Klohn Crippen Berger

Yukon Government

Faro Mine Complex, Yukon Territory

Operations, Maintenance and Surveillance Manual for: Secondary Dam, Intermediate Dam, Cross Valley Dam and Little Creek Dam

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March 2017

Klohn Crippen Berger

March 27, 2017

Yukon Government
Faro Mine Remediation Project
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PO Box 2703 (K-419)
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Carrie Gillis, A/Project Manager - Faro Mine Remediation Project

Dear Ms. Gillis:

Faro Mine Complex, Yukon Territory
Operations, Maintenance and Surveillance Manual for:
Secondary Dam, Intermediate Dam, Cross Valley Dam and Little Creek Dam

We are pleased to submit this Operations, Maintenance and Surveillance Manual (OMS) for: Secondary Dam, Intermediate Dam, Cross Valley Dam and Little Creek Dam. This updated manual is based on the earlier version prepared by BGC Engineering (BGC 2008c). It represents the result of a joint effort by the Yukon Government (YG), the care and Maintenance Contractor (currently Parsons) and Klohn Crippen Berger (KCB). The OMS manual is a "living document" that will require periodic review and updating as site reclamation work proceeds, and as directed by the Yukon Government.

This OMS manual follows the information requirements and approach outlined in the Canadian Dam Association (CDA) Dam Safety Guidelines (CDA 2013) and the Mining Association of Canada (MAC 2011) guidelines for Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities.

The manual is a guide for the safe operation of the facilities. Although there are numerous dams and dykes in the Faro Mine Complex, this manual covers only the Secondary Dam, Intermediate Dam, Cross Valley Dam, and Little Creek Dam.

Yours truly,

KLOHN CRIPPEN BERGER LTD.

David Willms, P.Eng.
Project Manager

DW:dl/jcp

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Yukon Government

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Operations, Maintenance and Surveillance Manual for: Secondary Dam, Intermediate Dam, Cross Valley Dam and Little Creek Dam

TABLE OF CONTENTS

1 OMS MANUAL PREPARATION 1
1.1 OMS Manual Development Team 1
1.2 OMS Manual Objectives 1
1.3 Resources and Scheduling 1
1.4 OMS Manual Control and Update 1
1.4.1 Distribution and Filing 1
1.4.2 Updating 2
1.4.3 Archiving 2
2 ROLES AND RESPONSIBILITIES 3
2.1 Internal 3
2.2 External Consultants 3
2.3 Competency and Training 4
2.3.1 Competency 4
2.3.2 Training 4
2.4 Managing Change 5
3 FACILTY DESCRIPTION 6
3.1 Facility Overview 6
3.2 Site Conditions 7
3.2.1 Climate 7
3.2.2 Geology 7
3.2.3 Hydrology 8
3.3 Facility Components 9
3.3.1 General 9
3.3.2 Survey Datum 10
3.3.3 Secondary Dam 10
3.3.4 Intermediate Dam 11
3.3.5 Cross Valley Dam 12
3.3.6 Little Creek Dam 13
3.4 Regulatory Requirements 14
3.5 Basis of Design and Design Criteria 15
3.5.1 Secondary Dam 15
3.5.2 Intermediate Dam 16
3.5.3 Cross Valley Dam 17
3.5.4 Little Creek Dam 19
3.6 Construction Summary 20

TABLE OF CONTENTS
(continued)

3.6.1 Secondary Dam 20
3.6.2 Intermediate Dam 20
3.6.3 Cross Valley Dam 21
3.6.4 Little Creek Dam 22
3.7 Document Control 22
4 KEY RISKS 23
4.1 Down Valley Tailings Facility 23
4.2 Little Creek Dam 23
5 OPERATION 24
5.1 Objective 24
5.2 Tailings Transport and Deposition 24
5.3 Dam and Basin Raising 24
5.4 Water Management 24
5.4.1 Secondary Dam 24
5.4.2 Intermediate Dam 25
5.4.3 Cross Valley Dam 26
5.4.4 Little Creek Dam 28
5.5 Environmental Protection 29
5.6 Safety and Security 29
5.7 Documentation 30
5.8 Reporting 30
6 MAINTENANCE 31
6.1 Objective 31
6.2 Maintenance Parameters 31
6.3 Routine and Predictive Maintenance 32
6.4 Event Driven Maintenance 33
6.5 Documentation 33
6.6 Reporting 34
7 SURVEILLANCE 35
7.1 Objective 35
7.2 Surveillance Parameters 35
7.2.1 Inspection 35
7.2.2 Instrumentation 35
7.3 Surveillance Procedures 36
7.3.1 Inspection 36

TABLE OF CONTENTS

(continued)

7.3.2 Instrumentation 36
7.3.3 Collation and Analysis of Data 37
7.3.4 Periodic Inspection and Review 37
7.4 Documentation 37
7.5 Reporting 37
8 EMERGENCY RESPONSE PLAN 38
9 CLOSING 44
REFERENCES 45

List of Tables

Table 1.1 Distribution of OMS Manual 2
Table 1.2 Record of Significant Revisions to the OMS Manual 2
Table 2.1 Assessment and Abandoned Mines – Government of Yukon Contact Information 3
Table 2.2 Consultant Contacts 4
Table 3.1 Estimated Floods for the Faro Mine Site 8
Table 3.2 General Characteristics of the Secondary Dam 11
Table 3.3 General Characteristics of the Intermediate Dam 12
Table 3.4 Cross Valley Dam General Characteristics 13
Table 3.5 Little Creek Dam General Characteristics 14
Table 3.6 Faro Effluent Quality Standards 15
Table 3.7 Secondary Dam Basis of Design, Design Criteria, and Elevations 16
Table 3.8 Intermediate Dam Basis of Design, Design Criteria, and Elevations 17
Table 3.9 Cross Valley Dam Basis of Design, Design Criteria, and Elevations 18
Table 3.10 Little Creek Dam Basis of Design, Design Criteria, and Elevations 19
Table 3.11 Secondary Dam – Construction Details 20
Table 3.12 Intermediate Dam - Construction Details 20
Table 3.13 Cross Valley Dam - Construction Details 21
Table 3.14 Little Creek Dam - Construction Details 22
Table 5.1 Secondary Impoundment Operating Parameters 25
Table 5.2 Intermediate Pond Operating Parameters 25
Table 5.3 Maximum Drawdown Rates for the Intermediate Pond 26
Table 5.4 Polishing Pond Operating Parameters 27
Table 5.5 Maximum Drawdown Rates for the Polishing Pond 27
Table 5.6 Little Creek Dam Pond Operating Parameters 28
Table 6.1 Maintenance Schedule 33
Table 8.1 Instrumentation Yellow Alert Levels 40

TABLE OF CONTENTS

(continued)

List of Figures

A-001 Site Location Plan
B-002 Mine Site Topography and Access Roads
B-003 Faro Site General Layout
B-004 Faro Site Detail Layout
B-005 Vangorda Plateau Site General Layout
B-006 Vangorda Plateau Site Detail Layout
A-007 Terminology for Dam Operations
B-008 Down Valley Tailings Facilities – Location of Test Holes
B-009 Secondary Dam – Foundation Stratigraphy
B-010 Secondary Dam – Instrumentation
B-011 Secondary Dam – West Limb – Typical Dam Sections
B-012 Secondary Dam – East Limb – Typical Dam Sections
A-013 Secondary Dam – West Limb – Cross Section Stability Analysis
A-014 Secondary Dam – East Limb – Cross Section Stability Analysis
A-015 Intermediate and Cross Valley Dams – 2003 Survey Profiles Location Plan
A-016 Intermediate Dam – 2003 Survey Profiles
A-017 Intermediate Dam – Foundation Stratigraphy
B-018 Intermediate Dam Instrumentation – Plan and Sections
B-019 Intermediate Dam – Typical Dam Section
A-020 Intermediate Dam – Spillway Rating Curve
A-021 Intermediate Dam – Stability Analysis Cross Section (Typical Conditions)
A-022 Intermediate Dam – Stability Analysis Cross Section (Rapid Draw Down)
A-023 Intermediate Dam – Elevation-Storage Curve
A-024 Cross Valley Dam – 2003 Survey Profiles
A-025 Cross Valley Dam – Foundation Stratigraphy
B-026 Cross Valley Dam Instrumentation – Plan and Sections
A-027 Cross Valley Dam – Typical Dam Section
B-028 Cross Valley Dam – Toe Drain – Profile and Detailed Plan
A-029 Cross Valley Dam – Spillway Rating Curve
A-030 Cross Valley Dam – Stability Analysis (Downstream Slope)
A-031 Cross Valley Dam – Stability Analysis (Upstream Slope)
A-032 Cross Valley Dam – Elevation-Storage Curve
A-033 Little Creek Dam – General Arrangement Plan
A-034 Little Creek Dam – Layout for Cut–Off Trench Excavation and Drainage Blanket
A-035 Little Creek Dam – Foundation Stratigraphy
A-036 Little Creek Dam – Instrumentation Location Plan
A-037 Little Creek Dam – Longitudinal Section with Drill Holes and Test Pits
A-038 Little Creek Dam – Transverse Section with Drill Holes and Test Pits
A-039 Little Creek Dam – Typical Dam Section
B-040 Little Creek Dam – Cross Sections and Details
B-041 Little Creek Dam – Spillway Design – Plan, Section and Details

TABLE OF CONTENTS

(continued)

A-042 Little Creek Dam – As–Built Spillway in Plan
A-043 Little Creek Dam – Spillway Channel Sections
A-044 Little Creek Dam – Elevation-Storage Curve

List of Appendices

Appendix I Minister's Determination Re Faro Mine Complex Reclamation and Closure Activities (Section 37(1) of Waters Act)

Appendix II Typical Dam Inspection Report Forms

Appendix III Instrumentation Summary and Monitoring Frequency

1 OMS MANUAL PREPARATION

1.1 OMS Manual Development Team

The Yukon Government (YG) is responsible for the preparation of this OMS manual with assistance from Klohn Crippen Berger Ltd. (KCB) and Parsons. KCB prepared the manual with input from Tlicho Engineering and Environmental Services (TEES), Parsons and YG. The YG representative is Carrie Gillis (alternate: Thaidra Sloane). The KCB representative is David Willms (alternate: Kate Patterson). The Parsons representative is Stu Waring.

1.2 OMS Manual Objectives

This manual serves as a reference document for the operation of four dams: The Secondary Dam, Intermediate Dam, Cross Valley Dam, and Little Creek Dam. This manual covers only the earth dams and civil water management aspects of the operation, maintenance, and surveillance of the facilities. It does not cover other aspects such as electrical, pumping and mechanical facilities, etc. The OMS manual outlines the following:

- the roles and responsibilities of personnel assigned to the site care and maintenance activities;
- the procedures and processes for managing change;
- the key components of the facility;
- the procedures required to operate, maintain and monitor the facilities to ensure they function according to design and regulatory requirements; and
- emergency and response procedures.

1.3 Resources and Scheduling

The Yukon Government is responsible for developing a reasonable budget and schedule to maintain, continually improve, periodically review, and update the OMS Manual.

1.4 OMS Manual Control and Update

1.4.1 Distribution and Filing

The distribution of the OMS manual is given in Table 1.1. Hard copies are located in the Site Manager's office on site, in the records room at the Assessment and Abandoned Mines (AAM) office in Whitehorse, and at the KCB office in Vancouver.

Table 1.1 Distribution of OMS Manual

Name	Copy No.	Position	Organization	Location	Contact Info
Carrie Gillis	1	A/Project Manager	AAM	Whitehorse, YT	(867) 456-6764
Stu Waring	2	Site Manager	Parsons	Faro, YT	867-994-2600 Ext 0001
David Willms	3	Project Manager	KCB	Vancouver, BC	604-251-8529

1.4.2 Updating

The OMS Manual is controlled by YG and is updated jointly by YG, KCB, and Parsons. The OMS Manual should be updated as required under Section 2.4.

The main reason for the 2017 update is to address comments from YG on the previous version and to update for the new care and maintenance contractor (Parsons). Table 1.2 shows the history of significant revision to the OMS Manual.

Table 1.2 Record of Significant Revisions to the OMS Manual

Date	Author(s)	Reason	Person Requesting Change	Position
2008	BGC	Historical	-	-
2014	YG/TEES/KCB	Under YG Management	Karen Furlong	Project Manager
2015	YG/TEES/KCB	Recommended By 2014 DSR	Karen Furlong	Project Manager
2017	YG/Parsons/KCB	New Care and Maintenance Contractor	Carrie Gillis	A/Project Manager

1.4.3 Archiving

This update supersedes previous versions of the OMS Manual. Out of date materials are removed as part of the OMS updates. Previous versions are maintained by YG and KCB for reference. Other reports such as records of dam performance that are referenced in this manual are archived by YG.

2 ROLES AND RESPONSIBILITIES

2.1 Internal

The care and maintenance activities at Faro Mine Complex are administered by the Assessment and Abandoned Mines (AAM) department of YG under the Faro Mine Remediation Project. YG is also the lead for implementation of the Faro Mine Remediation Project. YG is ultimately responsible for the safety and environmental impact of the mine. Contact details are in Table 2.1.

Table 2.1 Assessment and Abandoned Mines – Government of Yukon Contact Information

AAM Contacts	Position	Office #	Mobile #
Carrie Gillis	Project Manager	1-867-456-6764	(867) 332-4431
Thaidra Sloane	Senior Project Manager (Care and Maintenance)	1-867-456-6117	867-332-4155
Joshua Ojierenem	Project Manager (Operations and Maintenance)	1-867-456-6163	867-332-9019
During working hours: YG Communications Branch	Communications Desk	867-667-3123	
After working hours: Jesse Devost	YG Communications Director	867-332-1177	

2.2 External Consultants

- **Parsons** has been the site manager under contract with YG since April 2016. Parsons is responsible for environmental, hydrotechnical and visual geotechnical monitoring.
- **Indigenous and Northern Affairs Canada (INAC)** assumed responsibility for remediation design and closure planning and regulatory aspects in 2016 and will be responsible for a portion of on-site environmental monitoring after March 31, 2017.
- **Klohn Crippen Berger Ltd. (KCB)** is responsible for reviewing the geotechnical and hydrotechnical aspects of the Faro and Vangorda Plateau water and tailings storage dams, diversion channels, pit lakes and waste rock and overburden dumps.
- **Golder Associates Ltd. (Golder)** conducts periodical reviews of pit wall stability for the three pit lakes at Faro, Grum and Vangorda open pits. Golder is responsible for reviewing the stability of the pit walls and advising YG on ongoing care and maintenance of the pit walls. A failure of the pit walls could have downstream consequences for the tailings facilities if water was released from a pit lake due to a pit slope failure.
- **BGC Engineering Inc. (BGC)** provides engineering services for some mine components that affect the tailings dams such as diversions and dykes.

- The **Independent Peer Review Panel (IPRP)** comprising a variety of independent experts provides periodic review and advice to YG regarding the mine structures including the tailings dams.

Contact numbers for the consultants involved with the Secondary, Intermediate, Cross Valley and Little Creek Dams are provided in Table 2.2.

Table 2.2 Consultant Contacts

Contact	Position	Company	Phone
David Willms	Geotechnical	Klohn Crippen Berger	(604) 251-8597 (w) (604) 649-3921 (c)
Kate Patterson	Hydrotechnical	Klohn Crippen Berger	(604) 251-8487 (w) (778) 789-5283 (c)
Stu Waring	Site Manager	Parsons	867-994-2600 Ext 0001 867-689-0455 (c)
Tracy Parkin	Environmental Coordinator	Parsons	(867) 994-2600 Ext. 0004 (w) 1-867-335-6595 (c)
Jim Cassie	Geotechnical – Alternate	BGC	587-894-2664

2.3 Competency and Training

2.3.1 Competency

Staff of the care and maintenance contractor should be experienced in measuring flows, taking instrument readings, making visual observations, identifying maintenance or dam safety issues, and carrying out maintenance or repair work on the dams, spillways, and instruments. They should be capable of responding to a dam safety emergency and executing the Emergency Response Plan (ERP).

The consulting geotechnical engineer (KCB) should be a professional engineer who is experienced with tailings and water dam design and operation, and is familiar with the dams on site.

The dam owner representative (YG) should be familiar with the operations of the dams, the regulatory framework and risks posed by the dams.

2.3.2 Training

Site staff training on the use of the OMS manual is ongoing. YG plans to conduct similar training for site staff on the use of this updated manual. Records of these training activities will be kept on site. Records should include: date, participants, training content, etc.

There is a regular training program that consists of two phases:

- Phase 1: Introduce the components of the OMS Manual to new site staff. This will ensure that everyone is aware of their role and responsibility, particularly regarding reporting and acting on observations.
- Phase 2: Annual updating of the OMS and training to reflect ongoing changes in physical conditions, operating procedures, reporting procedures and management changes.

2.4 Managing Change

YG maintains this manual and approves the changes. Updates to the OMS manual are made jointly by YG, KCB, and Parsons as required in response to the following:

- changes to the various structures for closure and as part of maintenance;
- effects of aging of the various structures;
- conditions that are less than were assumed for design;
- changes in site management organization, facility description, roles and responsibilities, and operating and reporting procedures;
- suggestions for improvement;
- succession planning/training; and
- regulatory change.

3 FACILTY DESCRIPTION

3.1 Facility Overview

The Faro lead-zinc mining complex is located 200 km north-northeast of Whitehorse, Yukon, as shown on the site location plan in Figure A-001. It consists of the Faro Mine which operated from 1969 to 1992 at 5,000 to 9,300 tonnes per day, and the Vangorda Plateau Mine which operated from 1986 to 1998. Figure B-002 shows the layout and access roads for the Faro and Vangorda sites. Court-appointed Deloitte & Touche (2002) managed the site from 1998 to 2008, as interim receiver. YG has managed the mine complex since 2009. Denison Environmental Services was responsible for care, maintenance, and environmental protection from 2009 to 2012, focusing on a seasonal pumping and water treatment for the Faro and Vangorda open pits, and inspection and maintenance of dams and diversion structures. Responsibility for care and maintenance was assumed by Tlicho Engineering and Environmental Services (TEES) in 2012 and by Parsons in April 2016.

Anvil Mining Corporation began mining at the Faro mine site in 1969. During initial mine development, the Original Tailings Facility was created, along with the Fresh Water Supply Dam, then known as the Rose Creek Water Reservoir. The Original Dam was 20 m high including the starter dyke (Golder 2004). This Original Dam operated until 1973 and was later inundated by tailings deposited behind the Secondary Dam. The downstream slope of the Original Dam is buried by tailings with only the crest alignment visible. Golder Associates designed the Secondary Dam and construction started in 1974.

Mining was primarily from the large Faro No. 1 zone ore body (Main Pit) up to 1975. In 1975, operations were taken over by the Cyprus Anvil Mining Corporation. In 1979, further mineral resources were acquired, including the Faro No. 2 zone, Grum, Vangorda and Swim deposits. In response to the anticipated increasing mine production, the Intermediate Dam and Cross Valley Dam were built downstream of the Original and Secondary impoundments forming the Down Valley Tailings Facilities (Golder 1980). Initial construction of the Intermediate and Cross Valley dams was completed in 1981 (Golder 1982), prior to a two-year mine shut-down due to low metal prices. Curragh Resources took over the mining operations in 1985, taking the Vangorda and Grum pits into production on the Vangorda Plateau and continuing production of the No. 3 zone Faro Pit. This led to the continuation of underground ore extraction until 1992. Another mine shut down occurred in 1992 until 1994 when the Anvil Range Mining Corporation took control and focused on the Vangorda and Grum ore bodies until the most recent mine shut-down in 1998. By 1998 mining had depleted the known economic reserves at the Faro and Vangorda deposits and partially depleted the economic reserves at Grum.

Figures B-003 and B-005, respectively, show the general layout of the Faro and Vangorda Plateau sites.

The Faro mine site is located within the Rose Creek drainage basin, which drains via Anvil Creek into the Pelly River. There is no infrastructure or permanent human habitation downstream of the mine

along this drainage system. The Vangorda Plateau is drained by Vangorda Creek, which flows directly into Pelly River. The Town of Faro is located on Vangorda Creek, downstream of the mine site.

3.2 Site Conditions

3.2.1 Climate

Climate data from the Faro mine site weather station (at elevation 1158 m) for the period 1967 to 2007 indicates that the mean annual temperature was -2.1°C. The mean monthly maximum daily temperature was 14.9°C in July, while the mean monthly minimum temperature was -20.5°C in January. Months with above zero mean temperatures were May, June, July and August (BGC 2008c).

The 1984 – 2010 climate normals at the Faro Airport station (Station No. 2100517, elevation 716 m) indicate a mean annual precipitation of 320 mm, comprising roughly 65% as rainfall and 35% as snowfall. The monthly mean rainfall ranges from a minimum of 3 mm in April to a maximum of 56 mm in July.

Snow accumulation at the Faro tailings impoundment typically begins in October and the snow cover is generally melted by the end of April.

Prevailing wind direction in the region is from the southeast.

3.2.2 Geology

The Faro mining complex is located within the Yukon Plateau, on the north side of the Tintina Trench. This trench forms a broad, northwest trending valley occupied by the Pelly River, with a floodplain at about El. 600 m above sea level. The Vangorda Plateau is a subdivision of the Yukon Plateau, rising from El. 1000 m to El. 1400 m, and is drained by the Vangorda Creek and Rose Creek watersheds. To the northeast, the peaks of the Anvil Range Mountains rise above El. 2000 m.

Bedrock consists of regionally metamorphosed sedimentary rock ranging in age from late Precambrian to Permian (approximately 900 million to 250 million years ago). Metamorphic grade ranges from moderate (schist) to low (phyllite). Phyllites are common in the area and are classified as carbonaceous, calcareous or non-calcareous. The calcareous phyllite becomes calc-silicate rock at higher metamorphic grade.

Five stratiform, massive sulphide lead-zinc-silver ore bodies were discovered in the area: Faro, Grum, Vangorda, Grizzly and Swim.

The bedrock surface was shaped during the last ice age and covered with surficial deposits between 35,000 and 10,000 years ago. The surficial deposits consist of colluvial, glaciofluvial and morainal (till) as a discontinuous cover over bedrock in the upland areas. These deposits increase in thickness towards valleys such as Rose Creek. Glacial deposits are relatively absent above 1500 m elevation. The area surrounding the Vangorda Mine is characterized by a thick till blanket overlying bedrock. The till comprises a poorly sorted deposit of clay, silt, sand, gravel and angular boulders, commonly underlying glaciofluvial deposits in areas of former melt water drainage.

The Rose Creek Valley is infilled with a complex assemblage of fan and outwash sand and gravel deposits, dissected by stream channel and lacustrine materials. On the north side of the valley, prominent terraces and fans partly underlie the existing Down Valley tailings area. A large colluvial apron covers the south slope of Rose Creek Valley, extending upslope of the Cross Valley Dam to downstream of the Down Valley Tailings Facilities. Another colluvial apron extends along the base of the south slope of the Rose Creek Valley between the site of breached Fresh Water Storage Dam and the Original Impoundment. A large colluvial fan is located east of the upper Rose Creek near the Faro Pit.

Most of the surficial deposits in the Faro mine area are granular glacial or fluvial deposits. Glaciolacustrine deposits were noted near the Cross Valley and Intermediate dams, comprising fine sand to sandy silt up to 20 m thick. This unit is commonly buried by a sequence of sand and gravel.

The region is located within the discontinuous permafrost zone. In the Rose Creek Valley, most of the south valley wall consisted of frozen coarse till, whereas the same material in the north valley wall was unfrozen. Solifluction is common on slopes above the tree line. Frost shattered bedrock (Felsenmeer) is frequently found in the alpine areas of the Anvil Range.

3.2.3 Hydrology

Rose Creek and Vangorda Creek are the main watercourses on the property. As part of the 1996 closure plan, a comprehensive hydrological assessment was carried out for the Faro and Vangorda Plateau mine site areas (Robertson Geoconsultants 1996). A hydrotechnical assessment of the Faro mine site was undertaken in 2001 (NHC 2001) for the now breached Fresh Water Supply Dam and Down Valley Tailings Facility at the Faro mine site. Table 3.1 presents a summary of the Estimated Floods for the Faro Mine Site (after NHC 2004 and CH2M Hill 2012 for 100-year event).

Table 3.1 Estimated Floods for the Faro Mine Site

Mine Site Sub-Basins	Drainage Area (km^2)	2-Year (m^3/s)	50-Year (m^3/s)	100-Year (m^3/s)	200-Year (m^3/s)	500-Year (m^3/s)
North Fork Rose Creek at Flow Through Rock Drain	118	9.3	48	54	72	92
Fresh Water Supply Dam Catchment	67	5.6	31	33	49	63
Rose Creek above Tailings Diversion Channel	203	15	71	86	105	135
Rose Creek downstream of Tailings Diversion Channel	230	17	78	96	115	145

Rock outcrops are extensive in the upper portion of the basin, while the lower portions of the basin are overlain by low-permeability tills, frequently containing permafrost. These factors, in addition to the general lack of tree cover and topsoil or forest litter, result in increased runoff potential.

The Vangorda Creek watershed area is about 92 km^2, of which 17.7 km^2, lies above the headworks for the Vangorda Creek Diversion (Curragh 1988). The stream drops about 760 m in elevation from the

highest point on Mt. Mye to the Pelly River over a distance of about 18 km. The major tributary is Aex Creek, which joins Vangorda Creek, just above the Town of Faro.

Flow in Vangorda Creek has been monitored intermittently since 1975 at a hydrometric station located upstream of the Faro town site road crossing (Station no. 29bc003). Since 1977, this station has been operated by Department of Indian Affairs and Northern Development (DIAND), with flow measurements being taken only during ice-free periods. The catchment area above this gauging station is 91.2 km^2 (Robertson Geoconsultants 1996). Hydrology studies have used long period year-round data from Water Survey of Canada (WSC) stations to "patch" the missing stream flow data, using a series of analytical steps. The patched daily record was then converted into a monthly record to calculate mean monthly and mean annual flows. Mean annual runoff for the period from 1977 to 1995 (Robertson Geoconsultants 1996) for Vangorda Creek at Faro town site road was 0.68 m^3/s, equivalent to 235 mm of runoff over the catchment area.

Freshet occurs around May 31, based on when the peak is observed to occur at stream flow stations in the region.

3.3 Facility Components

3.3.1 General

Figure B-002 shows the mine site topography and access roads of the Faro Mine Complex, including the locations of the Secondary Dam, Intermediate Dam, Cross Valley Dam, and Little Creek Dam. The Secondary, Intermediate and Cross Valley dams are located in Rose Creek Valley (see Figures B-003 and B-004) and form the Down Valley Tailings Facility. The Secondary Dam was constructed in 1974 and the Intermediate and Cross Valley dams were constructed between 1981 and 1991. The Little Creek Dam, constructed in 1991, is located adjacent to Vangorda Creek to capture water discharging from the Vangorda Waste Rock Dump (see Figures B-005 and B-006). Summary descriptions of other mine structures shown on the general arrangements are included in the 2003 to 2008 Water Licence renewal application (Gartner Lee 2003 to 2008). A new interim water treatment plant at Faro site, the Faro Interim Water Treatment System (FIWTS) was commissioned in 2014 to treat water from Faro Pit and the Intermediate Pond.

All of the dams are earth and rockfill embankment structures.

The 2014 DSR (Worley Parsons 2015) classified the Intermediate Dam, Cross Valley Dam, and Little Creek Dam as high consequence structures. This agrees with the dam breach and inundation study (KCB 2014a). The Secondary Dam was not reviewed as part of the 2014 DSR since it was not within the scope of work. This dam should be included with the next DSR. Although the suggested frequency for DSRs as per the Canadian Dam Association (CDA) guidelines is 7 years for high consequence of failure structures, the release of the CDA 2014 technical bulletin “Application of Dam Safety Guidelines to Mining Dams” has necessitated an earlier review to assess several contaminated fluid/solid retention structures not previously considered dams. Therefore, YG has scheduled the next DSR for 2019.

3.3.2 Survey Datum

The figures contained in this report were compiled from a variety of sources, and no attempt was made to reconcile the various survey grids and vertical datum used. The reader is cautioned to be aware of the survey datum differences across the site. Each drawing is annotated showing the source of the drawing and the survey datum used. Refer to the document "Survey Standards and Infrastructure for Faro Mine Closure, May 31, 2010" for details.

In general, National Topographic System (NTS) base maps are based on the 1927 North American Datum (NAD27) and use the Universal Transverse Mercator (UTM) grid system. All recent as-built surveys of the dams done by Yukon Engineering Services (YES) were done using this datum. The vertical datum for NAD27 is mean sea level (msl).

The elevations shown on many of the dam drawings typically refer to either "Mine Datum" (MD) or Down Valley Datum" (DVD). The following conversion rules were applied to convert these elevations to metres above mean sea level (m amsl) (Robertson Geoconsultants 1996):

- To convert from Mine Datum to m amsl, subtract 33.3 m (109.2 ft).
- To convert from Down Valley Datum to m amsl, subtract 32.3 m (106 ft).

All elevations in the text of this manual are in m amsl and are noted as "El. XX m". Unless noted otherwise, the survey datum used in this OMS manual are:

- Secondary Dam – now NAD 27 (m amsl).
- Cross Valley Dam – originally DVD but now NAD 27 (m amsl).
- Intermediate Dam – originally DVD but now NAD 27 (m amsl).
- Little Creek Dam – elevations are referenced to NAD 27 datum (m amsl). However, both UTM and mine grid are used for the coordinate systems.

Both the dam crests and the spillways of the Intermediate and Cross Valley dams were surveyed by YES in 2003.

To clarify dam-related terminology, Figure A-007 illustrates some terms used in this report, such as freeboard, maximum water level (MWL), full supply level (FSL), etc. By familiarizing oneself with these terms, the reader will be able to follow descriptions given in various tables included herein.

3.3.3 Secondary Dam

The Secondary Dam contains the Secondary Impoundment, which is located on the north side of Rose Creek Valley. The West Limb of the Secondary Dam is defined as that curved portion which crosses the valley roughly north to south. The East Limb is the portion of the Secondary Dam aligned parallel to the south valley wall. The West Limb of the Secondary Dam was raised using centerline construction and compacted fill to a maximum height of 27 m above original ground; however, the downstream slope of the dam was partially inundated by tailings deposited in the Intermediate Pond.

The dam crest is approximately 13.7 m above the tailings in the Intermediate Pond. The East Limb is a low retention dyke (typically 4.3 m high) which was constructed of compacted fill. Tailings were deposited behind the Secondary Dam from 1975 to 1982 and then for approximately 5 months in 1986.

The Secondary Impoundment does not have capacity to store water; the tailings surface is sloped such that surface water from the impoundment flows to a ditch in the tailings along the upstream side of the dam and is routed to the spillway.

Figure B-008 shows the location plan of the Secondary Dam and test holes used for the subsoil investigation. Figure B-009 shows the foundation stratigraphy on a section along the dam crest. Figure B-010 shows instrumentation locations for the Secondary Dam.

The general characteristics of the Secondary Dam are summarized in Table 3.2.

Table 3.2 General Characteristics of the Secondary Dam

Type of Dam	Zoned earthfill dam (see Figure B-011 and Figure B-012 for typical dam sections).
Fill Details	▪ West Limb: Starter dam of general fill with a low hydraulic conductivity core, drainage blanket and filter zones. Raised using centreline method with compacted tailings sand along the dam centreline and sand and gravel. ▪ East Limb: compacted tailings sand with a granular outer shell on the downstream side.
Foundation Cut-off	No.
Purpose	Retain tailings solids, supernatant water and run-off water. Currently has no capacity to retain water.
Year Constructed	1974 to ≈1980.
Location	See Figures B-003 and B-004.
Access	Access to the north end of dam crest is via access road to Down Valley area from the main mine access road and across the emergency spillway. Access to south end of the dam via Canal Dyke crest of Rose Creek Diversion Channel.
Failure Consequence	High (SRK 2004 as cited by KC 2006, CDA 1999 classification. Dam has not been reassessed under CDA 2013 guidelines).
Reason for Consequence Classification	▪ Potential for release of non-compliant water and tailings, particularly if the East Limb was to fail into the Rose Creek Diversion.
Spillway	Yes – Unarmoured channel excavated in overburden.
Primary Means of Discharge	Surface runoff routed to spillway.

3.3.4 Intermediate Dam

The Intermediate Dam is located along the Rose Creek Valley, immediately downhill from the mine and milling operations. It was built in conjunction with the Cross Valley Dam beginning in 1981, with dam raises in 1988, 1989, and 1991 to a final crest elevation of 1049.4 m. The Intermediate Dam was built downstream of the Original and Secondary Impoundments as additional tailings storage was required.

Figure A-015 shows the location of the Intermediate and Cross Valley dams surveyed in 2003. The crest and the emergency spillway surveyed profiles are shown on Figure A-016. Figure B-008 shows

the location plan of test holes used for the subsoil investigation of the Intermediate Dam. Figure A-017 shows the foundation stratigraphy on a section along the dam crest. Figure B-018 shows instrumentation locations and cross sections for the Intermediate Dam.

The general characteristics of the Intermediate Dam are summarized in Table 3.3.

Table 3.3 General Characteristics of the Intermediate Dam

Type of Dam	Zoned earthfill dam (see Figure B-019 for typical dam section).
Fill Details	▪ Gravel shells with a silty till core. ▪ Starter dam with a vertical core, which was modified to an upstream sloping core during dam raises.
Foundation Cut-off	Partially silty-till cut-off.
Purpose	Retain tailings solids, supernatant water and run-off water.
Year Constructed	Staged construction during 1981, 1988, 1989 and 1991.
Location	See Figures B-003 and B-004.
Access	Access to north end of the dam is via access road to Down Valley area from the main mine access road and across the emergency spillway. Access to south end of dam is via Canal Dyke crest of Rose Creek Diversion Channel.
Failure Consequence	High (CDA 2013 classification, KCB 2014a).
Reason for Consequence Classification	▪ Potential for release of non-compliant water and tailings. ▪ Qualitative risk assessment damages include repair cost, regulatory fines and cleanup cost, with total cost estimated between US $10 million to $100 million (KCB 2008).
Spillway	Yes – Riprap-lined, excavated channel in overburden. Un-gated free overflow into channel.
Primary Means of Discharge	Removable 12-inch diameter carbon steel siphon.

3.3.5 Cross Valley Dam

The Cross Valley Dam is located immediately downstream of the Intermediate Dam, forming the Polishing Pond for the tailings containment system, as shown on Figure A-015. The dam was constructed to its final elevation of El. 1033.5 m in 1991. The crest and the lower portion of the spillway were surveyed in 2003, and the surveyed dam crest profile and the emergency spillway profile are shown in Figure A-024. Figure B-008 shows the location plan of test holes used for the subsoil investigation of the Cross Valley Dam. Figure A-025 shows the foundation stratigraphy on a section parallel to the dam crest. Figure B-026 shows instrumentation locations and cross sections for the Cross Valley Dam.

The general characteristics of the Cross Valley Dam is summarized in Table 3.4.

Table 3.4 Cross Valley Dam General Characteristics

Type	Zoned earthfill dam (see Figure A-027 for typical dam section).
Fill Details	Gravel shells with a central silty till core.
Foundation Cut-off	Partially silty-till cut-off.
Purpose	Serve as a polishing pond, and retain treatment residue (some of the residue was removed in 2001 and subsequent years). It has a design capacity to retain 60 days of treatment discharge water and seepage from the Intermediate Dam.
Year Constructed	1980-1981. Downstream toe drain added in 1991. (see Figure B-028).
Location	See Figures B-003 and B-004.
Access	Access to north end is via access road to Down Valley area from the main mine access road to dam toe area and cross the spillway channel from downstream reach and follow access road adjacent to the spillway up to dam crest. Access to south end of dam toe area is via the Canal-Dyke crest of Rose Creek Diversion Channel.
Failure Consequence	High (CDA 2013 classification, KCB 2014a).
Reason for Consequence Classification	▪ Potential for release of non-compliant water and treatment residue. ▪ Qualitative risk assessment damages include repair cost, regulatory fines and cleanup cost, with total cost estimated between US $10 million to $100 million (KCB 2008).
Spillway	Yes – Riprap-lined earthen channel with un-gated free overflow into channel.
Primary Means of Discharge	Removable 8-inch, 10-inch and 16-inch diameter HDPE siphons.

3.3.6 Little Creek Dam

Little Creek Dam was constructed in 1990, immediately northwest of the Vangorda Waste Rock Dump (see Figures B-005 and B-006) and impounds Little Creek Pond. The dam is located in the side valley of Little Creek, a small tributary of Vangorda Creek (approximately 90 m upstream of Vangorda Creek). Little Creek Pond was intended to hold water pumped from the Vangorda Pit, and seepage and runoff from the nearby Vangorda Waste Rock Dump. Currently, the pond collects seepage and runoff from the nearby Vangorda Waste Rock Dump which is pumped to Vangorda Pit for treatment.

A plan layout of Little Creek Dam is shown in Figure A-033. Figure A-034 shows the layout for the cutoff trench. Foundation stratigraphy is shown in Figure A-035 on a section along the dam crest. Instrumentation locations are shown in Figure A-036. A longitudinal dam section with drill holes and test pits is shown on Figure A-037, and a transverse dam section with similar information is shown on Figure A-038.

The catchment of Little Creek Pond has been significantly modified by the mining development on the Vangorda Plateau (Golder 1994), as summarized below:

- Some of the natural catchment has been redirected around Little Creek Dam following construction of a major NW-SE trending haul road.
- Some of the natural catchment has been intercepted through construction of a diversion ditch east of the Vangorda Waste Rock Dump (see Figure B-005).
- A collection ditch paralleling the south and west sides of the Vangorda Waste Rock Dump has increased the catchment (see Figure B-005).

- Pit drainage from both the Grum and Vangorda pits can be directed (by pumping) to Little Creek Pond when needed for water management.

The general characteristics of the Little Creek Dam are given in Table 3.5.

Table 3.5 Little Creek Dam General Characteristics

Type of Dam	Zoned earthfill dam (see Figures A-039 and B-040 for typical dam sections).
Fill Details	Homogeneous glacial till earthfill embankment with a downstream drainage blanket and finger drains.
Foundation Cut-off	Partial till cut-off.
Purpose	Originally collect water from Vangorda Pit, runoff and seepage coming from Vangorda Waste Rock Dump for treatment. Currently, water collected in the pond is pumped to Vangorda Pit, from where it is then pumped to the treatment plant.
Year Constructed	1990. CSP culvert "spillway" added in 1998.
Location	See Figures B-005 and B-006.
Access	Access to north end of dam is via the Vangorda Main Haul Road. Alternative access is around east and south side of Vangorda Waste Rock Dump.
Failure Consequence	Significant to High (CDA 2013 classification, KCB 2014a). A detailed dam breach and inundation analysis is required to confirm the classification.
Reason for Consequence Classification	Downstream consequences near the Town of Faro (KCB 2014a).
Spillway	Un-gated 900 mm CSP culvert to a riprap-lined earthen channel installed in 1998 (See Figures B-041, A-042 and A-043). No open channel spillway.
Primary Means of Discharge	Pumping to Vangorda Pit.
Appurtenances	Power sub-station, pump house for power supply, pump barge with a 30-hp Flygt pump, intake pipe, discharge pipe, power pole line, overflow spillway culvert and plunge pool. Note that the collection sump at the toe was never constructed.

3.4 Regulatory Requirements

Yukon Waters Act

Faro is no longer governed under a water license; however, the following information about the previous water license is provided for reference. In 2009, the Faro Mine Remediation Project obtained a Minister's Determination titled "Faro Mine Complex Reclamation and Closure Activities", as per Section 37(1) of the Waters Act (YG 2009), for works to be undertaken at the Faro Mine Complex. This document is included in Appendix I. Section C of the Minister's Determination, "Measures to be Taken," provides authorization for a list of activities that AAM may undertake to "prevent, counteract, mitigate, or remedy any resulting adverse effects on persons, property, or the environment, and in particular the Surrounding Waters." This Determination is an authorization provided by the YG's Department of Environment directly to AAM.

Metal Mining Effluent Regulations (MMER)

These regulations prescribe controls on the effluents and waste rock that can be released into certain bodies of water. These regulations do not apply to the Faro Mine Complex but since it is illegal at Faro

to deposit deleterious substances in fish bearing waters, the MMER have often been used to define what is considered deleterious.

Guidelines on Water Quality

The Canadian Environmental Quality Guidelines (CCME 2016) are used for the protection of aquatic life. However, in some instances, the Faro Effluent Quality Standards (Table 3.6) are used.

Table 3.6 Faro Effluent Quality Standards

Parameter	FEQS	Units
TSS	15	mg/L
Turbidity	15	NTU
Colour	20	Pt-Co units
pH	6.5	less than or equal to
Ammonia-N	1.3	mg/L
Antimony	0.1	mg/L
Arsenic	0.05	mg/L
Barium	1	mg/L
Cadmium	0.02	mg/L
Copper	0.2	mg/L
Cyanide (as CN)	0.05	mg/L
Lead	0.2	mg/L
Mercury	0.005	mg/L
Molybdenum	0.5	mg/L
Nickel	0.5	mg/L
Selenium	0.05	mg/L
Silver	0.1	mg/L
Zinc	0.5	mg/L
Bioassay	Pass 100% 96 hour LC50	
Oil or Grease	No visible or floating	

3.5 Basis of Design and Design Criteria

3.5.1 Secondary Dam

Basis of design, design criteria and as-built elevations for the Secondary Dam are summarized in Table 3.7.

Table 3.7 Secondary Dam Basis of Design, Design Criteria, and Elevations

Crest of Dam		El. 1060.2 m (BGC 2009)	
Top of Core		N/A – Dam raised without core after starter dam (≈El. 1051.6 m) completion.	
Environmental Design Flood (EDF) Required Storage and Level		N/A – Impoundment has negligible capacity to store water. Inflows are routed to the Intermediate Pond.	
Full Supply Level, FSL		N/A – Impoundment has negligible capacity to store water.	
Spillway Inlet		Unknown	
Design Freeboard		Unknown	
Actual Freeboard		N/A – Impoundment does not retain water.	
Impoundment Area		1 km^2 (including Original Impoundment).	
Total Storage Capacity		Unknown, total Down Valley Tailings Facility contains 28.6 Mm^3.	
Design Requirements	Slope Stability	Upstream/Downstream, static state	Minimum FS = 1.5
		Upstream, rapid drawdown	Minimum FS = 1.2
	Earthquake Peak Ground Acceleration (PGA)	Closure Requirement – 1:10,000 year	0.24 g (Atkinson 2013)[1]
		1:10,000 year	0.24 g (Atkinson 2013)
		Water Licence Requirement – 1:475 year	0.04 g (Atkinson 2013)
	Inflow Design Flood	Closure Requirement – PMF	Unknown
		CDA Requirement – 1/3 between 1:1,000 year and PMF	Unknown
		Water Licence Requirement – 1:500 year	Unknown
	Environmental Design Flood		Not defined
Spillway	Type	Earthen spillway	
	Rating Curve	Not available	
	Capacity	Unknown	
	Comments	Spillway and collection ditches on tailings appear to have been field fit without engineered design and are likely not adequate to pass the required flood. Likely susceptible to erosion during flood events.	
Static Slope Stability	Downstream	Unknown	
	Upstream	N/A	
Seismic Slope Stability	Comments	Able to withstand 1:10,000 year earthquake (assessed with PGA= 0.30 g; PGA was reduced to 0.24 g in 2013)[1] (KC 2006a, KC 2006b, Atkinson 2004, Atkinson 2013, CH2M Hill 2016). See Figures A-013 and A-014 for stability models.	

1. Approximately corresponds to a magnitude 6.0 to magnitude 7.3 earthquake less than 100 km from the site. Smaller magnitude events closer to the site or larger magnitude events at greater distance may also produce similar peak ground acceleration.

3.5.2 Intermediate Dam

Basis of design, design criteria and as-built elevations for the Intermediate Dam are provided in Table 3.8.

Table 3.8 Intermediate Dam Basis of Design, Design Criteria, and Elevations

Crest of Dam		El. 1049.4 m design crest El. 1048.8 m low point 2003 survey (NHC 2006)	
Top of Core		El. 1048.5 m (2003/2004 survey)	
Inflow Design Flood (IDF) Level		El. 1048.2 m, 500-year flood (NHC 2006)	
Full Supply Level, FSL		El. 1047.7 m (2005 survey)	
Spillway Inlet		El. 1047.7 m (2005 survey)	
Downstream Berm		El. ≈1031.7 m	
Design Freeboard		0.5 m (Golder 1980)	
Actual Freeboard		0.63 m, 500-year flood (NHC 2006)	
Design Seepage		0.22 m^3/s (Golder 1980)	
Impoundment Area		1 km^2 (not including Secondary Impoundment)	
Total Storage Capacity		Unknown, total Down Valley Tailings Facility contains 28.6 Mm^3	
Design Requirements	Slope Stability	Upstream/Downstream, static state	Minimum FS = 1.5
		Upstream, rapid drawdown	Minimum FS = 1.2
	Earthquake Peak Ground Acceleration (PGA)	Closure Requirement – 1:10,000 year	0.24 g (Atkinson 2013)[1]
		CDA Requirement – 1:2,500 year	0.12 g (Atkinson 2013)
		Water Licence Requirement – 1:475 year	0.04 g (Atkinson 2013)
	Inflow Design Flood	Closure Requirement – PMF	692 m^3/s (WMC 2006)
		CDA Requirement – 1/3 between 1:1,000 year and PMF	342 m^3/s (NHC 2004) (WMC 2006)
		Water Licence Requirement – 1:500 year	11.2 m^3/s (NHC 2006)
	Environmental Design Flood		Not defined
Spillway	Type	Earthen spillway	
	Rating Curve	See Figure A-020	
	Capacity	32 m^3/s, water level at top of dam core (NHC 2006) 63 m^3/s, water level at dam crest (NHC 2006)	
	Comments	Meets the requirements of the water license but not the higher requirements required by normal practice for a high hazard dam (CDA 2013).	
Static Slope Stability	Downstream	FS = 1.6 (see Figure A-021, BGC 2008a)	
	Upstream	FS = 1.6 (BGC 2008a)	
	Upstream, rapid drawdown	FS = 1.0 to 1.1 (see Figure A-022, BGC 2008a)	
Seismic Slope Stability	Comments	Able to withstand 1:10,000 year earthquake (assessed with PGA = 0.30 g; PGA was reduced to 0.24 g in 2013)[1] (KC 2006a, KC 2006b, Atkinson 2004, Atkinson 2013).	

Notes:

1. Approximately corresponds to a magnitude 6.0 to magnitude 7.3 earthquake less than 100 km from the site. Smaller magnitude events closer to the site or larger magnitude events at greater distance may also produce similar peak ground acceleration.

3.5.3 Cross Valley Dam

Basis of design, design criteria and as-built elevations for the Cross Valley Dam are summarized in Table 3.9.

Table 3.9 Cross Valley Dam Basis of Design, Design Criteria, and Elevations

Crest of Dam		El. 1033.5 m design (NHC 2006) El. 1032.7 m low point, 2003 survey (NHC 2006)	
Top of Core		El. 1032.5 m (Converted from Down Valley Datum survey data)	
Inflow Design Flood (IDF) Level		El. 1031.1 m, 500-year flood (NHC 2006)	
Full Supply Level, FSL		El. 1030.78 m	
Spillway Inlet		El. 1030.78 m (2003 survey)	
Design Freeboard		0.5 m design (NHC 2006)	
Actual Freeboard		1.6 m (475-year flood, NHC 2006)	
Design Seepage		0.03 m^3/s (Golder 1980)	
Pond Area		0.22 km^2	
Total Storage Capacity		1,400,000 m^3 (Gartner Lee 2002)	
Design Requirements	Slope Stability	Downstream static state	Minimum FS = 1.5
		Upstream, static state	Minimum FS = 1.5
	Earthquake Peak Ground Acceleration (PGA)	Closure Requirement – 1:10,000 year	0.24 g (Atkinson 2013)[1]
		CDA Requirement – 1:2,500 year	-
		Water Licence Requirement – 1:475 year	0.11 g for 1:500 year (KCB 2007)
	Inflow Design Flood	Closure Requirement – PMF	692 m^3/s (WMC 2006)
		CDA Requirement – 1/3 between 1:1,000 year and PMF	342 m^3/s (NHC 2004) (WMC 006)
		Water Licence Requirement – 1:475 year	15.5 m^3/s for 500 year (NHC 2006)
	Environmental Design Flood		Not defined
Spillway	Type	Earthen Spillway	
	Rating Curve	See Figure A-029.	
	Capacity	300 m^3/s, water level at top of dam core (NHC 2006) 375 m^3/s, water level at dam crest (NHC 2006)	
	Comments	The spillway has the appropriate capacity to handle the water licence requirement but not enough for the normal practice dam safety requirements for a high hazard dam (CDA 2013).	
Static Slope Stability	Downstream	FS = 1.6, See Figure A-030 for stability design chart (Golder 1980).	
	Upstream	FS = 1.6, See Figure A-031 for stability design chart (Golder 1980).	
Seismic Slope Stability	Comments	Able to withstand 1:10,000 year earthquake (assessed with PGA= 0.30 g; PGA was reduced to 0.24 g in 2013)[1] with tolerable deformation (Atkinson 2004, Atkinson 2013, CH2M Hill 2016).	

Notes:

1. Approximately corresponds to a magnitude 6.0 to magnitude 7.3 earthquake less than 100 km from the site. Smaller magnitude events closer to the site or larger magnitude events at greater distance may also produce similar peak ground acceleration.

3.5.4 Little Creek Dam

Basis of design, design criteria and as-built elevations for the Little Creek Dam are provided in Table 3.10.

Table 3.10 Little Creek Dam Basis of Design, Design Criteria, and Elevations

Crest of Dam		El. 1114.5 m to El. 1120 m. SRK (1998) indicates that the low point on the crest and core was surveyed at El. 1113.8 m. In 2001 a 0.45 m layer of compacted gravel was placed on the crest and core of the dam raising the current crest to El. 1114.3 m. The final crest elevation has not been surveyed.	
Top of Core		El. 1113.8 m	
Inflow Design Flood (IDF) Level		El. 1113.6 m, 200-year flood (SRK 1998)	
Full Supply Level, FSL		El. 1112.8 m	
Spillway Inlet		El. 1112.8 m	
Design Freeboard		1.9 m	
Actual Freeboard		0.7 m, 200-year flood (SRK 1998).	
Design Seepage		Undefined	
Reservoir Area		28,600 m^2	
Total Storage Capacity		122,000 m^3	
Design Requirements	Slope Stability	Downstream, steady state	Minimum FS = 1.5
		Upstream, steady state	Minimum FS = 1.5
	Earthquake	Closure Requirement – 1:500 year (Needs to be confirmed as part of future work)	0.08 g (Atkinson 2004)
		CDA Requirement – 1:500 year	0.08 g (Atkinson 2004)
		Water Licence Requirement – 1:475 year	0.08 g (Atkinson 2004)
	Inflow Design Flood	Closure Requirement – PMF	Unknown
		CDA Requirement – to be determined after confirmation of dam classification	Not defined
		Water Licence Requirement – 1:200 year	0.8 m^3/s peak (SRK 1998)
	Environmental Design Flood		Not defined
Spillway	Type	900 mm CMP culvert leading to an earthen spillway outflow channel.	
	Rating Curve	None found.	
	Capacity	0.8 m^3/s, water level at El. 1113.6 m (SRK 1998).	
	Comments	Need to update the hydrology and check against design criteria. Need to confirm closure requirement.	
Static Slope Stability	Downstream	None Found, likely acceptable given the cross section of the dam.	
	Upstream		
Seismic Slope Stability	Comments	None Found, likely acceptable given the cross section of the dam.	

3.6 Construction Summary

3.6.1 Secondary Dam

A summary of the construction of the Secondary Dam (see Figures B-011 and B-012 for typical dam sections) is given below in Table 3.11.

Table 3.11 Secondary Dam – Construction Details

Crest Width	6 m
Crest Length	2300 m
Max. Dam Height	West Limb: 28 m (above original foundation), 13.7 m above downstream tailings. East Limb: 4.5 m (typical).
U/S Slope	N/A – upstream tailings is against dam crest.
D/S Slope	West Limb: 2H:1V East Limb: 2H:1V
Description of Construction and Materials	▪ West Limb: Internally zoned downstream shell and compacted tailings on the crest. Tailings on both sides with an approximate tailings surface differential of 13.7 m. ▪ East Limb: Compacted tailings sand with a granular outer shell on the downstream side. ▪ West Limb: Centerline construction and compacted fill. ▪ East Limb: Low retention dyke constructed with compacted fill.
Method of Construction	▪ West Limb: Centreline raise. ▪ East Limb: Downstream raise.

3.6.2 Intermediate Dam

A summary of the construction of the Intermediate Dam (see Figure B-019 for typical dam section) is given below in Table 3.12.

Table 3.12 Intermediate Dam - Construction Details

Crest Width	6 m to 7 m
Crest Length	650 m
Max. Dam Height	32 m
U/S Slope	2H:1V
D/S Slope	2H:1V (2.1H:1V overall, including a 20 m wide berm).
Type/Source Of Construction Materials	▪ Three main dam fill materials: gravel/drain rock, filter, and silty glacial till. ▪ Gravel was from the upper-level terrace (north of Rose Creek and upstream of Cross Valley Dam), terrace deposits downstream of the Cross Valley Dam (outfall area of Rose Creek Diversion Channel and further D/S) and extension of the upper-level terraces in the north abutment area of the Cross Valley Dam. ▪ Glacial till was from the north valley wall and the Rose Creek Diversion Channel. ▪ Filter material was screened from the gravel and glacial till sources.

Description of Construction	▪ First stage (1981) - built to El. 1035.7 m (fill height of 20 m), raised to El. 1031.7 m in preparation for future raises. ▪ Second stage (1988) – raise to El. 1040.7 m, emergency spillway moved from south to north abutment. ▪ Third stage (1989) – raise to El. 1045.7 m. ▪ Final stage (1991) – raise to El. 1049.4 m, final emergency spillway at north abutment. ▪ Intermediate Dam and raise - designed by Golder Associates (1988, 1989, 1991), and constructed by Pelly Construction. ▪ Seepage is controlled by a 5 m wide inclined upstream glacial till blanket against the excavated terrace north of Station 0+550 m and a vertical low permeability till core with a foundation cut-off trench. The till core is inclined at 2H:1V above El. 1031.7 m. ▪ At end of construction, a 20 m downstream berm at El. 1031.7 m was kept in place to form an overall downstream slope of 2.1H:1V.
Method of Construction	Downstream raise.

3.6.3 Cross Valley Dam

A summary of the construction of the Cross Valley Dam (see Figure A-027 for typical dam section) is given below in Table 3.13.

Table 3.13 Cross Valley Dam - Construction Details

Crest Width	6 m to 7 m
Crest Length	500 m
Max. Dam Height	17 m
U/S Slope	2H:1V
D/S Slope	2H:1V
Type/Source of Construction Materials	▪ 3 main fill materials: gravel/ drain rock, filter, and glacial till. ▪ Gravel was from the upper-level terrace (north of Rose Creek and upstream of the Cross Valley Dam), terrace deposits downstream (D/S of the Cross Valley Dam in the outfall area of Rose Creek Diversion Channel and further D/S), extension of the upper-level terraces in the north abutment area of the Cross Valley Dam. ▪ Glacial till was from the north valley wall and the Rose Creek diversion channel. ▪ Filter material was screened from the gravel and glacial till sources.
Description of Construction	▪ Built in 1980-1981 as a water retaining structure. ▪ Cross Valley Dam and toe drain was designed by Golder Associates, and constructed by Pelly Construction Ltd. Seepage control measures include: an upstream seepage control blanket, a central till core and a partial foundation cut-off trench. The downstream toe drain was added in 1991 to improve seepage control.
Method of Construction	Downstream raise. (see Figure B-028).

3.6.4 Little Creek Dam

A summary of the construction of the Little Creek Dam (see Figure A-039 for typical dam section) is given below in Table 3.14.

Table 3.14 Little Creek Dam - Construction Details

Crest Width	10 m
Crest Length	310 m
Max. Dam Height	10 m
U/S Slope	2.5H:1V
D/S Slope	2H:1V
Type/Source of Construction Materials	▪ Main fill materials are glacial till and gravely sand drain. ▪ Glacial till from overburden stripping for Vangorda Pit. ▪ Gravelly sand excavated from within the collection pond.
Description of Construction	Homogeneous till dam with a foundation seepage cut-off trench and downstream blanket and finger drains. Constructed specifications called for 300 mm lifts compacted to 95% Standard Proctor maximum dry density. Construction completed between 1990 and 1991. See SRK 1991 for further construction details. Historically, a wet well, intake and discharge pipes were installed to convey water from the collection pond to the water treatment facility. A culvert spillway was added in 1998 at the south abutment. Currently water is pumped to the Vangorda Pit for treatment during ice-free period.
Method of Construction	Conventional dam construction.

3.7 Document Control

Documentation related to engineering, construction, and regulatory aspects of the dams is maintained by YG. The relevant document types are listed below.

- site investigation, geological and environmental reports;
- baseline reports;
- environmental assessment reports;
- laboratory and field testing results;
- design reports;
- construction reports;
- hydrological and meteorological reports;
- vendor manuals and drawings;
- tailings deposition and water management plans;
- dam inspection and dam safety review reports;
- environmental control and monitoring reports;
- instrumentation, surveillance and monitoring manuals and reports;
- risk assessment reports;
- serious incident reports;
- emergency preparedness, response and contingency plans; and
- decommissioning and closure plan.

4 KEY RISKS

This section summarizes key risks to dam safety.

4.1 Down Valley Tailings Facility

The primary risk to the Down Valley Tailings Facility is from flood events, as existing infrastructure only has capacity to route up to the 500-year return period event. This routing capacity is dependant on the Rose Creek Diversion Channel remaining intact, as the spillways have not been designed to convey flows that would result from a failure of the channel. Larger events may exceed the capacity of the diversions and dam spillways, which could lead to overtopping and failure of the dams. Events smaller than the 500-year event may result in spillway flow and release of contaminated water.

Rose Creek Diversion Channel

A failure of the Rose Creek Diversion Channel resulting in diversion flows being directed into the Intermediate Pond or Polishing Pond could overwhelm the ponds' spillways. High flows in diversion could also overtop the fuse plug resulting in significant flows into the Intermediate Pond, which may result in release of contaminated water and could also overwhelm the spillway. Primary ways the diversion could fail include:

- a flood event exceeding the capacity of the diversion;
- a slope failure damaging the berm containing the diversion; and
- a blockage of the diversion from debris or slope failure resulting in reduced capacity.

Intermediate Dam and Cross Valley Dam

High flows into the Intermediate Impoundment or Cross Valley (Polishing) Pond could overwhelm the 500-year event capacity of the dams' spillways resulting in overtopping and failures of the dams. Flows smaller than the 500-year event could still result in spillway flow and release of contaminated water. Primary ways the pond capacity could be exceeded or spillway could be overwhelmed include:

- rapid water level rise caused by high inflows due to diversion failure, major flood events, or flows in the Rose Creek Diversion Channel overtopping the fuse plug spillway; and
- obstructions in the spillways reducing their capacity.

4.2 Little Creek Dam

The primary risk to the Little Creek Dam is from flood events, as the spillway was only designed to route up to the 200-year event. High flows into the Little Creek Pond could overwhelm the spillway culvert and cause overtopping of the dam. Events smaller than the 200-year event could still result in spillway flow and release of contaminated water. Primary ways the pond capacity could be exceeded or the spillway could be overwhelmed include:

- rapid water level rise caused by high inflow from major flood events; and
- obstruction of the spillway reducing its capacity.

5 OPERATION

5.1 Objective

As the Faro Mining Complex is under care and maintenance the operational objective is to preserve the dams and associated infrastructure in a safe, functional condition in compliance with regulations and permits. The primary operational activity is managing the pond levels by treating and discharging pond water.

5.2 Tailings Transport and Deposition

The tailings facilities are in care and maintenance and as such, no tailings deposition is planned or is currently occurring in any of the impoundments discussed herein.

5.3 Dam and Basin Raising

No raises of the dams or impoundments are currently planned. The spillways for all three dams are undersized and unable to pass the current updated design flood for closure. A potential means of increasing spillway capacity involves raising the dams. Furthermore, the capacity of the dams and basins may be affected by closure work although formal closure plans have not yet been developed.

5.4 Water Management

Water management at the Faro Site involves managing treatment and discharge from the Intermediate Pond, the Polishing Pond, and Faro Pit. The FIWTS is used to treat water from the Intermediate Pond and Faro Pit, which is then discharged to the environment via the North Wall Interceptor Ditch if it meets water quality criteria, or to the Polishing Pond if it does not. Water from the Polishing Pond is discharged year-round when it meets discharge criteria. Water is also pumped and siphoned between the ponds as necessary to manage the water level in the ponds. The water management scheme should allow the water level in Faro Pit to be drawn down over time.

5.4.1 Secondary Dam

The Secondary Dam cannot impound water. The ditch on the upstream side of the dam drains runoff into the Intermediate Impoundment via a spillway cut on the north side of the impoundment. Operating Parameters for the Secondary Impoundment are summarized in Table 5.1.

Table 5.1 Secondary Impoundment Operating Parameters

Live Storage Capacity	0 m^3 (no capacity to impound water)
Full Supply Level	N/A
Lowest Water Level	N/A
Flood Level	N/A
Typical Pond Level Range	N/A
Historic Pond Level Range	N/A
Riprapped Zones	N/A (Tailings on upstream side are at dam crest level)
Storage Capacity Curve	N/A
Spillway Rating Curve	Unknown
Maximum Drawdown Rate	N/A
Inflows	▪ Precipitation & runoff.
Outflows	▪ Spillway (approximately 1.5 m wide by 1 m deep trench cut in right abutment). Flows not measured and capacity not defined. ▪ Seepage (not measured).

5.4.2 Intermediate Dam

Operating parameters for the Intermediate Pond are summarized in Table 5.2.

Table 5.2 Intermediate Pond Operating Parameters

Live Storage Capacity	800,000 m^3
Full Supply Level	El. 1047.7 m (Spillway inlet)
Lowest Water Level	El. 1043.0 m (May be possible to further lower water level if pumps can be placed in low point in pond).
Flood Level	El. 1048.2 m (500-year flood, NHC 2006)
Typical Pond Level Range	El. 1043.0 m to El. 1047.0 m
Historic Pond Level Range	El. 1043.0 m to El. 1048.1 m (minimum since 1999)
Riprapped Zones	El. 1043.2 m to El. 1045.2 m and El. 1046.7 m to El. 1048.7 m (See Figure B-019).
Storage Capacity Curve	See Figure A-023.
Spillway Rating Curve	NHC (2006) is presented on Figure A-020.
Maximum Drawdown Rate	See Table 5.3.
Inflows	▪ Precipitation & runoff. ▪ Spillway from Secondary Impoundment. ▪ Pumping from Polishing Pond (if drawdown of Polishing Pond is required, not part of normal operations).
Outflows	▪ Pumping to FIWTS (discharge to environment or Polishing Pond). ▪ Siphoning to Polishing Pond. ▪ Pumping to Faro Pit (if drawdown is required, not part of normal operations). ▪ Spillway (during extreme flood events, not part of normal operations).

Drawdown Procedures

Maximum drawdown rates for the Intermediate Pond are shown in Table 5.3.

Table 5.3 Maximum Drawdown Rates for the Intermediate Pond

Drawdown (m)	Maximum Rate (mm/day)	Minimum Total Duration[1] (days)
1st m	500	2
2nd m	200	10
3rd m	100	30
4th m and more	50	80

Notes:

1. Minimum total duration refers to the minimum number of days from the start of drawdown to reach the end of each drawdown interval. For example, if the Intermediate Pond is to be drawn down 4 m, the drawdown rates used must be low enough that no more than 1 m is drawn down in the first 2 days, no more than 2 m is drawn down in the first 10 days, no more than 3 m is drawn down in the first 30 days, and no more than 4 m is drawn down in the first 80 days.

The maximum recorded average drawdown rate over one week for the Intermediate Pond was 50 mm/day. If this rate of drawdown is exceeded over any period, the dam should be observed daily with particular attention to signs of instability on the upstream slope and all piezometers at the dam should be monitored weekly. During periods when drawdown is exceeding historic maximum rates, site monitoring data and observations of dam performance should be communicated to the geotechnical consultant weekly by e-mail, including photos (as needed). Furthermore, drawdown rates should not exceed the previous maximum drawdown rate by more than 100 mm/day, i.e. higher drawdown rates should be approached gradually on a trial basis to assess dam response.

It is important to note that the primary means of monitoring stability under rapid drawdown conditions is through visual observations as piezometers in the Intermediate Dam are not in suitable locations for monitoring upstream stability under rapid drawdown.

Because the technical background of the site personnel is not geotechnical, it is important for them to be vigilant in looking for unusual dam behaviour, such as: cracks, slope slumps, differential movements along the crest and dam slopes, etc. If anything appears to be different from what they have observed before, they should take photos both in close up and at distance to show the full picture of the observed condition. If unfavourable performance of the dam is observed, the geotechnical consultant should be immediately notified, and further drawdown of pond level should be stopped.

5.4.3 Cross Valley Dam

The Cross Valley Dam Impounds the Polishing Pond, also known as the Cross Valley Pond. Operating parameters for the Polishing Pond are summarized in Table 5.4.

Table 5.4 Polishing Pond Operating Parameters

Total Storage Capacity	2,100,000 m^3
Full Supply Level	El. 1030.78 m
Lowest Water Level	El. 1027.5 m (exposure of sludge beds, CH2MHILL 2013)
Flood Level	El. 1031.1 m (500-year flood, NCH 2006)
Typical Pond Level Range	El. 1027.0 m to El. 1030.0 m
Historic Pond Level Range	El. 1026.3 m to El. 1030.4 m (Since 2004). El. 1031.2 m recorded in 1998.
Base of Riprap	El. 1030.2 m
Storage Capacity Curve	See Figure A-032.
Spillway Rating Curve	See Figure A-029 (NHC 2006).
Maximum Drawdown Rate	See Table 5.5.
Inflows	▪ Precipitation & runoff. ▪ Siphoning from Intermediate Pond. ▪ Discharge from FIWTS when water quality does not meet discharge criteria. ▪ Spillway from Intermediate Pond (during extreme flood events, not part of normal operations).
Outflows	▪ Siphoning to Rose Creek (when water quality meets discharge criteria). ▪ Pumping to Intermediate Pond (if drawdown is required and water does not meet discharge criteria, not part of normal operations). ▪ Spillway (during extreme flood events, not part of normal operations).

Drawdown Procedures

Maximum drawdown rates for the Polishing Pond are shown in Table 5.5.

Table 5.5 Maximum Drawdown Rates for the Polishing Pond

Drawdown (m)	Maximum Rate (mm/day)	Minimum Total Duration[1] (days)
1st m	500	2
2nd m	500	4
3rd m	400	8
4th m and more	200	20

Notes:

1. Minimum total duration refers to the minimum number of days from the start of drawdown to reach the end of each drawdown interval. For example, if the Polishing Pond is to be drawn down 4 m, the drawdown rates used must be low enough that no more than 1 m is drawn down in the first 2 days, no more than 2 m is drawn down in the first 4 days, no more than 3 m is drawn down in the first 8 days, and no more than 4 m is drawn down in the first 20 days.

The maximum recorded average drawdown rate over one week for the Polishing Pond was 150 mm/day. If this rate of drawdown is exceeded over any period both the Intermediate Dam and Cross Valley Dam should be observed daily with particular attention to signs of instability on the downstream slope of the Intermediate Dam and the upstream slope of the Cross Valley Dam. All piezometers at both the Intermediate Dam and Cross Valley Dam should be monitored weekly. During drawdown that exceeds historic maximum rates, site monitoring data and observations of dam performance should be communicated to the geotechnical consultant weekly by e-mail, including photos (as needed). Furthermore, drawdown rates should not exceed the previous

maximum drawdown rate by more than 100 mm/day, i.e. higher drawdown rates should be approached gradually on a trial basis to assess dam response.

It is important to note that the primary means of monitoring stability under rapid drawdown conditions is through visual observations.

Because the technical background of the site personnel is not geotechnical, it is important for them to be vigilant in looking for unusual dam behaviour, such as: cracks, slope slumps, differential movements along the crest and dam slopes, etc. If anything appears to be different from what they have observed before, they should take photos both in close up and at distance to show the full picture of the observed condition. If unfavourable performance of a dam is observed, YG and the geotechnical consultant should be immediately notified.

5.4.4 Little Creek Dam

Storage Capacity and Conveyance

Operating parameters for Little Creek Pond are summarized in Table 5.6.

Table 5.6 Little Creek Dam Pond Operating Parameters

Total Storage Capacity	122,000 m^3
Full Supply Level	El. 1112.8 m (Spillway inlet)
Lowest Water Level	El. 1107.0 m
Flood Level	El. 1113.6 m (200-year flood, SRK 1998. Assumed pond is operating at Full Supply Level.)
Typical Pond Level Range	El. 1107.0 m to El. 1111.0 m (El. 1111.8 m is license limit)
Historic Pond Level Range	El. 1105.0 m to El. 1111.7 m (Since 1999)
Base of Riprap	No riprap placed.
Storage Capacity Curve	See Figure A-044 (SRK 1990).
Spillway Discharge Capacity	0.8 m^3/s at El. 1113.6 m
Maximum Drawdown Rate	Not defined. Maintain below historic rates.
Inflows	▪ Precipitation & runoff, primarily from Vangorda Waste Rock Dump.
Outflows	▪ Pumped to Vangorda Pit

Typically, the pond was drawn down to El. 1109 m before the winter shut-down period. Currently, the pond level is maintained below the design FSL, as the pond is no longer required to take water from the Vangorda Pit.

Originally, the wet well and pump house were used to pump water from the pond to the water treatment plant. Currently the pump house and associated pumping infrastructure are non-operational except the power supply. Water accumulating in the pond is pumped to the Vangorda Pit using a float with an electric 30-hp pump and 6-inch HDPE pipeline. Water from the pit is then transferred to the Vangorda water treatment plant.

5.5 Environmental Protection

The greatest environmental risk is from dam failure, therefore, dam safety is a critical element of environmental protection. During operations, accumulation and discharge of stored water from the four dams is managed by the Care and Maintenance Contractor as part of an annual Water Management Plan to meet downstream water quality objectives defined by YG.

5.6 Safety and Security

Mine Worker Safety

The following documents identify health and safety policies and procedures at the Mine Site:

- Parsons New Employee Site Orientation for Faro Mine Complex.
- Parsons Emergency Response Plan for Faro Mine Complex.
- Parsons Project Safety, Health & Environment Plan (PSHEP).

Downstream Public Safety (Dam Failure)

Downstream safety from dam failure is addressed in the emergency response plan. The most recent dam breach and inundation study (KCB 2014a) indicated that there are no permanent populations that could be killed or injured downstream of the Intermediate and Cross Valley dams; however, a failure of these dams could affect recreational land users or on-site mine staff. The dam breach and inundation study indicated that a failure of Little Creek Dam could result in loss of life for a small but unspecified number of people in the town of Faro.

Downstream Public Safety (Water Quality)

The following document identifies policies and procedures to protect the public from adverse downstream water quality from the three dams:

- Parsons Spill Contingency Plan for Faro Mine Complex.

Security

The public is not permitted to access the dams. Access to the mine is controlled by full time security personnel at the front gate and by locked gates elsewhere on the property. There is signage posted along the mine roads indicating that the area is controlled by the mine. There is a public road that runs close to the Mine, just south of the North Wall Interceptor Ditch that the public could potentially use to access the Intermediate Dam and Cross Valley Dam on foot; however, public trespass onto mine property is reported to the mine security office by mine staff. Security details are given in the following document:

- Parsons Site Security Plan for Faro Mine Complex.
- Parsons Project Safety, Health & Environment Plan (PSHEP).

5.7 Documentation

Documentation related to operations is maintained by YG. Documentation includes:

- instrumentation records;
- weekly visual inspection reports;
- photographs;
- pond level records;
- weekly look-ahead schedules;
- reports from external consultants; and
- documentation of maintenance and upgrades.

5.8 Reporting

The following reports are required:

- **Annual Review** - Dam safety reporting including a review of weekly inspections, instrument monitoring, and site inspections is required annually. The annual review documents the dam safety inspection and a review of water management structures. This is currently carried out by KCB.
- **OMS** – this document is updated as required.
- **Emergency Response Plan (ERP)** – Describes the response to alert levels and dam failure scenarios. Updated as required.
- **Dam Safety Review (DSR)** – Required every 5 years. External party to review the dam condition, design, operating practices, OMS Manual, and ERP.
- **Environmental Reporting** – As per Parsons Field Monitoring Plan for Faro Mine Complex
- Incident Reporting:
  - Employees involved in or witnessing an injury, worker exposure, environmental incident, or near miss must immediately report it to their Immediate Supervisor, who they in turn inform the Health & Safety Lead, as well as the Site Manager. All incidents of significance are immediately relayed to the Parsons Project Manager, or Parsons Program Director if the Project Manager is not immediately available.
  - The Health & Safety Lead, is to ensure that all Health & Safety incidents are reported to the Parsons GBU Health & Safety director and other management personnel (as required) within 4 hours using the Industry Safe Online Health and Safety Reporting System.
  - The Health & Safety Lead will also submit an initial Incident Report for all reported incidents and Near Misses to the AAM Department of the Yukon Government within 24 hours of the incident.

6 MAINTENANCE

6.1 Objective

This section provides guidance for the maintenance of the dams and related facilities in accordance with design and regulatory requirements, and company standards.

6.2 Maintenance Parameters

The following are maintained by the care and maintenance contractor:

- dam slopes;
- dam crests;
- spillways;
- instruments;
- surface drainage ditches and berms;
- diversion structures;
- vegetation;
- pipelines and pumps;
- site access; and
- equipment.

Typical maintenance procedures for all dams, including the spillway channels and diversion structures, are outlined below (Gartner Lee 2003):

- Investigate the potential causes of surficial cracks and review implications with Geotechnical Consultant. Do not cover any cracks prior to the site observation of these cracks by the Geotechnical Consultant, unless instructed otherwise by the Geotechnical Consultant. Generally, minor cracks can be graded over with either a grader or possibly a loader. Material used to backfill cracks should be compatible with the parent material proximal to the crack. After grading the crest of the dam, it is usual to grade the entire crest towards the upstream slope where riprap is located. Generally, the crest of a dam is never graded towards the downstream slope, unless erosion protection measures are placed.
- Riprap on the upstream dam slope and within spillway and diversion channels needs to be kept in good condition. Small erosional scarps can develop in response to ice and/or wave action on the upstream slope. Construction activity and vehicle access within and across the spillway may disturb riprap. Flood events and frost action may also disturb riprap placed around culvert inlets. Riprap placed for repair should be of similar size to the riprap that was eroded. A filter between the underlying material and the riprap may be required. Generally, angular riprap is preferable than rounded riprap. Larger stone sizes will be required if rounded riprap is used. Review the required stone size with the Geotechnical Consultant if rounded riprap is to be used. Any riprap placed should be compatible with adjacent ground so that no edges or corners would be formed to attract erosive energy.

- Erosion gullies and their associated debris cones should be backfilled and graded over to prevent enlargement of existing erosion. In some cases, erosion gullies could be formed as the result of settlement and/or cracks of nearby features such as crest and roads. The original causes of settlement and cracks should be assessed, before the gullies are backfilled. In general, material with angular particle shape is more resistant than that with rounded particle shape.
- Maintenance of the crest, spillway or other features of the dam to their initial design configurations is important for their proper function.
- Siphon pipes and the associated infrastructure needs to be kept in good operating condition so that it can be used for both routine and emergency water discharges. To that end, the siphon pipes should be kept in good condition with the pipe welds checked periodically and the pipes kept clear of blockages due to ice, snow and soil debris. It may be necessary to properly drain the pipes in the fall so that ice blockages do not occur when the pipes are required in the following spring. Valves and air suction inlet pipes must also be kept in good repair and inspected periodically to confirm their readiness for proper operation.
- Excessive growth of trees and shrubs on the dams and in the spillway and diversion channels must be removed. Growth of short grass, which does not hinder visual inspection of these structures or reduce the discharge capacity of the channels, is acceptable and would be beneficial in terms of providing erosion protection.
- Accumulated debris must be removed from the spillway on a regular basis.

Maintenance may also be required on the various monitoring instruments including staff gauges, weirs, piezometers, inclinometers and thermistors. The staff gauges should be checked to ensure that they are stable and have not been pushed over by ice action or water flows. If any settlement and/or standing water is noted around piezometer casing, the surface should be backfilled to prevent the ingress of surface water down the piezometer casing. Surface casing caps should be provided and maintained on all instrumentation to prevent their damage.

6.3 Routine and Predictive Maintenance

All components of the dam and impoundment should be inspected and maintained regularly. The parameters and frequency of inspections are included in Table 6.1. Maintenance is the responsibility of the care and maintenance contractor. Maintenance involving geotechnical structures will be conducted in consultation with the Geotechnical Consultant.

Table 6.1 Maintenance Schedule

Item #	Component	Monitoring	Maintenance Frequency
1	Dam slopes and crest.	Weekly Visual Inspections.	Annually or as required.
2	Riprap on upstream slope and spillway.		
3	Erosion gullies.		
4	Maintain design configurations of dams and water management structures.		
6	Vegetation.		
7	Spillway debris.		
8	Instrumentation.		
9	Rose Creek Diversion Channel		
10	Pipelines and pumps.	When in service, inspect pipes a minimum of twice daily.	Inspect pumps daily. Service when needed. Strip down, inspect, and repair annually.
11	Site access.	Active Security is present 24 hours a day throughout the year.	Security personnel complete an inspection report during rounds
12	Equipment availability and reliability.	Complete equipment condition check sheet prior to operation. Forward the documentation to Maintenance.	Determine the Preventative Maintenance inspection schedule based on either engine hours or calendar days.

6.4 Event Driven Maintenance

Under special circumstances such as heavy rainfall, pipeline rupture, a major flood, earthquake or similar event, the key components of the facilities will be immediately checked, monitored and repaired if required. Documentation for event driven maintenance will follow normal procedure but with additional urgency, including notification of YG and the Geotechnical Consultant, as appropriate. For emergency procedures, refer to the ERP.

Additional maintenance items may be identified during annual reviews, weekly inspections, or observations by mine staff. These should be prioritized and dealt with in a timely manner.

6.5 Documentation

All maintenance activities are to be documented in a consistent manner by the care and maintenance contractor. Maintenance records may become important sources of information to identify and deal with changed or changing conditions at the facility. Records that document maintenance may include:

- equipment logs;
- work history;
- frequency and cause of problems;
- component reliability;

- quality control records;
- diary or journal entries;
- communications and activity records;
- photos and/or videos;
- inventory of spares, materials, tools and equipment;
- critical spares list;
- schedules;
- change orders; and
- memos and reports.

6.6 Reporting

Maintenance of dams is reported in the annual review by the consulting geotechnical engineer (KCB) based on information provided by the care and maintenance contractor.

Observation of any unusual occurrence should be reported immediate to the consulting geotechnical engineer and follow the action plan outlined in the ERP. Unusual occurrences include the following:

- seismic events;
- major flood events;
- abnormal seepage flowing from any of the dam slopes or toe areas;
- piezometer reading discrepancies;
- piping of sediment at any location; and
- damage to any component of the dam or key structures.

7 SURVEILLANCE

7.1 Objective

The overall objective of surveillance is to identify unusual conditions or deviations from expected performance so that an appropriate response can be implemented. Surveillance is a critical element in the safe operation and maintenance of the facility. This section identifies the key surveillance parameters and procedures for monitoring the operation, safety and environmental performance of the facilities.

7.2 Surveillance Parameters

7.2.1 Inspection

The care and maintenance contractor conducts weekly visual inspections of the four dams and records observations on a standard form (Appendix II).

7.2.2 Instrumentation

A list of instruments and figures showing their locations is provided in Appendix III. The locations of the instruments related to dam safety are also shown on the following drawings:

- Secondary Dam – Figure B-010.
- Intermediate Dam – Figure B-018.
- Cross Valley Dam – Figure B-026.
- Little Creek Dam – Figure A-036.

Instrumentation at the dams consists of piezometers and thermistors. The piezometers are currently the primary instruments for dam safety. There are no inclinometers, survey pins or other means to monitor movement of the dams. As part of the 2016 work KCB developed recommendations to install inclinometers at the Intermediate, Cross Valley and Little Creek dams. Thermistor readings in the dams are no longer required, as the foundations have now thawed. There are staff gauges and weirs to measure flows downstream of the CVD but not the ID (since it flows into the polishing pond behind the CVD) or LCD. Standpipe piezometers downstream of the dams are also used to monitor water quality.

The diversion structures have flow measurement stations. The Rose Creek Diversion Channel has inclinometers and thermistors. Monitoring the slopes of the diversion is important because a blockage in the diversion due to a slope failure could cause the flow to enter the Intermediate Pond and then the Polishing Pond and could overtop the Cross Valley Dam and/or the Intermediate Dam. The Care and Maintenance Contractor visually monitors the slope daily and takes photographs from four fixed locations weekly.

7.3 Surveillance Procedures

7.3.1 Inspection

Visual monitoring is the responsibility of the care and maintenance contractor. Care and maintenance staff undertake weekly inspections of the visual condition of the dams. The inspectors note any changes to the structure including:

- settlement, cracks, or slumping anywhere on the dam;
- new or opening cracks on the dam crest or slopes;
- erosion on the dam slopes;
- ponding water on the crest or toe;
- displacements or erosion of the riprap on the upstream slope or within spillways;
- new or increasing amounts of seepage at the toe or downstream face (important to check for seepage at both abutments);
- presence or increase in the turbidity of seepage water that is not related to the influence of surface runoff; and
- pond elevation.

These observations are to be recorded in a log book, field form (Appendix II) or file so that changes may be documented. Selected photos and/or hand-drawn sketches can also be provided to illustrate details of description.

Following a significant event such as high rainfall, earthquake, overtopping of diversions, spillway flow, sudden deformation of the dam slopes, or any other cause for concern regarding dam safety, visual inspections and piezometer readings should immediately be carried out by the care and maintenance contractor.

7.3.2 Instrumentation

The instrumentation should be read at the frequency indicated in the most recent annual review. The recommended frequency of instrument monitoring from the 2016 Annual Review is included in Appendix III. The geotechnical consultant is currently responsible for taking the regular instrument readings and reviewing. For event driven instrumentation readings, the care and maintenance contractor will read the piezometers on the dams.

The instruments are used to check for the following:

- abnormally high piezometric levels or sudden changes;
- piezometric levels that exceed alert levels;
- high pond levels exceeding alert levels;

- sudden increase in the rate of deformation for the inclinometers at the Rose Creek Diversion Channel; and
- surface and groundwater quality.

7.3.3 Collation and Analysis of Data

The inspections, photos, and flow readings are combined in a data package by the care and maintenance contractor and sent to the consulting geotechnical engineer for review. The geotechnical engineer reads the instruments when on site. The care and maintenance contractor also reads them if required. These values are plotted over time. At the time of the instrument reading, the results should be compared to previous results and the alert levels to determine if the reading is reasonable and if an alert level should be triggered.

7.3.4 Periodic Inspection and Review

Inspection visits by a professional geotechnical engineer are also required. Over recent years, these inspections have been undertaken in May and June (following spring freshet and thawing) and August/September (following an entire summer season of runoff) to assess the conditions of the dams. Site visit memos and/or annual geotechnical inspection reports contain comments by the Geotechnical Consultant on required maintenance and monitoring issues to complement the typical monitoring protocols provided herein. Dam Safety Reviews (DSR) by an external consultant are required every 5 years. The dam condition, design, consequence, operating practices, OMS Manual, and ERP are reviewed as part of the DSR.

7.4 Documentation

The surveillance activities are recorded in the following documents by the care and maintenance contractor:

- field forms for visual inspections of dams;
- spreadsheet for pond levels; and
- spreadsheet of readings for: staff gauges, weirs, and flow measurements.

7.5 Reporting

Procedures for initiating emergency response alerts are described in the ERP. Operational performance that meets expectations as well as conditions that require adjustment to the design, operation, maintenance or surveillance are reported in the annual review by the geotechnical consulting engineer. Each year, the annual review report is required to be submitted to YG in its final form by March 31st of the following year.

8 EMERGENCY RESPONSE PLAN

The updated Emergency Response Plan (ERP), based on the earlier versions (KCB 2014b and BGC 2008b) specifies the following three alert levels in the increasing degree of severity that may threaten the safety of the dams:

- Yellow Alert (unusual condition requiring review).
- Orange Alert (emergency condition which triggers the ERP).
- Red Alert (imminent failure).

Yellow Alert level is the first or lowest level of action for a given incident. This level of action, assigned to typical operations and maintenance conditions, is covered in the OMS manual. The Site Manager, KCB, and YG should be notified and should review the situation to determine a course of action.

Orange and Red alert levels require activation of the Emergency Response Plan.

The following sections describe conditions for these alert levels.

Yellow Alert Conditions

- Flooding:
  - Heavy precipitation with potential to cause damage under current conditions (i.e. if culverts are plugged with ice, less runoff would be required to cause damage). There are high flows in road ditches and local creeks that may result in road ditch capacities being exceeded in some locations and water flow over access roads.
- Pond:
  - Pond level greater than the Yellow Alert levels in Table 8.1.
  - Pond level is greater than the full supply level but lower than the top of the core of the dam, i.e., the emergency spillway is operating within the design limit.
- Dam:
  - Warning signs include: appearance of new cracks or the opening of existing cracks on the dam crest and/or upstream/downstream dam faces, slope slumps, or significant trend of increasing pore pressures in several piezometers or high one-time reading from a single piezometer or unusual movement in an inclinometer (only for Canal Dyke).
- Piezometers:
  - Significant trend of increasing pore pressures in several piezometers or high one-time reading from a single piezometer or unusual movement in an inclinometer.
  - An increasing trend in the measured piezometric elevation that appears to exceed the historical maximum readings in Table 8.1.
  - Piezometer reading above the yellow alert level in Table 8.1.

- Increasing or decreasing trend in the piezometric levels without a corresponding change in the pond level.

- Seepage:
  - Appearance of new seepage discharge location, increase of monitored seepage turbidity and/or seepage rate, decreased piezometric level in piezometers near the downstream toe. Judgment and comparison to previous observations are required to differentiate normal changes related to recent precipitation, change in pond level or influence of surface runoff on observed seepage.
  - An increasing trend in the measured seepage rate at the toe seepage weirs that appears to exceed the historical maximum readings shown on Table 8.1.
  - Increasing or decreasing trend in seepage rate without a corresponding change in the pond level.
- Diversions:
  - For the Rose Creek Diversion Channel, the Yellow Alert level is reached when the water reaches 0.5 m below the crest of the Canal Dyke.
  - For the Faro Creek Diversion Channel, the Yellow Alert level is reached when the water is 0.8 m below the adjacent road surface.
  - For the Vangorda Diversion Flume, the Yellow Alert level is reached when the overall flume is full or near full and still rising (i.e. imminently in danger of overflowing).
  - Slumping occurs on the downhill side of the diversion channel, but does not interfere with road access. New tension cracks, either parallel or perpendicular to the channel alignment, are observed on either side of the channel slopes and/or below the diversion channel. Significant rock fall events. Minor slope failures occur in pit walls below diversion channels. There is evidence of ground thawing at depth along the Rose Creek Diversion Channel, accompanied by shear displacement detected in the slope inclinometer at similar depth.
- Seismic:
  - An earthquake event is felt at the mine site or in the Town of Faro or the earthquake is within 100 km of the mine site and with a magnitude greater than 3, based on the Natural Resources Canada Pacific Geoscience Centre. (http://www.earthquakescanada.nrcan.gc.ca/).
- Environmental:
  - Water level in the Intermediate Pond, Polishing Pond, or Little Creek Pond is within 0.5 m of dam spillway invert level.
  - Controlled release of non-compliant water (whether accidental or planned); Release is not the result of damage to infrastructure. Release can be manually stopped.

Table 8.1 Instrumentation Yellow Alert Levels

Instrument Type	Instrument ID	Historic Water El. Range (m)	Yellow Alert El. (m)	Additional Information
Secondary Dam (SD)				
Piezometer (Standpipe)	P81-6	1053.04 to 1055.37	1055.37 m	
	P81-7	1057.09 to 1057.19	1057.19 m	
	P81-8	1055.77 to 1055.87	1055.87 m	
	P03-01	1054.29 to 1055.60	1055.60 m	
	P03-02	1053.72 to 1056.41	1056.41 m	
	P03-03	1052.28 to 1056.02	1056.02 m	
Intermediate Dam (ID)				
Pond Elevation		1042.96 m to 1048.1 m	1047.7 m	Dam Crest = 1048.8 m Spillway = 1047.7 m
Piezometer (Pneumatic)	BH91-ID 3	Shallow (S) = 1036.33 to 1044.5 m Deep (D) = 1028.9 to 1038.04 m	S = 1039.2 m D = 1038 m	
	BH91-ID 4	Deep = 1026.74 to 1031.85 m	D = 1031.9 m	
Piezometer (Standpipe)	BH94-IDC-1	Dry	1035.5 m	
	BH-96-1	1027.37 m to 1031.65 m	1031.7 m	
	BH-96-2	1028.87 to 1047.3 m	1031.9 m	
	BH-96-3	A = 1026.62 to 1031.38 m	A = 1031.4 m	
	BH-96-4	A = 1027.61 to 1032.04 m D = 1026.60 to 1031.75 m	A = 1032.0 m D = 1031.8 m	
	BKS04-06	Dry	1037.0 m	
	BKS04-07	Dry	1037.7 m	Reported as damaged
Cross Valley Dam (CVD)				
Pond Elevation		1026.31 m to 1030.36 m	1030.78 m	Dam Crest = 1032.7 m Spillway = 1030.78 m
Piezometer (Standpipe)	CVDC-4	Deep = 1016.72 to 1019.05 m	1019.1 m	
	CVDC-7	Deep = 1015.27 to 1019.21 m	D = 1019.2 m	
	CVDC-9	Shallow = 1019.91 to 1024.74 m Deep = 1021.18 to 1025.61 m	S = 1024.7 m D = 1025.6 m	
	CVDT-2	1015.40 to 1019.5 m	1019.5 m	
	CVDP-1	1016.82 to 1019.83 m	1019.8 m	
	CVDP-5	Dry to 1022.05 m	1022.1 m	
	CVDP-6	1014.86 to 1019.55 m	1019.6 m	
	94 CVDC-1	1022.71 to 1024.58 m	1024.6 m	
	P01-02	Shallow = 1017.42 m to 1018.3 m Deep = 1017.86 m to 1019.73 m	S = 1018.3 m D = 1019.73 m	
	P01-11	1016.17 m to 1017.83 m	1017.83 m	
Weir	X11	2.6 L/s to 23.8 L/s	20.9 L/s	
	X12	0.02 L/s to 2.0 L/s	2.0 L/s	
	X13	7.5 L/s to 123 L/s	43.9 L/s	
	Weir 3	0.03 L/s to 7.1 L/s	7.1 L/s	

Instrument Type	Instrument ID	Historic Water El. Range (m)	Yellow Alert El. (m)	Additional Information
Little Creek Dam (LCD)				
Pond Elevation		1105.00 to 1111.70 m	1112.8 m	Licence Limit = 1111.8 m Emergency overflow = 1112.8 m Dam Crest = 1114.3 m
Piezometer (Pneumatic)	BH94 LCD-2	Shallow: 1100.50 to 1101.76 m Deep: 1098.54 to 1102.39 m	Increased trend of piezo level	
	BH94 LCD-3	Shallow: Dry to 1106.76 m Deep: 1102.89 to 1108.69 m	Increased trend of piezo level	
Piezometer (Standpipe)	P09 LCD-1	1093.45 to 1094.23 m	1093.82 m	
	P09 LCD-2	1093.26 to 1095.40 m	1093.41 m	
	P09 LCD-3	1091.83 to 1092.10 m	1092.06 m	
	P09 LCD-4	1082.00 to 1091.98 m	1086.76 m	
	P09 LCD-6	1087.47 to 1092.56 m	1087.47 m	
	P09 LCD-7	1096.93 to 1097.50 m	1097.50 m	

Orange Alert Conditions

- Flooding/Pond:
  - Pond level begins to rise above the top of the dam core but is still below dam crest level. The emergency spillway is in operation beyond its design limit or erosion is occurring.
- Dam:
  - Continuing and accelerating growth of cracks and slope slumps in length and width, observation of toe bulges, continuing rapid rise of piezometric levels, continuing increase of seepage rate and/or seepage turbidity, and/or increasing trend of observed dam or channel-retention dyke deformation.
- Seepage:
  - Rapid increase in seepage turbidity and/or seepage rate, or development of sinkholes on dam crest or upstream/downstream dam face.
  - Development of sand boils in the tailings or downstream of the dam.
  - Development of sinkholes anywhere on the dam, abutments or tailings beach.
- Diversions:
  - For the Rose Creek Diversion Channel, the Orange Alert level is defined by the water being within 0.25 m of the crest of the Canal Dyke, or if water is flowing over the emergency overflow at the (fuse-plug) diversion dam adjacent to the Secondary Tailings Dam.
  - Large slope slump occurs on the access road downhill of the diversion channel. Growth of monitored tension cracks in terms of width, depth and length. Slide debris has accumulated in the channel reaches about 1/3 of its original overall sectional area.

Increased shear displacement occurs at the slope inclinometers installed along the Rose Creek Diversion Channel.

- Seismic:
  - Visible physical damages occur on site following the event, but ground failures such as landslides and/or dam slope deformation and settlement do not appear to have the potential to trigger a dam failure mode.
- Environmental:
  - Large, unplanned release of non-compliant water; e.g. spillway flow, failure of sediment pond berm, etc. Flows can be stopped (e.g. repair sediment pond berm or stop discharging into sediment pond) or will cease naturally (spillway flow during freshet or a major storm event).

Red Alert Conditions

- Flooding/Pond:
  - Water is flowing at/over the dam crest and/or outside of the emergency spillway. Water level is rising. Failure of the dam is imminent.
- Dam:
  - Continuing deterioration of dam leading to potential collapse of dam crest due to crest settlement and/or slope failures. Upstream slope failure with attendant erosion of dam materials and/or any slope failure involving the dam crest are signs of severe dam distress.
  - Progressive enlargement of sinkholes on the dam, abutments or tailings beach, sand “boils” in the tailings, or whirlpools in the pond are signs of imminent dam failure. At the advanced stage, dam failure may be accompanied by slope failures resulting from erosion of dam materials by seepage flow, and eventually lead to dam breach by overtopping.
- Diversions:
  - Red Alert is reached for the Rose Creek Diversion Channel and Faro Creek Diversion channel diversion channels, when the water begins to overtop the containment dyke or road.
  - Blockage of diversion channel by debris from slope slump or rock fall leads to channel overtopping. Slope failure on the downhill side of the diversion channel removes any portion of the channel section along its reach adjacent to the pit-lake, tailings impoundment or pond.
- Seismic:
  - Significant physical damage occurs at a dam or a diversion channel following the seismic event.

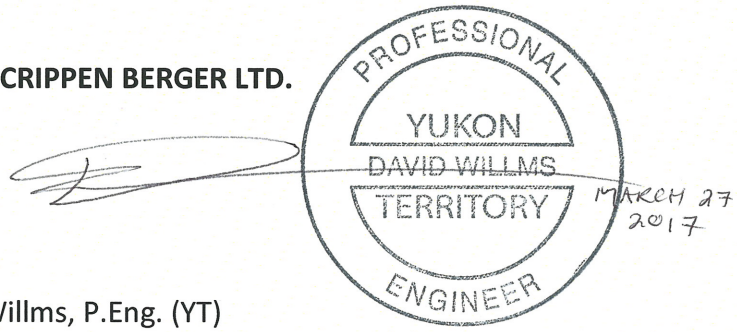
- Environmental:
  - Large, uncontrolled release of non-compliant water, treatment sludge or tailings due to major containment structure failure (i.e. dam failure, Rose Creek Diversion failing into the Intermediate Pond or Polishing Pond). Unable to stop flows. Major repair works required to restore containment.

9 CLOSING

This report, "Operations, Maintenance and Surveillance Manual: Secondary Dam, Intermediate Dam, Cross Valley Dam and Little Creek Dam", provides a compilation of data from numerous reports and drawings from various sources. KCB has not carried out any independent verification of such data and information.

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David Willms, P.Eng. (YT)
Geotechnical Engineer - Project Manager

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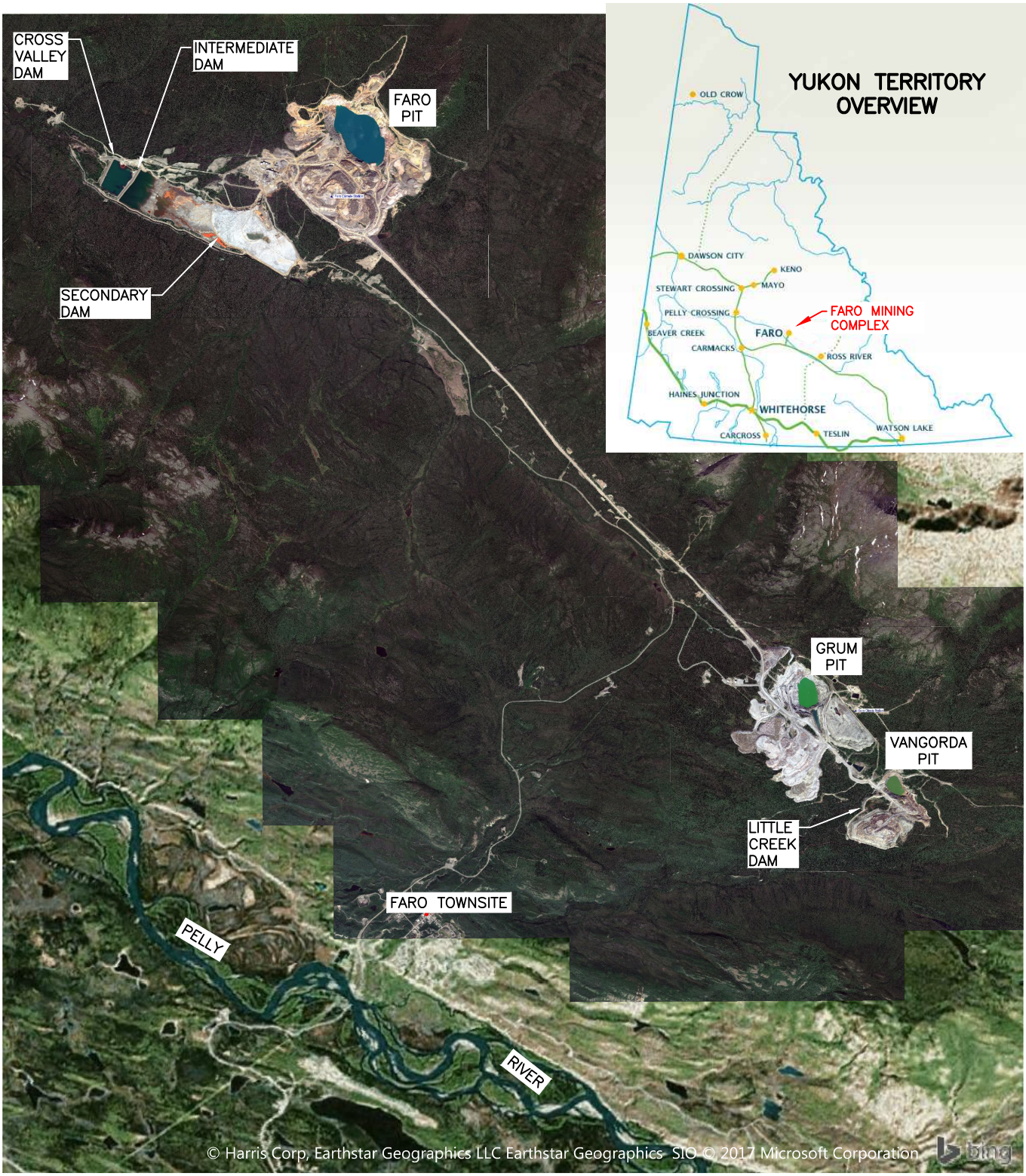
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FIGURES

A-001 Site Location Plan
B-002 Mine Site Topography and Access Roads
B-003 Faro Site General Layout
B-004 Faro Site Detail Layout
B-005 Vangorda Plateau Site General Layout
B-006 Vangorda Plateau Site Detail Layout
A-007 Terminology for Dam Operations
B-008 Down Valley Tailings Facilities – Location of Test Holes
B-009 Secondary Dam – Foundation Stratigraphy
B-010 Secondary Dam – Instrumentation
B-011 Secondary Dam – West Limb – Typical Dam Sections
B-012 Secondary Dam – East Limb – Typical Dam Sections
A-013 Secondary Dam – West Limb – Cross Section Stability Analysis
A-014 Secondary Dam – East Limb – Cross Section Stability Analysis
A-015 Intermediate and Cross Valley Dams – 2003 Survey Profiles Location Plan
A-016 Intermediate Dam – 2003 Survey Profiles
A-017 Intermediate Dam – Foundation Stratigraphy
B-018 Intermediate Dam Instrumentation – Plan and Sections
B-019 Intermediate Dam – Typical Dam Section
A-020 Intermediate Dam – Spillway Rating Curve
A-021 Intermediate Dam – Stability Analysis Cross Section (Typical Conditions)
A-022 Intermediate Dam – Stability Analysis Cross Section (Rapid Draw Down)
A-023 Intermediate Dam – Elevation-Storage Curve
A-024 Cross Valley Dam – 2003 Survey Profiles
A-025 Cross Valley Dam – Foundation Stratigraphy
B-026 Cross Valley Dam Instrumentation – Plan and Sections
A-027 Cross Valley Dam – Typical Dam Section
B-028 Cross Valley Dam – Toe Drain – Profile and Detailed Plan
A-029 Cross Valley Dam – Spillway Rating Curve
A-030 Cross Valley Dam – Stability Analysis (Downstream Slope)
A-031 Cross Valley Dam – Stability Analysis (Upstream Slope)
A-032 Cross Valley Dam – Elevation-Storage Curve
A-033 Little Creek Dam – General Arrangement Plan
A-034 Little Creek Dam – Layout for Cut–Off Trench Excavation and Drainage Blanket
A-035 Little Creek Dam – Foundation Stratigraphy
A-036 Little Creek Dam – Instrumentation Location Plan
A-037 Little Creek Dam – Longitudinal Section with Drill Holes and Test Pits
A-038 Little Creek Dam – Transverse Section with Drill Holes and Test Pits
A-039 Little Creek Dam – Typical Dam Section
B-040 Little Creek Dam – Cross Sections and Details
B-041 Little Creek Dam – Spillway Design – Plan, Section and Details
A-042 Little Creek Dam – As–Built Spillway in Plan
A-043 Little Creek Dam – Spillway Channel Sections
A-044 Little Creek Dam – Elevation-Storage Curve



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PROJECT

FARO MINE COMPLEX

TITLE

SITE LOCATION PLAN

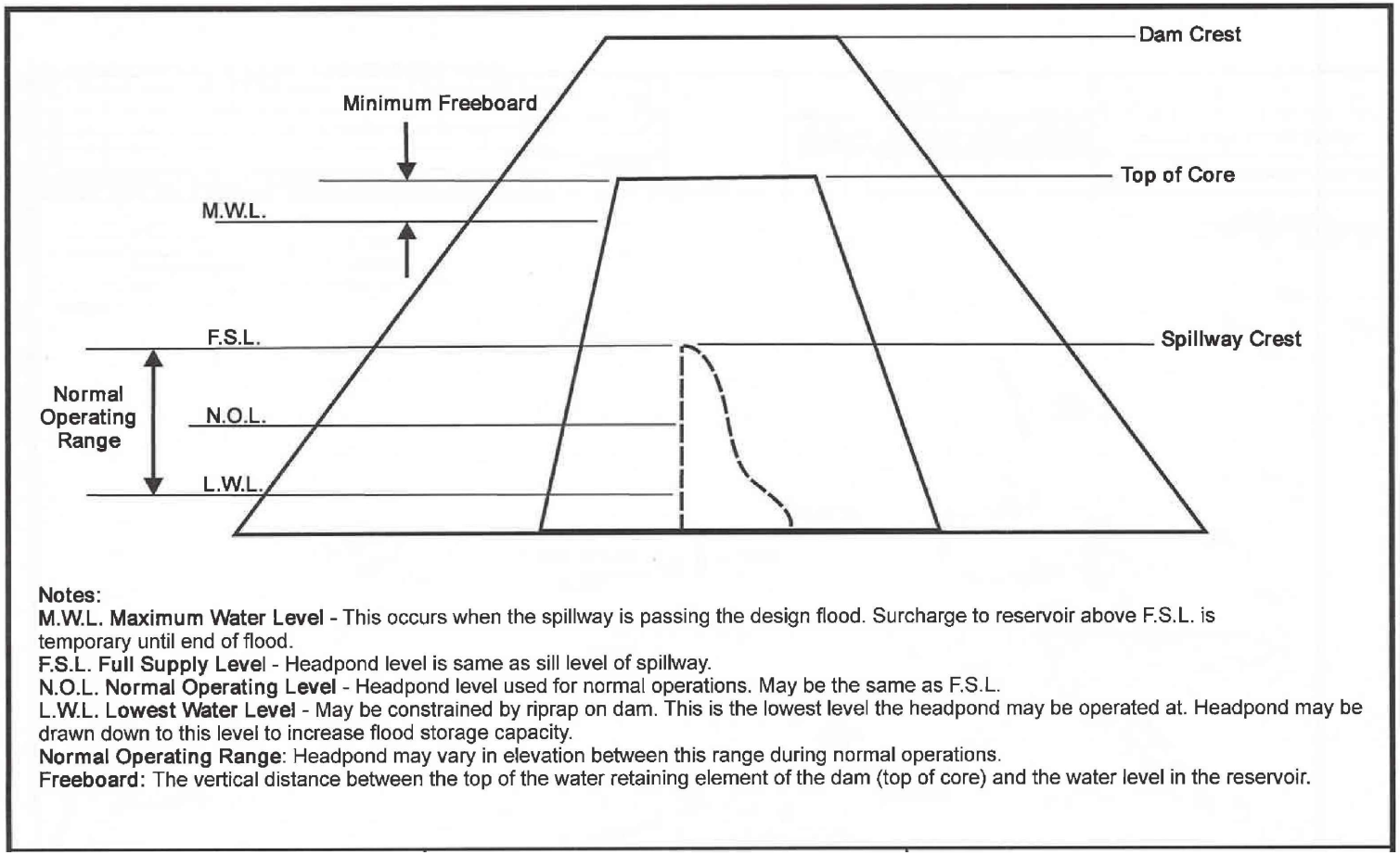
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FIG. No. A-001

KCB-R-MPA

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Xref File(s):
Image File(s): Map Sheet 1-1 Map Sheet 3-1 Map Sheet 3-2 Yukon Government yukon map - faro mine location

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Xref File(s):
Image File(s): terminology for dam operations Yukon Government



Notes:
M.W.L. Maximum Water Level - This occurs when the spillway is passing the design flood. Surcharge to reservoir above F.S.L. is temporary until end of flood.
F.S.L. Full Supply Level - Headpond level is same as sill level of spillway.
N.O.L. Normal Operating Level - Headpond level used for normal operations. May be the same as F.S.L.
L.W.L. Lowest Water Level - May be constrained by riprap on dam. This is the lowest level the headpond may be operated at. Headpond may be drawn down to this level to increase flood storage capacity.
Normal Operating Range: Headpond may vary in elevation between this range during normal operations.
Freeboard: The vertical distance between the top of the water retaining element of the dam (top of core) and the water level in the reservoir.

NOTE

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OMS MANUAL FOR DAMS

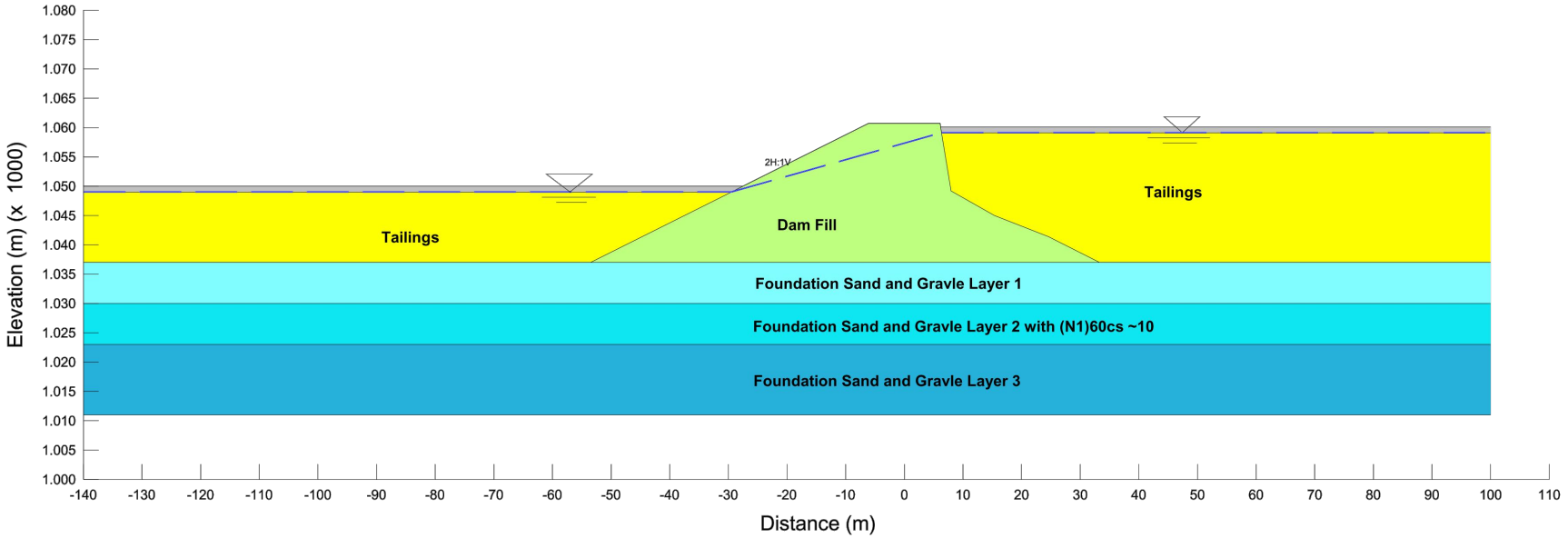
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FIG. No.: A–007

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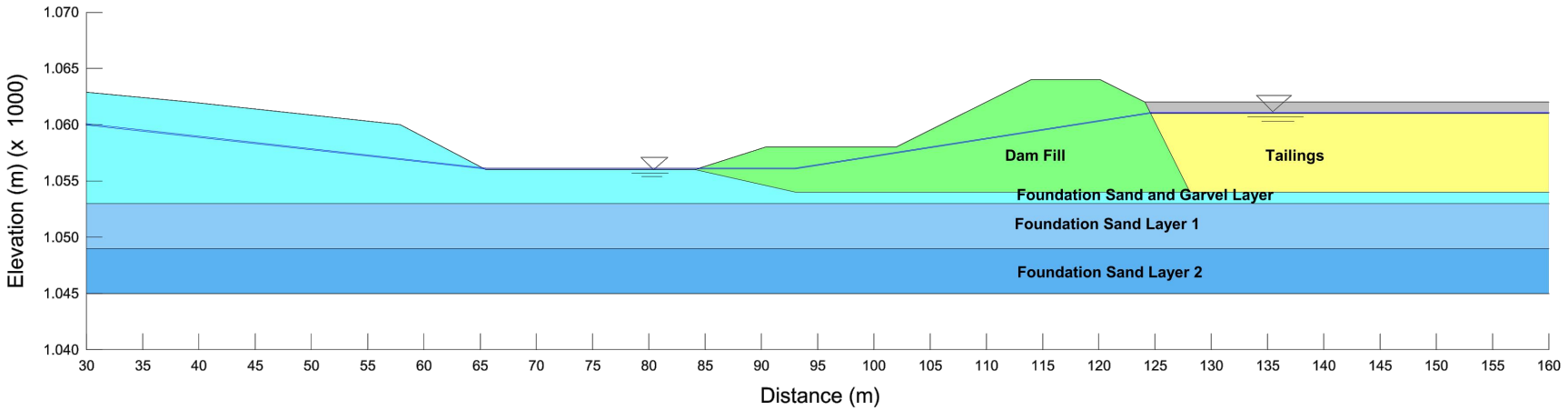
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WEST LIMB
CROSS SECTION STABILITY ANALYSIS

PROJECT No. M09770A06

FIG. No. A–013

KCB–R–MLA

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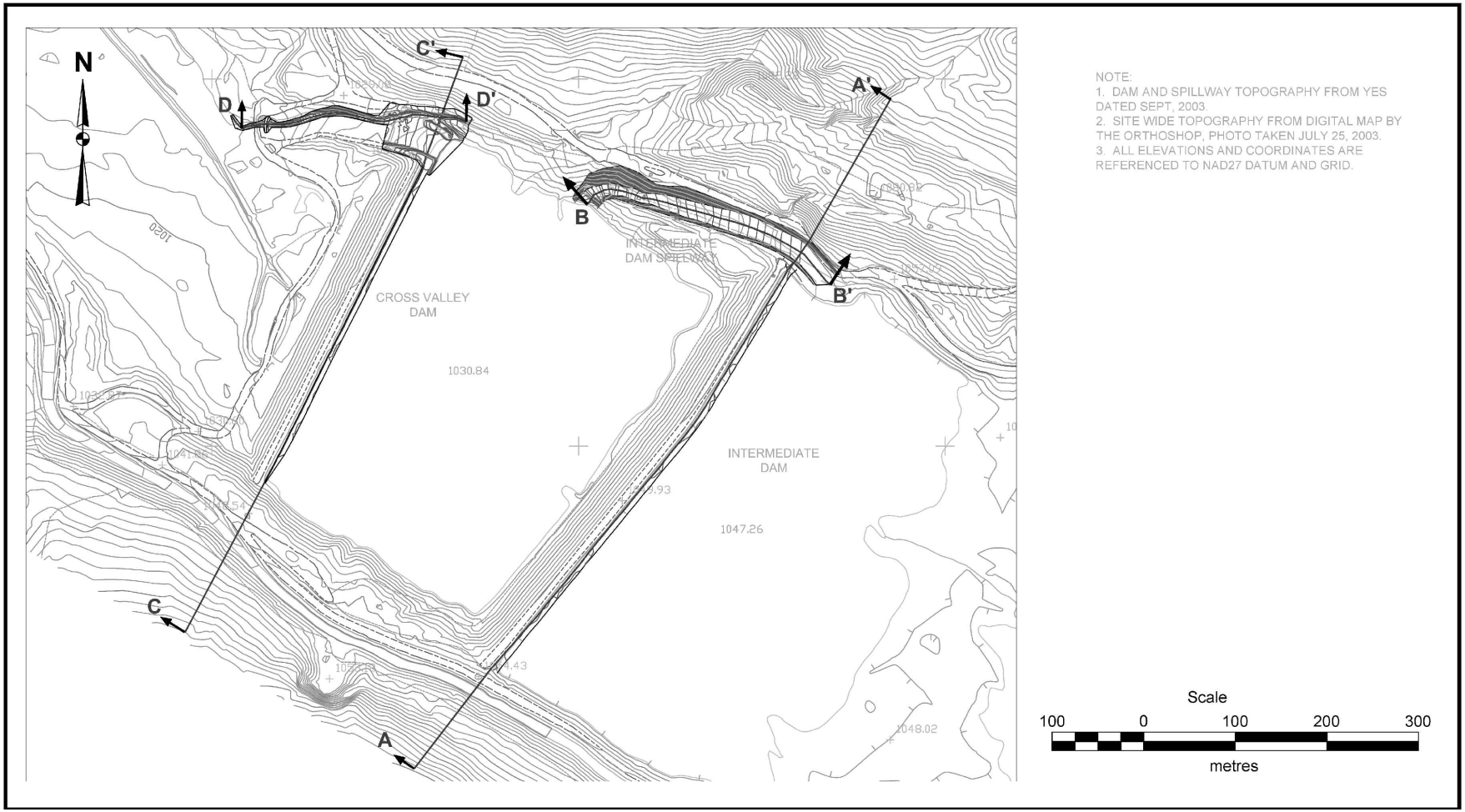
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EAST LIMB
CROSS SECTION STABILITY ANALYSIS

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FIG. No. A–014

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Xref File(s):
Image File(s): Fig A–008 – Intermediate Dam and Cross Valley Dam Location Plan0257–053–02 Yukon Government



NOTE

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PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

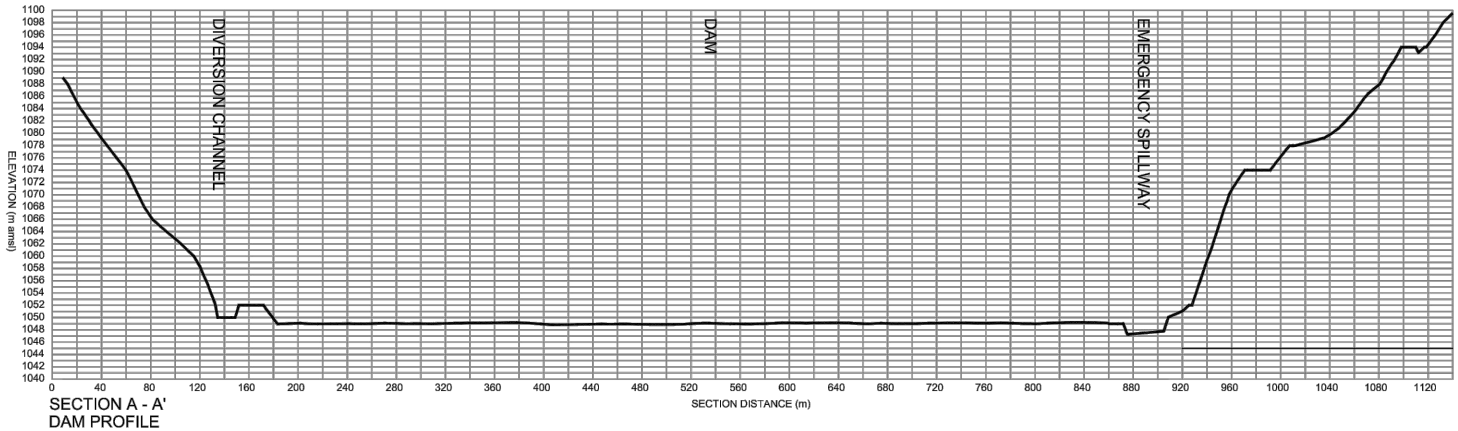
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2003 SURVEY PROFILES LOCATION PLAN

PROJECT No. M09770A06

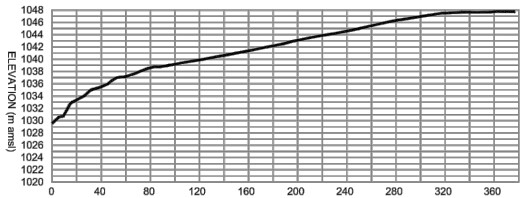
FIG. No. A–015

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Xref File(s):
Image File(s): Yukon Government



SECTION A - A'
DAM PROFILE



SECTION B - B'
EMERGENCY SPILLWAY PROFILE

NOTE:
1. DAM AND SPILLWAY TOPOGRAPHY FROM YES DATED SEPT, 2003.
2. SITE WIDE TOPOGRAPHY FROM DIGITAL MAP BY THE ORTHOSHOP, PHOTO TAKEN JULY 25, 2003.
3. ALL ELEVATIONS AND COORDINATES ARE REFERENCED TO NAD27 DATUM AND GRID.
4. LOCATION OF SECTIONS ON A-015

NOTE

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OMS MANUAL FOR DAMS

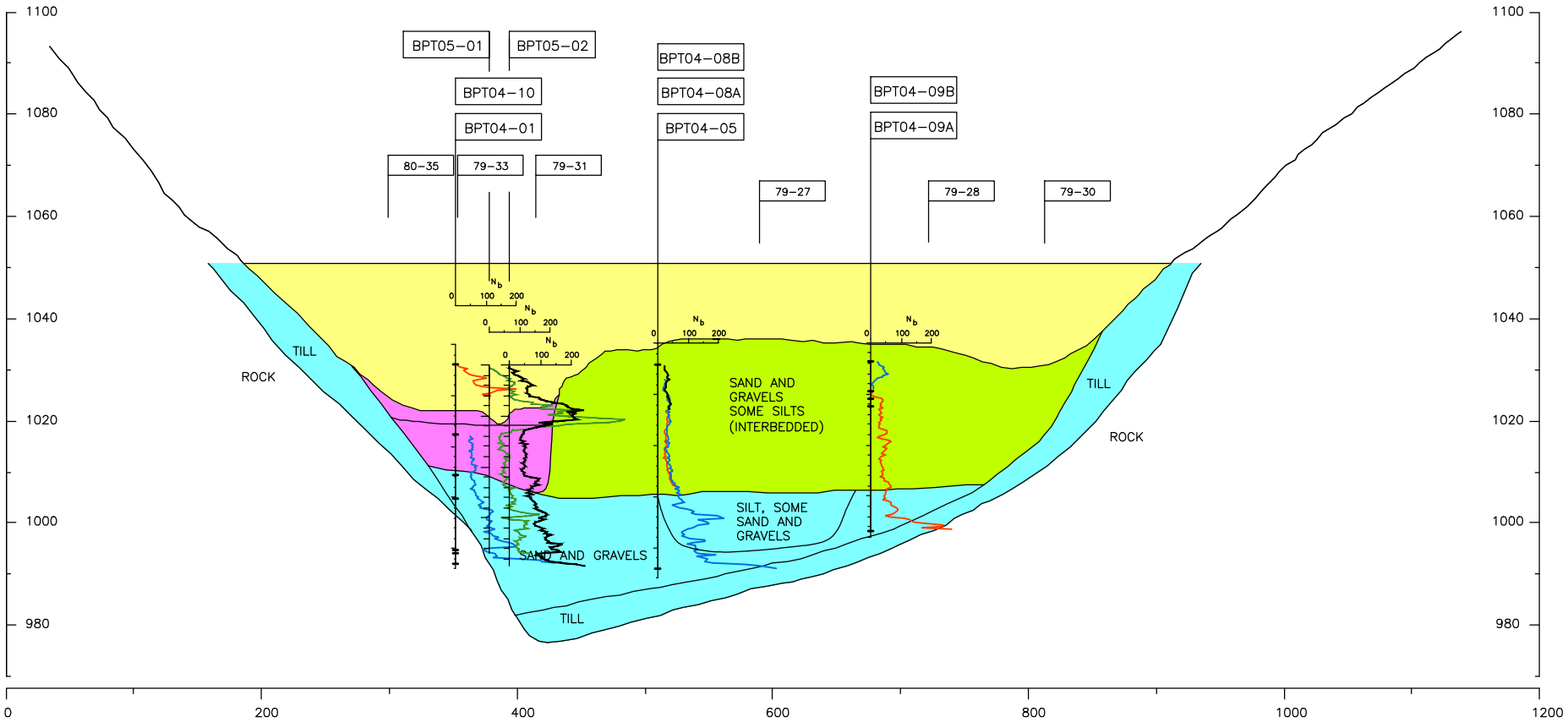
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2003 SURVEY PROFILES

PROJECT No.: M09770A06

FIG. No.: A–016

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Image File(s): Yukon Government



SECTION A (B–008)

LEGEND

- FILL
- ROSE CREEK SEDIMENTS
- GLACIO–FLUVIAL SEDIMENTS–TERRACE
- PLEISTOCENE SEDIMENTS

HORIZONTAL SCALE 0 125 m

NOTE

1. SECTION IS TAKEN FROM KLOHN LEONOFF (1981) DRAWING FOR GROUND CONDITIONS BENEATH CENTERLINE OF INTERMEDIATE DAM. KC BECKER HOLE INFORMATION IS SUPERIMPOSED AND WAS OBTAINED ON DOWNSTREAM BERM.

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

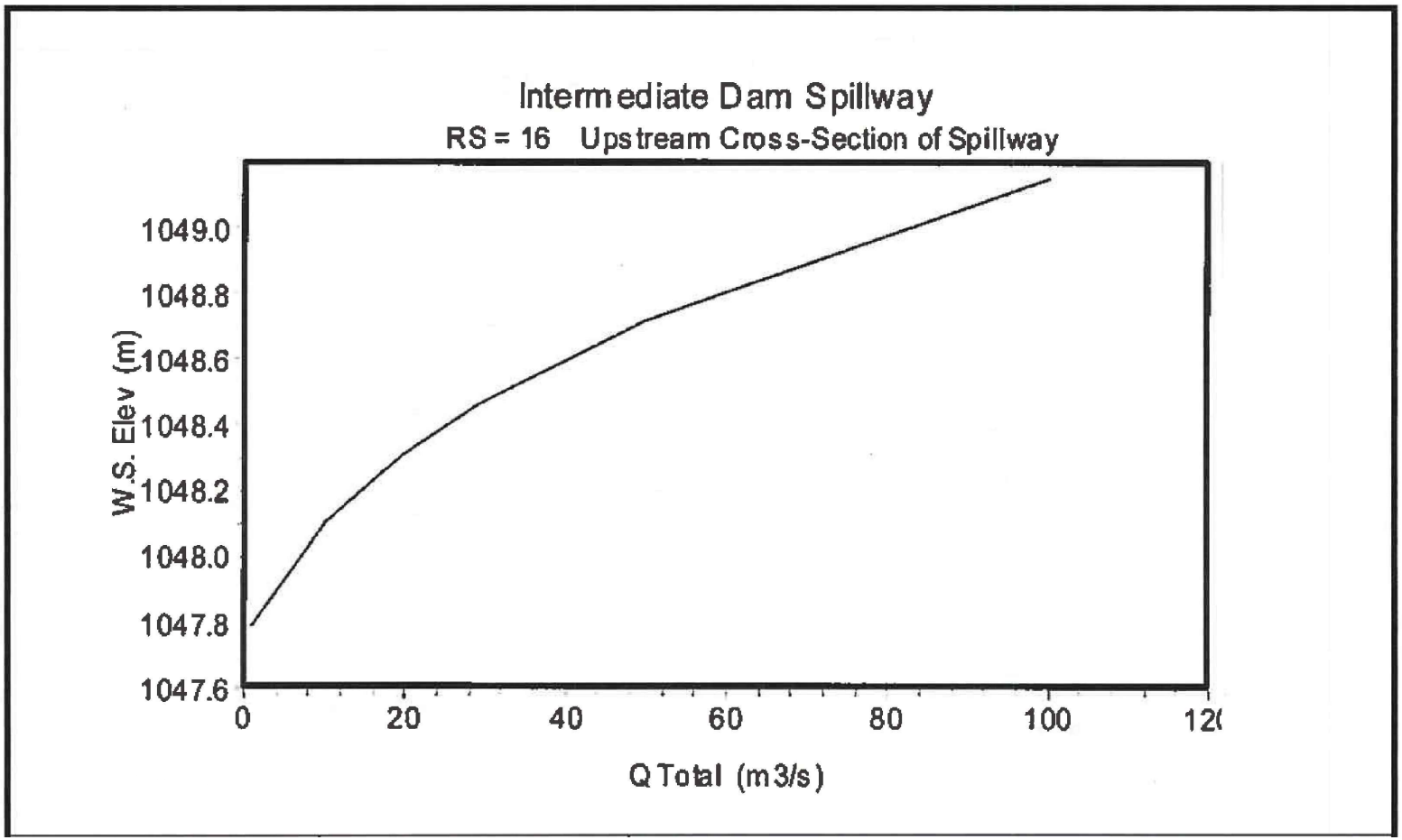
TITLE: INTERMEDIATE DAM FOUNDATION STRATIGRAPHY

PROJECT No. M09770A06

FIG. No. A–017

KCB–R–MLA

Time: 15:57:04 Date: 1/24/2017 Scale: 1:1(PS)
Drawing File: Z:\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–020_Intermediate_Dam_Spillway_Curve.dwg (jbokic)
Xref File(s):
Image File(s): FIG_A–016_Intermediate Dam Spillway Rating Curve Yukon Government



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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

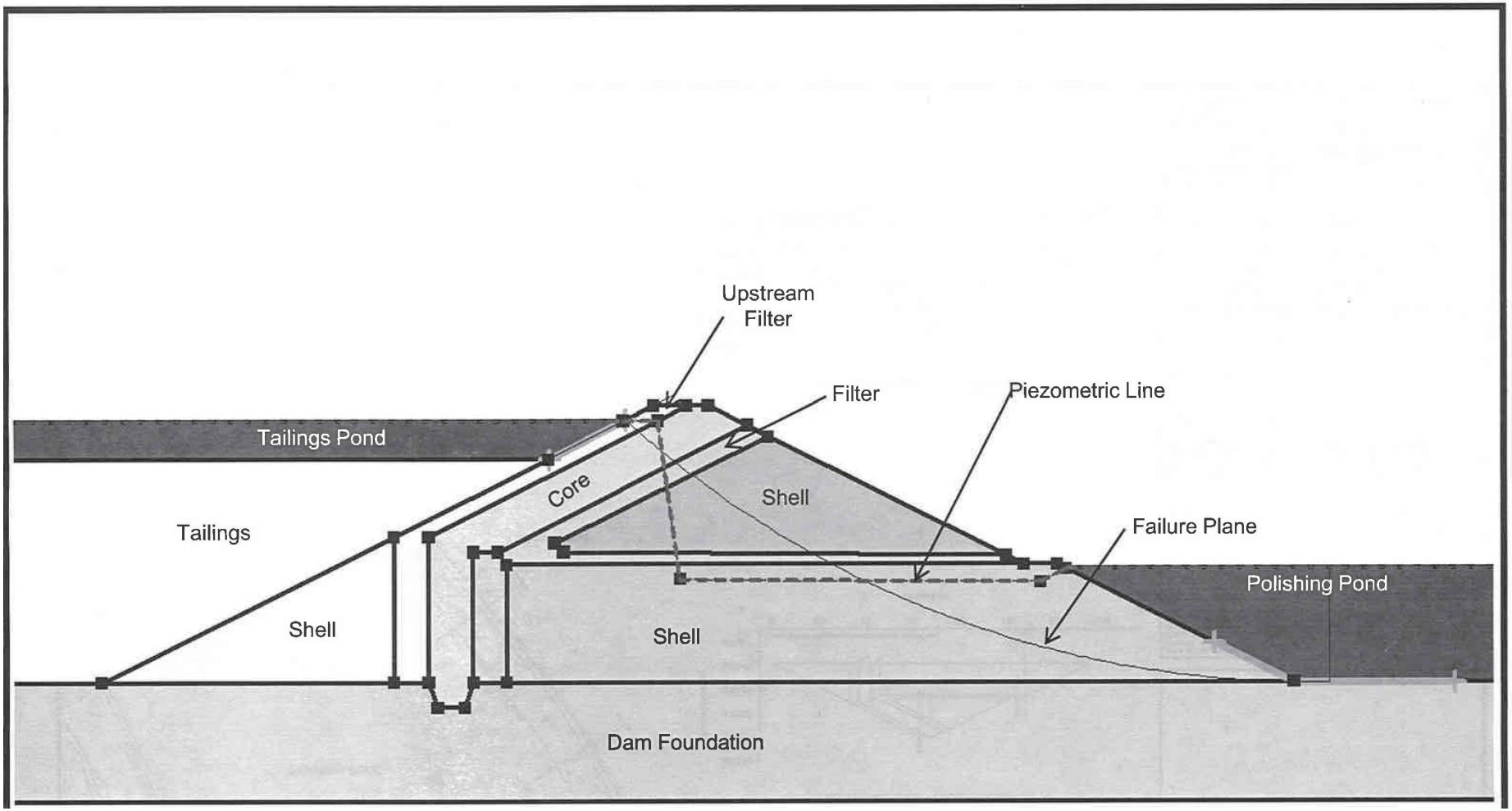
TITLE: INTERMEDIATE DAM
SPILLWAY RATING CURVE

PROJECT No. M09770A06

FIG. No. A–020

KCB–R–MLA

Time: 16:18:36 Date: 1/27/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 - GOY-Faro 2016-17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A-021_Intermediate_Dam_Stability_Analysis_cross_section.dwg (jbokic)
Xref File(s):
Image File(s): Fig A-013- DSStabAnalysis Yukon Government



NOTE

1. ORIGINAL SOURCE BY BGC ENGINEERING INC. (2008).

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

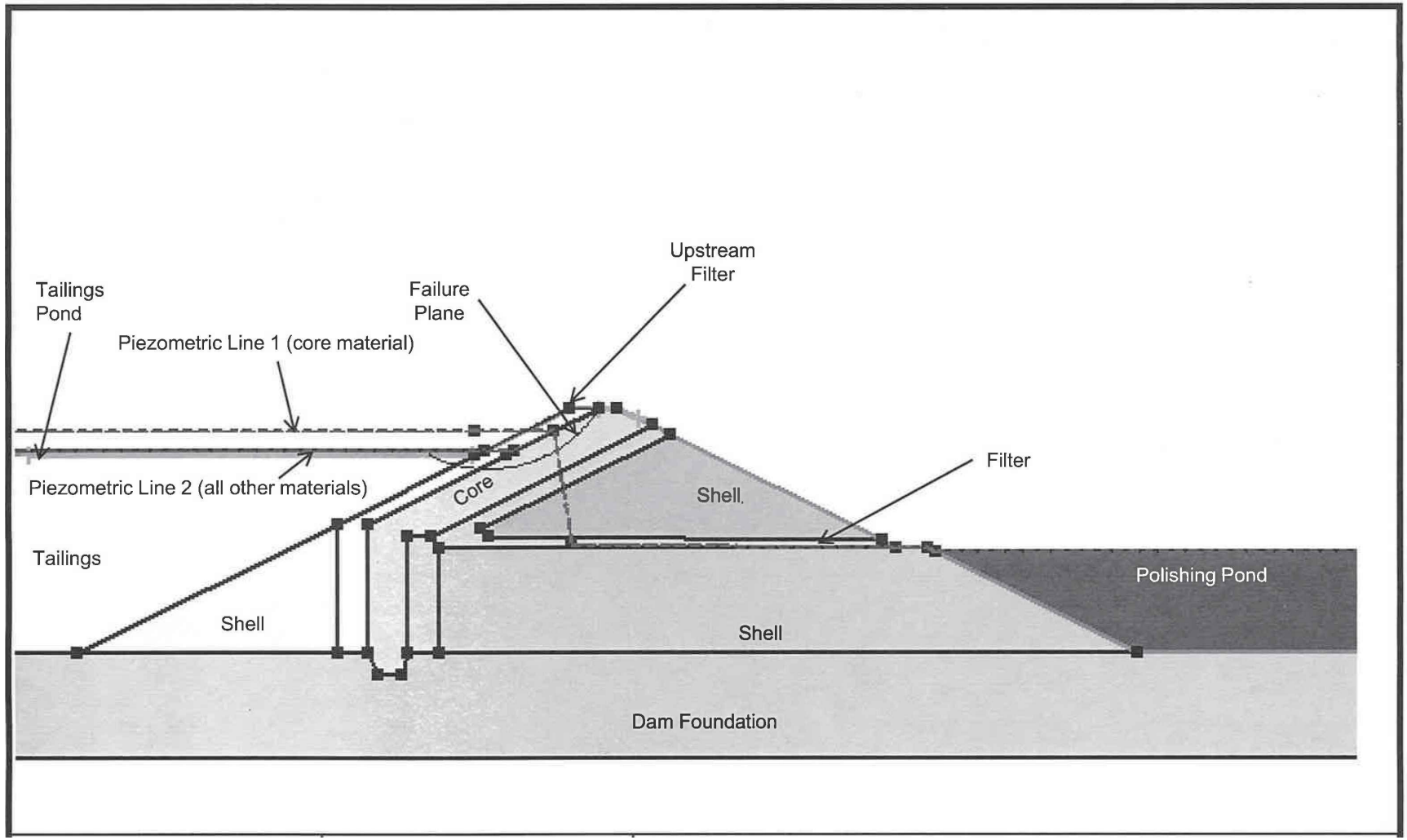
TITLE: INTERMEDIATE DAM
STABILITY ANALYSIS CROSS SECTION
(TYPICAL CONDITIONS)

PROJECT No. M09770A06

FIG. No. A-021

KCB-R-MLA

Time: 16:15:22 Date: 1/27/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 - GOY-Faro 2016-17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A-022_Intermediate_Dam_cross_section_rapid_drawdown.dwg (jbokic)
Xref File(s):
Image File(s): Fig A-014 - USStabAnalysis Yukon Government



NOTE

1. ORIGINAL SOURCE BY BGC ENGINEERING INC. (2008).

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CLIENT: Yukon Government

Klohn Crippen Berger

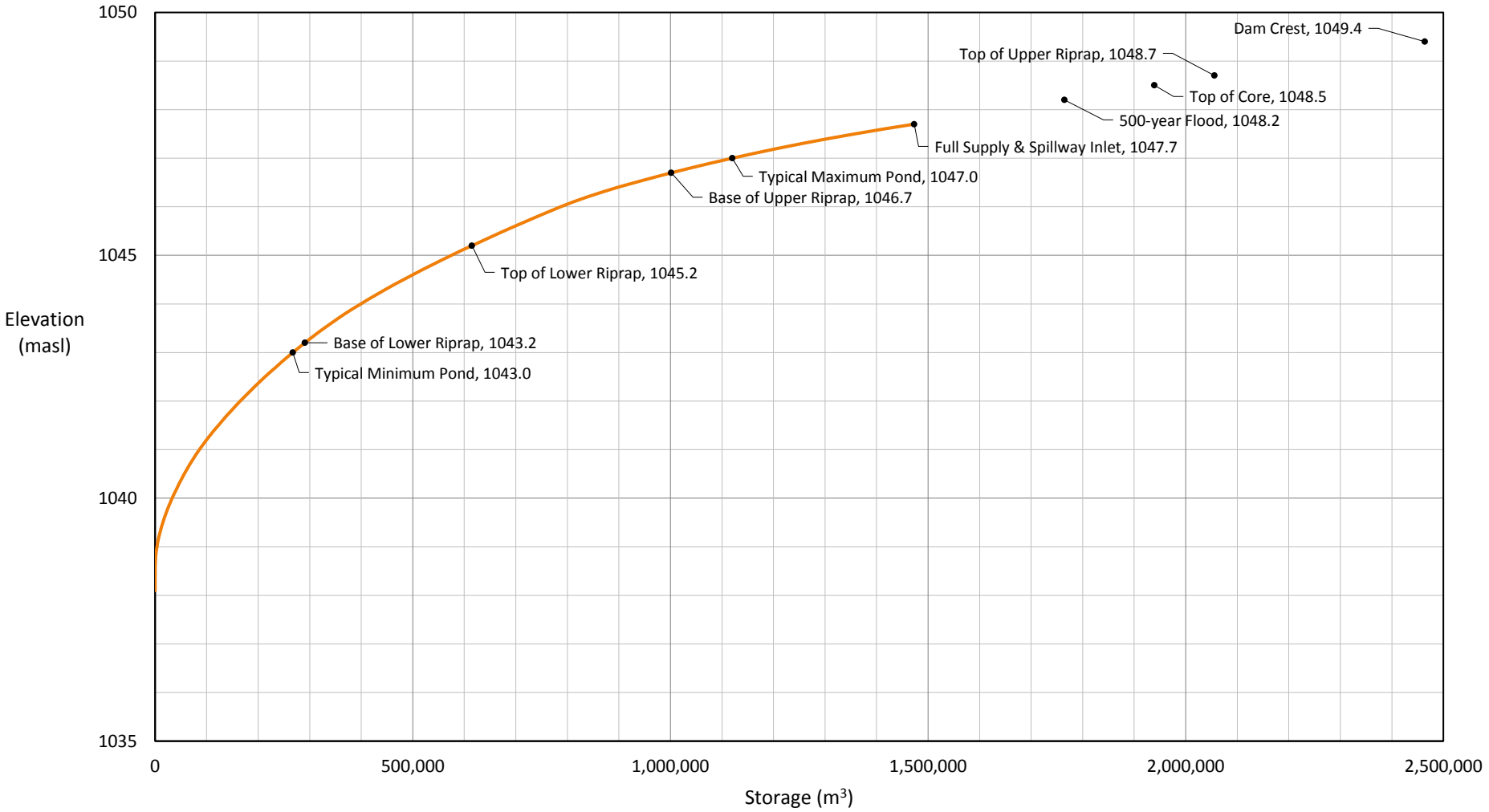
PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE: INTERMEDIATE DAM
STABILITY ANALYSIS CROSS SECTION
(RAPID DRAW DOWN)

PROJECT No. M09770A06

FIG. No. A-022

KCB-R-MLA



NOTES:
1. ELEVATION-STORAGE CURVE DATA PROVIDED BY YG
2. ELEVATION-STORAGE CURVE FROM COMBINED 2016 AURORA BATHYMETRY AND FARO LIDAR SURFACE
3. VALUES BEYOND END OF CURVE ARE EXTRAPOLATED AND UNDERESTIMATE VOLUME

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC, AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT, AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA, STATEMENTS, CONCLUSIONS, OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.

CLIENT

Klohn Crippen Berger

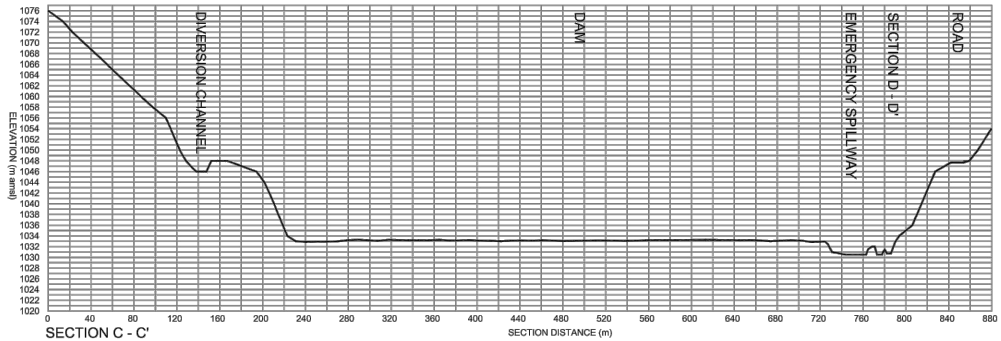
PROJECT
FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE
INTERMEDIATE DAM
ELEVATION-STORAGE CURVE

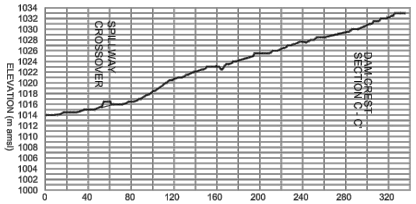
PROJECT No. M09770A06

FIG No. A-023

Time: 16:20:24 Date: 1/24/2017 Scale: 1:1(PS)
Drawing File: Z:\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–024_CrossValley_Dam_2003_survey_profiles.dwg (jbokic)
Xref File(s):
Image File(s): Yukon Government



SECTION C - C'
DAM PROFILE



SECTION D - D'
EMERGENCY SPILLWAY PROFILE

NOTE:
1. DAM AND SPILLWAY TOPOGRAPHY FROM YES DATED SEPT, 2003.
2. SITE WIDE TOPOGRAPHY FROM DIGITAL MAP BY THE ORTHOSHOP, PHOTO TAKEN JULY 25, 2003.
3. ALL ELEVATIONS AND COORDINATES ARE REFERENCED TO NAD27 DATUM AND GRID.
4. LOCATION OF SECTIONS ON A-015

NOTE

1. ORIGINAL SOURCE BY BGC ENGINEERING INC. (2008).

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

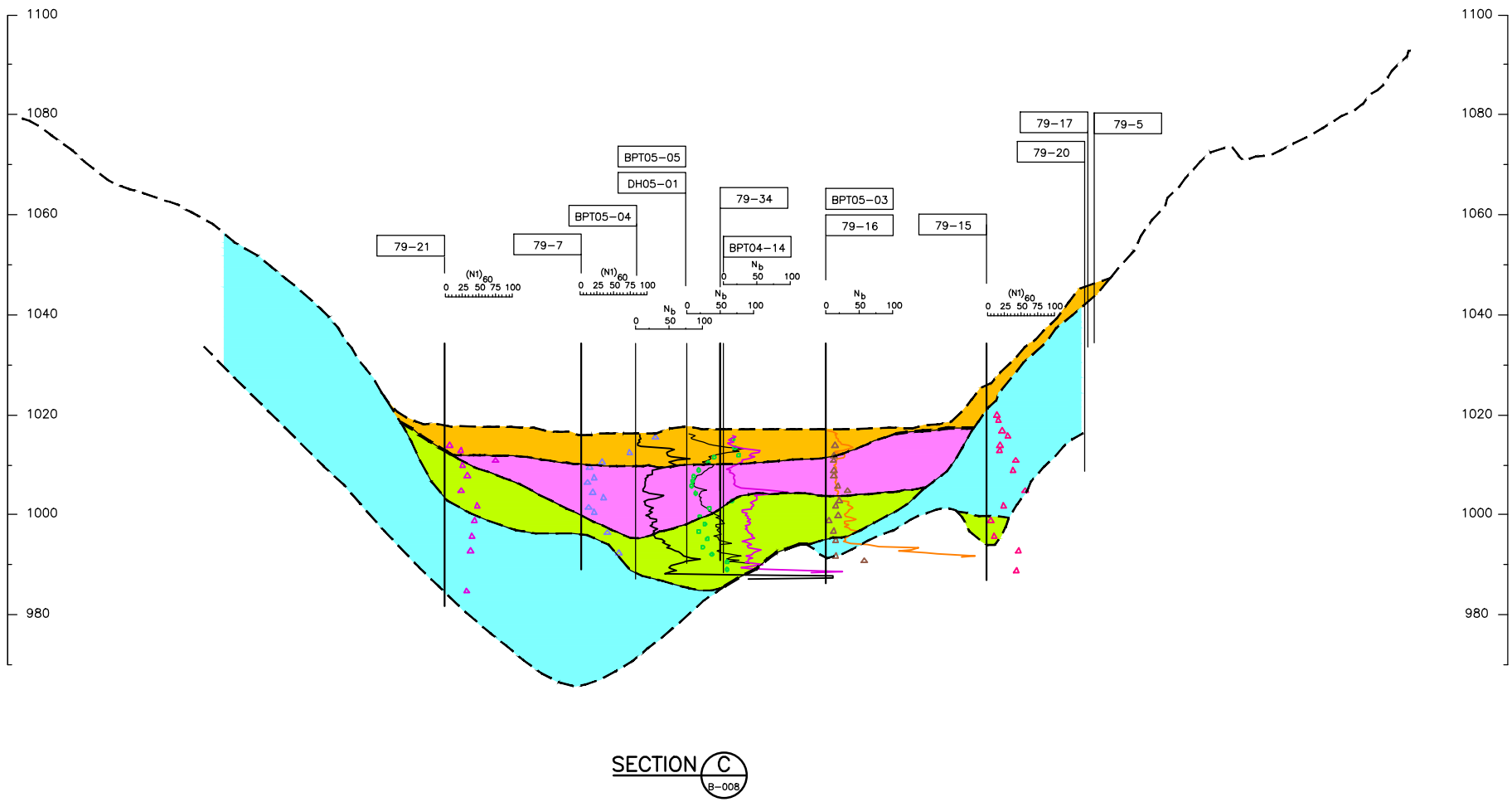
TITLE: CROSS VALLEY DAM
2003 SURVEY PROFILES

PROJECT No.: M09770A06

FIG. No.: A–024

KCB–R–MLA

Time: 16:47:25 Date: 1/27/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 - GOY-Faro 2016-17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A-025_CrossValley_Dam_FOUNDATION_STRATIGRAPHY.dwg (jbokic)
Xref File(s):
Image File(s): Yukon Government



SECTION C
B-008

LEGEND

- ROSE CREEK ALLUVIUM – DENSE
- ROSE CREEK ALLUVIUM – LOOSE
- PLEISTOCENE SANDS AND GRAVELS – DENSE
- PLEISTOCENE GLACIAL TILL

NOTES

1. SECTION IS TAKEN FROM KLOHN LEONOFF (1981) DRAWING AND UPDATED WITH KC BECKER AND DRILL HOLE INFORMATION.
2. FOUNDATION CONDITIONS ARE KNOWN ONLY AT THE TEST HOLE LOCATIONS. THE SOIL STRATIGRAPHY SHOWN BETWEEN THE TEST HOLES IS AN INTERPRETATION ONLY.
3. THE ACCURACY OF THE 79/80 TEST HOLE LOCATIONS IS NOT KNOWN.
4. N – MEASURED BECKER BLOW COUNTS AND $(N_1)_{60}$ – CORRECTED SPT/LPT BLOW COUNTS.

HORIZONTAL SCALE 0 100 m

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

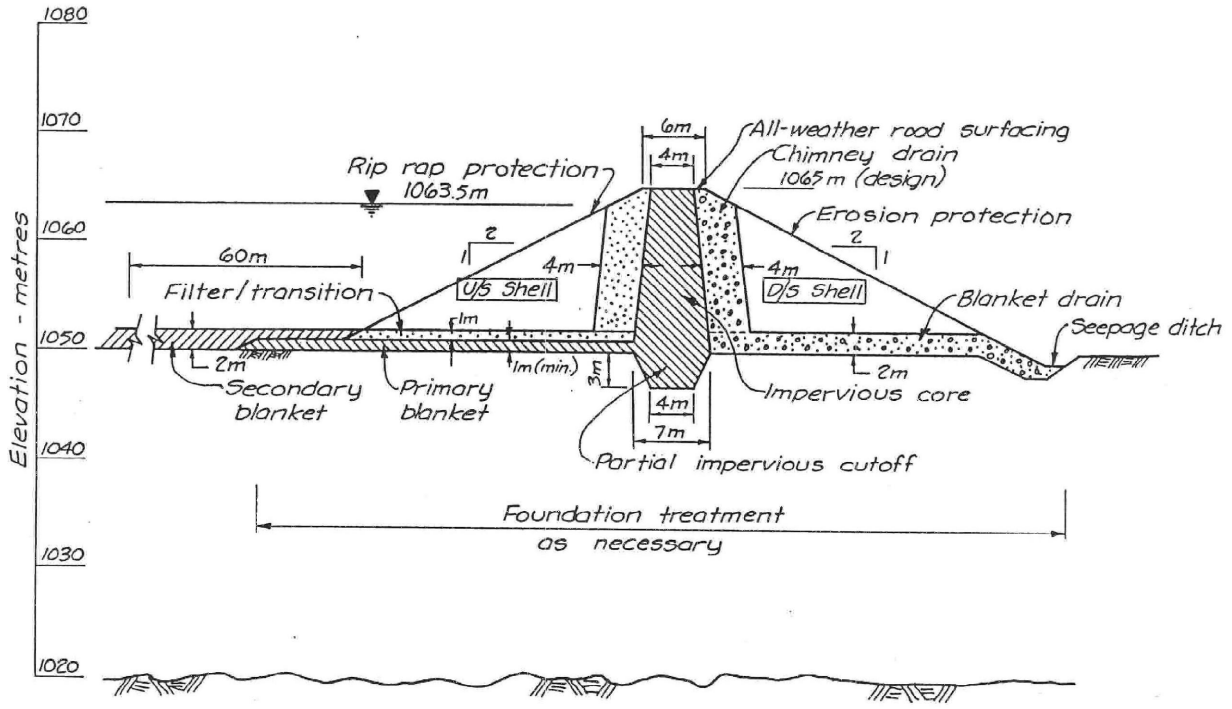
TITLE: CROSS VALLEY DAM
FOUNDATION STRATIGRAPHY

PROJECT No. M09770A06

FIG. No. A-025

KCB-R-MLA

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Drawing File: Z:\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–027_CrossValley_Dam_Typical_Section.dwg (jbokic)
Xref File(s):
Image File(s): Fig. A–020 – Cross Valley Dam – Typical Dam Section Figure 3.1 Yukon Government



NOTES:
FIGURE SHOWING THE TYPICAL DESIGN SECTION OF THE CROSS VALLEY DAM TAKEN FROM GOLDER ASSOCIATES REPORT TO CYPRUS ANVIL MINING DATED JUNE 1990.

NOTE

1. ORIGINAL SOURCE BY BGC ENGINEERING INC. (2008).

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

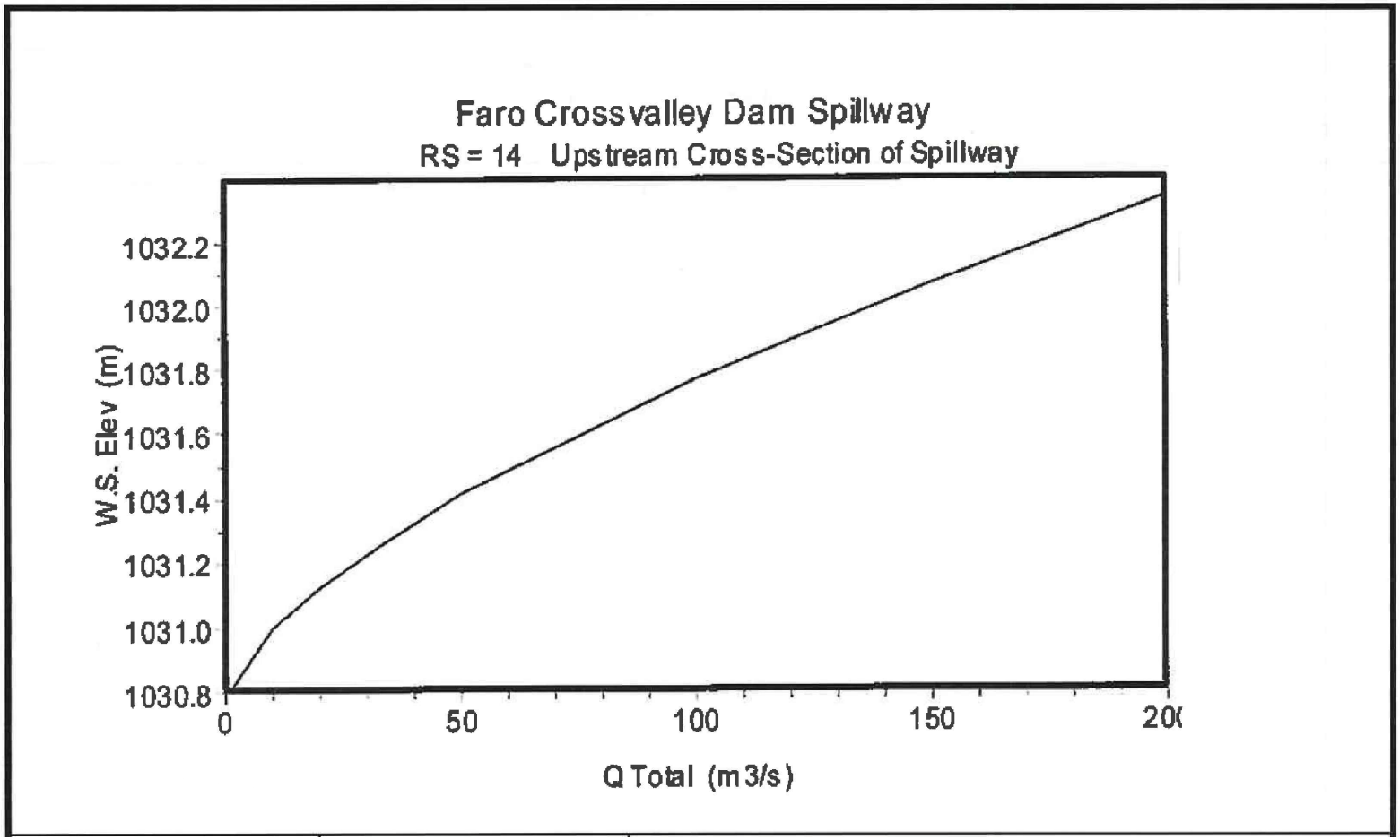
TITLE: CROSS VALLEY DAM
TYPICAL DAM SECTION

PROJECT No. M09770A06

FIG. No. A–027

KCB–R–MLA

Time: 16:45:05 Date: 1/24/2017 Scale: 1:1(PS)
Drawing File: Z:\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–029_CrossValleyDam_SpillwayRatingCurve.dwg (jbokic)
Xref File(s):
Image File(s): FIG_A–025_Cross Valley Dam Spillway Rating Curve Yukon Government



NOTES

1. ORIGINAL SOURCE BGC ENGINEERING INC. (2008).
2. DATUM: NAD27.

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

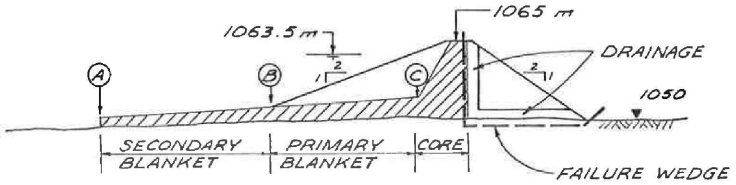
TITLE: CROSS VALLEY DAM
SPILLWAY RATING CURVE

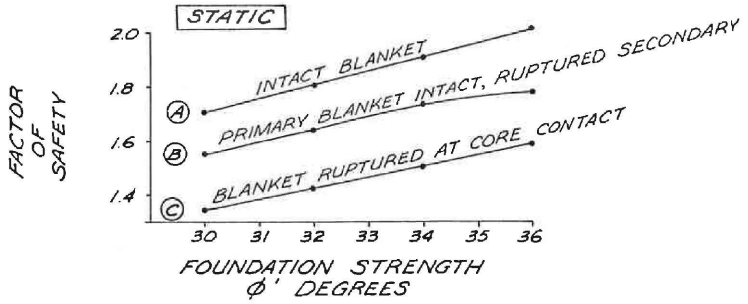
PROJECT No. M09770A06

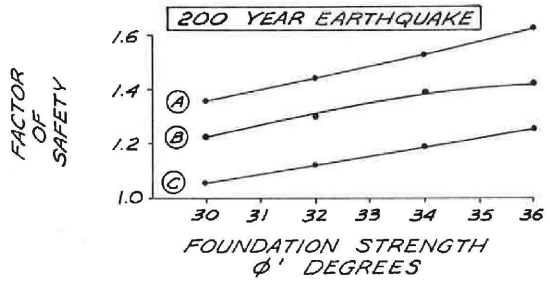
FIG. No. A–029

KCB–R–MLA

STABILITY ANALYSES - DOWNSTREAM SLOPE Figure VI- 5







Notes:
(1) Janbu analyses used to assess stability.
(2) Earthquake loading simulated by simple pseudodynamic method.
(3) Core strength chosen as C' = 0 Ø = 35°
(4) Core considered to be leaking.
(5) Impervious blanket considered effective downstream of points A, B, or C, eg. B assumes secondary blanket ruptured.

Project No. 792-2025 Drawn BAD Reviewed _____ Date May '80

Golder Associates

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NOTE

1. ORIGINAL SOURCE BY GOLDER ASSOCIATES (1980).

CLIENT
Yukon Government

Klohn Crippen Berger

PROJECT
FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE
CROSS VALLEY DAM
STABILITY ANALYSIS
(DOWNSTREAM SLOPE)

PROJECT No. M09770A06

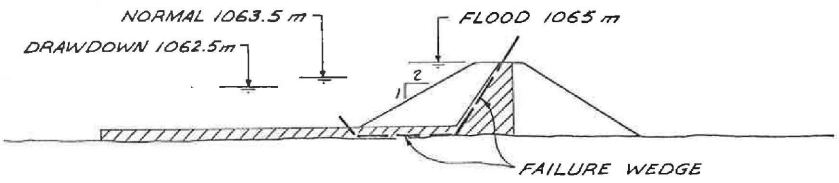
FIG. No. A-030

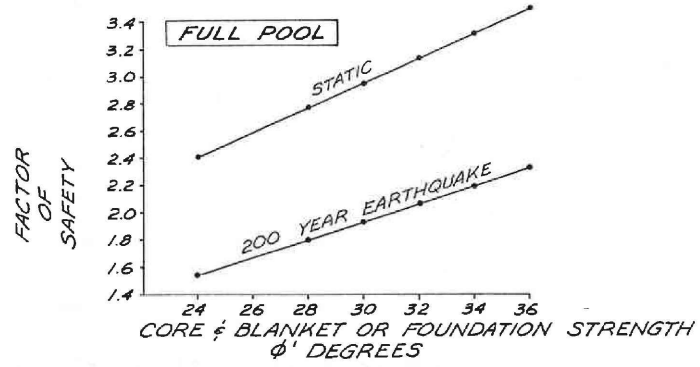
KCB-R-MPA

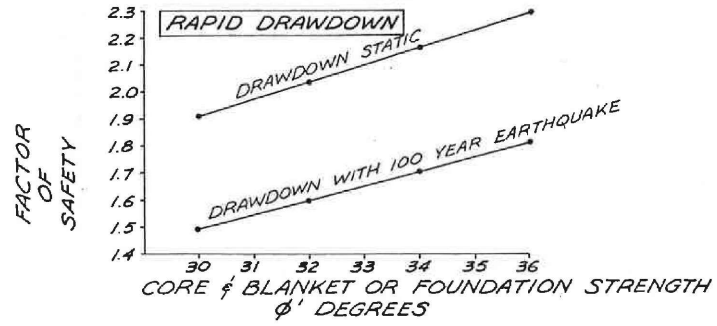
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Drawing File: Z:\M\VCR\M09770A06 - GOY-Faro 2016-17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A-030_CrossValley_Dam_StabilityAnalysis_downstream.dwg (jbokic)
Xref File(s):
Image File(s): FIG_A-021 Cross Valley Dam Downstream Slope Stability Yukon Government

STABILITY ANALYSES - UPSTREAM SLOPE

Figure VI-4







Notes:
(1) Janbu analyses used to assess stability.
(2) Earthquake loading simulated by simple pseudostatic method.
(3) Maximum drawdown of 2.5 m assuming no pore pressure dissipation from core or blanket.

Project No. 792-2035 Drawn BAD Reviewed ____ Date May 80

Golder Associates

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NOTE

1. ORIGINAL SOURCE BY GOLDER ASSOCIATES (1980).

CLIENT: Yukon Government

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE: CROSS VALLEY DAM
STABILITY ANALYSIS
(UPSTREAM SLOPE)

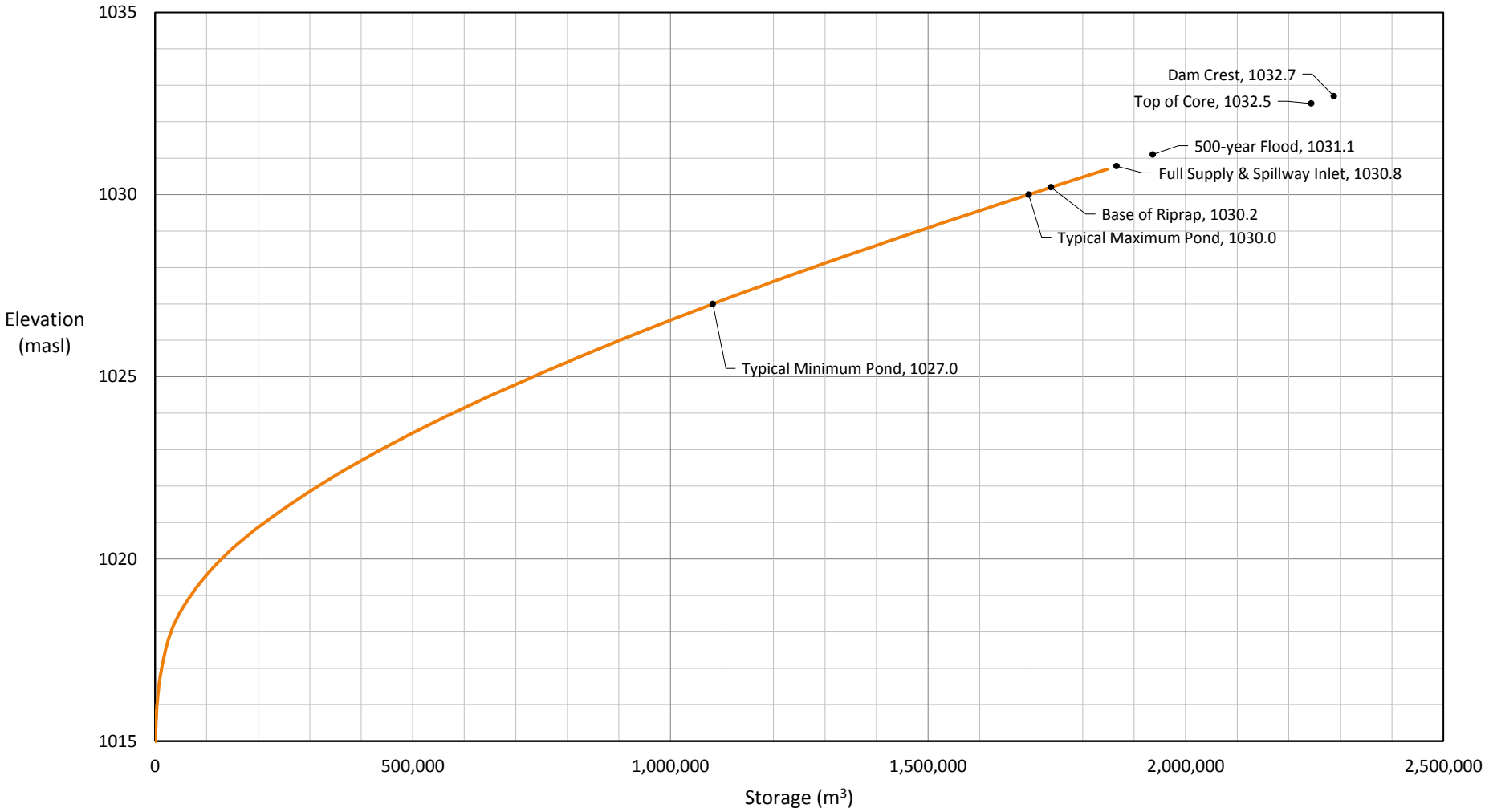
Klohn Crippen Berger

PROJECT No. M09770A06

FIG. No. A-031

KCB-R-MPA

Time: 16:57:18
Date: 1/24/2017
Scale: 1:2.5849(PS)
Drawing File: Z:\M\VCR\M09770A06 - GOY-Faro 2016-17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A-031_CrossValley_Dam_StabilityAnalysis_upstream.dwg (jbokic)
Xref File(s):
Image File(s): FIG_A-022 Cross Valley Dam Upstream Slope Stability Yukon Government



NOTES:
1. ELEVATION-STORAGE CURVE DATA PROVIDED BY YG
2. ELEVATION-STORAGE CURVE FROM COMBINED 2015 AURORA BATHYMETRY AND FARO LIDAR SURFACE
3. VALUES BEYOND END OF CURVE ARE EXTRAPOLATED AND UNDERESTIMATE VOLUME

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CLIENT

Klohn Crippen Berger

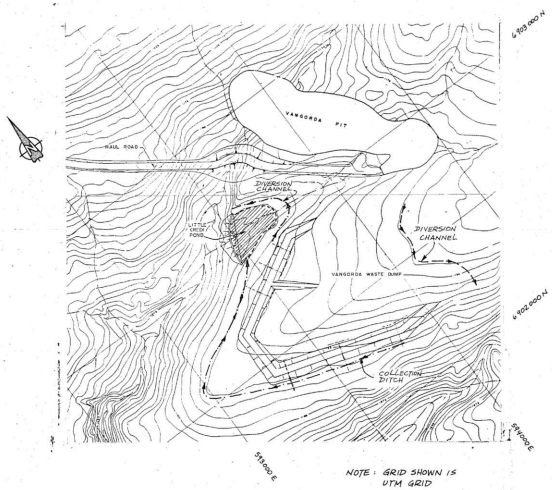
PROJECT
FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE
CROSS VALLEY DAM
ELEVATION-STORAGE CURVE

PROJECT No. M09770A06

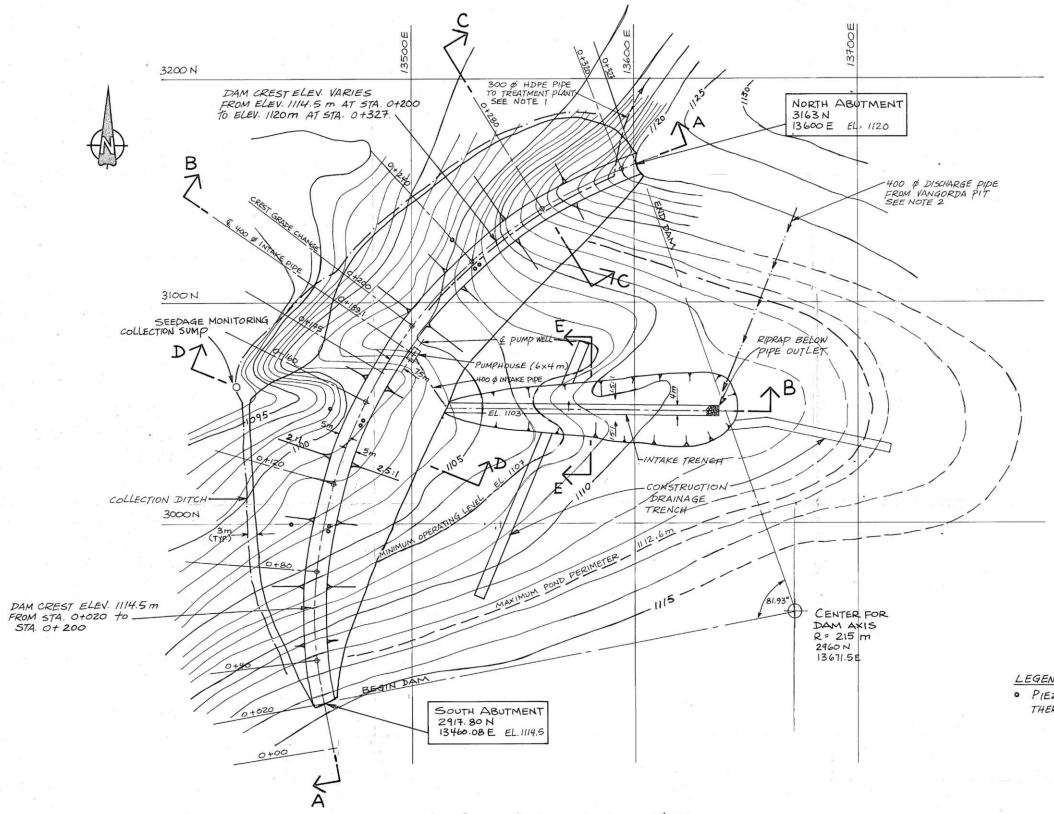
FIG No. A-032

Time: 15:57:36 Date: 1/26/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–033_LittleCreekDam_GA.dwg (jbokic)
Xref File(s):
Image File(s): Fig. A–027 Little Creek Dam – General Arrangement Plan Yukon Government



NOTE : GRID SHOWN IS UTM GRID

LOCATION PLAN
SCALE – 1:10 000



GENERAL ARRANGEMENT PLAN
SCALE – 1:1000
CONTOUR INTERVAL = 1 metre
GRID SHOWN IS MINE GRID
0 10 20 30 40 50 metres

LEGEND
○ PIEZOMETERS AND THERMISTORS.

NOTES:

1. Intake trench not surveyed.
2. Collection sump and collection ditch not yet constructed as of Jan./91.
3. Piezometers and thermistors to be installed.
4. Refer to drawing 60627-04 for cross-sections through dam.
5. Survey data by Lamerton Assoc.
6. Pipeline dimensions are in mm.
7. Diversion channel location to be determined in field.

NOTES

1. ORIGINAL SOURCE BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS (1990).
2. MINE GRID.

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

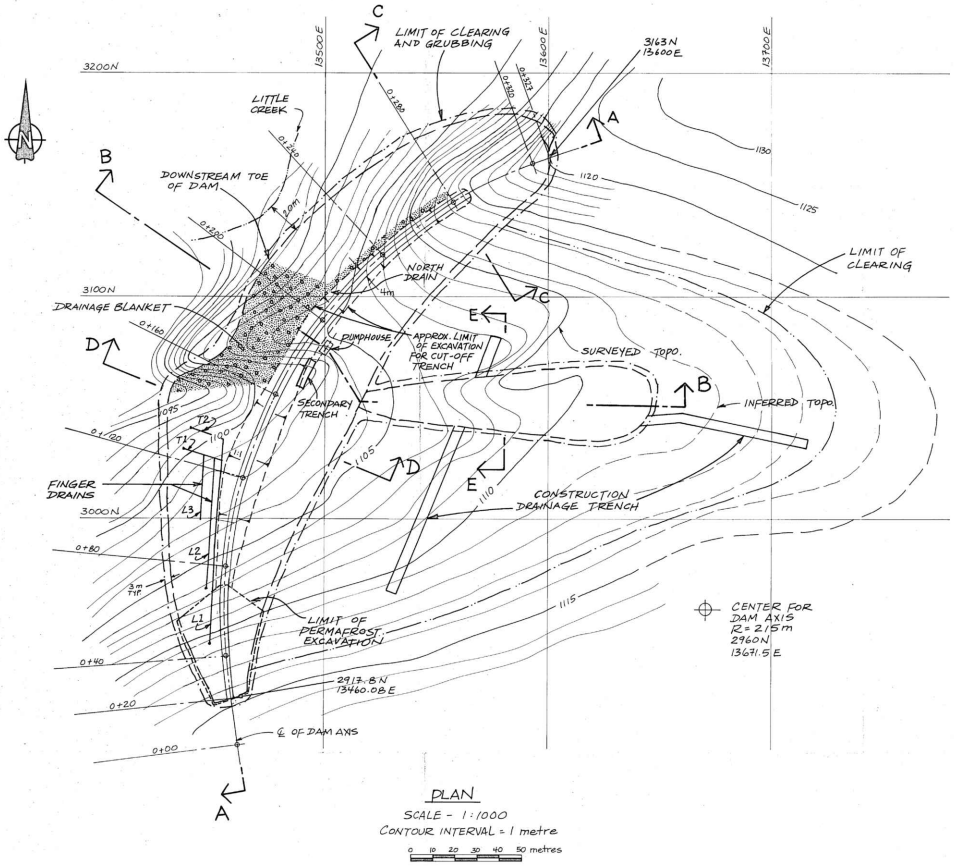
TITLE: LITTLE CREEK DAM
GENERAL ARRANGEMENT PLAN

PROJECT No. M09770A06

FIG. No. A–033

KCB–R–MLA

Time: 16:01:49 Date: 1/26/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–034_LittleCreekDam_Layouts_CutoffTrench.dwg (jbokic)
Xref File(s):
Image File(s): Fig. A–033 Little Creek Dam – Layouts for Cutoff Trench and Drainage Blanket Yukon Government



PLAN
SCALE – 1:1000
CONTOUR INTERVAL = 1 metre
0 10 20 30 40 50 metres

AS-BUILT COORDINATES OF DAM

℄ AS-BUILT STATION	NORTHING	EASTING
0+080	2977.48	13458.14
0+120	3016.19	13466.47
0+160	3052.89	13481.05
0+200	3085.38	13500.95
0+240	3114.07	13528.14
0+280	3135.26	13561.46
0+320	3152.23	13597.99

SURVEYED TRENCH FLOOR LOCATIONS

STA.	ELEV.	NORTHING	EASTING
0+070	1103.5	2967.7	13457.1
0+080	1100.9	2976.5	13457.2
0+100	1098.8	2995.6	13459.8
0+120	1097.6	3018.6	13457.2

NOTE

1. ORIGINAL SOURCE BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS (1990).

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

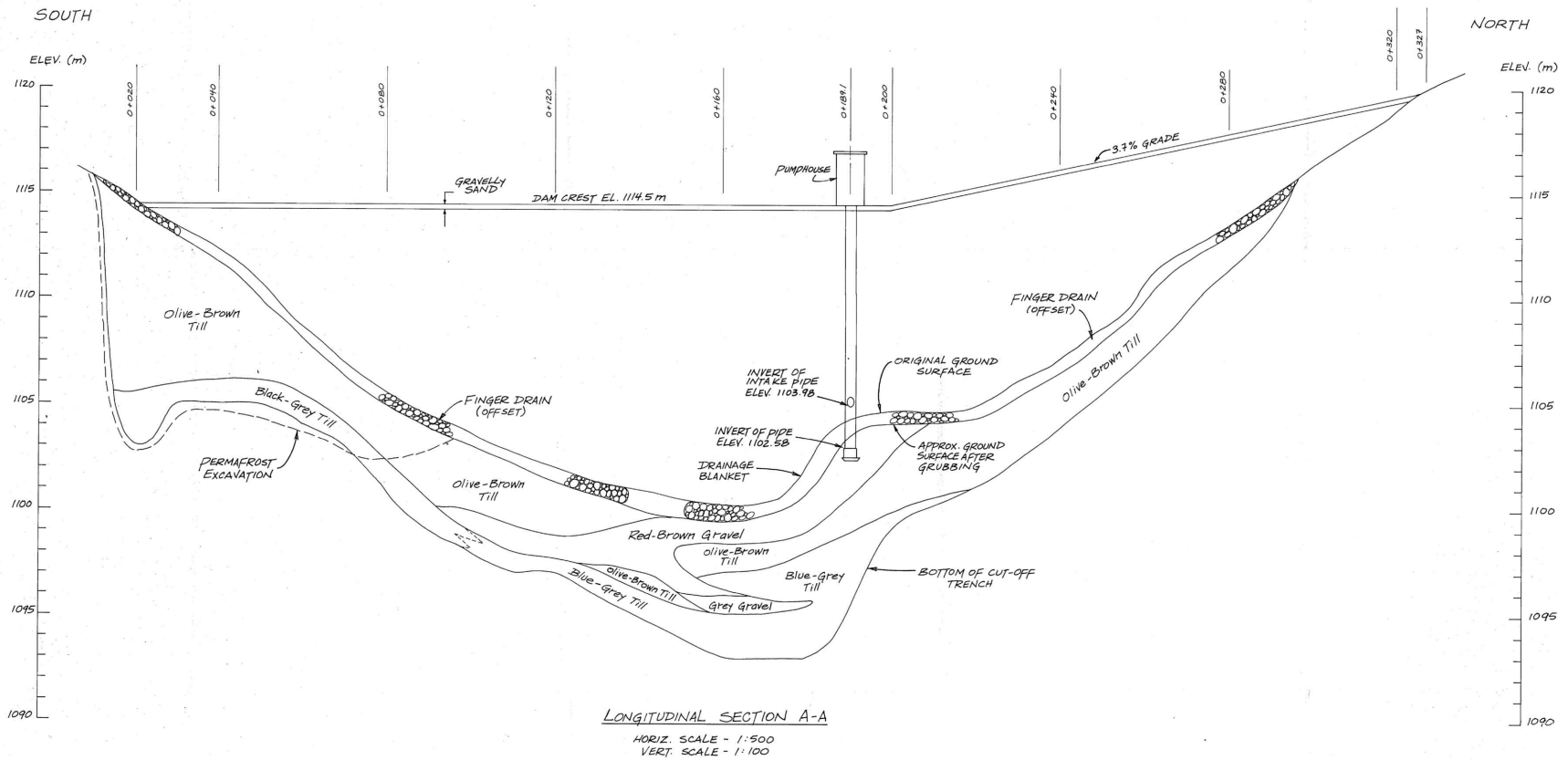
TITLE: LITTLE CREEK DAM
LAYOUT FOR CUT–OFF TRENCH
EXCAVATION AND DRAINAGE BLANKET

PROJECT No. M09770A06

FIG. No. A–034

KCB–R–MLA

Time: 16:04:21 Date: 1/26/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–035_Foundation_Stratigraphy.dwg (jbokic)
Xref File(s):
Image File(s): Fig. B–031 Little Creek Dam – Foundation Stratigraphy Yukon Government



LONGITUDINAL SECTION A-A

HORIZ. SCALE - 1:500
VERT. SCALE - 1:100

NOTES:

1. Stratigraphic profile is based on inspection of cut-off wall.
2. Drainage Blanket is offset 7-9 m downstream of section line.
3. Thickness of gravelly sand cover determined by CESL.
4. Wet well centerline is located 7.5 m upstream of dam centerline.

NOTE

1. ORIGINAL FIGURE PROVIDED BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS (1991).

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

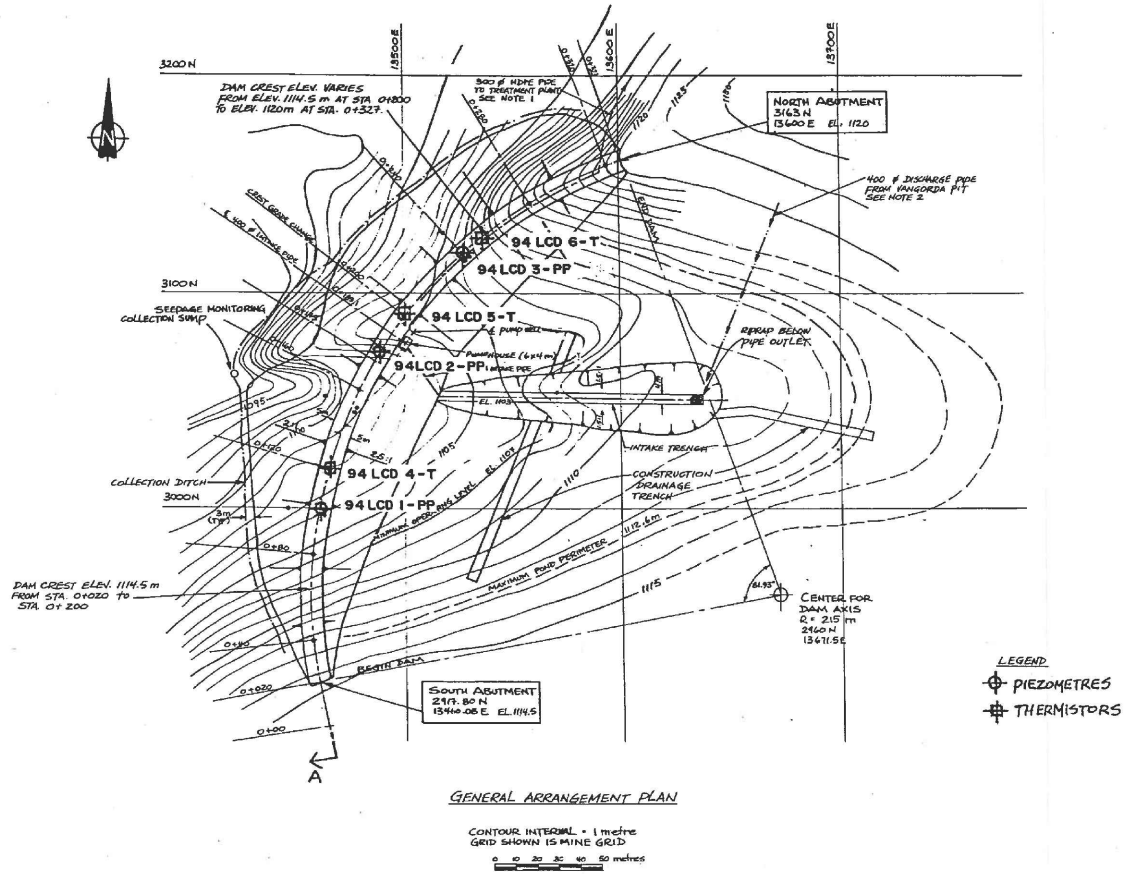
TITLE: LITTLE CREEK DAM
FOUNDATION STRATIGRAPHY

PROJECT No. M09770A06

FIG. No. A–035

KCB–R–MLA

Time: 16:07:20 Date: 1/26/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–036_LittleCreekDam_InstrumentationLocation.dwg (jbokic)
Xref File(s):
Image File(s): Fig. A–038 LITTLE CREEK POND VAN MINE 28 Yukon Government



GENERAL ARRANGEMENT PLAN

CONTOUR INTERVAL = 1 metre
GRID SHOWN IS MINE GRID
0 10 20 30 40 50 metres

NOTES

1. ORIGINAL SOURCE BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS (1998).
2. COORDINATE SYSTEM: MINE GRID.

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

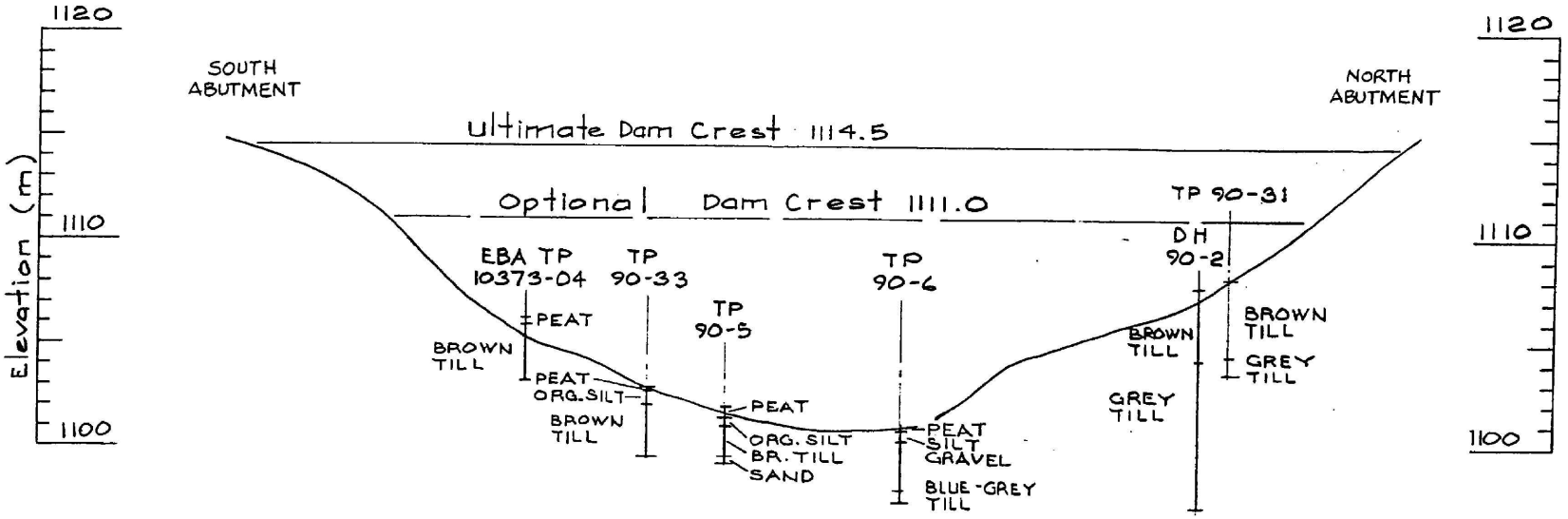
TITLE: LITTLE CREEK DAM
INSTRUMENTATION LOCATION PLAN

PROJECT No. M09770A06

FIG. No. A–036

KCB–R–MLA

Time: 16:10:16 Date: 1/26/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–037_LongitudinalSection_DHs&TPs.dwg (jbokic)
Xref File(s):
Image File(s): Fig. A–029 – Little Creek Dam – Longitudinal Section with Drill Holes and Test Pits Yukon Government



Scale Hor. 1:1000
Vert. 1:200
5X VERTICAL EXAGGERATION

NOTE

1. ORIGINAL FIGURE PROVIDED BY BGC ENGINEERING.

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

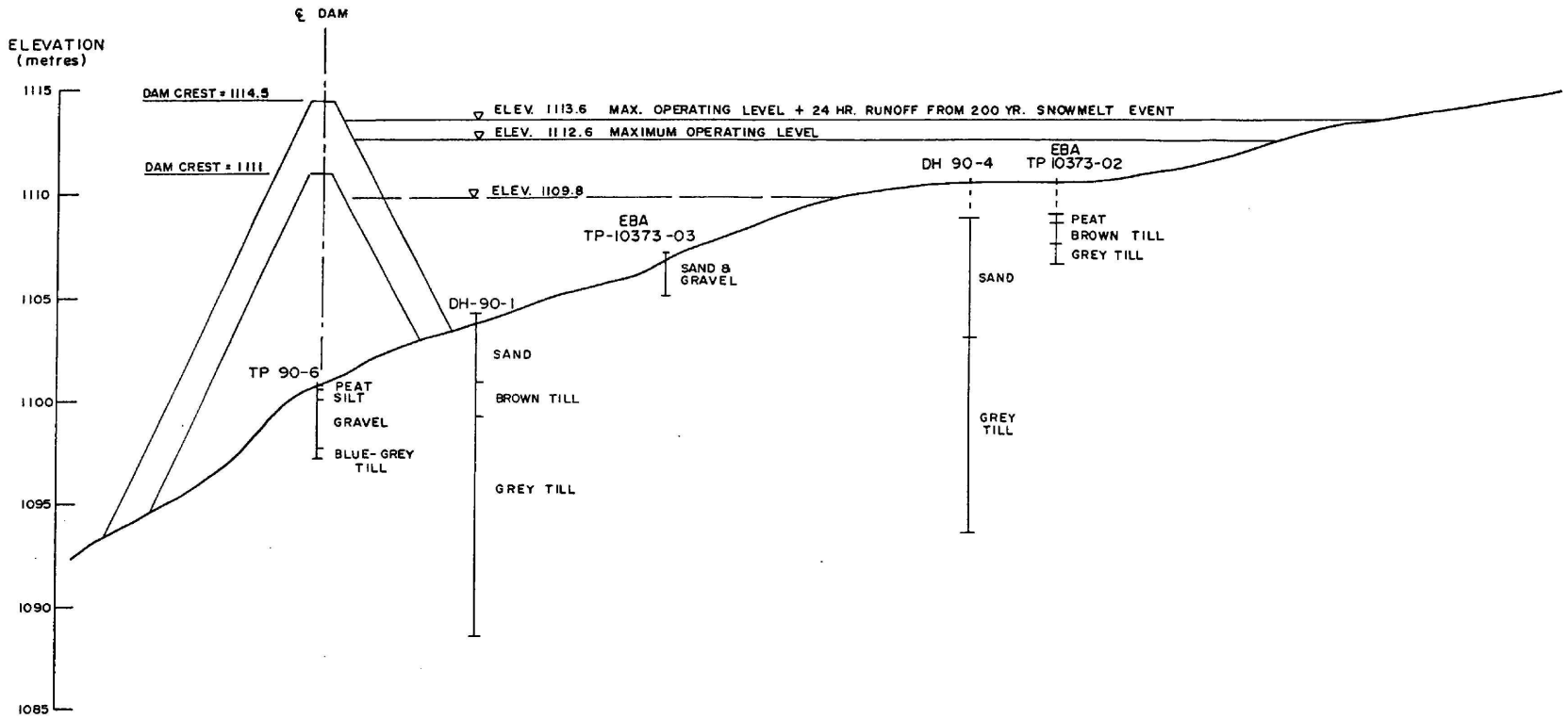
TITLE: LITTLE CREEK DAM
LONGITUDINAL SECTION WITH
DRILL HOLES AND TEST PITS

PROJECT No. M09770A06

FIG. No. A–037

KCB–R–MLA

Time: 16:12:58 Date: 1/26/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–038_LittleCreekDam_TransverseSection.dwg (jbokic)
Xref File(s):
Image File(s): Fig. A–030 Little Creek Dam – Transverse Section with Drill Holes and Test Pits Yukon Government



NOTES

1. ORIGINAL SOURCE BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS (1990).
2. 5X VERTICAL EXAGERATION.

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA,STATEMENTS,CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.

CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

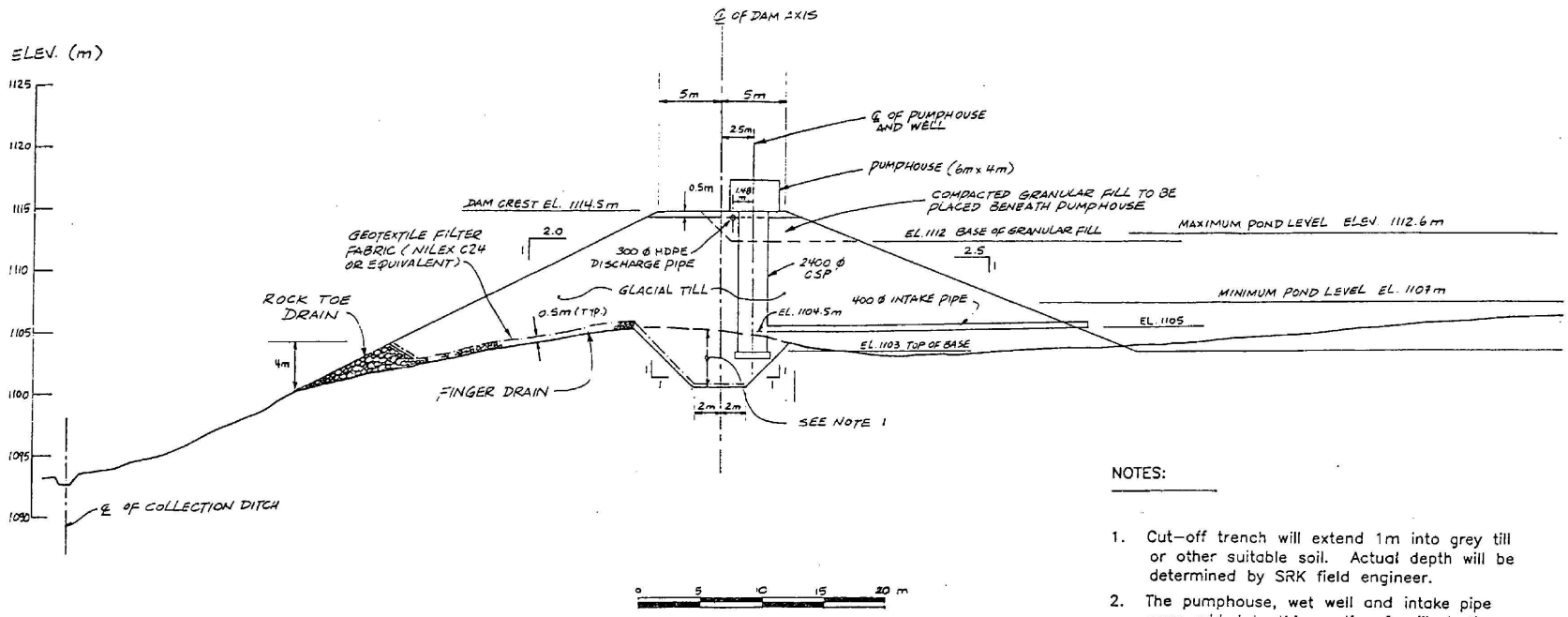
TITLE: LITTLE CREEK DAM
TRANSVERSE SECTION WITH
DRILL HOLES AND TEST PITS

PROJECT No. M09770A06

FIG. No. A–038

KCB–R–MLA

Time: 16:15:27 Date: 1/26/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–039_LittleCreekDam_TypicalDamSection.dwg (jbokic)
Xref File(s):
Image File(s): Fig. A–028 – Little Creek Dam – Typical Dam Section Yukon Government



NOTES:

1. Cut–off trench will extend 1m into grey till or other suitable soil. Actual depth will be determined by SRK field engineer.
2. The pumphouse, wet well and intake pipe were added to this section for illustrative purposes.

NOTE

1. ORIGINAL SOURCE BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS (1990).

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

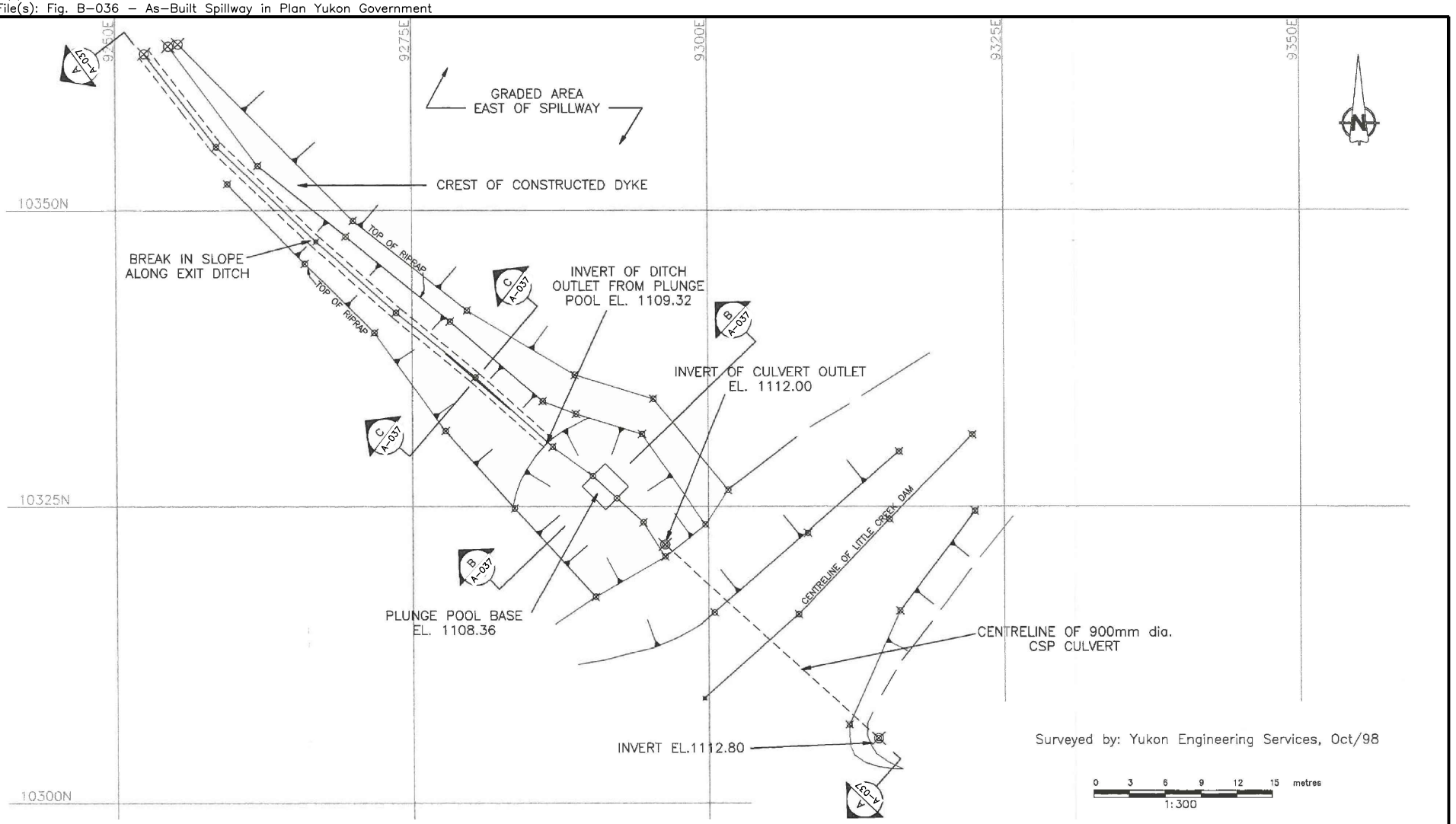
TITLE: LITTLE CREEK DAM
TYPICAL DAM SECTION

PROJECT No. M09770A06

FIG. No. A–039

KCB–R–MLA

Time: 16:25:06 Date: 1/26/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 – GOY–Faro 2016–17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A–042_Spillway_in_Plan.dwg (jbokic)
Xref File(s):
Image File(s): Fig. B–036 – As–Built Spillway in Plan Yukon Government



NOTES

1. ORIGINAL SOURCE BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS (1998).
2. SECTION VIEWS SHOWN ON FIGURE B–037 AND B–038.

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CLIENT: Yukon Government

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PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

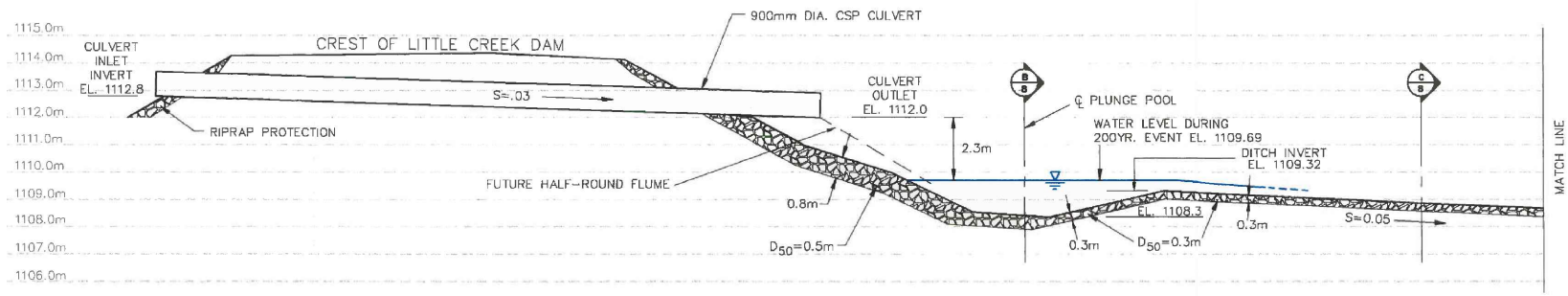
TITLE: LITTLE CREEK DAM
AS–BUILT SPILLWAY IN PLAN

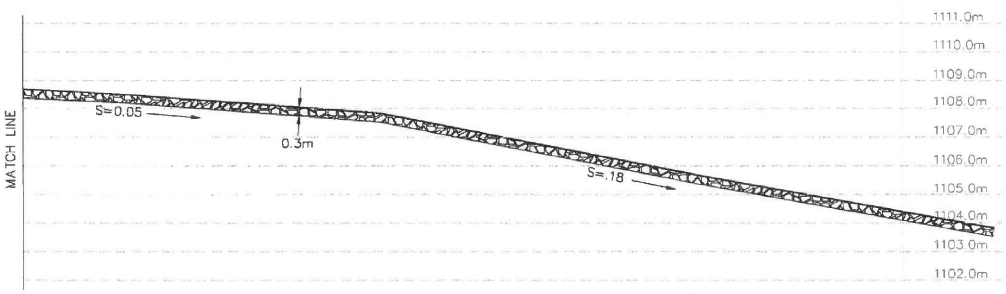
PROJECT No. M09770A06

FIG. No. A–042

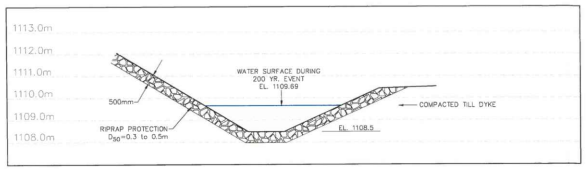
KCB–R–MLA

Time: 16:27:50 Date: 1/26/2017 Scale: 1:1(PS)
Drawing File: \\int.klohn.com\ProjData\M\VCR\M09770A06 - GOY-Faro 2016-17 Geotech\400 Drawings\CAD\OMS Manual\FIG_A-043_LittleCreekDam_AsBuiltSpillway_in_Sections.dwg (jbokic)
Xref File(s):
Image File(s): Fig. A-037a Little Creek Dam - As-Built Spillway in Sections_Section A-A Along Spillway Centreline Fig. A-037b Overflow System Sections Yukon Government



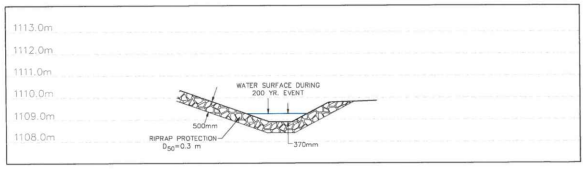


SECTION A-A
SCALE A



SECTION B-B - PLUNGE POOL

SECTION B-B
SCALE B



SECTION C-C - EXIT DITCH

SECTION C-C
SCALE B

SCALE A 0 1.5 3.0 4.5 6.0 7.5 metres

SCALE B

NOTES

1. ORIGINAL SOURCE BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS (1998).
2. DATUM: NAD27.
3. PLAN VIEW SHOWN ON FIGURE A-036.

LEGEND

——— As-Built Survey by Y.E.S. Oct 28/98 (top of rip rap)

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CLIENT: Yukon Government

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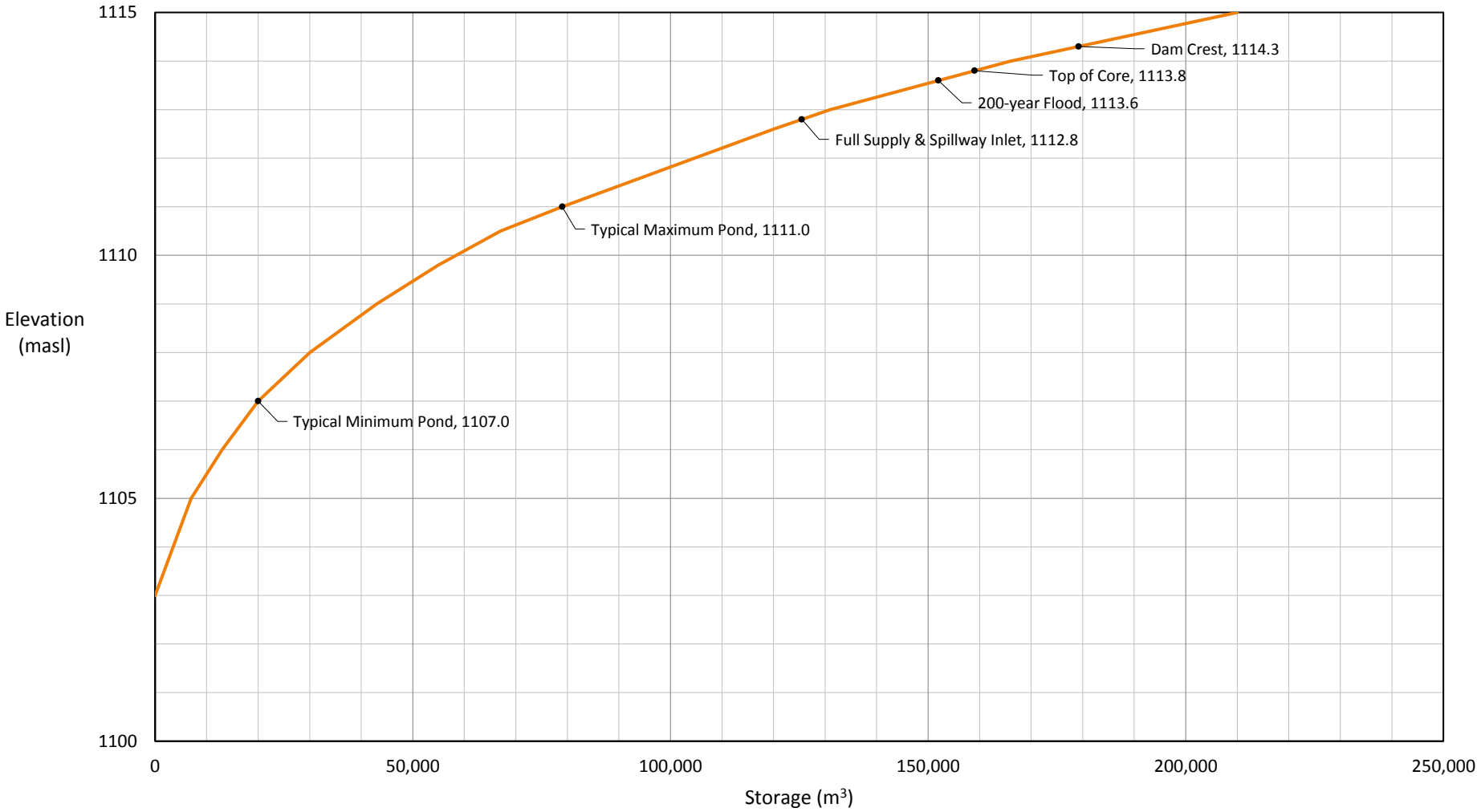
PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE: LITTLE CREEK DAM
SPILLWAY CHANNEL SECTIONS

PROJECT No. M09770A06

FIG. No. A-043

KCB-R-MLA



NOTES:
1. ADAPTED FROM ELEVATION-STORAGE CURVE PRESENTED IN SRK (1991).

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CLIENT

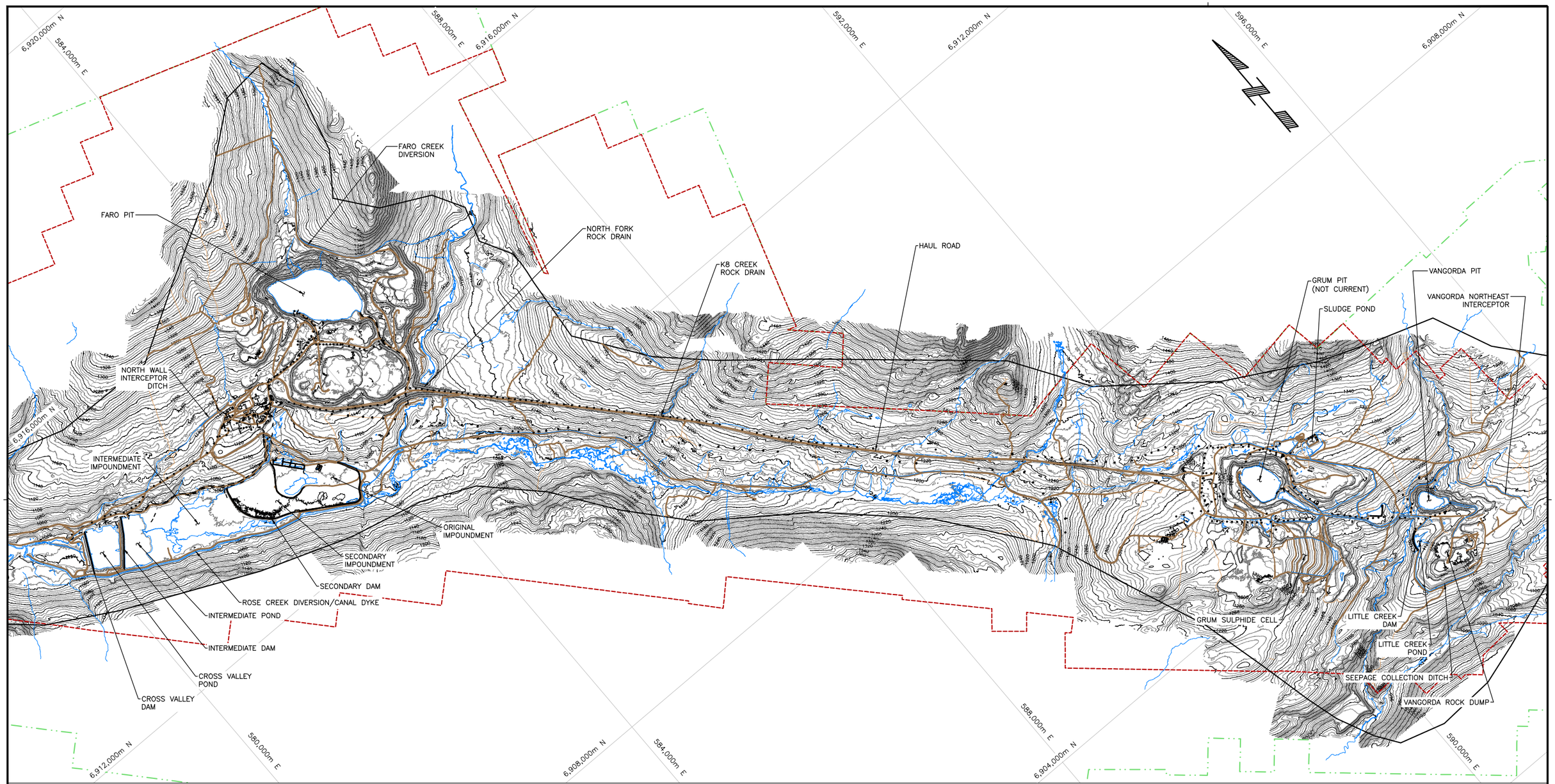
Klohn Crippen Berger

PROJECT
FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE
LITTLE CREEK DAM
ELEVATION-STORAGE CURVE

PROJECT No. M09770A06

FIG No. A-044



LEGEND

- PROTECTED AREA WITHDRAWN FROM STAKING MINERAL CLAIMS OIC #2007/168
- IMPACTED AREA BOUNDARY
- ACCESS ROADS
- STREAMS
- POWER POLE

SCALE 0 2000m

AS A MUTUAL PROTECTION TO OUR CLIENT, THE PUBLIC AND OURSELVES, ALL REPORTS AND DRAWINGS ARE SUBMITTED FOR THE CONFIDENTIAL INFORMATION OF OUR CLIENT FOR A SPECIFIC PROJECT AND AUTHORIZATION FOR USE AND/OR PUBLICATION OF DATA,STATEMENTS,CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS IS RESERVED PENDING OUR WRITTEN APPROVAL.

CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

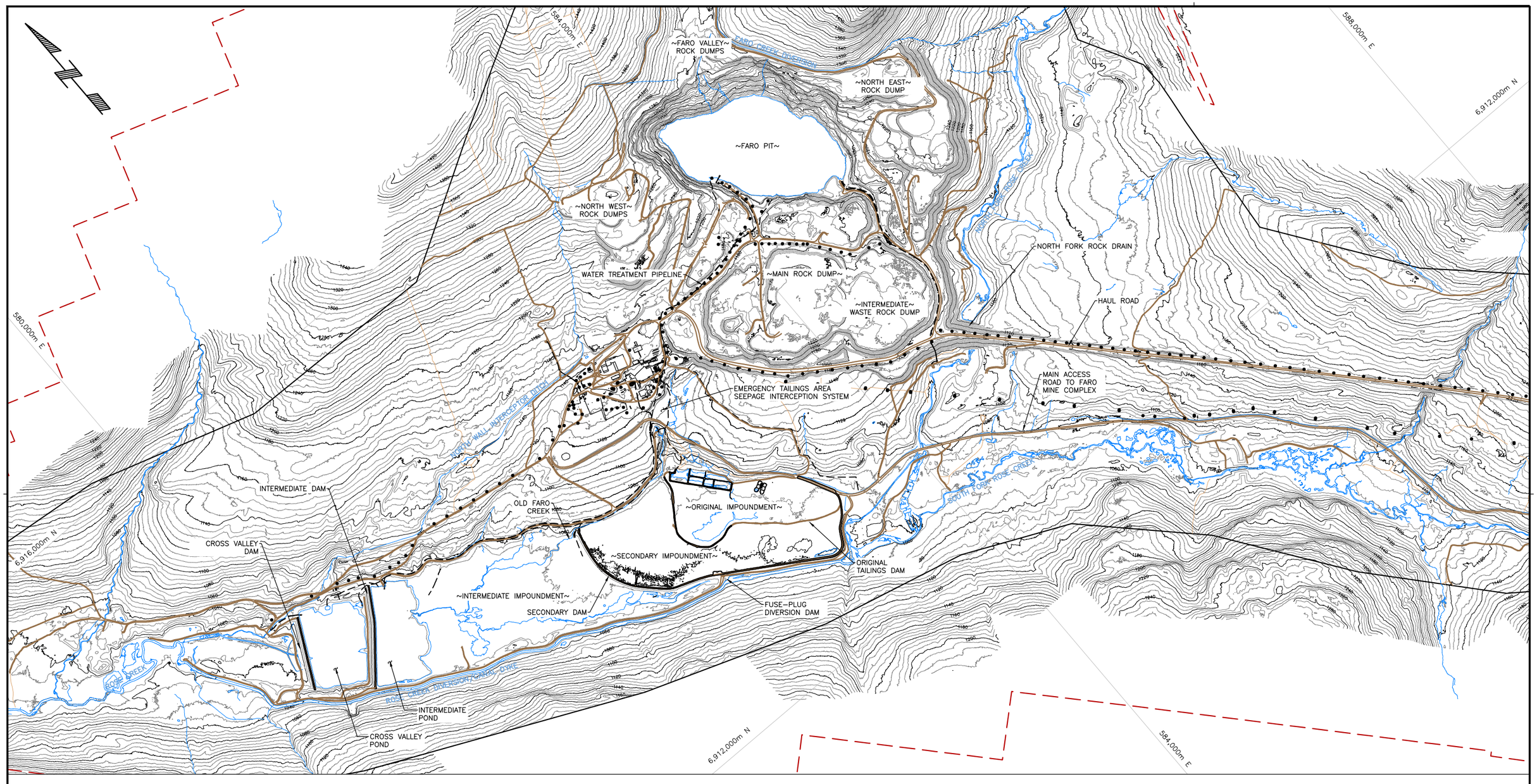
TITLE: MINE SITE TOPOGRAPHY AND ACCESS ROADS

PROJECT No. M09770A06

FIG. No. B-002

KCB-R-MLD

Date:1/29/2013 Time:13:25:10 Scale:1:2,585
Filename:Z:\M\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-002_SITE_TOPOGRAPHY.DWG
Xref File(s): bm-faro-130221; for insert-by others-faro site plan-130221
Image File(s): Yukon Government



LEGEND

- IMPACTED AREA BOUNDARY
- ACCESS ROADS
- STREAMS
- POWER POLE

SCALE 0 1000m

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

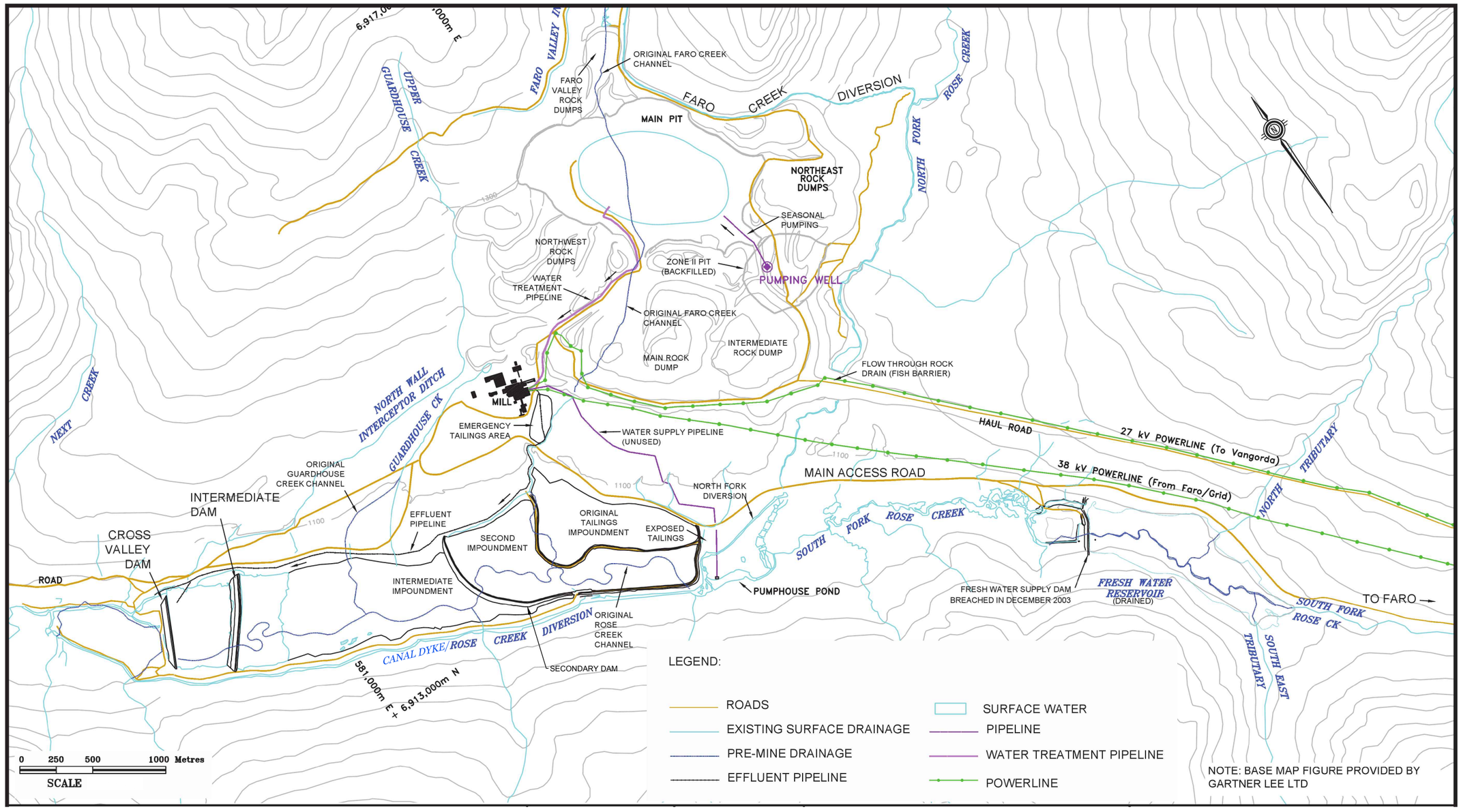
TITLE: FARO SITE GENERAL LAYOUT

PROJECT No. M09770A06

FIG. No. B-003

KCB-R-MLD

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Filename:Z:\MJVCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-003&B-005.DWG
Xref File(s): bm-faro-130221; for insert-by others-faro site plan-130221
Image File(s): Yukon Government



NOTE

1. ORIGINAL FIGURE PROVIDED BY BGC ENGINEERING.

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX OMS MANUAL FOR DAMS

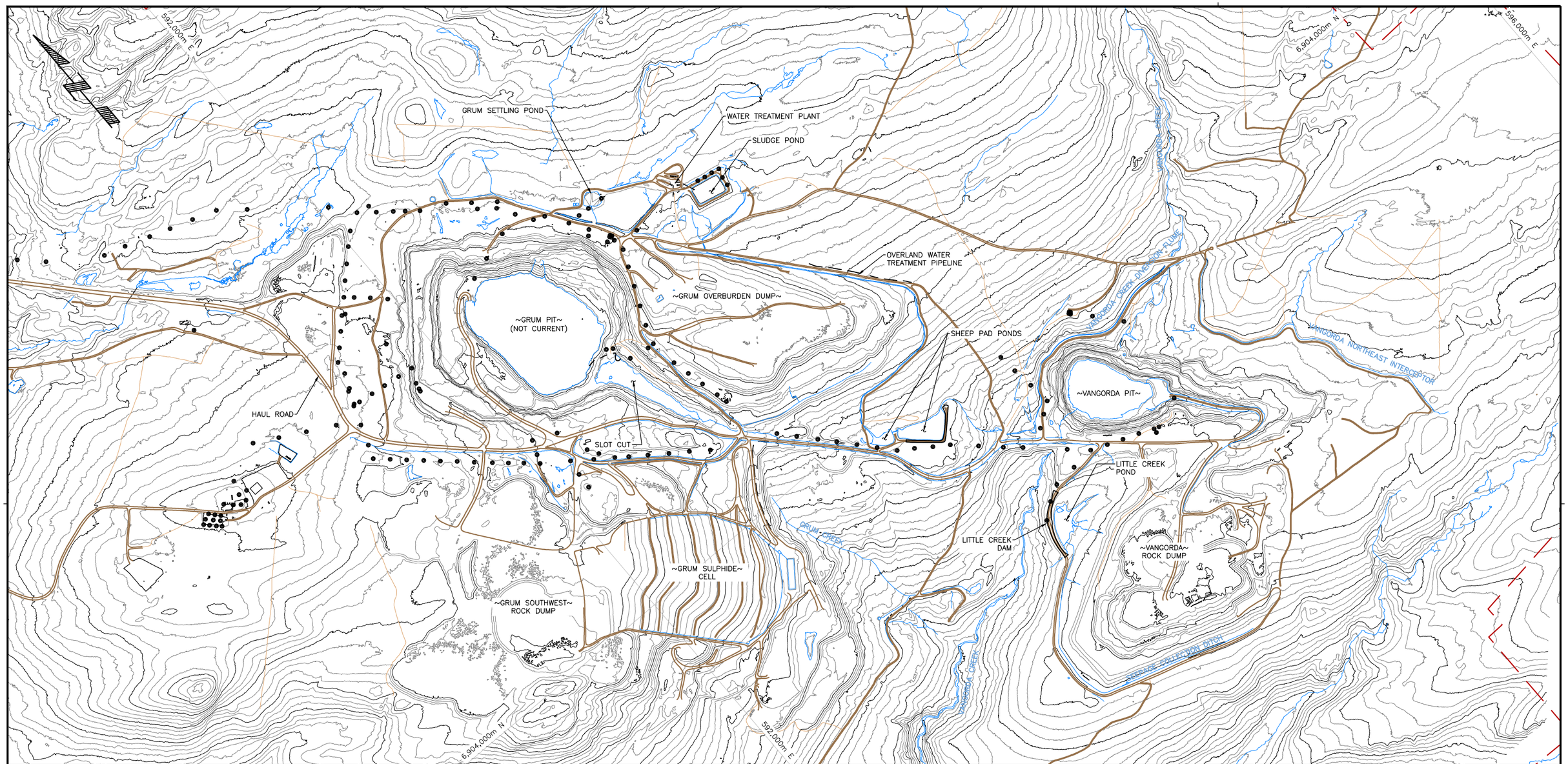
TITLE: FARO SITE DETAIL LAYOUT

PROJECT No. M09770A06

FIG. No. B-004

KCB-R-MLD

Date:1/29/2013 Time:13:25:10 Scale:1:2,585
Filename:Z:\MV\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-004_DETAIL_LAYOUT.DWG
Xref File(s):
Image File(s): Fig B-004a - Faro Site Detail Layout 0257-053-01 Yukon Government



LEGEND

- IMPACTED AREA BOUNDARY
- ACCESS ROADS
- STREAMS
- POWER POLE

SCALE 0 750m

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE: VANGORDA PLATEAU SITE
GENERAL LAYOUT

PROJECT No. M09770A06

FIG. No. B-005

KCB-R-MLD

Date:1/29/2013 Time:13:25:10 Scale:1:2,585
Filename:Z:\MV\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-003&B-005.DWG
Xref File(s): bm-faro-130221; for insert-by others-faro site plan-130221
Image File(s): Yukon Government

GRUM SETTLING POND
WATER TREATMENT PLANT
SLUDGE POND
WATER TREATMENT PLANT 500 mm DIA. DISCHARGE PIPE
TO DY
rip rap corner
rip rap corner
geotex
rip rap corner
old section rip rap @ 100m intervals
GRUM INTERCEPTOR DITCH
BLASTER'S SHACK
NEW DITCH ROAD
250 mm DIA. BURIED PIPELINE FROM LITTLE CREEK TO WATER TREATMENT PLANT
2400 mm DIA. FLUME SECTION
VANGORDA CREEK DIVERSION (FLUME)
OVERBURDEN DUMP
GRUM PIT
RIPRAP APRON
HALFROUND CMP CULVERT
SPILLWAY
EXIT CHUTE
PLUNGE POOL
VANGORDA PIT
PELLY POND
ORE TRANSFER PAD
WASTE ROCK PILES
AREA WHERE MATERIAL WAS REMOVED IN 1998
WASTE ROCK PILE
TILL STOCKPILE
OLD SHOP
U/G PORTAL
LUBE STATION
FUEL TANKS
MAINTENANCE STORAGE AREA
CORE SHACKS
SHEEP PAD SEDIMENT PONDS
LITTLE CREEK DAM
LITTLE CREEK POND
STARTER DIKE DIVERSION DITCH (REMOVED SEPT. 2001)
VANGORDA WASTE DUMP
BARITIC ORE STOCKPILE
TILL BERMS
APPROVED WATER LICENCE BOUNDARY OF VANGORDA WASTE DUMP
EMERGENCY SPILLWAY
GW-94-04
P94-04 A
P94-04 B
DRAIN No.6
DRAIN No.5
P94-03 A
P94-03 B
DRAIN No.4
REGRADED SLOPE (1994)
TILL COVER (1994)
DRAIN No.1
GW-94-05
GW-94-03
SUMP C
SUMP B
P94-02 A
P94-02 B
P94-02 C
P94-01 B
P94-01 A
DRAIN No.3
DRAIN No.2
GW-94-01
GW-94-02
SEEPAGE COLLECTION DITCH
VANGORDA CREEK
6,905,000 N
6,904,000 N
6,903,000 N
6,902,000 N
593,000 E
594,000 E
595,000 E
9400N
9600N
9800N
10000N
10200N
11000N
11200N
10800N
10600N
10400N
10000E
9800E
9600E
9400E
9200E
9000E
SCALE 0 250m

NOTES

1. ORIGINAL SOURCE BY DELOITTE & TOUCHE.
2. TOPOGRAPHIC MAP PROVIDED BY ANVIL RANGE MINING CORPORATION.

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX OMS MANUAL FOR DAMS

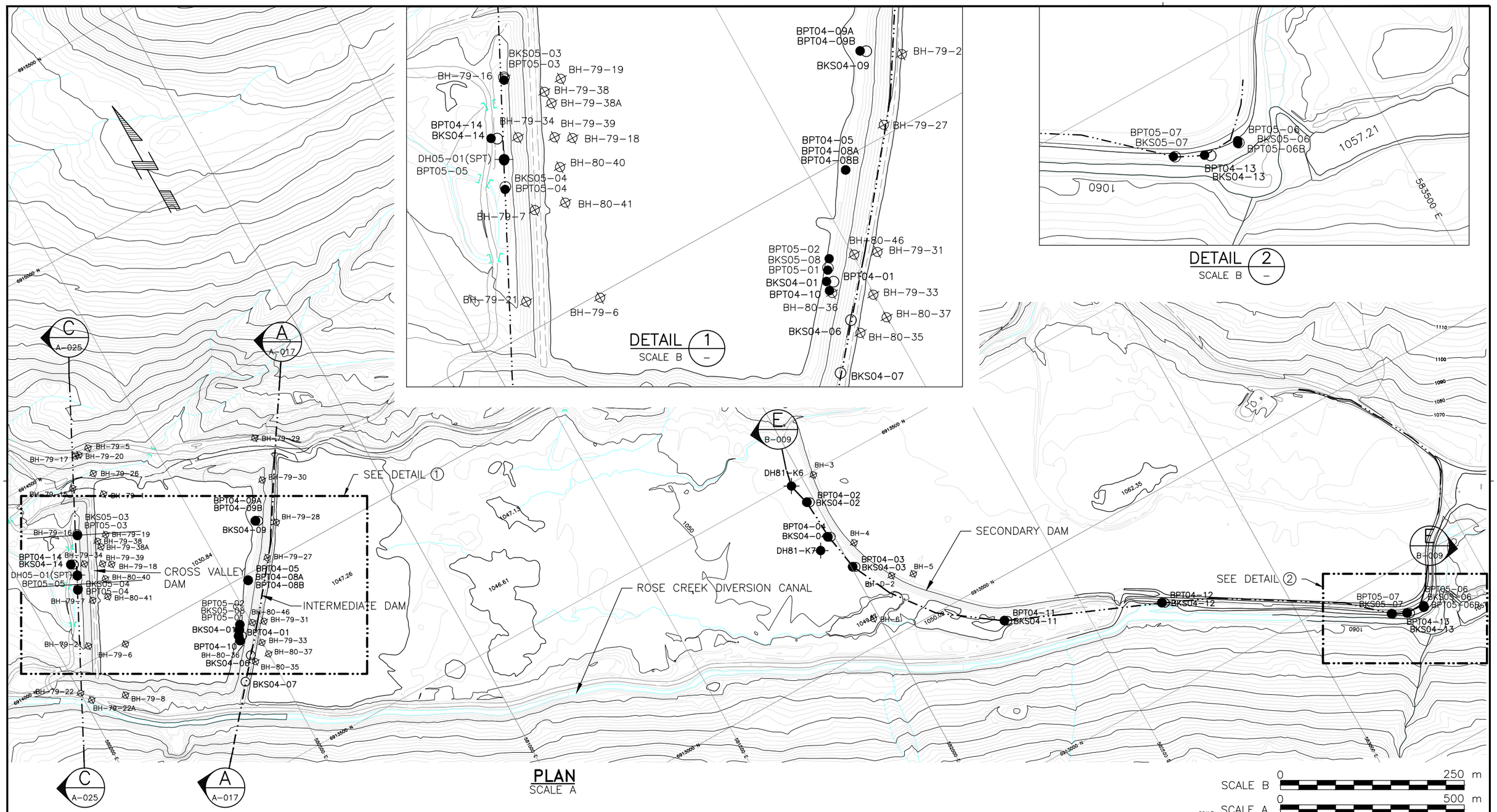
TITLE: VANGORDA PLATEAU SITE DETAIL LAYOUT

PROJECT No. M09770A06

FIG. No. B-006

KCB-R-MLD

Date:2/22/2013 Time:09:48:19 Scale:1:2,585
Filename:Z:\WVCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-006_VANGORDA_PLATEAU_DETAIL.DWG
Xref File(s):
Image File(s): Yukon Government



PLAN
SCALE A

SCALE B 0 250 m

SCALE A 0 500 m

LEGEND

- BH-80-36 — GOLDER TEST HOLE
- BKS05-03 — KLOHN CRIPPEN OPEN BECKER TEST
- BPT05-04 — KLOHN CRIPPEN CLOSED BECKER TEST
- DH05-01 — KLOHN CRIPPEN TEST HOLE

NOTES:

1. BASE PLAN TAKEN FROM 2003 FARO SITE PLAN1_Ver2000.DWG PROVIDED BY SRK.
2. CONTOUR INTERVAL IS 2m RELATIVE TO MEAN SEA LEVEL.
3. BH3 TO BH6 AND BH-D-2 LOCATIONS ARE APPROXIMATE.

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

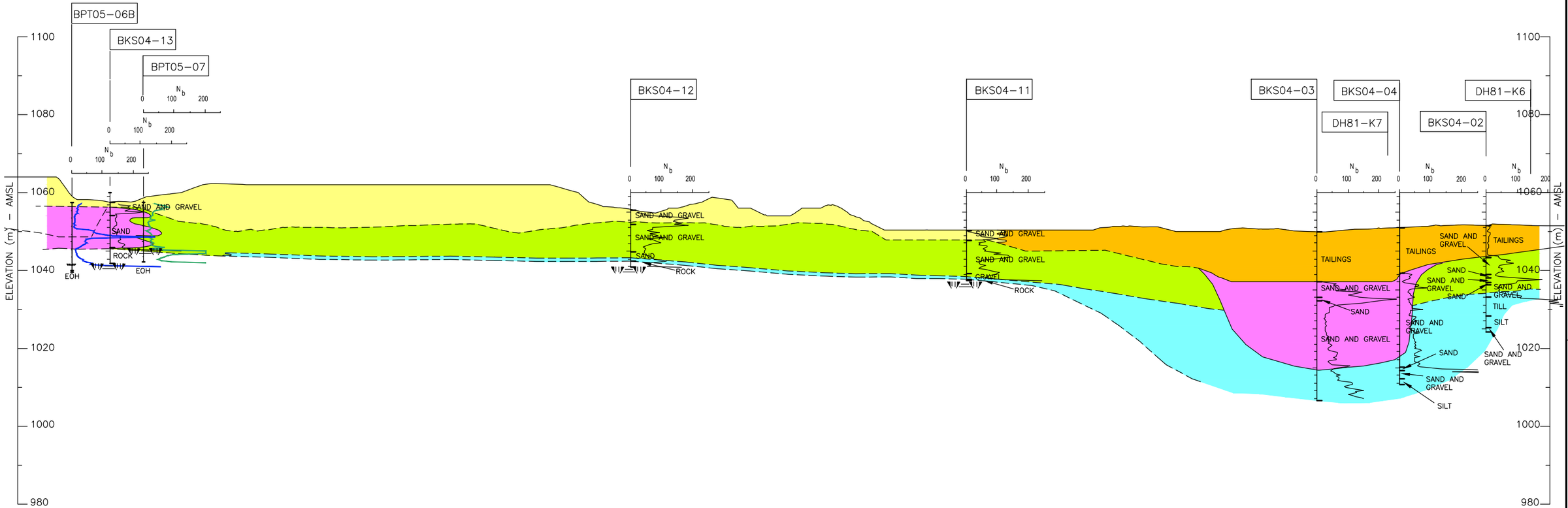
TITLE: DOWN VALLEY TAILINGS FACILITIES
LOCATION OF TEST HOLES

PROJECT No. M09770A06

FIG. No. B-008

KCB-R-MLD

Date:1/23/2017 Time:17:15:54 Scale:1:2,585
Filename:\\INT.KLOHN.COM\PROJDATA\MI\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-008_DOWNVALLEY_TAILINGS_FACILITY_TP_LOCATION_PLAN.DWG
Xref File(s): TESTHOLE; TESTHOLE75
Image File(s): Yukon Government



SECTION E
B-008

LEGEND

- FILL
- TAILINGS
- ROSE CREEK SEDIMENTS
- GLACIO-FLUVIAL SEDIMENTS-TERRACE
- PLEISTOCENE SEDIMENTS

VERTICAL SCALE 0 50 m

HORIZONTAL SCALE 0 200 m

SCALE

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

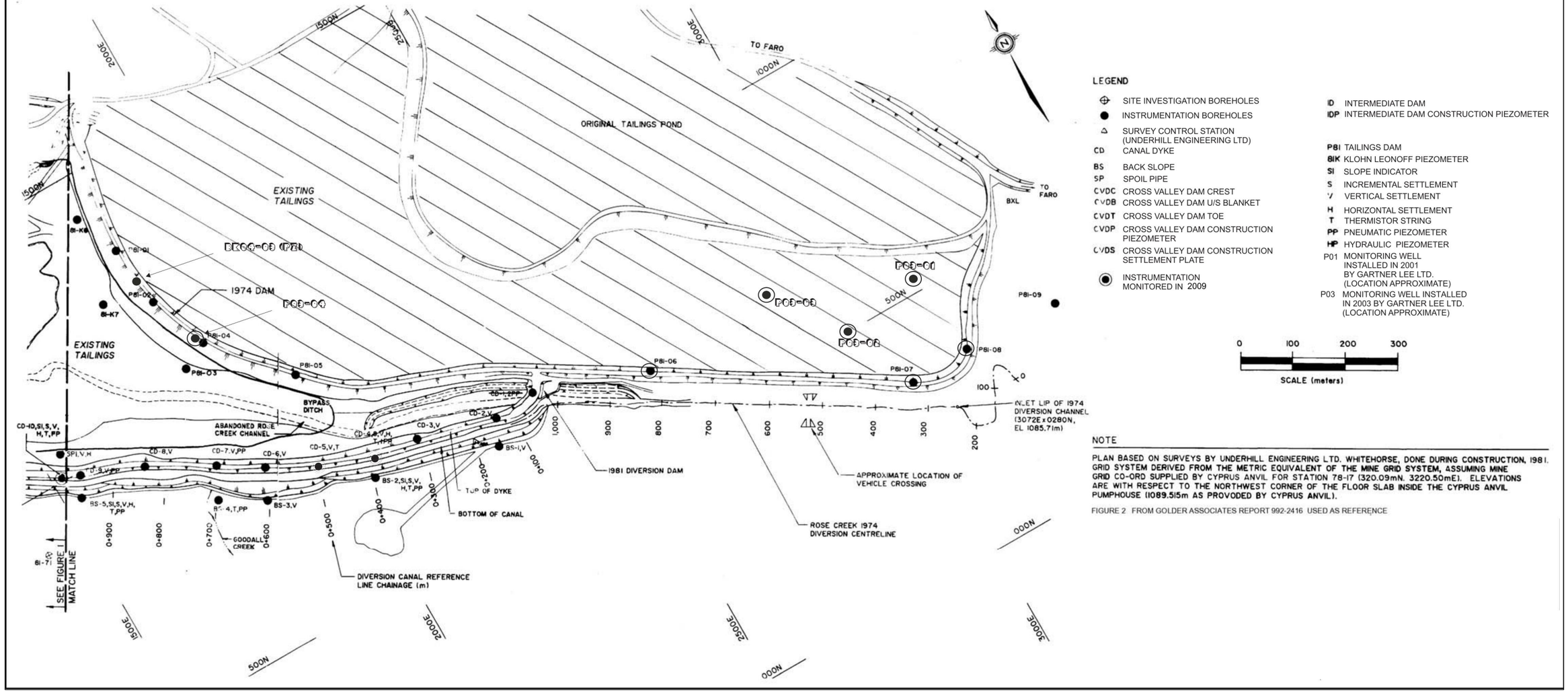
TITLE: SECONDARY DAM
FOUNDATION STRATIGRAPHY

PROJECT No. M09770A06

FIG. No. B-009

KCB-R-MLD

Date:1/24/2017 Time:13:08:53 Scale:1:2,585
Filename:\\INT.KLOHN.COM\PROJDATA\M\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-009_SECONDARY_DAM_FOUNDATION_STRATIGRAPHY.DWG
Xref File(s):
Image File(s): Yukon Government



NOTE

PLAN BASED ON SURVEYS BY UNDERHILL ENGINEERING LTD. WHITEHORSE, DONE DURING CONSTRUCTION, 1981. GRID SYSTEM DERIVED FROM THE METRIC EQUIVALENT OF THE MINE GRID SYSTEM, ASSUMING MINE GRID CO-ORD SUPPLIED BY CYPRUS ANVIL FOR STATION 78-17 (320.09mN, 3220.50mE). ELEVATIONS ARE WITH RESPECT TO THE NORTHWEST CORNER OF THE FLOOR SLAB INSIDE THE CYPRUS ANVIL PUMPHOUSE (1089.515m AS PROVODED BY CYPRUS ANVIL).

FIGURE 2 FROM GOLDER ASSOCIATES REPORT 992-2416 USED AS REFERENCE

NOTE

1. ORIGINAL FIGURE PROVIDED BY BGC ENGINEERING (2009).

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CLIENT: Yukon Government

Klohn Crippen Berger

SCALE

PROJECT: FARO MINE COMPLEX OMS MANUAL FOR DAMS

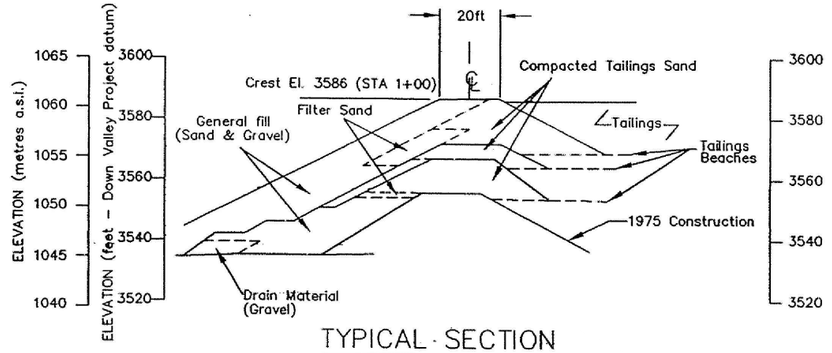
TITLE: SECONDARY DAM INSTRUMENTATION

PROJECT No. M09770A06

FIG. No. B-010

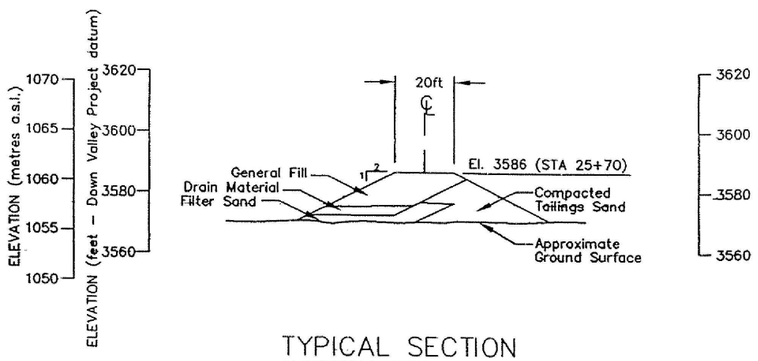
KCB-R-MLD

Date:1/24/2017 Time:13:08:53 Scale:1:2,585
Filename:Z:\M\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-010_SECONDARY_DAM_INSTRUMENTATION.DWG
Xref File(s):
Image File(s): Yukon Government



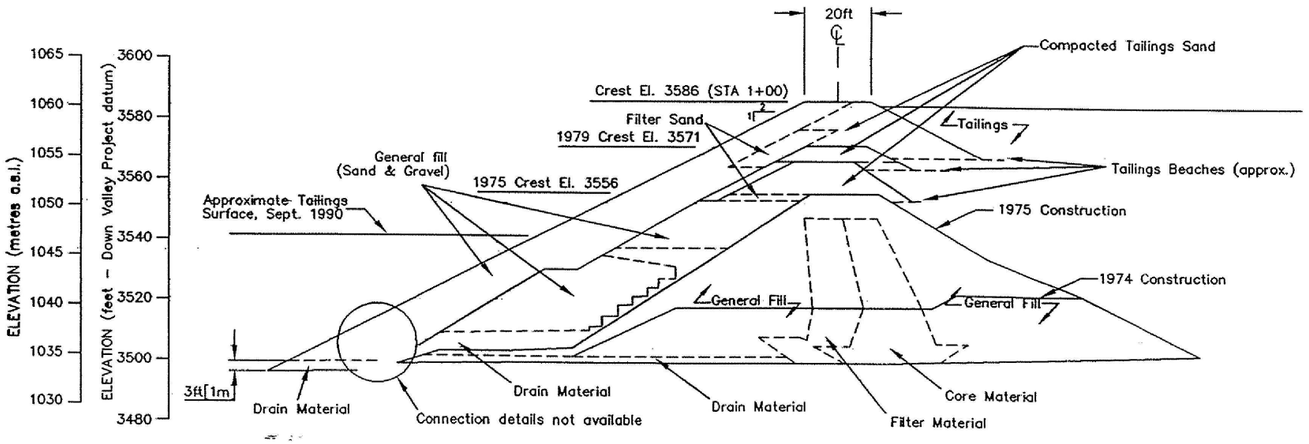
TYPICAL SECTION

(REPRESENTS STATIONS 0+00 TO 10+00, AND 19+00 TO 26+00)



TYPICAL SECTION

(REPRESENTS STATIONS 26+00 TO 27+86)



TYPICAL SECTION

(REPRESENTS STATIONS 10+00 TO 19+00)

REFERENCES

1. Golder, Brawner & Associates Dwg. V74011, "Construction Carried Out to End of 1975"' Sept. 1975.
2. Golder Associates, Report No. 782-2736, "1978 Dyke Raising for the Tailings Retention Facility, Faro, Yukon Territory", April 1979, Figure 2 "Tailings Dam, 1978 Construction".
3. Golder Associates, Report no. 802-2024, "Construction Report, Cyprus Anvil Mining Corporation, 1980 Raising of the Tailings Dam, Faro, Yukon Territory", Appendix II, (Tender Drawings).

NOTES

1. All elevations are in feet relative to the Down Valley Project datum. To convert to sea level datum (NAD 27), subtract 106ft (32.3m). To convert from feet to metres, multiply by 0.3048m/ft.

0 20 40 60 80 feet

Scale 1"= 50'

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE: SECONDARY DAM
WEST LIMB
TYPICAL DAM SECTIONS

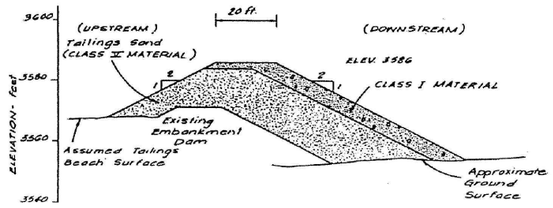
PROJECT No. M09770A06

FIG. No. B-011

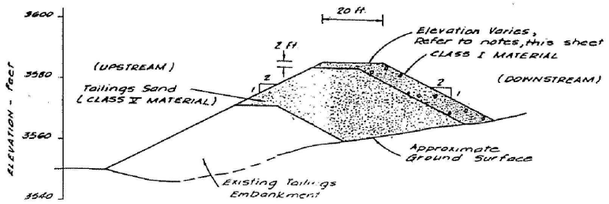
SCALE

KCB-R-MLD

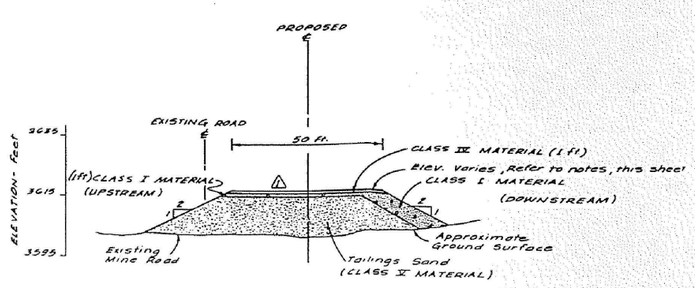
Date:1/24/2017 Time:13:08:53 Scale:1:2.585
Filename: \\NT.KLOHN.COM\PROJDATA\M\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-011_SECONDARY_DAM_WEST_LIMB_TYPICAL_DAM_SECTIONS.DWG
Xref File(s):
Image File(s): FIG-3-RFP Yukon Government



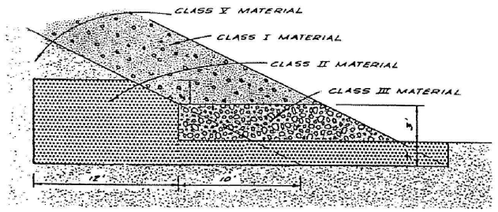
TRANSITION ZONE
TYPICAL SECTION
(REPRESENTS STATIONS 0+00 to 6+30)



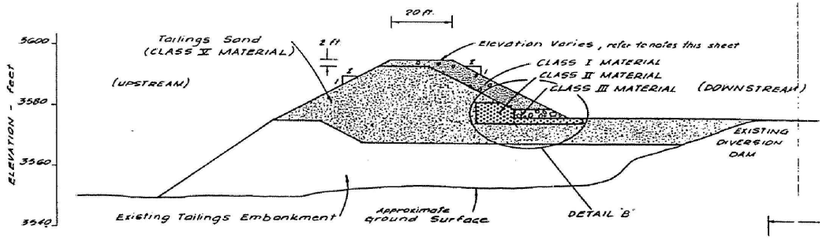
TYPICAL SECTION
(REPRESENTS STATIONS 6+30 to 28+00
AND 48+00 to 51+00)



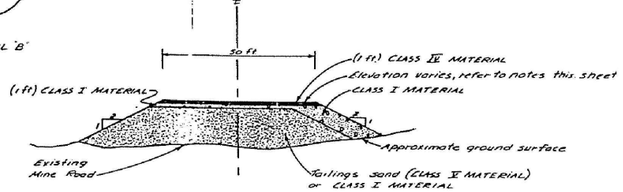
TYPICAL SECTION
(REPRESENTS STATIONS 51+00 to 61+30)



DETAIL 'B'



TYPICAL SECTION
(REPRESENTS STATIONS 28+00 to 48+00)



⚠3 TYPICAL SECTION
(Represents stations 1+37 S (49+60 E) to 4+00 S on existing mine road toward Faro)

⚠1 Mine road elevations
Sta. 4+00 S at El. 3594.45
To Sta. 11+85 S (Faro end) at El. 3604.65 > at 1.4 % slope

⚠2 Construct new mine road Sta. 4+00 S to 59+45 E so that surface, crown and superelevation conform with the curvature and sloping of the existing mine road profile.

NOTES

1. East Dam Station 0+00 to 6+30 is a transition zone which evenly shifts the centerline construction of the West Dam to downstream construction on the East Dam.
2. East Dam crest elevations:

   Station 0+00 at El 3586 feet
   to Station 20+00 at El 3586 feet > at 0.40% slope
   to Station 32+00 at El. 3580 feet > at 0.67 % slope ⚠2
   to Station 45+00 at El. 3600 feet
   to End of Construction at El. 3620 feet > at 1.33% slope
3. Area beneath proposed new construction foundation to be cleared of all deleterious materials and proof rolled with a heavy vibrating roller to the satisfaction of the engineer. Areas found to be unsuitable are to be subexcavated and replaced with Class I material compacted to 100% of the Standard Proctor Maximum dry density at optimum moisture content.
4. Materials used in 1980 construction to be compacted in 12" loose lift thickness to 100% of the Standard Proctor maximum dry density at the optimum moisture content.
5. Class III material not to be placed in direct contact with Class II material without a minimum 1 foot thick layer of Class II filter material in between.
6. All sections looking in direction of increasing station numbers.
7. All distances and elevations are subject to final field survey.
8. Top surface of existing embankment dams to be scarified for a depth of 0.5 feet prior to placement of new fill.
9. ⚠3 Construct new dam top road widths as follows so as to conform with existing mine road width at 60+00 E

Station	Width (ft)	Station	Width (ft)
29+00 E	50	34+00 E	44
31+00 E	48	37+00 E	43
32+00 E	46	38+00 E	42
33+00 E	41	39+00 E	41
34+00 E	41	39+55 E	40.35
35+00 E	42		

DRAWING TAKEN FROM:

Scale: 1 inch to 20 feet	CYPRUS ANVIL	TYPICAL EAST DAM SECTIONS	Golder Associates
Job No. 792-2041	Faro, Yukon Territory		
Drawing No. 5	Cyprus Anvil Mining Corporation	1980 EMBANKMENT DAM RAISING	Golder Geotechnical Consultants Ltd.
Drawn by R.W. / Reviewed by			Sheet 5 of 5
Date April 1980 / Date April 1980			

DISCLAIMER

THIS DRAWING WAS PREPARED BY GOLDER ASSOCIATES LTD. ("GOLDER") FOR THE ACCOUNT OF A CLIENT. THE MATERIAL IN IT REFLECTS SPECIFIC PROJECT PURPOSES RELATING TO THE FARO MINE AND GOLDER'S BEST JUDGEMENT IN LIGHT OF THE INFORMATION AVAILABLE TO GOLDER AT THE TIME OF PREPARATION. ANY USE WHICH ANVIL RANGE MINING CORPORATION ("ANVIL") OR ANY THIRD PARTY MAKES OF THIS DRAWING, OR ANY RELIANCE ON OR DECISIONS TO BE MADE BASED ON IT, ARE THE RESPONSIBILITY OF ANVIL AND SUCH THIRD PARTIES. GOLDER ACCEPTS NO RESPONSIBILITY FOR DAMAGES, IF ANY, SUFFERED BY ANVIL OR ANY THIRD PARTY AS A RESULT OF THE DECISIONS MADE OR ACTIONS BASED ON THIS DRAWING.

NOTES

1. ALL ELEVATIONS ARE IN FEET RELATIVE TO DOWN VALLEY PROJECT DATUM. SUBTRACT 106 FT, AND MULTIPLY BY 0.348 TO CONVERT TO METRES ABOVE MEAN SEA LEVEL.

SCALE

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

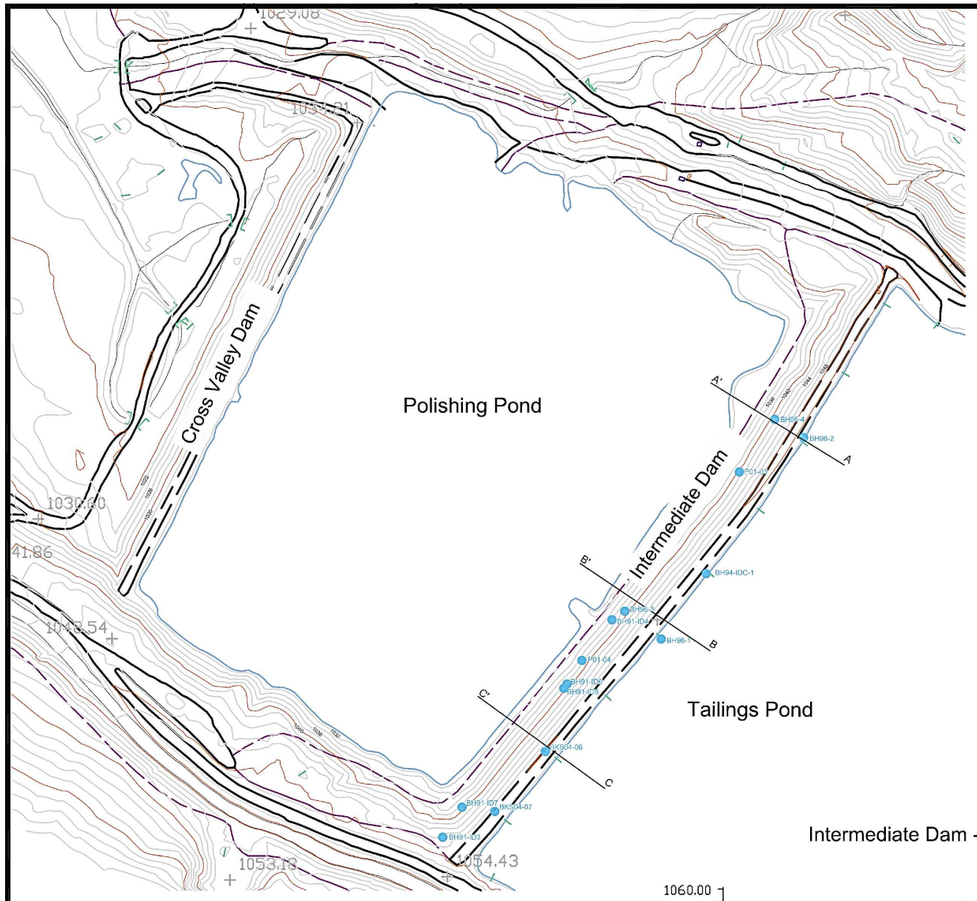
TITLE: SECONDARY DAM
EAST LIMB
TYPICAL DAM SECTIONS

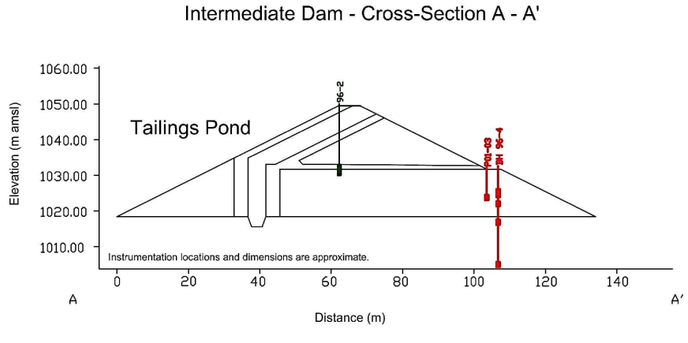
PROJECT No. M09770A06

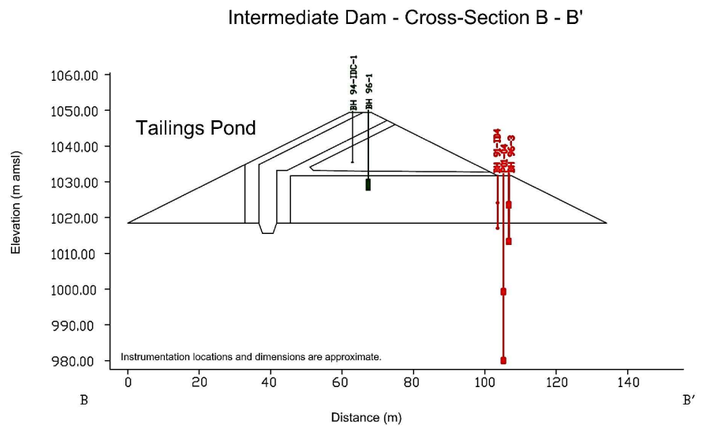
FIG. No. B-012

KCB-R-MLD

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Filename: \\INT.KLOHN.COM\PROJDATA\W\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-012_SECONDARY_DAM_EAST_LIMB_TYPICAL_DAM_SECTIONS.DWG
Xref File(s):
Image File(s): FIG-4-RFPR1 Yukon Government







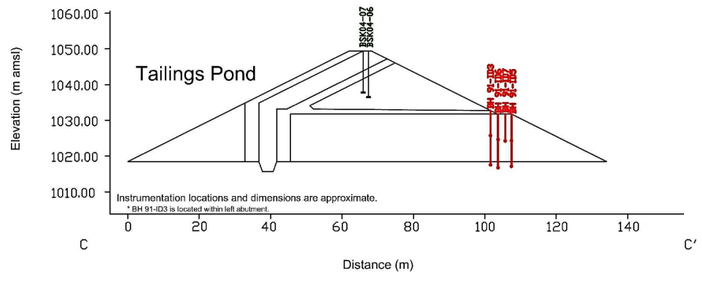


Fig. 9 Original Source: Figure 18 - 2009 Annual Geotechnical Evaluation and Instrumentation Review, Volume 1

NOTE:

1. ORIGINAL FIGURE PROVIDED BY BGC ENGINEERING (2010).

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

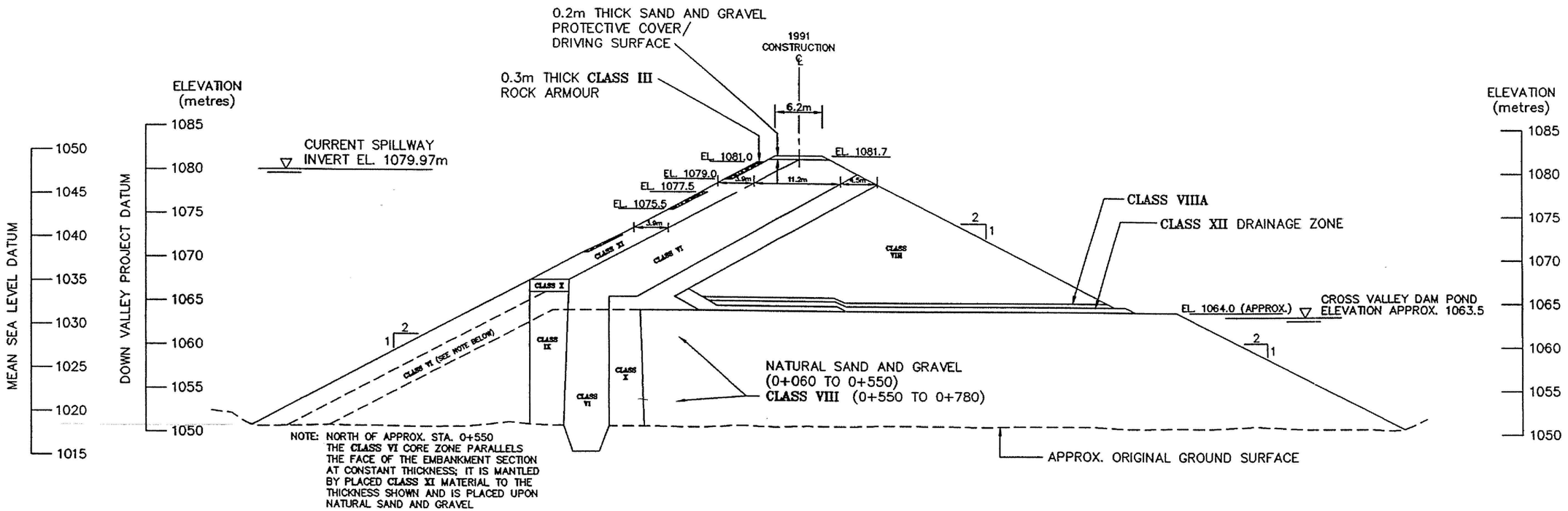
TITLE: INTERMEDIATE DAM INSTRUMENTATION PLAN AND SECTIONS

PROJECT No. M09770A06

FIG. No. B-018

KCB-R-MLD

Date:1/29/2013 Time:13:25:10 Scale:1:2.585
Filename:\\INT.KLOHN.COM\PROJDATA\M\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-018_INTERMEDIATE_DAM_INSTRUMENTATION_PLAN&SECTION.DWG
Xref File(s):
Image File(s): Fig. B-017 Intermediate Dam Instrumentation - Plan and Section Yukon Government



NOTE: NORTH OF APPROX. STA. 0+550 THE CLASS VI CORE ZONE PARALLELS THE FACE OF THE EMBANKMENT SECTION AT CONSTANT THICKNESS; IT IS MANTLED BY PLACED CLASS XI MATERIAL TO THE THICKNESS SHOWN AND IS PLACED UPON NATURAL SAND AND GRAVEL

NOTES :

1. Embankment geometry and internal zoning as shown in Golder Associates Drawing 912-2402-3, Int. Dam Raising & C.V. Dam Toe Drain, Cross Section and Detailed Plan, Rev. 1, Aug. 8, 1991.
2. All elevations are referenced to Down Valley Project Datum. Subtract 32.3m from elevations shown to convert to mean sea level (NAD27) datum.
3. Refer to Golder Associates as built reports for detailed descriptions of material classes. General descriptions as follows :

CLASS VI	Dam Core (glacial till)
CLASS VII	Upstream Shell (silty sand and gravel)
CLASS VIII	Downstream Shell (sand and gravel)
CLASS VIIIA	Drainage Filter (sand and gravel)
CLASS IX	Upstream Filter (silty sand)
CLASS X	Downstream Filter (sand and gravel)
CLASS XI	Tailings Sand (fine to medium sand)
CLASS XII	Drainage Zone (gravel)

0 5 10 15 20 25 metres

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

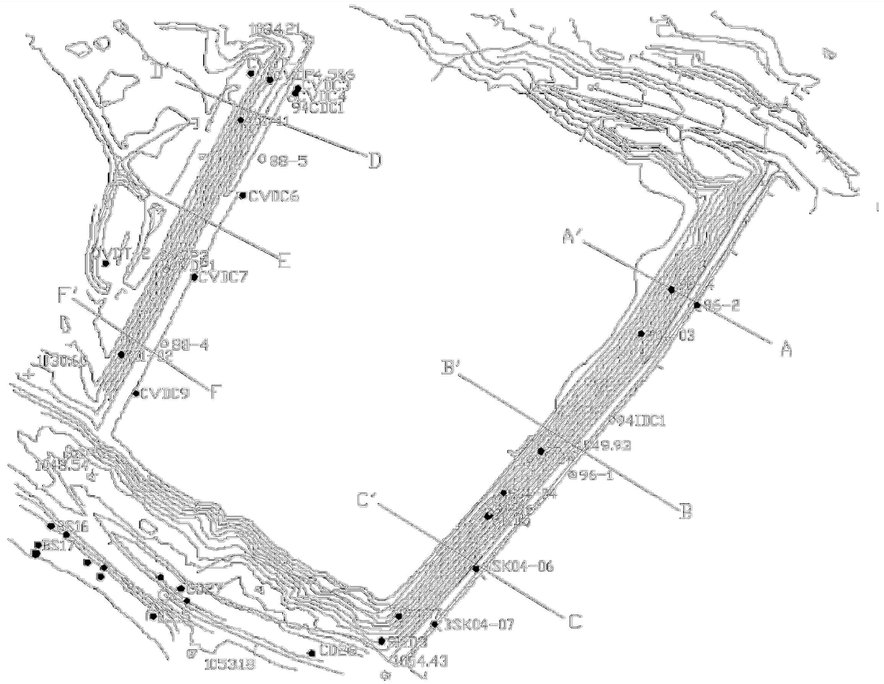
TITLE: INTERMEDIATE DAM
TYPICAL DAM SECTION

PROJECT No. M09237A06

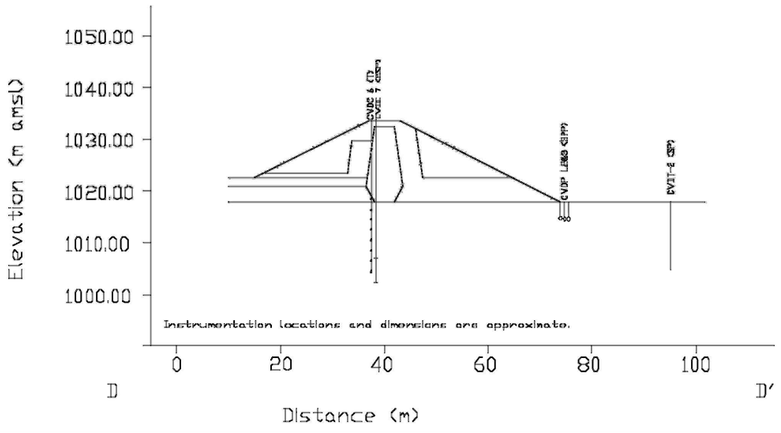
FIG. No. B-019

KCR-BM

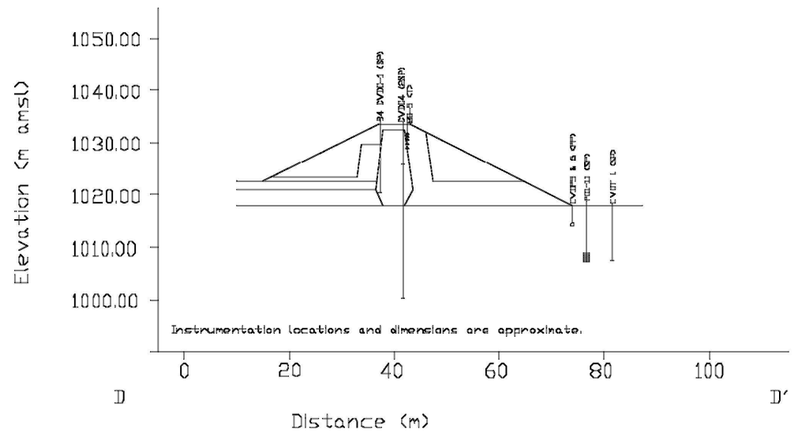
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Drawing File: Z:\M\VCR\M09770A06 - GOY-Faro 2016-17 Geotech\400 Drawings\CAD\OMS Manual\FIG_B-019_Intermediate_Dam_typical_section.dwg (jbokic)



Cross Valley Dam - Cross-Section E - E'



Cross Valley Dam - Cross-Section D - D'



Cross Valley Dam - Cross-Section F - F'

SP Standpipe Piezometers
PP Pneumatic Piezometers
T Thermistor Cables
Screened Intervals of Standipe Piezometers
Bottom of Standpipe Piezometers
Pneumatic Piezometer Tips
Thermistor Nodes

Original Source: Figure 24 - 2009 Geotechnical Evaluation and Instrumentation Review, Volume 1

NOTE

1. ORIGINAL FIGURE PROVIDED BY BGC ENGINEERING INC. (2010).

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

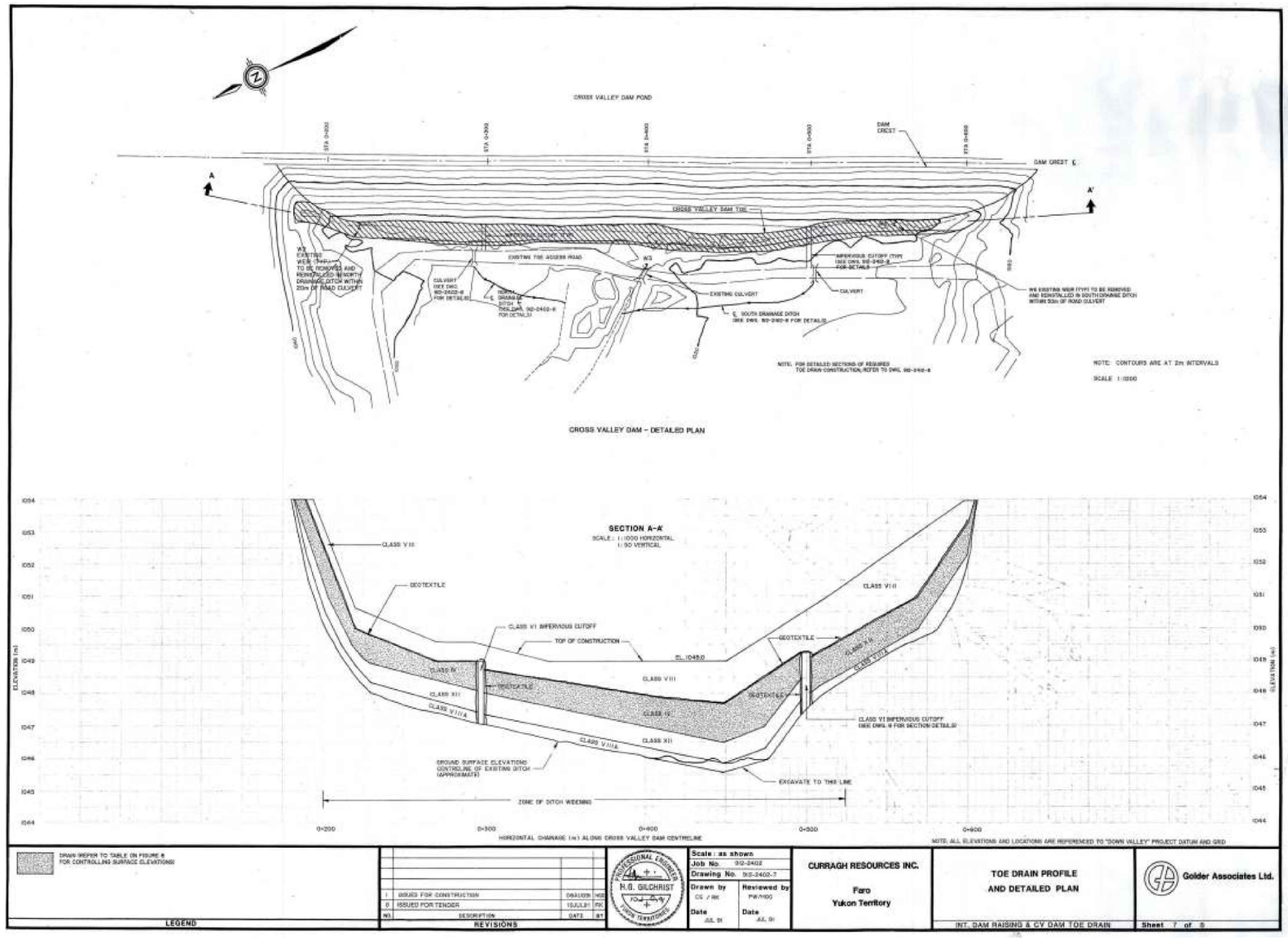
TITLE: CROSS VALLEY DAM INSTRUMENTATION PLAN AND SECTIONS

PROJECT No. M09770A06

FIG. No. B-026

KCB-R-MLD

Date:1/29/2013 Time:13:25:10 Scale:1:2.585
Filename:\\INT.KLOHN.COM\PROJDATA\W\VCR\M09770A06 - GOY-FARO 2016-17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B-026_CROSSVALLEYDAM_INSTRUMENTATIONPLAN&SECTION.DWG
Xref File(s):
Image File(s): FIG_B-026_CrossValley_InstrumentationPlan&Section Yukon Government



CROSS VALLEY DAM – DETAILED PLAN

DRAIN PROPER TO TABLE ON FIGURE 8 FOR CONTROLLING SURFACE ELEVATIONS

LEGEND

NO.	DESCRIPTION	DATE	BY
1	ISSUED FOR CONSTRUCTION	06/JUN/08	HGC
0	ISSUED FOR TENDER	10/JUL/91	RK

REVISIONS

PROFESSIONAL ENGINEER H.G. GILCHRIST YUKON TERRITORY

Scale: as shown
Job No. 902-2402
Drawing No. 902-2402-7
Drawn by CS / RK
Reviewed by PW/HGC
Date JUL 91
Date JUL 91

CURRAGH RESOURCES INC.
Faro
Yukon Territory

TOE DRAIN PROFILE AND DETAILED PLAN

INT. DAM RAISING & CV DAM TOE DRAIN

Golder Associates Ltd.

Sheet 7 of 8

Source: Golder Associates Ltd (1991)
Intermediate Dam Raising and
Cross Valley Toe Drain Construction Drawings.

Note: All elevations and coordinates are referenced to DVD.

NOTE

1. ORIGINAL FIGURE PROVIDED BY BGC ENGINEERING INC. (2008).
2. DVD IS DOWN VALLEY DATUM.

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CLIENT
Yukon Government
Klohn Crippen Berger

PROJECT
FARO MINE COMPLEX
OMS MANUAL FOR DAMS

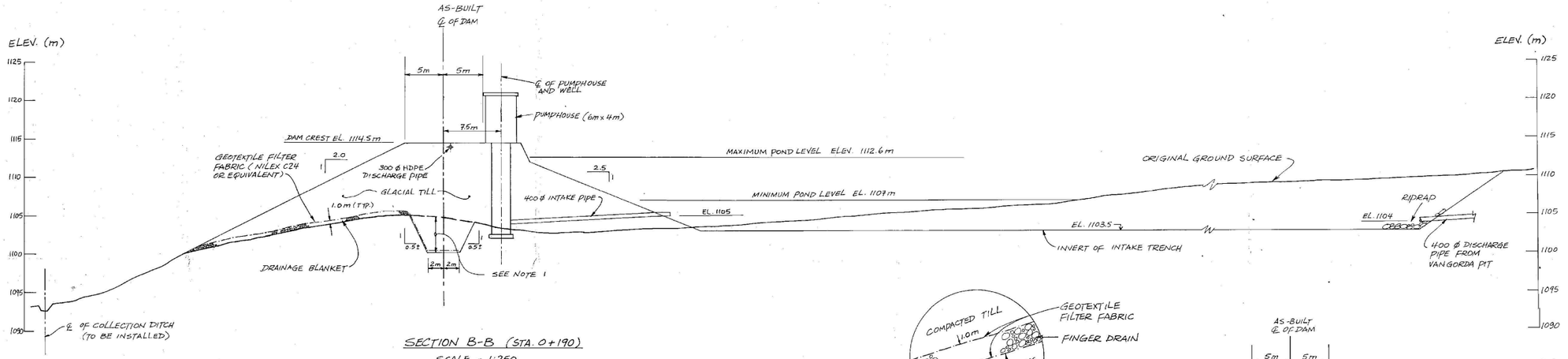
TITLE
CROSS VALLEY DAM
TOE DRAIN
PROFILE AND DETAILED PLAN

PROJECT No. M09770A06

FIG. No. B–028

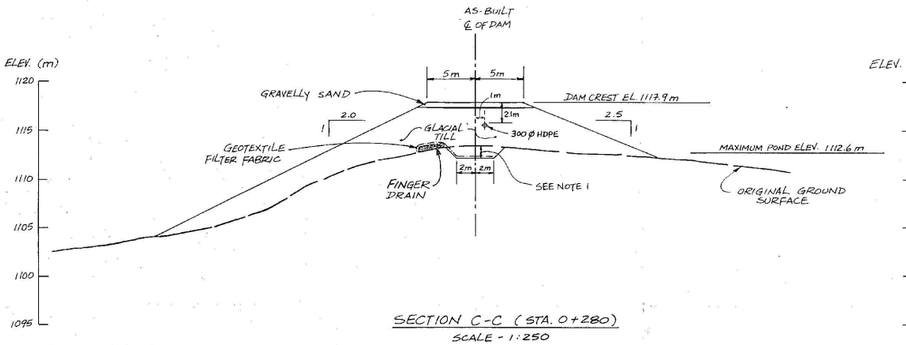
KCB–R–MLD

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Filename:Z:\MV\VCR\M09770A06 – GOY–FARO 2016–17 GEOTECH\400 DRAWINGS\CAD\OMS MANUAL\FIG_B–028_CROSSVALLEYDAM_TOEDRAIN_PROFILE&DETAILEDPLAN.DWG
Xref File(s):
Image File(s): Fig_B–023 – Cross Valley Dam – Toe Drain – Profile and Detailed Plan 21FINAL OMS 2008 Yukon Government



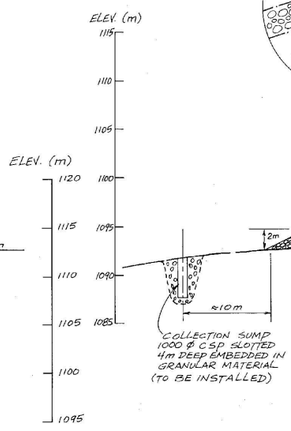
SECTION B-B (STA. 0+190)

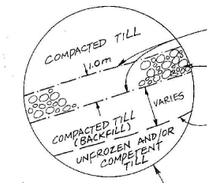
SCALE - 1:250

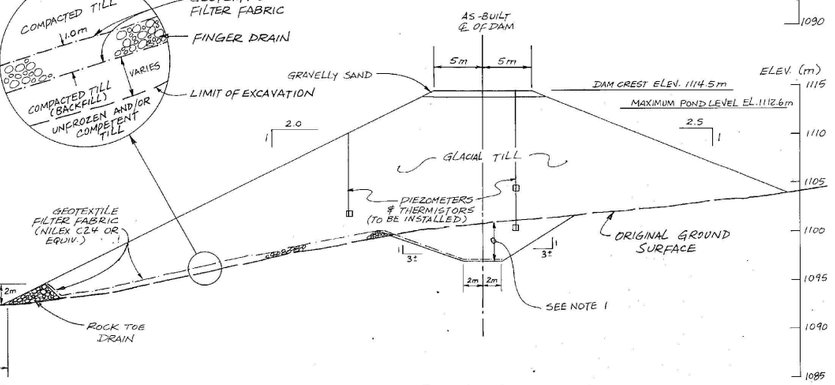


SECTION C-C (STA. 0+280)

SCALE - 1:250

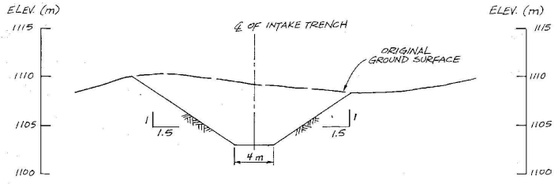






SECTION D-D (STA. 0+144)

SCALE - 1:250



SECTION E-E

SCALE - 1:250

NOTES:

1. CUT-OFF TRENCH VARIES: SEE DRWG. NO. 60627-03. AS DETERMINED BY SRK FIELD ENGINEER.
2. GLACIAL TILL FILL MATERIAL COMPACTED TO 90 PERCENT OF THE MODIFIED PROCTOR MAXIMUM DRY DENSITY IN 0.3m LIFTS
3. RIPRAP MATERIAL SHALL COMPLY WITH GRADATION REQUIREMENTS IN THE TECHNICAL SPECIFICATIONS.
4. PIEZOMETERS, THERMISTORS, COLLECTION DITCH AND COLLECTION SUMP NOT INSTALLED AS AT JAN. 1991.

NOTE

1. ORIGINAL FIGURE PROVIDED BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS (1990).

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CLIENT: Yukon Government

Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

TITLE: LITTLE CREEK DAM
CROSS SECTIONS AND DETAILS

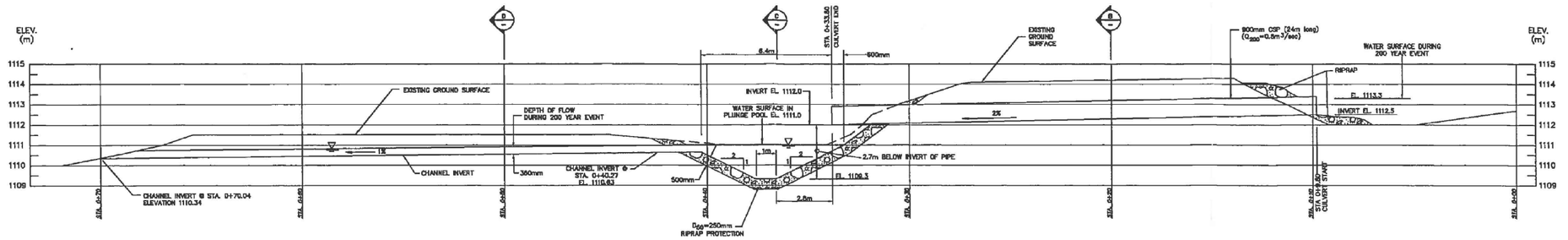
PROJECT No. M09770A06

FIG. No. B-040

SCALE

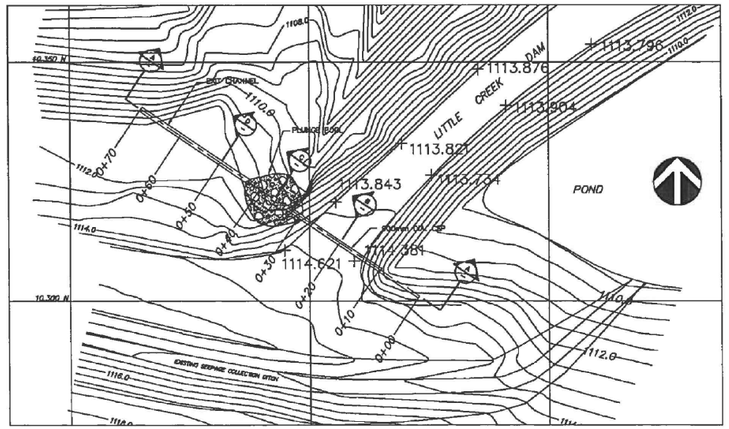
KCB-R-MLD

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Xref File(s):
Image File(s): Fig. B-032 Little Creek Dam - Cross Sections and Details Yukon Government



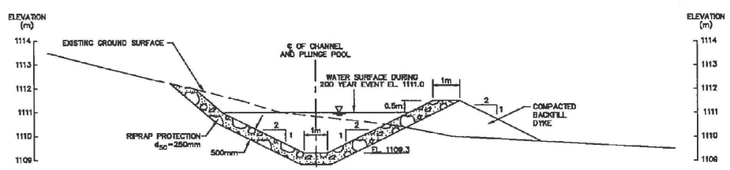
SECTION A

1:100



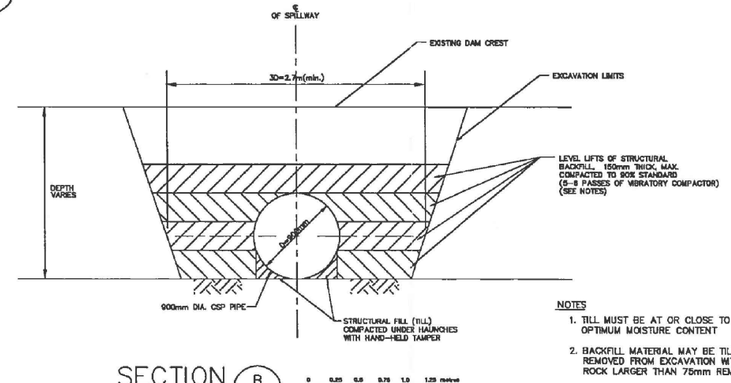
PLAN

1:800



SECTION C

1:100

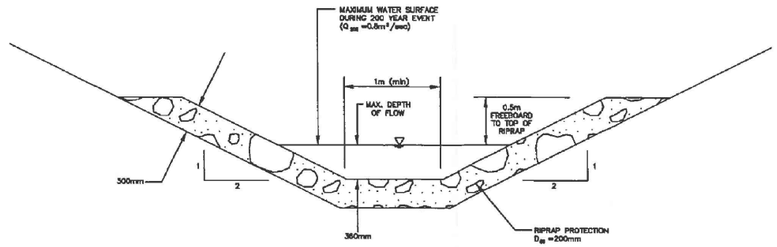


NOTES

1. TILL MUST BE AT OR CLOSE TO OPTIMUM MOISTURE CONTENT
2. BACKFILL MATERIAL MAY BE TILL REMOVED FROM EXCAVATION WITH ROCK LARGER THAN 75mm REMOVED

SECTION B

1:25



SECTION D

1:25

NOTE:

1. ORIGINAL FIGURE PROVIDED BY STEFFEN ROBERTSON & KIRSTEN CONSULTING ENGINEERS.

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CLIENT: Yukon Government

Klohn Crippen Berger

SCALE

PROJECT: FARO MINE COMPLEX OMS MANUAL FOR DAMS

TITLE: LITTLE CREEK DAM SPILLWAY DESIGN PLAN, SECTION AND DETAILS

PROJECT No. M09770A06

FIG. No. B-041

KCB-R-MLD

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Xref File(s):
Image File(s): Fig. B-035 - Little Creek Dam Spillway Design - PlanSection and Details Yukon Government

APPENDIX I

Minister's Determination Re Faro Mine Complex Reclamation and Closure Activities (Section 37(1) of Waters Act)

Yukon
Environment

Box 2703, Whitehorse,
Yukon Y1A 2C6

Minister's Determination

(Subsection 37(1) of *Waters Act*)

Re Faro Mine Complex Reclamation and Closure Activities

A. Statement of Facts

1. On April 21, 1998, Deloitte & Touche Inc. was appointed by the Ontario Superior Court of Justice as interim receiver ("Interim Receiver") for the Faro Mine Complex (the "Mine") on behalf of Anvil Range Mining Corporation.

2. The Interim Receiver has focused on care and maintenance at the Mine, ensuring that the water flowing from the Mine meets the requirements of Water Licence QZ03-059.

3. On February 28, 2009, the Interim Receiver will be discharged by court order of the Ontario Superior Court of Justice, recognized by the Supreme Court of Yukon, from its responsibilities at the Mine. The assets and real property related to the Mine will be distributed according to the court order.

4. The Mine contains, or is adjacent to waters that include Faro Creek, Rose Creek, and Vangorda Creek (the "Surrounding Waters").

5. Due to the past operations and practices at the Mine, water has accumulated and been stored in pits at the Mine known as the Faro, Grum, and Vangorda pits (the "Waste Water"). The Waste Water is highly contaminated because it contains elevated concentrations of heavy metals and acids.

6. Due to the instability of the dams and diversion channels at the Mine, there continues to be a risk that the Waste Waters may release from the pits and thereby deposit waste into the Surrounding Waters

B. Reasonable Grounds for Belief

I, Kevin McDonnell, acting on behalf of the Minister of the Department of Environment, have reasonable grounds to believe, based upon the facts above, that:

a. the works related to the use of waters or deposit of waste at the Mine have been permanently abandoned; and

b. that a danger to persons, property and the environment may result due to the past operation and the abandonment of the works at the Mine.

C. Measures to be Taken

I hereby authorize officials or agents of the Assessment and Abandoned Mines Branch, Department of Energy Mines and Resources, Government of Yukon ("Abandoned Mines") to use the following reasonable measures to prevent, counteract, mitigate, or remedy any resulting adverse effect on persons, property, or the environment, and in particular the Surrounding Waters:

1. Access the Mine and surrounding area, with the exception of any place being used as a temporary or permanent private dwelling-place.

2. Collection, testing, treatment, and discharge of treated Waste Water.

3. Maintaining, upgrading, inspecting and improving the diversions and dams at the Mine.

4. Re-sloping and covering and/or relocating waste rock to prevent further contamination of any of the waters at or around the Mine;

5. Construction of a water treatment plant at the Mine.

6. Any such other activities either directly or indirectly related to the use of waters or deposit of waste in waters that are necessary in order to undertake any of the above.

This determination is effective as of the date of signature.

Feb 27/09
Date of Signature

Kevin McDonnell
Director,
Water Resources Branch
Department of Environment,
Government of Yukon

APPENDIX II

Typical Dam Inspection Report Forms

TAILINGS DAM INSPECTION REPORT

All parts of inspection sheet should be completed. Adverse conditions should be described. Additional information may be put on attached pages.

PROJECT NO. _____ INSPECTION DATE _____

DAM NO. _____ LOCATION _____

PERSONNEL

Engineer _____ Others _____

Company Representative _____ _____

WEATHER

	Current	Last 3 Days	Last 2 Weeks
Dry	☐	☐	☐
Frost	☐	☐	☐
Rain	☐	☐	☐
Heavy Rain	☐	☐	☐

STATUS OF DISPOSAL FACILITY

Active ☐ Closed ☐ Notes: _____

DAM INFORMATION

Pond Elevation _____ Freeboard _____

Crest Elevation _____ Distance from Pond to Crest _____

DAM CONSTRUCTION METHOD

Upstream ☐ Other _____

Centreline ☐ _____

Downstream ☐ _____

LOCAL CONSTRUCTION ACTIVITIES

Spigotting ☐ _____

Cycloning ☐ _____

End Discharge ☐ _____

Dam Raising ☐ _____

Other ☐ _____

REASON FOR INSPECTION

Routine ☐ _____

Special Condition ☐ _____

NOTES

TAILINGS DAM INSPECTION REPORT

Upstream Slope / Tailings Beach

No.	Item	Chkd	Condition		
			Rating *	Remarks / Description	Photograph No.
1.	Slope Protection				
2.	Surface Erosion				
3.	Surface Settlements/ Depressions				
4.	Sinkholes				
5.	Cracks/Movements				
6.	Debris				
7.	Vegetation				
8.	Evidence of High Water Table				
9.	Other Unusual Conditions				
Notes:					
(If space insufficient, continue on separate sheet)					

* Legend
S = Satisfactory. Will fulfill intended purpose.
F = Fair. Will fulfill intended purpose. Maintenance or further study required.
P = Poor. May not fulfill intended purpose. Repair or modification required.
U = Unsatisfactory. Will not fulfill purpose. Repair or modification required.
N = Not inspected.

TAILINGS DAM INSPECTION REPORT

Dam Crest

No.	Item	Chkd	Condition		
			Rating *	Remarks / Description	Photograph No.
1.	Surface Cracks (a) Transverse				
	(b) Longitudinal				
2.	Settlements/Depressions				
3.	Sinkholes				
4.	Lateral Movements				
5.	Surface Protections				
6.	Erosion				
7.	Vegetation				
8.	Animal Burrows				
Notes:					
(If space insufficient, continue on separate sheet)					

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F = Fair. Will fulfill intended purpose. Maintenance or further study required.
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U = Unsatisfactory. Will not fulfill purpose. Repair or modification required.
N = Not inspected.

TAILINGS DAM INSPECTION REPORT

Downstream Dam Slope

No.	Item	Chkd	Condition		
			Rating *	Remarks / Description	Photograph No.
1.	Slope Protection				
2.	Surface Erosion				
3.	Surface Settlements/ Depressions				
4.	Sinkholes				
5.	Cracks/Slope Movements				
6.	Seepage/Wet Areas				
7.	Animal Burrows				
8.	Vegetation				
9.	Slope Angle				
10.	Other Unusual Conditions				
Notes:					
(If space insufficient, continue on separate sheet)					

* Legend
S = Satisfactory. Will fulfill intended purpose.
F = Fair. Will fulfill intended purpose. Maintenance or further study required.
P = Poor. May not fulfill intended purpose. Repair or modification required.
U = Unsatisfactory. Will not fulfill purpose. Repair or modification required.
N = Not inspected.

TAILINGS DAM INSPECTION REPORT

Right Dam Abutment
Looking Downstream

No.	Item	Chkd	Condition		
			Rating *	Remarks / Description	Photograph No.
1.	Surface Condition				
2.	Vegetation and Debris				
3.	Slope Protection				
4.	Movements				
5.	Erosion				
6.	Seepage/Wet Areas				
7.	Other Unusual Conditions				

Notes:

(If space insufficient, continue on separate sheet)

* Legend
S = Satisfactory. Will fulfill intended purpose.
F = Fair. Will fulfill intended purpose. Maintenance or further study required.
P = Poor. May not fulfill intended purpose. Repair or modification required.
U = Unsatisfactory. Will not fulfill purpose. Repair or modification required.
N = Not inspected.

TAILINGS DAM INSPECTION REPORT

Left Dam Abutment
Looking Downstream

No.	Item	Chkd	Condition		
			Rating *	Remarks / Description	Photograph No.
1.	Surface Condition				
2.	Vegetation and Debris				
3.	Slope Protection				
4.	Movements				
5.	Erosion				
6.	Seepage/Wet Areas				
7.	Other Unusual Conditions				

Notes:

(If space insufficient, continue on separate sheet)

* Legend
S = Satisfactory. Will fulfill intended purpose.
F = Fair. Will fulfill intended purpose. Maintenance or further study required.
P = Poor. May not fulfill intended purpose. Repair or modification required.
U = Unsatisfactory. Will not fulfill purpose. Repair or modification required.
N = Not inspected.

TAILINGS DAM INSPECTION REPORT

Toe Drainage and Seepage Collection Ditches

No.	Item	Chkd	Condition		
			Rating *	Remarks / Description	Photograph No.
1.	Seepage/Wet Areas				
2.	Signs of Instability				
3.	Vegetation				
4.	Other Unusual Conditions				
Notes:					
(If space insufficient, continue on separate sheet)					

* Legend
S = Satisfactory. Will fulfill intended purpose.
F = Fair. Will fulfill intended purpose. Maintenance or further study required.
P = Poor. May not fulfill intended purpose. Repair or modification required.
U = Unsatisfactory. Will not fulfill purpose. Repair or modification required.
N = Not inspected.

TAILINGS DAM INSPECTION REPORT

Instrumentation

No.	Item	Chkd	Condition		
			Rating *	Remarks / Description	Photograph No.
1.	Piezometers				
2.	Standpipes				
3.	Survey Monuments				
4.	Inclinometers				
5.	Relief Wells				
6.	Weirs				
7.	Other				

Notes:

(If space insufficient, continue on separate sheet)

* Legend
S = Satisfactory. Will fulfill intended purpose.
F = Fair. Will fulfill intended purpose. Maintenance or further study required.
P = Poor. May not fulfill intended purpose. Repair or modification required.
U = Unsatisfactory. Will not fulfill purpose. Repair or modification required.
N = Not inspected.

TAILINGS DAM INSPECTION REPORT

Spillway

No.	Item	Chkd	Condition		
			Rating *	Remarks / Description	Photograph No.
1.	Slope Protection				
2.	Surface Erosion				
3.	Surface Settlements/ Depressions				
4.	Sinkholes				
5.	Cracks/Movements				
6.	Debris				
7.	Vegetation				
8.	Evidence of High Water Table				
9.	Other Unusual Conditions				

Notes:

(If space insufficient, continue on separate sheet)

* Legend
S = Satisfactory. Will fulfill intended purpose.
F = Fair. Will fulfill intended purpose. Maintenance or further study required.
P = Poor. May not fulfill intended purpose. Repair or modification required.
U = Unsatisfactory. Will not fulfill purpose. Repair or modification required.
N = Not inspected.
N/A = Not Applicable.

APPENDIX III

Instrumentation Summary and Monitoring Frequency

Appendix III
Instrumentation Summary and Monitoring Frequency

This appendix summarizes the monitoring frequency for instruments at the Faro Mine Complex, as recommended in the 2016 Annual Review report. Also included are tables of known instruments and their status. Instrument locations for the Cross Valley Dam, Intermediate Dam, Secondary Dam, Rose Creek Diversion, Little Creek Dam and Vangorda Waste Rock Dump are shown in Figure III-1 to Figure III-4.

III-1 INSTRUMENTATION MONITORING FREQUENCY

Table III-1 Instrumentation Monitoring Frequency

			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Rose Creek Diversion Channel														
	Thermistors	Canal Dyke: CD-10, CD-15, CD-21, CD-26, BGC05-04, BGC05-07						M						
		Spoil Pile: SP-2, SP-3, SP-5						M						
		Back Slope: BS-5, BS-9, BS-10, BS-12						M			M			
	Inclinometers	Canal Dyke: CD-10, -15, -21. BH91-CD1, BGC05-05, -08.	One successful reading for all inclinometers											
		Spoil Pile: SP-2	One successful reading for all inclinometers											
		Back Slope: BS-5, BS-9, BS-10	Two successful readings for all inclinometers: one in spring/summer, the other in fall											
	Piezometers	Canal Dyke: CD-13(D), -15, -21(S), -26. BGC05-02, -03, -06.					M	M			M			
		Back Slope: BS-5, BS-9					M	M			M			
	Staff Gauges	RCDC-4				Daily	Daily	Daily	W	W	W			
	Flows	RCDC-4 (Obtain one reading during high flow at freshet)				M	M	M	M	M	M	M		
Cross Valley Dam														
	Piezometers	CVDC-4(D), -7(D), -9. CVDT-2. CVDP-1, -5, -6. 94 CVDC-1, P01-11					M	M			M			
	Weir Flows	X11, X12, X13, Weir 3	W	W	W	W	W	W	W	W	W	W	W	W
	Elevations	Polishing Pond	W	W	W	W	W	W	W	W	W	W	W	W
	Visual Inspection	Visual Inspections of dam and spillway as required in the water license.	W	W	W	W	W	W	W	W	W	W	W	W
Intermediate Dam														
	Piezometers	91ID-3, -4(D). 94-IDC-1, 96-1, -2, -3(A), -4(A, D). BKS04-06, -07.					M	M			M			
	Observe	Seepage observations near south abutment					M	M		M	M			
	Elevations	Intermediate Pond	W	W	W	W	W	W	W	W	W	W	W	W
	Visual Inspection	Visual Inspections of the dam and spillway.	W	W	W	W	W	W	W	W	W	W	W	W
Secondary Dam														
	Piezometers	P81-6, P81-7, P81-8, P03-01, P03-02, P03-03					M	M			M			
North Fork Rock Drain														
	Data Loggers	NFRD2B (Relocate NFRD2B or establish new staff gauge downstream)				M	M	M	M	M	M	M		
	Staff Gauges	NFRD2B, X2 (Relocate NFRD2B or establish new staff gauge downstream)				Daily	Daily	W	W	M	M	M		
	Flows	NFRD2B, X2				M	M	M	M	M	M	M		
	Water Elevation	NF1					W	W	W	TAM	TAM			
	Observe	NF1, NF2	M	M	M	M	M	M	M	M	M	M	M	M
K8 Rock Drain														
	Observe						M	M	M					
Faro Creek Diversion Channel														
	Staff Gauges	FCD-1, FCD-2, FCD-3, FCD-4				TAM	TAM	M	M	M	M	M		
	Flows	FCD-1, FCD-2, FCD-3, FCD-4				TAM	TAM	M	M	M	M	M		
Faro Pit														
	Observe	Faro Pit	M	M	M	M	M	M	M	M	M	M	M	M
Grum Pit														
	Observe	Grum Pit Wall	M	M	M	M	M	M	M	M	M	M	M	M
Vangorda Pit														
	Observe	Vangorda Pit Wall	M	M	M	M	M	M	M	M	M	M	M	M
Vangorda Waste Rock Dump														
	Observe	Weirs: V28, V29, V30, V31, V32, V33					M	M	M	M	M	M		
		Drainage Ditch						M						
		Northeast Dump Crest						M						
	Flows	V29, V30, V31, V32, V33					M	M	M	M	M	M		
	Piezometers	V39, 40, 41, 42, 43, 44, 45, 47. PW-10-01, -02, -03, -04, -05.					M				M			
	Standpipe Data Loggers	PW-10-01, -02, -03, and -05 (DH1, DH2, DH3, DH5)					M				M			
Little Creek Dam														
	Piezometers	BH94 LCD-2, -3, P09-LCD-1, -2, -3, -4, -6, -7					M				M			
	Visual Inspection	Visual inspections of the dam and spillway.	W	W	W	W	W	W	W	W	W	W	W	W
Vangorda Creek Diversion														
	Observe	Trash rack at headworks				M	M	M	M	M	M			
		Seepage collection pond				M	M	M						
		Side Slopes Above Flume					M	M						
Sludge Pond Embankment														
	Observe	Downstream slopes and embankment				M	M				M			
Fresh Water Pond														
	Observe	Spillway from Fresh Water Pond to Grum Interceptor Ditch					M				M			
Grum Interceptor Ditch and Sheep Pad Pond														
	Observe	Outlets / Inlets to Ditch				M	M				M			
		Sheep Pad Pond Dyke				M	M				M			

Note:
M – Monthly
W – Weekly
TAM – Twice a month

III-2 KNOWN INSTRUMENTATION SUMMARY

Table III-2 Inclinometer Summary

Area	Instrument Name	Easting (m) (NAD27 UTM)	Northing (m) (NAD27 UTM)	Bottom Depth (m)	Reading Start Depth (m)	Status	Comments
Cross Valley Dam	BH91-CD1	581,007	6,913,352	11.25	11	Functioning	
	BH94CD-1	580,533	6,913,591	2.5		Not functioning	
Rose Creek Diversion Channel	BGC05-05	580,859	6,913,424	11.75	11.5	Functioning	
	BGC05-08	580,701	6,913,521	12.75	13	Functioning	Keep reading with bottom depth of 12.5 m.
	BS-5	581,740	6,913,008	10.4	10	Functioning	
	BS-9	581,216	6,913,254	10.35	10	Functioning	
	BS-10	580,856	6,913,363	10.4	10	Functioning	
	CD-10	581,723	6,913,066	10.4	10	Functioning	
	CD-15	581,218	6,913,289	9.6	9.5	Functioning	
	CD-19	580,892	6,913,410	3.5	10	Not functioning	
	CD-21	580,703	6,913,504	10.05	10	Functioning	
	SP-2	581,263	6,913,326	7.25	7	Functioning	
	SP-5	580,236	6,913,773			Questionable	Pipe broken below ground surface.

Table III-3 Standpipe Piezometer Summary

Area	Instrument	Easting (m) (NAD27 UTM)	Northing (m) (NAD27 UTM)	Top of Casing Elevation (m)	Screen Top Depth (m)	Screen Bottom Depth (m)	Status	Comment
Cross Valley Dam	94-CVDC-1	580,253	6,914,336	1034.02		13.0	Functioning	
	CVDC-4-D	580,256	6,914,340	1033.60		33.9	Functioning	
	CVDC-4-S	580,256	6,914,340	1033.41		25.5	Not functioning	Blocked at 7.6 m
	CVDC-7-D	580,149	6,914,132	1033.47		30.6	Functioning	
	CVDC-7-S	580,149	6,914,132	1033.55		25.8	Questionable	Slow response to falling head test
	CVDC-9-D	580,097	6,914,028	1033.47		32.8	Functioning	
	CVDC-9-S	580,097	6,914,028	1033.55		25.8	Functioning	
	CVDT-1	580,208	6,914,362	1018.57		10.7	Not functioning	
	CVDT-2	580,091	6,914,157	1019.83		13.6	Functioning	
	P01-02	580,066	6,914,048				Questionable	Not measured recently
	P01-11	580,199	6,914,312	1017.87		10.6	Functioning	
	P03-09	580,059	6,914,210	1018.53			Unknown	Not measured recently
Grum Pit	SRK09-GSA	592,621	6,904,684				Functioning	
	SRK09-GSB	592,631	6,904,684				Functioning	
Intermediate Dam	BH94-IDC-1	580,595	6,913,975	1049.48		14.0	Functioning	
	BH96-1	580,552	6,913,924	1049.83	18.8	21.8	Functioning	
	BH96-2	580,686	6,914,105	1049.94	17.1	20.1	Functioning	
	BH96-3-A	580,520	6,913,947	1032.13	7.4	9.0	Functioning	
	BH96-3-B	580,520	6,913,947	1032.07	17.7	19.2	Questionable	Slow response to falling head test
	BH96-4-A	580,653	6,914,125	1033.11	5.7	6.5	Functioning	
	BH96-4-B	580,653	6,914,125	1033.03	9.8	11.3	Questionable	Blocked at El. 1029 m
	BH96-4-C	580,653	6,914,125	1033.07	15.0	16.5	Questionable	Blocked at El. 1020 m
	BH96-4-D	580,653	6,914,125	1033.04	26.8	28.3	Functioning	

Area	Instrument	Easting (m) (NAD27 UTM)	Northing (m) (NAD27 UTM)	Top of Casing Elevation (m)	Screen Top Depth (m)	Screen Bottom Depth (m)	Status	Comment
	BKS04-06	580,457	6,913,803	1050.61	12.8	13.1	Functioning	
	BKS04-07	580,408	6,913,750	1050.71	11.5	11.8	Functioning	
	P01-03	580,627	6,914,077	1032.13	7.8	9.3	Questionable	Slow response to falling head test
	P01-04-A	580,484	6,913,899	1032.77	31.7	33.2	Not functioning	
	P01-04-B	580,484	6,913,899	1032.77	51.0	52.5	Questionable	Slow response to falling head test
	P03-08	580,969	6,913,520	1048.42			Unknown	Not measured recently
Little Creek Dam	P09-LCD-1	593,483	6,903,144	1097.53			Functioning	
	P09-LCD-2	593,476	6,903,139	1097.69			Functioning	
	P09-LCD-3	593,456	6,903,114	1093.71			Functioning	
	P09-LCD-4	593,441	6,903,094	1093.68			Functioning	
	P09-LCD-6	593,426	6,903,064	1096.21			Functioning	
	P09-LCD-7	593,431	6,903,014	1101.68			Functioning	
Secondary Dam	P03-01	583,288	6,912,588	1061.11			Functioning	
	P03-02	583,121	6,912,578	1060.59			Functioning	
	P03-03	583,056	6,912,705	1061.49			Functioning	
	P03-04	582,066	6,913,189	1061.30			Unknown	Not measured recently
	P03-06	582,561	6,913,314	1062.90			Unknown	Not measured recently
	P81-06	582,790	6,912,686	1060.87		6.0	Questionable	Slow response to falling head test
	P81-07	583,221	6,912,421	1064.08		6.1	Functioning	
	P81-08	583,323	6,912,405	1064.00		7.5	Functioning	
Vangorda Waste Rock Dump	GW-94-01 (V34)	593,538	6,902,300	1117.45			Functioning	
	GW-94-02 (V35)	593,287	6,902,379	1117.41			Functioning	
	GW-94-03 (V36)	593,244	6,902,741	1118.43			Functioning	
	GW-94-04 (V37)	593,425	6,902,906	1116.17			Functioning	
	GW-94-05 (V38)			1101.67			Unknown	Not measured recently

Area	Instrument	Easting (m) (NAD27 UTM)	Northing (m) (NAD27 UTM)	Top of Casing Elevation (m)	Screen Top Depth (m)	Screen Bottom Depth (m)	Status	Comment
	P2001-02A	593,241	6,902,689	1122.78			Unknown	
	P2001-02B	593,241	6,902,689	1122.77			Unknown	
	P2001-03	593,206	6,902,706	1120.00			Unknown	
	P-94-01A (V39)	593,356	6,902,429	1136.56			Functioning	
	P-94-01B (V40)	593,356	6,902,429	1136.49			Functioning	
	P-94-02A (V41)	593,278	6,902,572	1138.41			Functioning	
	P-94-02B (V42)	593,278	6,902,562	1138.33			Functioning	
	P-94-02C (V43)	593,255	6,902,528	1129.84			Functioning	
	P-94-03A (V44)	593,485	6,902,800	1134.37			Functioning	
	P-94-03B (V45)	593,475	6,902,790	1134.46			Questionable	Slow response to falling head test
	P-94-04A (V46)	593,667	6,902,901				Not functioning	
	P-94-04B (V47)	593,657	6,902,891	1134.33			Functioning	
	PW-10-01 (DH1)	593,683	6,902,847	1149.08			Functioning	
	PW-10-02 (DH2)	593,318	6,902,638	1139.30			Functioning	
	PW-10-03 (DH3)	593,327	6,902,494	1137.72			Functioning	
	PW-10-04 (DH4)	593,849	6,902,319	1141.69			Questionable	Slow response to falling head test
	PW-10-05 (DH5)	593,631	6,902,510	1180.39			Functioning	

Table III-4 Pneumatic Piezometer Summary

Area	Instrument	Easting (m) (NAD27 UTM)	Northing (m) (NAD27 UTM)	Tip Elevation (m)	Status	Comment
Cross Valley Dam	CVDP-1	580,115	6,914,145	1014.51	Functioning	
	CVDP-3	580,115	6,914,145	1014.71	Not functioning	
	CVDP-5	580,221	6,914,362	1014.28	Functioning	
	CVDP-6	580,221	6,914,362	1014.37	Functioning	
Intermediate Dam	BH91-ID3-D	580,345	6,913,726	1028.62	Functioning	
	BH91-ID3-S	580,345	6,913,726	1036.82	Functioning	
	BH91-ID4-D	580,505	6,913,925	1017.08	Functioning	
	BH91-ID4-S	580,505	6,913,925	1024.22	Questionable	
	BH91-ID5-D	580,472	6,913,862	1017.08	Not functioning	
	BH91-ID5-S	580,472	6,913,862	1024.30	Not functioning	
	BH91-ID6-D	580,461	6,913,877	1016.90	Not functioning	
	BH91-ID6-S	580,461	6,913,877	1024.80	Not functioning	
	BH91-ID7	580,374	6,913,779	1025.95	Not functioning	
Little Creek Dam	BH94-LCD1-D	593,453	6,902,995	1097.00	Functioning	
	BH94-LCD1-S	593,453	6,902,995	1103.60	Questionable	No bubbles returned.
	BH94-LCD2-D	593,476	6,903,064	1094.90	Functioning	
	BH94-LCD2-S	593,476	6,903,064	1100.50	Functioning	
	BH94-LCD3-D	593,524	6,903,122	1101.20	Functioning	
	BH94-LCD3-S	593,524	6,903,122	1105.50	Functioning	
Rose Creek Diversion Channel	BGC05-02	580,879	6,913,412	1044.65	Functioning	
	BGC05-03	580,866	6,913,418	1050.64	Functioning	
	BGC05-06-D	580,709	6,913,519	1041.50	Functioning	
	BGC05-06-S	580,709	6,913,519	1046.78	Functioning	
	BS-5	581,740	6,913,008	1053.00	Functioning	

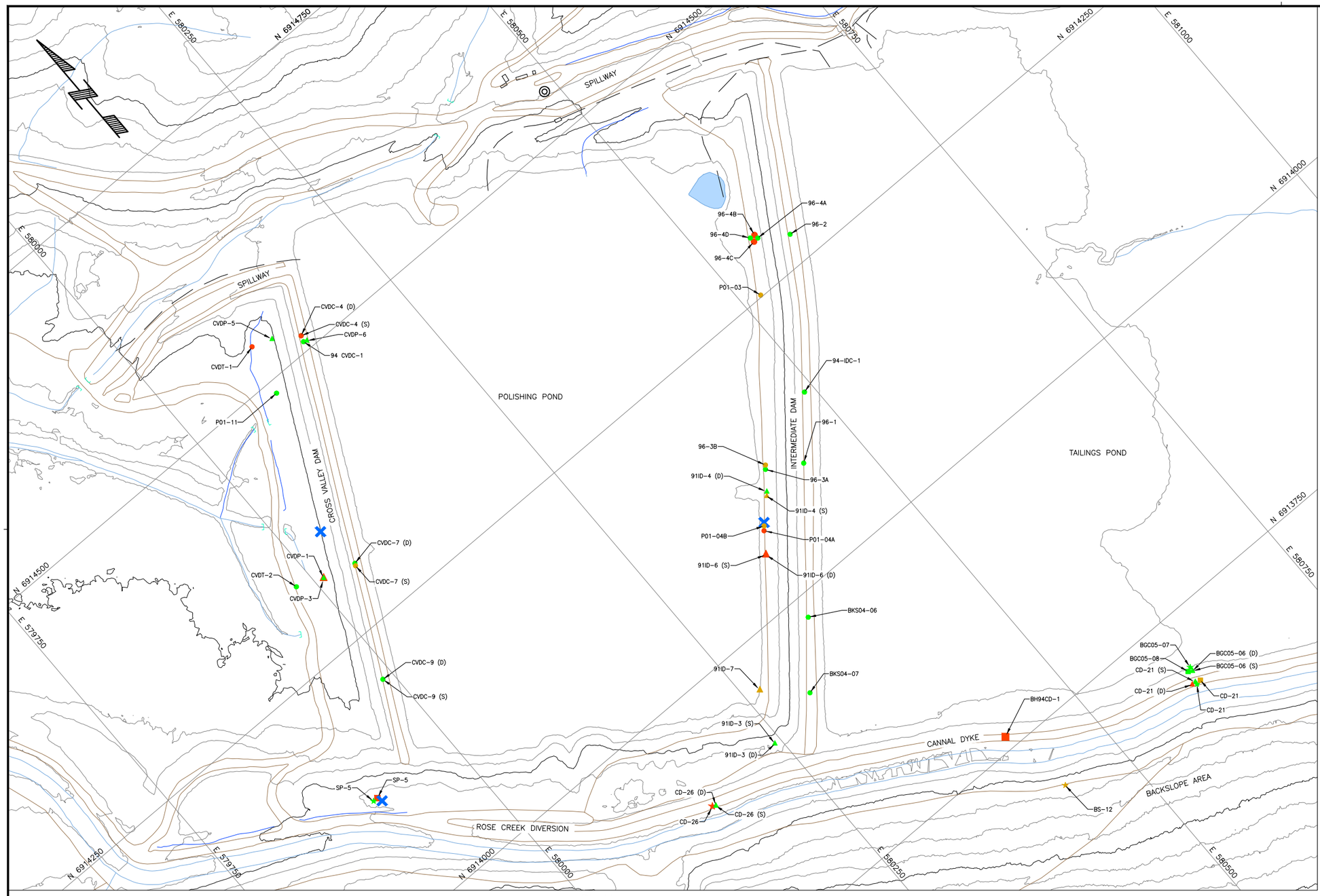
Area	Instrument	Easting (m) (NAD27 UTM)	Northing (m) (NAD27 UTM)	Tip Elevation (m)	Status	Comment
	BS-9	581,216	6,913,254	1045.00	Functioning	
	CD-13-D	581,386	6,913,197	1044.70	Functioning	
	CD-13-S	581,386	6,913,197	1048.70	Questionable	
	CD-15-D	581,218	6,913,289	1043.30	Functioning	
	CD-15-S	581,218	6,913,289	1048.10	Functioning	
	CD-21-D	580,703	6,913,504	1042.00	Not functioning	
	CD-21-S	580,703	6,913,504	1047.50	Functioning	
	CD-26-D	580,267	6,913,733	1042.00	Functioning	
	CD-26-S	580,267	6,913,733	1048.20	Functioning	

Table III-5 Thermistor Summary

Area	Instrument	Easting (m) (NAD27 UTM)	Northing (m) (NAD27 UTM)	Status	Comments
Cross Valley Dam	BH88-4	580,117	6,914,061	Unknown	
	CVDC-6	580,197	6,914,225	Unknown	
Little Creek Dam	BH94-LCD4	593,456	6,903,014	Unknown	
	BH94-LCD5	593,497	6,903,095	Unknown	
	BH94-LCD6	593,535	6,903,126	Unknown	
Rose Creek Diversion Channel	BGC05-04	580,861	6,913,420	Not functioning	
	BGC05-07	580,714	6,913,518	Functioning	
	BS-5	581,740	6,913,008	Functioning	
	BS-9	581,216	6,913,254	Functioning	
	BS-10	580,856	6,913,363	Functioning	
	BS-12	580,539	6,913,512	Functioning	
	CD-10	581,723	6,913,066	Functioning	
	CD-15	581,218	6,913,289	Functioning	
	CD-21	580,703	6,913,504	Functioning	
	CD-26	580,267	6,913,733	Questionable	
	SP-2	581,263	6,913,326	Functioning	
	SP-3	581,006	6,913,375	Functioning	
	SP-5	580,236	6,913,773	Functioning	

Table III-6 Weir and Staff Gauge Summary

Area	Type	Instrument	Easting (m, NAD27 UTM)	Northing (m, NAD27 UTM)
Cross Valley Dam	Weir	Weir 3	580,112	6,914,203
		X11	580,102	6,914,276
		X12	580,076	6,914,111
		X13	580,070	6,914,260
Faro Creek Diversion Channel	Staff Gauge	FCD-1	585,469	6,916,567
		FCD-2	585,026	6,915,674
		FCD-3	585,071	6,915,255
		FCD-4	585,346	6,914,854
North Fork Rock Drain	Staff Gauge	NF1	584,999	6,913,119
		NF2	584,811	6,912,864
		NFRD-2B	584,184	6,912,589
		X2	584,158	6,912,552
North Wall Interceptor Ditch	Weir	NWID		
Rose Creek Diversion Channel	Staff Gauge	RCDC-4	583,228	6,912,381
Vangorda Waste Rock Dump	Weir	V28	593,834	6,902,242
		V29	593,579	6,902,327
		V30	593,322	6,902,404
		V31	593,430	6,902,811
		V32	593,537	6,902,869
		V33	593,623	6,902,911
	Weir	GC Weir	592,886	6,903,216



PLAN
SCALE A

SCALE A 0 100 m

LEGEND

- STANDPIPE PIEZOMETER
- PNEUMATIC PIEZOMETER
- INCLINOMETER
- THERMISTERS
- FUNCTIONING INSTRUMENT
- QUESTIONABLE INSTRUMENT
- DEFUNCT INSTRUMENT
- RECOMMENDED INCLINOMETER

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Klohn Crippen Berger

PROJECT: FARO MINE COMPLEX
OMS MANUAL FOR DAMS

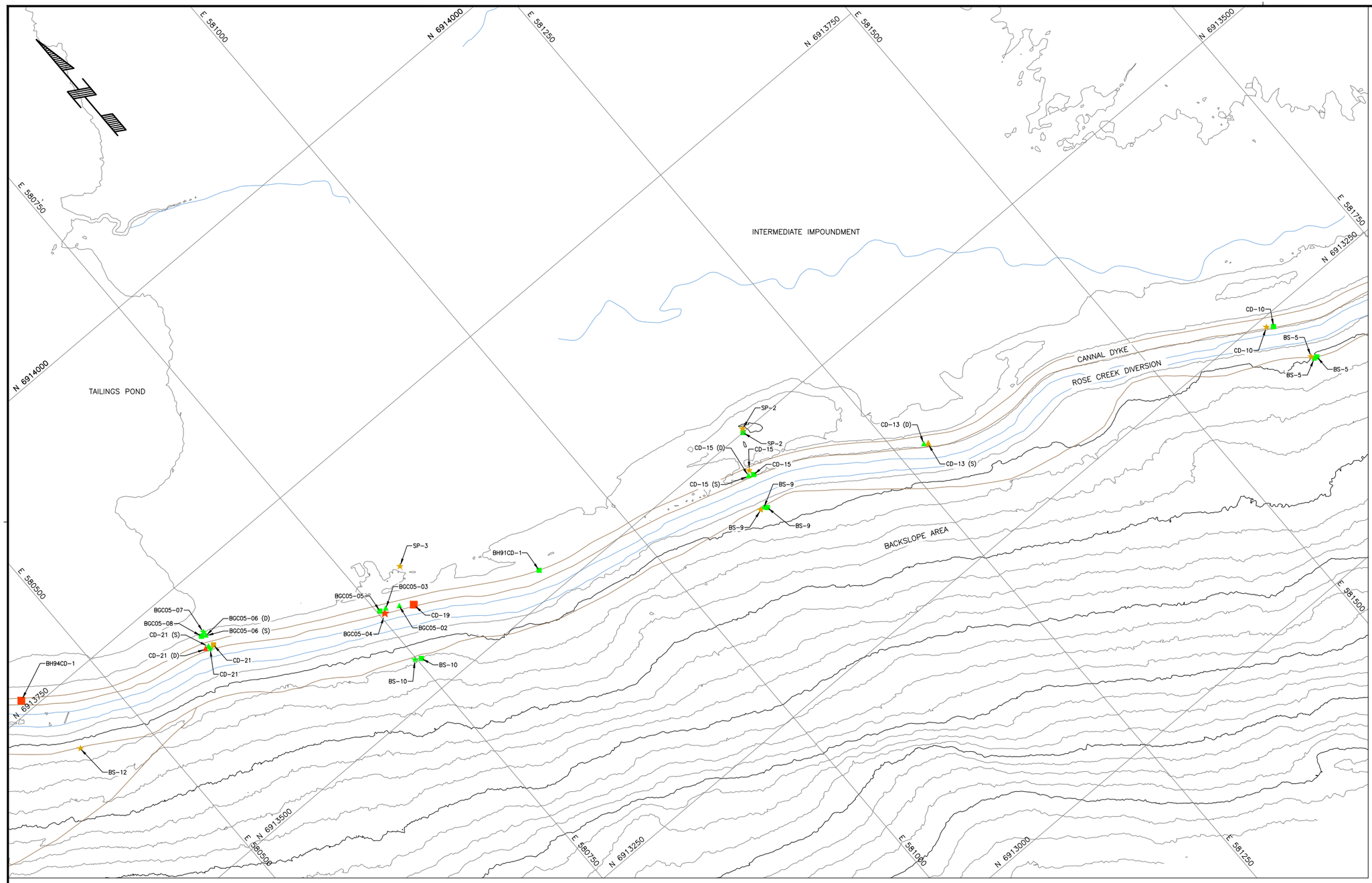
TITLE: CROSS VALLEY & INTERMEDIATE DAMS INSTRUMENTATION

PROJECT No. M09770A06

FIG. No. III-1

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PLAN
SCALE A

SCALE A 0 100 m

LEGEND

- STANDPIPE PIEZOMETER
- PNEUMATIC PIEZOMETER
- INCLINOMETER
- THERMISTERS
- FUNCTIONING INSTRUMENT
- QUESTIONABLE INSTRUMENT
- DEFUNCT INSTRUMENT

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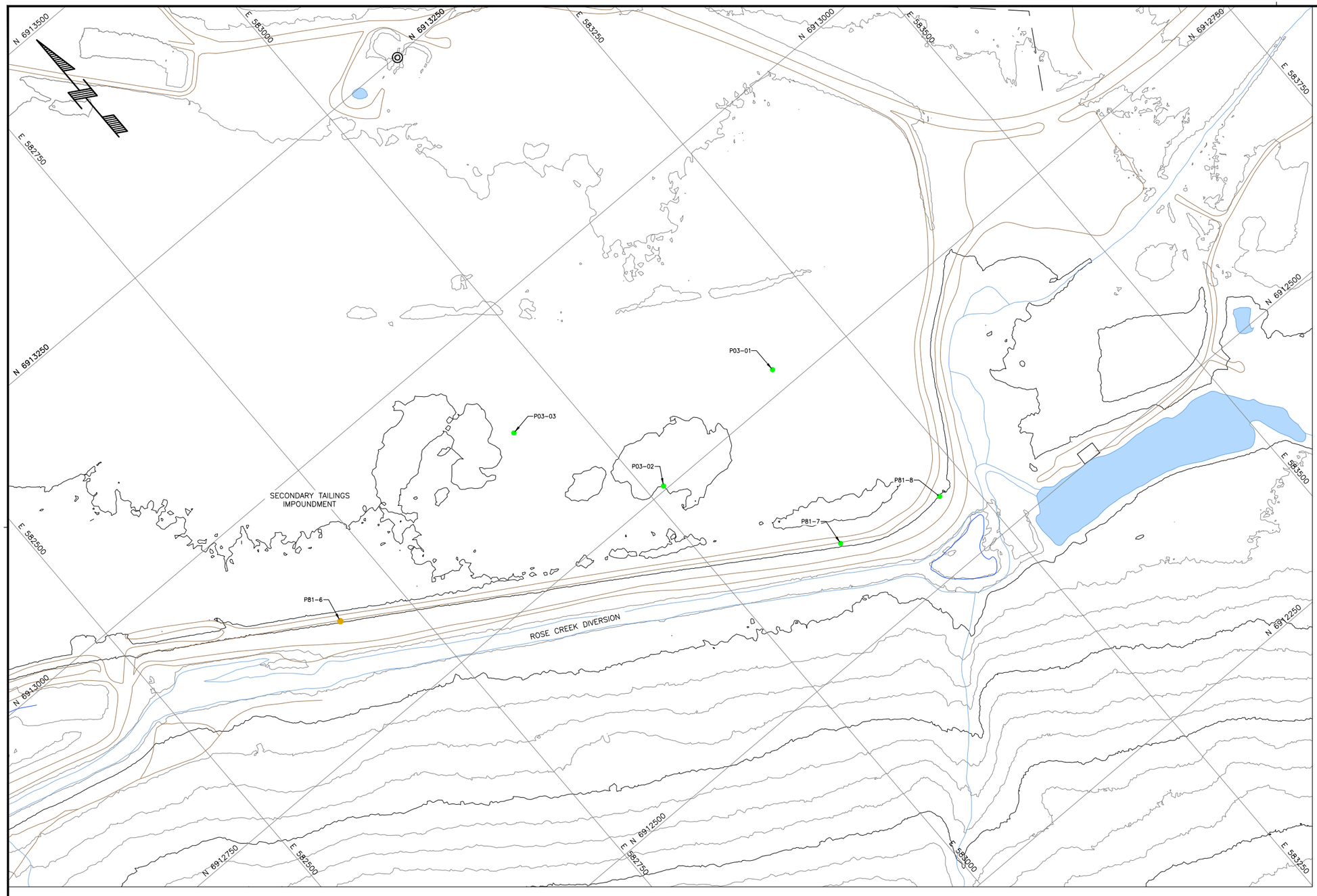
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PROJECT No. M09770A06

FIG. No. III-2

KCB-R-MLD

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PLAN
SCALE A

SCALE A 0 100 m

LEGEND

- STANDPIPE PIEZOMETER
- FUNCTIONING INSTRUMENT
- QUESTIONABLE INSTRUMENT
- DEFUNCT INSTRUMENT

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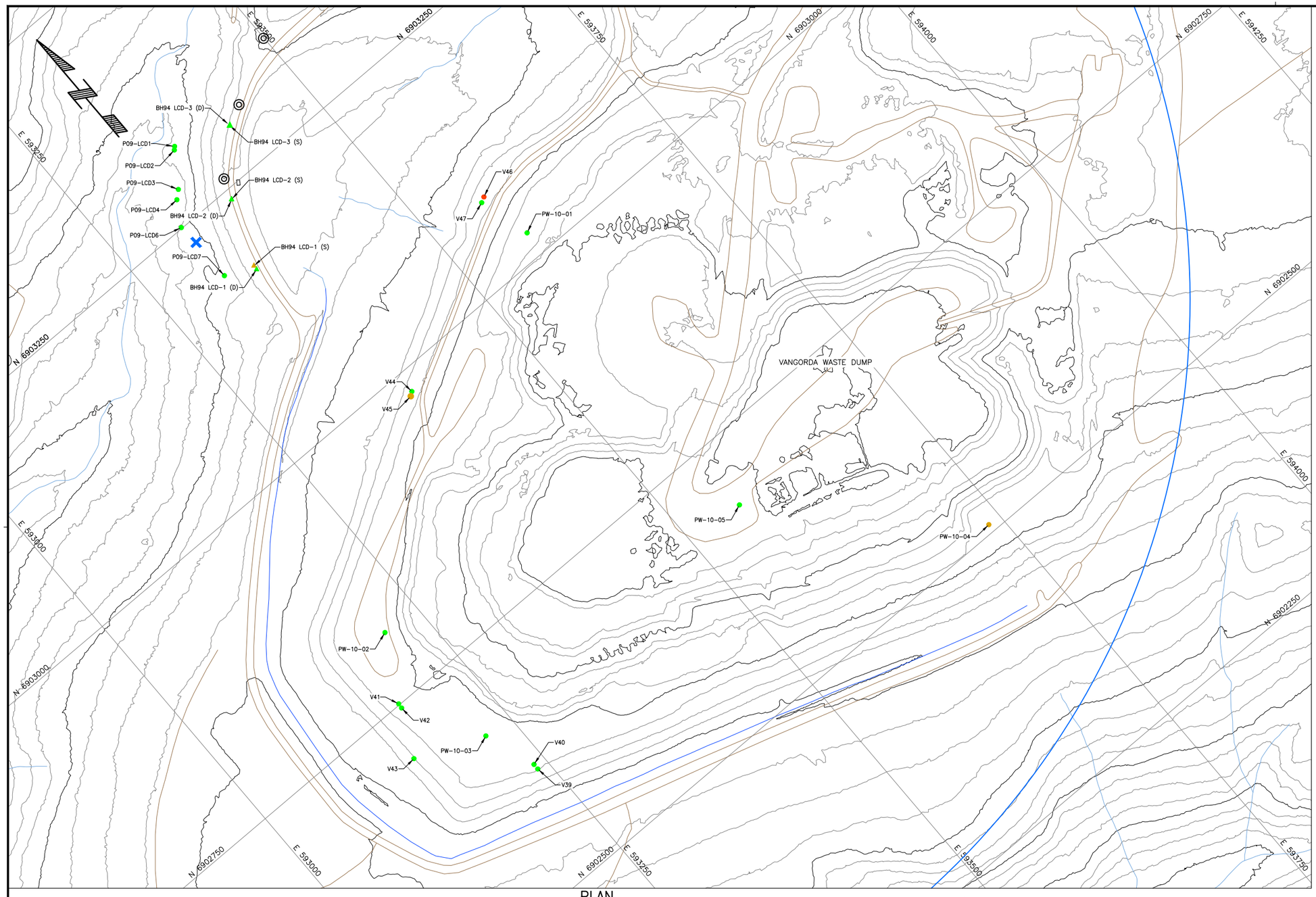
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PROJECT No. M09770A06

FIG. No. III-3

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PLAN
SCALE A

SCALE A 0 100 m

LEGEND

- STANDPIPE PIEZOMETER
- PNEUMATIC PIEZOMETER
- FUNCTIONING INSTRUMENT
- QUESTIONABLE INSTRUMENT
- DEFUNCT INSTRUMENT
- RECOMMENDED INCLINOMETER

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PROJECT: FARO MINE COMPLEX
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TITLE: LITTLE CREEK & VANGORDA WASTE ROCK DUMP INSTRUMENTATION

PROJECT No. M09770A06

FIG. No. III-4

KCB-R-MLD

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