

**NORTH AMERICAN METALS CORP.
GOLDEN BEAR MINE**



**TAILINGS STORAGE FACILITY AND HEAP LEACH FACILITIES
REPORT ON 2014 DAM SAFETY INSPECTION**

PREPARED FOR:

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Knight Piésold
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NORTH AMERICAN METALS CORP. GOLDEN BEAR MINE

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EXECUTIVE SUMMARY

The Golden Bear Mine, located in northwestern British Columbia approximately 100 km west of the Town of Dease Lake, was closed in 2001, and the closure and reclamation activities were completed in 2004. The previous geotechnical inspection was completed in 2009 by Knight Piésold Ltd. North American Metals Corp. (NAMC) requested that Knight Piésold Ltd. conduct the 2014 dam safety inspection for the reclaimed tailings storage facility and two heap leach facilities as part of the scheduled post closure geotechnical inspections.

The Tailings Storage Facility, and the Fleece Bowl and Totem Creek Heap Leach Facilities were inspected on September 10, 2014. The findings of the 2014 dam safety inspection were as follows:

Tailings Storage Facility

- No signs of instability or surface erosion were observed at the reclaimed facility.
- The surface runoff and groundwater drainage/collection systems were operating as designed.

The consequence category (classification) of the tailings dam has been previously classified as LOW for dams defined by the Canadian Dam Association (CDA) “Dam Safety Guidelines” (published 1999). This was based on the potential consequence of failure and the consequence categories. There have been no physical changes that would necessitate a revision of the consequence category. However, a revised version of the Canadian Dam Association (CDA) “Dam Safety Guidelines” was published in 2007 and updated in 2013. This document includes changes to the dam classification and associated design earthquake and flood events. The dam classification for the Golden Bear mine tailings facility has been reassessed using the revised 2013 Guidelines and the tailings dam remains in the LOW consequence category.

The Golden Bear Mine tailings dam falls under the Closure – Passive Care Phase using the new CDA Technical Bulletin Safety Guidelines for Mining Dams. The dam is considered to be in a stable state condition and sufficient experience has been gained with the structure and sufficient monitoring completed to demonstrate no further intervention is required by NAMC. The dam is in a passive state and does not have operating personnel on site or regular surveillance. The current closure design satisfies the target levels for flood hazard and earthquake hazards for a LOW dam classification outlined in the CDA Technical Bulletin.

Fleece Bowl Heap Leach Facility

- No signs of instability or surface erosion were observed.
- The V-Notch outlet drain and foundation drainage system were operating as designed.

Totem Creek Heap Leach Facility

- No signs of instability or surface erosion were observed.
- The V-Notch outlet drain and foundation drainage system were operating as designed.

The three facilities were observed to be in a good condition with no geotechnical issues. The next geotechnical inspection is scheduled for the summer or fall of 2019.

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ACRONYMS AND ABBREVIATIONS

BC	British Columbia
CDA	Canadian Dam Association
HDPE	High Density Polyethylene
KP	Knight Piésold Ltd.
LCRS	Leachate Collection and Recovery System
NAMC	North American Metals Corp.
PMF	Probable Maximum Flood

LIST OF UNITS AND SYMBOLS

km	Kilometre
m ³	Cubic metres
masl	Metres above sea level
mil	Thousandth of an inch
US gpm	US gallons per minute

1 – INTRODUCTION

1.1 PROJECT DESCRIPTION

The Golden Bear Mine, located in northwestern British Columbia approximately 100 km west of the Town of Dease Lake, was closed in 2001, and the closure and reclamation activities were essentially completed in 2004. The previous geotechnical inspection was completed in 2009. North American Metals Corp. (NAMC), a subsidiary of Goldcorp Inc., retained Knight Piésold Ltd. (KP) to complete the 2014 dam safety inspection for the reclaimed tailings storage facility and two heap leach facilities as part of the periodic post closure dam safety inspections. The location of the Golden Bear Mine is shown on Figure 1.1.

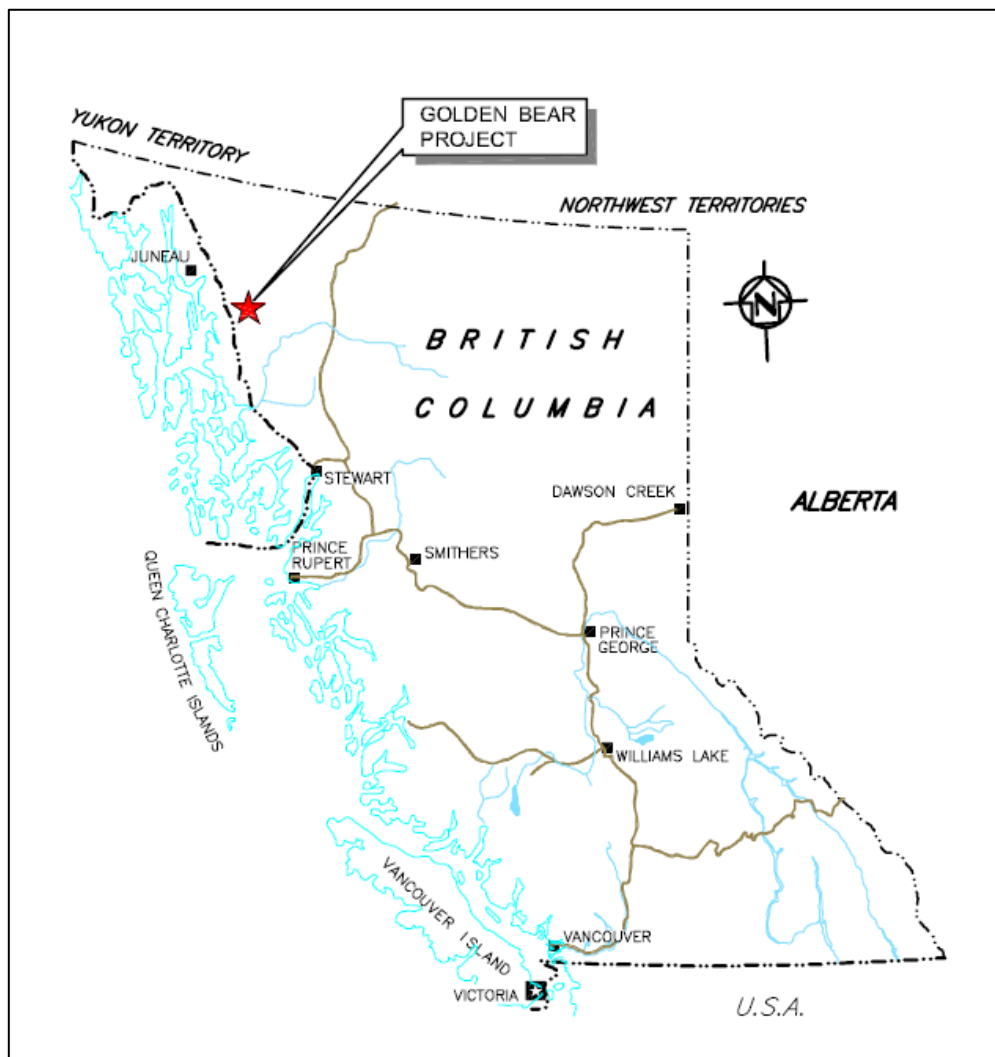


Figure 1.1 Project Location

The general arrangement for the site is shown on Figure 1.2.

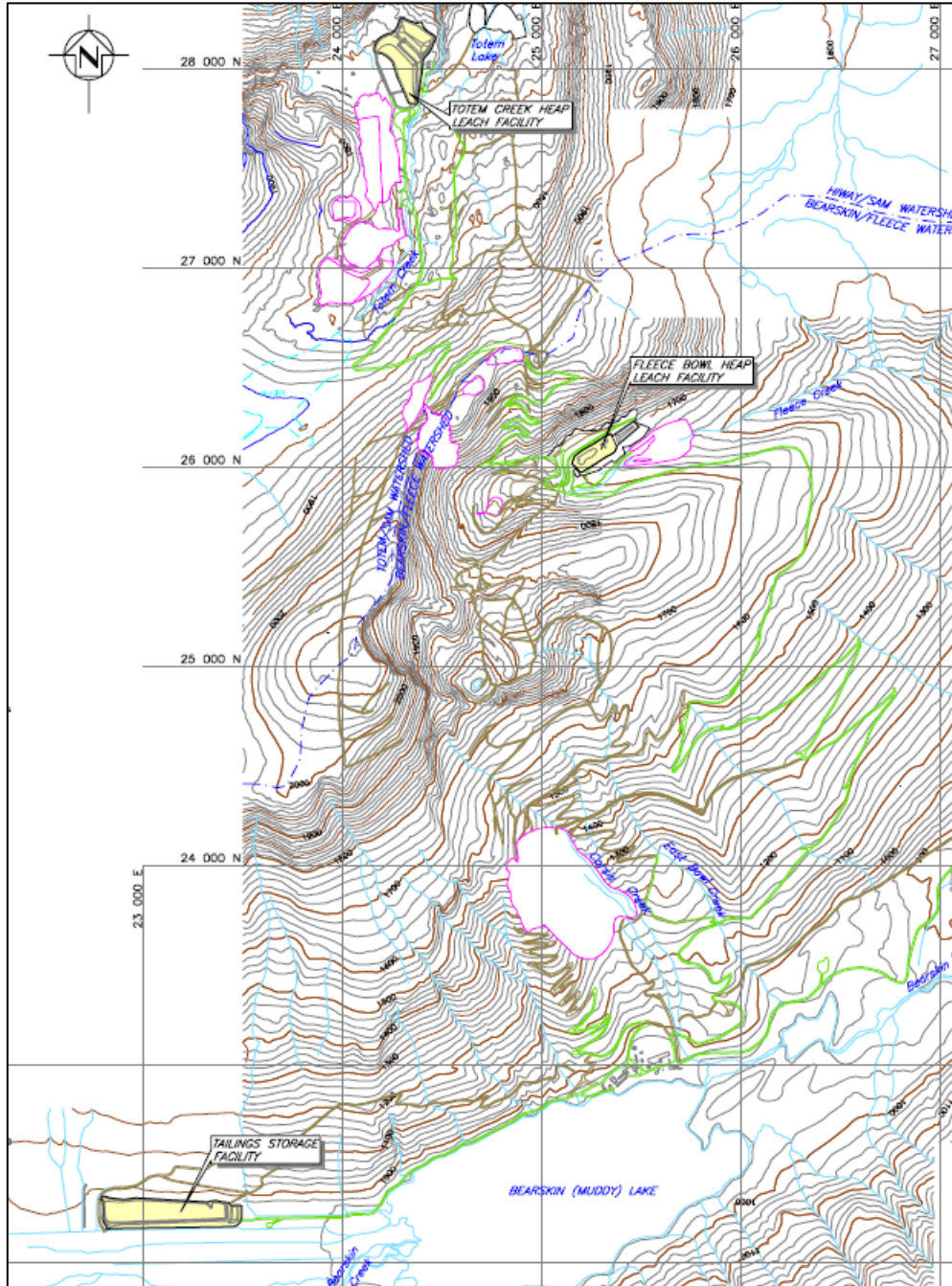


Figure 1.2 Site General Arrangement

The dam safety inspection has been conducted to meet the guidelines issued by the Ministry of Energy and Mines date August 2013. The inspection report is based on information contained in previous KP reports on the project, and on observations made by Mr. Bruno Borntraeger P.Eng. of Knight Piésold during a site visit on September 10, 2014.

This 2014 dam safety inspection report describes the current conditions of the various components of the tailings storage facility, and the Fleece Bowl and Totem Creek heap leach facilities. Selected site photographs are attached as Appendix A. Relevant drawings are provided in Appendix B.

1.1 RELEVANT DOCUMENTS

The following documents are referred to, or are relevant and should be read in conjunction with this report:

- “Tailings Storage Facility and Heap Leach Facilities Report on 2009 Annual Inspection, Ref No. VA101-65/6-1” dated November 30, 2009.
- “Tailings Storage Facility and Heap Leach Facilities Report on 2007 Annual Inspection, Ref No. VA101-65/5-1” dated November 22, 2007.
- “Tailings Storage Facility, Report on 2005 Annual Inspection, Ref. No. VA101-65/4-1” dated March 23, 2006.
- “Tailings Storage Facility and Heap Leach Facilities, Report on 2004 Closure Construction Activities, Ref. No. VA101-65/3-1” dated February 11, 2005.
- “Tailings Storage Facility and Heap Leach Facilities, Report on 2003 Closure Construction Activities, Ref. No. VA101-65/2-2” dated March 16, 2004.
- “Tailings Storage Facility and Heap Leach Facilities, Closure Design Report, Ref. No. VA101-65/2-1” dated July 11, 2003.
- “Tailings Storage Facility Closure Design Report, Ref. No. 11154/21-1” dated June 30, 2000.

2 – TAILINGS STORAGE FACILITY

2.1 FACILITY OVERVIEW

The Tailings Storage Facility (TSF) at the Golden Bear Mine is located in an accreting braided alluvial flood plain of Bearskin Creek upstream of Bearskin Lake as shown on Figure 1.2. This TSF was originally designed for eight stages of construction to an elevation of 990.0 metres. The initial construction of the TSF was carried out during the summer of 1989, with Stage II constructed to elevation 974.5 metres in 1991, Stage III to elevation 977.25 metres in 1992 and Stage IV to elevation 979.5 metres in 1993. Tailings deposition into the impoundment ceased in September 1994. Treated heap leach facility solutions were discharged seasonally into the TSF from 1997 to 2002.

The TSF consists of a three-sided embankment adjacent to the valley slope and utilizes construction materials from an alluvial fan deposit immediately to the west of the facility. The TSF includes the following basic items:

- A compacted soil embankment, enclosing an area approximately 650 metres long by 130 metres wide.
- A compacted soil liner beneath a sand and gravel drainage layer containing perforated pipes that drain to the decant tower.
- A decommissioned decant tower.
- An overflow closure spillway.
- Drainage ditches and sub-surface drains to collect, control and divert surface and sub-surface flows around the facility.
- A surface capping of alluvial material over the tailings to eliminate tailings dusting.

Vibrating wire piezometer instrumentation was initially installed to monitor construction pore pressures and consolidation of the tailings mass. The piezometer monitoring was stopped in 1997 as no construction activity or tailings deposition had occurred since 1994, and the dam was found to be stable for post-closure conditions.

2.2 CLOSURE ACTIVITIES

Closure and reclamation work at the TSF commenced in 2000 and included the following items:

- Construction of tailings surface covers from the alluvial fan deposit and a thin layer of growth medium.
- Removal of the polishing pond.
- Construction of the overflow closure spillway.
- Placement of large riprap boulders in a trench along the northwest toe of the dam for erosion protection.
- Removal of the decant pipework and valves as well as filling the decant tower with concrete.
- Placement of large boulders at the outlet of the groundwater outlet pipes for erosion protection.
- Removal of the pump house and associated pipes and pipeworks.

In 2004, the groundwater interceptor ditches were backfilled with materials obtained from the alluvial fan and from re-grading of the airstrip. Swales were constructed across the airstrip to divert surface water runoff to the low point in the flood plain and away from the tailings embankment toe.

2.3 2014 ANNUAL INSPECTION

The as-built layout and cross sections for the TSF closure are shown on Drawing 11154-21-001. The closed facility was previously inspected in 2003, 2004, 2005, 2007 and 2009 following the proposed schedule outlined to the ministry in 2003. Pertinent observations regarding the condition of the current TSF were made during the 2014 TSF annual inspection. Selected site photos are presented in Appendix A (Photographs 1 to 6), and major findings from the 2014 inspection are highlighted below:

- No signs of instability, such as cracks or deformation were observed in the embankment crest and fill slopes or the cover capping material.
- Limited surface runoff from the north slope flows onto the closure cover and infiltrates into the tailings pile and is subsequently collected in the groundwater drainage system. The cover remains dry and firm, and vegetation has established on the surface.
- No signs of erosion from surface water runoff were noted at the entire facility.
- No evidence of flow through the overflow spillway was noted.
- The groundwater outlet pipes continue to discharge into the open channel. The flow was visually estimated at 250 to 400 US gpm during the inspection.
- The slope above the TSF where an avalanche had deposited woody debris on the tailings cover (noted in the 2009 inspection) has re-vegetated.
- Beavers have worked their way up from Bearskin Lake and dammed off the stream diversion ditch backing up the water level in the ditch to the groundwater drain outlet and establishing a swamp that had been drained for tailings facility construction.

In summary, the TSF was observed to be in good condition with no geotechnical issues outstanding.

2.4 DAM PERFORMANCE REVIEW

The consequence (hazard) category of the tailings dam has been previously assessed as “LOW” based on the potential consequence of failure and the consequence categories for dams (defined by the Canadian Dam Association “Dam Safety Guidelines”, 1999). The potential for loss of life, and the environmental and socio-economic impacts following a failure of the tailings dam are low. Therefore, a “LOW” consequence category was assigned for the TSF dam at the Golden Bear Mine.

Previous design studies have adopted the 1 in 1,000 return period design earthquake for seismic stability and the Probable Maximum Flood (PMF) storm event for water management requirements. These extreme events satisfy the design requirements for a “LOW” consequence classification dam. The closure spillway was designed and constructed to accommodate runoff from the 24-hour Probable Maximum Precipitation storm event. The static and seismic stability of the tailings embankment is satisfactory.

There have been no physical changes that would necessitate a revision of the consequence category. However, a revised version of the Canadian Dam Association (CDA) “Dam Safety Guidelines” was published in 2007 and updated in 2013. This document includes changes to the dam classification and associated design earthquake and flood events. The dam classification for the Golden Bear mine tailings facility has been reassessed using the revised 2013 Guidelines and the tailings dam remains in the LOW consequence category.

The CDA issued a Technical Bulletin in October 2014 to provide dam safety guidance for Mining Dams. This technical bulletin was reviewed as part of this dam safety inspection. The Golden Bear Mine tailings dam falls under the Closure – Passive Care Phase using the new Technical Bulletin Safety Guidelines for Mining Dams. The dam is considered to be in a stable state condition and sufficient experience has been gained with the structure and sufficient monitoring completed demonstrating no further intervention is required by NAMC. The dam is in a passive state and does not have operating personnel on site or regular surveillance. The closure design satisfies the target levels for flood hazard and earthquake hazards for a LOW dam classification outlined in this Technical Bulletin.

3 – FLEECE BOWL HEAP LEACH FACILITY

3.1 FACILITY OVERVIEW

The Fleece Bowl Heap Leach Facility is situated at the headwaters of the Fleece Creek Valley as shown on Figure 1.2. The seasonal heap leach operation commenced in 1997 and continued to produce gold until 2001. The Fleece Bowl Heap Leach Facility included the following design features:

- Foundation drainage systems within the natural ground in areas where springs or seeps were encountered.
- Shaping of the site to enhance drainage towards the collection sump.
- Zoned earthfill confining embankments.
- A leach pad pore volume storage capacity of 11,000 m³.
- An engineered liner system consisting of an 80 mil HDPE inner liner, geonet LCRS, and an 80 mil HDPE outer liner.
- An overliner layer consisting of screened crushed ore.
- A solution collection sump and a network of solution collection pipes.
- An events pond sized for 14,000 m³ of solution storage.
- An events pond liner system consisting of an 80 mil HDPE geomembrane overlying 300 mm of lower permeability soil liner.
- Diversion ditches directed around the facility into natural drainage courses.

3.2 CLOSURE ACTIVITIES

The Fleece Bowl Heap Leach Facility has been closed and reclaimed as a free draining, hydraulically stable pile since 2003. The facility has previously been rinsed and reclaimed by perforating the liner system. The exposed geomembrane at the Fleece Bowl leach pad was cut and buried. A V-notch drainage channel was constructed at the sump during the summer of 2003. This involved excavating a channel through the confining embankment and removing a portion of the geosynthetic liner system. The V-Notch channel was then backfilled with a graded filter to provide a self-draining pathway out of the heap through a chute and plunge pool lined with boulders into a natural drainage course.

The Fleece Bowl Events Pond was reclaimed during the summer of 2003. The HDPE geomembrane was folded down into the bottom of the pond and the downstream confining embankment was graded into the pond, burying the geomembrane. The surface was then re-graded to a gentle slope to produce a naturally free-draining slope that blended into the surrounding landscape.

3.3 2014 ANNUAL INSPECTION

The as-built details of the Fleece Bowl Heap Leach Facility V-Notch channel were previously shown on Drawing 101-65/2-030. The closure construction activities at the Fleece Bowl Heap Leach Facility were previously inspected in 2003 and 2004, during and after reclamation. The facility has been reclaimed in accordance with the construction drawings and satisfied the design objectives. A geotechnical inspection was completed in 2009. Relevant observations regarding the performance of the closed Fleece Bowl Heap Leach Facility were made during the 2014 dam safety inspection. Selected photographs (Photographs 7 to 12) of the reclaimed Fleece Bowl Heap Leach Facility and

the re-graded Events Pond are presented in Appendix A. Major findings from the 2014 inspection are highlighted below:

- No signs of instability were observed in the crest and slopes of the heap leach facility.
- No signs of erosion from surface water runoff were noted at the reclaimed heap leach facility, crest, slopes or regarded water storage dam area.
- The V-Notch outlet drain functions well and satisfies the closure design objectives. The discharge flow was visually estimated at 5 to 10 US gpm during the inspection.

The reclaimed Fleece Bowl Heap Leach Facility was observed to be in a good condition with no geotechnical issues.

4 – TOTEM CREEK HEAP LEACH FACILITY

4.1 FACILITY OVERVIEW

The Totem Creek Heap Leach Facility is located at a relatively broad plateau as shown on Figure 1.2. The seasonal heap leach operation commenced in 1997 and closed in 2001. The Totem Creek Heap Leach Facility has similar design features to the Fleece Bowl Heap Leach Facility as follows:

- Foundation drainage systems within the natural ground in areas where springs or seeps were encountered.
- Shaping of the site to enhance drainage towards the collection sump.
- Zoned earthfill confining embankments.
- A leach pad pore volume storage capacity of 16,000 m³.
- An engineered liner system consisting of a 60 mil HDPE inner liner, geonet LCRS, and a 60 mil HDPE outer liner.
- An overliner layer consisting of selected free draining ore.
- A solution collection sump and a network of solution collection pipes.
- An events pond sized for 40,500 m³ of solution storage.
- An events pond liner system consisting of a 60 mil HDPE geomembrane overlying 300 mm of lower permeability soil liner.
- Diversion ditches directed around the facility into natural drainage course.

4.2 CLOSURE ACTIVITIES

Closure construction activities at the Totem Creek Heap Leach Facility included burying the exposed geomembrane around the perimeter of the heap with either random fill or rinsed leach ore. The overflow spillway was relocated to the north side of the facility and lined with boulders for erosion protection and to maintain an overflow spillway after the removal of the events pond. The V-notch excavation and closure drainage system for the heap was completed in 2004.

The Totem Creek Events Pond was reclaimed during the summer of 2004. The HDPE geomembrane was folded down into the bottom of the pond and the downstream confining embankment was graded into the pond burying the geomembrane. The surface was then re-graded to a gentle slope to produce a naturally free draining slope that blended into the surrounding landscape.

4.3 2014 ANNUAL INSPECTION

The closure construction activities at the Totem Creek Heap Leach Facility were inspected during reclamation in the summer of 2004. The as-built details of the Totem Heap Leach Facility V-Notch channel are shown on Drawing 101-65/2-020. A geotechnical inspection was completed in 2009. Observations regarding the performance of the closed Totem Creek Heap Leach Facility were made during the 2014 annual inspection. Selected photographs (Photographs 13 to 18) of the reclaimed Totem Creek Heap Leach Facility and the re-graded events pond are presented in Appendix A. Major findings from the 2014 inspection are highlighted below:

- No signs of instability were observed in the crest and slopes of the heap leach facility.
- No signs of erosion from surface water runoff were noted at the reclaimed heap leach facility.
- The V-Notch outlet drain functions well and satisfies the closure design objectives. The outlet flow was visually estimated at 1 to 2 US gpm during the inspection.

The reclaimed facility was observed to be in a good condition with no geotechnical issues.

5 – REFERENCES

CDA – Canadian Dam Association, (2014) “Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams”.

CDA - Canadian Dam Association, (2013), “Dam Safety Guidelines”.

CDA - Canadian Dam Association, (2007), “Dam Safety Guidelines”.

CDA - Canadian Dam Association, (1999), “Dam Safety Guidelines”.

6 – CERTIFICATION

This report was prepared, reviewed and approved by the undersigned.



Prepared:

Bruno Borotraeger Oct 20, 2014

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Project Manager

Reviewed and
Approved:

Ken Embree

Ken Embree, P.Eng.
Managing Principal

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APPENDIX A

PHOTOGRAPHS

(Pages A-1 to A-9)



PHOTO 1 – Overview of Tailings Storage Facility (Looking East)



PHOTO 2 – Reclaimed Embankment Crest (Looking West)

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PHOTO 3 – Reclaimed Tailings Facility Surface (Looking East)



PHOTO 4 – Riprap Erosion Protection along Toe of Downstream TSF Embankment Slope (Looking East)

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PHOTO 5 – Riprap Erosion Protection in TSF Spillway Channel (Looking West)



PHOTO 6 – Groundwater Discharge Point at TSF (Looking West)

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PHOTO 7 – Overview of Fleece Bowl Heap Leach Facility (Looking East)



PHOTO 8 – Fleece Bowl Heap Leach Facility V-Notch Outlet Drain in Confining Embankment (Looking West)

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PHOTO 9 – Water Flow from Fleece Bowl Heap Leach Facility V-Notch (Looking South)



PHOTO 10 – Reclaimed Water Storage Dam Area (Looking East)

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PHOTO 11 – Reclaimed Bench at Fleece Bowl Heap Leach Facility
(Looking West)



PHOTO 12 – Re-graded Fleece Bowl Events Pond Area (Looking East)

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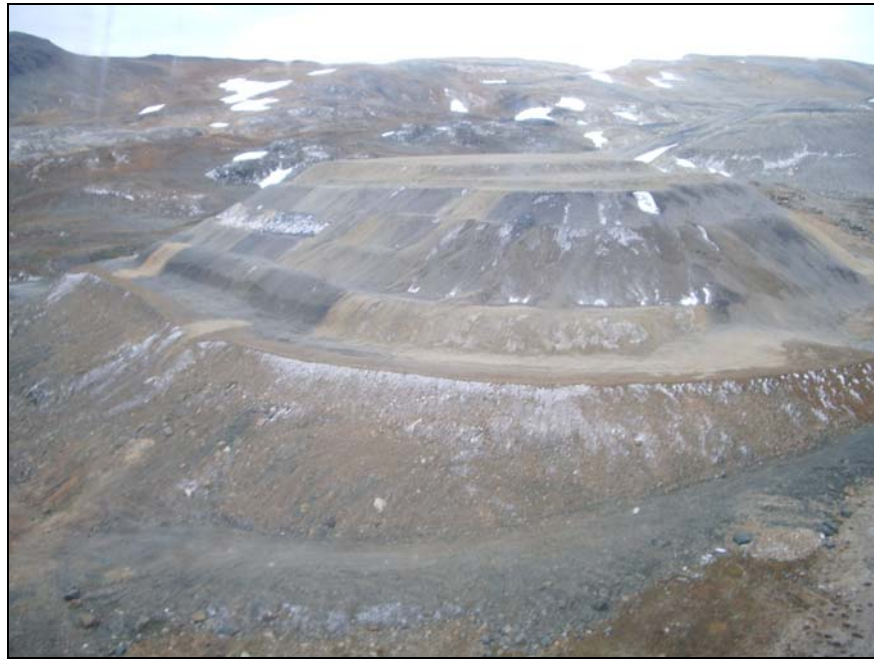


PHOTO 13 – Overview of Totem Creek Heap Leach Facility (Looking North)



PHOTO 14 – Totem Creek Heap Leach Facility V-Notch Outlet Drain in Confining Embankment (Looking South)

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PHOTO 15 – Water Flow from Totem Creek Heap Leach Facility V-Notch Outlet Drain (Looking South)



PHOTO 16 – Totem Creek Facility V-Notch Discharge Point into Existing Swale (Looking South)

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PHOTO 17 – Reclaimed Confining Embankment at Totem Creek Heap Leach Facility (Looking South)



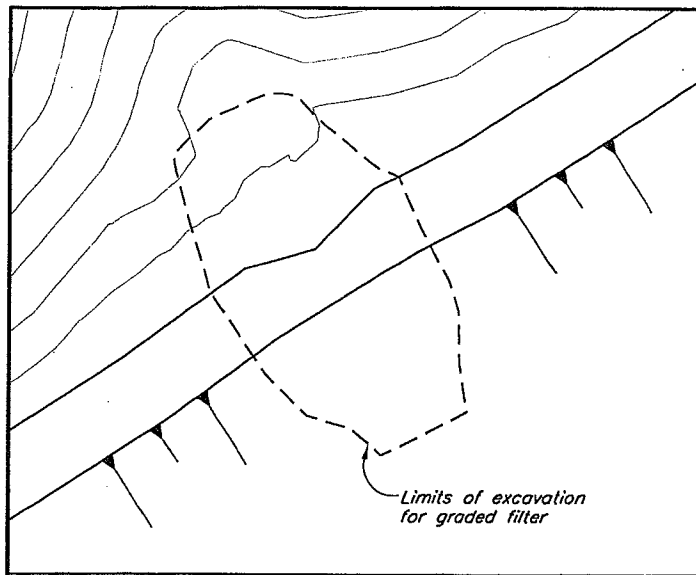
PHOTO 18 – Re-graded Totem Creek Events Pond Area (Looking Northeast)

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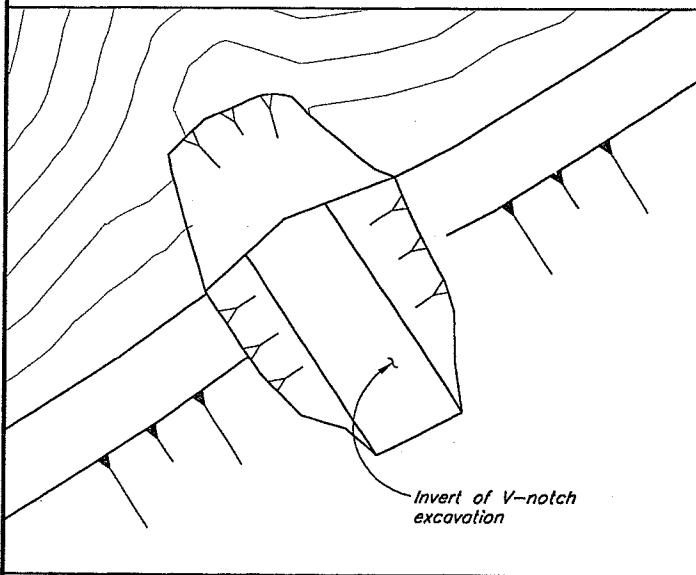
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DRAWINGS

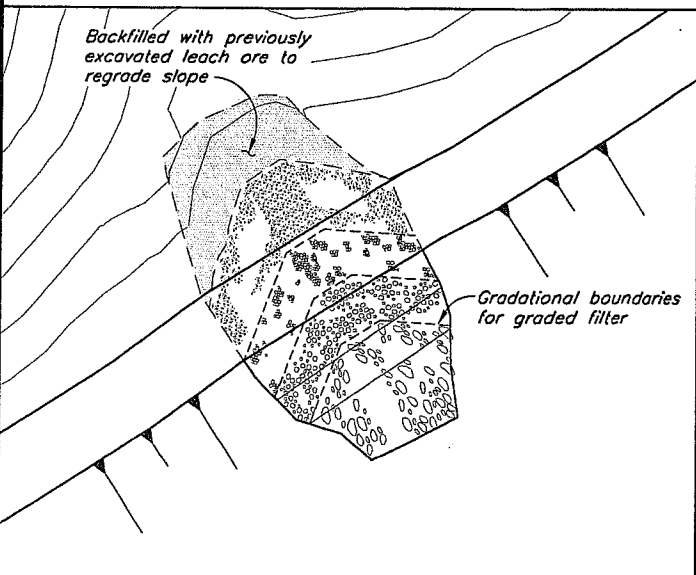
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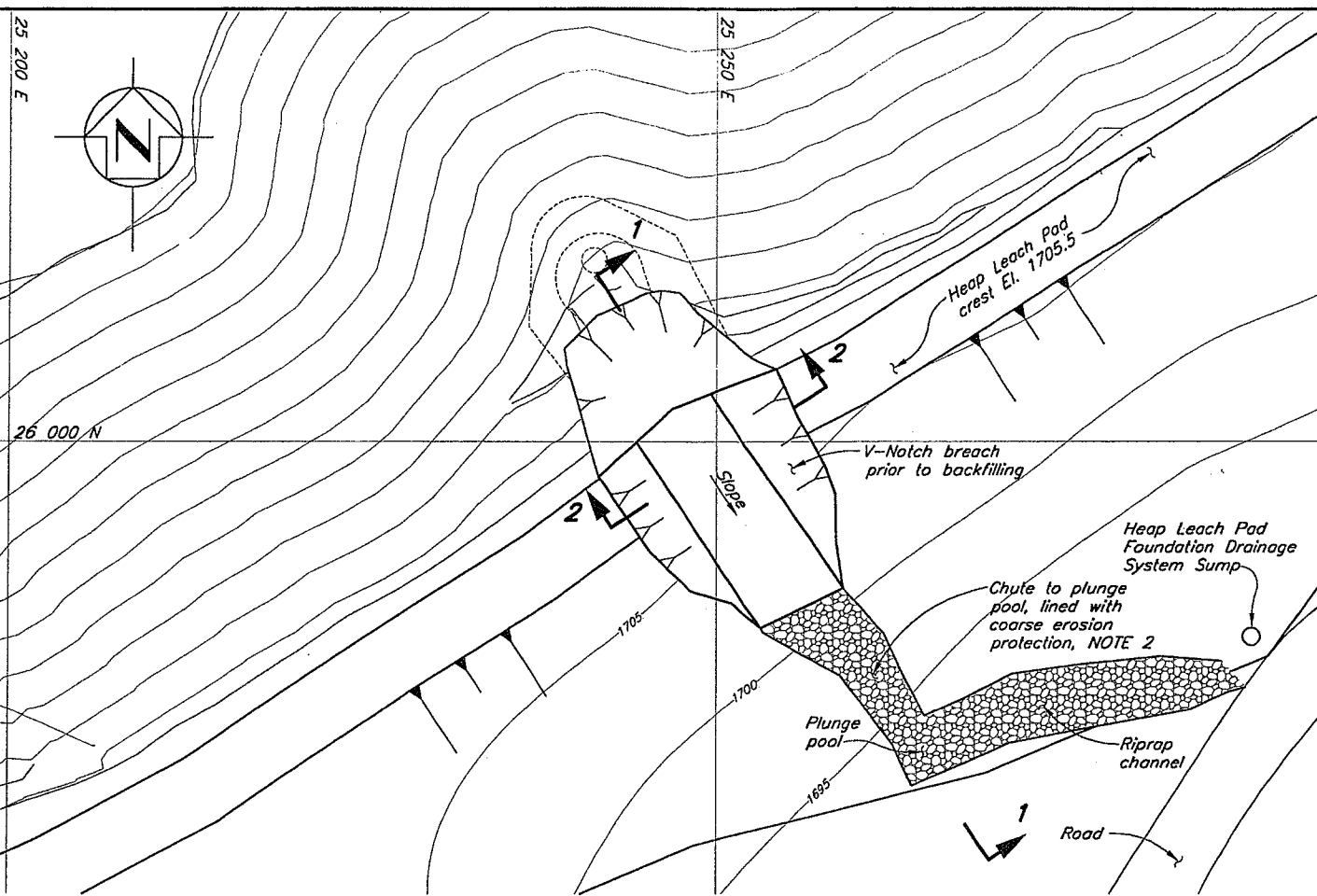
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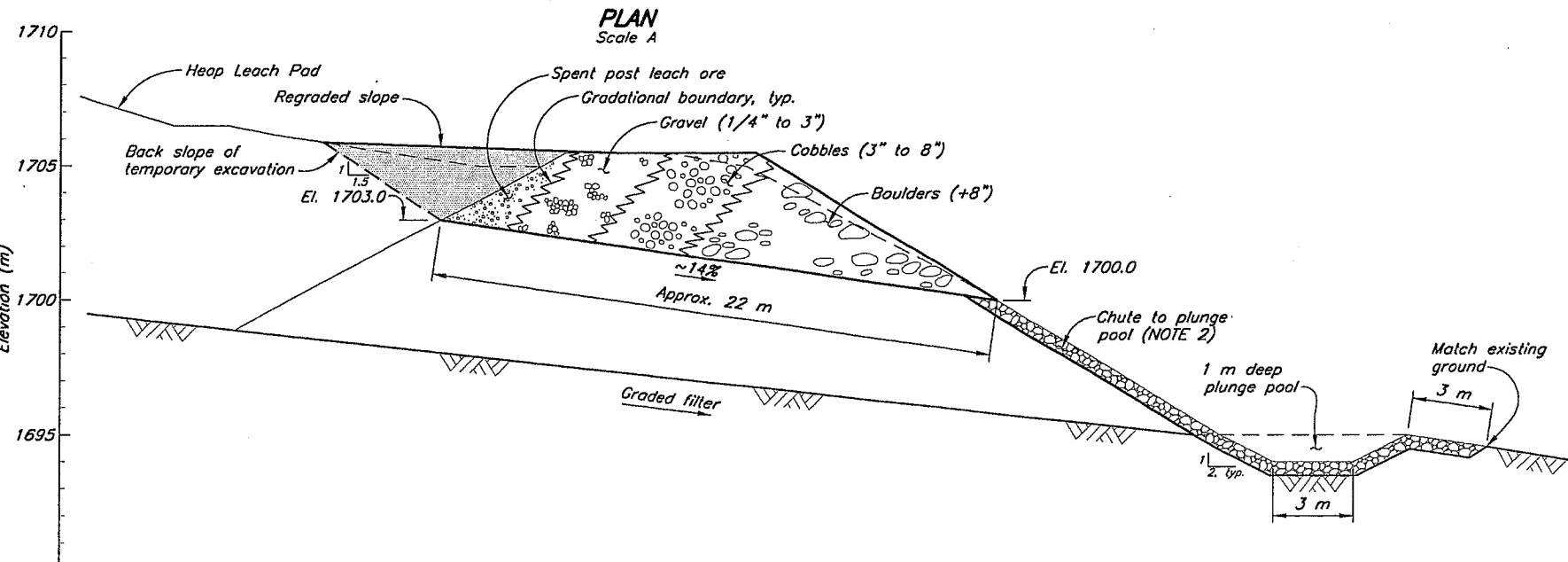
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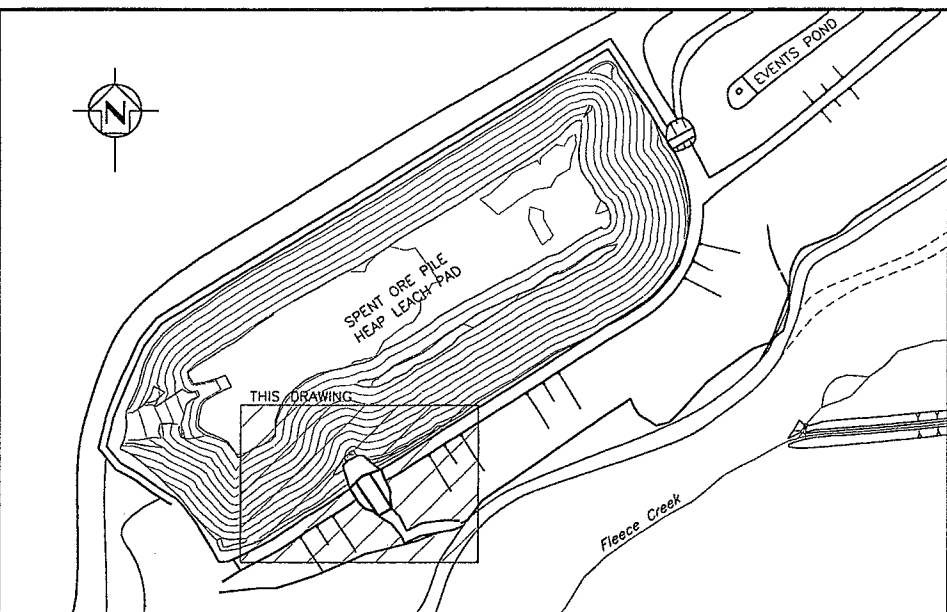
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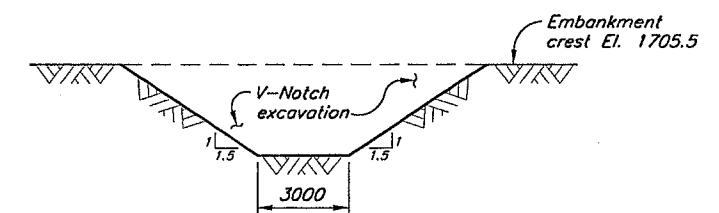
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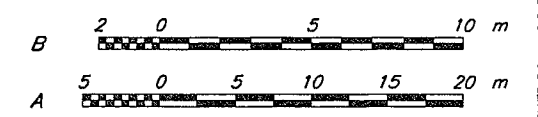
KEY PLAN
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SECTION 2
Scale B

NOTES

1. All dimensions are in millimetres and elevations in metres, unless noted otherwise.
2. Coarse erosion protection consisted of 6" to 12" dia. rock.



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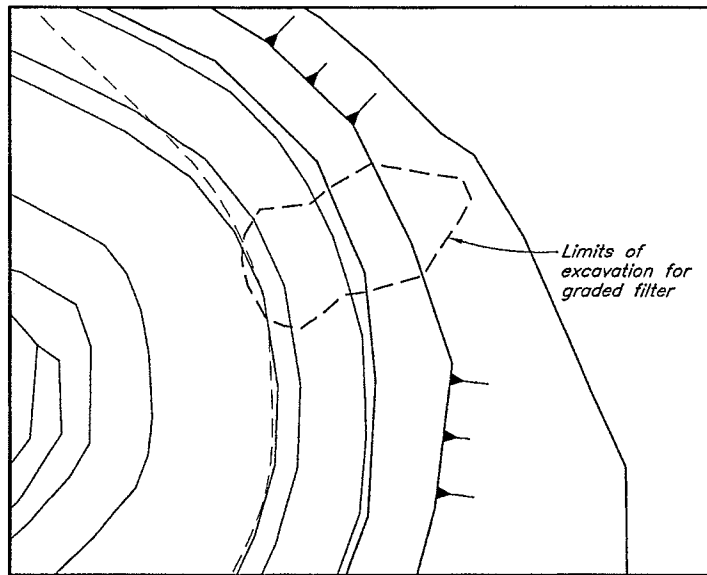
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FLEECE BOWL HEAP LEACH FACILITY
V-NOTCH BREACH
PLAN, SECTIONS & DETAILS

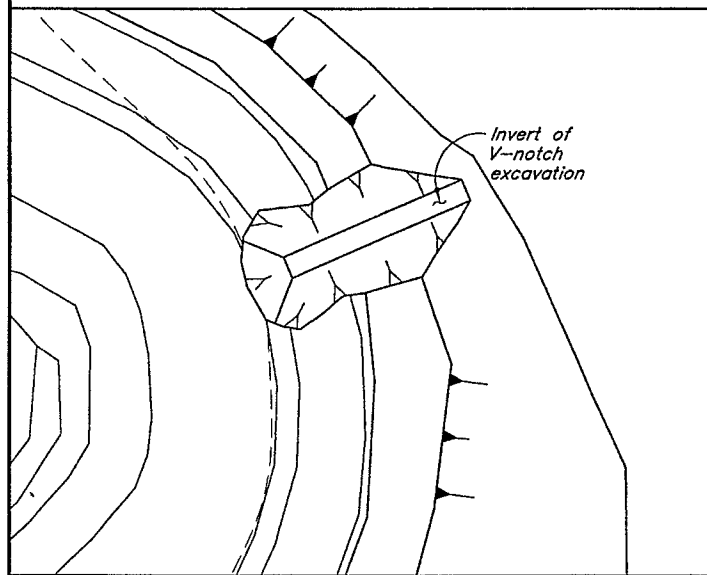
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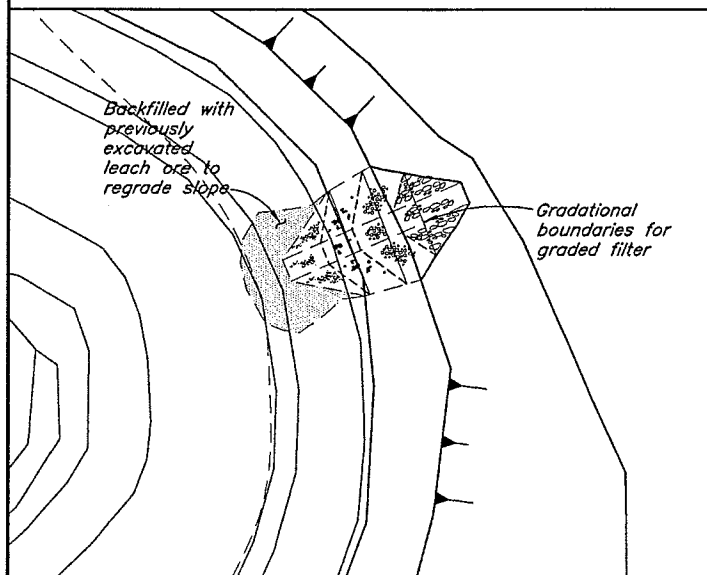
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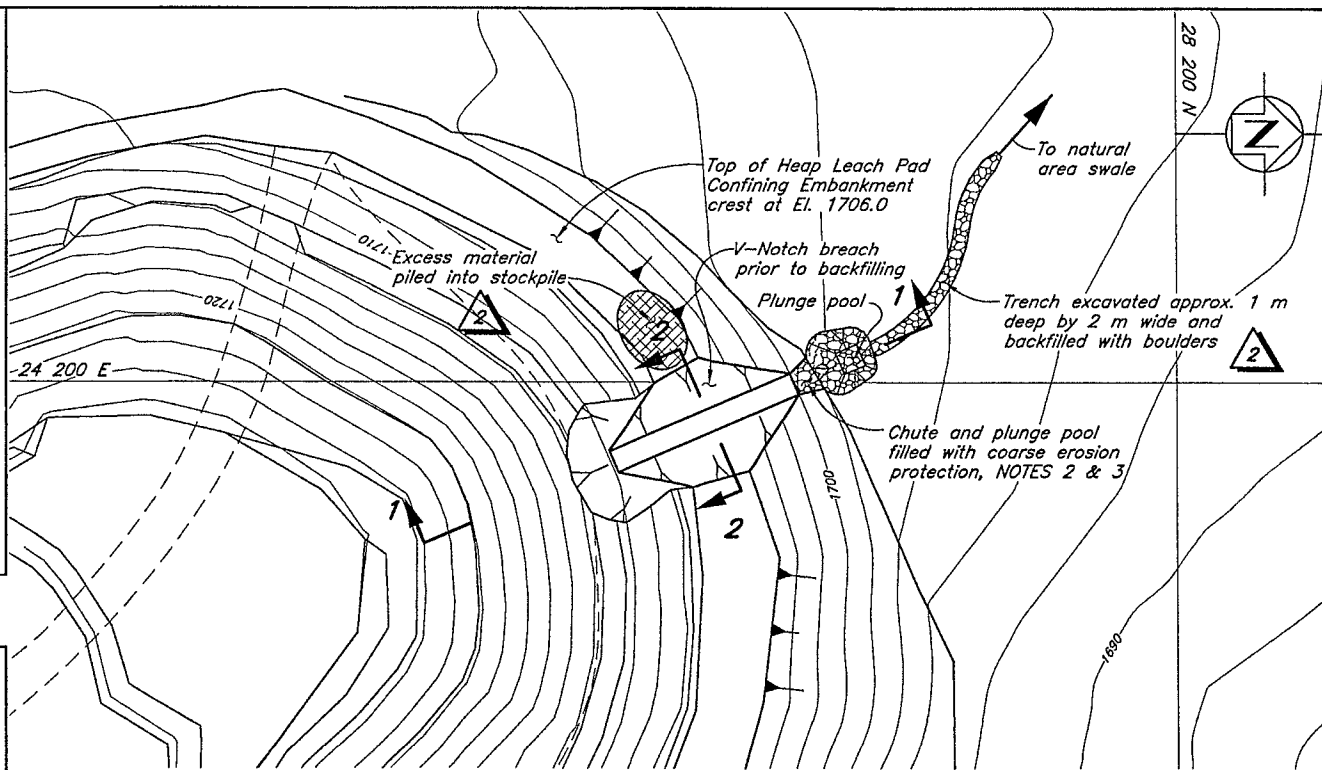
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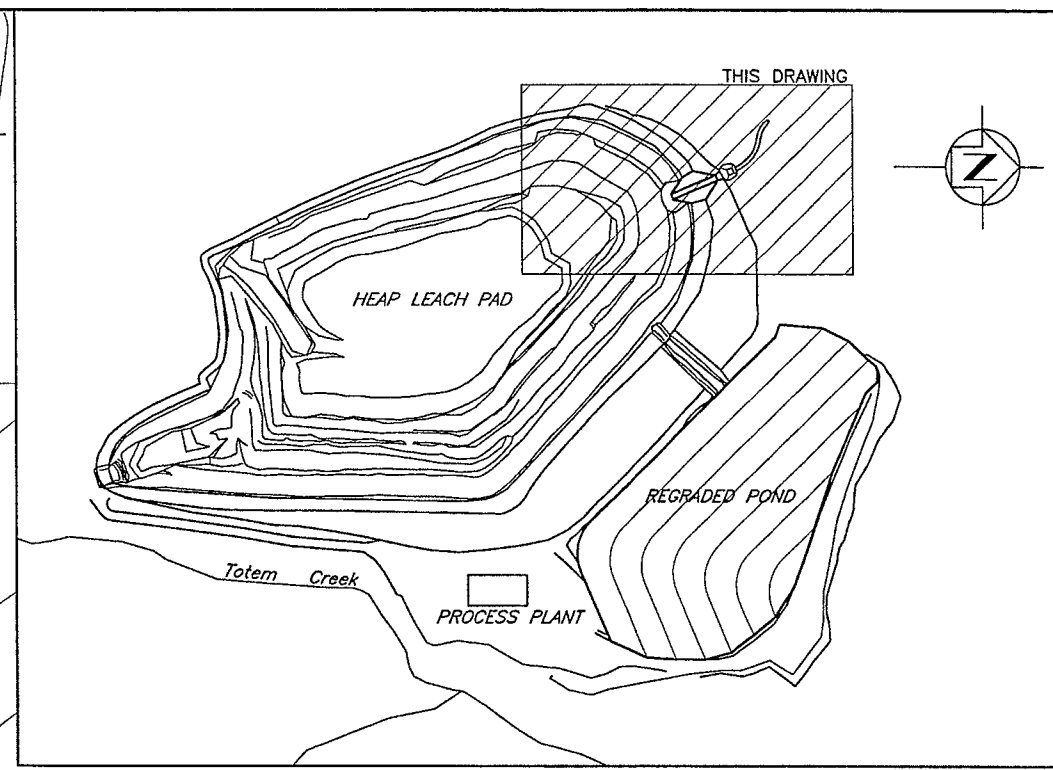
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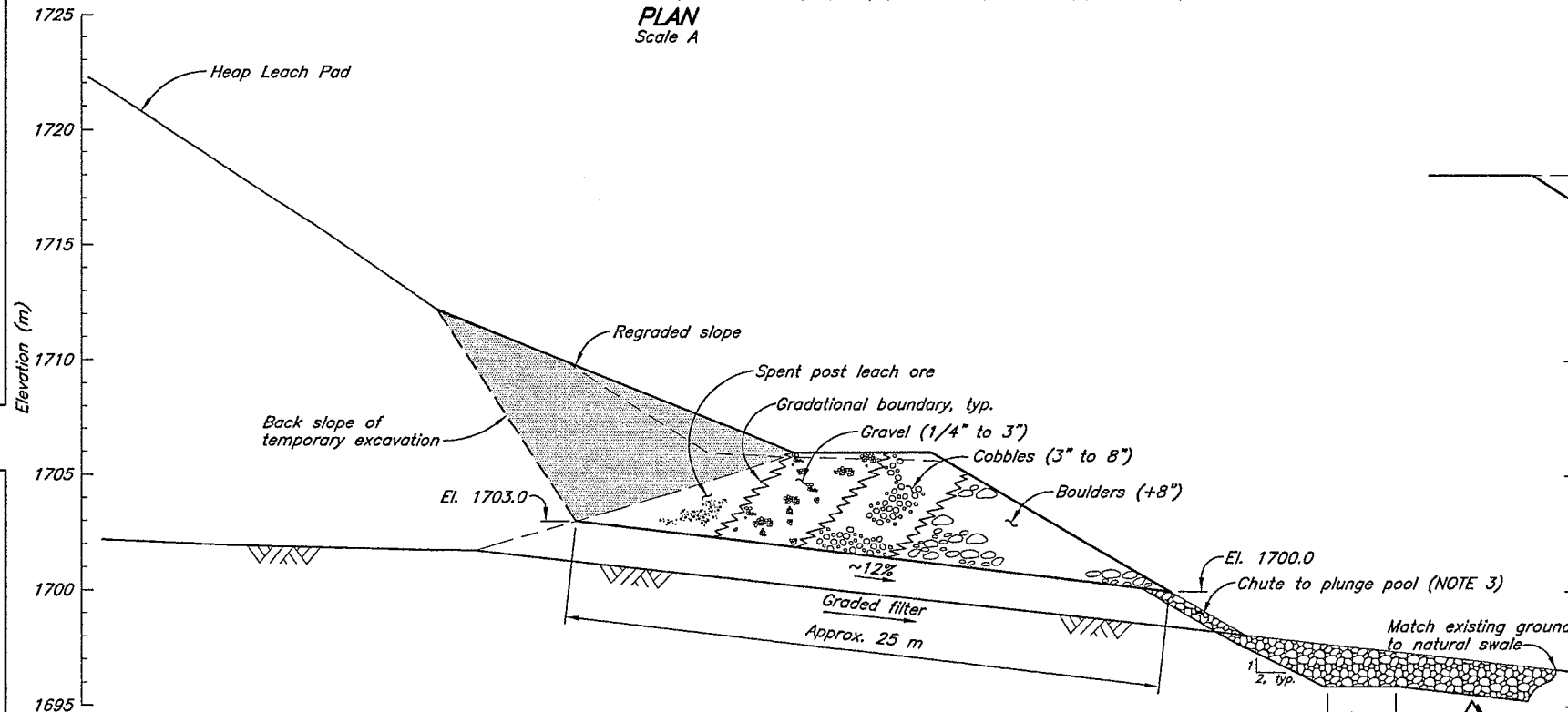
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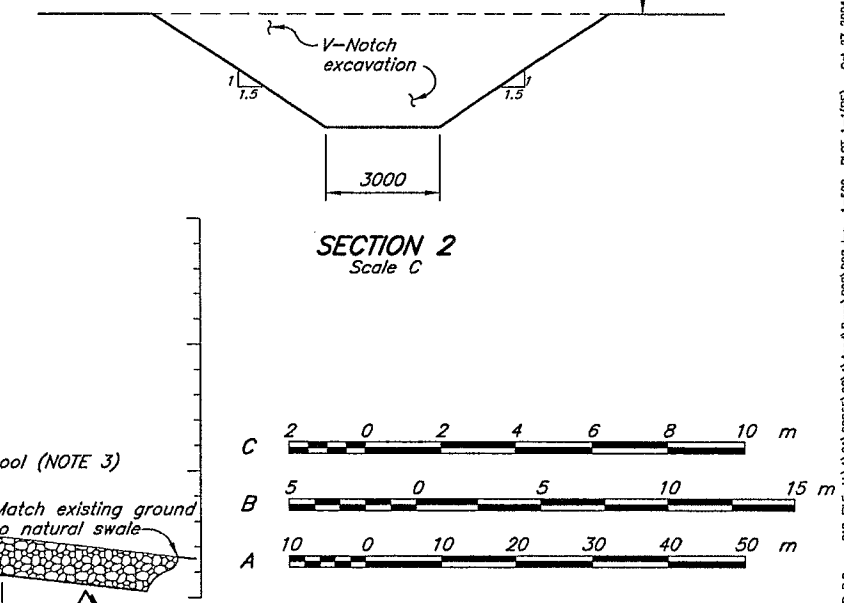
PLAN
Scale A



KEY PLAN
NTS



SECTION 1
Scale B



SECTION 2
Scale C

NOTES

- All dimensions are in millimetres and elevations in metres, unless noted otherwise.
- Coarse erosion protection 6" to 12" dia. rock.
- Plunge pool filled with boulder to allow flow to remain below surface.

DISCLAIMER

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PROFESSIONAL ENGINEER

B. Borntraeger

2/6/2005

Knicht Piésold
CONSULTING

NORTH AMERICAN METALS CORP.

GOLDEN BEAR MINE

TOTEM CREEK HEAP LEACH FACILITY
V-NOTCH BREACH
PLAN, SECTIONS & DETAILS

PROJECT/ASSIGNMENT NO. VA101-65/2

DRAWING NO. 020

REVISION 2

DRG. NO.	DESCRIPTION	REV.	DATE	DESIGN	DRAWN	CHK'D	APP'D
-	REFERENCE DRAWINGS						

REV.	DATE	DESCRIPTION	DESIGN	DRAWN	CHK'D	APP'D
2	07FEB'05	AS-BUILT	BB	NSD	KJB	KJB
1	18AUG'03	ISSUED FOR CONSTRUCTION	BB	WAL	KJB	KJB
0	11JUL'03	ISSUED FOR REPORT	BB	NSD	KJB	KJB

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REF. FILE :

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