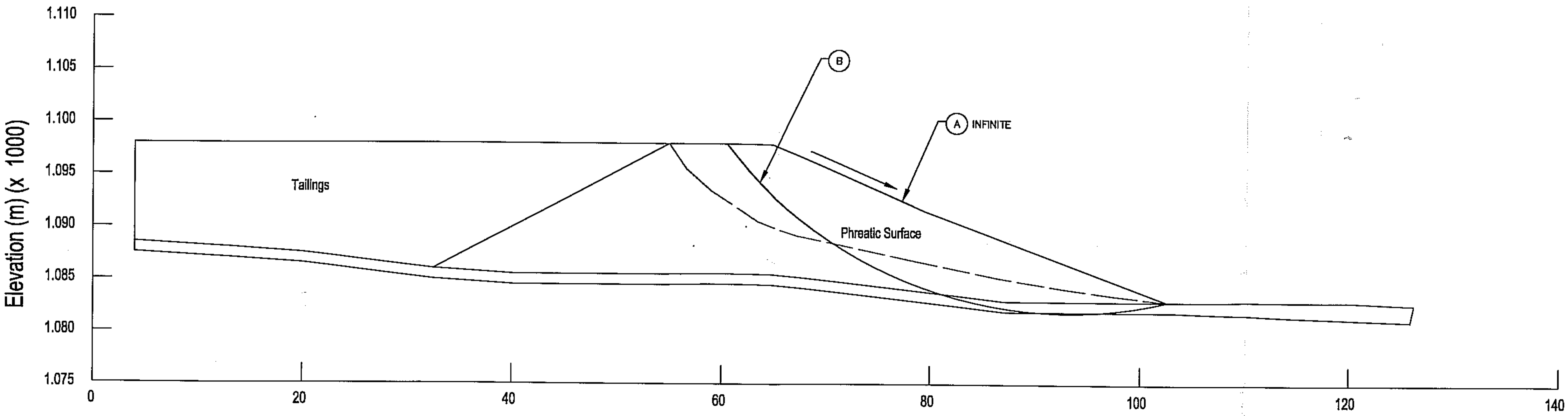
Failure Surface	**Description**	**Factors of Safety (1:1000yr seismic event)**	
		Static	Psuedo-Static (a_{max}=0.089g)
1	Slope Face	1.63	1.28
2	Deep	1.83	1.43

In the long term, the phreatic level in the tailings that abut the North Dam will be at or below the cofferdam that separates the drainage catchments for the North and South Dams (i.e. elevation 1098, or less). Piezometric conditions are not likely to be as severe as they have been previously and may well be similar to what they are presently. The safety factors shown in Table 10-2 and Figure 10-5 are, therefore, conservative representations of the long-term conditions at the North Dam.

The peak acceleration used in the analysis was 0.089 g, which corresponds to the 1:1000 year seismic event 0.071g, times as amplification factor of 1.25 to account for the foundation sediments. As failure of the tailings dams does not pose a significant risk to public health and safety after closure, the minimum return period of 1000 years as specified in the water license was adopted in calculating the factors of safety. This is based on the following factors:

- The levels of contaminants are low.
- There is no potential for acid generation.
- The surface area of the impoundment is less than 50 ha.
- After closure there is very low risk to public safety.

This is consistent with the guidelines recommended in the publication "Mine Reclamation in the Northwest Territories and the Yukon", Indian and Northern Affairs Canada (INAC, 1992).



Material Properties Assumed in Stability Analysis				
Layer	Description	Unit Weight (kN/m^3)	Effective Angle of Friction (?)	Effective Cohesion C' (kPa)
A	Tailings	18.0	25	0
B	Sand & Gravel	20.6	33	0
C	Sandy, Gravelly Silt - Till	20.6	35	0
D	Bedrock	19.5	45	0

Failure Surface	Description	Factors of Safety	
		Static	Pseudo-Static (a_{max}=0.089g)
1	Slope Face	1.63	1.28
2	Deep	1.83	1.43

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Sä DENA HES DETAILED
DECOMMISSIONING AND RECLAMATION PLAN

NORTH DAM
STABILITY ANALYSIS

DRAWN BY:	CHECKED BY:	FIGURE NO.	REV.
MH	CCS	10–5	
DATE: AUG. 9,1999	PROJ. NO. 1CC005.05		

10.4 CLOSURE SCENARIO 2

10.4.1 General

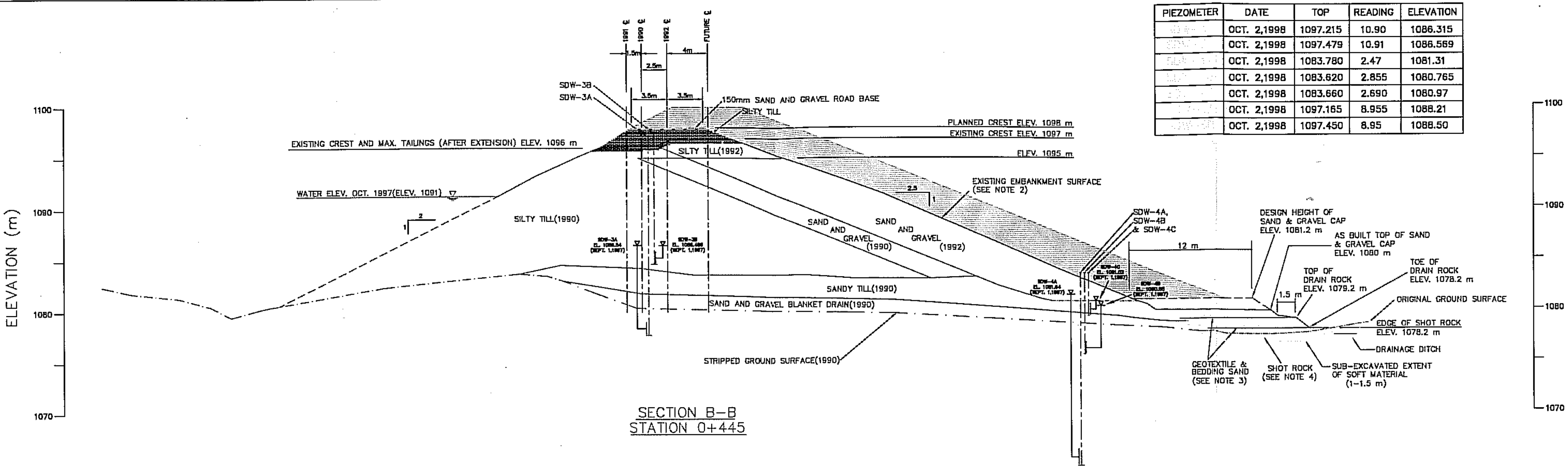
Scenario 2 calls for a 4-m raise to the North Dam (Ultimate crest EL.1102 and a 4-m raise to the South Dam (Ultimate crest EL.1100). The tailings will be deposited such that at closure, the pond will be near the west abutment of the South Dam. The invert of the permanent spillway at closure will be established at an elevation that prevents erosion of the tailings, but minimizes the depth of water which ponds on the surface of the impoundments (Figure 10-2.

With Scenario 2, the stability of both the North and South Dams must be considered. However, with a 4-m raise of the North Dam, the critical failure surface would be along the downstream slope and therefore, the safety factors at closure are expected to be similar to the values in Table 10-2. Comparatively more severe conditions will coincide with the South Dam as a result of its greater height, thicker foundation sediments and the relatively close proximity of the small residual pond. For these reasons, the stability analyses associated with Scenario 2 address only the South Dam.

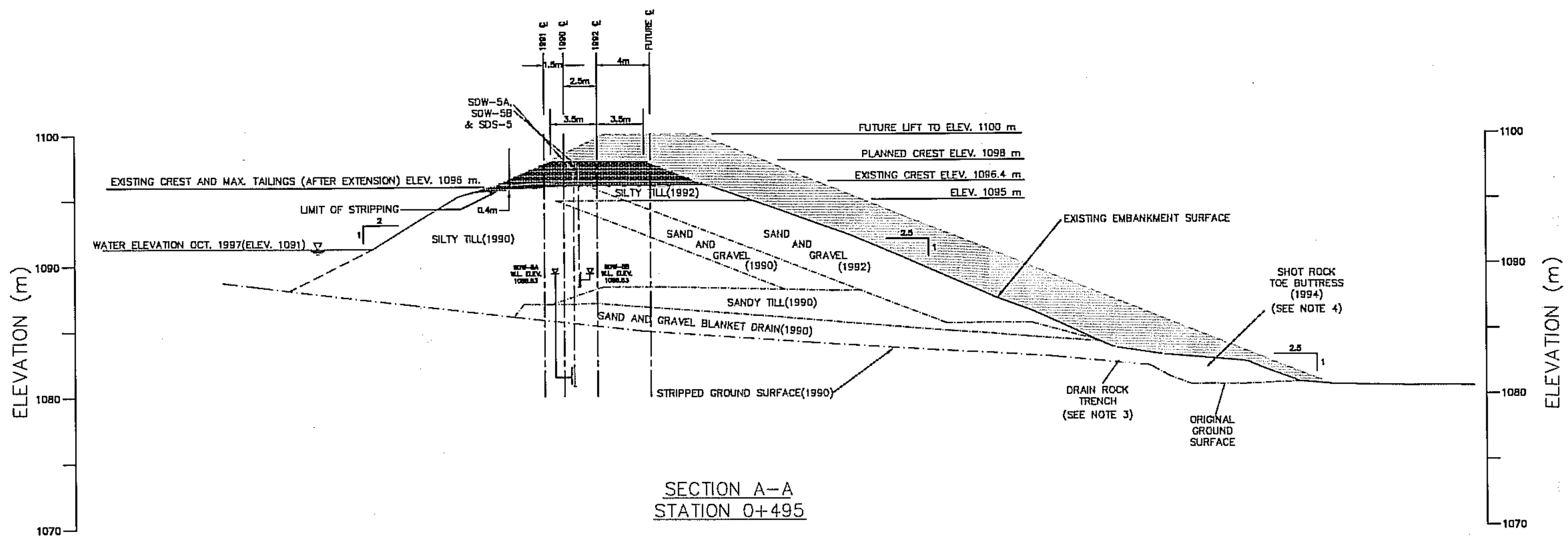
10.4.2 South Dam Configuration

The South Dam has a current crest elevation of 1096 to 1097 m, which corresponds to a dam height between 17 and 18 m (Figure 10-6 and Figure 10-7). Further operation would require the dam be raised to elevation 1100 m or a height of 21 m. Its configuration is similar to the North Dam, with a 2H:1V upstream slope, and a 2.5H:1V downstream slope. However, unlike the North Dam, a small stabilizing rock buttress is present at the toe of the South Dam. Two zones grading from upstream silty till through a downstream sandy till make up the dam section, along with a sandy gravel blanket drain. The buttress is comprised of a 1m thick layer of drainrock capped with 2 metres of sand and gravel.

PIEZOMETER	DATE	TOP	READING	ELEVATION
[illegible]	OCT. 2,1998	1097.215	10.90	1086.315
[illegible]	OCT. 2,1998	1097.479	10.91	1086.569
[illegible]	OCT. 2,1998	1083.780	2.47	1081.31
[illegible]	OCT. 2,1998	1083.620	2.855	1080.765
[illegible]	OCT. 2,1998	1083.660	2.690	1080.97
[illegible]	OCT. 2,1998	1097.165	8.955	1088.21
[illegible]	OCT. 2,1998	1097.450	8.95	1088.50



SECTION B–B
STATION 0+445



SECTION A–A
STATION 0+495

LEGEND

EXTENSION OF DAM

EXISTING DAM

NOTES
1. STRIPPED GROUND SURFACE AND EXISTING DAM ZONES FROM Y.E.S. AS-BUILT DRAWINGS, JULY 1991.
2. EXISTING DAM SURFACE FROM SURVEY COMPLETED AUGUST 1997.
3. DRAIN ROCK FILTER CRITERIA – 5mm $< D_{15} <$ 25mm
   0.3m THICK BEDDING LAYER OF PIT RUN SAND AND GRAVEL OVER SHOT ROCK PLATFORM.
4. SHOT ROCK CONSISTS OF BLASTED LIMESTONE FROM JEWELBOX PIT.

0 5 10 15 20 25 METRES

SCALE – 1:400

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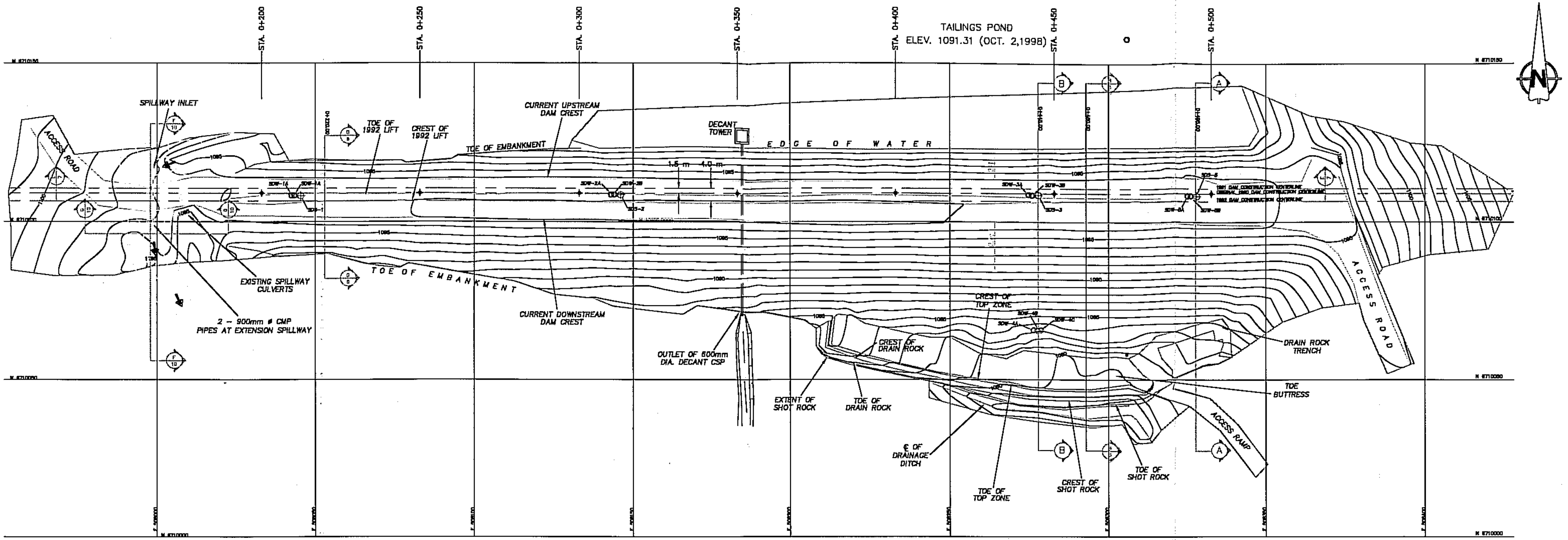
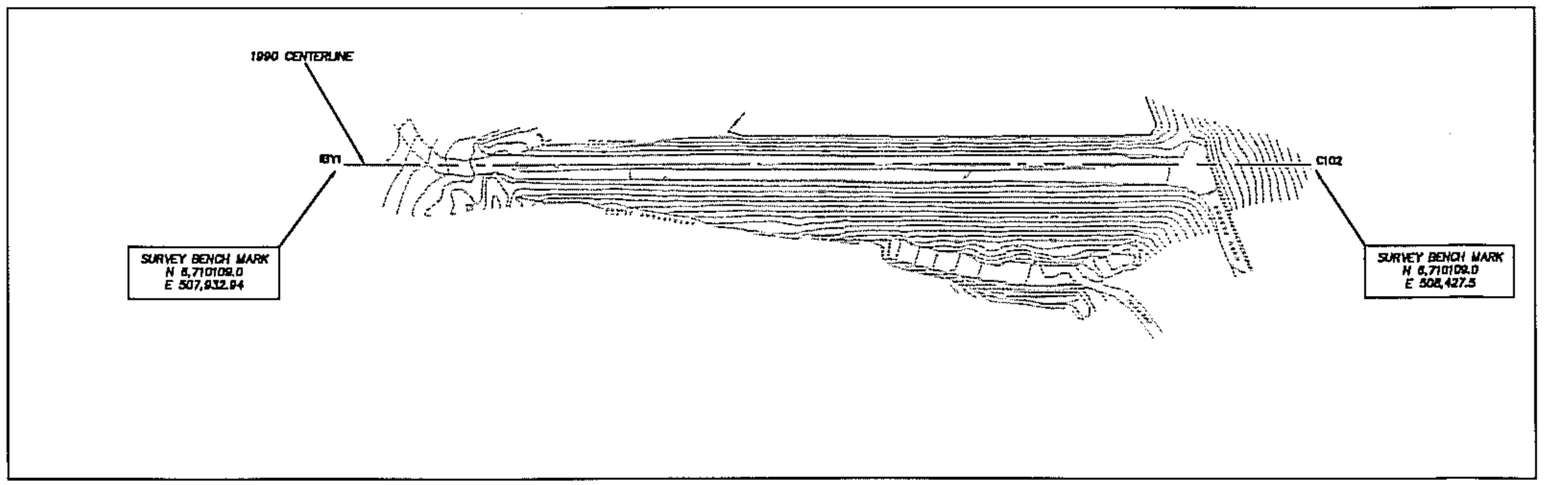
SECTION 0+445 & 0+495 SOUTH DAM

DRAWN BY: MH	CHECKED BY: CCS	FIGURE NO.	REV.
DATE: AUG. 6,1999	PROJ. NO. 1CC005.05	10–7	





LEGEND

SDW–1A	PIEZOMETERS
SDS–1	SETTLEMENT GAUGES

NOTES : 1. SURVEY DATA PROVIDED BY YUKON ENGINEERING SERVICES LTD., OCT. 1997
2. DIMENSIONS IN METRES
3. GRID IS UTM

0 62.5 125 187.5 250 312.5metres
SCALE 1:1250

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DECOMMISSIONING AND RECLAMATION PLAN

SOUTH DAM
PLAN VIEW OF EXISTING STRUCTURE

DRAWN BY:	CHECKED BY:	FIGURE NO.	REV.
MH	CCS	10–6	
DATE: AUG. 6,1999	PROJ. NO. 1CC005.05		

10.4.3 Foundation Conditions at the South Dam

Following removal of the organic soils during dam construction, the foundation conditions at the site of the South Dam typically consist of gravelly, silty sand (till) overlying gravelly sand overlying till overlying bedrock. The total thickness of these deposits is often 4 to 8 m and the interlayer of gravelly sand is usually 1 to 2 m thick. In some areas, especially on the east side of the valley, the gravelly sand is either very thin or absent.

10.4.4 South Dam Performance

The major part of the South Dam was constructed over two construction seasons, in 1990 and 1991. Additional works consisting primarily of an additional lift to the dam crest and a toe buttress were constructed in 1997.

Seepage and sand boils were observed in the area downstream of the dam as water ponded behind the structure during the early stages of operation. In addition, seepage was observed near the east abutment and near the toe in the central portion of the dam.

Over the last five years, piezometric levels have been recorded in the South Dam at piezometers located both along the centreline of the dam and at the toe (Figure 10-6). The records indicate that although the levels in the dam fill are controlled reasonably well by the drainage blanket, elevated levels have been recorded in the piezometers at the toe of the dam (SDW-4A, 4B and 4C) and have demonstrated a sensitivity to water levels in the pond. The well tip of SDW-4A is located within deep gravel zones, which are believed to be hydraulically connected to the water stored in the pond upstream. Although piezometers SDW-4C and 4B are not as sensitive to the pond level as 4A, the levels indicated pore pressures in the drainage blanket and in the underlying shallow gravel zones.

In order to provide a greater safety factor against a rotational failure, Cominco constructed the existing toe buttress along the toe of the South Dam in the fall of 1997 and in the summer of 1998. Details of this work are presented in “Construction Report South Dam (SRK, 1992) and Toe Buttress (SRK, 1997)”.

10.4.5 North and South Dam Stability Analysis

The original stability results associated with the dam design studies are included in Section 10.3.5.

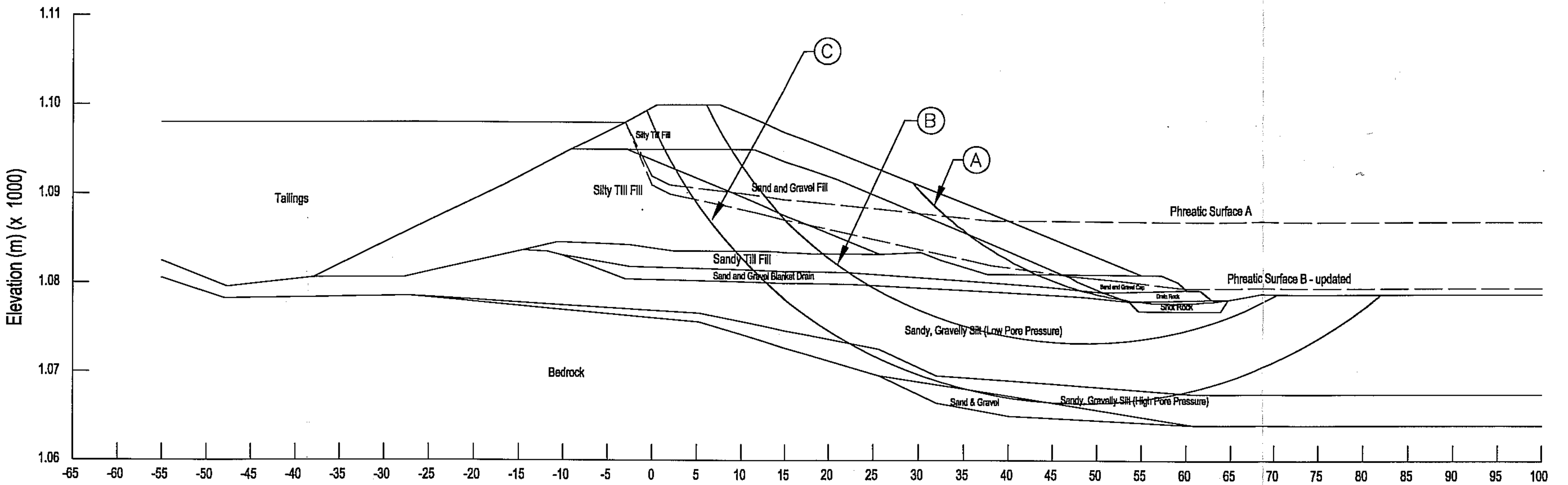
To the extent that the North Dam is raised 4 m, the impact on North Dam stability will be inconsequential as a result of the shallow bedrock foundation. The minimum factor of safety will coincide with that of a sliding failure at the slope face, and will be numerically the same as it was under Scenario 1.

In consideration of the 2-m raise of the South Dam associated with Scenario 2, the long-term stability has been analyzed using the computer program SLOPE/W. The results of these analyses are provided in Figure 10-8 and the following Table 10-3.

Table 10-3 FOS Results, Scenario 2, South Dam

Failure Surface	Description	Factors of Safety (1 in 1000 yr seismic event)	
		Static	Psuedo-Static (a_{max}=0.089g)
1	Shallow	1.59	1.24
2	Intermediate	1.71	1.36
3	Deep	1.83	1.39

The 1:1000 year event was used as the basis for the earthquake evaluation for the same reasons it was used at the North Dam (Section 10.3.5). Essentially, the potential impact to the environment and public health and safety are low.



Material Properties Assumed in Stability Analysis					
Layer	Description	Unit Weight (kN/m^3)	Effective Angle of Friction (?)	Effective Cohesion C' (kPa)	Phreatic Surface
A	Tailings	18.0	25	0	B
B	Silty Till	20.6	33	0	B
C	Sand & Gravel	20.6	33	0	B
D	Sandy Till	19.5	33	0	B
E	Sand & Gravel Blanket Drain	19.5	33	0	B
F	Sandy, Gravelly Silt (Low Pore Pressure)	22.0	35	0	B
G	Sandy, Gravelly Silt (High Pore Pressure)	22.0	35	0	A
H	Sand & Gravel	21.6	35	0	A
I	Bedrock	29.4	45	0	A
J	Sand & Gravel Cap	19.5	33	0	B
K	Drain Rock	19.5	35	0	B
L	Shot Rock	20.5	35	0	B

Failure Surface	Description	Factors of Safety	
		Static	Pseudo-Static (a_{max}=0.089g)
1	Shallow	1.59	1.24
2	Intermediate	1.71	1.36
3	Deep	1.83	1.39

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SOUTH DAM
STABILITY ANALYSIS

DRAWN BY:	MH	CHECKED BY:	CCS	FIGURE NO.	REV.
DATE:	AUG. 9,1999	PROJ. NO.	1CC005.05	10–8	

10.5 CONCLUSIONS AND RECOMMENDATIONS

10.5.1 Scenario 1

Under Scenario 1, the South Dam would be breached and only the North Dam would be left standing. The North Dam is classed as having a low environmental impact for purposes of closure design and there are no public safety concerns.

The historic performance of the North Dam and recent stability analyses indicate that its critical factor of safety corresponds to a sliding failure along its downstream slope. The long-term factors of safety against such a failure are 1.63 under static loading conditions and 1.28 under pseudo-static conditions corresponding to the 1:1000 year seismic event. These results exceed the minimum safety factors associated with conventional closure criteria. As a result, no additional activities are required for purposes of the North Dam slope stability.

10.5.2 Scenario 2

Under Scenario 2, the North and South Dams will be raised 4 metres. The potential impact of failure of these dams on the environmental and on public health and safety is low.

Even though the North dam would be raised, the critical factor of safety will correspond to a sliding failure along its downstream slope. As such, the minimum factor of safety at the North Da m is the same as for Scenario 1. The results exceed the minimum safety factors associated with conventional closure criteria and, therefore, no additional activities are required for purposes of the North Dam slope stability.

At the South Dam, the historic performance of the dam and recent stability analyses indicate that the critical factor of safety corresponds to a shallow circular failure near its downstream toe. The long-term factors of safety against such a failure are 1.59 under static loading conditions and 1.24 under pseudo-static conditions corresponding to the 1:1000 year event. These results exceed the minimum safety factors associated with conventional closure criteria. As a result, no additional activities are required at closure for purposes of the South Dam slope stability.

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JANUARY 2010 UPDATE

APPENDIX C – WATER QUALITY MONITORING DATA

Prepared by:

ACCESS CONSULTING GROUP

SRK Consulting Engineers and Scientists

MH-02 North Dam Seepage

	2004			2005							2006										
	6-Jan	7-Feb	2-Mar	21-Jun	12-Jul	10-Aug	13-Sep	11-Oct	17-Nov	10-Dec	10-Jan	5-Feb	10-Mar	21-May	13-Jun	5-Jul	14-Aug	15-Sep	15-Oct	1-Nov	16-Dec
Physical Properties																					
pH - Lab	8.2	8.2	8.1	8.2	8.2	8.1	8.1	8.2	8.1	7.9	7.8	8.1	8	8.3	8.3	8.3	8.2	8.2	8.1	8.2	7.9
pH - Field				7.7	7.62	7.37	7.8	7.8	7.41	7.3	7.43	7.52	7.16	7.86	7.63	7.83	7.67	7.76	7.46	7.13	6.64
Conductivity - Field (uS/cm)	380	384	392																		
Conductivity - Lab (uS/cm)				914	1010	1020	1000	1020	982	1140	1170	1180	1240	1020	1010	1060	1060	1020	1040	1050	1200
Total Suspended Solids (mg/L)	10	42	10	2	2	2	2	2	6	2	2	4	8	2	2	2	2	2	2	2	17
Total Dissolved Solids (mg/L)	224	220	224	666	738	758	726	750	706	850	960	886	930	750	746	796	786	770	762	736	896
Turbidity (NTU)				2.5	2.1	2.2	1.2	2.1	6.9	0.6	5.2	6.7	7.8	1.6	1.8	2.5	2.1	3	3.1	2.7	57.5
Turbidity - Field (NTU)					1090	1380	10.5	1070	1120	1210	1290	1230	1300	890	680	1030	900	910	970	990	940
Flow (L/min)				43	36	30.00	30.00	24.00	20.00	24.00	5.00	5	5.00		23.00	10.00	8.00	16.00	5.00	5.00	4.00
Temperature - Field (ºC)																					
Hardness (mg/L)	205	214	221	530	600	590	570	580	590	700	670	680	700	600	600	610	610	590	640	590	680
Anions (mg/L)																					
Alkalinity (CaCO3)	179	182	190	287	321	326	298	311	288	343	346	346	352	326	313	318	323	329	326	328	325
Alkalinity				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sulphate	25.2	26.9	26.3	249	277	273	290	279	277	326	341	406	383	274	303	302	331	309	273	292	369
Misc. Inorganics (mg/L)																					
Hydroxide (OH)				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)				0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Bicarbonate (HCO3)				350	392	398	363	379	352	418	422	423	430	398	382	388	394	401	398	400	397
Ammonia Nitrogen	0.0025	0.0025	0.0025	0.089	0.05	0.099	0.078	0.108	0.11	0.119	0.13	0.164	0.178	0.083	0.073	0.032	0.061	0.095	0.114	0.112	0.127
Nitrate-Nitrite				0.01	0.01	0.04	0.03	0.01	0.02	0.03	0.06	0.05	0.06	0.01	0.01	0.01	0.02	0.03	0.01	0.01	0.01
Cyanide (mg/L)																					
Cyanide - Total	0.0003	0.0009	0.0018	0.0019	0.0018	0.0013	0.001	0.0003	0.0006	0.0003	0.0012	0.0011	0.001	0.0016	0.0017	0.0013	0.001	0.0011	0.0012	0.0012	0.0008
Total Metals (ug/L)																					
Aluminum	340	1910	90	10	10	10	10	10	10	20	10	10	40	10	10	10	10	10	4	10	80
Antimony	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	0.5	25	25
Arsenic	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	2	25	25
Barium	56	78	50	96	108	103	95	88	90	98	108	115	123	110	113	105	101	99	96	86	145
Beryllium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Bismuth	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25	25
Boron	4	4	4	4	4	4	4	4	4	4	4	4	4	4	10	4	4	4	4	4	4
Cadmium	1	370	0.14	0.47	0.33	0.27	0.35	0.29	0.59	0.53	3.51	0.35	0.41	0.32	0.34	0.16	0.18	0.23	0.22	0.18	0.69
Chromium	2.5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.5	2.5	6
Cobalt	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.8	2.5	5
Copper	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.3	2.5	2.5
Iron	469	2480	110	475	385	351	359	435	1480	479	798	1300	1470	466	473	420	479	517	601	505	9210
Lead	50	28700	3.08	5.77	1.54	2.08	1	0.32	9.52	7.33	1.98	2.36	5.4	2.14	2.2	2.12	1.39	8.36	0.48	0.48	20.5
Lithium																			2		
Manganese	15	36	8	2380	2650	2510	2270	2530	2710	2090	2620	2900	3300	2600	2590	2910	2910	2820	3040	2490	7950
Mercury																			0.005		
Molybdenum	2.5	2.5	5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Nickel	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Phosphorus	50	100	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50
Selenium	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	0.5	15	15
Silicon				3970	4720	4870	4840	5020	5110	5730	5750	5620	5830	4780	4860	4360	5160	5180	5600	5190	4820
Silver	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	0.05	5	5
Strontium	237	251	258	601	709	675	660	653	635	778	757	773	794	670	685	745	700	683	690	648	705
Tellurium	25	25	25																		
Thallium	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	15	0.05	15	15
Tin	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Titanium	1.5	51	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Uranium				2.62	2.72	2.51	2.5	2.37	2.56	3.22	3.15	3.26	3.43	2.88	2.8	2.72	2.67	2.59	2.52	2.85	1.89
Vanadium	2.5	6	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc	52	71	19	104	80	88	116	114	149	228	147	140	147	82	81	63	67	80	99	88	168
Zirconium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total Metals (mg/L)																					
Calcium	69.9	71.9	75.4	184	205	201	195	201	202	244	232	235	240	209	209	208	208	203	219	202	235
Magnesium	7.35	8.3	7.91	17.5	20.6	20.9	19.9	20.1	19.9	22.9	22.9	23	23.6	18.6	18.7	22	21.7	20.7	21.8	20.3	23.3
Potassium	2	1	0.5	1	2	1	4	0.5	1	2	1	1	1	1	1	1	2	2	2	0.5	1
Sodium	1.01	1.01	1.07	14.6	18.1	18.8	16.4	14.9	15.2	17.1	17.5	17.4	17.3	14.4	14.4	17.8	18.6	15.8	16	14.7	13.9
Sulphur	8.4	8.8	9.3	80.6	90.8	88.1	91.1	90.8	93	112	108	117	124	94.6	96.8	102	99.8	95.6	97.4	91.8	123

	2007															2008				2009		
	17-Jan	18-Jan	19-Feb	26-Mar	27-Apr	21-May	19-Jun	19-Jun	19-Jul	12-Aug	15-Sep	21-Oct	14-Nov	15-Nov	3-Dec	3-Mar	2-Jul	15-Aug	23-Oct	18-Jan	13-Feb	18-Mar
Physical Properties																						
pH - Lab	7.9		8.1	8.1	7.9	8.1		8.1	8.2	8.1	8	8	8.1		7.9	8	8.2	8.2	8.2	8	8	8
pH - Field		7.21	7.55	7.47	7.19	7.34	7.59		8.07	7.66	7.35	7.84		7.21	7.79							
Conductivity - Field (uS/cm)																						
Conductivity - Lab (uS/cm)	1190		1210	1140	1230	526		869	960	961	920	970	1000		1100	1100	990	1000	990	1100	1200	1300
Total Suspended Solids (mg/L)	39		2	19	4	2		2	2	2	2	2	5		82	11	2	2	7	39	2	25
Total Dissolved Solids (mg/L)	910		904	840	932	364		676	698	710	710	730	760		790	850	730	710	830	840	850	930
Turbidity (NTU)	44.9		2.1	12.4	12.8	1.4		1.5	1.1	1.7	1.6	0.5	1.4		38	10.2	2.4	1.2	2.2	6	1	12.5
Turbidity - Field (NTU)		930	1030	960	990	470	750		710	700	710	810		700	710							
Flow (L/min)		4.00				10.00		10.00	7.00	5.00		5.00		12.00	12.00							
Temperature - Field (ºC)																						
Hardness (mg/L)	632		680	650	716	272		499	559	542	544	599	621		723	713	166	559	595	597	699	778
Anions (mg/L)																						
Alkalinity (CaCO3)	324		332	361	323	173		272	296	300	311	280	280		290	350	280	320	280	300	290	290
Alkalinity	0.25		0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sulphate	392		401	285	377	102		232	247	240	252	289	286		331	371	290	270	16	360	390	480
Misc. Inorganics (mg/L)																						
Hydroxide (OH)	0.25		0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25		0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Bicarbonate (HCO3)	395		405	440	394	211		332	361	366	379	340	350		360	430	340	390	350	360	350	360
Ammonia Nitrogen	0.183		0.191	0.113	0.168	0.016		0.065	0.056	0.045	0.079	0.155	0.162		0.127	0.133	0.033	0.029	0.097	0.19	0.273	0.224
Nitrate-Nitrite	0.03		0.02	0.02	0.03	0.01		0.01	0.01	0.01	0.03	0.03	0.04		0.04	0.05	0.01	0.03	0.02	0.14	0.06	0.06
Cyanide (mg/L)																						
Cyanide - Total	0.0011		0.0009	0.0008	0.0009	0.0003		0.0003	0.0011	0.0011	0.0011	0.008	0.0011		0.0008	0.001	0.0107	0.0007	0.0007	0.0014	0.0011	0.0003
Total Metals (ug/L)																						
Aluminum	30		10	50	30	20		20	40	40	10	9	113		912	32	35	9	18	44	8	112
Antimony	25		25	25	25	25		25	25	25	25	0.25	0.25		0.5	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Arsenic	25		25	25	25	25		25	25	25	25	0.7	1		6.4	2	1.3	1.3	2.1	4.4	0.6	3.9
Barium	93		100	105	110	59		94	105	102	88	88	87		133	95	49	78	85	107	88	133
Beryllium	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.05	0.05		0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Bismuth	25		25	25	25	25		25	25	25	25	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Boron	10		11	4	4	4		4	4	4	4	48	7		27	2.5	25	25	25	25	25	25
Cadmium	0.3		0.36	0.37	0.41	1.28		0.53	0.19	0.18	0.15	1.01	0.521		2.94	1.16	0.015	0.342	0.419	10.8	0.355	5.08
Chromium	2.5		2.5	6	2.5	2.5		5	6	2.5	2.5	0.5	0.5		2	0.5	2	0.5	0.5	0.5	0.5	0.5
Cobalt	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.7	2.9		6.3	3.1	1.5	1.9	2.7	4.1	3.5	6.5
Copper	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	3.4	1.6		6.9	19.6	0.5	0.3	0.2	2.2	0.8	2.2
Iron	351		297	1690	1410	262		343	306	433	364	357	571		4550	2570	278	268	769	4180	266	3580
Lead	2.31		2.9	11.3	4.82	6		1.34	1.82	13.9	0.66	3.36	33.5		322	12	0.8	1.26	5.49	123	1.79	104
Lithium																						
Manganese	2800		3420	4180	3490	856		2040	2080	2080	2340	2150	2360		5190	2890	1080	1910	2610	3160	3010	4370
Mercury																						
Molybdenum	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.5	0.5		1	0.5	1	0.5	0.5	0.5	0.5	0.5
Nickel	4		4	4	4	4		4	4	4	4	1	2		5	1	0.5	1	1	2	2	2
Phosphorus	50		50	50	50	50		50	50	50	50											
Selenium	15		15	15	15	15		15	15	15	15	0.1	0.1		0.2	0.2	0.3	0.2	0.2	0.2	0.1	0.2
Silicon	5630		5310	6940	5490	2530		3990	4690	4690	4740	4950	4600		6350	5210	4380	4290	5310	5440	5900	5330
Silver	5		5	5	5	5		5	5	5	5	0.01	0.03		0.26	0.01	0.01	0.01	0.01	0.03	0.01	0.03
Strontium	738		748	794	777	307		564	666	637	602	611	614		731	765	302	628	648	689	716	890
Tellurium																						
Thallium	15		15	15	15	15		15	15	15	15	0.025	0.025		0.11	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Tin	10		10	10	10	10		10	10	10	10	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Titanium	1.5		1.5	1.5	1.5	1.5		1.5	1.5	1.5	1.5	2.5	7		44	5	7	2.5	11	2.5	2.5	2.5
Uranium	2.71		2.9	2.57	2.88	0.97		1.89	2.33	2.3	2.32	2.27	2.64		2.61	2.73	0.57	2.68	2.5	2.69	3.02	3.19
Vanadium	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc	139		146	127	129	210		100	78	100	78	156	158		507	112	72	91	173	349	167	352
Zirconium	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	0.25		0.9	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total Metals (mg/L)																						
Calcium	216		235	208	249	97.1		176	195	188	187	214	221		257	250	45.1	194	205	209	245	272
Magnesium	22.5		22.3	31.7	22.7	7.27		14.8	17.6	17.9	18.6	15.6	16.6		19.7	21.7	12.9	18.5	20.1	18.4	21.6	23.7
Potassium	2		1	1	1	1		2	2	2	2	1.72	1.71		1.95	1.91	2.21	1.84	1.65	1.57	1.86	2.11
Sodium	15.8		15.5	16.1	15.8	7.36		11.3	16.4	14.8	15.3	14.8	15.1		16	17	1850	14.5	13.7	13	15	16.6
Sulphur	105		124	106	136	36.9		78.6	90.3	84.6	82.7	104	103		121	135	114	92	103	112	148	166

MH-01B Tailings Pond

	2005	2006				2007			2008			2009	
	4-Sep	**8-Jan**	**9-Apr**	**12-Jun**	**11-Sep**	**19-Jun**	**17-Sep**	**7-Dec**	**24-Mar**	**21-Jun**	**21-Oct**	**18-Jan**	**31-Mar**
Physical Properties													
pH - Lab		8	7.7	8	8.4	8.2	8.1	8.2	8.3	8.3	8.5	8.2	8.2
pH - Field	7.67	8.37	7.87	8.18		8.24	8.04	8.04					
Conductivity - Field (uS/cm)													
Conductivity - Lab (uS/cm)		407	211	261	321	271	336	350	540	320	380	410	420
Total Suspended Solids (mg/L)		2	2	2	2	2	2	2	10	2	8	6	5
Total Dissolved Solids (mg/L)		266	140	152	200	191	212	220	330	210	270	220	250
Turbidity (NTU)		0.3	0.5	2.1	1	1.5	0.7	0.9	3	1.6	3.9	1.7	1.1
Turbidity - Field (NTU)	780	410	220	280		260	280	270					
Flow (L/min)													
Temperature - Field (ºC)													
Hardness (mg/L)		220	120	140	180	158	200	209	362	179	210	215	240
Anions (mg/L)													
Alkalinity (CaCO3)		194	83.2	119	152	135	167	170	270	150	190	200	210
Alkalinity		0.25	0.25	0.25	1.5	0.25	0.25	0.25	0.25	0.25	4.2	0.25	0.25
Sulphate		26.5	35.2	16.9	19.9	17.3	21.9	19.5	57	16	21	26	27
Misc. Inorganics (mg/L)													
Hydroxide (OH)		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)		0.25	0.25	0.25	1.8	0.25	0.25	0.25	0.25	0.25	5	0.25	0.25
Bicarbonate (HCO3)		237	102	145	182	165	204	210	320	180	220	240	250
Ammonia Nitrogen		0.044	0.119	0.081	0.006	0.0025	0.0025	0.025	0.012	0.0025	0.0025	0.028	0.0025
Nitrate-Nitrite		0.03	0.34	0.01	0.01	0.01	0.01	0.01	0.07	0.01	0.01	0.12	0.05
Cyanide (mg/L)													
Cyanide - Total		0.0003	0.0015	0.0003	0.0006	0.0003	0.0003	0.0003	0.0011	0.0003	0.0003	0.0005	0.0003
Total Metals (ug/L)													
Aluminum		10	10	20	20	40	10	7	9	50	91	11	6
Antimony		25	25	25	25	25	25	0.25	0.7	0.25	0.25	0.25	2.7
Arsenic		25	25	25	25	25	25	0.6	1	0.4	0.9	0.6	0.6
Barium		39	14	29	34	32	39	49	50	36	37	44	45
Beryllium		0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.05
Bismuth		25	25	25	25	25	25	0.5	0.5	0.5	0.5	0.5	0.5
Boron		4	4	4	4	4	4	6	2.5	25	25	25	25
Cadmium		0.38	0.11	0.63	0.19	0.5	0.12	0.076	0.09	0.342	0.143	0.25	0.111
Chromium		2.5	2.5	2.5	2.5	2.5	2.5	0.5	0.5	0.5	0.5	0.5	0.5
Cobalt		2.5	2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25	0.25	0.25	0.25
Copper		2.5	2.5	2.5	2.5	2.5	2.5	4.1	4.3	1.1	1.8	10.3	1.7
Iron		11	21	118	28	91	49	63	17	96	218	34	21
Lead		2.85	2.23	32.3	3.13	6.75	10.7	0.746	0.837	5.97	21.6	3.61	2.21
Lithium													
Manganese		3	6	79	11	40	13	3	8	27	38	11	9
Mercury													
Mercury													
Molybdenum		2.5	2.5	2.5	2.5	2.5	2.5	2	5	2	2	2	2
Nickel		4	4	4	4	4	4	0.5	1	0.5	0.5	0.5	0.5
Phosphorus		50	50	50	50	50	50						
Selenium		15	15	15	15	15	15	0.6	1.2	0.8	0.7	0.8	0.7
Silicon		2280	1590	1920	2000	2070	2090	2460	6060	2220	2510	2820	3230
Silver		5	5	5	5	5	5	0.01	0.01	0.01	0.02	0.01	0.01
Strontium		264	149	161	212	182	244	255	479	215	269	292	312
Tellurium													
Thallium		15	15	15	15	15	15	0.025	0.025	0.025	0.025	0.025	0.025
Tin		10	10	10	10	10	10	2.5	2.5	2.5	2.5	2.5	2.5
Titanium		1.5	1.5	1.5	1.5	1.5	1.5	2.5	2.5	2.5	13	2.5	2.5
Uranium		1.62	1.04	0.93	1.2	0.88	1.19	1.1	2.83	1.25	1.44	1.73	1.59
Vanadium		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc		33	40	105	28	87	31	29	22	49	46	38	38
Zirconium		2.5	2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25	0.25	0.25	0.25
Total Metals (mg/L)													
Calcium		70.2	29.3	48.7	61.7	53.1	65.7	70.3	109	59.5	68	69.9	77.4
Magnesium		9.84	12.1	5.42	7.46	6.19	8.64	8.17	21.5	7.34	9.88	9.94	11.3
Potassium		0.5	0.5	0.5	0.5	0.5	0.5	1.08	2.05	0.83	0.83	0.88	0.93
Sodium		1.06	1.17	0.52	0.76	0.55	0.82	1.2	2.16	0.69	0.87	0.95	0.98
Sulphur		8.5	10	5.8	6.8	5.8	7	6	20	6	10	9	9

MH-04 Camp Creek	2005	2006			2007			2008	2009	
	4-Sep	8-Jan	9-Apr	12-Jun	19-Jun	17-Sep	7-Dec	21-Jun	18-Jan	31-Mar
Physical Properties										
pH - Lab		7.9	8.2	8.2	8.2	8.1	8.2	8.3	8.2	8.3
pH - Field	8.14	8.5	8.48	8.11	8.19	8.17	8.41			
Conductivity - Field (uS/cm)										
Conductivity - Lab (uS/cm)		319	325	277	262	297	300	280	310	320
Total Suspended Solids (mg/L)		2	5	2	2	2	2	6	2	2
Total Dissolved Solids (mg/L)		208	218	172	186	190	190	150	160	190
Turbidity (NTU)		0.2	2.2	0.1	0.3	0.2	0.9	0.5	0.7	0.9
Turbidity - Field (NTU)	350	350	370	280	280	300	300			
Flow (L/min)					272.00	136.00	120.00			
Temperature - Field (ºC)										
Hardness (mg/L)		170	210	160	152	178	174	42.8	162	168
Anions (mg/L)										
Alkalinity (CaCO3)		154	188	136	132	150	150	130	150	150
Alkalinity		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Sulphate		15.1	5.4	10.2	12.8	14.8	14.4	9.4	14	14
Misc. Inorganics (mg/L)										
Hydroxide (OH)		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Bicarbonate (HCO3)		188	229	166	161	183	180	160	190	190
Ammonia Nitrogen		0.0025	0.019	0.006	0.0025	0.0025	0.0025	0.0025	0.007	0.0025
Nitrate-Nitrite		0.34	0.01	0.2	0.17	0.2	0.31	0.16	0.37	0.28
Cyanide (mg/L)										
Cyanide - Total		0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0348	0.0003	0.0003
Total Metals (ug/L)										
Aluminum		10	40	30	30	10	15	37	16	5
Antimony		25	25	25	25	25	0.25	0.25	0.25	0.25
Arsenic		25	25	25	25	25	0.4	0.4	0.3	0.3
Barium		22	292	20	19	26	22	12	23	23
Beryllium		0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.05	0.05
Bismuth		25	25	25	25	25	0.5	0.5	0.5	0.5
Boron		4	4	4	4	4	2.5	25	25	25
Cadmium		0.37	0.06	0.23	0.25	0.23	0.27	0.04	0.26	0.227
Chromium		2.5	2.5	2.5	2.5	2.5	0.5	1	0.5	0.5
Cobalt		2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25	0.25
Copper		2.5	2.5	2.5	2.5	2.5	0.5	0.5	0.1	0.7
Iron		17	36	30	17	11	21	49	20	6
Lead		0.61	0.55	1.1	1.08	0.71	0.591	0.33	0.547	0.215
Lithium										
Manganese		1	5	2	1	3	2	1	0.5	0.5
Mercury										
Molybdenum		2.5	2.5	2.5	2.5	2.5	0.5	0.5	0.5	0.5
Nickel		4	4	4	4	4	0.5	0.5	0.5	0.5
Phosphorus		50	50	50	50	50				
Selenium		15	15	15	15	15	0.7	0.5	0.8	0.8
Silicon		3140	3050	2760	2700	3080	2910	3150	3580	3560
Silver		5	5	5	5	5	0.01	0.01	0.01	0.01
Strontium		191	133	175	165	199	199	131	210	214
Tellurium										
Thallium		15	15	15	15	15	0.025	0.025	0.025	0.025
Tin		10	10	10	10	10	2.5	2.5	2.5	2.5
Titanium		1.5	1.5	1.5	1.5	1.5	2.5	6	2.5	2.5
Uranium		1.07	3.13	0.65	0.65	0.82	0.915	0.28	0.995	0.938
Vanadium		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc		7	2.5	7	10	8	8	7	8	7
Zirconium		2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25	0.25
Total Metals (mg/L)										
Calcium		62.5	59.3	58.7	56.5	65.5	64.3	13.4	59.4	61.9
Magnesium		3.19	14.7	2.65	2.62	3.38	3.37	2.28	3.26	3.36
Potassium		0.5	0.5	0.5	0.5	0.5	0.4	4.21	0.36	0.38
Sodium		0.87	0.67	0.71	0.7	0.93	0.9	1850	0.85	0.84
Sulphur		4.7	1.2	3.6	4.5	5.2	4	6	5	5

MH-05 Portal Creek	2006 14-Jun
Physical Properties	
pH - Lab	8.2
pH - Field	8.13
Conductivity - Field (uS/cm)	
Conductivity - Lab (uS/cm)	358
Total Suspended Solids (mg/L)	2
Total Dissolved Solids (mg/L)	222
Turbidity (NTU)	0.05
Turbidity - Field (NTU)	380
Flow (L/min)	91.00
Temperature - Field (ºC)	
Hardness (mg/L)	200
Anions (mg/L)	
Alkalinity (CaCO3)	128
Alkalinity	0.25
Sulphate	52.2
Misc. Inorganics (mg/L)	
Hydroxide (OH)	0.25
Carbonate (CO3)	0.25
Bicarbonate (HCO3)	156
Ammonia Nitrogen	0.005
Nitrate-Nitrite	2.7
Cyanide (mg/L)	
Cyanide - Total	0.0003
Total Metals (ug/L)	
Aluminum	10
Antimony	25
Arsenic	25
Barium	10
Beryllium	0.1
Bismuth	25
Boron	4
Cadmium	0.26
Chromium	2.5
Cobalt	2.5
Copper	2.5
Iron	2.5
Lead	2.59
Lithium	0
Manganese	1
Mercury	0
Molybdenum	2.5
Nickel	4
Phosphorus	50
Selenium	15
Silicon	4310
Silver	5
Strontium	194
Tellurium	0
Thallium	15
Tin	10
Titanium	1.5
Uranium	0.96
Vanadium	2.5
Zinc	19
Zirconium	2.5
Total Metals (mg/L)	
Calcium	74
Magnesium	3.26
Potassium	0.5
Sodium	0.83
Sulphur	15.9

MH-06A Reclaim Pond Discharge

	2005				2006		2007				2008
	21-Jun	12-Jul	17-Jul	13-Sep	21-Jun	28-Jun	29-May	6-Jun	13-Jun	19-Jun	24-Jun
Physical Properties											
pH - Lab	8.2	8.1	8.2		8.4	8.4	8.2	8.2	8.1		8.4
pH - Field	8.14	8.25	8.2	8.03						8.22	
Conductivity - Field (uS/cm)											
Conductivity - Lab (uS/cm)	276	321	325		329	331	280	280	280		330
Total Suspended Solids (mg/L)	2	2	2		6	10	6	6	6		2
Total Dissolved Solids (mg/L)	162	182	226		210	218	174	176	176		180
Turbidity (NTU)	2.1	1.4	0.6		3.4	1.4	1.1	1.8	1.8		1.1
Turbidity - Field (NTU)		330	330	500						290	
Flow (L/min)	3800	3800									
Temperature - Field (ºC)											
Hardness (mg/L)	150	180	180		190	190	158	156	156		192
Anions (mg/L)											
Alkalinity (CaCO3)	134	156	156		162	162	139	139	138		160
Alkalinity	0.25	0.25	0.25		2.8	3	0.25	0.25	0.25		1.4
Sulphate	13.5	17.9	17		14.1	14	13.6	12.8	12.6		17
Misc. Inorganics (mg/L)											
Hydroxide (OH)	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25		0.25
Carbonate (CO3)	0.25	0.25	0.25		3.3	3.6	0.25	0.25	0.25		1.6
Bicarbonate (HCO3)	164	190	190		190	190	170	170	169		190
Ammonia Nitrogen	0.009	0.0025	0.025		0.0025	0.0025	0.013	0.029	0.021		0.0025
Nitrate-Nitrite	0.01	0.01	0.01		0.01	0.01	0.02	0.01	0.01		0.01
Cyanide (mg/L)											
Cyanide - Total	0.0005	0.0005	0.0007		0.0003	0.0003	0.0003	0.0003	0.0003		0.0003
Total Metals (ug/L)											
Aluminum	20	30	10		100	40	100	80	80		28
Antimony	25	25	25		25	25	25	25	25		0.25
Arsenic	25	25	25		25	25	25	25	25		0.6
Barium	42	48	46		56	57	45	45	44		49
Beryllium	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1		0.05
Bismuth	25	25	25		25	25	25	25	25		0.5
Boron	4	4	4		4	4	4	4	4		25
Cadmium	0.06	0.06	0.06		0.05	0.06	0.06	0.05	0.05		0.054
Chromium	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5		0.5
Cobalt	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5		0.25
Copper	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5		1.5
Iron	53	31	37		186	83	182	174	166		59
Lead	1.98	1.03	0.7		2.46	1.4	3.54	3.22	3.04		1.34
Lithium											
Manganese	15	11	15		22	17	53	52	51		20
Mercury											
Molybdenum	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2
Nickel	4	4	4		4	4	4	4	4		0.5
Phosphorus	50	50	50		50	50	50	50	50		
Selenium	15	15	15		15	15	15	15	15		0.8
Silicon	2040	2270	2210		2450	2420	2210	2210	2180		2670
Silver	5	5	5		5	5	5	5	5		0.01
Strontium	187	222	212		237	243	193	192	190		252
Tellurium											
Thallium	15	15	15		15	15	15	15	15		0.025
Tin	10	10	10		10	10	10	10	10		2.5
Titanium	1.5	1.5	1.5		1.5	1.5	1.5	1.5	1.5		2.5
Uranium	0.74	0.97	0.96		0.81	0.88	0.65	0.68	0.68		1.02
Vanadium	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5		2.5
Zinc	6	24	8		6	2.5	9	9	7		6
Zirconium	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5		0.25
Total Metals (mg/L)											
Calcium	53.8	62.2	62.2		63.9	65.1	54.7	54.2	54.2		65.2
Magnesium	4.92	6.42	6.37		6.46	6.56	5.12	5.08	5.03		7.19
Potassium	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5		0.94
Sodium	0.66	0.78	1.79		1.03	1.05	0.72	0.69	0.69		1.09
Sulphur	4.8	5.9	5.8		5.2	5.5	4.7	4.7	4.6		5

MH-06B Reclaim Pond

	2005	2006				2007			2008			2009
	4-Sep	2-Jan	9-Apr	12-Jun	11-Sep	19-Jun	17-Sep	7-Dec	24-Mar	21-Jun	21-Oct	18-Jan
Physical Properties												
pH - Lab		7.9	8.1	8.2	8.3	8.2	8.2	8.2	8	8.3	8.5	8.2
pH - Field	8.12	8.29	8.46	8.08		8.2	8.17	8.16				
Conductivity - Field (uS/cm)												
Conductivity - Lab (uS/cm)		382	424	239	349	271	335	360	1400	320	370	520
Total Suspended Solids (mg/L)		2	5	2	2	13	2	2	2	2	10	2
Total Dissolved Solids (mg/L)		256	276	150	208	188	214	220	960	190	250	300
Turbidity (NTU)		0.8	2.4	0.9	1.1	1.2	0.5	0.9	0.6	1.2	2.6	1.2
Turbidity - Field (NTU)	390	380	490	260		290	310	330				
Flow (L/min)												
Temperature - Field (ºC)												
Hardness (mg/L)		210	260	130	200	156	201	207	1010	198	205	282
Anions (mg/L)												
Alkalinity (CaCO3)		186	216	116	178	137	175	180	780	150	180	260
Alkalinity		0.25	0.25	0.25	0.9	0.25	0.25	0.25	0.25	0.25	3.9	0.25
Sulphate		19.1	37	11.3	14.3	13.7	15.2	19.3	122	14	18	28
Misc. Inorganics (mg/L)												
Hydroxide (OH)		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)		0.25	0.25	0.25	1.1	0.25	0.25	0.25	0.25	0.25	4.6	0.25
Bicarbonate (HCO3)		227	263	141	214	168	214	210	950	190	210	320
Ammonia Nitrogen		0.028	0.01	0.056	0.01	0.037	0.021	0.029	0.0025	0.0025	0.0025	0.076
Nitrite Nitrogen												
Nitrate-Nitrite		0.01	0.07	0.01	0.01	0.01	0.01	0.01	0.19	0.01	0.01	0.03
Nitrate Nitrogen Dissolved												
Total Nitrogen												
Cyanide (mg/L)												
Cyanide - Total		0.0003	0.0006	0.0005	0.0003	0.0003	0.0003	0.0003	0.0015	0.0003	0.0003	0.0006
Cyanide - WAD												
Total Metals (ug/L)												
Aluminum		10	20	20	30	150	10	10	7	123	51	7
Antimony		25	25	25	25	25	25	0.25	1	0.25	0.25	0.25
Arsenic		25	25	25	25	25	25	0.5	3.5	0.6	0.9	0.6
Barium		56	64	35	56	45	54	49	180	48	48	71
Beryllium		0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.05	0.05	0.05
Bismuth		25	25	25	25	25	25	0.5	0.5	0.5	0.5	0.5
Boron		4	4	4	4	4	4	2.5	16	25	25	25
Cadmium		0.02	0.06	0.07	0.03	0.08	0.03	0.05	0.04	0.056	0.032	0.15
Chromium		2.5	2.5	2.5	2.5	2.5	2.5	0.5	0.5	0.5	0.5	0.5
Cobalt		2.5	2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25	0.25	0.25
Copper		2.5	2.5	2.5	2.5	2.5	2.5	1.5	5.4	1.3	1.7	3.8
Iron		14	27	52	47	282	45	28	10	266	110	20
Lead		0.16	0.82	1.03	0.79	3.39	4.3	0.433	0.095	3.59	1.54	0.655
Lithium		0	0	0	0	0	0	0	0	0	0	0
Manganese		9	6	23	23	58	34	5	1	40	26	3
Mercury		0	0	0	0	0	0	0	0	0	0	0
Molybdenum		2.5	2.5	2.5	2.5	2.5	2.5	2	18	2	2	3
Nickel		4	4	4	4	4	4	0.5	2	0.5	0.5	0.5
Phosphorus		50	50	50	50	50	50	0	0	0	0	0
Selenium		15	15	15	15	15	15	0.6	3.6	0.7	0.7	0.9
Silicon		2900	3540	1950	2630	2290	2630	2630	19600	2780	2680	3910
Silver		5	5	5	5	5	5	0.01	0.01	0.01	0.01	0.01
Strontium		257	337	159	240	187	253	256	1490	242	262	387
Tellurium		0	0	0	0	0	0	0	0	0	0	0
Thallium		15	15	15	15	15	15	0.025	0.025	0.025	0.025	0.025
Tin		10	10	10	10	10	10	2.5	2.5	2.5	2.5	2.5
Titanium		1.5	1.5	1.5	1.5	1.5	1.5	2.5	2.5	6	14	2.5
Uranium		1.18	1.38	0.69	0.98	0.73	0.97	1.13	6.89	1.02	1.21	1.89
Vanadium		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc		2.5	20	13	2.5	9	6	10	2.5	8	10	20
Zirconium		2.5	2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25	0.25	0.25
Total Metals (mg/L)												
Calcium		70.7	84.4	46.8	70.3	54.2	68.5	69.6	307	67.2	68.2	93.7
Magnesium		7.46	13.1	4.3	6.71	5.02	7.35	8.18	58.5	7.21	8.43	11.7
Potassium		0.5	2	0.5	0.5	0.5	0.5	0.95	8.35	0.98	0.93	1.33
Sodium		1.23	2.14	0.66	1.17	0.72	1.03	1.05	8.22	1.01	1.02	1.45
Sulphur		6.2	10.5	4	5.3	4.6	5.6	6	49	6	8	10

MH-07 Reclaim Dam Seepage

	2005							2006										
	21-Jun	12-Jul	10-Aug	13-Sep	11-Oct	17-Nov	10-Dec	10-Jan	5-Feb	10-Mar	21-May	13-Jun	5-Jul	14-Aug	15-Sep	15-Oct	1-Nov	16-Dec
Physical Properties																		
pH - Lab	8.3	8.2	8.3	8.2	8.3	8.2	8.1	8	8.3	8.2		8.4	8.4	8.3	8.4	8.3	8.3	8.2
pH - Field	7.98	8.07	8.04	8.07	8.25	8.2	8.12	8.09	8.17	7.74	8.17	8.34	8.28	8.09	8.14	7.88	7.82	7.69
Conductivity - Field (uS/cm)																		
Conductivity - Lab (uS/cm)	441	430	460	465	465	449	447	453	441	455		465	458	453	459	462	467	445
Total Suspended Solids (mg/L)	61	25	2	2	2	2	9	2	2	31		17	2	2	2	2	2	2
Total Dissolved Solids (mg/L)	264	234	284	266	270	256	256	296	252	260		276	274	252	270	268	278	250
Turbidity (NTU)	8.2	3.1	0.3	0.3	0.5	0.6	3.3	1	1	12.4		0.9	0.2	0.1	0.2	0.3	0.3	0.6
Turbidity - Field (NTU)		460	500	290	300	370	490	490	480	490	470	490	470	460	460	470	500	470
Flow (L/min)	70	70	66.00	62.00	62.00	60.00	62.00	27.00	29	32.00		91.00	23.00	20.00	60.00	25.00	25.00	25.00
Temperature - Field (ºC)																		
Hardness (mg/L)	270	250	270	280	260	260	270	250	250	250		280	270	260	270	280	260	250
Anions (mg/L)																		
Alkalinity (CaCO3)	229	223	242	242	241	235	234	234	232	235		254	241	259	246	251	252	221
Alkalinity	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		5	5.6	2.5	3.9	1.9	1.7	0.25
Sulphate	19.3	16.9	19.9	17.3	15.4	13.5	14.6	15.2	17.1	15		11.3	12.2	0.25	13.9	12.9	12.9	12.4
Misc. Inorganics (mg/L)																		
Hydroxide (OH)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		6	6.7	3	4.7	2.3	2.1	0.25
Bicarbonate (HCO3)	279	272	295	295	294	287	286	286	283	286		298	280	310	290	302	304	269
Ammonia Nitrogen	0.0025	0.0025	0.011	0.0025	0.0025	0.007	0.031	0.0025	0.015	0.0025		0.008	0.0025	0.035	0.006	0.0025	0.008	0.0025
Nitrate-Nitrite	0.24	0.14	0.18	0.12	0.12	0.12	0.12	0.17	0.12	0.13		0.33	0.16	0.12	0.12	0.15	0.13	0.18
Cyanide (mg/L)																		
Cyanide - Total	0.0003	0.0007	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)																		
Aluminum	600	70	10	20	10	10	180	40	10	300		70	10	10	40	11	20	10
Antimony	25	25	25	25	25	25	25	25	25	25		25	25	25	25	0.5	25	25
Arsenic	25	25	25	25	25	25	25	25	25	25		25	25	25	25	0.5	25	25
Barium	90	87	83	85	79	79	78	74	78	92		67	88	88	84	85	82	116
Beryllium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1
Bismuth	25	25	25	25	25	25	25	25	25	25		25	25	25	25	25	25	25
Boron	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4
Cadmium	1.64	0.68	0.57	0.62	0.58	0.58	1	0.54	0.55	0.94		0.58	0.5	0.55	0.61	0.54	0.57	0.8
Chromium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.5	2.5	2.5
Cobalt	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	2.5	2.5
Copper	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.3	2.5	2.5
Iron	1220	162	10	26	21	15	255	75	37	1200		169	2.5	6	82	13	13	9
Lead	131	15.3	2.17	2.36	2.06	1.92	42.6	10.3	5.1	25.6		28.7	2.45	1.45	7.95	1.81	1.97	3.03
Lithium																3		
Manganese	225	69	23	43	49	57	108	76	61	225		119	17	34	67	50	73	134
Mercury																0.005		
Molybdenum	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5
Nickel	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4
Phosphorus	50	50	50	50	50	50	50	50	50	100		50	50	50	50	50	50	50
Selenium	15	15	15	15	15	15	15	15	15	15		15	15	15	15	0.5	15	15
Silicon	3870	3510	3490	3740	3710	3870	4070	3770	3750	4320		3140	3270	3940	3830	4060	3820	4310
Silver	5	5	5	5	5	5	5	5	5	5		5	5	5	5	0.05	5	5
Strontium	298	292	301	325	306	309	318	291	293	299		314	319	300	306	314	297	296
Tellurium																		
Thallium	15	15	15	15	15	15	15	15	15	15		15	15	15	15	0.05	15	15
Tin	10	10	10	10	10	10	10	10	10	10		10	10	10	10	10	10	10
Titanium	10	1.5	1.5	1.5	1.5	1.5	4	1.5	1.5	1.5		1.5	1.5	1.5	1.5	1.5	1.5	1.5
Uranium	0.94	0.87	0.91	1.02	0.94	1.13	0.96	1.01	0.91	0.95		0.84	0.87	0.88	0.97	0.87	0.92	1.02
Vanadium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc	411	158	155	171	164	150	234	160	155	196		124	138	157	159	163	158	206
Zirconium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total Metals (mg/L)																		
Calcium	82.5	79.9	85.2	88.4	85.6	85.9	88.4	81.3	81.9	82.7		81.1	83.9	85.2	86.9	91.6	84.6	84.8
Magnesium	15.3	12.6	13.2	13.3	11.9	12.2	12.9	11.7	11	11.8		19.6	13.6	12.2	12.1	12.3	11.6	8.11
Potassium	0.5	2	0.5	2	0.5	2	1	0.5	1	0.5		0.5	0.5	1	1	1	0.5	1
Sodium	1.52	1.73	2.06	1.97	1.8	2.12	1.9	1.93	1.88	1.96		1.16	1.78	1.91	1.78	1.83	1.67	2.01
Sulphur	6.6	5.8	5.3	5.7	5.2	4.7	5	4.6	5	4.7		3.7	4.8	4.5	4.9	4.5	4.2	4.7

	2007															2008				2009		
	17-Jan	18-Jan	19-Feb	26-Mar	27-Apr	21-May	19-Jun	19-Jun	19-Jul	12-Aug	15-Sep	21-Oct	14-Nov	15-Nov	3-Dec	3-Mar	24-Jun	15-Aug	23-Oct	18-Jan	13-Feb	18-Mar
Physical Properties																						
pH - Lab		8.2	8.2	8.2	8.2	8.3		8.3	8.3	8.2	8.2	8.2	8.2		8.2	8.3	8.4	8.3	8.5	8.2	8.2	8.2
pH - Field	7.87		7.91	7.88	8.05	8.0	8.24		7.94	8.06	7.93	8.1		7.9	8.2							
Conductivity - Field (uS/cm)																						
Conductivity - Lab (uS/cm)		423	433	436	415	479		482	486	478	450	420	410		400	400	500	460	470	350	440	450
Total Suspended Solids (mg/L)		17	5	6	2	2		2	2	2	2	2	2		5	2	2	2	2	7	2	21
Total Dissolved Solids (mg/L)		262	248	244	252	276		278	276	280	274	260	260		250	240	290	250	320	220	280	300
Turbidity (NTU)		34	0.7	1.6	0.5	0.7		0.4	0.3	0.3	0.3	0.3	0.5		1.2	0.6	0.3	0.3	0.3	1.3	3.5	4.7
Turbidity - Field (NTU)	430		420	440	430	430	460		430	450	420	410		400	370							
Flow (L/min)	28.00					45.00		45.00	40.00	35.00		35.00		50.00	60.00							
Temperature - Field (ºC)																						
Hardness (mg/L)		253	233	235	234	271		280	291	271	270	234	231		255	237	329	267	269	192	260	265
Anions (mg/L)																						
Alkalinity (CaCO3)		221	222	223	214	268		263	264	260	251	220	210		210	210	270	250	260	180	240	240
Alkalinity		0.25	0.25	0.25	0.25	0.25		0.25	3.5	0.25	0.25	0.25	0.25		0.25	0.25	6.4	0.25	8.9	0.25	0.25	0.25
Sulphate		13.9	14	13.5	13.8	7.9		11	11.1	15.7	11.5	22.2	16.3		17	17.1	8.9	14	13	19	17	14
Misc. Inorganics (mg/L)																						
Hydroxide (OH)		0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)		0.25	0.25	0.25	0.25	0.25		0.25	4.2	0.25	0.25	0.25	0.25		0.25	0.25	7.7	0.25	11	0.25	0.25	0.25
Bicarbonate (HCO3)		269	271	272	261	327		320	313	317	306	270	260		250	250	320	310	290	220	290	290
Ammonia Nitrogen		0.0025	0.0025	0.0025	0.0025	0.0025		0.0025	0.0025	0.0025	0.0025	0.026	0.011		0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.078	0.0025
Nitrate-Nitrite		0.2	0.19	0.19	0.12	0.55		0.27	0.27	0.23	0.14	0.13	0.14		0.13	0.13	0.38	0.15	0.1	0.36	0.1	0.09
Cyanide (mg/L)																						
Cyanide - Total		0.0003	0.0003	0.0005	0.0003	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)																						
Aluminum		1280	20	70	10	30		40	30	10	10	8	11		19	26	9	8	8	36	27	203
Antimony		25	25	25	25	25		25	25	25	25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Arsenic		25	25	25	25	25		25	25	25	25	0.3	0.3		0.3	0.3	0.2	0.3	0.5	0.4	0.3	0.6
Barium		157	106	113	75	54		68	72	72	80	80	87		86	74	60	79	75	42	76	86
Beryllium		0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.05	0.05		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Bismuth		25	25	25	25	25		25	25	25	25	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Boron		9	4	4	4	4		4	4	4	4	29	2.5		17	2.5	25	25	25	25	25	25
Cadmium		4.89	0.75	1.02	0.59	0.35		0.48	0.61	0.45	0.52	0.5	0.514		0.499	0.534	0.334	0.536	0.475	0.23	0.437	1.28
Chromium		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cobalt		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Copper		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.2	0.5		0.7	0.7	0.4	0.4	0.6	1.7	0.5	1
Iron		1970	28	102	10	42		53	20	10	25	16	49		37	57	15	22	19	81	57	452
Lead		620	21.8	38.5	3.43	5.27		6.72	5.47	2.42	3.26	1.94	2.73		2.97	3.9	3.19	1.95	2.07	1.6	9.17	31.3
Lithium																						
Manganese		1900	109	171	64	66		63	98	89	71	185	244		275	185	55	132	77	4	64	307
Mercury																						
Molybdenum		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	1	1		2	1	0.5	1	1	0.5	1	1
Nickel		4	4	4	4	4		4	4	4	4	0.5	0.5		1	0.5	0.5	0.5	0.5	0.5	0.5	1
Phosphorus		50	50	50	50	50		50	50	50	50											
Selenium		15	15	15	15	15		15	15	15	15	0.3	0.3		0.3	0.3	0.3	0.3	0.2	0.8	0.05	0.1
Silicon		6650	4360	4430	3470	2680		3040	3220	3220	3620	3320	3530		3470	3490	3300	3780	4050	3890	3990	3440
Silver		5	5	5	5	5		5	5	5	5	0.01	0.01		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.03
Strontium		307	279	289	272	307		310	337	318	310	283	282		301	278	382	321	337	247	320	339
Tellurium																						
Thallium		15	15	15	15	15		15	15	15	15	0.025	0.025		0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Tin		10	10	10	10	10		10	10	10	10	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Titanium		37	1.5	1.5	1.5	1.5		1.5	1.5	1.5	1.5	2.5	2.5		2.5	2.5	2.5	2.5	8	2.5	2.5	5
Uranium		1.09	1.04	1.12	0.81	0.72		0.85	0.84	0.93	0.96	0.877	0.983		0.907	0.939	0.89	0.978	0.996	1.41	1.06	0.938
Vanadium		9	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc		1340	206	243	159	71		114	132	115	147	116	116		119	86	55	109	156	16	139	253
Zirconium		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total Metals (mg/L)																						
Calcium		86.2	80.4	80.9	77.5	74.1		81.7	83.2	79.3	84.3	74.5	74.8		83.4	77.4	89.6	83.6	84.4	68.5	82.6	83.4
Magnesium		9.03	7.79	8.05	9.95	21		18.5	20.1	17.8	14.4	11.7	10.8		11.3	10.6	25.6	14.2	14.1	4.98	13.1	13.7
Potassium		2	0.5	1	0.5	1		0.5	1	0.5	0.5	0.9	0.92		1.16	1.03	0.74	1.05	0.95	0.49	0.95	0.99
Sodium		1.93	1.85	1.9	1.57	0.91		1.32	1.28	1.25	1.7	1.46	1.49		1.87	1.65	1.29	1.7	1.51	1.08	1.54	1.61
Sulphur		4.7	4.5	4.6	4.8	2.7		3.9	4	3.8	4.2	4	6		6	6	3	5	5	5	6	5

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	2005							2006										
	21-Jun	12-Jul	10-Aug	13-Sep	11-Oct	17-Nov	10-Dec	10-Jan	5-Feb	10-Mar	21-May	13-Jun	5-Jul	14-Aug	15-Sep	15-Oct	1-Nov	16-Dec
Physical Properties																		
pH - Lab	8.2	8	8.2	8	8.2	7.8	8	7.8	8.2	8.2		8.3	8.4	8.3	8.3	8.3	8.2	8.2
pH - Field	8.07	8.25	8.26	8.23	8.19	8.19	8.27	8.19	8.23	8.12	8.35	8.39	8.35	8.27	8.36	8.1	8.02	8.12
Conductivity - Field (uS/cm)																		
Conductivity - Lab (uS/cm)	271	270	266	266	261	277	283	294	296	297		281	271	270	264	268	269	290
Total Suspended Solids (mg/L)	2	2	2	2	2	2	2	2	2	2		2	2	2	2	2	2	2
Total Dissolved Solids (mg/L)	162	148	164	152	152	158	158	226	162	172		176	176	158	156	164	154	154
Turbidity (NTU)	0.1	0.2	0.3	0.2	0.3	0.3	0.3	0.2	0.4	0.3		0.2	0.4	0.05	0.4	0.1	0.2	0.8
Turbidity - Field (NTU)		390	290	400	500	300	290	320	330	330	230	310	280	280	310	280	290	310
Flow (L/min)	60	50	38.00	34.00	46.00	40.00	46.00	7.00	5	5.00		91.00	14.00	8.00	28.00	4.00	3.00	4.00
Temperature - Field (ºC)																		
Hardness (mg/L)	150	160	170	150	140	160	170	160	160	160		160	170	150	150	160	140	160
Anions (mg/L)																		
Alkalinity (CaCO3)	143	141	139	136	132	142	147	150	154	153		149	140	142	139	139	141	143
Alkalinity	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	1.4	1.2	1	0.25	0.25	0.25
Sulphate	5.1	4.7	4.9	6.2	6.2	5.8	6	6.2	7.6	6.4		2.5	3	0.25	3.9	5.2	5.3	4.1
Misc. Inorganics (mg/L)																		
Hydroxide (OH)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	1.7	1.4	1.2	0.25	0.25	0.25
Bicarbonate (HCO3)	175	172	170	166	161	174	180	183	187	187		181	168	171	167	170	172	175
Ammonia Nitrogen	0.006	0.0025	0.005	0.0025	0.0025	0.0025	0.0025	0.0025	0.012	0.0025		0.0025	0.0025	0.0025	0.015	0.0025	0.0025	0.0025
Nitrate-Nitrite	0.04	0.04	0.05	0.04	0.04	0.08	0.09	0.11	0.1	0.11		0.04	0.04	0.03	0.04	0.07	0.07	0.1
Cyanide (mg/L)																		
Cyanide - Total	0.0015	0.0003	0.0006	0.0003	0.0003	0.0003	0.0008	0.0003	0.0003	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)																		
Aluminum	10	10	1990	10	10	30	10	10	10	10		10	1180	10	130	6	20	10
Antimony	25	25	25	25	25	25	25	25	25	25		25	25	25	25	0.5	25	25
Arsenic	25	25	25	25	25	25	25	25	25	25		25	25	25	25	1	25	25
Barium	56	53	108	48	41	59	63	59	63	65		78	105	54	47	53	49	62
Beryllium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1
Bismuth	25	25	25	25	25	25	25	25	25	25		25	25	25	25	25	25	25
Boron	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4
Cadmium	0.09	0.08	1.49	0.08	0.07	0.05	0.06	0.14	0.16	0.04		0.11	1.17	0.04	0.16	0.03	0.04	0.09
Chromium	2.5	2.5	9	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.5	2.5	2.5
Cobalt	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	2.5	2.5
Copper	2.5	2.5	12	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	7	2.5	2.5	0.4	2.5	2.5
Iron	8	9	3710	10	2.5	29	15	20	30	9		16	1900	10	215	13	21	28
Lead	0.03	0.16	12.3	0.03	0.01	0.3	0.39	0.65	11.2	0.15		0.06	8.13	0.09	0.75	0.04	0.09	0.65
Lithium																1		
Manganese	0.5	0.5	174	0.5	0.5	4	2	8	16	0.5		2	199	4	17	3	9	19
Mercury																0.005		
Molybdenum	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5
Nickel	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4
Phosphorus	50	50	400	50	50	50	50	50	50	50		50	200	50	50	50	50	50
Selenium	15	15	15	15	15	15	15	15	15	15		15	15	15	15	0.5	15	15
Silicon	5200	5430	8220	5500	5430	4240	4230	4070	4080	4230		4990	6620	3850	5610	4160	3770	3990
Silver	5	5	5	5	5	5	5	5	5	5		5	5	5	5	0.05	5	5
Strontium	149	158	163	154	144	176	185	170	180	181		149	177	164	145	171	153	178
Tellurium																		
Thallium	15	15	15	15	15	15	15	15	15	15		15	15	15	15	0.05	15	15
Tin	10	10	10	10	10	10	10	10	10	10		10	10	10	10	10	10	10
Titanium	1.5	1.5	72	1.5	1.5	1.5	1.5	1.5	1.5	1.5		1.5	21	1.5	1.5	1.5	1.5	1.5
Uranium	0.64	0.66	1.19	0.69	0.64	0.86	0.85	0.85	0.79	0.86		0.63	0.92	0.61	0.7	0.64	0.65	0.73
Vanadium	2.5	2.5	14	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	7	2.5	2.5	2.5	2.5	2.5
Zinc	25	18	124	10	10	2.5	2.5	8	8	2.5		17	97	2.5	14	2.5	2.5	2.5
Zirconium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total Metals (mg/L)																		
Calcium	52.6	54.1	56.6	52.3	49.4	55.5	58.3	54	56.1	56.4		53.8	57.6	52.4	50.2	56	49.4	54.6
Magnesium	5.51	5.33	6.37	5.16	4.72	5.4	5.64	5.45	5.71	5.82		6.46	6.27	4.9	4.9	4.87	4.45	5.43
Potassium	0.5	0.5	2	1	0.5	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5
Sodium	0.78	0.82	1.09	0.86	0.73	1.06	0.93	0.91	0.86	0.84		0.71	0.93	0.9	0.84	0.88	0.76	0.89
Sulphur	1.4	1.6	1.8	2	1.7	2	2.1	1.9	2.1	2.1		1.1	1.9	1.9	1.7	2	1.8	2.1

	2007														
	17-Jan	18-Jan	19-Feb	26-Mar	27-Apr	21-May	19-Jun	19-Jun	19-Jul	12-Aug	15-Sep	21-Oct	14-Nov	15-Nov	3-Dec
Physical Properties															
pH - Lab		8.1	8.2	8.2	8.2	8.1		8.2	8.3	8.3	8.1	8.2	8.2		8.2
pH - Field	8.0		8.0	8.0	8.01	7.99	8.38		8.22	8.36	8.17	8.19		8.19	8.46
Conductivity - Field (uS/cm)															
Conductivity - Lab (uS/cm)		284	301	300	306	209		232	236	252	250	260	270		280
Total Suspended Solids (mg/L)		2	2	2	2	25		2	5	2	2	2	2		2
Total Dissolved Solids (mg/L)		170	170	172	184	132		144	136	148	154	160	160		170
Turbidity (NTU)		1.6	0.05	0.3	0.3	13.3		0.5	1.4	0.1	0.2	0.4	0.3		0.7
Turbidity - Field (NTU)	310		310	310	310	470	230		230	260	250	280		270	280
Flow (L/min)	4.00					7.00		7.00	6.00	5.00		5.00		20.00	24.00
Temperature - Field (ºC)															
Hardness (mg/L)		160	159	160	172	114		129	134	139	146	156	150		168
Anions (mg/L)															
Alkalinity (CaCO3)		150	155	154	158	108		119	122	130	134	140	140		150
Alkalinity		0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25		0.25
Sulphate		4.6	5.7	5.7	5.3	3.2		4.1	3.5	5.6	3.4	6.6	5.4		6
Misc. Inorganics (mg/L)															
Hydroxide (OH)		0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25		0.25
Carbonate (CO3)		0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25		0.25
Bicarbonate (HCO3)		183	189	188	193	132		146	148	159	164	170	170		180
Ammonia Nitrogen		0.0025	0.0025	0.0025	0.0025	0.0025		0.0025	0.0025	0.0025	0.0025	0.01	0.0025		0.006
Nitrate-Nitrite		0.1	0.1	0.11	0.09	0.13		0.08	0.05	0.04	0.03	0.08	0.09		0.09
Cyanide (mg/L)															
Cyanide - Total		0.0003	0.0003	0.0003	0.0003	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003	0.0003		0.0003
Total Metals (ug/L)															
Aluminum		50	10	50	10	640		20	150	10	20	7	6		28
Antimony		25	25	25	25	25		25	25	25	25	0.25	0.25		0.25
Arsenic		25	25	25	25	25		25	25	25	25	1.2	1.1		1.2
Barium		64	62	66	70	47		38	44	47	51	57	58		64
Beryllium		0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.05	0.05		0.05
Bismuth		25	25	25	25	25		25	25	25	25	0.5	0.5		0.5
Boron		4	8	4	4	4		4	4	4	4	20	2.5		12
Cadmium		0.04	0.03	0.06	0.05	0.12		0.05	0.05	0.04	0.04	0.045	0.036		0.052
Chromium		2.5	2.5	6	2.5	2.5		2.5	2.5	2.5	2.5	0.5	0.5		0.5
Cobalt		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	0.25		0.25
Copper		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.4	0.2		3.4
Iron		44	16	266	15	888		46	169	59	33	30	33		83
Lead		0.66	0.24	0.48	0.13	2.35		0.53	0.47	1.01	0.17	0.16	3.6		1.21
Lithium															
Manganese		5	2	7	1	30		3	6	6	13	19	22		33
Mercury															
Molybdenum		2.5	2.5	7	2.5	2.5		2.5	2.5	2.5	2.5	1	1		1
Nickel		4	4	4	4	4		4	4	4	4	0.5	0.5		0.5
Phosphorus		50	50	50	50	50		50	50	50	50				
Selenium		15	15	15	15	15		15	15	15	15	0.6	0.5		0.7
Silicon		4100	4030	4150	4310	3950		3470	3820	3750	3870	4160	3790		4160
Silver		5	5	5	5	5		5	5	5	5	0.01	0.01		0.01
Strontium		183	176	181	190	130		141	156	158	162	181	168		195
Tellurium															
Thallium		15	15	15	15	15		15	15	15	15	0.025	0.025		0.025
Tin		10	10	10	10	10		10	10	10	10	2.5	2.5		2.5
Titanium		1.5	1.5	1.5	1.5	13		1.5	1.5	1.5	1.5	2.5	2.5		2.5
Uranium		0.76	0.76	0.82	0.79	0.44		0.51	0.52	0.57	0.61	0.663	0.761		0.765
Vanadium		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5		2.5
Zinc		5	2.5	2.5	2.5	24		2.5	6	6	2.5	2.5	2.5		8
Zirconium		2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	0.25		0.25
Total Metals (mg/L)															
Calcium		54.6	54.4	54.5	58.8	39.8		45.5	47.1	48.6	50.8	53.8	51.5		58
Magnesium		5.67	5.57	5.78	6.1	3.51		3.67	3.94	4.28	4.64	5.15	5.1		5.63
Potassium		0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	2.14	0.33		0.44
Sodium		0.81	0.91	0.85	0.96	0.55		0.68	0.68	0.76	0.84	755	0.82		0.98
Sulphur		2	2	2.1	2.3	1.2		1.6	1.4	1.6	1.7	1.5	1.5		1.5

	2008				2009		
	3-Mar	24-Jun	15-Aug	23-Oct	18-Jan	13-Feb	18-Mar
Physical Properties							
pH - Lab	8.2	8.3	8.3	8.4	8.2	8.1	8.2
pH - Field							
Conductivity - Field (uS/cm)							
Conductivity - Lab (uS/cm)	300	250	270	270	280	280	290
Total Suspended Solids (mg/L)	6	2	2	2	30	2	4
Total Dissolved Solids (mg/L)	170	150	150	190	160	170	210
Turbidity (NTU)	0.2	0.4	0.2	0.2	3.1	0.4	1.6
Turbidity - Field (NTU)							
Flow (L/min)							
Temperature - Field (ºC)							
Hardness (mg/L)	174	141	133	141	154	153	165
Anions (mg/L)							
Alkalinity (CaCO3)	150	120	140	140	150	150	150
Alkalinity	0.25	0.25	1.1	1.8	0.25	0.25	0.25
Sulphate	6.1	4.6	5.6	5	6.9	6.4	5.8
Misc. Inorganics (mg/L)							
Hydroxide (OH)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25	0.25	1.3	2.2	0.25	0.25	0.25
Bicarbonate (HCO3)	190	150	170	170	180	190	190
Ammonia Nitrogen	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Nitrate-Nitrite	0.1	0.05	0.03	0.06	0.19	0.1	0.1
Cyanide (mg/L)							
Cyanide - Total	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)							
Aluminum	9	53	10	10	378	14	26
Antimony	0.9	0.25	0.25	0.25	0.25	0.25	0.25
Arsenic	1	1.2	1.1	1.3	1.9	1	1.3
Barium	63	45	46	49	71	66	78
Beryllium	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Bismuth	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Boron	2.5	25	25	25	25	25	25
Cadmium	0.039	0.039	0.041	0.038	0.149	0.061	0.063
Chromium	0.5	2	0.5	0.5	1	0.5	0.5
Cobalt	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Copper	1.6	1.8	0.3	0.6	1.5	0.9	1
Iron	32	77	27	39	630	72	98
Lead	0.241	0.483	0.083	0.302	2.56	0.552	0.596
Lithium							
Manganese	21	4	8	7	36	11	18
Mercury							
Molybdenum	1	1	1	1	1	1	1
Nickel	0.5	1	0.5	0.5	0.5	1	0.5
Phosphorus							
Selenium	0.7	0.5	0.5	0.5	0.7	0.6	0.8
Silicon	4000	4000	3620	4270	4750	4640	3770
Silver	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Strontium	191	169	155	173	186	197	199
Tellurium							
Thallium	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Tin	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Titanium	2.5	2.5	2.5	9	12	2.5	2.5
Uranium	0.824	0.563	0.645	0.655	0.806	0.877	0.757
Vanadium	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc	7	13	2.5	2.5	13	2.5	7
Zirconium	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total Metals (mg/L)							
Calcium	59	49.1	45.7	48.6	52.5	52	55.4
Magnesium	6.58	4.56	4.66	4.78	5.54	5.58	6.48
Potassium	0.38	0.34	0.28	0.33	0.34	0.35	0.36
Sodium	1.03	0.87	0.82	0.8	0.88	0.87	0.93
Sulphur	1.5	1.5	1.5	1.5	1.5	1.5	1.5

MH-11 Upper False Canyon Creek

	2005							2006										
	21-Jun	12-Jul	10-Aug	13-Sep	11-Oct	17-Nov	10-Dec	10-Jan	5-Feb	10-Mar	21-May	14-Jun	5-Jul	14-Aug	15-Sep	15-Oct	1-Nov	17-Dec
Physical Properties																		
pH - Lab	8.2	8.2	8.3	8.1	8.4	8.1	8.2	8.1	8.3	8.3		8.3	8.4	8.4	8.4	8.3	8.2	8.2
pH - Field	8.27	8.37	8.53	8.21	8.52	8.3	8.32	8.38	8.28	8.28	8.24	8.3	8.51	8.49	8.32	8.18	8.13	8.14
Conductivity - Field (uS/cm)																		
Conductivity - Lab (uS/cm)	285	319	328	385	338	389	399	415	418	422		298	322	330	336	336	339	405
Total Suspended Solids (mg/L)	2	2	2	2	2	6	11	2	2	4		2	2	2	2	2	2	2
Total Dissolved Solids (mg/L)	166	180	212	218	204	218	236	266	244	246		186	214	208	198	200	200	224
Turbidity (NTU)	1.9	1.8	0.4	0.3	0.2	0.7	1.7	0.4	0.3	0.2		0.3	0.2	0.05	0.1	0.2	0.3	0.3
Turbidity - Field (NTU)		350	360	310	370	400	440	450	460	490	320	310	340	340	320	350	360	430
Flow (L/min)	6352	6700	4600	4220	5760	5700	5760		5500	5750		6300	5000	4000	4000	4000	4000	4000
Temperature - Field (ºC)																		
Hardness (mg/L)	160	190	190	230	190	230	240	230	230	230		170	180	190	190	200	180	220
Anions (mg/L)																		
Alkalinity (CaCO3)	139	156	161	198	162	198	207	211	216	217		146	176	167	165	160	167	199
Alkalinity	0.25	0.25	2.7	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	2.9	3	2.1	1.4	0.25	0.25
Sulphate	20.4	16.4	16.5	13.5	17.7	12.7	13.2	14.1	16.3	15.1		13.1	12.7	1.1	17.8	18.3	16.9	11.5
Misc. Inorganics (mg/L)																		
Hydroxide (OH)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25	0.25	3.2	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	3.4	3.6	2.6	1.7	0.25	0.25
Bicarbonate (HCO3)	170	191	190	242	198	242	252	257	263	265		179	208	197	196	192	204	243
Ammonia Nitrogen	0.009	0.0025	0.006	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025		0.011	0.0025	0.0025	0.011	0.0025	0.008	0.0025
Nitrate-Nitrite	0.04	0.01	0.14	0.09	0.22	0.16	0.12	0.13	0.08	0.08		0.18	0.16	0.15	0.19	0.27	0.25	0.1
Cyanide (mg/L)																		
Cyanide - Total	0.0003	0.0006	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)																		
Aluminum	50	40	20	10	10	50	10	10	10	30		60	10	10	10	19	30	10
Antimony	25	25	25	25	25	25	25	25	25	25		25	25	25	25	0.5	25	25
Arsenic	25	25	25	25	25	25	25	25	25	25		25	25	25	25	0.5	25	25
Barium	38	46	34	75	35	74	81	78	81	86		30	34	35	35	35	33	77
Beryllium	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1
Bismuth	25	25	25	25	25	25	25	25	25	25		25	25	25	25	25	25	25
Boron	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4
Cadmium	0.15	0.14	0.2	0.11	0.15	0.19	0.11	0.33	0.07	0.11		0.19	0.17	0.16	0.16	0.16	0.28	0.11
Chromium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.5	2.5	2.5
Cobalt	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	2.5	2.5
Copper	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.8	2.5	2.5
Iron	75	48	28	82	7	214	102	67	64	132		82	6	6	7	24	21	45
Lead	12.2	15.8	1.58	0.9	0.27	4.85	1.29	0.76	0.41	2.49		1.46	0.56	0.49	0.45	0.66	6.31	1.12
Lithium																1		
Manganese	12	13	4	23	2	36	27	22	21	25		5	2	3	3	3	3	18
Mercury																0.005		
Molybdenum	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5
Nickel	4	4	4	4	4	4	4	4	4	4		4	4	4	4	4	4	4
Phosphorus	50	50	50	50	50	50	50	50	50	50		50	50	50	50	50	50	50
Selenium	15	15	15	15	15	15	15	15	15	15		15	15	15	15	0.5	15	15
Silicon	2440	2500	3020	3700	3190	3930	4080	3910	3830	4020		3080	2910	3350	3180	3380	3110	3710
Silver	5	5	5	5	5	5	5	5	5	5		5	5	5	5	0.05	5	5
Strontium	191	224	208	264	218	257	275	259	267	271		195	222	214	217	220	197	261
Tellurium																		
Thallium	15	15	15	15	15	15	15	15	15	15		15	15	15	15	0.05	15	15
Tin	10	10	10	10	10	10	10	10	10	10		10	10	10	10	10	10	10
Titanium	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		1.5	1.5	1.5	1.5	1.5	1.5	1.5
Uranium	0.79	0.88	0.97	1.07	1.03	1.37	1.34	1.37	1.09	1.39		0.81	0.93	0.94	1.11	1	1.03	1.16
Vanadium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc	24	38	12	9	10	24	13	11	8	18		8	8	9	5	14	33	17
Zirconium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5
Total Metals (mg/L)																		
Calcium	57.6	65.5	68.2	77	69.6	76.7	80.8	75.9	77	77.4		63.2	66.8	68.8	70.6	74.3	64.4	75.6
Magnesium	4.48	6.14	4.12	8.58	4.38	8.81	9.94	9.45	9.62	9.87		3.51	4.18	4.32	4.37	4.38	4.03	8.68
Potassium	0.5	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1		0.5	0.5	0.5	0.5	0.5	0.5	0.5
Sodium	0.73	0.91	1.11	1.31	0.91	1.49	1.53	1.53	1.51	1.59		0.72	0.96	1.03	1.02	0.98	0.91	1.37
Sulphur	4.5	6	5.4	4.6	5.9	4.6	4.7	4.5	4.7	4.7		4.2	4.9	5.3	6.3	6.6	5.5	4.6

	2007														
	17-Jan	18-Jan	19-Feb	26-Mar	27-Apr	21-May	19-Jun	19-Jun	19-Jul	12-Aug	15-Sep	21-Oct	14-Nov	15-Nov	3-Dec
Physical Properties															
pH - Lab	8.2		8.3	8.2	8.3	8.2		8.3	8.2	8.3	8.3	8.3	8.3		8.3
pH - Field		8.07	8.05	8.04	8.14	8.13	8.34		8.52	8.42	8.31	8.25		8.38	8.34
Conductivity - Field (uS/cm)															
Conductivity - Lab (uS/cm)	399		439	430	415	292		288	308	326	320	330	350		340
Total Suspended Solids (mg/L)	2		2	2	2	70		6	2	2	2	2	2		2
Total Dissolved Solids (mg/L)	246		244	248	254	182		180	178	186	196	210	240		210
Turbidity (NTU)	0.4		0.2	1	0.3	31.5		1.2	0.6	0.6	0.1	0.3	0.3		0.3
Turbidity - Field (NTU)		410	450	450	420	410	300		290	330	280	340		340	340
Flow (L/min)		4000				11600		11600	7300	11000		3700		3500	350
Temperature - Field (ºC)															
Hardness (mg/L)	232		233	240	240	166		161	173	182	186	195	195		217
Anions (mg/L)															
Alkalinity (CaCO3)	211		224	223	215	147		143	149	161	162	170	170		170
Alkalinity	0.25		0.25	0.25	0.25	0.25		0.25	0.25	1.4	0.25	0.25	0.25		0.25
Sulphate	13.4		13	12.5	12.5	9.6		13.1	11.9	14.5	14.4	13.4	13.6		14.5
Misc. Inorganics (mg/L)															
Hydroxide (OH)	0.25		0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25		0.25
Carbonate (CO3)	0.25		0.25	0.25	0.25	0.25		0.25	0.25	1.7	0.25	0.25	0.25		0.25
Bicarbonate (HCO3)	258		273	272	263	179		174	181	193	197	210	210		210
Ammonia Nitrogen	0.0025		0.0025	0.0025	0.0025	0.0025		0.0025	0.059	0.0025	0.0025	0.0025	0.0025		0.0025
Nitrate-Nitrite	0.08		0.19	0.2	0.12	0.25		0.08	0.14	0.04	0.11	0.22	0.28		0.27
Cyanide (mg/L)															
Cyanide - Total	0.0003		0.0003	0.0005	0.0003	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003	0.0006		0.0003
Total Metals (ug/L)															
Aluminum	30		70	150	10	1420		60	60	40	10	9	9		15
Antimony	25		25	25	25	25		25	25	25	25	0.25	0.25		0.25
Arsenic	25		25	25	25	25		25	25	25	25	0.4	0.4		0.5
Barium	84		108	118	77	54		37	31	47	35	38	39		40
Beryllium	0.1		0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.05	0.05		0.05
Bismuth	25		25	25	25	25		25	25	25	25	0.5	0.5		0.5
Boron	4		8	4	4	4		4	4	4	4	13	2.5		10
Cadmium	0.08		1.07	1.34	0.61	0.51		0.13	0.21	0.1	0.22	0.226	0.246		0.303
Chromium	2.5		2.5	2.5	2.5	5		2.5	2.5	2.5	2.5	0.5	0.5		0.5
Cobalt	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	0.25		0.25
Copper	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.1	0.2		1.5
Iron	54		93	220	9	1950		113	64	115	7	18	12		40
Lead	0.75		48.8	78.3	3.72	20.7		3.42	2.62	2.88	2.55	2.04	2.8		5.56
Lithium															
Manganese	19		208	261	66	53		29	4	15	4	3	4		13
Mercury															
Molybdenum	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.5	0.5		0.5
Nickel	4		4	4	4	4		4	4	4	4	0.5	0.5		0.5
Phosphorus	50		50	50	50	100		50	50	50	50				
Selenium	15		15	15	15	15		15	15	15	15	0.7	0.6		0.8
Silicon	3890		4370	4630	3560	4740		2520	3080	2590	3090	3370	2920		3280
Silver	5		5	5	5	5		5	5	5	5	0.01	0.01		0.01
Strontium	278		277	292	278	199		189	210	233	214	231	230		253
Tellurium															
Thallium	15		15	15	15	15		15	15	15	15	0.025	0.025		0.025
Tin	10		10	10	10	10		10	10	10	10	2.5	2.5		2.5
Titanium	1.5		1.5	1.5	1.5	39		1.5	1.5	1.5	1.5	2.5	2.5		2.5
Uranium	1.22		1.04	1.11	0.85	0.8		0.72	0.77	0.94	1.06	1.17	1.34		1.33
Vanadium	2.5		2.5	2.5	2.5	6		2.5	2.5	2.5	2.5	2.5	2.5		2.5
Zinc	18		259	315	165	43		11	13	12	19	20	29		42
Zirconium	2.5		2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25	0.25		0.25
Total Metals (mg/L)															
Calcium	77.4		80.5	82.5	79.5	59.4		57.2	63.4	63.5	67.5	70.5	70.4		78.4
Magnesium	9.52		7.73	8.15	10.2	4.28		4.3	3.56	5.83	4.28	4.69	4.75		5.15
Potassium	1		1	1	0.5	1		0.5	0.5	0.5	0.5	0.49	0.48		0.66
Sodium	1.41		1.85	1.91	1.62	0.72		0.74	0.8	0.91	1	1.03	0.97		1.42
Sulphur	4.6		4.4	4.7	5	3.4		4.5	4.4	5	5.1	5	5		5

	2008						
	3-Mar	24-Jun	15-Aug	23-Oct	18-Jan	13-Feb	18-Mar
Physical Properties							
pH - Lab	8.3	8.4	8.4	8.5	8.3	8.3	8.3
pH - Field							
Conductivity - Field (uS/cm)							
Conductivity - Lab (uS/cm)	350	300	330	340	440	350	360
Total Suspended Solids (mg/L)	2	2	2	2	45	2	2
Total Dissolved Solids (mg/L)	220	170	190	210	240	210	220
Turbidity (NTU)	0.2	0.3	0.1	0.2	21.5	0.3	1
Turbidity - Field (NTU)							
Flow (L/min)							
Temperature - Field (ºC)							
Hardness (mg/L)	213	184	174	189	248	186	194
Anions (mg/L)							
Alkalinity (CaCO3)	180	140	170	170	230	180	180
Alkalinity	0.25	1.2	2.9	3.8	0.25	0.25	0.25
Sulphate	13.5	11	13	16	14	14	14
Misc. Inorganics (mg/L)							
Hydroxide (OH)	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25	1.4	3.5	4.6	0.25	0.25	0.25
Bicarbonate (HCO3)	220	170	200	200	290	220	220
Ammonia Nitrogen	0.0025	0.007	0.0025	0.0025	0.0025	0.0025	0.0025
Nitrate-Nitrite	0.25	0.13	0.11	0.22	0.2	0.26	0.25
Cyanide (mg/L)							
Cyanide - Total	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)							
Aluminum	16	233	51	9	365	6	6
Antimony	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Arsenic	0.5	0.7	0.5	0.6	0.8	0.4	0.5
Barium	42	36	34	35	82	39	43
Beryllium	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Bismuth	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Boron	2.5	25	25	25	25	25	25
Cadmium	0.464	0.389	0.227	0.156	1.44	0.153	0.143
Chromium	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Cobalt	0.25	0.25	0.25	0.25	0.6	0.25	0.25
Copper	2.7	0.9	0.6	0.3	1.6	0.3	0.3
Iron	30	354	124	2.5	732	9	7
Lead	7.03	29.1	1.63	0.403	73.3	0.631	0.628
Lithium							
Manganese	11	30	6	2	393	0.5	0.5
Mercury							
Molybdenum	0.5	0.5	0.5	0.5	1	0.5	0.5
Nickel	0.5	1	0.5	0.5	2	0.5	0.5
Phosphorus							
Selenium	0.8	0.5	0.6	0.7	0.2	0.7	0.9
Silicon	3480	3320	3300	3470	4320	3780	2830
Silver	0.01	0.01	0.01	0.01	0.05	0.01	0.01
Strontium	249	228	215	236	310	242	250
Tellurium							
Thallium	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Tin	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Titanium	2.5	10	2.5	10	12	2.5	2.5
Uranium	1.41	0.879	1.04	1.12	1.14	1.41	1.31
Vanadium	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc	51	35	10	10	268	10	16
Zirconium	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Total Metals (mg/L)							
Calcium	76.1	66.6	62.7	68.2	79.2	66.5	68.9
Magnesium	5.61	4.19	4.3	4.59	12.1	4.84	5.41
Potassium	0.56	0.49	0.42	0.5	0.89	0.46	0.5
Sodium	1.19	1.04	1	0.98	1.5	0.97	1.01
Sulphur	6	4	5	7	5	7	6

MH-13 False Canyon Creek - Upper Creek

	2005		2006				2007					2008				2009
	4-Sep	21-Dec	27-Mar	8-Jun	30-Aug	15-Dec	9-Apr	22-Jul	13-Sep	13-Sep	27-Nov	7-Mar	17-Jun	10-Oct	28-Dec	30-Mar
Physical Properties																
pH - Lab	8.1	7.9		8.2	8.3	8.3	7.9	8.2	8.1	8.1	8.2	8.1	8.3	8.5	8.2	8.3
pH - Field	7.36	8.2	8.5	8.05		7.33	7.04	8.06		8.02	8.10					
Conductivity - Field (uS/cm)																
Conductivity - Lab (uS/cm)	358	382		261	388	400	233	306	338	338	360	410	310	380	370	390
Total Suspended Solids (mg/L)	2	2		20	14	2	9	2	7	7	2	2	8	5	8	2
Total Dissolved Solids (mg/L)	196	240		164	210	220	144	178	202	202	210	210	170	250	210	220
Turbidity (NTU)	0.9	1		9	4.9	0.4	2.7	0.6	1	1	0.4	0.4	0.6	1.4	1	1.7
Turbidity - Field (NTU)	420	420	450	280		380	250	300		310	350					
Flow (L/min)																
Temperature - Field (ºC)																
Hardness (mg/L)	210	210		150	220	220	124	177	197	197	218	237	188	203	201	228
Anions (mg/L)																
Alkalinity (CaCO3)	192	200		157	200	202	117	160	181	181	190	220	160	210	200	210
Alkalinity	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1	5.3	0.25	0.25
Sulphate	7.5	8.9		6.4	5.9	6.8	7.7	6.1	4.5	4.5	11.3	12.5	8.9	6.6	8.2	9.3
Misc. Inorganics (mg/L)																
Hydroxide (OH)	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1.2	6.4	0.25	0.25
Bicarbonate (HCO3)	234	245		191	244	246	143	195	221	221	230	270	190	240	240	250
Ammonia Nitrogen	0.0025	0.0025		0.058	0.046	0.178	0.454	0.009	0.012	0.012	0.037	0.017	0.0025	0.0025	0.024	0.0025
Nitrate-Nitrite	0.01	0.1		0.07	0.01	0.09	0.06	0.02	0.03	0.03	0.04	0.18	0.04	0.04	0.22	0.14
Cyanide (mg/L)																
Cyanide - Total	0.0005	0.0003		0.0006	0.0006	0.0003	0.0017	0.0003	0.0003	0.0003	0.0009	0.0003	0.0005	0.0003	0.0003	0.0003
Total Metals (ug/L)																
Aluminum	10	10		170	70	10	30	60	30	30	5	6	255	28	18	27
Antimony	25	25		25	25	25	25	25	25	25	0.25	0.25	0.25	0.25	0.25	0.25
Arsenic	25	25		25	25	25	25	25	25	25	0.05	0.05	0.5	0.4	0.1	0.3
Barium	137	140		104	150	145	114	127	142	142	182	169	134	149	156	157
Beryllium	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.05
Bismuth	25	25		25	25	25	25	25	25	25	0.5	0.5	0.5	0.5	0.5	0.5
Boron	4	4		4	4	4	4	4	4	4	9	2.5	25	25	25	25
Cadmium	0.08	0.13		0.08	0.18	0.03	0.19	0.1	0.03	0.03	0.026	0.011	0.156	0.019	0.036	0.037
Chromium	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.5	0.5	1	0.5	0.5	0.5
Cobalt	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25	0.25	0.25	0.25
Copper	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.9	0.6	1.6	0.3	0.8	1.3
Iron	182	182		386	519	207	1230	157	295	295	8	8	470	207	111	252
Lead	2.4	2.02		0.96	1.24	0.58	1.18	0.48	0.15	0.15	0.521	0.446	1.77	0.207	0.581	0.574
Lithium																
Manganese	13	14		18	102	18	229	10	17	17	2	1	18	20	3	11
Mercury																
Molybdenum	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.5	0.5	0.5	0.5	0.5	1
Nickel	4	4		4	4	4	4	4	4	4	0.5	0.5	1	0.5	0.5	0.5
Phosphorus	50	50		50	50	50	50	50	50	50						
Selenium	15	15		15	15	15	15	15	15	15	1.1	1.5	0.8	0.5	0.6	0.7
Silicon	2810	3370		2680	2880	3210	2530	2850	2820	2820	2280	2900	3050	3120	3560	3670
Silver	5	5		5	5	5	5	5	5	5	0.01	0.01	0.01	0.01	0.01	0.01
Strontium	195	185		140	191	197	112	177	189	189	213	254	194	209	207	216
Tellurium																
Thallium	15	15		15	15	15	15	15	15	15	0.025	0.025	0.025	0.025	0.025	0.025
Tin	10	10		10	10	10	10	10	10	10	2.5	2.5	2.5	2.5	2.5	2.5
Titanium	1.5	1.5		1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5	2.5	7	10	2.5	2.5
Uranium	1.32	1.6		0.87	1.24	1.49	0.46	0.74	0.87	0.87	0.458	0.563	0.922	0.954	1.37	1.49
Vanadium	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc	2.5	6		2.5	2.5	10	2.5	5	13	13	5	2.5	11	2.5	2.5	6
Zirconium	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25	0.25	0.25	0.25
Total Metals (mg/L)																
Calcium	61.8	60.6		46	65.8	63.5	31.2	53.2	58.8	58.8	61.6	64.6	55.7	58.4	58.9	65
Magnesium	13.2	14.4		8.5	13.1	14.7	11.1	10.6	12.3	12.3	15.6	18.4	11.9	13.8	13.2	15.9
Potassium	0.5	0.5		0.5	0.5	0.5	2	1	0.5	0.5	0.64	0.63	0.52	0.47	0.47	0.44
Sodium	0.97	1.06		0.69	1.04	1.03	1.1	0.93	1.06	1.06	1.11	1.2	1.18	1.03	1.24	1.03
Sulphur	2.5	2.8		2.2	2.4	3.2	2	2	2.1	2.1	4	5	3	4	1.5	5

MH-14 False Canyon Creek - Lower Creek

	2005		2006				2007					2008				2009
	4-Sep	21-Dec	27-Mar	8-Jun	30-Aug	15-Dec	9-Apr	22-Jul	13-Sep	13-Sep	27-Nov	7-Mar	17-Jun	10-Oct	28-Dec	30-Mar
Physical Properties																
pH - Lab	8	7.9		8.3	8.2	8.3	8.1	8.3	8	8	8.2	8.2	8.4	8.4	8.4	8.3
pH - Field	7.42	8.02	8.45	7.98		7.52	7.71	8.24		8.16	8.11					
Conductivity - Field (uS/cm)																
Conductivity - Lab (uS/cm)	388	389		291	401	404	374	315	365	365	370	390	310	380	410	400
Total Suspended Solids (mg/L)	2	2		2	2	51	11	6	2	2	24	5	10	2	30	2
Total Dissolved Solids (mg/L)	212	238		166	222	210	228	184	214	214	220	210	170	260	230	230
Turbidity (NTU)	0.2	0.3		0.2	0.3	1	3.4	0.9	0.3	0.3	6.6	2.2	0.8	0.1	2.7	3
Turbidity - Field (NTU)	560	430	420	310		410	390	310		320	350					
Flow (L/min)																
Temperature - Field (ºC)																
Hardness (mg/L)	220	210		170	240	220	213	183	217	217	234	230	159	207	219	224
Anions (mg/L)																
Alkalinity (CaCO3)	209	206		155	216	205	200	166	199	199	200	210	160	210	220	210
Alkalinity	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1.4	4	2.8	0.25
Sulphate	7.3	7.8		5.8	6.1	5.4	6.9	5.8	6	6	8.8	8.6	8.1	5.5	10	9.3
Misc. Inorganics (mg/L)																
Hydroxide (OH)	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	1.6	4.8	3.3	0.25
Bicarbonate (HCO3)	255	251		189	263	250	244	203	243	243	240	260	190	250	260	260
Ammonia Nitrogen	0.0025	0.0025		0.029	0.0025	0.0025	0.02	0.0025	0.0025	0.0025	0.013	0.0025	0.0025	0.0025	0.038	0.024
Nitrate-Nitrite	0.08	0.09		0.01	0.08	0.09	0.13	0.01	0.05	0.05	0.1	0.13	0.05	0.05	0.23	0.13
Cyanide (mg/L)																
Cyanide - Total	0.0003	0.0003		0.0005	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0016	0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)																
Aluminum	10	10		10	20	90	60	220	10	10	1380	105	126	16	45	100
Antimony	25	25		25	25	25	25	25	25	25	0.25	0.25	0.25	0.25	0.25	0.25
Arsenic	25	25		25	25	25	25	25	25	25	1.4	0.4	0.4	0.3	0.2	0.4
Barium	174	167		119	177	179	172	144	179	179	233	171	110	178	182	182
Beryllium	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.05	0.05	0.05	0.05
Bismuth	25	25		25	25	25	25	25	25	25	0.5	0.5	0.5	0.5	0.5	0.5
Boron	4	4		4	4	4	4	4	4	4	7	2.5	25	25	25	25
Cadmium	0.06	0.05		0.04	0.08	0.04	0.09	0.11	0.03	0.03	0.295	0.033	0.135	0.026	0.026	0.039
Chromium	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	3	0.5	1	0.5	0.5	0.5
Cobalt	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.9	0.25	0.25	0.25	0.25	0.25
Copper	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	3.7	1	1.5	0.3	0.5	1.3
Iron	59	17		31	25	194	382	398	9	9	2760	381	356	23	178	349
Lead	6.31	0.22		0.6	0.07	0.24	1.03	0.61	0.3	0.3	2.36	0.513	1.19	0.499	0.176	0.509
Lithium																
Manganese	0.5	0.5		3	0.5	2	21	20	0.5	0.5	104	19	12	1	5	19
Mercury																
Molybdenum	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.5	0.5	0.5	1	0.5	0.5
Nickel	4	4		4	4	4	4	4	4	4	3	0.5	2	0.5	0.5	0.5
Phosphorus	50	50		50	50	50	50	50	50	50						
Selenium	15	15		15	15	15	15	15	15	15	1.1	1	0.6	0.4	0.9	0.9
Silicon	3340	3500		2880	3670	3570	3620	3170	3750	3750	4630	3550	2480	4130	4000	3870
Silver	5	5		5	5	5	5	5	5	5	0.06	0.01	0.01	0.01	0.01	0.01
Strontium	202	194		144	204	213	222	197	203	203	231	254	165	210	245	244
Tellurium																
Thallium	15	15		15	15	15	15	15	15	15	0.025	0.025	0.025	0.025	0.025	0.025
Tin	10	10		10	10	10	10	10	10	10	2.5	2.5	2.5	2.5	2.5	2.5
Titanium	1.5	1.5		1.5	1.5	1.5	1.5	1.5	1.5	1.5	25	2.5	2.5	7	2.5	2.5
Uranium	0.98	1.01		0.75	0.89	0.88	0.81	0.68	0.78	0.78	0.895	0.893	0.921	0.813	0.836	0.803
Vanadium	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc	19	2.5		2.5	2.5	2.5	2.5	6	2.5	2.5	21	6	14	2.5	2.5	6
Zirconium	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25	0.25	0.25	0.25
Total Metals (mg/L)																
Calcium	65.2	61.9		50	70.2	65.4	61.6	54.3	63.8	63.8	69.2	66.6	47.4	59.7	60.8	63
Magnesium	14.8	13.7		10.7	15.1	14.5	14.5	11.6	14.1	14.1	14.9	15.5	9.85	14.1	16.4	16.1
Potassium	0.5	0.5		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.94	0.61	0.43	0.51	0.67	0.6
Sodium	1.18	1.29		0.89	1.18	1.26	1.42	1.08	1.22	1.22	1.63	1.64	1	1.07	1.52	1.48
Sulphur	2.5	2.3		2.1	2.7	2.9	3.3	2.3	2.2	2.2	3	4	1.5	3	3	5

MH-16 False Canyon Creek - Lower Creek

	2005		2006				2007					2008	
	4-Sep	21-Dec	27-Mar	8-Jun	30-Aug	15-Dec	9-Apr	22-Jul	13-Sep	13-Sep	27-Nov	7-Mar	17-Jun
Physical Properties													
pH - Lab	8.2	8.1		8.3	8.3	8.2	8.2	8.3	7.5	7.5	8.2	8.3	8.4
pH - Field	8.26	8.43	8.67	8.18		8.06	8.06	8.36		8.3	8.16		
Conductivity - Field (uS/cm)													
Conductivity - Lab (uS/cm)	371	396		281	382	403	384	320	898	898	370	380	320
Total Suspended Solids (mg/L)	2	2		6	2	2	2	6	2	2	2	2	5
Total Dissolved Solids (mg/L)	210	254		150	220	214	232	184	216	216	230	210	170
Turbidity (NTU)	0.9	0.9		0.8	0.7	0.6	1.1	1.1	0.9	0.9	1.4	1	1.1
Turbidity - Field (NTU)	400	410	230	300		400	410	310		300	350		
Flow (L/min)													
Temperature - Field (ºC)													
Hardness (mg/L)	220	220		170	230	220	163	182	216	216	220	227	183
Anions (mg/L)													
Alkalinity (CaCO3)	202	209		147	207	203	209	170	409	409	200	220	160
Alkalinity	0.25	0.25		1.2	2.3	0.25	0.25	1.4	0.25	0.25	0.25	1.2	1.3
Sulphate	6.9	8.3		6.9	4.9	5.7	4.5	4.8	5	5	8	6.8	8.1
Misc. Inorganics (mg/L)													
Hydroxide (OH)	0.25	0.25		0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25	0.25		1.4	2.7	0.25	0.25	1.7	0.25	0.25	0.25	1.4	1.6
Bicarbonate (HCO3)	247	256		176	246	248	255	204	499	499	240	260	190
Ammonia Nitrogen	0.0025	0.0025		0.0025	0.044	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025	0.0025
Nitrate-Nitrite	0.01	0.1		0.02	0.01	0.1	0.12	0.01	0.01	0.01	0.08	0.11	0.02
Cyanide (mg/L)													
Cyanide - Total	0.0003	0.0003		0.0003	0.0003	0.0003	0.0052	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)													
Aluminum	10	30		70	20	10	10	90	20	20	22	13	96
Antimony	25	25		25	25	25	25	25	25	25	0.25	0.25	0.25
Arsenic	25	25		25	25	25	25	25	25	25	0.3	0.3	0.5
Barium	164	166		122	175	169	132	145	163	163	157	170	129
Beryllium	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.05	0.05	0.05
Bismuth	25	25		25	25	25	25	25	25	25	0.5	0.5	0.5
Boron	4	4		4	4	4	4	4	4	4	6	2.5	25
Cadmium	0.02	0.02		0.03	0.07	0.03	0.01	0.03	0.03	0.03	0.01	0.042	0.055
Chromium	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.5	0.5	0.5
Cobalt	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25
Copper	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.4	0.5	0.7
Iron	175	157		198	175	144	179	228	174	174	187	88	254
Lead	4.37	0.49		0.31	0.15	0.06	0.21	0.2	0.37	0.37	0.087	0.086	0.538
Lithium													
Manganese	12	13		14	12	12	12	17	12	12	11	5	15
Mercury													
Mercury													
Molybdenum	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.5	1	1
Nickel	4	4		4	4	4	4	4	4	4	0.5	0.5	0.5
Phosphorus	50	50		50	50	50	50	50	50	50			
Selenium	15	15		15	15	15	15	15	15	15	0.6	0.7	0.6
Silicon	2920	3680		2720	3180	3480	3530	3060	3070	3070	3490	3000	2800
Silver	5	5		5	5	5	5	5	5	5	0.01	0.01	0.01
Strontium	206	200		156	209	207	158	183	204	204	205	232	181
Tellurium													
Thallium	15	15		15	15	15	15	15	15	15	0.025	0.025	0.025
Tin	10	10		10	10	10	10	10	10	10	2.5	2.5	2.5
Titanium	1.5	1.5		1.5	1.5	1.5	1.5	1.5	1.5	1.5	2.5	2.5	2.5
Uranium	0.85	0.93		0.76	0.82	0.84	0.85	0.65	0.81	0.81	0.915	0.951	0.963
Vanadium	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Zinc	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	7
Zirconium	2.5	2.5		2.5	2.5	2.5	2.5	2.5	2.5	2.5	0.25	0.25	0.25
Total Metals (mg/L)													
Calcium	63.2	62.6		50	67.6	62.8	42.6	53.4	63	63	64.3	65.2	53.9
Magnesium	14.3	14.7		10.3	14.3	14.6	13.8	11.8	14.2	14.2	14.3	15.5	11.8
Potassium	0.5	0.5		0.5	0.5	0.5	2	0.5	0.5	0.5	0.47	0.52	0.45
Sodium	1.32	1.41		0.9	1.34	1.31	974	0.93	1.33	1.33	1.3	1.5	1.1
Sulphur	2.3	2.6		2.5	2.2	2.9	2.6	2	2.4	2.4	3	1.5	3

MH-22 Burnick Portal Discharge

	2003			2005					2006				2007
	1-Jun	21-Jun	12-Jul	10-Aug	13-Sep	11-Oct	13-Jun	5-Jul	14-Aug	15-Sep	15-Oct	1-Nov	15-Sep
Physical Properties													
pH - Lab	8.1	7.8	7.7	7.9	7.6	8.1		8.3	8.3	8.3	8.2	8.1	
pH - Field	7.6	8.09	8.15	8.21	7.38	8.28	8.2	8.41	8.43	8.2	8.16	8.18	8.07
Conductivity - Field (uS/cm)	233												
Conductivity - Lab (uS/cm)		228	261	274	286	291		270	283	291	290	293	
Total Suspended Solids (mg/L)	2	2	2	2	2	2		2	2	2	2	2	
Total Dissolved Solids (mg/L)	158	134	136	176	168	170		174	184	182	178	182	
Turbidity (NTU)		0.5	0.5	0.4	0.2	0.3		0.6	0.2	0.1	0.1	0.2	
Turbidity - Field (NTU)			280	530	710	320	250	270	300	490	310	300	220
Flow (L/min)	480	70	70	68.00	60.00	62.00		19.00	20.00	58.00	12.00	8.00	
Temperature - Field (ºC)	5												
Hardness (mg/L)	114	120	140	150	160	150		140	150	160	160	150	
Anions (mg/L)													
Alkalinity (CaCO3)	87.7	87.9	98.1	103	104	105		96.3	106	108	104	106	
Alkalinity		0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	
Sulphate	33.3	27	34	34.1	39.3	40.3		34.8	45.3	42.3	42.3	42.6	
Misc. Inorganics (mg/L)													
Hydroxide (OH)		0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	
Carbonate (CO3)		0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25	
Bicarbonate (HCO3)		107	120	126	127	128		118	130	132	127	130	
Ammonia Nitrogen	0.006	0.0025	0.0025	0.0025	0.0025	0.0025		0.0025	0.0025	0.011	0.0025	0.0025	
Nitrate-Nitrite		0.21	0.2	0.21	0.19	0.17		0.21	0.18	0.18	0.19	0.18	
Cyanide (mg/L)													
Cyanide - Total	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003	
Total Metals (ug/L)													
Aluminum	30	20	30	10	10	10		10	10	10	3	10	
Antimony	25	25	25	25	25	25		25	25	25	3	25	
Arsenic	25	25	25	25	25	25		25	25	25	5	25	
Barium	13	14	16	15	18	16		17	17	17	16	15	
Beryllium	0.1	0.1	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	
Bismuth	25	25	25	25	25	25		25	25	25	25	25	
Boron	4	4	4	4	4	4		4	4	4	4	4	
Cadmium	2.2	1.75	1.91	2.06	2.36	2.39		1.96	2	2.28	2.26	2.32	
Chromium	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	0.5	2.5	
Cobalt	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	0.25	2.5	
Copper	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	0.3	2.5	
Iron	50	22	18	5	5	2.5		12	2.5	2.5	9	11	
Lead	3.1	0.97	0.44	0.45	0.43	0.43		0.76	0.55	0.56	0.49	0.69	
Lithium											7		
Manganese	7	5	3	1	0.5	0.5		3	0.5	0.5	0.5	0.5	
Mercury											0.005		
Molybdenum	2.5	7	13	10	11	11		11	9	13	12	10	
Nickel	4	4	4	4	4	4		4	4	4	4	4	
Phosphorus	50	50	50	50	50	50		50	50	50	50	50	
Selenium	15	15	15	15	15	15		15	15	30	13	15	
Silicon		4040	4280	4200	4430	4440		3970	4580	4440	4760	4440	
Silver	5	5	5	5	5	5		5	5	5	0.05	5	
Strontium	203	178	212	214	244	240		219	224	237	251	227	
Tellurium	25												
Thallium	15	15	15	15	15	15		15	15	15	0.05	15	
Tin	10	10	10	10	10	10		10	10	10	10	10	
Titanium	1.5	1.5	1.5	1.5	1.5	1.5		1.5	1.5	1.5	1.5	1.5	
Uranium		2.96	3.64	3.99	4.48	4.38		3.38	3.94	4.71	4.34	4.54	
Vanadium	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	
Zinc	362	212	303	382	444	441		327	410	436	471	443	
Zirconium	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	2.5	
Total Metals (mg/L)													
Calcium	38.4	40.5	46.5	48.2	52.1	50.8		46.3	50.1	52	53.6	48.7	
Magnesium	4.43	4.83	5.92	6.11	6.84	6.47		6	6.73	6.67	6.48	6.03	
Potassium	0.5	0.5	0.5	0.5	0.5	0.5		0.5	0.5	0.5	0.5	0.5	
Sodium	0.89	0.72	0.79	1.04	0.92	0.84		0.88	0.94	0.94	0.93	0.88	
Sulphur	10.1	8.8	11	11.8	13.4	13.3		11.6	12.6	13.6	14	13	

MH-22A Burnick Portal Discharge Bypass

	2006	2007					2008	
	13-Jun	19-Jun	19-Jun	19-Jul	12-Aug	15-Sep	24-Jun	15-Aug
Physical Properties								
pH - Lab	7.9		8.1	8.2	8.3	8.1	8.1	8.3
pH - Field	8.34	8.31		8.27	8.45			
Conductivity - Field (uS/cm)								
Conductivity - Lab (uS/cm)	217		209	225	247	259	220	270
Total Suspended Solids (mg/L)	2		2	2	2	2	2	2
Total Dissolved Solids (mg/L)	142		132	140	150	164	140	150
Turbidity (NTU)	0.5		0.4	0.5	0.6	0.2	0.3	0.5
Turbidity - Field (NTU)	230	220		220	240			
Flow (L/min)	68.00		54.00	50.00	45.00			
Temperature - Field (ºC)								
Hardness (mg/L)	120		116	118	131	137	118	145
Anions (mg/L)								
Alkalinity (CaCO3)	83.6		83.6	85.8	94.9	97.5	83	100
Alkalinity	0.25		0.25	0.25	0.25	0.25	0.25	0.25
Sulphate	25.1		23.4	25.5	29.4	34.8	23	37
Misc. Inorganics (mg/L)								
Hydroxide (OH)	0.25		0.25	0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25		0.25	0.25	0.25	0.25	0.25	0.25
Bicarbonate (HCO3)	102		102	105	116	119	100	120
Ammonia Nitrogen	0.005		0.0025	0.0025	0.0025	0.0025	0.006	0.0025
Nitrate-Nitrite	0.25		0.21	0.17	0.19	0.17	0.17	0.13
Cyanide (mg/L)								
Cyanide - Total	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)								
Aluminum	50		50	40	10	10	13	18
Antimony	25		25	25	25	25	2.7	3.5
Arsenic	25		25	25	25	25	4	4.8
Barium	14		15	14	16	16	15	17
Beryllium	0.1		0.1	0.1	0.1	0.1	0.05	0.05
Bismuth	25		25	25	25	25	0.5	0.5
Boron	4		4	4	4	4	25	25
Cadmium	1.81		1.63	1.76	1.89	1.83	2.02	0.89
Chromium	2.5		2.5	2.5	2.5	2.5	0.5	2
Cobalt	2.5		2.5	2.5	2.5	2.5	0.25	0.25
Copper	2.5		2.5	2.5	2.5	2.5	0.4	0.4
Iron	103		185	47	14	6	24	36
Lead	2.73		1.46	1.55	5.26	0.81	0.962	0.82
Lithium								
Manganese	12		8	7	4	3	6	3
Mercury								
Mercury								
Molybdenum	2.5		10	9	10	10	12	12
Nickel	9		4	4	4	4	3	2
Phosphorus	50		50	50	50	50		
Selenium	15		15	15	15	15	8.6	12.3
Silicon	4370		3880	4490	4090	3990	4160	4520
Silver	5		5	5	5	5	0.01	0.01
Strontium	181		168	197	194	199	181	210
Tellurium								
Thallium	15		15	15	15	15	0.025	0.025
Tin	10		10	10	10	10	2.5	2.5
Titanium	1.5		1.5	1.5	1.5	1.5	2.5	8
Uranium	2.39		2.26	2.41	3.18	3.57	2.29	1.81
Vanadium	2.5		2.5	2.5	2.5	2.5	2.5	2.5
Zinc	216		192	237	282	332	161	315
Zirconium	2.5		2.5	2.5	2.5	2.5	0.25	0.25
Total Metals (mg/L)								
Calcium	39.4		39.1	39.8	43.8	45.4	39.3	47.6
Magnesium	4.39		4.36	4.55	5.24	5.7	4.72	6.4
Potassium	0.5		0.5	0.5	0.5	0.5	0.48	1.1
Sodium	0.71		0.75	0.76	0.86	0.84	0.82	1830
Sulphur	8.1		8.1	8.7	10.2	11.1	9	16

MH-25 Main Zone 1380 Portal

	2005				2006				2007					2008
	21-Jun	12-Jul	10-Aug	13-Sep	14-Jun	5-Jul	14-Aug	15-Sep	19-Jun	19-Jun	19-Jul	12-Aug	15-Sep	15-Aug
Physical Properties														
pH - Lab	6.5	6.4	6.6	6.5	6.6	7.5	7.6	7.5		7.4	7.5	7.5	7.4	7.4
pH - Field	7.38	7.31	7.59		7.46	7.42	7.61	7.72	7.23		7.38	7.51	7.35	
Conductivity - Field (uS/cm)														
Conductivity - Lab (uS/cm)	474	582	560	650	372	584	548	596		346	496	533	518	480
Total Suspended Solids (mg/L)	9	2	16	2	28	20	2	17		49	2	30	10	6
Total Dissolved Solids (mg/L)	372	426	442	492	272	466	410	458		292	362	396	398	320
Turbidity (NTU)	2.9	6.3	10.1	0.8	4.3	10.4	0.3	0.6		4.2	0.7	2.8	1.8	2.2
Turbidity - Field (NTU)		640	620		380	600	560	690	370		440	490	510	
Flow (L/min)	24	22	14.00	10.00	39.00	5.00	4.00	6.00		22.00	12.00	18.00		
Temperature - Field (ºC)														
Hardness (mg/L)	210	260	250	300	150	250	240	260		148	199	191	225	192
Anions (mg/L)														
Alkalinity (CaCO3)	31.9	37	44.7	43.2	30.6	32.2	43.7	39		29.7	34.2	38.4	46.9	47
Alkalinity	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25
Sulphate	203	272	221	309	145	250	245	257		141	189	205	209	180
Misc. Inorganics (mg/L)														
Hydroxide (OH)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25
Carbonate (CO3)	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25		0.25	0.25	0.25	0.25	0.25
Bicarbonate (HCO3)	38.9	45.2	54.6	52.7	37.3	39.3	53.4	47.6		36.2	41.7	46.8	57.2	57
Ammonia Nitrogen	0.008	0.0025	0.015	0.011	0.009	0.0025	0.005	0.016		0.0025	0.0025	0.0025	0.0025	0.0025
Nitrate-Nitrite	0.33	0.45	0.63	0.77	0.36	0.55	0.7	0.77		0.29	0.51	0.53	0.65	0.56
Cyanide (mg/L)														
Cyanide - Total	0.0003	0.0007	0.0005	0.0003	0.0003	0.0003	0.0003	0.0003		0.0003	0.0003	0.0003	0.0003	0.0003
Total Metals (ug/L)														
Aluminum	110	190	290	100	390	380	30	170		970	110	200	260	64
Antimony	25	25	25	25	25	25	25	25		25	25	80	25	0.25
Arsenic	25	25	25	25	25	25	25	25		25	25	25	25	0.3
Barium	14	15	15	14	15	17	12	13		22	14	12	15	12
Beryllium	0.1	0.1	0.1	0.1	0.3	0.1	0.1	0.1		0.3	0.1	0.3	0.1	0.05
Bismuth	25	25	25	25	25	25	25	25		25	25	25	25	0.5
Boron	4	4	4	4	4	4	4	4		4	4	4	4	25
Cadmium	368	456	352	431	302	402	323	400		320	371	421	311	305
Chromium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	5	2.5	0.5
Cobalt	5	2.5	5	2.5	9	2.5	2.5	7		8	6	11	2.5	1.8
Copper	2.5	2.5	2.5	2.5	7	2.5	2.5	2.5		11	2.5	11	2.5	0.8
Iron	523	490	652	334	2860	1430	95	797		3540	417	1660	536	172
Lead	927	327	365	378	3360	1070	85.2	1530		4200	551	9320	310	126
Lithium														
Manganese	210	202	316	669	503	198	123	303		638	254	369	154	62
Mercury														
Molybdenum	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.5
Nickel	4	4	4	4	4	4	4	4		4	4	4	4	1
Phosphorus	50	50	50	50	100	50	50	50		100	50	50	50	
Selenium	15	15	15	15	15	15	15	15		15	15	15	15	3.8
Silicon	3550	4190	4380	4370	5320	4800	4190	4740		6790	3530	4540	4280	3380
Silver	5	5	5	5	5	5	5	5		5	5	5	5	0.13
Strontium	72	89	80	102	52	91	82	88		51	75	68	80	75
Tellurium														
Thallium	15	15	15	15	15	15	15	15		15	15	15	15	0.025
Tin	10	10	10	10	10	10	10	10		10	10	10	10	2.5
Titanium	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5		21	1.5	1.5	1.5	10
Uranium	0.1	0.07	0.1	0.09	0.15	0.11	0.05	0.11		0.23	0.09	0.15	0.12	0.067
Vanadium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		6	2.5	8	2.5	2.5
Zinc	36700	48500	45100	49000	36600	50000	42100	48100		41800	41000	42400	37000	29000
Zirconium	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5		2.5	2.5	2.5	2.5	0.25
Total Metals (mg/L)														
Calcium	78.5	97.7	93.8	114	57.5	95.9	91.1	98.2		54.8	75.9	72.5	85.6	72.8
Magnesium	2.43	2.94	2.86	3.11	2.13	3.27	2.81	3		2.74	2.41	2.39	2.69	2.46
Potassium	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5		0.5	0.5	4	0.5	0.47
Sodium	0.42	0.51	0.76	0.67	0.24	0.64	0.71	0.7		0.48	0.44	0.66	0.63	0.87
Sulphur	67.8	89	79.6	100	50.6	88.6	77.3	87.2		51	69.8	65.2	71	64

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JANUARY 2010 UPDATE

APPENDIX D – WATER QUALITY GRAPHS

Prepared by:

ACCESS CONSULTING GROUP

SRK Consulting Engineers and Scientists

FIGURE D-1 MH-4 Sulphate

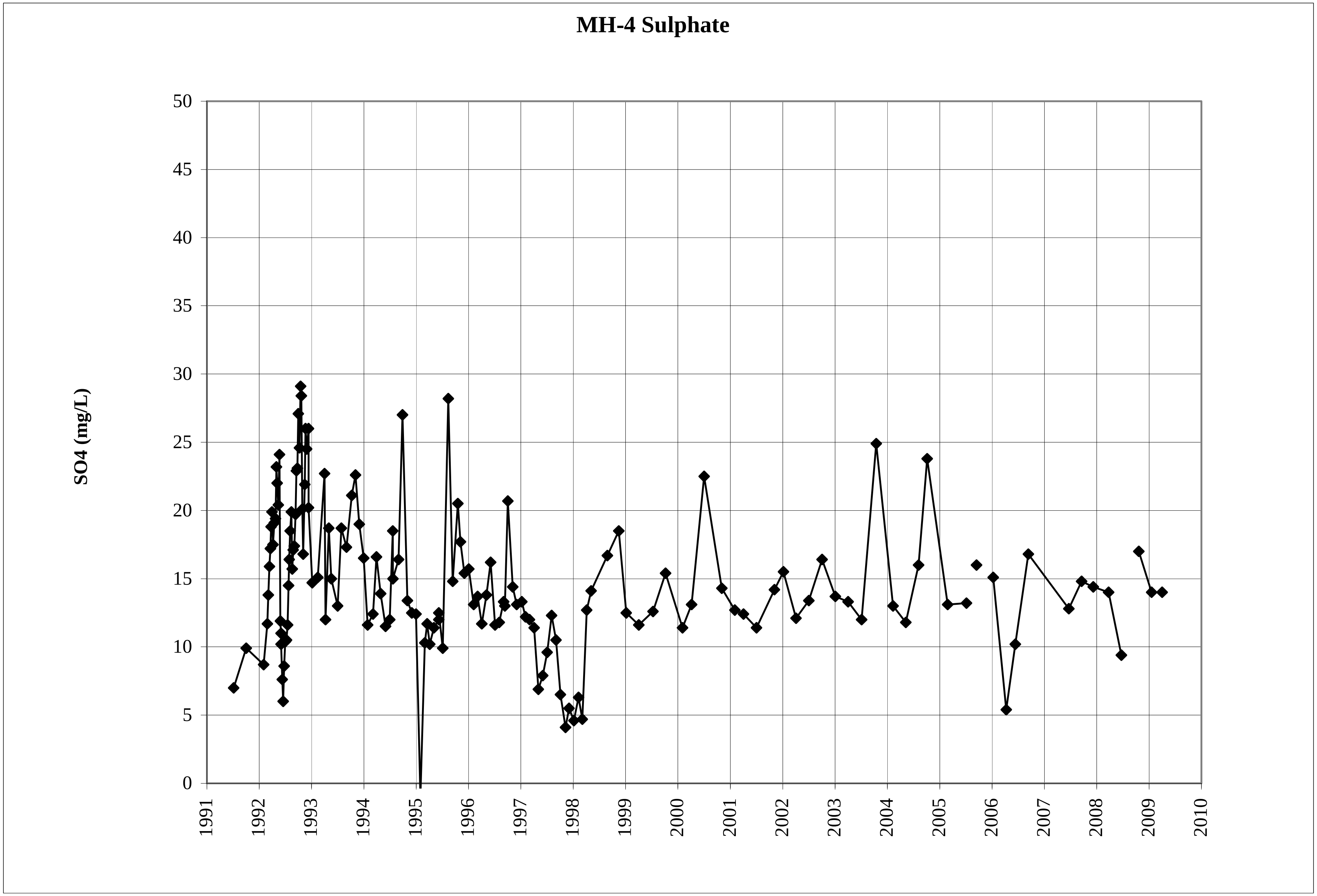


FIGURE D-2 MH-4 Total Zinc

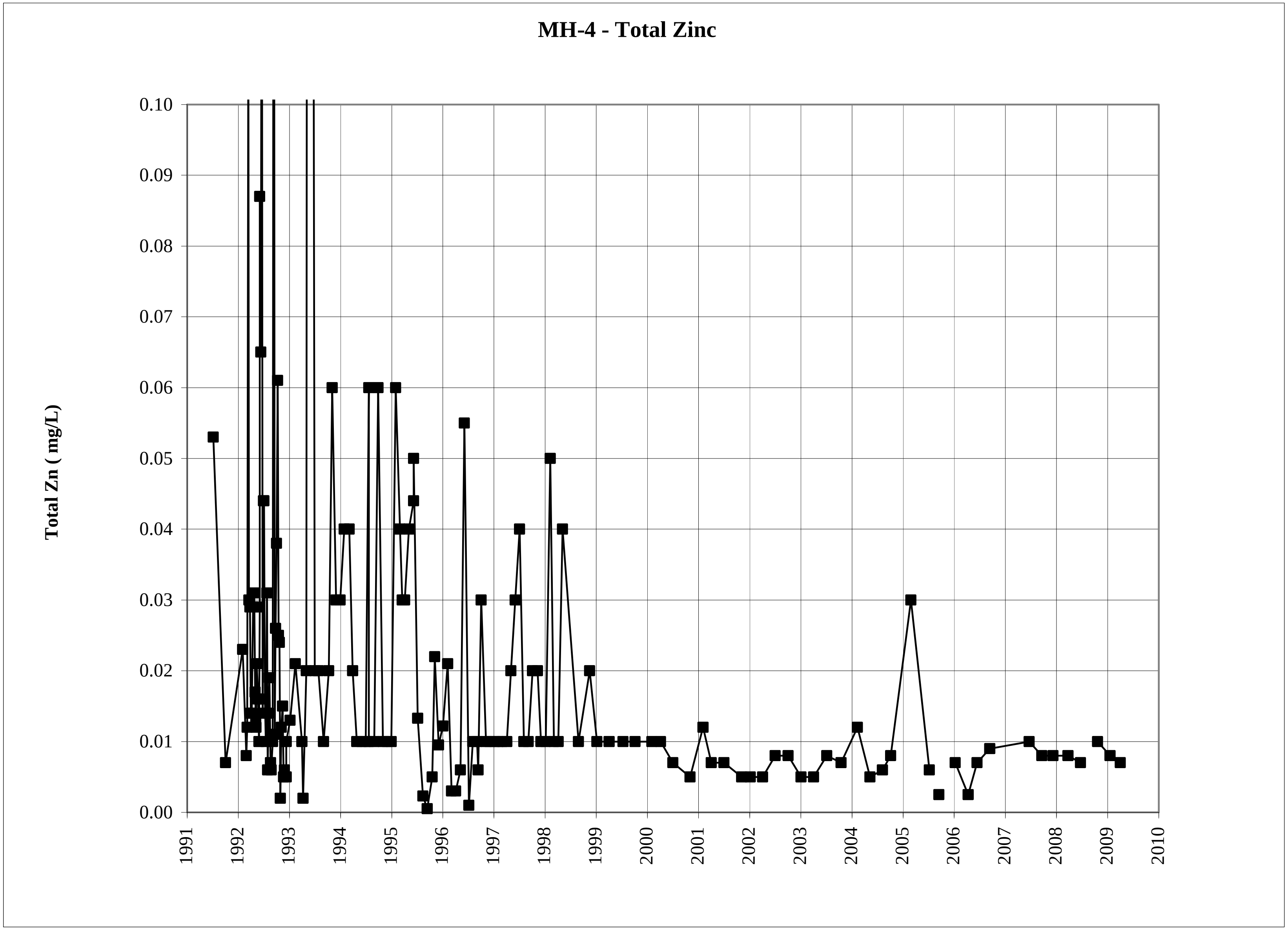


FIGURE D-3 MH-7 Sulphate

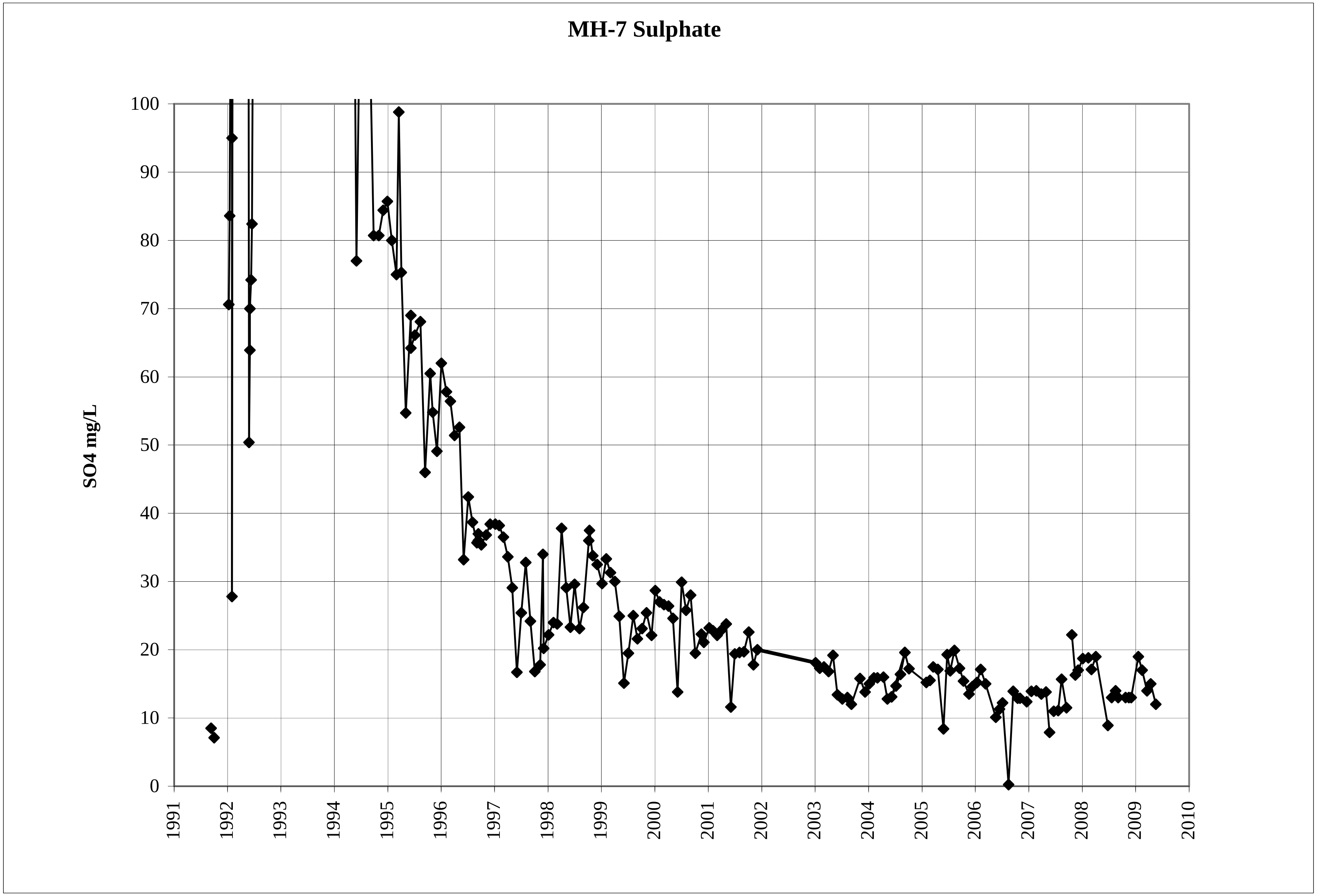


FIGURE D-4 MH-7 Total Zinc

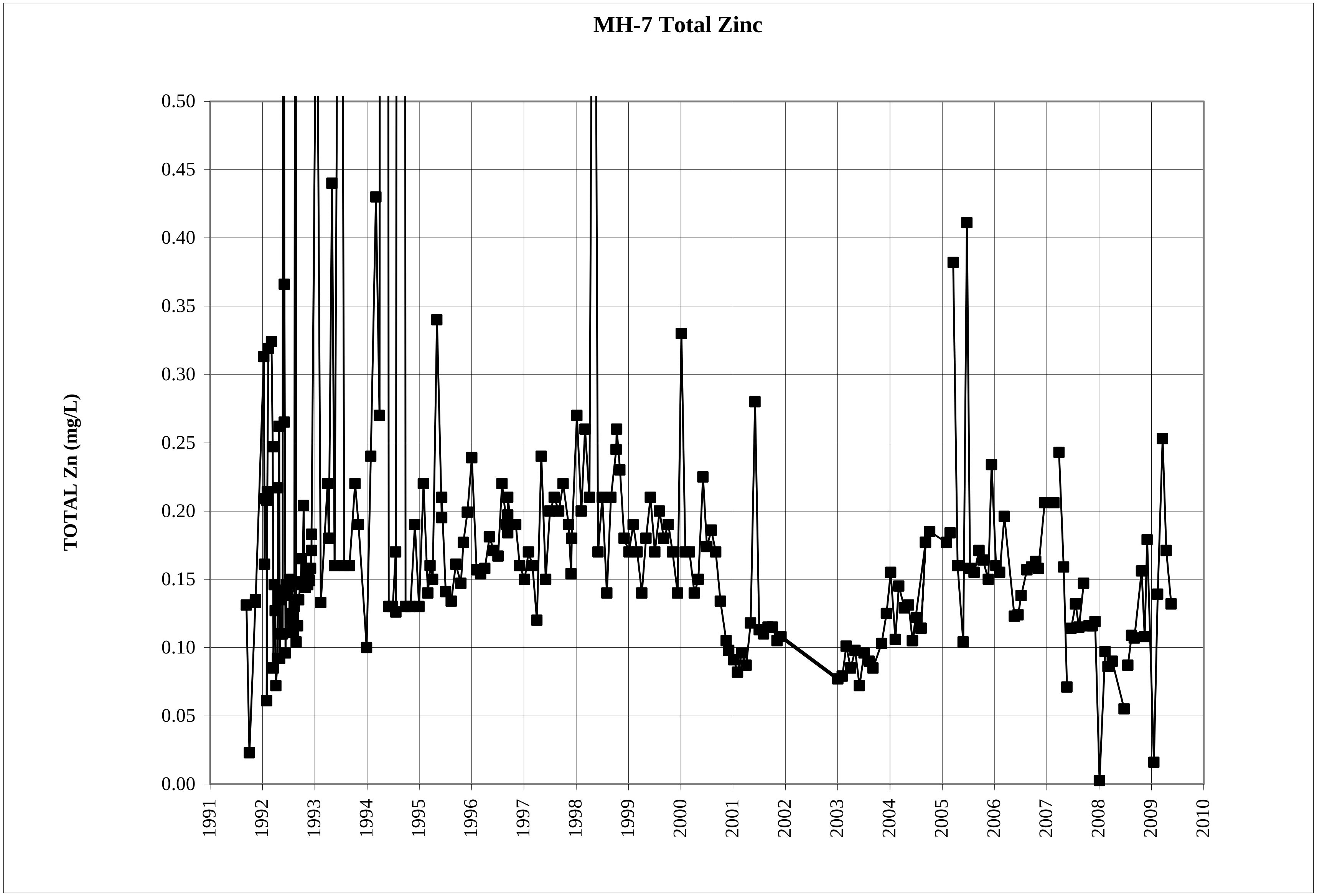


FIGURE D-5   MH-11 Sulphate

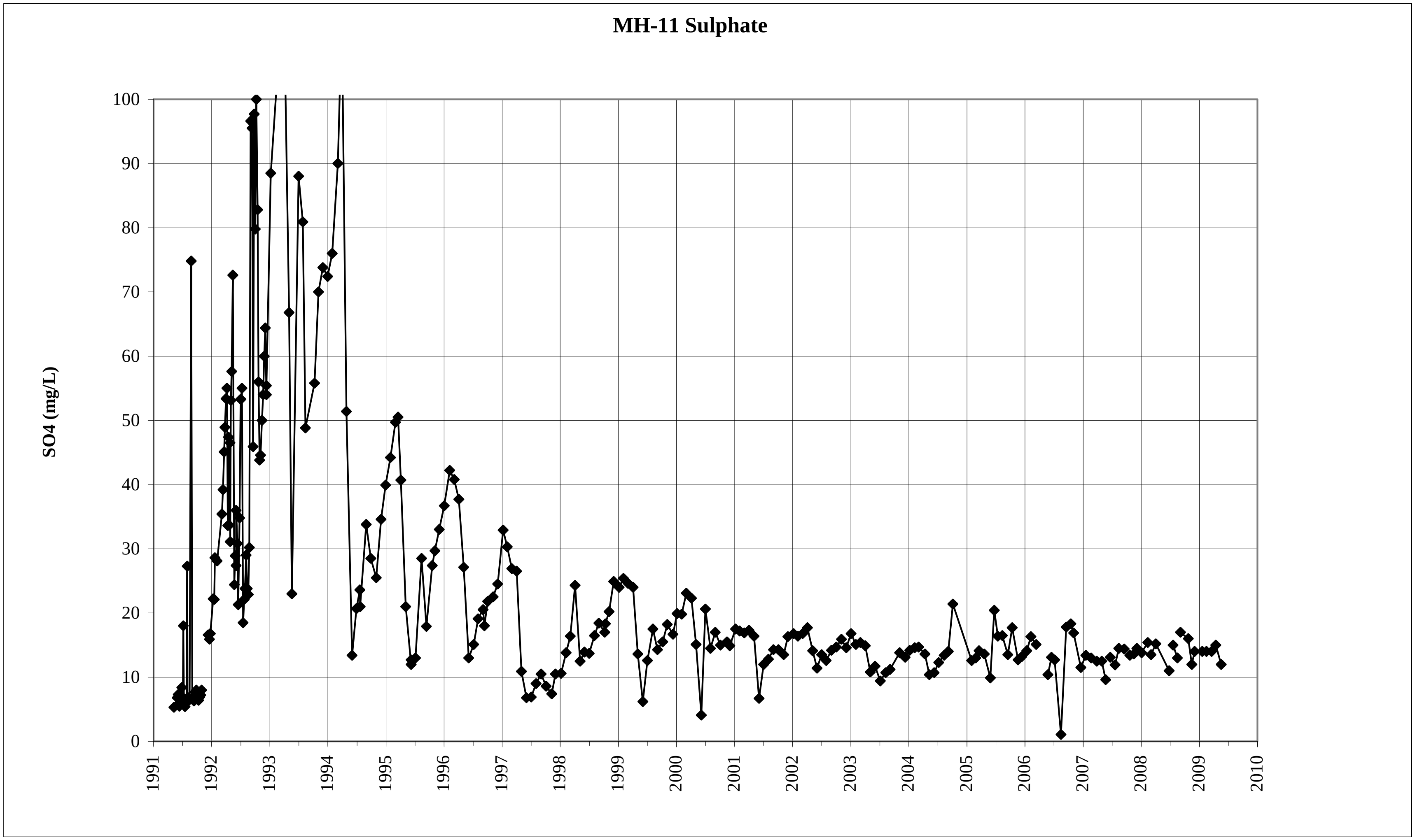


FIGURE D-6 MH-11 Total Zinc

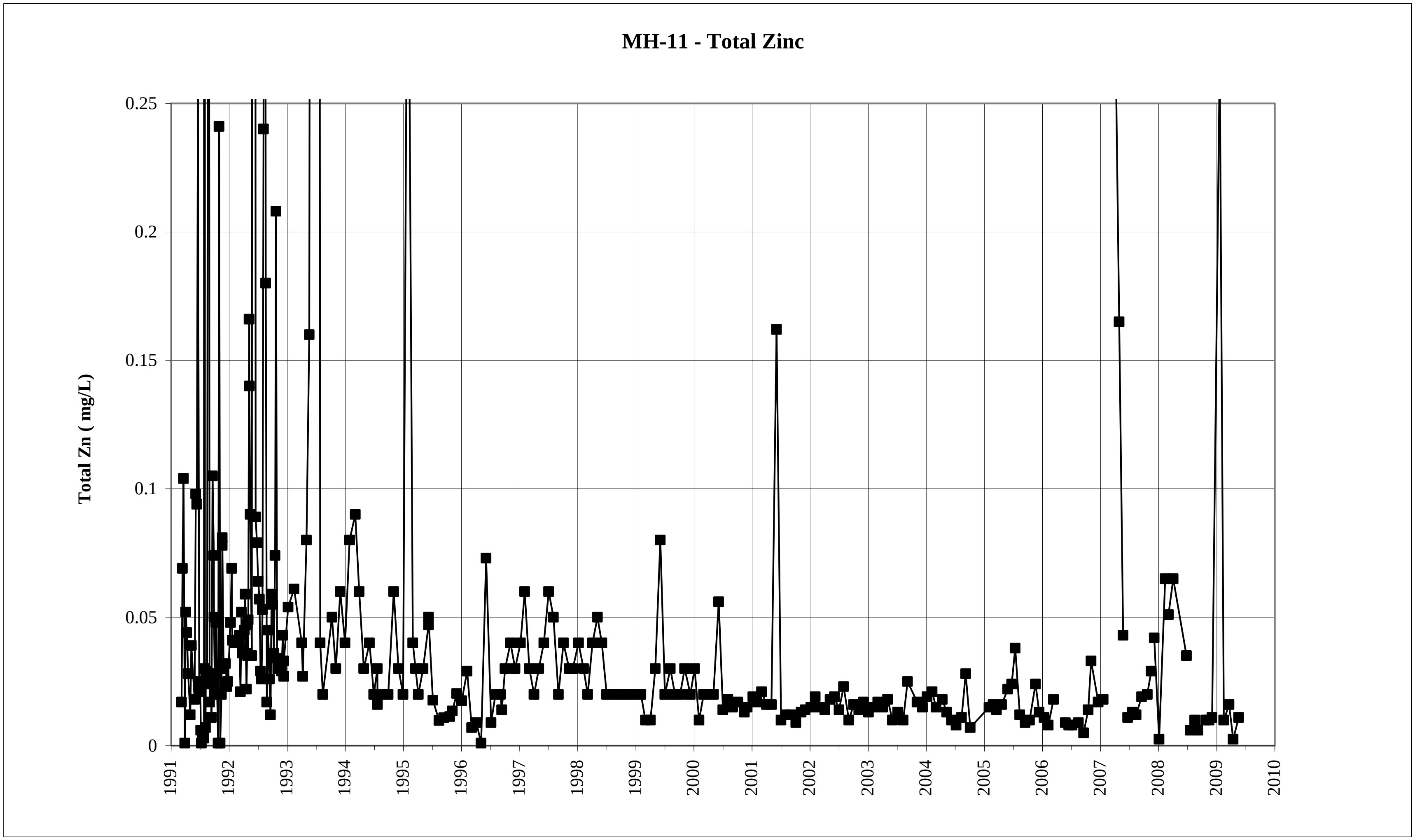


FIGURE D-7 MH-13 Sulphate

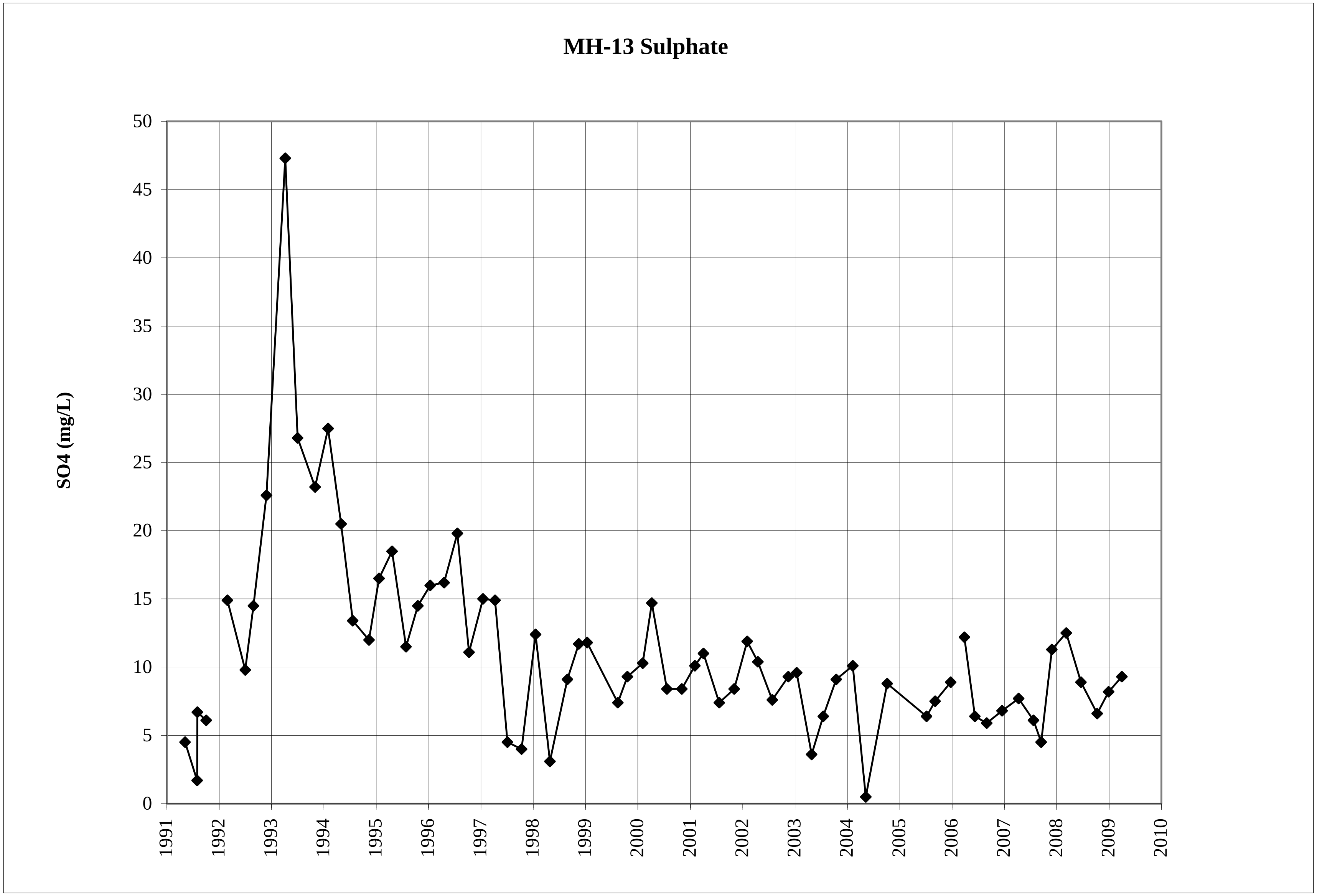


FIGURE D-8   MH-13 Total Zinc

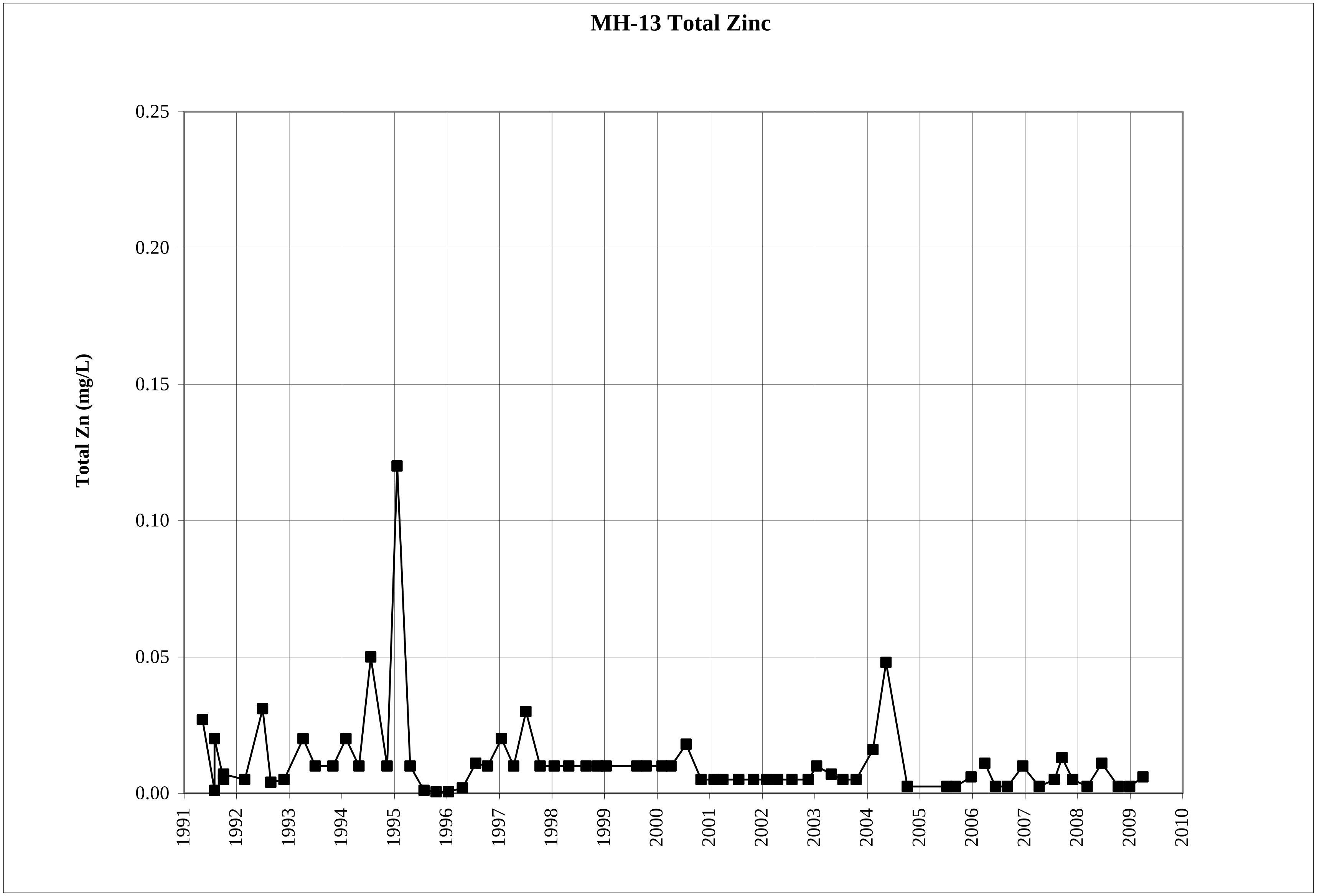


FIGURE D-9   MH-2 Sulphate

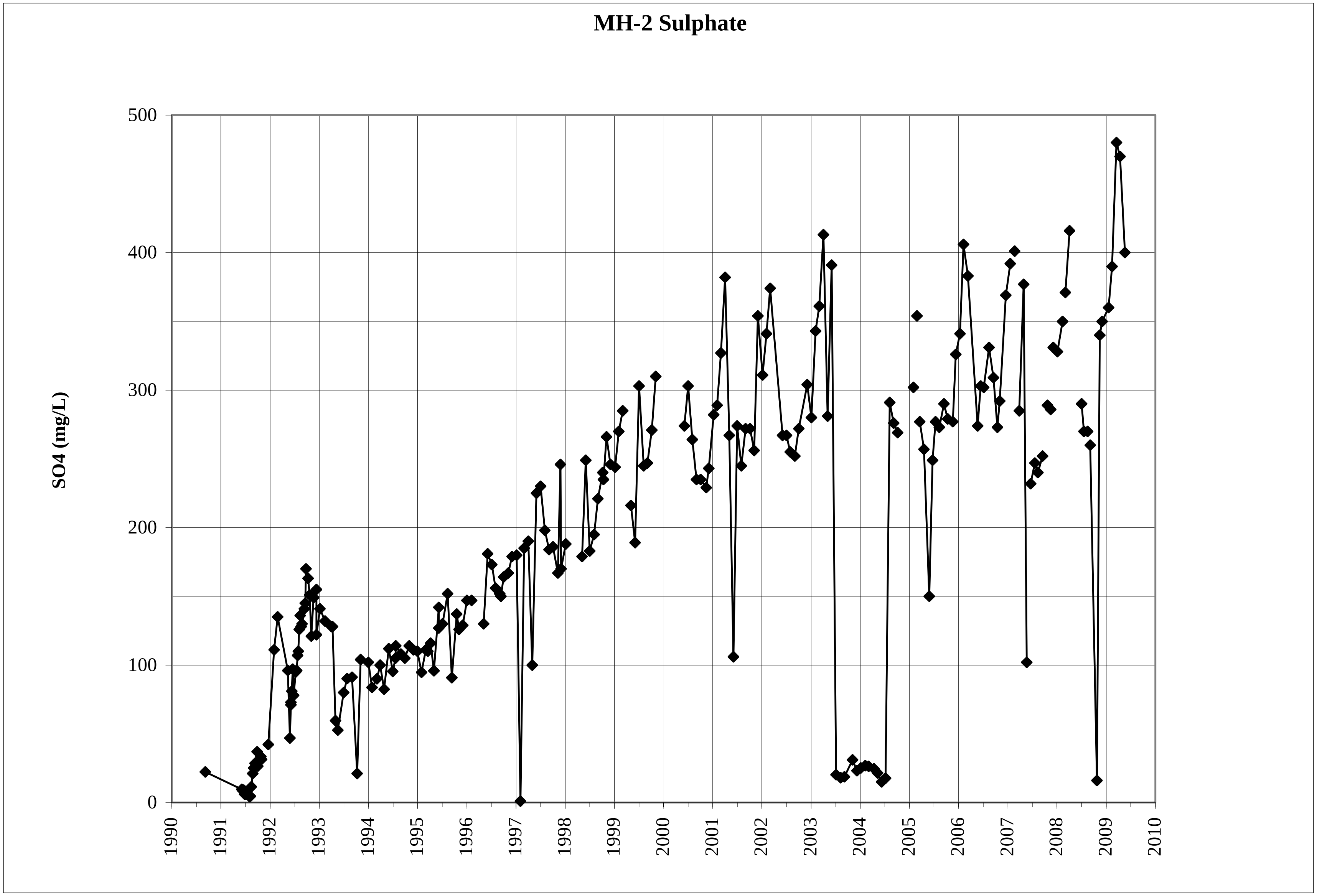


FIGURE D-10 MH-2 Total Zinc

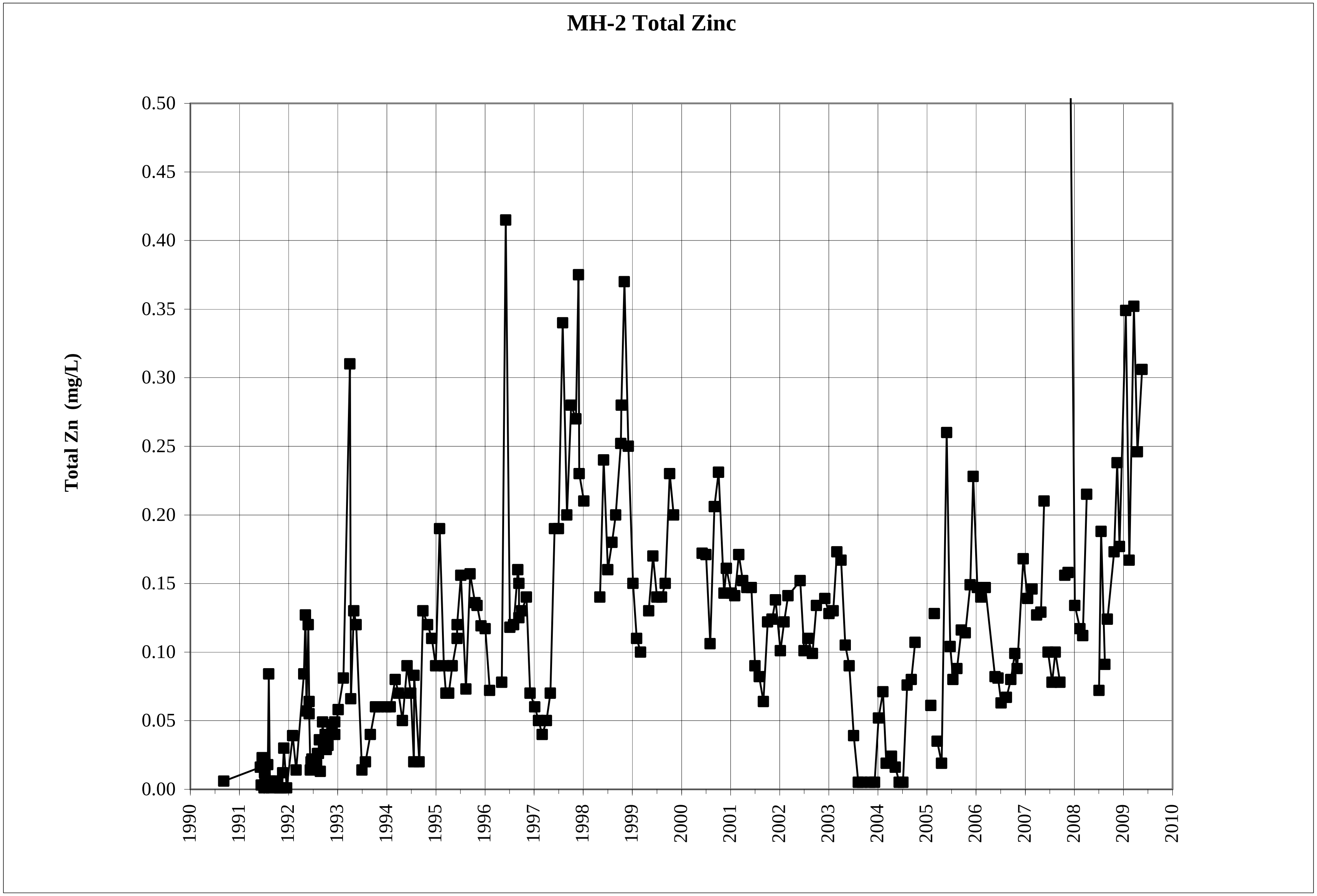


FIGURE D-11 MH-2 Total Zinc When Winter TSS <= 10 mg/L

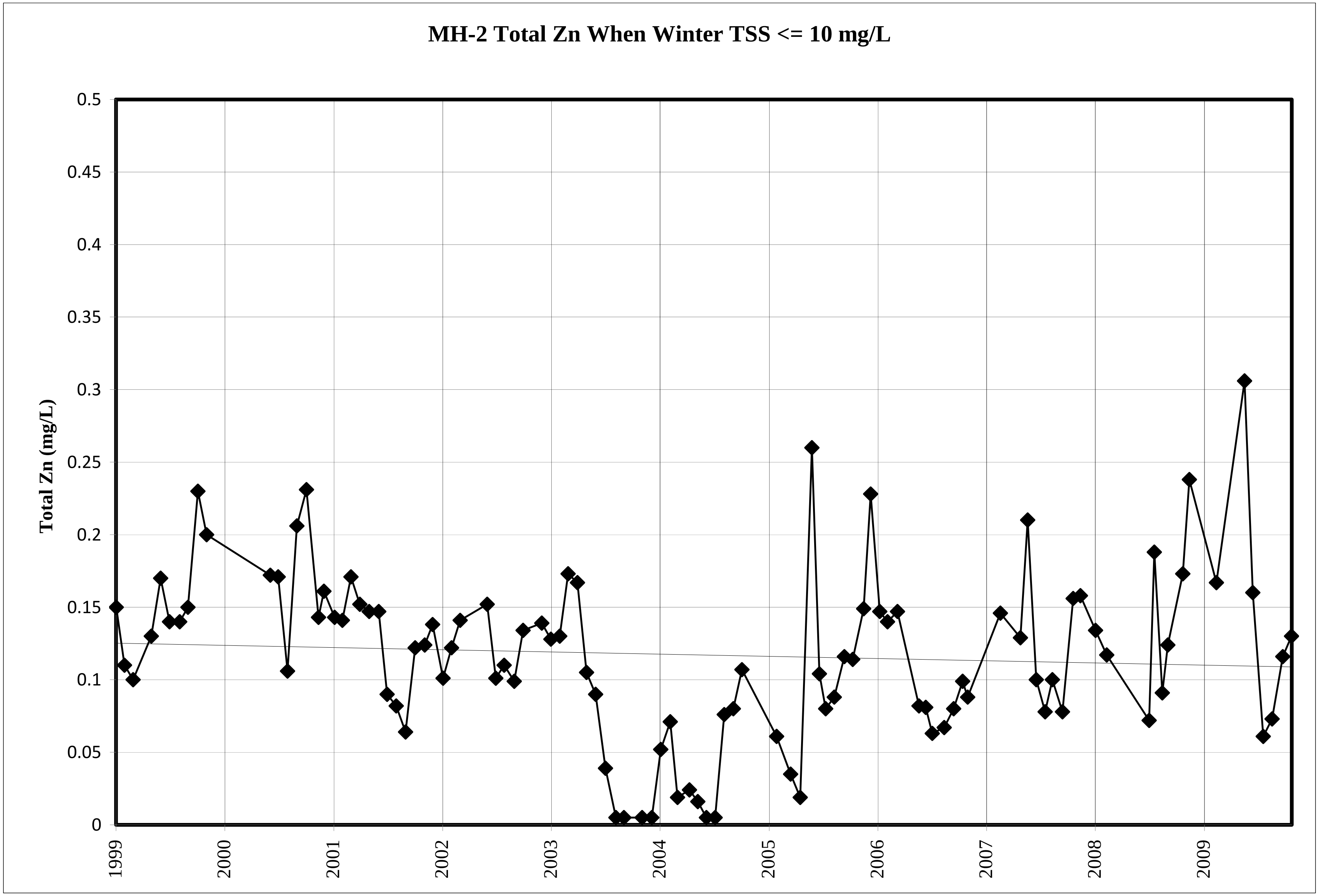


FIGURE D-12 MH-22 Sulphate

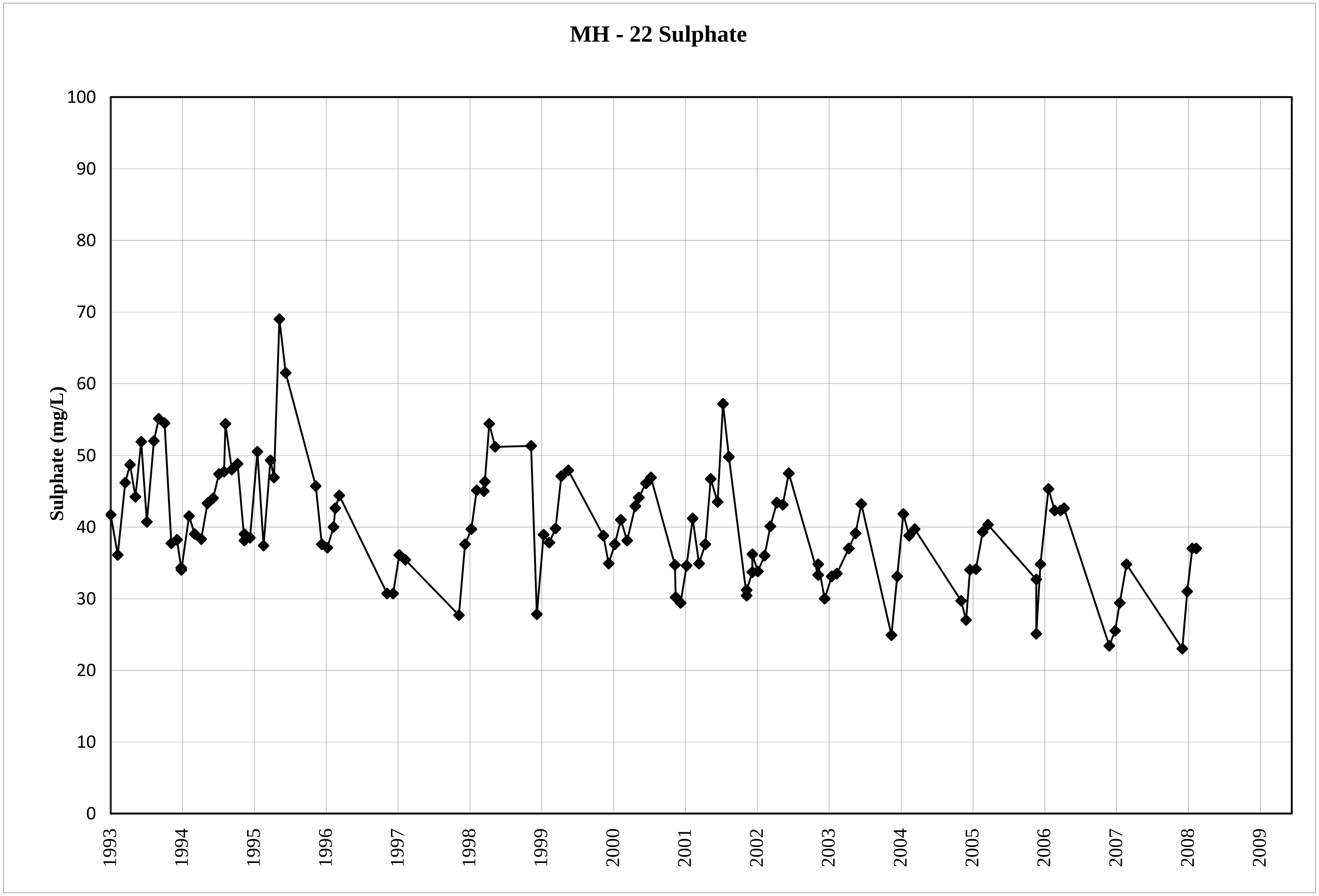


FIGURE D-13 Mh-22 Total Zinc

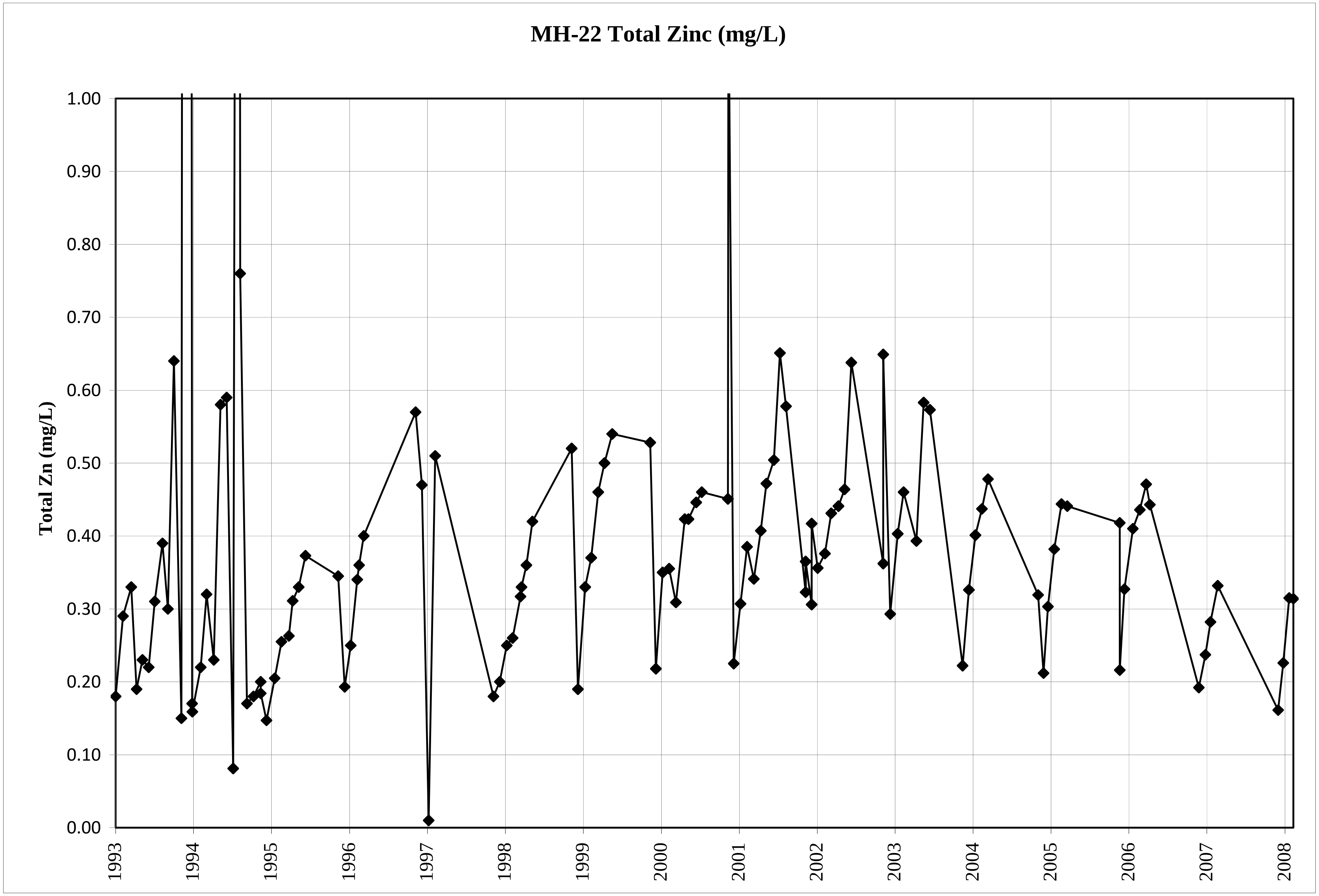


FIGURE D-14 MH-16 Sulphate

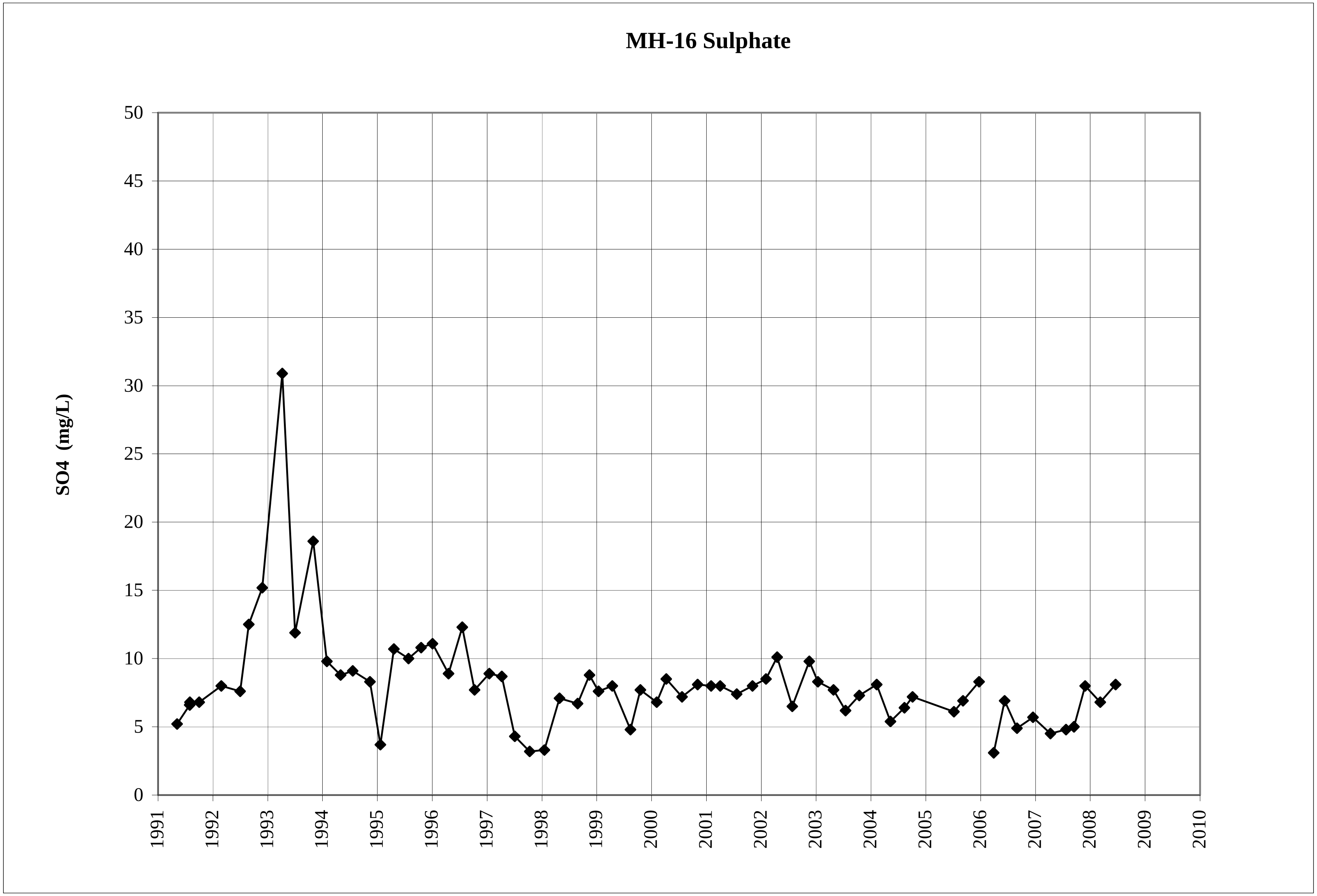
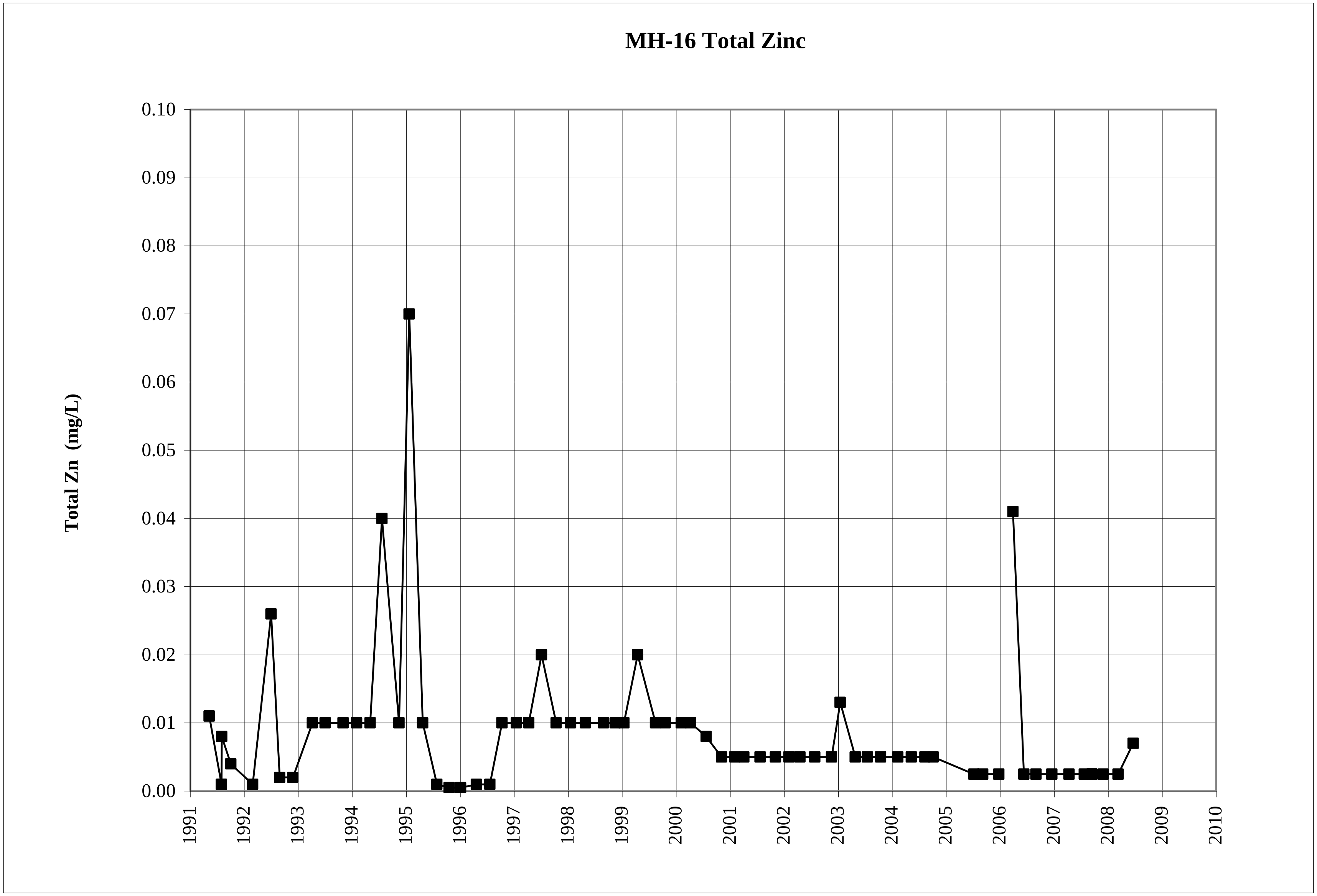


FIGURE D-15   MH-16 Total Zinc



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DETAILED DECOMMISSIONING & RECLAMATION PLAN

JANUARY 2010 UPDATE

APPENDIX E – MARCH 2007 SRK LETTER REPORT
"SÄ DENA HES MINE – 1380 PORTAL"

Prepared by:

ACCESS
CONSULTING GROUP

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March 12, 2007
1CT008.014

Teck Cominco Limited
601 Knighton Road
Kimberley, B.C.
V1O 1C7

Attention: Bruce Donald

Dear Bruce

Sä Dena Hes Mine – 1380 Portal

Following the meeting with agency representatives at the Yukon Government offices on September 12, 2006, it was agreed to provide a brief synthesis of the conceptual model for discharge and attenuation of zinc from the 1380 Portal and evaluation of the potential effect of loss of attenuation capacity in the headwaters of Camp Creek.

Description of Flow and Chemistry Observations

The 1380 Portal accesses a very short adit into the Main Zone. Drainage from the portal was first sampled in June 1999 as part of preparation of the Closure Plan. The drainage was clear, colourless and non-acidic but was found to contain 41 mg/L zinc.

Teck Cominco inspected the adit in June 2003 to determine the source of drainage from the portal. Two sources of inflowing groundwater were found (Figure 1). Zinc concentrations were relatively low (1.36 and 0.22 mg/L). The water was then observed to contact mineralized wall rubble and zinc concentrations increased to 40 to 46 mg/L. Concentrations did not increase further as the water flowed toward the portal (Figure 1).

Drainage exiting the portal had consistent chemistry when monitored every other day in June and July 2000. Zinc concentrations varied between 40 and 50 mg/L, and the water was near pH neutral and dominated by sulphate, calcium and zinc.

Following heavy rain in June 2003, flow from the portal was observed to flow in two directions (Figure 1). The major flow entered the waste rock dump on the slopes above the creek and flowed through the waste rock not far from the surface before entering the creek. The same condition had been observed in the previous year. This water was sampled in July 2002 and found to have similar total dissolved solids to the portal drainage but had slightly lower sulphate, much lower zinc (10 mg/L compared to 49 mg/L at the portal) but higher calcium and alkalinity. The water pH was also higher (7.8 compared to 7.2).

The smaller component of flow from the portal followed the road down toward a former settling pond and then into the gully (Figure 1). Teck Cominco's monitoring of waters in the gully in June 2003 showed that dissolved zinc concentrations in the gully decreased from 34.7 mg/L to 11.1 mg/L before the flow disappeared (Figure 1). No significant increase in flow in the gully was observed to account for the decrease in zinc concentrations

Water chemistry resembling the flow in the gully is not seen at any locations downstream despite monitoring by SRK of several springs feeding the headwaters of Camp Creek in July 2002. These locations are all several hundred metres from the locations where flow in the gully disappears. The main spring feeding Camp Creek was dominated by calcium and alkalinity (Figure 1). Zinc concentrations were 0.013 mg/L and sulphate 26 mg/L. No aspects of the spring water chemistry allowed it to be linked to the flow in the gully. Flow and chemistry measurements in Camp Creek during the bi-daily monitoring in June and July 2000 showed that the zinc load in Camp Creek was much lower than in the 1380 Portal drainage. However, sulphate loads in Camp Creek were consistently higher than in the portal drainage.

Conceptual Model

Zinc in the portal drainage originates from leaching of sphalerite in decomposing mineralized rock inside the adit. Oxidation of sphalerite (ZnS) produces zinc sulphate which is readily dissolved. Thermodynamic calculations showed that the drainage water was at maximum solubility for zinc carbonate. This explained Teck Cominco's observation that the zinc concentration in the drainage along the floor of the adit did not increase despite contact with mineralized rock along the flow path.

The decrease in zinc concentrations in the waste rock pile and along the gully may in part be explained by dilution but flows did not increase sufficiently to account for the decrease in zinc concentration from about 40 mg/L to near 10 mg/L. Thermodynamic calculations again showed that the waters were near maximum solubility for zinc carbonate despite the decrease in zinc concentrations. This could be explained by reaction of the drainage waters with dissolving marble causing the observed increase in pH and precipitation of zinc as zinc carbonate. This demonstrated that natural attenuation of zinc occurs by contact with the marble waste rock and talus in the gully.

There are two reasonable explanations for the increase in sulphate load in Camp Creek but deficit of zinc load in Camp Creek. Either the flow in the gully does not report to Camp Creek and the zinc and sulphate load in Camp Creek are from some other source, or the flow in the gully reports to Camp Creek but zinc is removed from the gully flow before it joins Camp Creek. The explanation for lack of zinc in this case would also need to account for the presence of sulphate load greater than found emanating from the portal. The monitoring data do not allow the two explanations to be evaluated.

SRK evaluated the second explanation experimentally by applying portal drainage to crushed marble comparable to the talus and natural rock placed in a laboratory column. The results clearly showed that sulphate was unaffected by passage through the column but zinc was removed becoming undetectable (<0.001 mg/L). The column was dismantled and rock near the top of the column was cemented by a zinc-bearing mineral which confirmed that the zinc was removed by precipitation. Zinc removal was far more effective than could be confirmed by thermodynamic calculations. While this did not prove that this removal mechanism occurs in the field, it confirmed that the natural soils at the site are capable of very efficiently removing zinc from the portal drainage. Removal of zinc could occur by two attenuation mechanisms. The first involves reaction with dissolving marble waste rock near the portal to produce zinc carbonate and resulted in concentrations near 10 mg/L. The second mechanism occurs in the soils further down slope and results in concentrations near 0.001 mg/L. Based on the results of the experiment, SRK calculated that the flow path length (600 m) between the gully and Camp Creek contained sufficient attenuation capacity to explain the lack of zinc load in Camp Creek in the time since the portal was opened.

The column experiment suggested that the rock had a finite attenuation capacity to remove zinc to low levels and it was predicted that this attenuation capacity could eventually be exhausted. Therefore, agency representatives have requested an evaluation of the effect of loss of attenuation capacity in the soils on water quality in Camp Creek. The results of a simple dilution calculation are provided in Table 1. The effect of loss of attenuation capacity is shown by the columns labelled “Breakthrough”, which is simulated by assuming that the dominant load in the gully comes from the 1380 Portal and that the breakthrough concentration would be 10 mg/L. This concentration was selected (rather than the 40 to 50 mg/L observed at the portal) because the first zinc removal step occurs by reaction between dissolving limestone and the portal drainage which would be expected to persist and not be affected by formation of precipitates as occurs in the soil.

Table 1 shows that at location MH4 in Camp Creek predicted zinc concentrations are about 0.1 mg/L due to the roughly 100 times dilution in the Camp Creek. Further downstream at MH11 below the effect of South Dam seepage and Jewel Box Hill, predicted zinc concentrations are 0.04 to 0.06 mg/L. At MH13 in South False Canyon Creek, predicted concentrations are 0.01 to 0.02 mg/L. In reality, other chemical and biological factors will result in lower zinc concentrations than predicted by dilution effects alone.

The Metal Mining Effluent Regulations (MMER) do not currently apply to the Sa Dena Hes mine as it was not operating at the time that the MMER came into effect. However, if the mine re-starts production, the MMERs would then apply. The MMER would require that the mine meet the Schedule 4 authorized limit for metals concentrations at the Final Discharge Point. Teck Cominco assert (B. Donald, personal communication), based on MMER definitions, a logical location for this compliance point would be at MH11. The Schedule 4 authorized limit for zinc is 0.5 mg/L, the same as the current Water Licence standard. At MH4 the predicted zinc concentrations would be well below the 0.5 mg/L MMER standard, and at MH11, they would almost meet CCME guidelines (0.03 mg/L).

Conclusions

The conceptual model currently consists of the following components:

- Zinc sourced from dissolution of sphalerite oxidation products.
- Partial attenuation of zinc in the waste rock and gully below the 1380 Portal by interaction with dissolving marble-rich waste rock and soils.
- Strong attenuation of zinc in soils downstream of where the gully flow disappears.
- Minimal dilution of zinc concentrations by dilute surface waters.
- Unknown fate of gully drainage.

Using the conceptual model, and assuming that flow from the gully does report to Camp Creek, it was predicted that in the event of total loss of zinc attenuation capacity of the soils, zinc concentrations in Camp Creek would remain well below MMER standards and by MH11 (the logical “Final Discharge Point”) could almost meet the CCME criterion.

Please contact the undersigned if you have any questions.

Yours truly,

SRK Consulting (Canada) Inc.

Stephen Day, P.Geo.
Principal Geochemist

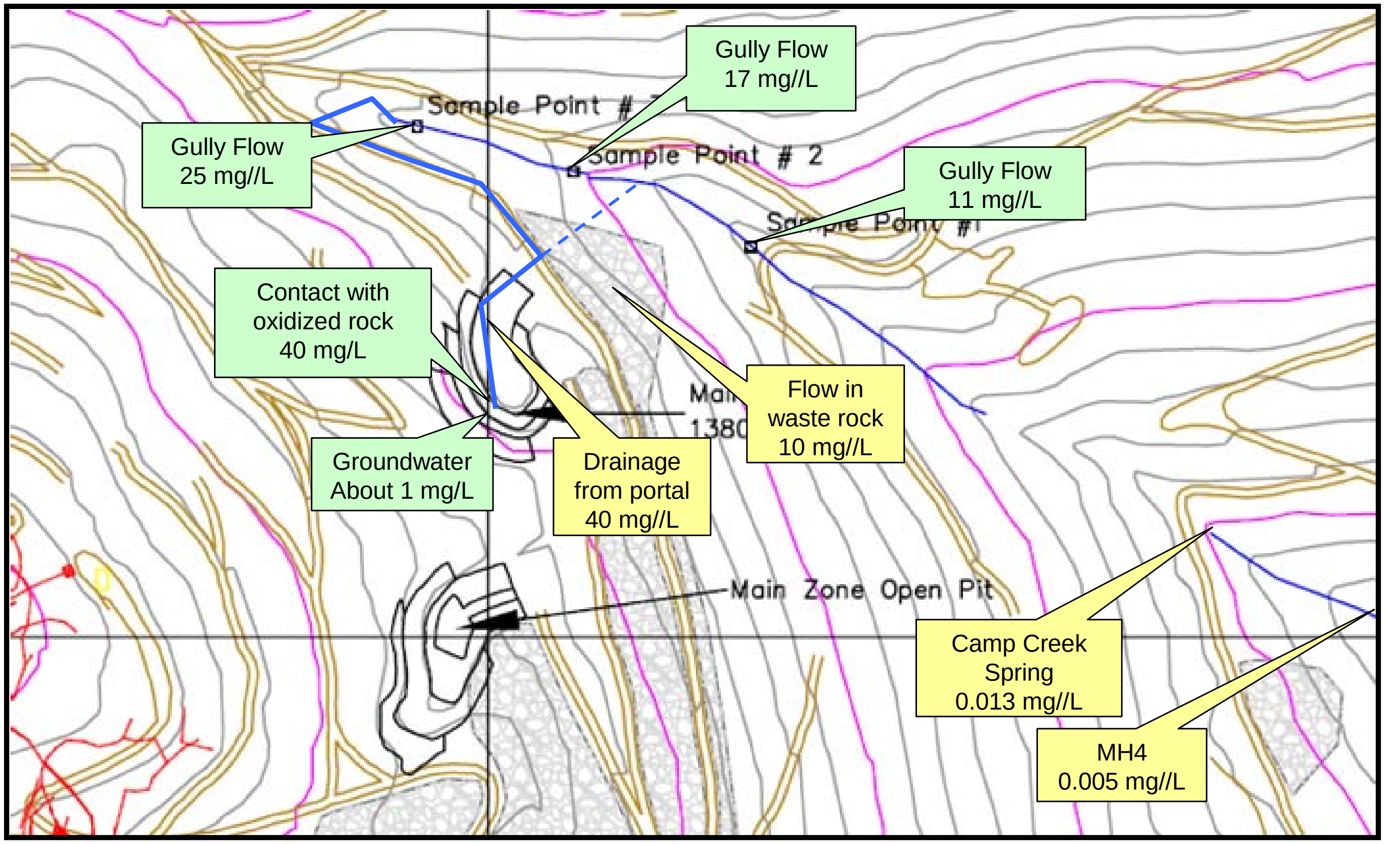

Figure 1: Compilation of Dissolved Zinc Concentrations as Determined by SRK (1999, 2000, 2002) (Yellow boxes) and Teck Cominco (2003) (Green boxes). Approximate flow paths between the portal and gully are shown.

Table 1: Calculated Effect on Camp Creek Water Quality Due to Loss of Attenuation Capacity in the Soils Below 1380 Portal

Month	1380 Portal		MH4			MH11			MH13		
		Zinc		Zinc			Zinc			Zinc	
	Flow	Breakthrough	Flow	Current	Breakthrough	Flow	Current	Breakthrough	Flow	Current	Breakthrough
	m^3/mo	mg/L	m^3/mo	mg/L	mg/L	m^3/mo	mg/L	mg/L	m^3/mo	mg/L	mg/L
June	2592	10	248570	0.007	0.1	667269	0.02	0.06	2093002	0.005	0.02
August	625	10	71502	0.006	0.1	203186	0.01	0.04	651751	0.005	0.01
October	446	10	51151	0.008	0.1	168422	0.01	0.04	568190	0.005	0.01

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DETAILED DECOMMISSIONING & RECLAMATION PLAN

JANUARY 2010 UPDATE

APPENDIX F – 2005 SÄ DENA HES MINE WATER QUALITY & LOADING REASSESSMENT

Prepared by:

ACCESS CONSULTING GROUP

SRK Consulting
Engineers and Scientists

Sä Dena Hes Mine

Water Quality and Loading Re-Assessment

Report Prepared for

TeckCominco Ltd.

Report Prepared by

SRK Consulting
Engineers and Scientists

January 2005

Sä Dena Hes Mine

Water Quality and Loading Re-Assessment

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SRK Project Number 1CT006.008

January 2005

Authors

Stephen Day, P.Geo

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1 Introduction

Appendix B of the 2000 Detailed Decommissioning & Reclamation (D&R) Plan for the Sä Dena Hes Mine contained an evaluation of loadings in surface water flows as a tool for evaluating reclamation priorities. Inputs to the model were based on flow and water quality data available up to 1998 during which water quality was changing following cessation of mining at the site in 1992. The current Type “A” Licence requires an update of the loading calculations. SRK Consulting (Canada) Inc. (SRK) was retained by TeckCominco Ltd. to review water quality data collected in the last six years and re-calculate the loadings. The purpose of the review was to determine whether significant changes in water chemistry have occurred and how these might affect overall loadings from the site.

2 Methods

2.1 Water Quality Trends

The original water quality database containing water quality data up to December 1998 was updated using information provided by TeckCominco. The original and revized databases were merged into a single spreadsheet. Water quality trends were evaluated using time-series plots. Based on previous experience, the review was focussed on the following parameters for the indicated reasons:

- **Sulphate**. Sulphate is an indicator of the effect of the site on surface water chemistry due to oxidation of sulphide minerals in mine facilities although it may also be released by leaching of natural sulphate minerals. After leaving the individual mine sources, sulphate is typically chemically conservative[1] at Sä Dena Hes due to the effects of dilution which prevents precipitation of sulphates. It is therefore a useful parameter for understanding trends and tracking sources of load.

- **Total Suspended Solids (TSS)**. TSS was evaluated because the database contains metal concentrations determined primarily on unfiltered samples. It typically therefore provides an indication of possible differences between leaching effects which release metals in dissolved form and erosional processes that release metals in suspended form. Suspended matter may also be produced by chemical precipitation though this does not appear to be a common process at Sä Dena Hes.

[1] “Conservative” in this context means that the mass of sulphate is unchanged. Concentrations may fluctuate due to addition of water, but once a quantity of sulphate is added to the water it is not removed from solution either by formation of a solid or by chemical transformation to another dissolved species.

- **Total Zinc**. Dissolved zinc concentrations are a direct indicator of release of zinc produced by oxidation of zinc sulphide. Provided that TSS is very low, total zinc loadings can also be used to indicate the effects of zinc leaching from mine facilities.

2.2 Loading Calculation

The loading calculation approach was comparable to that used for the 2000 Detailed D&R Plan. The overall flow network considered in the loading calculation is shown in Figure 1. Monitoring locations are shown in Appendix A.

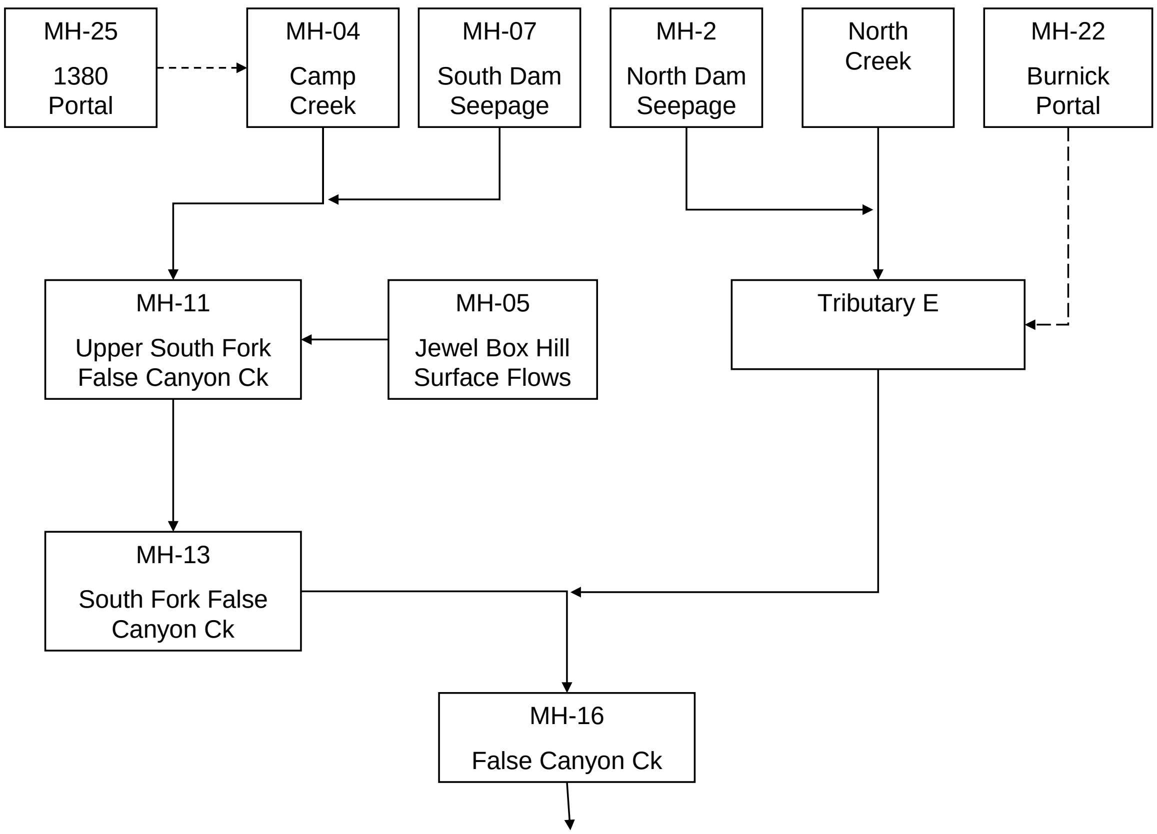


Figure 1. Flow Network Used in Loading Calculations. Solid lines indicate surface flow connections. Dashed line indicates subsurface flow connection.

The flow network used in the 2000 Detailed D&R Plan considered MH-22 (North Hill Settlement Basin) as a direct surface flow connection to Tributary E. Subsequent work reported by SRK Consulting (2003) has demonstrated that MH-22 does not have a surface connection to Tributary E and that soils in the slopes below MH-22 significantly attenuate zinc concentrations to low levels (<0.001 mg/L). Sulphate is not attenuated and monitoring sulphate concentrations are used for calculation. The original loading balance has been re-calculated and the current loading balance calculated using attenuated zinc concentrations for MH-22 indicated by laboratory studies.

MH-25 (Main Zone 1380 Portal) was not specifically included in the 2000 Detailed D&R Plan because the source is part of the MH-4 catchment though not through surface flow. The approach used to include MH-25 in the load balance is the same as that for MH-22. Attenuated zinc concentrations from laboratory tests and sulphate concentrations from site monitoring were used as inputs to the load balance.

The inputs to the loading calculation are surface water flows and chemistry. In the previous version, data collected from the three years prior to and including 1998 (ie 1996, 1997 and 1998) were used to calculate monthly median concentrations and flow rates. For the current version, a similar approach was used though 2004 was not included because the complete dataset for that year was not available. If possible, median input values were calculated for 2001, 2002 and 2003. For sites with limited data, the range was expanded. MH-04 statistics were estimated from 1999 to 2003. Data collected from MH-02 in 2003 and 2004 are believed to be erroneous by TeckCominco and were not used. Data from 2000 were used instead. Data for MH-25 were available for 2002 and 2003.

For small discrete flows (MH-02, MH-07, MH-22 and MH-25), flow rates are routinely recorded at the time of water sample collection. Median flow rates were calculated based on the year ranges indicated above. Flow measurements are not collected for the creeks (Camp Creek, False Canyon Creek). For the load calculations, average monthly flows calculated for the 2000 Detailed D&R Plan were used for the creeks.

Loadings were calculated for sulphate and zinc for the reasons indicated in Section 2.1. The loads for each source in each month are calculated in kg/month. To evaluate the significance of sources of individual loadings in the basin, the percentages of load compared to the load at the lowest station (MH-16) were calculated.

Finally, the background zinc and sulphate loadings and concentrations for each component of the basin were back-calculated using:

Background Loading = Loading at Station – Loading at Upstream Sources

Background Concentration =

(Loading at Station – Loading at Upstream Sources)/(Flow at Station – Flow at Upstream Sources)

The background loading calculation provides the context for the mine area loadings by indicating the contribution from natural weathering of soils and background in the catchment basin. The background concentrations indicate variations in the natural release of sulphate and zinc, potential missing sources in the mine area, and overall reliability of the balance.

3 Results and Discussion

3.1 Data Trends

3.1.1 South Fork False Canyon Creek

The main known sources in this catchment area are Camp Creek (MH-04) and seepage from the South Dam (MH-07). The east slope of Jewelbox Hill also contributes to the catchment area but not through visible surface flow. Intermittent flow is observed near the site gatehouse.

Camp Creek (MH-04) receives flow from the natural mineralized exposure on the north side of Jewelbox Hill as well as from the Main Zone Pit and 1380 Portal (MH-25) via subsurface flow. The 1380 Portal continues to be a source of elevated zinc concentrations and loads exceeding loads at MH-04 (Figure 2). Investigations subsequent to the 2000 Detailed D&R Plan (SRK Consulting 2003) indicated that this load reduction is probably occurring as a result of strong attenuation in waste rock and talus below the portal.

Monitoring results for MH-04 indicate that zinc concentrations have been low and decreasing slightly since 1998 (Figure 3). Sulphate concentrations have been relatively stable for at least ten years.

Monitoring data for the South Dam seepage (MH-07) show a continuing long term decrease in sulphate concentrations which began when operations ceased. Zinc concentrations appeared to increase in the late 1990s reaching concentrations approaching 0.3 mg/L following a trend opposite to sulphate. Zinc concentrations decreased from 1998 to 2001. In 2003 and 2004, zinc concentrations increased from 0.07 mg/L to 0.18 mg/L (Figure 4).

Limited data are available for MH-05 and were not included in the review or subsequent loading calculations.

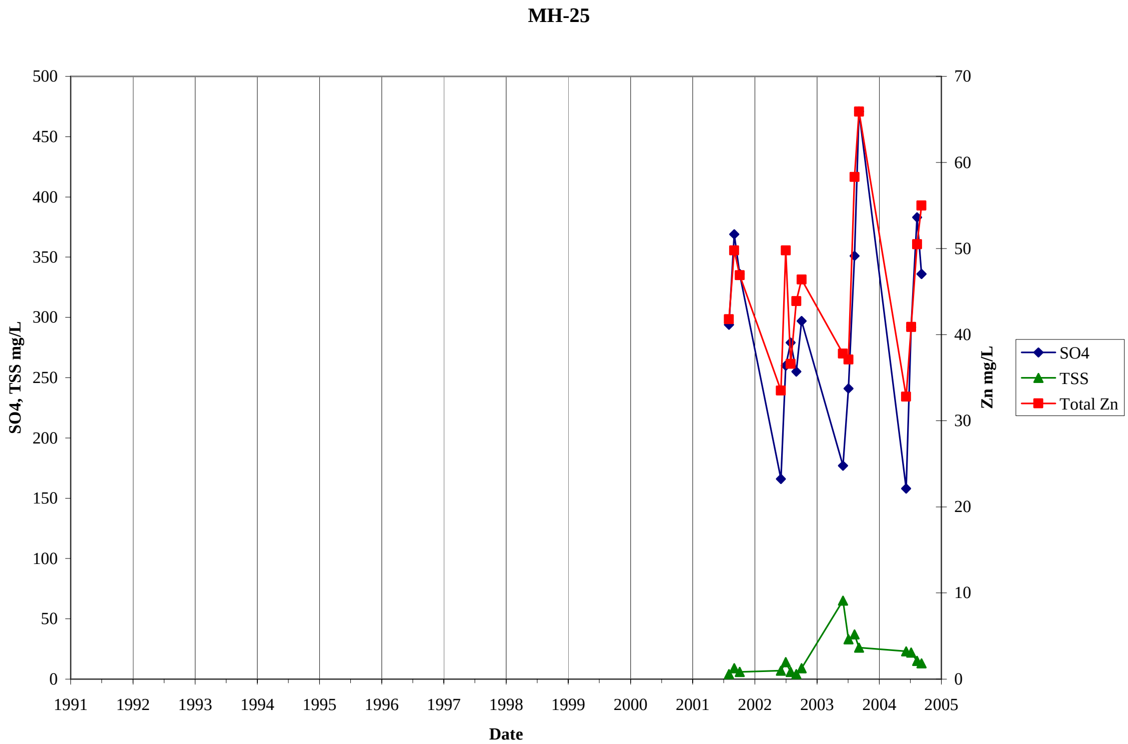


Figure 2. Monitoring Results for 1380 Portal (MH-25).

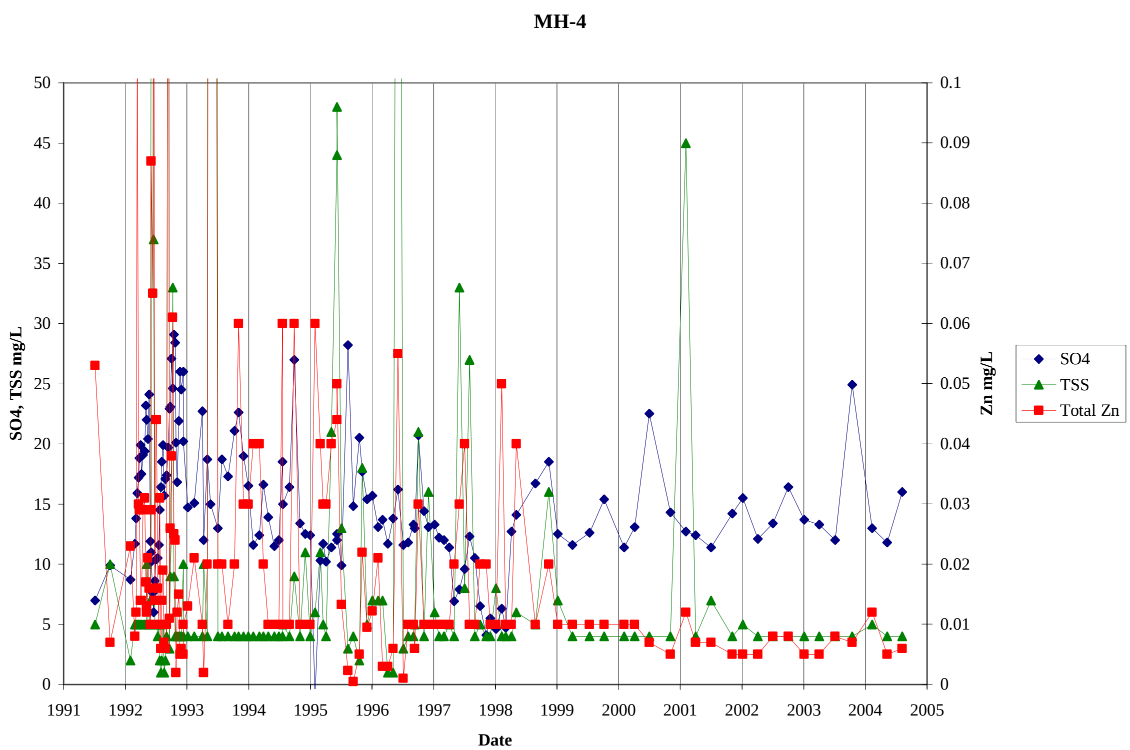


Figure 3. Monitoring Results for Camp Creek at MH-4

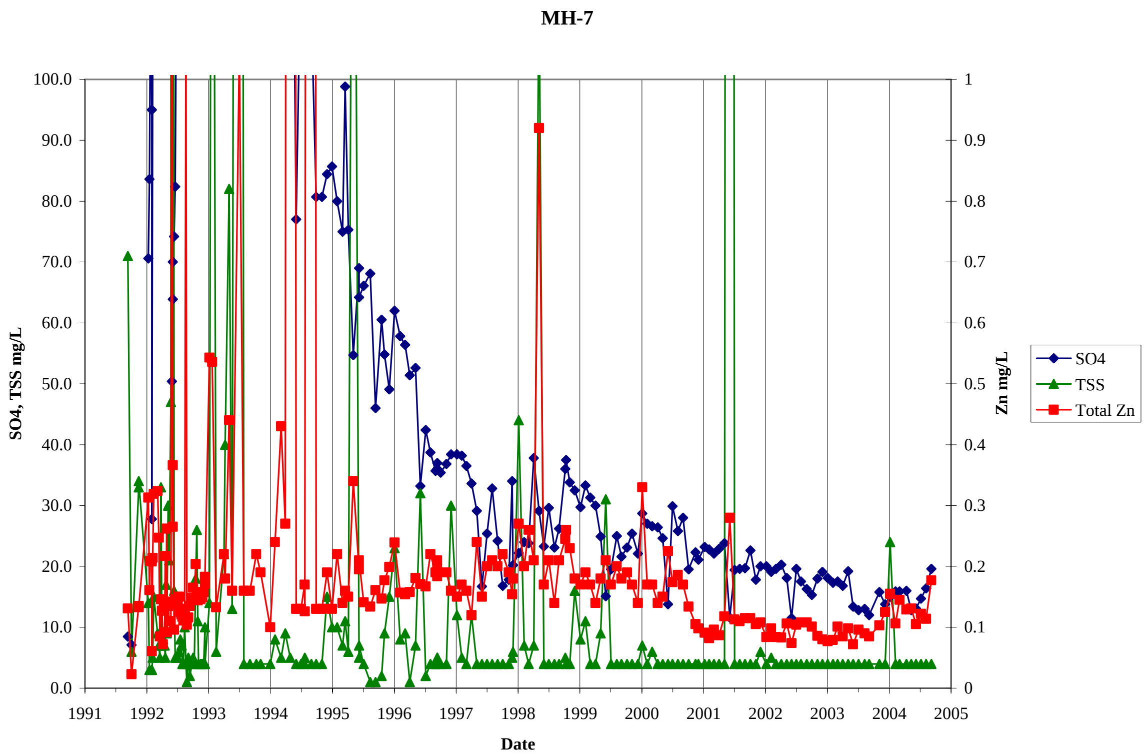


Figure 4. Monitoring Results for South Dam Seepage (MH-07)

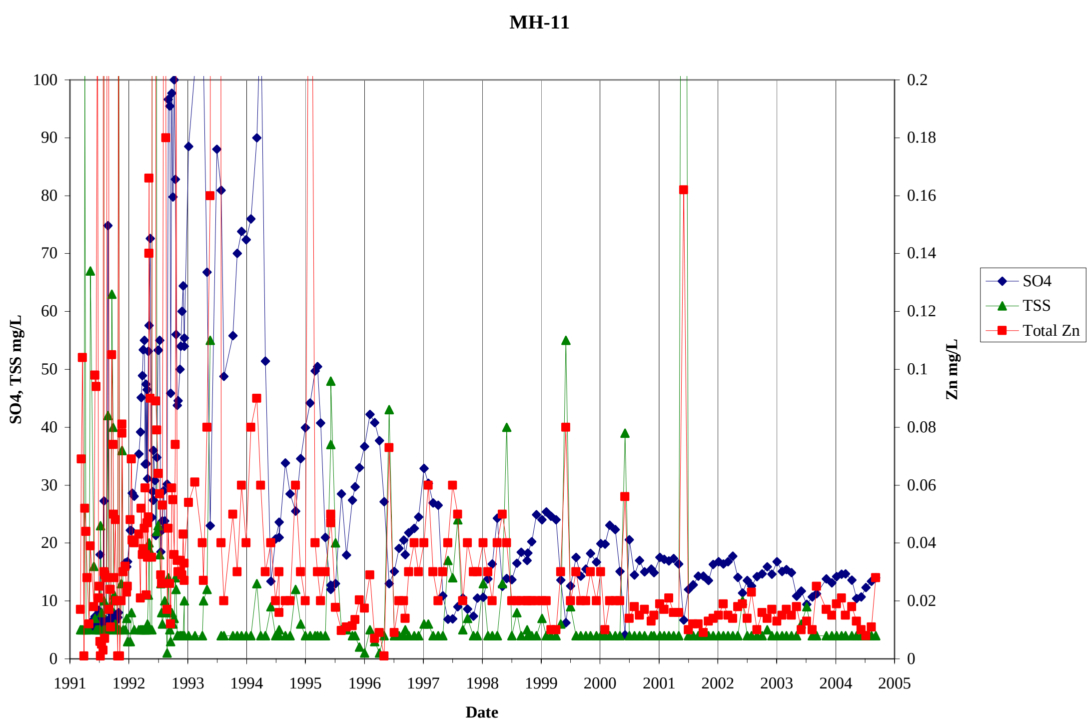


Figure 5. Monitoring Results for MH-11

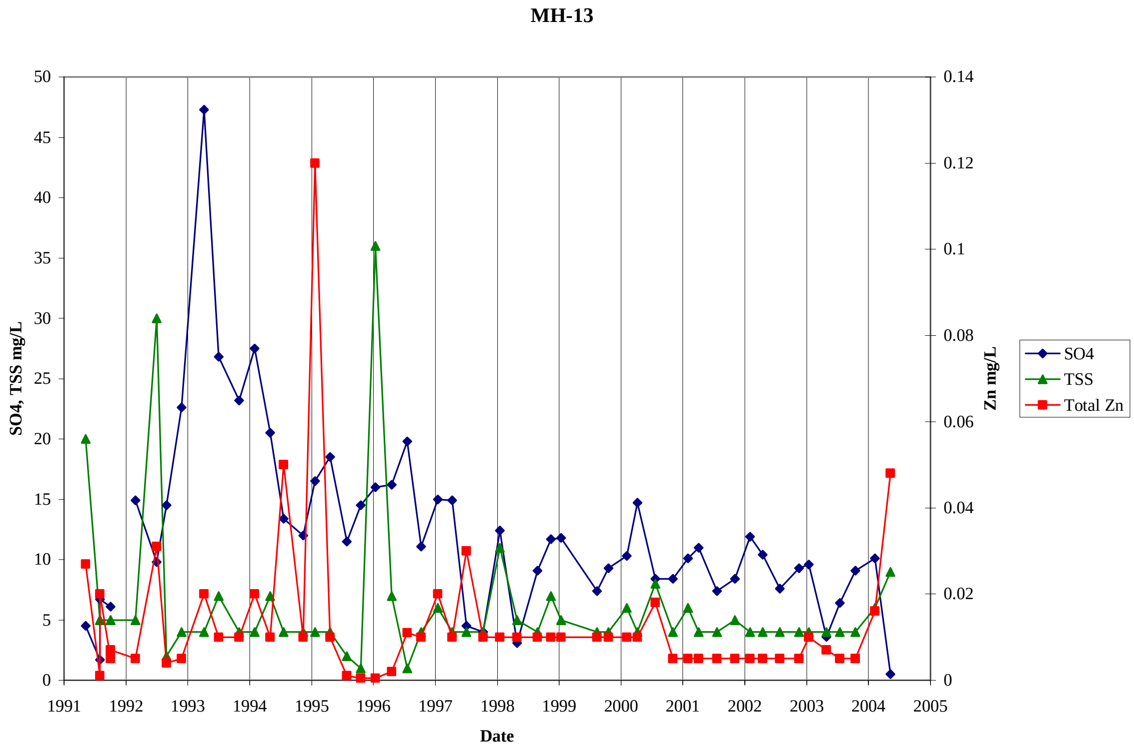


Figure 6. Monitoring Results for MH-13.

MH-11 is roughly 3 km downstream of the South Dam. This site has shown a steady decrease in sulphate concentrations matching the decrease at MH-07 (Figure 5). Zinc has shown the same general trend though with a slight upward trend since 2001. The zinc concentration in September 2004 was 0.028 mg/L.

MH-13 is several kilometres downstream from MH-11 in False Canyon Creek. This site has also shown a steady decrease in sulphate concentrations. Zinc concentrations have remained low (Figure 6). The last two results in 2004 showed a slight increase to 0.048 mg/L, but this appears to be related to a corresponding increase in TSS to 9 mg/L.

3.1.2 Tributary E Catchment

Seepage from the North Dam (MH-02) and the North Hill Settlement Basin (MH-22) are monitored in the Tributary E Catchment. As shown in Figure 1, the latter site receives the Burnick Portal discharge and runoff from the 1200 Portal area but does not have a surface water connection to Tributary E.

MH-2 has shown significant trends since the Detailed D&R Plan was prepared (Figure 7). Sulphate concentrations continued to increase reaching 413 mg/L in 2003. In contrast, zinc concentrations reached peak levels near 0.3 mg/L in 1998 and have since decreased to less than 0.1 mg/L. The decrease in zinc concentrations probably reflects the removal of wind blown tailings from the dam face by TeckCominco. The increase in sulphate concentrations is maybe due to increase in the influence of oxidation of tailings relative to draindown of residual dilute process water.

In mid-2003, the monitoring results indicated a very sharp decrease in all parameters and then increased again in 2004 to levels observed prior to the decrease. The reason for this discontinuous trend is unknown. No changes in the physical environment at the North Dam occurred during this period. TeckCominco has indicated that it most likely represents technician error.

Monitoring results for the North Hill Settlement Basin (MH-22) indicate stable slightly decreasing sulphate concentrations below 50 mg/L and erratic possibly increasing zinc concentrations (Figure 8). Zinc concentrations vary widely seasonally from 0.2 to 0.6 mg/L. The long term increase is suggested by increases in the lowest and highest concentrations observed. The increase may be a result of continuing decomposition of sphalerite boulders in the underground mine and waste rock dump at the portal.

3.1.3 MH-16

MH-16 is in False Canyon Creek downstream of the confluence with Tributary E. Like MH-11 and MH-13, sulphate concentrations initially decreased but have remained stable since 1998 (Figure 9). Likewise, zinc concentrations have remained very low since 2001.

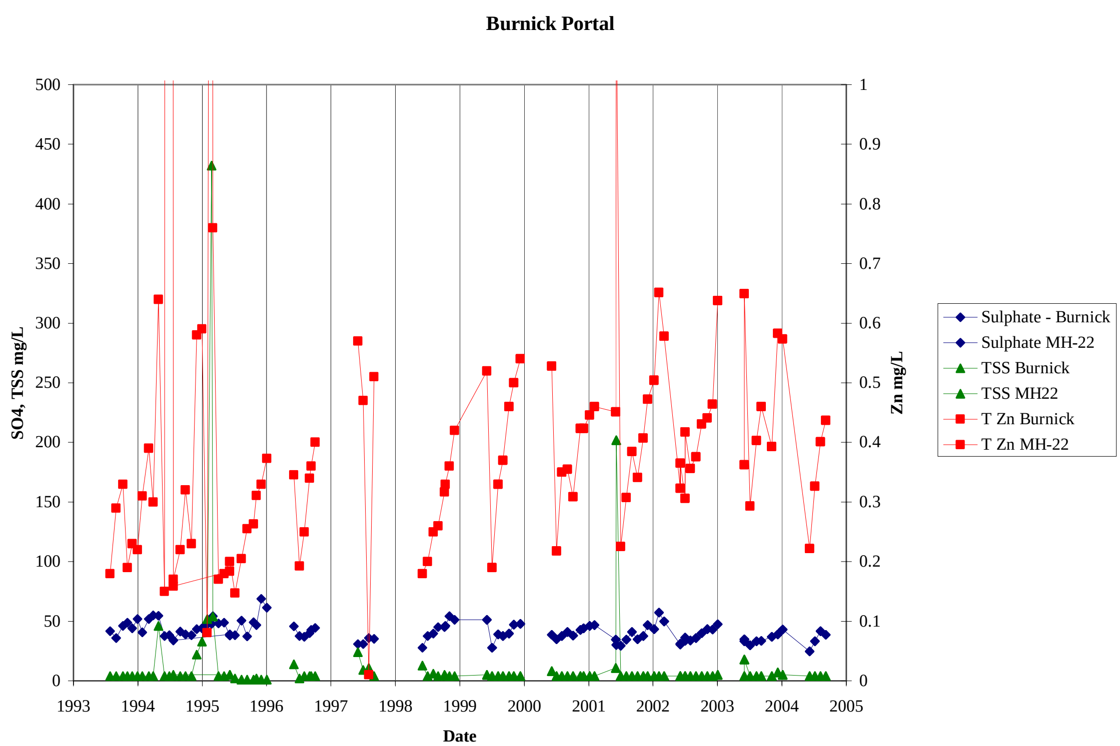


Figure 7. Monitoring Results for North Dam Seepage (MH-02).

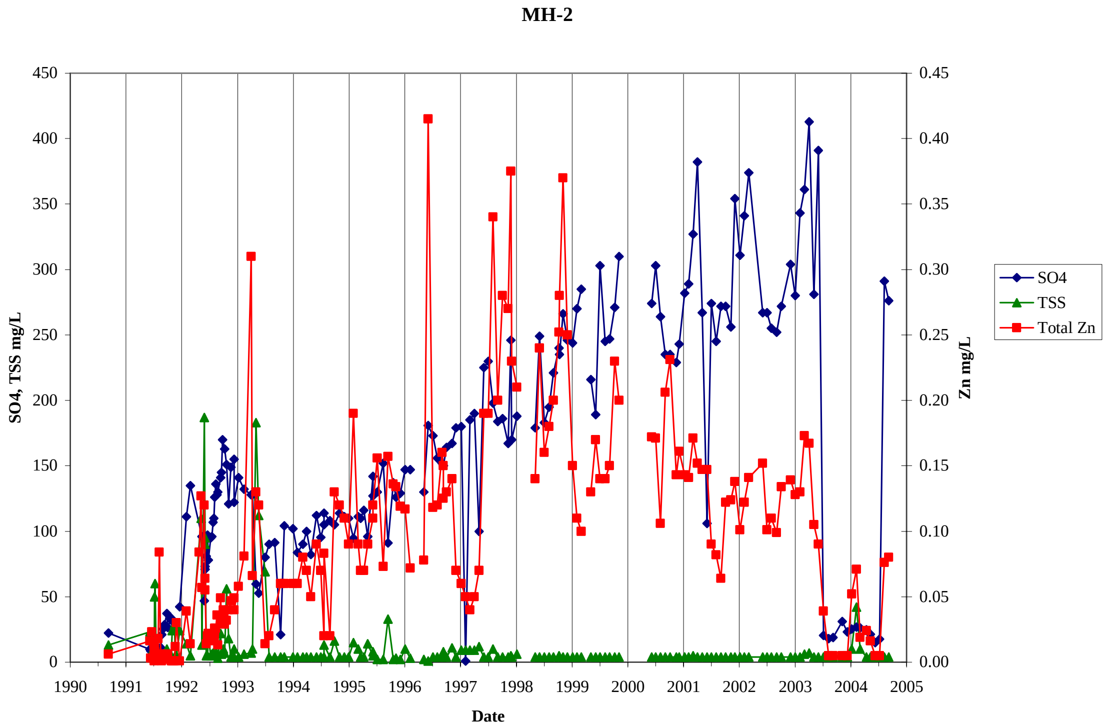


Figure 8. Monitoring Results for North Hill Settlement Basin (MH-22)

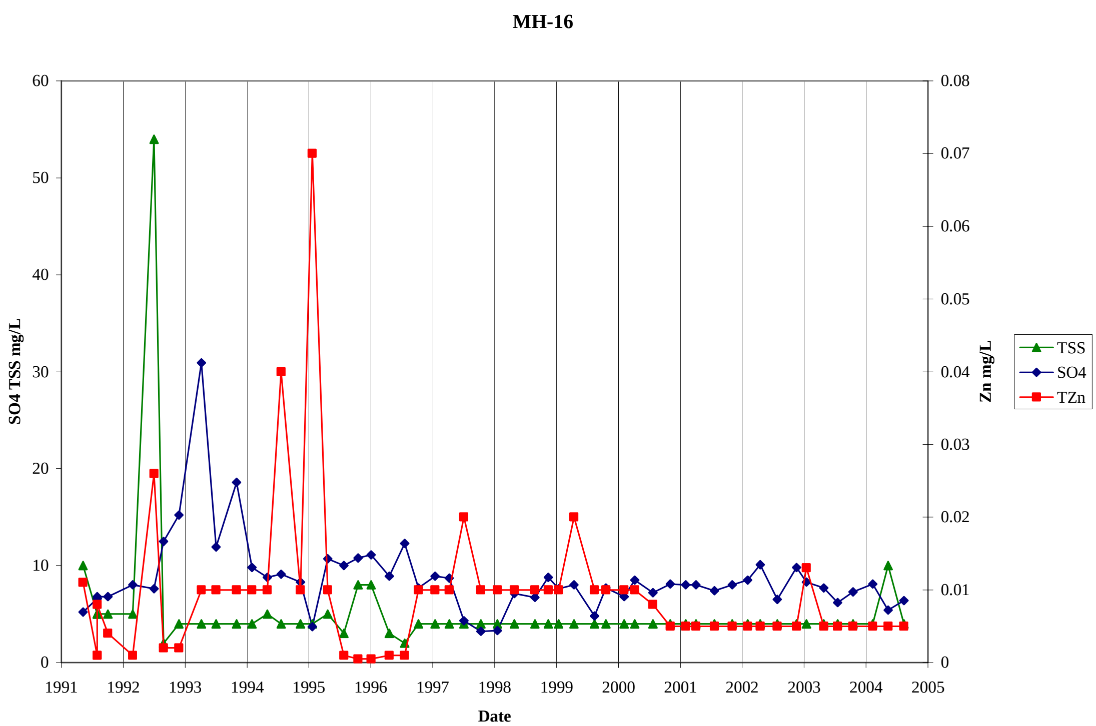


Figure 9. Monitoring Results for False Canyon Creek Below Tributary E.

3.2 Loading Calculation

In the following discussion, the loading calculations presented in the 2000 D&R Plan are referred to as the "1998" results. The current calculations are referred to as the "2003" results.

Results of the loading calculation are presented in Table 1. In the catchment area originating from the south side of the site, the largest sulphate loading from areas affected by mining is Camp Creek (MH-4). MH-25 may contribute part of the sulphate but negligible zinc load through subsurface flow. The balance of sulphate load may originate from small waste rock dumps, roads and natural mineralized exposures on Jewel Box Hill.

South Dam seepage is less important as a source of sulphate loading. Sulphate concentrations are slightly higher than Camp Creek but the flow volume is much lower. The dam seepage in contrast contributes comparable zinc load to Camp Creek due to the higher zinc concentrations in the former. The proportion of loading at MH-16 from these sources is relatively low with the majority of loading originating from natural background sources rather than the mine area, but the effect of the slight changes since the late 1990s is apparent. The increase in sulphate concentrations and decrease in zinc concentrations has translated to MH-04 becoming a slightly greater source of sulphate and a lesser source of zinc in 2003 compared to 1998. The South Dam seepage (MH-7) has decreased as a source of sulphate but generally increased as a source of zinc.

Table 1. Summary of Loading Calculation.

				2003								2000 Detailed D&R Plan			
				Flow and Load at Station				Load Proportion of MH-16		Calculated Background		Load Proportion of MH-16		Calculated Background	
Month, Basin and Site	Measured Flow	SO_4	Zn	Calc'd Flow	Flow Used	SO_4	Zn	SO_4	Zn	SO_4	Zn	SO_4	Zn	SO_4	Zn
	L/min	mg/L	mg/L	dm^3/mo	m^3/mo	kg/mo	kg/mo	%	%	mg/L	mg/L	%	%	mg/L	mg/L
South Fork Catchment															
Attenuated MH-25															
January	10	317	0.001	15	446	141	0.0	4%	0%						
June	60	172	0.001	249	2592	445	0.0	1%	0%						
August	14	293	0.001	72	625	183	0.0	1%	0%						
October	10	317	0.001	51	446	141	0.0	1%	0%						
MH-04															
January	-	14	0.005	15	14850	203	0.1	6%	2%			5%	9%		
June	-	14	0.007	249	248570	3505	1.6	8%	5%			4%	15%		
August	-	16	0.006	72	71502	1144	0.4	9%	4%			7%	5%		
October	-	16	0.008	51	51151	839	0.4	6%	4%			6%	7%		
MH-07															
January	102	21	0.123		4553	94	0.6	3%	15%			19%	89%		
June	200	13	0.165		8640	114	1.4	0%	5%			1%	3%		
August	150	18	0.112		6696	121	0.7	1%	8%			1%	5%		
October	178	21	0.125		7924	167	1.0	1%	11%			1%	6%		
MH-11															
January	-	17	0.015	43	42759	718	0.6	21%	17%	18	0.0003	47%	97%	48	0.000
June	7621	11	0.019	667	667269	7607	12.7	18%	42%	10	0.024	16%	39%	19	0.03
August	6486	12	0.011	203	203186	2387	2.2	18%	23%	9	0.008	22%	28%	20	0.0021
October	8304	15	0.013	168	168422	2442	2.1	18%	23%	13	0.006	22%	37%	22	0.028
MH-13															
January	-	10	0.008	138	137835	1358	1.0	40%	28%	7	0.004	60%	133%	5	0.008
June	-	9	0.005	2093	2093002	18628	10.5	43%	35%	8	-0.002	79%	108%	31	0.029
August	-	8	0.005	652	651751	5377	3.3	40%	34%	7	0.002	43%	20%	8	-0.003
October	-	9	0.005	568	568190	5171	2.8	39%	31%	7	0.002	37%	21%	7	-0.006
Tributary E Catchment															
MH-2															
January	15	297	0.122		670	199	0.1	6%	2%			11%	22%		
June	150	267	0.152		6480	1730	1.0	4%	3%			1%	2%		
August	32	255	0.094		1406	358	0.1	3%	1%			1%	1%		
October	40	272	0.134		1786	486	0.2	4%	3%			1%	2%		
Attenuated MH-22															
January	23	46	0.001		1027	47	0.0	1%	0%			4%	0%		
June	172	32	0.001		7409	239	0.0	1%	0%			1%	0%		
August	112	34	0.001		5000	169	0.0	1%	0%			1%	0%		
October	113	38	0.001		5022	188	0.0	1%	0%			0%	0%		
Whole Basin															
MH-16															
January	-	8	0.009	413	413117	3367	3.7	100%	100%	7	0.008	100%	100%	5	-0.003
June	-	7	0.005	5993	5993369	43452	30.0	100%	100%	7	0.005	100%	100%	3	-0.003
August	-	7	0.005	1938	1937863	13371	9.7	100%	100%	6	0.005	100%	100%	8	0.01
October	-	7	0.005	1825	1825002	13323	9.1	100%	100%	7	0.004	100%	100%	8	0.009

Notes:
1. Concentrations at MH-4 were not available for June, and were not available for June and August for MH-13 and MH-16. Concentrations indicated are averages for the nearest available months.

The downstream stations MH-11 and MH-13 show that sulphate and zinc loadings have not changed significantly since 1998. Some months show slight increases since 1998 while others show decreases. The differences reflect variability in the monitoring data rather than any significant monthly differences. The decrease in sulphate concentrations was already well-established in 1998 hence the lack of a systematic difference between 1998 and 2003.

The calculation of typically positive but low background sulphate and zinc concentrations indicates that both sulphate and zinc are behaving as chemically conservative parameters (see Section 2.1) and that there is probably little load attenuation occurring downstream of the site. Background zinc and sulphate concentrations at MH-11 are slightly greater than at MH-13 as expected due to the local effect of Jewelbox Hill at MH-11 which could include load from the site not accounted for by measured sources as well as natural runoff from mineralized outcrops. The same effect was apparent in 1998.

In the Tributary E catchment, the significance of MH-2 as a source of sulphate has increased due to the increase in sulphate concentrations. At the same time, seepage volumes appear to have increased by a factor of about 80% on average further increasing the sulphate load. This also explains why zinc loads have not decreased despite the decrease in zinc concentrations.

Sulphate concentrations from MH-22 (North Hill Settlement Basin) are not attenuated by contact with soils along the subsurface connection but contribute a low proportion of the sulphate loading in the basin which has not changed significantly since 1998. The recalculation of zinc loads using the attenuated concentrations indicated by testwork shows that this site contributes less than 0.1% of zinc load to MH-16.

It is not possible to calculate a load balance or baseline concentrations for Tributary E because station MH-12 is no longer monitored.

Comparison of all sources of loading with MH-16 indicates that not all loading at MH-16 can be accounted for by known mine area sources. For example, in June, only 12% of sulphate and 13% of zinc load comes from known mine site discharges to surface water. A further 6% and 29% of sulphate and zinc respectively appears to originate as non-point sources (mine and natural) in the Jewelbox Hill area. The remaining balance of 82% of sulphate and 58% of zinc is background loading in the basin not related to the mine. Overall, background weathering and erosion is the largest source of loading of these parameters in the basin.

4 Conclusions

Monitoring results indicate that some changes in water chemistry have occurred since the previous loading calculation presented in the Detailed D&R Plan, including:

- Negligible zinc loading effect from Main Zone 1380 Portal (MH-25) in MH-4 due to attenuation by contact with rock and soil along the subsurface flowpath.

- Decreasing zinc concentrations in Camp Creek (MH-4).

- Increasing zinc concentrations and decreasing sulphate concentrations in the South Dam seepage (MH-7) which has apparently translated into decreasing sulphate concentrations at downstream stations in False Canyon Creek (MH-11 and MH-13). The increase in zinc concentrations at MH-7 is not apparent at MH-11 or MH-13.

- Significant decreasing zinc and increasing sulphate concentrationsn in seepage from the North Dam (MH-2). Flow rates appear to have increased resulting in no net decrease in zinc load and further increase in sulphate load.

- Negligible effect from zinc concentrations at MH-22 (North Hill Settlement Basin) due to attenuation in soils downslope from the monitoring location indicated by laboratory tests in 2002. Field inspections indicate that this flow does not connect by surface to Tributary E.

The loading analysis reflects these changes but does not indicate a significant effect on overall loadings in the False Canyon Creek catchment area because the contributions from mine site sources are relatively small in the context of the whole basin. The dominant source of sulphate and zinc loading in the catchment area is natural weathering of rocks and soil unrelated to mining activity.

The overall conclusions of the loading calculation are the same as those presented previously in the Detailed D&R Plan.

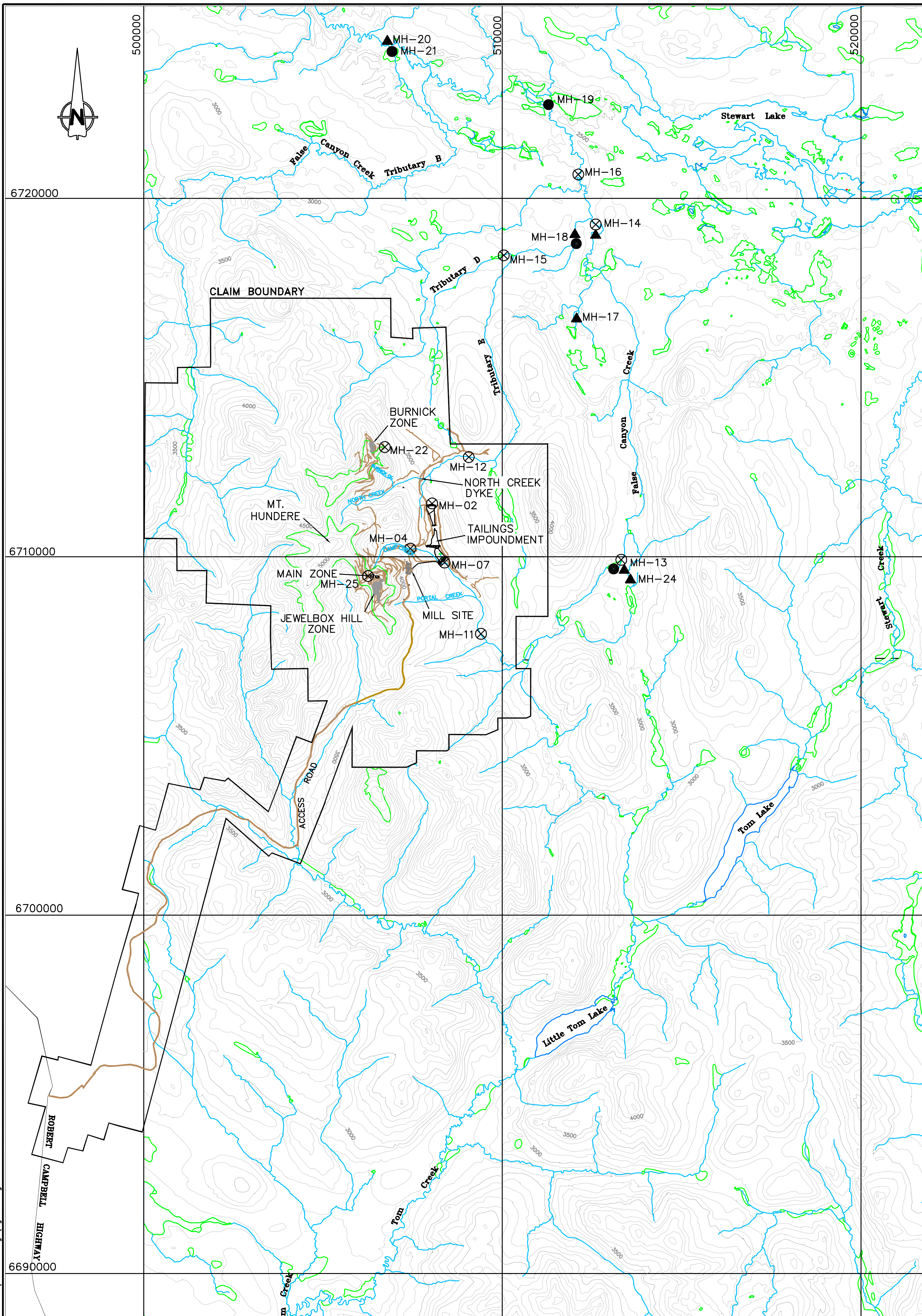
5 References

Access Mining Consultants and SRK Consulting. 2000. Sä Dena Hes Mine Detailed Decommissioning & Reclamation Plan. Prepared for Cominco Ltd. February 2000.

SRK Consulting 2003. 2002 Geochemical Projects - Sä Dena Hes Mine. Reported prepared for TeckCominco Ltd. March 2003.

Appendix A

Location of Monitoring Stations



NTS: 105 A/06, 105 A/07
105 A/10, 105 A/11

CONTOUR INTERVAL 100 FEET

0 1000 2000 3000 4000 5000 metres
1:100,000

NOTE
BASE TOPOGRAPHY FROM NORTH AMERICAN DATUM 1983
ALL SURFACE FACILITIES AND BOUNDARIES HAVE BEEN
ADJUSTED FROM NAD 1927

LEGEND
⊗ WATER MONITORING STATION
▲ FISH MONITORING STATION
● BENTHIC MONITORING STATION

SRK Consulting
Engineers and Scientists

teckcominco

SA DENA HES
Water Quality and Loading Re-Assessment

SITE PLAN

PROJECT NO.	DATE	APPROVED	FIGURE
1CT008.06	Jan. 2005	S.D.	1