



EAGLE GOLD PROJECT

WASTE ROCK AND OVERBURDEN FACILITY MANAGEMENT PLAN

Version 2017-01

JUNE 2017

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DOCUMENT CONTROL

Submission History

Version Number	Version Date	Document Description and Revisions Made
2014-01	July 2014	Original submission in support of an application to the Yukon Water Board for a Type A Water Use License for the full Construction, Operation and Closure of the Project. Version 2014-01 was also submitted to the Department of Energy, Mines and Resources in support of an application for a Quartz Mining Licence allowing the full Construction, Operation and Closure of the Project.
2017-01	July 2017	Revisions made to reflect the current site general arrangement and submitted to the Department of Energy, Mines and Resources and the Yukon Water Board in advance of Project construction.

Version 2017-01 of the Waste Rock and Overburden Facility Management Plan (the Plan) for the Project has been revised in July 2017 to update Version 2014-01 submitted in 2014. The table below is intended to identify modifications to the Plan and provide the rationale for such modifications.

Version 2017-01 Revisions

Section	Revision/Rationale
1 Introduction	Text insertion to explain that construction and operation of the WRSAs are not included within Stage 1 Construction activities and that detailed designs will be provided prior their construction as required by the regulatory approvals issued for the Project.
1.1 Waste Rock Storage Areas	Updated text to explain that the designs presented in Appendix A and discussed within the Plan are preliminary but final designs will be based on the same design criteria.
1.1.1 Platinum Gulch Waste Rock Storage Area	Updated text to better describe the optimized size and location of the facility.
1.1.2 Eagle Pup Waste Rock Storage Area	Updated text to better describe the optimized size and location of the facility.
1.2 Temporary Ore Stockpile	Updated text to better describe the optimized size and location of the facility.
1.3 Reclamation Stockpiles	Updated text to better describe the optimized size and location of the facilities.
1.4 Ice-Rich Overburden Storage Areas	Updated volume estimates of material required for storage in the facility based on the optimized site layout.
1.5 Water Management	Updated description of water management infrastructure to be consistent with the update Construction and Operations Water Management Plan and the

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Section	Revision/Rationale
Infrastructure	optimized site layout.
1.6 Tables of Concordance	Update text to reflect additional design refinements and ongoing data collection and analysis relevant to the Terms and Conditions of Recommendation and Proponent Commitments.
Figures 1.1-1, 1.3-1 and 1.4-1	Updated figures to reflect the optimized site layout.
2.1-1 Waste Rock	Updated text to reflect the reduction in material to be managed and to better describe the size of the storage facilities.
2.1.2 Overburden	Updated text to reflect the reduction in material to be managed.
2.4.1 Water Management Pond	Updated description of water management infrastructure to be consistent with the update Construction and Operations Water Management Plan and the optimized site layout.
2.4.2 Sediment Basins	Minor text updates to clarify design specifications.
2.4.3 Ditches	Minor text updates to clarify design specifications.
2.4.4 Waste Rock Drains	Updated text to explain that the designs for the drains are preliminary and will be updated as required by the regulatory approvals prior to construction.
3.1 Foundation Conditions	Minor text updates to reflect the collection of additional geotechnical information.
3.1.3 Reclamation Stockpiles	Complete revision to reflect the optimized placement and size of the reclamation stockpiles.
3.2.1 WRSA Rock Drains and Seepage	Updated text to explain that the designs for the drains are preliminary and will be updated as required by the regulatory approvals prior to construction.
3.3.1 Waste Rock Storage Area	Updated text to reference that components of clearing, stripping and grubbing will be done in accordance with the updated Frozen Materials Management Plan.
3.3.3 Reclamation Soil Stockpile	Minor text updates to reflect the optimized size of the reclamation stockpiles.
3.4.1.1 Eagle Pup Waste Rock Storage Area	Updated text to reflect the reduction in material to be managed and to better describe the size of the storage facility.
3.4.1.2 Platinum Gulch Waste Rock Storage Area	Updated text to reflect the reduction in material to be managed and to better describe the size of the storage facility.
3.4.2 Temporary Ore Stockpile	Updated text to better describe the optimized facility.

Section	Revision/Rationale
3.5.1 Waste Rock Storage Areas	▪ Updated text to explain that during construction of the WRSAs additional investigations will be conducted to delineate and characterize soils containing excess ice in specific areas. ▪ Updated text to describe the sequential loading of the WRSAs.
3.5.2 Ice Rich Overburden Storage Area	▪ Inserted text to explain the further stability assessment of the IROSA design presented in the final design of the facility.
3.7 Surface Water Management	▪ Updated text to ensure consistency with the updated Construction and Operations Water Management Plan.
3.8.2 Types of Waste	▪ Inserted text to reflect license conditions with respect to construction grade waste rock.
3.8.4 Waste Volumes and Disposal Schedule	▪ Updated text to explain the optimized mine schedule.
Appendix B	▪ Removal of appendix containing the preliminary design of the IROSA as final designs have been provided in the Frozen Materials Management Plan.

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1 INTRODUCTION

This Waste Rock and Overburden Facility Management Plan describes the types of waste rock and overburden (including reclamation soils and temporary ore stockpiles) that will be constructed and/or encountered on site and how these materials will be characterized, segregated, and stored to ensure long-term chemical and physical stability. This plan provides details about the design, construction and operation of each waste rock and overburden storage facility, and summarizes closure strategies considered during the design, construction and operation of each facility.

Stage 1 Construction of the Project will not include development of the Waste Rock Storage Areas (WRSAs); however, WRSA designs are currently being refined as part of detailed engineering. The design of the Eagle Pup and Platinum Gulch WRSAs will be provided prior to the construction of the waste rock storage facilities as required by the regulatory approvals issued for the Eagle Gold Project.

Figure 1.1-1 shows the general arrangement of the facilities described in this plan, including the waste rock storage areas, the temporary ore stockpile, the reclamation stockpiles and the ice-rich overburden storage area.

1.1 WASTE ROCK STORAGE AREAS

Upon the commencement of open pit development, waste rock is scheduled to go to one of two areas:

- Platinum Gulch Waste Rock Storage Area (PG WRSA)
- Eagle Pup Waste Rock Storage Area (EP WRSA)

The WRSAs are located within a short haul distance from the open pit; they will provide adequate capacity for waste rock over the life of the mine (LOM). Waste rock will be hauled from the pit via strategically positioned egress points. As part of the mine plan, the upper internal pit ramp will ultimately be mined out and external ramps will be constructed to access the upper lifts of the WRSAs.

Appendix A (Geotechnical Assessment and Design of the Waste Rock Storage Areas) provides preliminary details regarding the geotechnical assessment and design of both WRSAs. The final design for the WRSAs will be based on the same design criteria presented in Appendix A.

1.1.1 Platinum Gulch Waste Rock Storage Area

The PG WRSA will be filled within the first three years of production and contain approximately 21.6 Mt with a footprint of 33 ha. The PG WRSA will be constructed in 45 m lift heights with an ultimate crest elevation of 1,298 masl and an overall height of approximately 345 m. At the end of its operational life, the PG WRSA will have an overall slope of approximately 2.5H:1V. The Platinum Gulch drainage is moderately steep with the valley bottom sloping at approximately 21° in the PG WRSA footprint.

1.1.2 Eagle Pup Waste Rock Storage Area

The EP WRSA will contain approximately 78 Mt of waste rock and 15 Mt of low grade material over the LOM contained within a footprint of 83 ha. The low grade material will be kept segregated and accessible for future

processing as feasible. It will be constructed in 45 m lift heights with an ultimate crest elevation of approximately 1,250 masl and an overall height of approximately 315 m. At the end of its construction the EP WRSA will have an overall slope angle of approximately 2.5H:1V. Within the footprint of the WRSA the valley bottom of the Eagle Pup drainage ranges in slope from approximately 8° to 25°.

1.2 TEMPORARY ORE STOCKPILE

The temporary ore stockpile will lie directly west of the primary crusher and contain up to approximately 3 Mt of seasonally crushed ore (after primary crusher but before secondary crusher) within a footprint of 7.8 ha. All of this crushed ore will be reclaimed each year for stacking on the heap leach facility (HLF). Crushed ore will be delivered to the temporary stockpile at a rate of approximately 29,500 t/day during an approximately 90-day cold winter period (November to March) when ore will not be stacked on the heap, and then the ore will be reclaimed at a rate of approximately 470 tonnes per hour (t/h) and fed back into the crushing circuit during the remainder of the year. During winter each year, the maximum footprint of the temporary ore stockpile will be comprised of two benches; the crushed ore transfer station will be on the upper bench.

1.3 RECLAMATION STOCKPILES

Based on the earthworks materials take-off estimates for activities undertaken during the construction phase of the Project, a total of approximately 270,000 m³ of excess cut, including topsoil, frozen (non-ice-rich) and non-frozen overburden soils will be stored in the various designated reclamation stockpiles. This is expected to satisfy the overall requirement for topsoil required for closure covers; additional material required for the covers will be sourced from available finer-grained placer tailings in the Dublin Gulch and Haggart Creek valleys, as necessary. Reclamation stockpiles to contain these materials will be developed during the construction phase in up to three areas located to the north and west of the crushers and west of the heap leach facility. Haul trucks will access the reclamation stockpile areas via main and secondary mine site roads; the material will be end dumped, re-graded and then vegetated with an indigenous temporary cover to minimize erosion following Best Management Practices as outlined in the Water Management Plan. The three reclamation stockpile areas noted in Figure 1.3-1 have a combined area of ~9.6 ha, and will need to contain approximately 300,000 m³ of material at an average thickness of 3 to 5 m. The stockpiles will be developed more or less with overall slopes equivalent to the existing slopes in the areas, which range from approximately 5H:1V to 8H:1V.

1.4 ICE-RICH OVERBURDEN STORAGE AREA

Based on the proposed General Arrangement of the Project facilities and a detailed assessment of material take-offs, including reviews of facility cross sections, cut and fill requirements, test pit logs, photos and borehole records, a materials management strategy was developed to consider the thickness, lateral extent and grain size of ice-rich soil horizons/lenses that would be encountered during the construction of each facility. This strategy is described in detail in the Frozen Material Management Plan. An estimated quantity of ice-rich soils expected to be hauled and stored within the ice-rich overburden storage area (IROS) during project construction is approximately 113,000 m³ plus another 15% (~17,000 m³) for swell and another 15% (20,000 m³) for contingency, for a total of approximately 150,000 m³. The combined estimated storage capacity of the initial storage area amounts to about 255,000 m³, so has considerable room for considerable expansion, if needed.

The IROSA will lie in an area that was previously developed for placer mining, along the east valley wall within the Haggart Creek Valley (Figure 1.4-1). The area is currently comprised of several large mounded tailings piles that separate four large depressions from the main Haggart Creek channel. The design includes tying five berms into the existing mounded tailings and till side-slopes to create four separate storage areas. The berms will be constructed using coarse tailings material and a filter material on the upstream slope to promote draining of excess pore water while containing the fine-grained ice rich overburden. More details on the IROSA design are provided in the Frozen Material Management Plan.

1.5 WATER MANAGEMENT INFRASTRUCTURE

A Construction and Operations Water Management Plan has been developed to proactively manage sediment-laden, contact and non-contact water throughout the construction and operation phases of the Project, including the development and operation of the waste rock storage areas, temporary stockpiles and other storage areas. The Reclamation and Closure Plan provides strategies for the management of Project influenced water during the closure and post-closure phases of the Project, including the closure and post-closure monitoring of the waste rock storage areas and other storage areas. The plans have several functional components, each developed from specific design basis and criteria, and supported by the integration of baseline studies and various water-related modeling exercises, that includes:

- a construction water management plan,
- a sediment and erosion control plan,
- an operational water management plan
- a closure water management plan, and
- a post-closure water management plan.

Key water management infrastructure and facilities that will be utilized during the development, operation and closure of rock storage areas and materials stockpiles include:

- the Lower Dublin South Pond, which will operate as a sediment control pond and also collect site runoff and WRSA seepage,
- the Platinum Gulch Pond, which will operate as a polishing pond for WRSA seepage and pit-water during the closure phase of the Project,
- three main collection ditches (A, B and C)
- slope interceptor and roadside collection ditches
- localized sediment basins or exfiltration ponds
- culverts and above or below ground piping as needed in certain areas.

1.6 TABLES OF CONCORDANCE

The following two tables of concordance summarize how applicable commitments made by StrataGold during the environmental assessment process, including the decision document terms and conditions and our project commitments have been addressed.

Table 1.6-1: Table of Concordance for the Project Decision Document Relevant to this Plan

No.	Terms and Conditions	Where Addressed
<i>To decrease variability around geochemical characterization and validate hydrogeochemical predictions:</i>		
54.	The Proponent shall complete geochemical characterization of the expanded open pit including representative rock units for the total amount of waste rock and ore being mined (132 million tonnes of waste rock and 92 million tonnes of ore). This characterization should include kinetic testing to predict metal leaching potential.	See Final Report: Geochemical Characterization – Eagle Gold Project (SRK 2014)
55.	The Proponent shall incorporate results of the new geochemical characterization into the overall geochemical characterization of rock units to be excavated by the Project and revise the source term predictions accordingly. The Proponent shall ensure that this information is available prior to the regulatory approval process.	See Final Report: Geochemical Characterization – Eagle Gold Project (SRK 2014); See Mine Waste Geochemical Source Term Predictions – Model Description and Results (Lorax 2014) See Technical Memorandum Eagle Gold Mine - Update on geochemical source terms (Lorax 2017)
<i>To minimize potential effects due to metal leaching from waste rock used as construction material:</i>		
60.	The Proponent shall ensure waste rock used to construct on-site infrastructure does not contribute to exceedance of water quality guidelines due to metal leaching. The Proponent shall actively segregate waste rock based on metal leaching potential so that it is used appropriately.	See Final Report: Geochemical Characterization – Eagle Gold Project (SRK 2014); See Mine Waste Geochemical Source Term Predictions – Model Description and Results (Lorax 2014) See Technical Memorandum Eagle Gold Mine - Update on geochemical source terms (Lorax 2017) See Section 6 of Environmental Monitoring, Surveillance and Adaptive Management Plan
<i>To mitigate significant adverse effects related to permafrost degradation on environmental quality:</i>		
82.	The Proponent shall ensure sufficient storage is available for temporary containment, management, and thawing of excavated ice rich soils/permafrost.	See Frozen Materials Management Plan
<i>To mitigate significant adverse effects related to terrain and WRSA instability on environmental quality:</i>		
88.	The Proponent shall use methods, other than fill blankets as insulation or preloading and draining permafrost areas, to manage areas of ice rich soils/permafrost below the WRSAs.	See Frozen Materials Management Plan and Water Management Plan

No.	Terms and Conditions	Where Addressed
89.	The Proponent shall implement the mitigations outlined in Section 7.0 of Appendix 7 to the Supplementary Information Report (VIT 2012a) regarding the stability of the WRSAs including: conducting additional investigations to determine the liquefaction potential; and buttressing the ice-rich lobe on Eagle Pup WRSA at an early stage in the work.	See Sections 3.3.1, 3.4.1.4 and 3.5.1 of this Plan. Additional consideration of this condition will be included in the final detailed design of the WRSA to be submitted prior to their construction.
90.	The Proponent shall conduct further investigations on less durable rock considered for use in the rock drains beneath the WRSAs. Should this rock be incapable of maintaining long-term drainage due to mechanical degradation, the Proponent shall ensure additional measures are implemented, such as construction of subdrains in addition to rock drains or using alternative durable rock, to protect against reduced flow volumes and increased pore water pressure in the WRSAs.	See 4 th paragraph of Section 3.2.1 in this Plan Additional consideration of this condition will be included in Drain Rock Durability Testing Plan required by QZ14-041.

Table 1.6-2: Table of Concordance for Project Commitments Relevant to this Plan

No.	Proponent Commitments	Where Addressed
<i>Surficial Geology, Terrain, and Soils</i>		
1	Victoria Gold (VIT) will complete geotechnical investigations as part of detailed mine planning during the permitting stage, prior to construction. Once exact locations for Project infrastructure have been identified, qualified professionals will carry out on-site terrain stability assessments in areas identified as having potential terrain stability issues.	See the following: 2011 Geotechnical Investigation for Mine Site Infrastructure Factual Data Report (BGC 2012a). 2011 Geotechnical Investigation for Mine Site Infrastructure Foundation Report. Final Report (BGC 2012b). Geotechnical Assessment and Design of the Waste Rock Storage Areas (BGC 2012c) 2012 Geotechnical Investigation for Mine Site Infrastructure Factual Data Report (BGC 2012e) 2016 Heap Leach Facility Geotechnical Investigation (BGC 2017) Geotechnical Design Ice-Rich Overburden Storage Area Berms (NELPCo 2013). Geotechnical Design Update and IFC Drawings Haggart Creek Ice-Rich Overburden Storage Area (NELPCo 2017a).
2	VIT will establish a program to monitor permafrost conditions adjacent to cleared areas within the Project footprint once mine infrastructure is constructed. Downslope movement and soil moisture will be monitored. Monitoring frequency will be sufficient	See Environmental Monitoring, Surveillance and Adaptive Management Plan and Water Management Plan

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	to assess the effects of freshet, large storm events, and other weather conditions that may affect terrain stability.	
3	A qualified environmental professional/technician with appropriate knowledge and training will monitor Project construction and closure activities. The professional/technician will: 1) ensure that soil material suitable for reclamation is salvaged and stored; and 2) evaluate topsoil volumes, based on soil stockpile dimensions, to determine whether there is sufficient material for reclamation. If a shortage is calculated, additional areas of overburden salvage will be identified. If the quality of topsoil does not meet the requirements of the Conceptual Closure and Reclamation Plan (Appendix 24), additional areas of soil salvage will need to be identified.	Section 3.6 of this Plan; will be part of Construction Quality Assurance and Quality Control Plan
4	Soil stockpiles will be checked regularly, after storm events, and during/following freshet to ensure vegetation cover is maintained and erosion control measures are effective.	See Environmental Monitoring, Surveillance and Adaptive Management Plan and Water Management Plan
5	VIT will monitor the effectiveness of soil mitigation to evaluate compaction, rutting, drainage and re-contouring prior to re-vegetation.	See Environmental Monitoring, Surveillance and Adaptive Management Plan and Reclamation and Closure Plan
9	VIT will implement an Erosion and Sediment Control Plan for the footprint area during construction, operations and closure and reclamation (Environmental Management Plans – Appendix 30).	See Water Management Plan
Water Quality and Aquatic Biota		
13	VIT will assess the need for, and will select additional mitigations to meet regulatory water quality standards, based on an adaptive management approach. Possible options include: a) Using constructed or engineered wetland systems (e.g., a semi-passive anaerobic wetland) down-gradient of the heap leach facility and waste rock storage areas to reduce arsenic, nitrogen and phosphorus levels. b) Developing a lower permeability reclamation cover for the waste rock storage areas. For example, decreasing net infiltration through the cover from 20% to 10% of Net P would provide a 50% reduction in seepage volumes and loads of arsenic, other metals, and nutrients. c) Further review of alternative approaches to heap detoxification used at other closed mines (e.g., at Brewery Creek nutrients were added to the heap to detoxify cyanide and reduce levels of metals and ammonia).	See Reclamation and Closure Plan
14	VIT will implement codified erosion prevention and sediment control practices and the Water Management Plan (Appendix 18) to prevent sediment release during construction (sediment control ponds).	See Water Management Plan

16	VIT will construct and maintain diversion channels to keep non-contact water away from mine activities. These will be built with erosion protection measures and designed to convey large runoff volumes. Design criteria will be determined based on water license requirements.	See Water Management Plan
17	Sediment control ponds will be constructed and maintained to allow fine sediments to settle out. Permanent sediment control ponds will be sized for a 1:200 year 24-hour flood event and temporary sediment control ponds will be sized for a 1:100 year 24-hour flood event.	See Water Management Plan
19	Groundwater wells downstream of the waste rock storage areas will be monitored to assess accuracy of predictions of effects on groundwater quality.	See Environmental Monitoring, Surveillance and Adaptive Management Plan
Fish and Fish Habitat		
22	VIT will provide qualified environmental managers who will be familiar with relevant territorial and federal acts and regulations pertaining to instream construction activities related to fish and fish habitat protection.	See Section 3.6 of this Plan; will be part of Construction Quality Assurance and Quality Control Plan
23	The following are commitments of particular importance to fish and fish habitat: a) During construction, inspection and monitoring of suspended sediments will be required within Project area watercourses to ensure sediment and erosion control measures have been implemented effectively and are functioning in accordance with regulatory requirements and commitments in the Erosion and Sediment Control Plan (Environmental Management Plans – Appendix 30). b) During operations and closure, monitoring will be conducted periodically to confirm that reclamation efforts and environmental protection measures, such as sediment and erosion control provisions, are properly maintained and functioning until no longer required. c) Once mitigation measures are no longer required, the VIT environmental manager will ensure that non-biodegradable materials are removed and disposed of in an appropriate manner. d) During operations and closure, water quality monitoring programs will comply with Metal Mining Effluent Regulations' requirements for effluent characterization and receiving environment conditions.	See Water Management Plan See Section 3.6 of this Plan; will be part of Construction Quality Assurance and Quality Control Plan See Environmental Monitoring, Surveillance and Adaptive Management Plan
25	VIT will implement the following measures to control soil erosion and leaks from equipment into fish habitat:	See Water Management Plan

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	a) Minimize the extent of clearing, grubbing, and grading adjacent to watercourses to that required for safe vehicle access and construction activities b) Restrict vehicle and construction traffic in the vicinity of water courses to existing roads, and restrict crossing to existing bridges where possible, using appropriate temporary crossing methods where needed (e.g., temporary bridges) c) Flag environmentally sensitive areas before clearing and construction begins near watercourses d) Re-vegetate where soil stabilization and erosion control is required e) Protect stockpiles from erosion with tarps, sumps, or berms f) Stage the timing of activities for construction within 16 m of all watercourses and retain buffer zones until construction activities begin to limit time of bank and soil exposure g) Maintain 30 m riparian buffer between mine components (including temporary work spaces and stockpiles) and fish-bearing watercourses h) Implement a rigorous erosion and sediment control program including sediment and erosion control ponds sized to 1:100 year 24-hour flood event i) Monitor total suspended solids and turbidity levels from sediment control ponds prior to release j) Ensure industrial equipment operating near fish-bearing watercourses is in good working order and free of leaks.	See Section 3.6 of this Plan; will be part of Construction Quality Assurance and Quality Control Plan See Environmental Monitoring, Surveillance and Adaptive Management Plan
Vegetation Resources		
30	VIT makes the following monitoring commitments: a) Include results of re-vegetation monitoring in Annual Reclamation Reports submitted to Yukon Energy, Mines, and Resources. b) Work with the First Nation of Na-Cho Nyäk Dun to incorporate traditional environmental knowledge in reclamation programs and investigate opportunities to involve community members in monitoring programs c) Conduct vegetation sampling in conjunction with soils sampling during all Project phases to monitor the extent and effects of metals loading as a result of dust deposition. d) Develop a monitoring plan (during the permitting process to monitor trace elements in vegetation and to further define the baseline trace element concentration in species used by First Nations and wildlife. Continue monitoring throughout the operations phase to validate the predictions for soils metals loading made by the dust dispersion model.	See Environmental Monitoring, Surveillance and Adaptive Management Plan See Reclamation and Closure Plan

	e) Reclamation research and monitoring—a reclamation research program will be established during the operations phase with the purpose of establishing trials on the Platinum Gulch waste rock storage area. This program will investigate various planting and seeding practices appropriate to site-specific closure issues and end land-use objectives, including the use of native and traditional use species. Reclamation monitoring will be continued in the closure and post-closure phases with the purpose of assessing reclamation success.	
32	VIT makes the following commitments to minimize potential effects of clearing on vegetation resources: a) Flag and stake known rare plant locations near the maximum disturbance boundary and instruct equipment operators to avoid these areas. Conduct regular monitoring of these sites during construction and operations. b) Reduce vegetation loss in areas around the footprint perimeter by adhering closely to construction plans, and avoiding off- site machine use. c) Clear the necessary trees and tall shrubs within the transmission line RoW during periods when the ground is frozen and snow-covered to minimize the disturbance to low shrubs, the moss layer, and topsoil. d) Minimize the extent of grubbing, stripping, and the removal of shrubs and herbaceous species where possible. e) When clearing is required, retain the humus layer and vegetation root mat, when possible. f) Re-vegetation of disturbed soils where appropriate to encourage slope stability and minimize soil degradation and erosion.	See Section 3.6 of this Plan; will be part of Construction Quality Assurance and Quality Control Plan See Environmental Monitoring, Surveillance and Adaptive Management Plan
33	VIT makes the following commitments to minimize potential effects on wetlands and riparian areas: a) Minimize disturbance in sensitive areas by implementing best management practices including the creation and maintenance of buffer zones around riparian and wetland ecosystems. b) Maintain existing drainage patterns to and from wetlands in areas outside of the disturbance footprint. c) When clearing is required, retain the humus layer and vegetation root mat to the extent practical, to reduce the potential for soil erosion and deposition in riparian and wetland ecosystems. d) Employ hand cutting of vegetation near access road and	Section 3.6 of this Plan; will be part of Construction Quality Assurance and Quality Control Plan See Environmental Monitoring, Surveillance and Adaptive Management Plan

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	transmission-line stream crossings to reduce disturbance to riparian areas during construction of the transmission line.	
Wildlife		
38	VIT will implement the following clearing practices to minimize potential effects on wildlife: a) Minimize Project footprint. Site clearing will be minimized to only the area needed to safely construct and operate the Project. Before clearing, wildlife habitat features (e.g., mineral licks, dens, nest trees, snags, rocky outcrops, small ponds/seepages) will be identified and evaluated to determine if they can be maintained. Even if small, these patches will benefit wildlife and contribute to reclamation. b) Clear vegetation outside of the breeding bird windows. Where this is not possible, VIT will consult with the appropriate regulators (Yukon Government, CWS) and develop management strategies. These strategies are likely to include surveying the area to be cleared for nests a maximum of one week prior to clearing. Bird nests will be identified and protected until nesting has completed.	Section 3.6 of this Plan; will be part of Construction Quality Assurance and Quality Control Plan See Wildlife Protection Plan
40	Implement a progressive Conceptual Closure and Reclamation Plan (Appendix 24). VIT will: a) re-vegetate reclamation areas with native species consistent with surrounding vegetation, except where regulatory agencies indicate that natural succession is preferable; and b) maximize use of direct placement techniques (minimizing stockpiling) to minimize the loss of biological activity in reclamation capping materials.	See Reclamation and Closure Plan
Conceptual Closure and Reclamation Plan		
105	During construction, an environmental monitor will be on site to monitor activities and to verify compliance with the provisions of all applicable permits, licenses and approvals. The environmental monitor will: a) Conduct monitoring programs as required under the respective permits, licenses, and approvals, and report the results of such programs, as required b) Ensure that soil salvage and replacement activities are completed appropriately to meet reclamation objectives c) Ensure that vegetative erosion control cover is established on soil stockpiles and on any other areas of disturbance, as appropriate d) Provide direction and recommend implementation measures aimed at avoiding or minimizing adverse environmental effects e) Implement erosion control measures such as installation of	Section 3.6 of this Plan; will be part of Construction Quality Assurance and Quality Control Plan

	riprap, erosion control blankets, silt fences and filter fabrics.	
106	As soon as reclamation areas become available, VIT will establish trials testing plant species suitable for reclamation in the Project footprint and trials testing vegetation establishment/growth on various topsoil depths and waste rock material. Information obtained from the trials/monitoring programs will be used to adjust reclamation activities or methods that will be best suited for reclaiming remaining mine disturbance areas.	Section 3.6 of this Plan; will be part of Construction Quality Assurance and Quality Control Plan See Reclamation and Closure Plan
Environmental Management Plans		
110	VIT is committed to developing and implementing Environmental Management Plans (Appendix 30) with the following components: a) Erosion and Sediment Control Plan b) Fugitive Dust Control Plan c) Combustion Source Control Plan d) Vegetation Management Plan e) Wildlife Protection and Management Plan f) Environmental Monitoring Plan g) Schedule of Environmentally Sensitive Activity h) Heritage Resources Protection Plan i) Traffic and Access Management Plan j) Occupational Health and Safety Plan k) Cyanide Transportation Management Plan l) Spill Contingency Plan m) Noise Abatement Plan n) Waste Management Plan o) Water Management Plan p) Closure and Reclamation Plan.	See the following: Water Management Plan Dust Control Plan Wildlife Protection Plan Environmental Monitoring and Adaptive Management Plan Spill Response Plan Solid Waste and Special Waste Management Plan Cyanide Management Plan Heritage Resources Protection Plan Traffic Management Plan

Table 1.6-3: Table of Concordance for the Project Quartz Mining License and Water Use Licences Relevant to this Plan

No.	Terms and Conditions	Where Addressed
Water Use License QZ14-041		
40.	The Licensee shall characterize the foundation soils at all interim and final toes of waste rock benches proposed for the site. The characterization shall be sufficient to identify the presence of Ice-Rich Soil and the ability of foundation soils (when thawed) to resist liquefaction under the design seismic loading.	See Section 3.2 This condition will be included in the final detailed design of the WRSAs to be submitted prior to their construction.
41.	Where Ice-Rich Soil is located underneath interim or final toes of proposed waste rock benches in the WRSAs, the Ice-Rich Soil will either be removed, or induced to thaw and drained in a controlled manner prior placement of waste rock.	See Section 3.2 This condition will be included in the final detailed design of the WRSAs to be submitted prior to their construction.

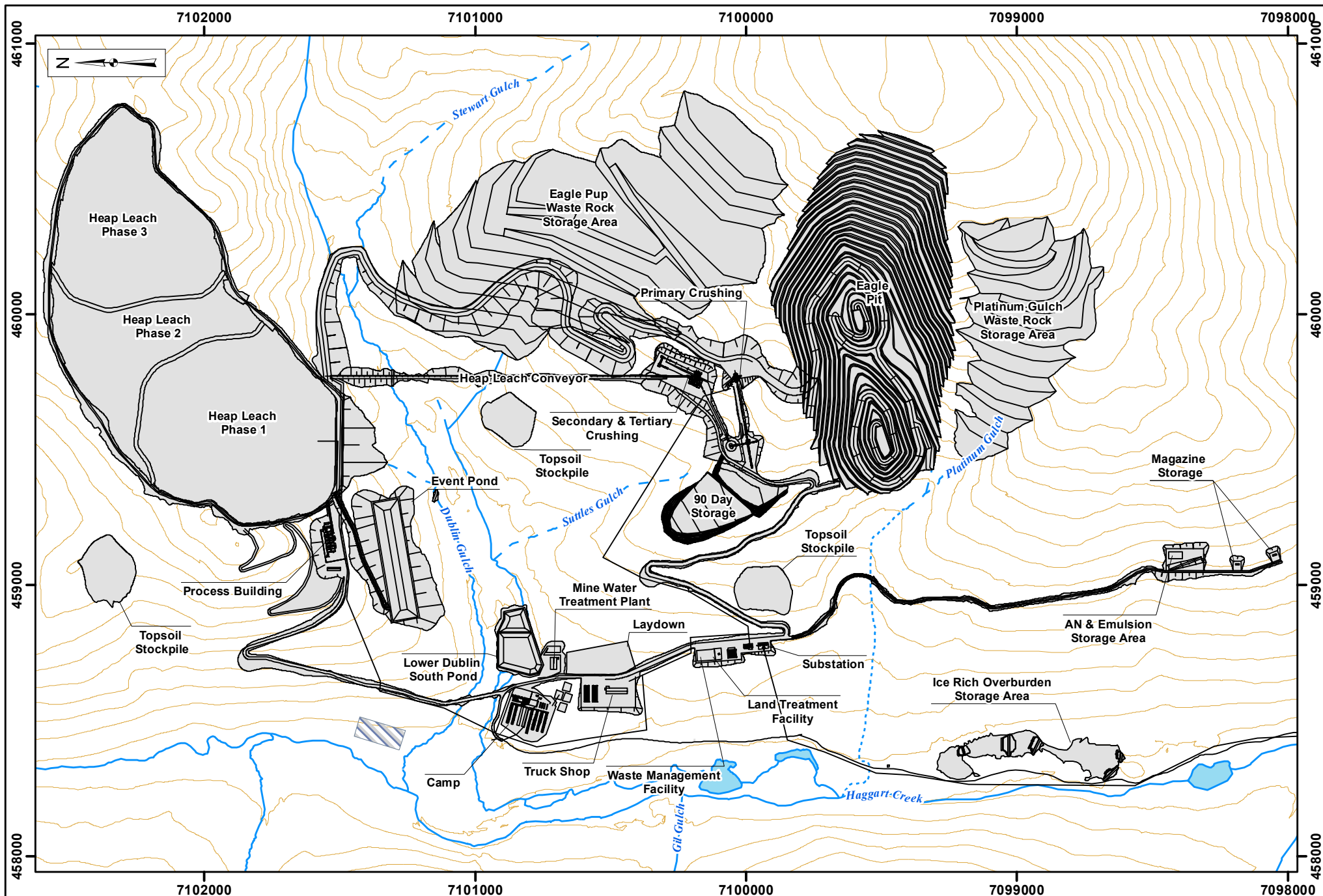
Eagle Gold Project

Waste Rock and Overburden Facility Management Plan

Section 1 Introduction

No.	Terms and Conditions	Where Addressed
42.	Rock drains within the WRSAs shall be designed and built for long term performance that accounts for the specified properties of the rock that are presented in the final detailed design.	See Section 3.2 Additional consideration of this condition will be included in Drain Rock Durability Testing Plan required by QZ14-041.
77.	At least 30 days prior to construction of each WRSA, the Licensee shall submit a final design for that WRSA based upon the submitted preliminary design report included in the Application and shall be compliant with any requirements identified in this licence.	To be completed at least 30 days prior to construction of each WRSA.
80.	The final design shall include a specific definition of what constitutes Ice-Rich Soils within the two WRSAs by consideration of moisture content, ice content and distribution, soil, type and structure, and required performance of thawed soils within the limits of the WRSAs.	See the Frozen Materials Management Plan.
81.	The final designs of the WRSAs shall include specified and measurable durability criteria for rock materials to be used in rock drains.	Additional consideration of this condition will be included in Drain Rock Durability Testing Plan required by QZ14-041.
90.	The Licensee shall submit 30 days prior to construction of the IROSA, final detailed designs for the proposed overburden storage areas, including the IROSA that are based upon the Frozen Materials Management Plan and compliant with any requirements identified in this licence.	See IFC Drawing Package in the Frozen Materials Management Plan
118.	The Licensee shall update the Geochemical Monitoring Program to include metal leaching monitoring and classification criteria for Construction Grade Waste Rock.	See Section 3.8 Waste Rock Generation and Disposal
153.	The Licensee shall submit 30 days prior to the construction of the first WRSA, a drain rock durability testing plan to establish design criteria for durability for rock to be used in the rock drains at the WRSAs.	To be completed at least 30 days prior to construction of the first WRSA.
Quartz Mining License QML-0011:		
9.3.	The Licensee must follow the procedures for determining the acid rock drainage or metal leaching potential of all material that may be stored on surface or used for construction purposes as set out in the approved plan listed in Schedule C titled "Geochemical characterization of Proposed Excavation Areas and Borrow Sources from the Eagle Gold Project, Yukon", dated May 2013, or any amendment to this plan once the amendment becomes an approved plan.	See Section 3.8 Waste Rock Generation and Disposal.
9.4	Waste rock used for construction or fill purposes must have a pH of at least 5.0, a NP:AP ratio of at least 3:1, and a total sulphide sulphur content of no greater than 0.3%.	See Section 3.8 Waste Rock Generation and Disposal.

No.	Terms and Conditions	Where Addressed
13.2	The Licensee must ensure that an inspection of the physical stability of all engineered structures, works and installations located at the site is conducted by an independent engineer by October 1st of each year of the term of this License, including the heap leach facility, the heap leach facility embankment, the waste rock storage areas, the open pit and any diversion structures or dams and any other engineered facilities or works associated with the Undertaking.	See section 3.6 Construction Quality Assurance / Quality Control
Sched C, Part 2 1.5	The following plans are approved, subject to the listed conditions. "Waste Rock and Overburden Facility Management Plan, Version 2014-01" dated July 2014 and prepared by StrataGold Corporation. a) Quality Assurance and Quality Control Plan and field screening report for geochemical characterization must be submitted to the Director for review prior to utilizing excavated rock for construction purposes; (b) the Licensee shall conduct further investigations on less durable rock considered for use in the rock drains beneath the waste rock storage area. Should the rock be incapable of maintaining long-term drainage due to mechanical degradation, the Licensee shall ensure additional measures are implemented to protect against reduced flow volumes and increased pore water pressure;	See Section 3.6 Construction Quality Assurance / Quality Control See Section 3.8 Waste Rock Generation and Disposal. Additional consideration of this condition will be included in Drain Rock Durability Testing Plan required by QZ14-041.



Legend:

- | | | | | | |
|--|---------------|--|--------------|--|---------------|
| | Facility | | Perennial | | Waterbody |
| | Reserved Area | | Ephemeral | | Contour (25m) |
| | | | Intermittent | | |



Projection:

NAD 83 UTM
Zone 8N

Date:

2017/07/12

Drawn By:

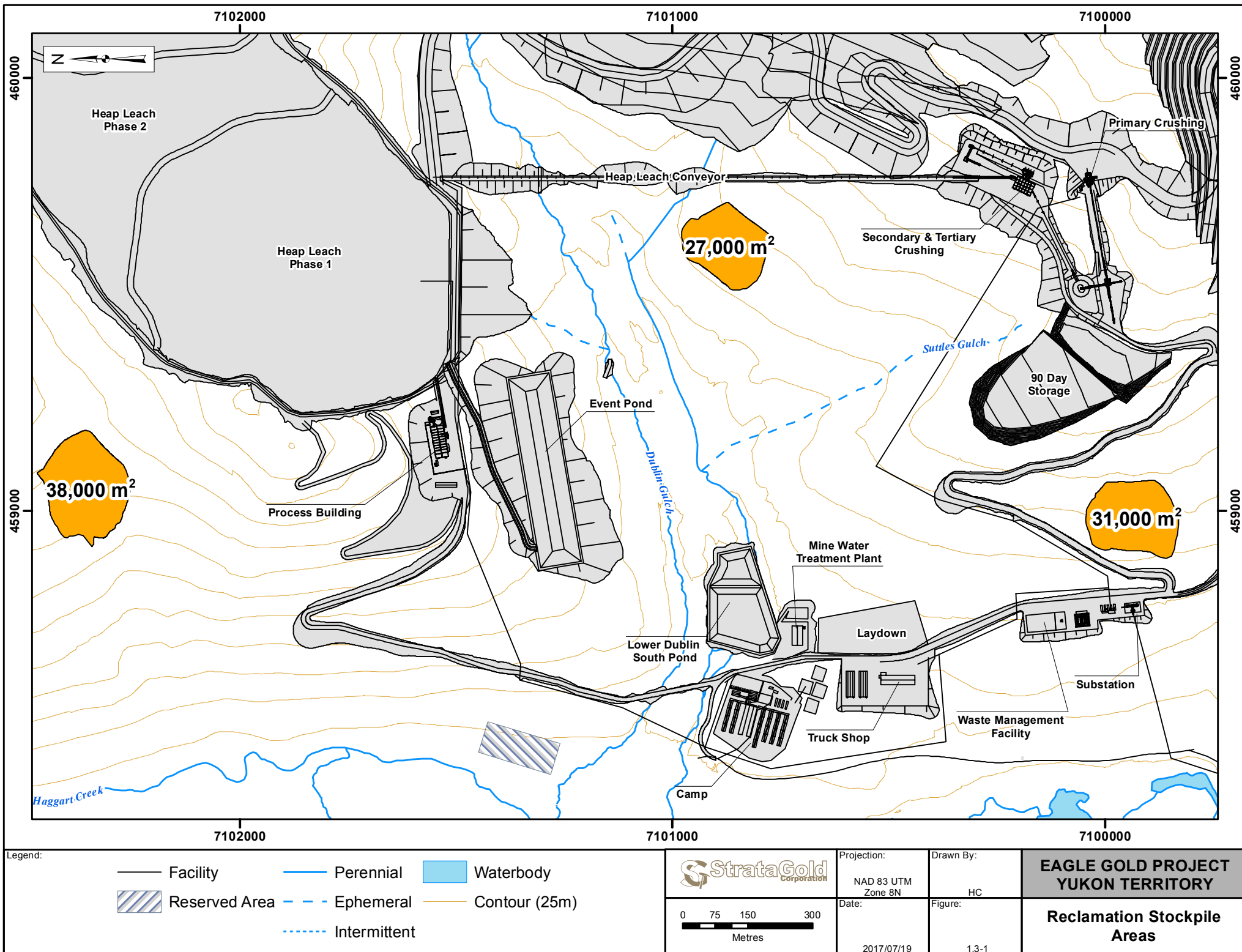
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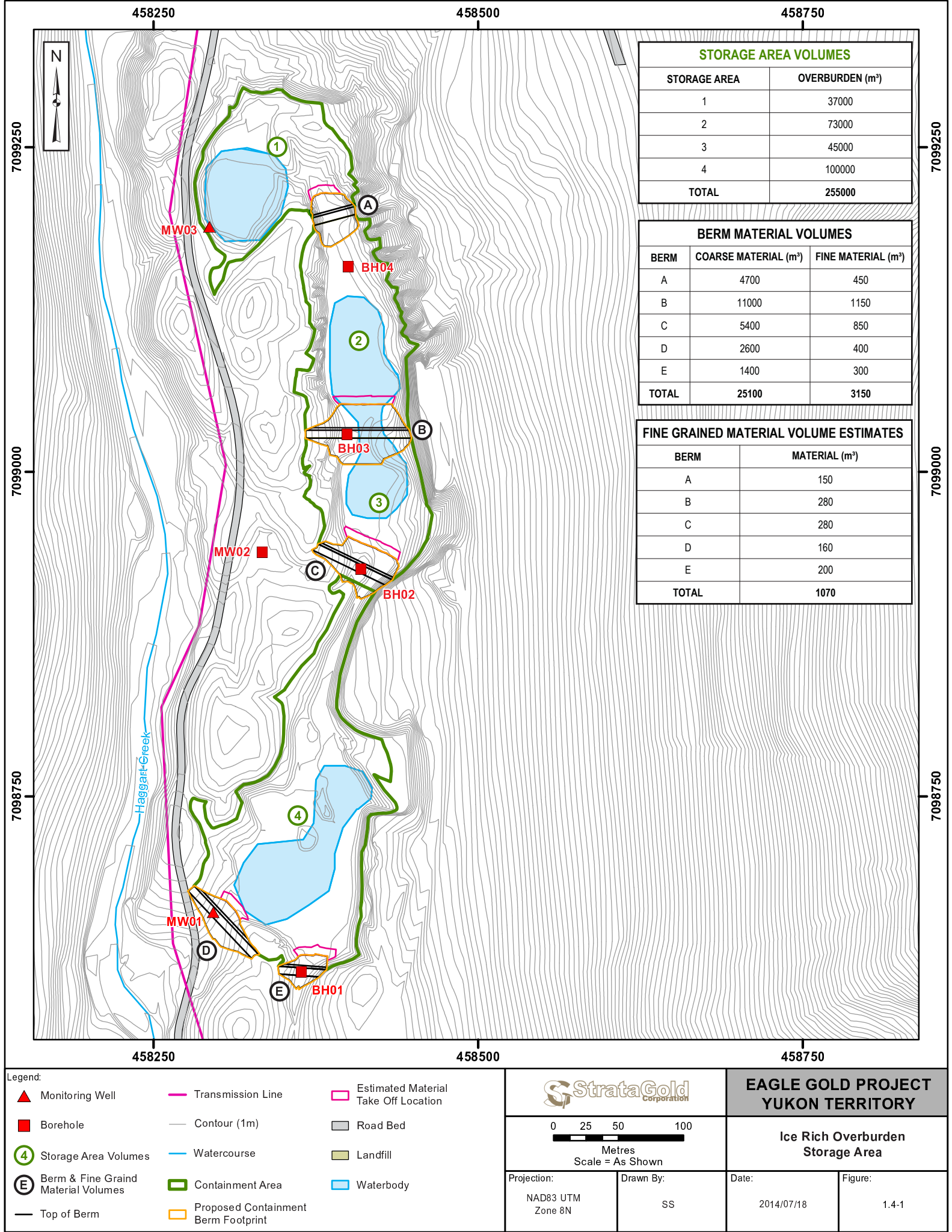
Figure:

1.1-1

**EAGLE GOLD PROJECT
YUKON TERRITORY**

Site General Arrangement





STORAGE AREA VOLUMES	
STORAGE AREA	OVERBURDEN (m³)
1	37000
2	73000
3	45000
4	100000
TOTAL	255000

BERM MATERIAL VOLUMES		
BERM	COARSE MATERIAL (m³)	FINE MATERIAL (m³)
A	4700	450
B	11000	1150
C	5400	850
D	2600	400
E	1400	300
TOTAL	25100	3150

FINE GRAINED MATERIAL VOLUME ESTIMATES	
BERM	MATERIAL (m³)
A	150
B	280
C	280
D	160
E	200
TOTAL	1070

Legend:

▲ Monitoring Well

■ Borehole

④ Storage Area Volumes

Ⓔ Berm & Fine Grained Material Volumes

— Top of Berm

— Transmission Line

— Contour (1m)

— Watercourse

— Containment Area

— Proposed Containment Berm Footprint

□ Estimated Material Take Off Location

▬ Road Bed

▬ Landfill

▬ Waterbody

StrataGold Corporation

0 25 50 100 Metres
Scale = As Shown

Projection: NAD83 UTM Zone 8N

**EAGLE GOLD PROJECT
YUKON TERRITORY**

**Ice Rich Overburden
Storage Area**

Date: 2014/07/18

Figure: 1.4-1

2 DESIGN CRITERIA

2.1 ROCK AND OVERBURDEN QUANTITIES

2.1.1 Waste Rock

Approximately 114.5 Mt of waste rock (including low grade ore) will be produced over the life of the mine. Based on the optimization of the site layout, approximately 91.0 Mt of waste rock will be disposed during the first seven plus years when the heap leach facility (HLF) reaches current design capacity. Most of the waste rock produced over the life of the mine (92.8 Mt) will be stored in the EP WRSA, while the remaining 21.6 Mt will be deposited in the PG WRSA. The annual deposition rates, including pre-stripping totals during the second year of construction will range from approximately 2 Mt to 14 Mt per year in the PG WRSA, and 0.3 Mt to 15.7 Mt per year in the EP WRSA. Waste rock will be comprised of the following six types of material: oxidized granodiorite, fresh granodiorite, altered granodiorite, oxidized metasediments, fresh metasediments and overburden.

2.1.2 Overburden

Based on the earthworks materials take-off estimates, a total of approximately 270,000 m³ of excess cut, including topsoil, frozen (non-ice-rich) and non-frozen overburden soils will be excavated and stored in the various designated reclamation stockpiles during the first phase of construction. The material take-off estimates developed for the Project do not currently include estimates for the construction of Phase 2 and 3 of the HLF.

2.2 WASTE ROCK MATERIALS PROPERTIES

Waste rock to be placed in the WRSAs will consist of a mixture of metasediments from the Hyland Group and intrusives related to the Dublin Gulch granodiorite stock. The intact strengths of these rocks have been estimated from laboratory testing of drill core samples, point load testing, and core logging observations. The laboratory tests provide relatively precise strengths for a number of samples which can then be used to calibrate the strength estimates from the larger point load testing database. The resulting strength estimates based on the point load testing are then checked against the more general estimates of strength from the core logging observations to arrive at an average strength for each unit. Based on laboratory testing, point load testing, and core logging observations the design uniaxial compressive strengths (UCS) of the metasediments and the intrusives are estimated to be 80 MPa and 135 MPa, respectively.

In-situ fracture spacing of the rocks have been measured as part of open pit design studies (BGC, 2012d) and have been used to estimate average dimensions of the rock block sizes, prior to blasting. The length of the various discontinuity sets will heavily influence the waste rock block size; however, limited information is available on the discontinuity lengths as the majority of the observations are derived from core, which are small in diameter and have a sampling bias due to their orientation. Preliminary estimates indicate that the metasediments and intrusives will have average in-situ block sizes of about 0.1 and 0.2 m in diameter, respectively. Blasting induced fractures during mining operations will also have an impact on block size. Based on their higher strength and mineralogy, the intrusive rocks would be the most desirable construction materials,

and will likely be the most durable from the open pit area; however, siliceous metasedimentary rocks (e.g. quartzites) may also be suitable for construction materials. Material properties, including densities, moisture contents and material strengths are discussed further in Section 3.5 (Stability and Settlement Analyses).

2.3 GEOTECHNICAL DESIGN CRITERIA

2.3.1 Waste Rock Storage Areas

Geotechnical design criteria are shown in Table 2.3-1. These criteria selected for the WRSAs are based on those recommended by the Yukon Water Board (2009), the British Columbia Mine Waste Rock Pile Research Committee (1991), and the technical experts responsible for the design. The design criteria assumes an overall slope angle of 2.5H:1V, and under static loading conditions a minimum factor of safety (FOS) of 1.3 for short term developments (e.g. during mine operations) and a minimum FOS of 1.5 for long term (e.g. closure) stability of the WRSAs. Under pseudo-static seismic loading conditions the design criteria assumes a minimum FOS of 1.1. Based on an evaluation of the potential seismic activity for the project site, the assumed seismic design event for the WRSAs is an earthquake with a 1-in-475-year return period that generates a peak horizontal ground acceleration (PGA) of 0.14 g (BGC, 2011b).

Table 2.3-1: Geotechnical Design Criteria for WRSAs

Criteria	Description
Static Factor of Safety – short term (mine operations)	1.3
Static Factor of Safety – long term (post-closure)	1.5
Pseudo-static Factor of Safety – short and long term	1.1
Design Earthquake Return Period	1-in-475-year event
Overall Slope Angle	2.5H:1V

2.3.2 Reclamation Stockpiles

The reclamation stockpiles will be comprised of salvaged topsoil and unused cut material from across the site. The unused cut material will consist of primarily colluvium and weathered bedrock, and will be used in the stockpile as general fill or structural fill to buttress areas or benches used to store topsoil. While the natural topography of the stockpile areas ranges from approximately 5H:1V to 8H:1V, the maximum bench slope angle can be as steep as 2H:1V if structural fill is used (Table 2.3-2).

Table 2.3-2: Geotechnical Design Criteria for Reclamation Stockpiles

Criteria	Description
Static Factor of Safety – short term (mine operations)	1.3
Pseudo-static Factor of Safety – short and long term	1.1
Overall Slope Angle	5H:1V
Maximum Bench Slope Angle with General Fill	3H:1V
Maximum Bench Slope Angle with Structural Fill	2H:1V

2.3.3 Temporary Ore Stockpile

At its maximum extent in late March of each year, the temporary ore stockpile will have an average vertical thickness of ~17m, with an overall slope of 4H:1V, and will consist entirely of primary crushed ore, which is assumed to be deposited on terraces via grasshopper conveyors at the angle of repose ($\geq 1\text{H:1V}$). Thus, the ore stockpile will be comprised of several long sloping benches of crushed ore with maximum fill slopes of 1H:1V spread across a greater area with an overall stockpile slope of 4H:1V.

2.3.4 Ice-Rich Overburden Storage Area

The storage area berms are designed to be flow through structures that will allow for excess pore water resulting in the thaw of ice-rich material to drain laterally and vertically into the surrounding subsurface soils. The material used to construct the berms will be sourced from existing placer tailings available in the vicinity of the proposed storage area. The berms are classified as Dump Stability Class II, following the 1991 British Columbia Mined Rock and Overburden Piles Investigation and Design Manual Interim Guidelines (Design Manual).

The Design Manual provides interim guidelines regarding minimum factors of safety which should be adhered to in mine waste pile design. The storage area berms have been designed according to the factors of safety that are presented in Table 2.3-3. These guidelines have been chosen from presented ranges of values using past experience and the existing site conditions and material properties determined through site investigation and laboratory testing. For more details regarding the storage berm concepts, design criteria and the consequence classification see the Frozen Material Management Plan.

Table 2.3-3: Minimum Factor of Safety

Condition	Minimum Factor of Safety
Static	1.3
Pseudostatic	1.0

2.4 HYDROLOGIC CRITERIA

Design basis and criteria, and the designs for all water management infrastructure referred to here are discussed in more detail in the Construction and Operations Water Management Plan.

2.4.1 Water Management Pond

The Lower Dublin South Pond (LDSP) will be constructed to manage contact water at site during construction and will also serve as the contact water management pond throughout operations.

The LDSP has been designed in accordance with Guidelines for Assessing the Design, Size and Operation of Sedimentation Ponds Used in Mining (BC MOELP, 1996) and with the Dam Safety Guidelines (CDA, 2007). The LDSP storage capacity is sized to hold the 1 in 10 year 24 hour storm event of 61,000 m³ and provide a detention time of at least 24 hours for any sediment particles sized 0.005 mm (and larger) to settle out. The spillway of the LDSP is designed to pass the 1 in 1000 year 24-hour storm event while still maintaining at least

0.5 m of freeboard. The LDSP will have a total storage capacity of approximately 74,450 m³ (approximately 13,000 m³ more than the design event).

2.4.2 Sediment Basins

Temporary sediment traps and sediment basins will be constructed at the end of collection ditches to detain sediment-laden runoff long enough to allow sediment to settle out. The size of the temporary sediment trap/basin is dependent on the ditch design flows. The exact locations and final geometry of each trap will be field fitted to integrate with the terrain to minimize disturbance. The engineer of record or construction manager shall review and approve the sizing and location of these basins prior to construction.

Two sizes of sediment basins, designated SB1 and SB2, have been developed for the site and will be used for different size catchments draining areas that are under or following construction, and that will be adjacent to and down-gradient from the rock storage areas and reclamation stockpiles, temporary ore stockpile and ice rich overburden storage area. The sizing and dimensions of the two sediment basins are described in the Water Management Plan are summarized in Table 2.4-1. The width and length dimensions correspond to the top of the wet storage area, at the base of the outlet structure.

Table 2.4-1: Temporary Sediment Basin Design Specifications

	Sediment Basin Size 1	Sediment Basin Size 2
Drainage Area (hectares)	<1	1 - 2
Width (m)	10	12
Length (m)	20	25
Depth of Wet Storage (m)	1	1
Minimum Spillway Weir Length (m)	2	4

2.4.3 Ditches

There are two different types of ditches considered in the Construction and Operations Water Management Plan: a runoff collection/interceptor ditch and a diversion ditch.

A collection ditch placed above the cut slope will intercept water and direct it to less erosion prone areas. A corrugated metal half-pipe (CHP) will be used in terrain that is steeper than 15%, as the maximum velocities on such slopes are likely too high for practical riprap channel protection. A minimum diameter of CHP of 1.0 m will be used on the site.

General locations and conditions for collection ditches may include the placement:

- below disturbed existing slopes to divert sediment-laden water to control facilities,
- at or near the perimeter of a construction area to prevent sediment-laden runoff from leaving the site, or
- below disturbed areas before stabilization to prevent erosion.

Collection ditches are sized to convey the runoff from a 10-year 24-hour storm event and include armouring for a 100-year 24-hour storm event assuming that the entire up-gradient catchment area has been disturbed and contributes sediment-laden runoff to the seepage collection and recycle ponds.

Diversion ditches will be constructed up-gradient of disturbed areas to intercept clean surface water runoff. A diversion ditch is a channel lined with vegetation, riprap, or other flexible, erosion resistant material. The main design considerations are the design flow and velocity of the water expected in the channel. In general, diversion ditches will be designed to convey the 10-year 24-hour peak storm and include armouring for a 100-year 24-hour peak storm for the estimated watershed size, and will discharge through a stabilized outlet designed to handle the expected runoff velocities and flows from the ditch without scouring. Diversion ditches located upslope of key mine infrastructure, however, will be sized to convey the runoff from a 100-year 24-hour storm event.

2.4.4 Waste Rock Drains

The preliminary design for the rock drains beneath the WRSAs have been sized based on an estimated runoff from a 200-year return period precipitation event. A dominant (D_{50}) particle size of 0.1 m will be placed through selective use of waste rock, segregation by screening, or end dumping of waste rock. The drains will be constructed out of non-metal leaching, non-acid generating, clean, durable intrusive waste rock with a D_{50} of at least 0.1 m and a maximum particle size of 1 m.

As required by the regulatory approvals issued for the Project, final detailed designs for the WSRAs and the rock drains will be provided prior to construction of the WRSAs. The final designs will include a Rock Drain Durability Testing Plan to ensure that material selected for construction of the rock drains meet the final design criteria for the drains.

3 STORAGE FACILITY DESIGN

3.1 FOUNDATION CONDITIONS

Geotechnical site investigation programs were undertaken in 2009, 2010, 2011, 2012 and 2016 to investigate subsurface conditions at selected mine facilities (BGC2010, 2011a, 2012a, 2012b and 2017). Geotechnical investigations were also undertaken in 2013 to investigate subsurface conditions at the ice-rich overburden storage area (EBA, 2013). Detailed boring logs for the foundations of the stockpiles and rock storage areas are found in the referenced geotechnical documents; foundation conditions within the WRSA footprints have also been documented previously by Knight Piesold (1996) and Sitka (1996). Sections 3.0 and 4.0, and Drawings 5, 6 and 7 of Appendix A provide a summary of relevant subsurface data in the WRSA foundations.

3.1.1 Waste Rock Storage Areas

3.1.1.1 Surficial Conditions

A thin organic cover is widespread across the Project site overlying the other overburden units. The cover primarily consists of vegetative mat, moss, silt and sand, and other organic matter in varying proportions. The typical observed thickness is 0.2 to 0.3m.

The WRSAs will be founded on overburden composed of colluvium and completely weathered bedrock. The overburden is moderately thick (typically 0 to 10m) but highly variable and predominantly consists of soils ranging from boulders and cobbles with some silt and sand, to silty sand with gravel and some cobbles.

A distinct colluvial unit was observed within a lobate landform in the Eagle Pup drainage area (Figure 3.1-1). This unit contains completely weathered rock fragments mixed with excess ice, including frequent inclusions of massive ice and covers an area of approximately one ha.

Colluvium was typically observed to be underlain by a horizon of weathered rock. The weathering profiles vary substantially across the site, depending on parent rock type and other local factors. Weathered rock is considered to be part of the overburden where it is completely weathered or residual soils.

3.1.1.2 Subsurface

The metasedimentary rock (e.g. quartzite, schist and phyllite) nearest the ground surface was often observed to be completely weathered to silt with some to trace gravel or sand and gravel with cobbles and trace to some silt and clay. The gravel and cobble clasts tended to be friable, platy and exhibit a 'soapy' film due to the weathering/alteration. The transition from highly or completely weathered rock to a more competent, unweathered rock mass is highly variable; unweathered rock was generally not observed in test pits, and usually not observed at shallow depths in drill holes.

The near-surface granodiorite intrusive rock was often observed to be either completely weathered to a silty sand, or sandy silt, or highly weathered to a poorly graded sand. The thickness of the weathered horizon was highly variable.

Two major rock types were encountered below the overburden soils within the footprints of the WRSAs; metasediments and intrusives. The metasedimentary bedrock encountered ranges from schist to quartzite and is the most common bedrock types encountered. Intrusive rock (granodiorite) was encountered in boreholes and at outcrops in the upper portions of the Platinum Gulch and Eagle Pup valleys. In general bedrock was encountered at depths ranging from 0 to 44 m with an average depth of 6.9 m.

Frozen ground is widespread throughout the footprint of the EP WRSA and frequently contained excess ice. Frozen ground is also locally present in the footprint of the PG WRSA and, where present, typically contains excess ice.

The depths to groundwater observed range from 0.4 to 8.2 m. Multiple seeps were also observed along road cuts in both Eagle Pup and Platinum Gulch. It is presumed that the groundwater table forms a subdued replica of the surface topography, with the water table relatively close to the surface in the valley bottoms, while at greater depths along the valley walls. More description of the groundwater regime within the Eagle Pup and Platinum Gulch valleys is found in Stantec (2012), BGC (2013) and BGC (2014).

3.1.2 Temporary Ore Stockpile

The footprint of the temporary ore stockpile is underlain by a mix of frozen silty colluvium and coarser non-frozen sandy to gravelly colluvium; the colluvium in turn overlies highly to moderately weathered metasedimentary bedrock at depths greater than 3 m. In many cases the contact is gradational and is difficult to discern, but outcrops along some roadcuts and a few boreholes in the vicinity indicate Type 2 and Type 3 rock is present at shallow (2 m) to moderate (5 m) depths. Type 3 rock is defined as being rock that is highly or less weathered, has intact strength greater than R0 (i.e. minimum UCS strength 1 MPa), and can generally be excavated with normal excavating equipment, with approximately 40 % requiring ripping. Type 2 rock is defined as rock with a Rock Mass Rating (RMR, Bieniawski, 1976) of 30 or greater, with 50 % or greater core recovery. Type 2 rock will generally require ripping, with approximately 35 % that can be excavated with normal excavation equipment.

3.1.3 Reclamation Stockpiles

Reclamation stockpile A is situated on a west-facing mid-slope area underlain by discontinuous warm permafrost. Typically a thin (~0.2 m) organic cover overlies loose and highly variable colluvium comprised of primarily sand and silt with angular cobbles and boulders. The permafrost zones are comprised of both ice-rich and non-ice-rich material encountered generally fairly close to the surface (within the upper 2.0 to 3.0 m). The thickness of the colluvium varies from a thin veneer uphill to the east and much thicker (up to 5 m) downslope, where it grades somewhat imperceptibly into highly weathered metasedimentary bedrock.

In comparison, reclamation stockpile B is situated on a north-facing mid-slope area underlain by more extensive permafrost and occurrences of ice-rich zones. The colluvium underlying the thin organic layer is typically finer-grained, with higher percentages of silt and sand and less gravel. The overall colluvial thickness is deeper (up to 10 m in some boreholes) and it also grades somewhat imperceptibly into metasedimentary bedrock.

Reclamation stockpile C is located on a saddle north and west of the HLF Phase 1 footprint on flat to moderately sloping terrain. While there is limited geotechnical data in the area, based on surface mapping the area is likely underlain by a relatively thin layer of silt, sandy gravelly colluvium, which grades into

metasedimentary bedrock. Typically, residuum (weathered bedrock) outcrops at the surface, and permafrost while present is predominantly non-ice-rich.

3.1.4 Ice Rich Overburden Storage Area

3.1.4.1 Surficial Conditions

The site for the proposed IROSA mainly consists of four depressions situated between mounded sand and gravel tailings produced by historical placer mining activities and eastern till cliffs. The tailings are sparsely to non-vegetated, with higher densities of brush occurring within low lying areas. An overgrown road that traverses east and uphill from the till cliffs connects with tailings at the southern end of the storage area. A portion of the road includes a ditch that diverts mountainside surface runoff away from the placer tailings area.

Four intermittent ponds have formed at the base of the depressions and east of the mounded tailings deposits. These ponds are leaky-confined by fine-grained sediments and are perched above the local groundwater table.

Surface water drains into the depressions from two main sources of runoff from the eastern slope. Runoff overflows from each depression within the valley and drains from north to south to the southernmost pond, where it exfiltrates to subsurface soils. At the time of the drilling and site work, there was no active outlet from the confined valley.

3.1.4.2 Subsurface Conditions

The soils encountered beneath the tailings included disturbed alluvial and fluvial sands and gravels overlying silt till and weathered bedrock. The soil stratum encountered in each borehole is described in the borehole logs in the Frozen Materials Management Plan.

The in-situ subsurface soil densities varied from very loose to compact sands, compact clay, and very dense to hard till and weathered bedrock. Standard Penetration Tests (SPTs) could not be completed in strata or tailings that contained high percentage of cobbles and boulders.

Bedrock in the area is characterized as zones of metasediments (interbedded quartzites and phyllites) and granodiorite. The drill equipment used for this geotechnical investigation was able to drill into weathered bedrock, but unable to penetrate into competent bedrock. A rough comparison using topographic maps and borehole locations indicates that bedrock is highest in elevation in the north portion of the area and decreases gradually to the south while dipping towards the east.

Although the project area is located in a zone of discontinuous permafrost, permafrost was not encountered during the geotechnical investigation; based on subsurface investigations completed in placer tailings material throughout the area, permafrost is not expected to occur anywhere in the IROSA.

Groundwater was encountered below the perched tailings ponds at roughly the same elevation as Haggart Creek, which lies ~100 m to the west. Initial water level readings taken at the time of the investigation, indicate that ground water elevations varied from ~736 m asl to ~744.0 m asl or at least 5 m below the base of the IROSA valley floor.

3.2 MATERIAL STORAGE CONDITIONS

3.2.1 WRSA Rock Drains and Seepage

Groundwater was observed flowing into nine test pits in Eagle Pup and two in Platinum Gulch. The depths to groundwater observed ranged from 0.4 m to 8.2 m bgs. Multiple seeps were also observed along road cuts in both Eagle Pup and Platinum Gulch as shown on Drawing 8 in Appendix A. It is assumed that the groundwater table forms a subdued replica of the surface topography, with the water table relatively close to the surface in the valley bottom and deeper along the valley walls.

The Eagle Pup and Platinum Gulch drainages each consist of a single main valley that broadens and steepens in the uplands; due to their intermittent nature, the channels in each valley are poorly developed or defined along some reaches. However, the potential magnitude of flows in these drainages, especially during freshet, as well as the present of discharging springs, warrant the construction of engineered rock drains to convey expected flows through the WRSAs. The rock drains beneath the WRSAs have been sized based on the estimated runoff from a 200-year return period precipitation event.

It has been assumed that a dominant particle size of 0.1 m will be placed in the rock drains through selective use of waste rock, segregation by screening, or end dumping of waste rock. It has also been assumed that the rock drains will have a porosity of 30 %. Based on these assumptions, and applying a preliminary factor of safety of 4, the cross-sectional area of the preliminary design of the rock drains at the toe of the EP WRSA is 210m² and 58 m² for the PG WRSA. The safety factor of 4 is conservative and has been applied to the cross-sectional areas of the rock drain to account for:

- uncertainty in the block size estimates
- potential migration of fine grained materials into the voids in the drain
- potential freezing of the drain
- decrease in void ratio over time due to compression, and
- potential degradation of the rock drain material over time.

The safety factor and these assumptions will be re-evaluated once the drain rock material has been selected during detailed design, and the site-specific conditions of the rock drains are further evaluated.

To ensure that the rock drains maintain their flow capacity over time they will be constructed out of non-metal leaching, non-acid generating, clean, durable intrusive waste rock with a D₅₀ of at least 0.1 m and a maximum particle size of 1 m. Intrusive rocks will be utilized in the construction of the rock drains to the greatest extent possible, due to their higher strength and greater block size than metasedimentary rock. In the event that sufficient quantities of intrusive rock are not available, metasedimentary rocks may be used to construction portions of the rock drain in Eagle Pup. If mine scheduling dictates that the metasedimentary rocks are to be incorporated into the rock drains, the rock will be evaluated to ensure that their mechanical degradation is appropriate for use as construction materials. As noted above, the final design of the rock drains will incorporate the findings of the Rock Drain Durability Testing Plan to ensure that material selected for construction of the rock drains meet the final design criteria for the drains.

The alignments of the rock drains for both WRSAs are shown on Drawing 8 in Appendix A.

3.2.2 Permafrost and Excess Ice across the Project Site

Frozen ground is widespread but discontinuous throughout the footprint of the Project, primarily on lower elevations of north-facing slopes. This includes ground proposed to be developed for the reclamation stockpiles and the EP WRSA, and somewhat less so for the PG WRSA and the temporary ore stockpile. In some areas, the frozen ground contains excess ice. Frozen ground and excess ice observations along cross-sections A and B in the EP WRSA are shown on Drawings 5 and 6 of Appendix A, respectively. Frozen ground is also locally present in the footprint of the PG WRSA and, where present, typically contains excess ice. The distribution of the observed frozen ground conditions in the EP and PG WRSA footprints are shown on Drawing 8 of Appendix A. Where present in test pits and boreholes, frozen ground was observed to an average depth of approximately 2.3 m in the EP WRSA and 1.0 m in the PG WRSA. Average depths to frozen ground were generally 0.5 to 1.0 m bgs when present in both the reclamation and temporary ore stockpiles, and the thicknesses of soils containing excess ice were approximately 1.3 m in the temporary ore stockpile footprint, and over 1.5 m in the reclamation stockpile footprints. In general, the frozen material is silty colluvium and the non-frozen material is coarser (sandy gravelly colluvium). Temperature measurements recorded in boreholes situated across this area of interest is typically warm ($< -0.5^{\circ}\text{C}$), characteristic of low-grade permafrost.

3.3 CLEARING, STRIPPING AND GRUBBING

3.3.1 Waste Rock Storage Area

The WRSAs will be constructed in areas that contain discontinuous permafrost, which may contain excess ice. Areas of permafrost with excess ice will be treated by either stripping, to encourage thawing and drainage, or excavation and removal as dictated by the Frozen Materials Management Plan to expose stable soils before covering with waste rock. Prior to construction, additional investigations will be undertaken to further delineate and characterize the areas used for buttressing and designated for final and interim toes, and identified as containing pervasive excess ice. Further details on the management of frozen material encountered during the development of the waste rock storage areas is described in the Frozen Material Management Plan. The clearing and stripping will be undertaken in as short a time as practicable, if the ground is frozen and does not require a long duration to thaw, in advance of waste rock placement to minimize the exposure period of the de-vegetated ground thus limiting the erosion potential of the areas. Water management practices including sediment and erosion control measures during the construction of the WRSAs are described in the Water Management Plan.

In the footprint of the rock drains, organic soils will be cleared and grubbed to an average depth of 0.3m in preparation for the placement of the drain rock. Suitable rock will then be placed for the rock drains to a minimum height of 4 m.

Waste rock placement will be sequenced such that the ice-rich lobate landform identified in the Eagle Pup drainage is buttressed with waste rock prior to advancing the WRSA upslope (see Section 3.4.1.4 below). Depending on the extent of excess ice, these areas may be excavated and replaced with coarse durable rock, or the area could be sequentially loaded over relatively longer periods with waste rock to allow the ice time to thaw and the water generated to dissipate prior to constructing the full lift.

Overburden and fill materials that are not required for reclamation and that are placed in the WRSAs will be placed with coarse, durable waste rock at a ratio such that the overall strength of the mixture is dictated by the waste rock to ensure stability. In addition, overburden spoil materials will not be concentrated along the foundation or within the final side slopes of the WRSAs.

3.3.2 Temporary Ore Stockpile

Runoff collection ditches and sediment basins will be constructed along the down-gradient boundary of the temporary ore stockpile footprint prior to clearing and grubbing activities. The temporary ore stockpile will be constructed in an area that contains discontinuous permafrost, which may contain excess ice. Areas of permafrost with excess ice will be treated by either stripping, to encourage thawing and drainage, or excavation and removal to the IROSA to expose stable soils before cutting or covering with structural fill (to form the sloping terraces). Further details on the management of frozen material encountered during the development of the temporary ore stockpile is described in the Frozen Material Management Plan. The clearing and stripping will be undertaken in as short a time as practicable, if frozen ground does not require substantial thawing period, in advance of the initial crushed ore placement to minimize the exposure period of the de-vegetated ground thus limiting the erosion potential of the areas. Water management practices including sediment and erosion control measures during the construction of the temporary ore stockpile are described in the Water Management Plan.

3.3.3 Reclamation Soil Stockpile

Runoff collection ditches and sediment basins will be constructed along the down-gradient boundaries of the three reclamation soil stockpiles prior to any top soil or overburden material storage activity. In general, these areas will not be cleared and grubbed to avoid disturbing and exposing the permafrost to thawing. Reclaimed top soil and/or overburden material will be end dumped directly on the existing ground. The exceptions would be areas where toe buttresses are required to provide stability for the relatively thin (i.e., 3 to 5 m) pile.

3.3.4 Ice-Rich Overburden Storage Area

Very little site preparation is required for the development of the IROSA. In general, the silt and clay tailings presently located along the upstream toe of each storage area berm should be relocated to allow for increased infiltration of excess pore water into the subsurface ground water once the filter berms are constructed. The relocated material, however, is assumed to stay within the perimeter of the IROSA. Excavation areas and volumes for each filter berm area are detailed in the Frozen Materials Management Plan. The existing soil within the footprint of the filter berm will be scarified to enhance bonding between the natural soils and fill. The berm will be keyed into the side slopes, where feasible, by at least a meter to create interlocking of the fill and side slopes.

3.4 TRANSPORT, DISPOSAL AND DEVELOPMENT

3.4.1 Waste Rock Storage Areas

3.4.1.1 Eagle Pup Waste Rock Storage Area

The EP WRSA will contain most of the waste rock generated from the open pit and will be developed as a valley fill using haul trucks. At its ultimate configuration the EP WRSA will cover an area of approximately 83 ha and will contain approximately 78 million tonnes of waste rock, low grade ore and overburden. Based on the geotechnical assessment and preliminary design considerations described in Appendix A, the EP WRSA will be constructed in 45 m lift heights with an overall height of approximately 315 m. At the end of its construction the waste rock pile will have an overall angle of approximately 2.5H:1V. Within the footprint of the EP WRSA the valley bottom of the Eagle Pup drainage ranges in slope from approximately 8° to 25°. The preliminary configuration of the EP WRSA is provided in plan view in Appendix A on Drawing 2 and in cross-section on Drawings 5 and 6.

The EP WRSA will be initiated part way up the drainage in the second year of construction. Bottom up construction (see Section 3.4.1.4) will then be generally utilized to advance the EP WRSA upslope to its ultimate height while the lowest lift is progressively pushed out. Following this, nearly all of the lifts will be progressively pushed out until the final toe is established. The upper lifts will then continue to be pushed out until the overall angle is increased to a final surface slope of approximately 2.5H:1V.

3.4.1.2 Platinum Gulch Waste Rock Storage Area

The PG WRSA will also be developed early in the mine life as a valley fill using haul trucks. At its ultimate configuration the PG WRSA will cover an area of approximately 33 ha and will contain approximately 22 million tonnes of waste rock and overburden. The PG WRSA will be constructed in 45 m lift heights with an overall height of approximately 345 m. At the end of its construction the waste rock pile surface will have an overall slope of approximately 2.5H:1V. The Platinum Gulch drainage is moderately steep with the valley bottom sloping at approximately 21° in the WRSA footprint. The ultimate preliminary of the PG WRSA is provided in plan view in Appendix A on Drawing 2 and in cross-section on Drawing 7.

The PG WRSA will be initiated in the upper reaches of the drainage. Independent lifts will then be constructed both above and below this elevation. The final toe will be established and the lower lifts expanded outwards. Finally, the upper lifts will be expanded outwards to the final overall surface slope of 2.5H:1V. A series of plans showing the preliminary progression of the WRSA is provided in Appendix A on Drawings A-1 to A-15.

3.4.1.3 General Material Placement and Sequencing

Overburden and fill materials that are not required for reclamation and that are placed in the WRSAs will be placed with coarse, durable waste rock at a ratio such that the overall strength of the mixture is dictated by the waste rock. In general, this will not exceed 20% overburden by volume, and overburden materials will be placed in areas away from the foundation or the final side slopes of the WRSAs. Because overburden materials will be less likely to drain when subsequent lifts are placed and could generate localized excess pore pressures, and contribute to slope instability, measures will be taken to maintain heterogeneity in material types in any one area. In addition, if overburden is temporarily stockpiled on the WRSAs for later use as reclamation cover then it

will be placed away from the edge of the WRSAs so as not to influence the stability of the waste rock piles. In general, the waste rock from the open pit area is not anticipated to consist of materials that are prone to weathering and/or degradation. However, if waste rock prone to weathering and/or mechanical degradation is encountered it will be treated as overburden and handled as outlined above.

3.4.1.4 Other Placement and Sequencing Considerations

A distinct lobate landform comprised of ice-rich colluvium with frequent inclusions of massive ice was encountered in the Eagle Pup drainage (Drawing 4 of Appendix A). This ice-rich area is approximately 1 ha and was encountered to a depth of greater than 26.1 m bgs. Due to its extensive depth which cannot be excavated, a sequence of waste rock placement was developed so that the ice-rich lobe is buttressed with waste rock prior to advancing the WRSA upslope above it. This will be achieved by first constructing a lift of waste rock immediately below the ice-rich landform, which will act as a platform for subsequent lifts. Once this platform lift is established, the next lift of waste rock (i.e. the buttressing lift) will be constructed in front of the ice-rich landform such that it extends out a sufficient distance (at least 135 m) from the native ground surface so that the ice-rich landform is supported. The overall angle of the combined lifts at this stage of the EP WRSA development will not exceed 3H:1V.

Following this initial waste placement sequencing, the EP WRSA will continue to be developed upwards at an overall angle of 3H:1V. The buttress will be widened by approximately 65 m for a total width of at least 200 m. Once the buttress is extended out to a width of at least 200 m from the native ground surface, the WRSA will be developed upwards at an overall angle of about 2.5H:1V.

3.4.2 Temporary Ore Stockpile

As noted above, the temporary ore stockpile will be built on long gently sloping benches that are cut into colluvium/weathered rock; crushed ore (i.e., 250 mm or less or ~6-inch minus) will be deposited on the benches with angle of repose slope faces (or 1H:1V). The ore will be placed on the lower bench first sometime during late November of each year, before proceeding to the next higher bench. At its maximum extent in late March of each year, the stockpile will have an average vertical thickness of ~17m on each bench, with an overall slope across all benches of 4H:1V.

3.4.3 Reclamation Soil Stockpile

During the summer months, as the ground thaws, instabilities may occur near the toes of the reclamation stockpiles if they are advanced over thawed or thawing ground that contains excess ice. Seasonal dumping campaigns focusing on advancing the stockpiles out onto native ground during the winter months and building on existing lifts during the summer months will be considered as much as is feasible to limit the advancement of these facilities onto thawed or thawing ground.

3.4.4 Ice-Rich Overburden Storage Area

The design of the IROSA is provided in the Frozen Materials Management Plan; it includes the construction of five filter berms that will form four storage areas within depressions built during historical placer mining activity in a tailings area situated along the east side of the Haggart Creek valley. The crests of the berms will vary from

five to eight metres in height with an upstream and downstream slope of 2H:1V. The berms will tie into the contours of the mounded tailings piles at elevations ranging from 750 to 758 m asl. The crest width may range between four and six meters as required for accessibility. Table 3.4-1 lists the volumes for estimated storage capacity and required coarse aggregate and filter material for each berm.

Table 3.4-1: Estimated Storage Capacity and Volume of Berm Material

Storage Area	Overburden (m ³)	
1	37,000	
2	73,000	
3	45,000	
4	100,000	
Total	255,000	
Berm	Coarse Material (m ³)	Fine Material (m ³)
A	4,700	450
B	11,000	1,150
C	5,400	850
D	2,600	400
E	1,400	300
Total	25,100	3,150

3.5 STABILITY AND SETTLEMENT ANALYSES

3.5.1 Waste Rock Storage Areas

Geotechnical studies in support of the analyses, including site-specific sampling and testing of materials present in the WRSA foundation are provided in BGC (2010, 2011, 2012a, and 2012b), and are summarized in Appendix A. In general, the existing soils and rock that comprise the WRSA foundation consist of overburden (organics, colluvium and completely weathered bedrock) and bedrock (primarily metasediments although some granodiorite was encountered in the upper portions of both the Platinum Gulch and Eagle Pup valleys). Frozen ground (generally no colder than -1 °C) is widespread throughout the footprint of the EP WRSA, is locally present in the PG WRSA footprint, and was observed to an average depth of approximately 3 m. In both valleys, excess ice is also common.

Material properties used in the stability analyses were based on the site investigation results, laboratory testing, and experience with materials showing similar characteristics. A summary of the relevant material properties is provided in Table 3.5-1.

Table 3.5-1: Summary of Material Properties used in Stability Analyses

Material Type	Unit Weight (kN/m ³)	Effective Stress Parameters		Total Stress Parameters	
		Friction Angle (°)	Cohesion (kPa)	Friction Angle (°)	Cohesion (kPa)
Waste Rock	19	Non-linear strength function ¹		Non-linear strength function ¹	
Colluvium – ice-poor	18	34	0	30	0

Material Type	Unit Weight (kN/m ³)	Effective Stress Parameters		Total Stress Parameters	
		Friction Angle (°)	Cohesion (kPa)	Friction Angle (°)	Cohesion (kPa)
Colluvium – ice-rich	18	30	0	30	0
Bedrock – completely weathered	20	35	50	35	50
Bedrock – Type 3	27	Hoek-Brown strength function ²		Hoek-Brown strength function ²	
Bedrock – Type 2	27				
Bedrock – Type 1	27				

Notes:

- 1: $\Phi_r = \Phi' - R(\log(S/\sigma_n))$, where Φ' is internal angle of friction, Φ_r is the residual angle of friction, σ_n is the effective normal stress, R = equivalent roughness and S = equivalent strength.
- 2: See Table 3.5-3.
- 3: Source: Table 5-4 in Appendix A (BGC 2012c)

The shear strength of the waste rock in both WRSAs was modeled using an empirical approach suggested by Barton and Kjaernsli (1981) for rockfills as described in Appendix A. Table 3.5-2 provides a summary of the strength parameters assumed for the waste rock.

Table 3.5-2: Waste Rock Strength Parameters

Parameter	Value	Source
D50	100 mm	Estimated from fracture spacing measured geotechnical drillholes in the open pit area
UCS (Uniaxial Compressive Strength)	80 MPa	Estimated from UCS and point load testing conducted by BGC (2012b)
R (Equivalent Roughness)	4	Angular, rough rockfill with a porosity of 30%
S (Equivalent Strength)	20 MPa	Based on a UCS of 80 MPa and a D50 of 100 mm
Residual Friction Angle	31°	Estimated from direct shear testing conducted by BGC (2012b)

Notes: Source – Table 5-5 in Appendix A (BGC 2012c)

A rock mass strength envelope was developed for each bedrock category using the Hoek-Brown criteria (Hoek et al., 2002). The parameters required for the Hoek-Brown criteria are outlined below and provided in Table 3.5-3.

- Geological strength index (GSI) of the rock mass
- Unconfined Compressive Strength (UCS) of the intact rock
- Material constant (m_i) of the intact rock

- An assumed rock mass disturbance factor (“D”) which downgrades the rock mass strength based on the type of excavation method and stress relief.

Table 3.5-3: Hoek-Brown Parameters for Bedrock

Unit	Hoek-Brown Input Parameters			Hoek-Brown Strength Properties		
	GSI ²	UCS ³	m _i	m _b	s	a
Type 1 Rock	51	54	11	1.912	0.0043	0.505
Type 2 Rock	36	33	6	0.610	0.0008	0.515
Type 3 Rock	28	25	6	0.459	0.0003	0.526

Notes:

1. The Hoek-Brown failure criteria have been estimated using a disturbance factor ('D') of 0 for all units.
2. Median RMR₇₆ parameters are used for each geotechnical unit.
3. UCS for Type 1 and Type 2 rocks are estimated from point load testing. UCS for Type 3 rock is estimated from median strength grades.
4. Source: Table 5-6 in Appendix A (BGC 2012c)

Stability analyses described in Appendix A to support the preliminary geotechnical design criteria indicate that, in general, excess pore pressures could be generated in areas of the foundation containing excess ice when the foundation materials thaw, reducing the effective shear strength of the foundation soils; although the Frozen Materials Management Plan describes the strategies for mitigating areas with excess ice, it was assumed for the stability analyses that the distribution of excess ice is not fully identified with the data currently available. Therefore, for the purposes of evaluating a range of scenarios during waste placement, the following two pore pressure scenarios (cases) were considered for the stability analyses: 1. No excess pore pressures are generated in the overburden. 2. Excess pore pressures are generated in the upper 3 m of the overburden throughout the entire footprints of the WRSAs.

Case 1 is considered appropriate for both short term (e.g. during mine operations) and long term (e.g. post-closure) timeframes. Case 2, however, is only considered appropriate for short term timeframes as it is estimated that pore pressures generated by excess ice thawing from waste rock placement will have dissipated well before the end of the mine life. Applying Case 2 to evaluations of the overall stability of the WRSAs is also considered to be a conservative approach given that it is unlikely that excess ice is pervasive throughout the WRSA footprints.

The proposed EP WRSA meets the design criteria for FOS for most of the cases considered. The exception is for the scenario where a slip surface initiates along the crest of the lowest lift. For this specific scenario the lowest lift could become unstable if excess pore pressures are generated in the foundation as a result of excess ice thawing. Therefore, during construction, additional investigations will be conducted to delineate and characterize soils containing excess ice in specific areas where final and interim toes of the WRSAs will be located. If it is determined that excess ice is pervasive throughout these areas then:

- the lower lift may be re-graded to a shallower angle along the face of the lift,
- the excess ice material may be excavated (following protocols in the Frozen Material Management Plan) and replaced with coarse, durable and free-draining waste rock, and/or
- the area could be sequentially loaded with waste rock over a relatively long time period to allow time for the ice to thaw and the pore pressures to dissipate prior to constructing the full height of the lift.

The proposed PG WRSA meets the design criteria for FOS for Case 1, where excess pore pressures are not generated in the overburden. However, for Case 1, potential slip surfaces initiating along the crest of individual lifts that toe out on native ground do not meet the FOS criteria under static or pseudo-static loading. Therefore, it will be necessary to re-grade or re-slope lifts that toe out onto native ground (i.e. final or interim toes, or isolated lifts) to flatter angles to achieve an acceptable level of stability. This could be implemented during the reclamation plan for the PG WRSA, as this is planned to occur midway in the mine life. Further, the pseudo-static analyses assume that liquefaction does not occur in either the foundation or the waste rock. While liquefaction is not expected to occur with the types and distribution of site soils observed in the WRSA footprints, the resistance of these materials to liquefaction will be further assessed at detailed design prior to commissioning.

For Case 2, the FOS criteria are not met when excess pore pressures are generated in the foundation. Although, based on the information available excess ice is not pervasive throughout Platinum Gulch, the assumptions for Case 2 are unlikely. Prior to and during foundation preparation, additional investigations will be undertaken to delineate and characterize specific areas containing excess ice within the WRSA footprint. If excess ice is found to be pervasive then mitigative measures noted above for the EP WRSA will be conducted in addition to possibly using bottom-up construction. Further, depending on where excess ice is located (e.g. near the toes of individual lifts), site-specific waste rock placement procedures may need to be implemented to allow pore pressures that are generated an adequate time to dissipate prior to constructing each lift. These procedures could include pre-loading selected areas of the WRSA.

3.5.2 Ice Rich Overburden Storage Area

Limit equilibrium stability analyses were conducted on the filter berms to determine the factors of safety against slope failure both during construction and mine operation. All analyses were completed using the commercially available, two dimensional software SLOPE/W (Geo-Slope International Ltd., Version 7.19); more details on the stability analyses is provided in NELPCo (2013) (in Appendix A of the Frozen Materials Management Plan. The process followed the following methodology:

- a slip mechanism was assumed;
- the shear resistance required to equilibrate the assumed slip mechanism was calculated using statics;
- the calculated shear resistance required for equilibrium was compared with the available shear strength in terms of a factor of safety; and
- the slip mechanism with the lowest factor of safety was determined through iteration.

Earthquake loading was modeled using a pseudo-static peak horizontal ground acceleration taken from the 2010 National Building Code Seismic Hazard calculation. The stability analysis was completed using cross

sections through the deepest section of the berms. The stability analysis yielded factors of safety that met or exceeded the minimum factors of safety as per the recommendations of the Design Manual (1991) published by the British Columbia Mine Waste Rock Pile Research Committee.

Three failure modes were considered in the stability analysis: shallow-seated, deep-seated, and pseudostatic failures. It was found that a shallow failure is the most probable type of failure on the downstream and upstream faces. These failures would occur on the face of the berm only, would not extend far from the base of the berm and are not considered to be critical to the stability of the design provided the slump is repaired promptly. Stability was checked for both empty and full capacity storage areas.

The deep-seated failures are considered to be of greater concern; therefore, a deep-seated critical slip surface would involve a larger portion of the berm core and have a larger impact on the berm stability, possibly resulting in some flowage of the thawing ice-rich material to the next down-gradient storage cell, and in the case of the last berm, towards Haggart Creek. While a deep-seated failure is not likely, this condition was considered in the stability analysis.

The resulting factors of safety from the stability analyses are summarized in Table 3.5-4. In general, all berms met or exceeded the minimum factor of safety recommended by the Design Manual.

Table 3.5-4: Summary of Factors of Safety for IROSA Stability Analyses

Berm	Scenario	Failure Type and Corresponding FOS		
		Shallow	Deep Seated	Pseudostatic
A	Downstream	1.4	1.5	1.1
	Upstream	1.5	1.5	1.2
	Overburden Placed	1.4	1.5	1.1
B	Downstream	1.5	1.7	1.1
	Upstream	1.6	1.6	1.2
	Overburden Placed	1.5	1.7	1.1
C	Downstream	1.5	1.7	1.1
	Upstream	1.5	1.6	1.1
	Overburden Placed	1.5	1.6	1.1
D	Downstream	1.6	1.6	1.1
	Upstream	1.5	1.6	1.1
	Overburden Placed	1.5	1.8	1.1
E	Downstream	1.6	1.9	1.2
	Upstream	1.3	1.9	1.2
	Overburden Placed	1.6	1.9	1.2

Note: source – NELPCo (2013).

Further assessment of the 2013 IROSA design was undertaken (NELPCo 2017 – in Appendix A of FMMP) to address the following additional seismic considerations:

- Review and update seismic hazard parameters used in IROSA design;
- Check potential for triggering of seismic liquefaction in susceptible soils;

- Re-run slope stability models, including the post-seismic (liquefied) case for embankments where triggering of liquefaction is expected in the subgrade soils;
- Estimate embankment displacements under seismic and post-seismic (liquefied) conditions; and
- Check material gradations of the embankment and embankment face materials for compatibility with respect to filtering criteria.

Results of the IROSA design update confirm that the recommendations provided in the 2013 design report are valid. It is expected that locally sourced tailings material can be used to build the embankments, and that embankment stability for static and seismic conditions is acceptable in all cases.

However, potentially liquefiable soils have been identified in the vicinity of Embankment A and C, and without mitigation, there could be some associated risk of embankment slope failure and/or large displacements, particularly for embankments in the northern half of the IROSA. This risk has been mitigated by modifying the sequence of construction of each filter berm. See Section 5.2 of NELPCo (2017).

3.6 CONSTRUCTION QUALITY ASSURANCE / QUALITY CONTROL

A construction quality assurance and quality control plan will be developed for the WRSAs, the IROSA, reclamation stockpiles and the temporary ore stockpile prior to commissioning to ensure that the parameters used during the design process are achieved. Elements that will be considered include:

- a qualified environmental professional/technician with appropriate knowledge and training will monitor Project construction and closure activities,
- monitoring of cut slopes and fill material,
- salvaging and storing soil material suitable for reclamation,
- an evaluation of topsoil volumes, and based on soil stockpile dimensions, a determination of whether there is sufficient material for reclamation,
- foundation preparation,
- permafrost (and excess ice rich material) identification,
- construction of berms, lifts, interceptor ditches and sediment basins,
- implementation of construction constraints related to climate conditions,
- photographs of the construction process at each stage of construction, and
- preparation of construction record drawings signed and sealed by a Professional Engineer registered in the Yukon, where appropriate.

3.7 SURFACE WATER MANAGEMENT

Construction water management is included in the Water Management Plan; it describes the capability of the site water management infrastructure to contain, control and convey short duration extreme rainfall events (i.e., 10-year 24-hr event, 100- year 24-hr event, or the Probable Maximum Precipitation). Water management

facilities are designed with two specific operating modes: 1) service conditions, which include day-to-day operations, and 2) ultimate limit conditions, which include provisions for safely handling extreme peak runoff events.

The sediment and erosion control plan section of the Construction and Operations Water Management Plan describes the best management practices (BMPs) that will be implemented on site and detailed site-specific plans that address the construction objectives of the Project, and provides strategies and design objectives with appropriate flexibility to allow the design elements to be field-fit to suit the conditions encountered during construction (i.e., adaptive management approach).

Designs for surface water management facilities and various operational controls for various seasonal conditions (e.g., low flow and freezing) are described in the Water Management Plan. In general, wherever possible and practical, surface water flows will be diverted away from the WRSAs, reclamation stockpiles, the IROSA and the temporary ore stockpile. Grading, crowning, or in-sloping the running surfaces of operating lifts to divert water away from areas which are important to overall stability, such as along outer perimeters of the facilities will also be constructed, if required. Further, surfaces will be graded to avoid ponding, and swales and/or ditches will be constructed within the surface of the piles that tie into natural drainage channels, and which will convey surface water away from the catchments.

Surface runoff is routed to the sediment basins by interceptor ditches that run along the toes of the facilities, and seepage will be intercepted from the WRSAs by rock drains and conveyed to the LDSP. Water contained in the LDSP will either be integrated into the process system as make up water, or discharged directly to Haggart Creek or to Haggart Creek via treatment in the mine water treatment plant, as necessary.

3.8 WASTE ROCK GENERATION AND DISPOSAL OPERATIONS

3.8.1 Operation, Maintenance and Surveillance Plan

An Operation, Maintenance and Surveillance (OMS) Manual for the Eagle Gold Project Waste Rock Storage Areas will be prepared as a prerequisite for commissioning the facilities and will account for any facility design or operational changes that may occur during the construction phase of the Project.

The WRSAs will provide for the storage of non-economic ore and rock. Since the WRSA designs incorporate water management infrastructure (e.g., rock drains), the OMS Manual will be prepared following the guidance as outlined in the Mining Association of Canada's (MAC) document *Developing an Operation, Maintenance and Surveillance Manual for Tailings and Water Management Facilities* (MAC, 2011).

The OMS Manual will provide a framework for actions and a basis for measuring performance and demonstrating due diligence for the WRSA operations. As discussed in the 2011 MAC guidance document, key items and activities covered in the Manual will include, as appropriate, the following:

- roles and responsibilities of personnel assigned to OMS activities for the WRSAs,
- description of the WRSAs including site conditions, key components, regulatory requirements, and design criteria,

- facility operations including lift development, grading, erosion and sediment control, environmental protection, and documentation and reporting,
- facility maintenance including routine and event-driven maintenance, and documentation and reporting,
- facility surveillance including routine, event-driven and annual comprehensive inspections and documentation and reporting, and,
- emergency preparedness and response planning.

The OMS Manual will cover WRSA operations from construction through operations, reclamation and closure. It will present procedures that will be implemented by appropriate mine personnel for the operation, maintenance, and surveillance of the WRSA to ensure that it is functioning as designed; meets regulatory and corporate environmental policy obligations; and assists in minimizing the potential for environmental degradation to occur.

3.8.2 Types of Waste

Ore and waste rock material has been categorized into the following lithologies:

- Oxidised Metasediments
- Fresh Metasediments
- Oxidised Granodiorite
- Fresh Granodiorite
- Altered Granodiorite
- Overburden

Geochemical characterization programs to characterize the acid rock drainage and metal leaching (ARD/ML) potential associated with these rock materials are provided in SRK (2013) and SRK (2014). Characterization of the six rock types indicated that carbonates, predominantly calcite, were generally well in excess of sulphides. Calcite content was generally 1 to 4% (from X-ray diffraction) whereas sulphur was most often less than 0.5% (from Leco S and ICP-S). Static testing showed a strong propensity towards non-acid generating conditions with the large majority of samples tested having a neutralization potential to acid potential ratio above 4 the threshold value for which material is typically considered to have no potential for acid generation (Price 1997). Acid rock drainage (ARD) is therefore not anticipated for the Project. Statistical summaries demonstrate that there are no major differences in the ARD potential of the different rock types.

Kinetic testing based on humidity cell testing and a field barrel program indicate that, although pH conditions are expected to be neutral, some metal leaching may still occur. This may include leaching of sulphate, arsenic, cadmium, manganese, antimony, selenium and uranium, and potentially also fluoride, iron, lead, molybdenum, and zinc.

This suite of parameters largely reflects the sulphur mineral suite present; namely arsenopyrite (arsenic), metallic bismuth (bismuth), sulphosalts and tetrahedrite (antimony ±lead, copper and zinc), sphalerite (zinc, cadmium), and molybdenite (molybdenum). Selenium and uranium may be present as substitution ions in these minerals or as unique minerals not previously described. In general, the mean values of these metals and

metalloids are similar between the material types; however, the maximum values are often higher in the granodiorite, particularly where alteration is noted.

The potential for metals and others constituents to leach as a result of weathering of the various rock types was assessed in the kinetic testing program. In all cases, calculations of depletion times indicated that neutralization potential would outlast sulphur, supporting the classification of non-acid generating potential for these materials. Humidity cell leachate quality from the standard cells typically reflected buffered pH values (7 to 8), generally low to moderately low concentrations of sulphate (typically less than 50 mg/L), and variable concentrations of parameters of interest for the Project.

Characterization of overburden materials (i.e. soil, colluvium and placer tailings) potentially used for construction indicated that, in general, that these surficial materials were not potentially acid generating. Although a small proportion appeared to have some acid-generating potential, sulphide concentrations were generally low, and, given that the particle surfaces have already been exposed to air and water, it is reasonable to assume that the sulphides were encapsulated within larger particles, and would therefore not result in any additional oxidation of sulphides or release of metals if used for construction.

As required by QML-0011, waste rock used for construction or fill purposes will have a pH of at least 5.0, a NP:AP ratio of at least 3:1, and a total sulphide sulphur content of no greater than 0.3% following procedures in Section 3.6 of the Environmental Monitoring, Surveillance and Adaptive Management Plan.

3.8.3 Waste Characterization and Segregation Protocol

The geochemical characteristics of both WRSAs are anticipated to be similar though the seepage quality may vary due to the difference in the volume of stored material. Based on the geochemical characterization work conducted, neither facility is anticipated to produce acidic seepage, though metal leaching at neutral pH is expected to occur. The calculation of depletion times from the kinetic testing program indicated that neutralization potential would outlast sulphur supporting the classification of non-acid generating potential. Humidity cell leachate quality from the standard cells typically reflected buffered pH values (7 to 8), generally low to moderately low concentrations of sulphate (typically less than 50 mg/L), and variable concentrations of parameters of interest for the Project.

Very minor proportions of waste rock may have some propensity, albeit likely low, to generate localized acidity. Samples in this category do not tend to group systematically by lithology, nor does any one parameter such as sulphide content definitively identify a sample as potentially acid generating. It is therefore not feasible, nor necessarily of any significant benefit, to sort the small proportion of waste that may have a low potential to generate acid from the vast majority that is anticipated to be non-acid generating. Therefore, waste rock will be placed in the WRSAs without regard for different chemical composition.

3.8.4 Waste Volumes and Disposal Schedule

Table 3.8-1 provide the various material types removed from the pit by year and to each destination (waste material to Eagle Pup or Platinum Gulch WRSAs and ore to primary crusher, temporary ore stockpile and HLF). The pre-strip material (approx. 2.1Mt) is included in the Year -1 quantities.

The annual amount of each waste rock type mined was calculated by querying the geological block model between the yearly mined-out surfaces generated from the final production schedule. The destination of each waste type was estimated by visually comparing source locations to the planned waste dump lifts being constructed on a yearly basis. All the more competent granodiorite material is planned to be sent to the EP WRSA (except some pre-strip material which will be used for construction aggregate or overliner material for the HLF), especially in the lower lifts, to enhance its stability. The upper portion of the PG WRSA will consist primarily of overburden type material, which will allow it to be reclaimed after it is no longer needed (end of production year 3) by pushing this material down and covering the lower lifts with dozers.

All ore from the pit will be sent to the primary crusher. All of this material will then be sent on to the HLF; however, the temporary ore stockpile will temporarily store ore material mined in the cold winter months after primary crushing. Each year, the ore from the temporary ore stockpile will be reclaimed back into the crushing circuit in advance of the secondary crushers and ultimately stacked on the HLF for leaching over the remaining 275 days (approximate duration based on ambient temperatures).

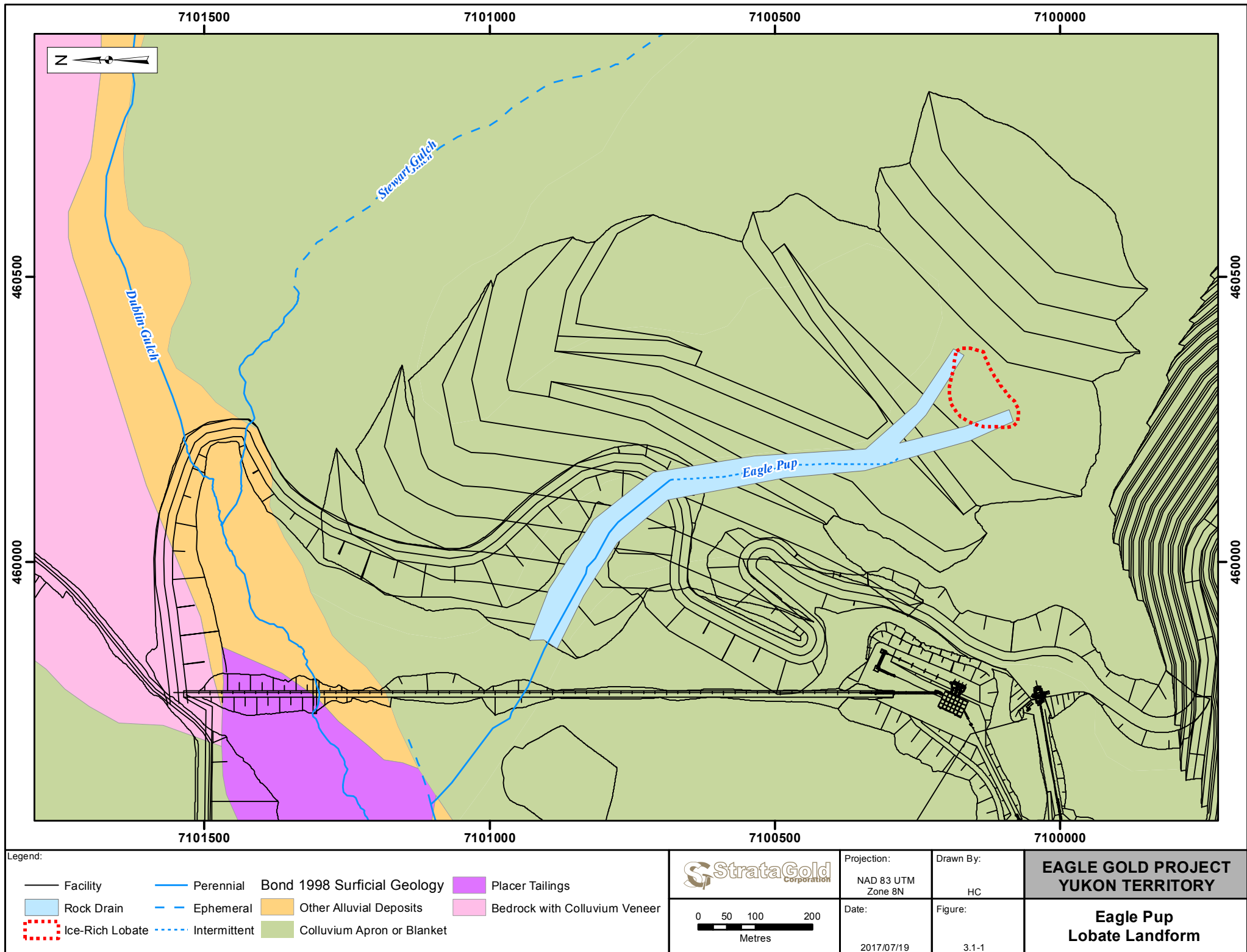
Eagle Gold Project

Waste Rock and Overburden Facility Management Plan

Section 3 Storage Facility Design

Table 3.8-1: Indicative Tonnes of Ore and Waste Types Mined from the Pit by Year and Destination

	←Construction		Operations →									Potential Future Project Expansion*			
Year	-2	-1	1	2	3	4	5	6	7	8	Total	8	9	10	Total
ORE MINED															
Ore to Crusher (kt)	0	16	8,760	10,950	10,949	10,950	10,950	10,950	10,951	2,524	77,000	8,376	10,300	5,600	101,276
Ore Grade (g/t)	-	0.49	0.75	0.81	0.77	0.78	0.80	0.71	0.62	0.61	0.731	0.61	0.58	0.71	0.714
Contained (koz)	0	0	212	287	272	275	282	251	218	49	1,846	164	192	128	2,330
Expected Recovery (%)	-	-	72.9%	72.9%	72.9%	72.9%	72.9%	72.9%	72.9%	72.9%	72.9%	72.9%	72.9%	72.9%	72.9%
Recovered (koz)	0	0	155	209	198	200	206	183	159	36	1,346	119	140	93	1,699
WASTE MINED															
Eagle Pup Waste (kt)	0	255	4,177	9	9,083	15,320	10,026	7,745	7,791	3,158	57,564	6,133	11,928	2,125	77,750
to Low Grade Stockpile (kt)	0	9	1,104	1,642	1,517	367	1,391	1,712	2,213	1,814	11,769	0	2,535	788	15,092
Platinum Gulch Waste (kt)	0	1,810	2,709	14,062	3,039	0	0	0	0	0	21,620	0	0	0	21,620
Total Waste Mined (kt)	-	2,074	7,990	15,712	13,639	15,686	11,418	9,458	10,003	4,972	90,953	6,133	14,462	2,913	114,462
TOTAL MATERIAL MINED (kt)	-	2,090	16,751	26,663	24,588	26,636	22,367	20,408	20,954	7,496	167,953	14,510	24,762	8,513	215,738
ORE TO HEAP LEACH PAD (kt)	-	-	8,760	10,950	10,949	10,950	10,950	10,950	10,951	2,524	77,000	8,376	10,300	5,600	101,276
STRIP RATIO (wt:ot)	-	-	0.91	1.43	1.25	1.43	1.04	0.86	0.91	1.97	1.18	0.73	1.40	0.52	1.13



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APPENDIX A

Geotechnical Assessment and Design of the Waste Rock Storage Areas, Eagle Gold Project Feasibility Study, Dublin Gulch, Yukon

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VICTORIA GOLD CORPORATION

**EAGLE GOLD PROJECT FEASIBILITY STUDY
DUBLIN GULCH, YUKON**

**GEOTECHNICAL ASSESSMENT AND DESIGN OF
THE WASTE ROCK STORAGE AREAS**

FINAL

PROJECT NO: 0792-006
DATE: February 23, 2012
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February 23, 2012
Project No: 0792-006

Michael Padula
Victoria Gold Corporation
680 - 1066 West Hastings Street
Vancouver, BC V6E 3X2

Dear Mr. Padula,

Re: Eagle Gold Project Feasibility Study. Geotechnical Assessment and Design of the Waste Rock Storage Areas – FINAL Report

Please find attached the above referenced FINAL report, dated February 23, 2011. Thank you for the continued opportunity to work on this interesting and technically challenging mine development project. Should you have any questions or concerns, please do not hesitate to contact the undersigned.

Yours sincerely,

BGC ENGINEERING INC.
per:

Warren Newcomen, M.S., P.Eng., P.E.
Senior Geotechnical Engineer

EXECUTIVE SUMMARY

General

The Eagle Gold project is a proposed gold mine located in the Dublin Gulch area of central Yukon approximately 40 km north-northeast of Mayo and 350 km north of Whitehorse. Waste rock generated from mining activities will be placed in two waste rock storage areas (WRSAs): the Eagle Pup WRSA located to the north of the open pit; and the Platinum Gulch WRSA located to the south of the open pit.

The Eagle Pup WRSA will be developed as a valley fill using haul trucks and will contain the majority of the waste rock generated by the open pit. At its ultimate configuration the Eagle Pup WRSA will cover an area of approximately 94 ha and will contain approximately 118.7 million tonnes of waste rock and overburden. The WRSA will be constructed in 45 m lift heights from an elevation of approximately 935 m above sea level (asl) to 1,298 m asl, resulting in an overall height of approximately 363 m and a maximum vertical thickness of approximately 140 m. At the end of the mine life the waste rock pile will have an overall angle of approximately 2.5H:1V.

The Platinum Gulch WRSA will be used to store waste rock early in the mine life and will also be developed as a valley fill using haul trucks. At its ultimate configuration the Platinum Gulch WRSA will cover an area of approximately 38 ha and will contain approximately 13.7 million tonnes of waste rock and overburden. The Platinum Gulch WRSA will be constructed in 45 m lift heights from an elevation of approximately 1,020 m asl to 1,388 m asl, resulting in an overall height of approximately 368 m and a maximum vertical thickness of 40 m. At the end of the mine life the waste rock pile will have an overall angle of approximately 2.4H:1V.

Foundation and Waste Rock Characterization

Excavated rock placed in the Eagle Pup and Platinum Gulch WRSAs will be primarily composed of a mixture of metasediments from the Hyland Group and intrusives related to the Dublin Gulch granodiorite stock. The strengths of the two primary waste rock types have been quantified from open pit geotechnical investigations. Based on laboratory testing and index testing the average uniaxial compressive strength (UCS) of the metasediments and the intrusives are estimated to be 80 MPa and 135 MPa, respectively. The strength of the waste rock has the potential to vary significantly during development of the waste rock piles, particularly in the early years of their development. Placement and quality of waste rock and overburden will have to be closely monitored in critical areas, such as the foundation of the WRSAs, final and interim toes, and in areas that require engineered fills.

In general, the WRSAs will be founded on overburden composed of colluvium and completely weathered bedrock. The overburden is moderately thick (typically 0 to 10 m) but highly variable and predominantly consists of soils ranging from boulders and cobbles with some silt and sand, to silty sand with gravel and some cobbles. Frozen ground, often

containing excess ice, was encountered in the footprints of the WRSAs. Depending on the thickness, initial temperature, and timing of the waste rock placement, the thermal regime of the initially frozen foundation may be altered during construction. The rate of thaw will dictate the ability of the soils to dissipate the water generated.

Stability Analyses

Geotechnical design criteria selected for the Eagle Pup and Platinum Gulch WRSAs are generally based on those recommended by the Yukon Water Board (2009) and the British Columbia Mine Waste Rock Pile Research Committee (1991). It is recommended that under static loading conditions a minimum factor of safety of 1.3 be achieved to short term developments (e.g. during mine operations) and that a minimum factor of safety of 1.5 be applied to the long term (e.g. closure) stability of the WRSAs. Under pseudo-static seismic loading conditions it is recommended that a minimum factor of safety of 1.1 be achieved. Based on an evaluation of the potential seismic activity for the project site the recommended seismic design event for the WRSAs is an earthquake with a 1-in-475-year return period that generates a peak horizontal ground acceleration (PGA) of 0.14 g (BGC, 2011b).

Excess pore pressures could be generated in areas of the foundation containing excess ice when the foundation materials thaw, reducing the effective shear strength of the foundation soils; however, the distribution of excess ice cannot be confidently determined with the data currently available. Therefore, for the purposes of evaluating a range of scenarios during waste placement, the following two pore pressure scenarios (cases) were considered for the stability analyses:

1. No excess pore pressures are generated in the overburden.
2. Excess pore pressures are generated in the upper 3 m of the overburden throughout the entire footprints of the WRSAs.

Case 1 is considered appropriate for both short term (e.g. during mine operations) and long term (e.g. post-closure) timeframes. Case 2, however, is only considered appropriate for short term timeframes as it is estimated that pore pressures generated by excess ice thawing from waste rock placement will have dissipated well before the end of the mine life. Applying Case 2 to evaluations of the overall stability of the WRSAs is also considered to be a conservative approach given that it is unlikely that excess ice is pervasive throughout the WRSA footprints

The proposed Eagle Pup WRSA meets the recommended factors of safety for most of the cases considered. The exception is for the scenario where a slip surface initiates along the crest of the lowest lift. For this specific scenario the lowest lift could become unstable if excess pore pressures are generated in the foundation as a result of excess ice thawing. Therefore, it is recommended that additional investigations be undertaken to delineate and characterize soils containing excess ice in areas where final and interim toes of the WRSAs will be located. If it is determined that excess ice is pervasive throughout these areas then

mitigative measures of the lower lift may be required such as re-grading the face of the lift to a shallower angle or excavating the ice-rich material and replacing it with coarse, durable and free-draining waste rock. Alternatively the area could be pre-loaded with waste rock to allow time for the ice to thaw and the pore pressures to dissipate prior to constructing the full height of the lift.

The stability analyses indicate that the overall stability of the Platinum Gulch WRSA meets the recommended factors of safety for the case where excess pore pressures are not generated in the overburden. However, potential slip surfaces initiating along the crest of individual lifts that toe out on native ground do not meet the recommended factors of safety under static or pseudo-static loading for this case. Therefore, it will be necessary to re-grade or re-slope lifts that toe out on native ground (i.e. final or interim toes, or isolated lifts) to flatter angles achieve an acceptable level of stability. This could be implemented in the reclamation plan for the Platinum Gulch WRSA, as this is planned to occur early in the mine life.

The recommended factors of safety are not met for any of the scenarios considered in Platinum Gulch when excess pore pressures are generated in the foundation. Although it is considered unlikely that excess ice is pervasive throughout Platinum Gulch, based on the information available, there is currently insufficient data to complete a thorough assessment. Therefore, it is recommended that additional investigations be undertaken to delineate and characterize soils containing excess ice throughout the footprint of the Platinum Gulch WRSA. If excess ice is found to be pervasive then mitigative measures may be required such as excavating the ice-rich material from areas critical for stability and replacing it with coarse, durable waste rock and/or utilizing bottom-up construction. Depending on where the excess ice is located (e.g. near the toes of individual lifts), waste rock placement procedures may need to be implemented to allow pore pressures generated adequate time to dissipate prior to constructing each lift of the WRSA. These procedures could include pre-loading selected areas of the WRSA.

Rock Drain

The Eagle Pup and Platinum Gulch drainages each consist of a single main channel that broadens in their uplands. Surface flows occur in the valleys and groundwater springs have been noted along road cuts. The potential magnitude of flow in the drainages, as well as the presence of discharging springs, warrant construction of engineered rock drains to convey expected flows through the WRSAs. The rock drains beneath the WRSAs have been sized based on the estimated runoff from a 200-year return period precipitation event.

To determine the characteristics of potential rock drain materials, the in-situ fracture spacing of waste rock has been estimated and used to predict typical dimensions for the waste rock materials. Based on these estimates, it has been assumed that a dominant particle size of 0.1 m can be attained by exercising control over the size and quality of the materials being

placed in the rock drains either through selective use of waste rock, segregation by screening, or end dumping of waste rock. It has also been assumed that the rock drains will have a porosity of 30%. Utilizing these estimates, and applying a factor of safety of 4, the recommended cross-sectional area of the rock drains at the toe of the WRSAs is 210 m² for Eagle Pup and 58 m² for Platinum Gulch. The safety factor of 4 has been applied to the cross-sectional areas of the rock drain to account for:

- Uncertainty in the block size estimates
- Potential migration of fine grained materials into the voids in the drain
- Potential freezing of the drain
- Decrease in void ratio over time due to compression
- Potential degradation of the rock drain material over time

The rock drains must maintain their flow capacity and therefore cannot degrade over time. Thus, it is recommended that the rock drains be constructed out of non-metal leaching, non-acid generating, clean, durable intrusive waste rock with a D₅₀ of at least 0.1 m and a maximum particle size of 1 m. Intrusive rocks are the preferred materials for rock drain construction due to their higher strength and greater block size than the metasedimentary rocks. However, based on the waste rock production schedule provided by Tetra Tech Wardrop on February 6, 2012, sufficient quantities of intrusive waste rock may not be available early in the mine life to construct the rock drain. Therefore, it may be necessary to use metasedimentary rocks to construct portions of the rock drain in Eagle Pup. It is BGC's understanding that these materials may be sourced from a cut near the primary crusher. The limited amount of subsurface information available in this area indicates that potentially suitable metasediments may be present below a depth of about 10 to 15 m; however, further drilling in this area is required to confirm the characteristics of the rock in the primary crusher area and their extent. If mine scheduling dictates that the metasedimentary rocks from the primary crusher area be incorporated into the rock drains it is recommended that the susceptibility of these materials to mechanical degradation be evaluated to determine if they are suitable as rock drain construction materials.

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LIMITATIONS

BGC Engineering Inc. (BGC) prepared this document for the account of Victoria Gold Corporation. The material in it reflects the judgment of BGC staff in light of the information available to BGC at the time of document preparation. Any use which a third party makes of this document or any reliance on decisions to be based on it is the responsibility of such third parties. BGC accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this document.

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1.0 INTRODUCTION

1.1. General

BGC Engineering Inc. (BGC) has been retained by Victoria Gold Corporation (Victoria) to complete a Feasibility Study (FS) level geotechnical assessment of the proposed waste rock storage areas (WRSAs) for the Eagle Gold project, located in the Dublin Gulch area of central Yukon. The Eagle Gold project includes two WRSAs; one located in the Eagle Pup drainage and the other in the Platinum Gulch drainage. This report summarizes the geotechnical assessments and design recommendations for both the Eagle Pup and Platinum Gulch WRSAs.

The work described herein has been carried out in conjunction with FS work conducted by Tetra Tech WEI Inc. (Tetra Tech Wardrop). The analyses and interpretations included in this report are based on the following information provided by Tetra Tech Wardrop on the dates indicated:

- Open pit layout provided on November 15, 2011
- Waste rock production schedule provided on February 6, 2012
- Mine facility layouts provided on November 23, 2012 with revisions on February 15, 2012
- Eagle Pup WRSA layout provided on January 20, 2012 with revisions on February 15, 2012
- Platinum Gulch WRSA layout provided on January 20, 2012 with revisions on February 15, 2012.

Minor adjustments to the WRSA geometries and dump sequencing were made by Tetra Tech Wardrop after February 15, 2012 to optimize equipment requirements and production scheduling; however, these have not been incorporated into the waste rock volumes and WRSA heights outlined in our report.

1.2. Previous Work

Mineral exploration activities have been carried out in the Dublin Gulch area since the late 1800s, with drilling of the current pit area beginning in 1978. Geological and engineering studies and reports related to the current locations of the WRSAs have been conducted by Knight Piesold Ltd. (Knight Piesold), Sitka Corp. (Sitka), and Scott Wilson Roscoe Postle Associates Ltd. (Scott Wilson RPA) and include the following:

- Knight Piesold, 1996 – *Report on Feasibility Design of the Mine Waste Rock Storage Area*
- Sitka, 1996 – *Field Investigation Data Report, Dublin Gulch Project*
- Scott Wilson RPA, 2010 – *Pre-feasibility Study on the Eagle Gold Project, Yukon Territory, Canada*

Engineering design work was previously completed on the WRSAs to an extent considered to be feasibility level (Knight Piesold, 1996); however, changes in property ownership, a mineral resource update, new mine plan options, and changes to resource/reserve reporting requirements have resulted in the current feasibility study.

1.3. Current Scope of Work

The FS level geotechnical assessments conducted by BGC for the WRSAs of the Eagle Gold project consisted of the following tasks and deliverables:

- Compilation and review of existing geotechnical data.
- Surface and subsurface investigations to provide additional geotechnical data for the FS.
- Geotechnical assessment and stability assessments of the WRSA based on the data available and the design criteria established by Victoria, Tetra Tech Wardrop, and BGC.
- Recommendations for additional work to be completed at subsequent levels of study for the project to optimize the design of the WRSAs.
- A geotechnical design report outlining the tasks noted above.

This geotechnical design report, and associated drawings and appendices, contains the following information:

1. The project setting and factual data sources that form the basis for this work (Sections 2 and 3).
2. Interpretations of the factual data to characterize the foundation and waste rock materials (Section 4).
3. The FS design of the WRSAs including layouts, stability analyses, and rock drain designs (Section 5).
4. Additional consideration in the design and construction of the WRSAs (Section 6).
5. A summary of the work completed and recommendations for further work (Section 7).

2.0 PROJECT SITE CHARACTERIZATION

2.1. Project Location and Description

The Eagle Gold project is a proposed gold mine located in the Dublin Gulch area of central Yukon approximately 40 km north-northeast of Mayo and 350 km north of Whitehorse (Figure 2-1). The project area is situated within a historically active mining region; exploration targets and mines located near the site include: Mt. Haldane, McQuestern, Keno Hill, and Brewery Creek.

The base case operating scenario for the project includes open pit mining with the ore undergoing three stages of crushing followed by heap leaching and recovery of gold from solution in a carbon adsorption, desorption, and recovery (ADR) plant. The general arrangement of the proposed mine facilities is shown on Drawing 1.

The open pit is expected to produce approximately 92 million tonnes of mineralized resource and 132 million tonnes of waste rock and overburden, based on the production schedule provided to BGC on February 6, 2012. The ore will be placed in a valley heap fill located in the Ann Gulch drainage and will span over and partially fill the middle reaches of the Dublin Gulch drainage.

Waste rock generated from mining activities will be placed in two areas: the Eagle Pup drainage located to the north of the open pit; and the Platinum Gulch drainage located to the south of the open pit (Drawing 1). The Eagle Pup WRSA will contain the majority of the waste rock generated from the open pit and will be developed as a valley fill using haul trucks. At its ultimate configuration the Eagle Pup WRSA will contain approximately 118.7 million tonnes of waste rock, reaching a maximum elevation of 1,298 m above sea level (asl) (Drawing 2). The Platinum Gulch WRSA will also be developed as a valley fill using haul trucks and will be used to store waste rock early in the mine life. At its ultimate configuration the Platinum Gulch WRSA will contain approximately 13.7 million tonnes of waste rock and overburden, reaching a maximum elevation of 1,388 m asl (Drawing 2).

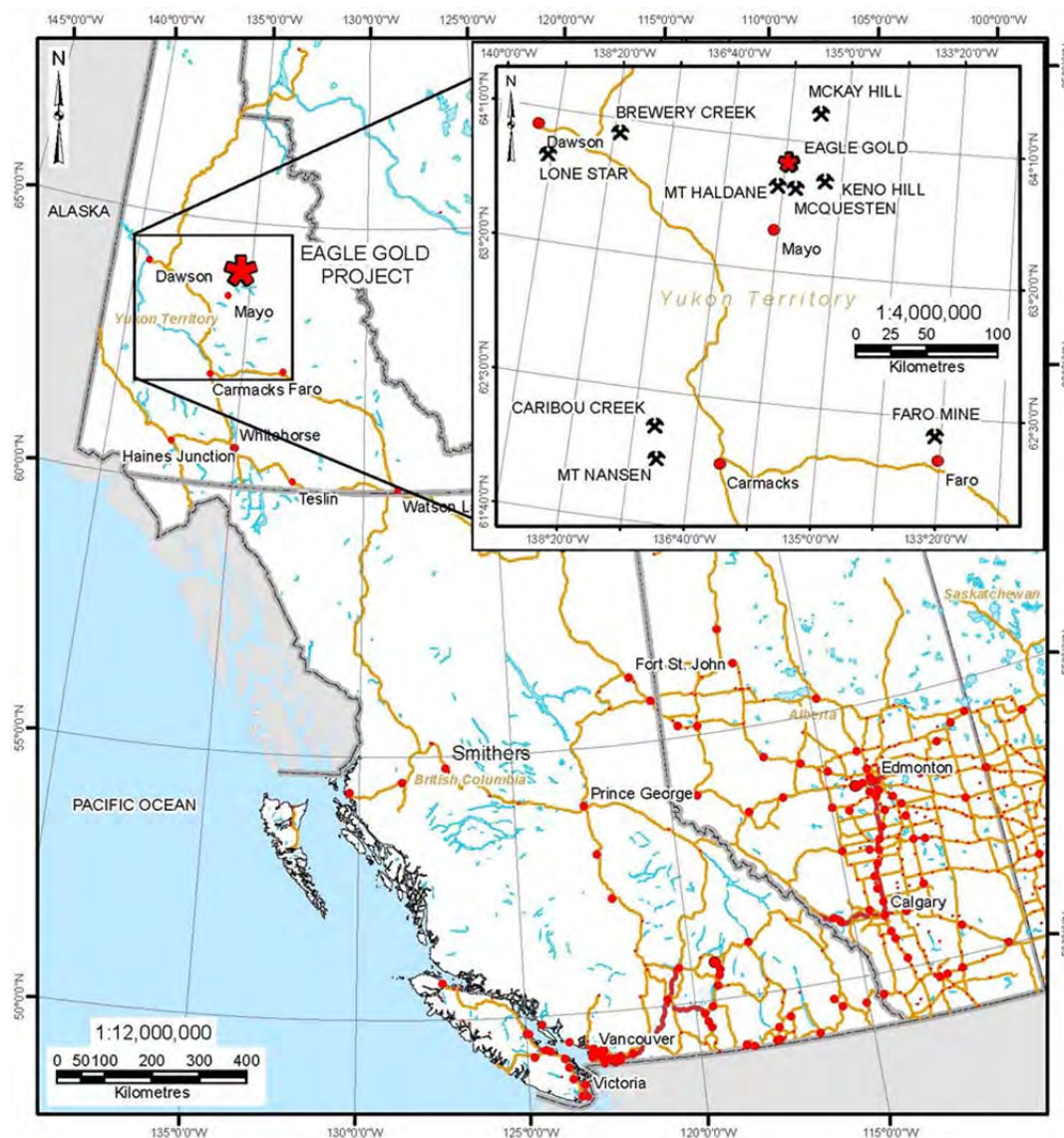


Figure 2-1. Eagle Gold Project Site Location Map

2.2. Physiography

The project area is located in Stewart Plateau which is a physiographic subdivision of the Yukon Plateau. This area is characterized by broad, rolling hills of moderate relief with elevations ranging from approximately 750 m asl in the valley bottoms to over 1,500 m asl in the uplands. The upland areas generally coincide with resistant rock types such as local felsic intrusions. Major drainages in the area include Haggart Creek and Lynx Creek. In its lower reaches Haggart Creek is an extension of Lynx Creek and occupies a very large, broad, U-shaped glacial valley. In its upper reaches Haggart Creek is a much narrower U-shaped glacial valley indicating that it has been less extensively glaciated. Tributaries to

Haggart Creek include Dublin Gulch, Gill Gulch, and Fisher Gulch. These tributaries are much narrower V-shaped valleys with steep valley side slopes. Tributaries to Dublin Gulch include the Eagle Pup and Platinum Gulch drainages, which are proposed for placement of the WRSA's. The Eagle drainage is relatively broad drainage, while the Platinum Gulch drainage is V-shaped and incised.

2.3. Climate

The project area is located within the Mayo Lake-Ross River Eco-region with the St. Elias mountain range to the west being the most dominant physical feature in the region affecting the climate (Stantec, 2010). The St. Elias range tends to block moist maritime air masses resulting in reduced air temperatures and precipitation. As a result the project area is characterized as having a sub-Arctic "continental" type climate with moderate total annual precipitation and extreme temperature variations (Stantec, 2010). Average annual precipitation over the property ranges from 375 to 600 mm, with July being the wettest month (Knight Piesold, 1996). Approximately half of the precipitation falls as snow with daily temperatures below freezing from October through to April (Knight Piesold, 1996). The average monthly temperatures range from a low of approximately -23°C in January to a high of approximately 13°C in July. Temperatures as low as -60°C have been recorded during the winter months, and as high as 35°C during the summer months (Knight Piesold, 1996).

2.4. Permafrost

Based on permafrost distribution maps (Brown, 1978), the project area lies within a zone of discontinuous permafrost. On the regional scale permafrost distribution is typically controlled by mean annual temperature and precipitation, whereas on a local scale it is controlled by vegetation, surface sediments, soil moisture, slope aspect, and snow depth. Within the project area permafrost is typically found on north- and east-facing slopes, highlands, and poorly drained valley bottoms. Coarse-grained, free draining soils are typically ice-free, whereas fine-grained deposits are more likely to contain ice. When encountered the permafrost at the site is generally relatively warm with an average temperature close to 0°C.

2.5. Hydrology

The project area is primarily located within the Dublin Gulch catchment which is a tributary to Haggart Creek. Other drainages which are important to the project site include Ann Gulch, Stewart Gulch, Eagle Pup, Stuttle Gulch, and Platinum Gulch all of which are direct tributaries to either Dublin Gulch or Haggart Creek. Stream flows in the Yukon are typically characterized by peak flows in the spring and low or no flows in the winter. The peak spring flows are generally driven by snow melt or rain-on-snow events with flows decreasing following the disappearance of snow (Knight Piesold, 1996). Intense late summer rainstorms can also generate high flow events particularly within smaller basins such as Dublin Gulch

(Knight Piesold, 1996). The smallest stream flows coincide with the winter months when ice develops on all rivers and many of the smaller streams freeze entirely (Knight Piesold, 1996).

2.6. Geologic Setting

2.6.1. Bedrock Geology

The project area is underlain by Proterozoic to Lower Cambrian metasediments of the Hyland Group which have been intruded by Cretaceous age stocks, dykes, and sills (Knight Piesold, 1996). The metasediments are comprised of intercalated quartzites, phyllites, and minor limestones. The quartzites are variably gritty, micaceous, and massive and the phyllites are comprised of muscovite-sericite and chlorite (Scott Wilson RPA, 2010). The metasediments have been deformed by a regional Cretaceous thrusting event that resulted in the formation of moderate to strong foliation. Subsequent folding has resulted in the foliation generally dipping moderately northwest to southwest throughout the project area. Following the regional deformation the country rocks were intruded by Cretaceous age stocks, dykes, and sills ranging in composition from quartz monzonite to quartz diorite (Knight Piesold, 1996). The Dublin Gulch granodiorite stock is the largest of these intrusions throughout the project site and trends approximately 070° coincident with the axis of the Dublin Gulch anticline (Scott Wilson RPA, 2010).

2.6.2. Surficial Geology

The surficial geology of the project area has been mapped by Bond (1998) and is illustrated in Drawing 3. Pleistocene and Holocene colluvial deposits are abundant in the project area and generally consist of diamicton, gravel, shattered bedrock, and lenses of sand and silt derived from chemical and physical weathering of bedrock and surficial materials. Transport of surface material occurs as creep, sheetwash, and mass wasting and is common on all slopes in the area.

Glacial till is infrequently observed in the project area (Bond, 1998). Where till does occur, it is generally either a silty or sandy clay matrix with clasts up to cobble size. The valley bottom is dominated by alluvium and placer mining tailings. The north facing uplands are covered by an apron or blanket of colluvium over bedrock, as compared with the southern facing uplands, where bedrock is nearer to surface and covered by a veneer of colluvium. The Haggart Creek valley to the west of the project site is filled with a mix of alluvial deposits and placer tailings. A till blanket has been mapped along the east side of Haggart Creek, south of its confluence with Dublin Gulch.

3.0 GEOTECHNICAL DATABASE

3.1. Site Investigations

Geotechnical site investigation programs were undertaken by BGC in 2009, 2010, and 2011 to investigate subsurface conditions at selected mine facilities, including the WRSAs. Details of the site investigation programs are available under separate covers (BGC, 2010, 2011a, 2012a). A summary of the available data is provided below. Foundation conditions within the WRSA footprints have also been documented by Knight Piesold (1996) and Sitka (1996). The results of the site investigations from these studies that pertain to the WRSAs are summarized in Section 4.

3.1.1. Test Pit Investigations

Since 1995 a total of eighty-two test pit excavations have been completed within or adjacent to the current proposed footprint of the Eagle Pup WRSA (Drawing 4). Thirty-one of the test pits were completed by BGC, forty-nine by Sitka, and two by Knight Piesold. During the same time period eighteen test pit excavations were completed within or adjacent to the Platinum Gulch WRSA (Drawing 4). Seven of these were completed by BGC and the other eleven by Sitka. The distribution of the test pits is outlined in Table 3-1. The depths of the test pit excavations ranged from 1 to 9 m. Geotechnical logging was completed for all test pits and representative samples were collected from the pits for laboratory analyses. Detailed logs for the test pits and the results of the laboratory testing are included in BGC's site investigation reports (2010, 2011a, 2012a), Knight Piesold's design report (1996), and Sitka's site investigation report (1996).

3.1.2. Borehole Investigations

Since 1995 a total of eighteen boreholes have been completed within or adjacent to the current proposed footprint of the Eagle Pup WRSA (Drawing 4). Ten of the boreholes were completed by BGC, seven by Sitka, and one by Knight Piesold. During the same time period nine boreholes were completed within or adjacent to the Platinum Gulch WRSA (Drawing 4); four of these were completed by BGC and the other five by Sitka. The distribution of the boreholes is outlined Table 3-1. All but four of the boreholes were completed with diamond drill rigs. As part of the 2011 investigations, BGC completed four boreholes with auger rigs, two of which were drilled with a Cold Regions Research and Engineering Laboratory (CRREL) core barrel to sample ground ice and frozen soils. The boreholes were drilled to an average depth of approximately 30 m, with the deepest hole drilled to nearly 65 m. Geotechnical logging was conducted for all boreholes and representative samples were collected for laboratory analyses. Detailed logs for the boreholes and the results of the laboratory testing are included in BGC's site investigation reports (2010, 2011a, 2012a), Knight Piesold's design report (1996), and Sitka's site investigation report (1996).

Table 3-1. Site Investigations in the WRSAs

Consulting Firm	Number of Test Pits		Number of Boreholes	
	Eagle Pup	Platinum Gulch	Eagle Pup	Platinum Gulch
Knight Piesold	2	0	1	0
Sitka	49	11	7	5
BGC	31	7	10	4
Total	82	18	18	9

Notes:

1. Site investigations were completed by Knight Piesold (1996), Sitka (1996), and BGC (2010, 2011a, and 2012a).

3.2. Laboratory Testing

Laboratory index testing was conducted for selected soil samples collected from test pits and boreholes completed within or adjacent to the proposed footprints of the WRSAs. Testing conducted as part of the BGC site investigations included grain size distributions (15 combined sieve analyses and hydrometer tests, and 17 sieve analyses), Atterberg limits testing (7 tests), and moisture content determination (50 tests). Laboratory reports for the testing completed can be found in the BGC site investigation reports (2010, 2011a, 2012a).

Knight Piesold (1996) also conducted laboratory testing as part of the FS work completed in 1996. In addition to soil index testing, Knight Piesold completed multi-stage consolidated-undrained (CU) triaxial tests on five soil samples collected from test pits completed in Bawn Bay Gulch located to the northeast of the WRSAs. The samples were compacted to 95% Modified Proctor maximum dry density at approximately the natural moisture content and then CU testing was completed with confining stresses ranging from 250 to 1,000 kPa. The grain size distribution of some of the samples tested closely approximates those of the colluvium encountered by BGC in the WRSAs. The results of the testing of these samples, which have similar characteristic to the colluvium encountered in the WRSAs, are discussed in Section 5.3.3.

4.0 FOUNDATION AND WASTE ROCK CHARACTERIZATION

4.1. Overburden

4.1.1. Organics

A thin organic cover is widespread across the project site overlying the other overburden units. The cover primarily consists of vegetative root mat, moss, silt and sand, and other organic matter in varying proportions. The typical observed thickness was in the order of 0.2 to 0.3 m.

4.1.2. Colluvium

Colluvium was generally encountered on sloping ground throughout the site, below the organic cover. The relative density of the colluvium was variable and generally ranged from loose to compact. The gradation and thickness of the colluvium was observed to be highly variable, predominantly ranging from boulders and cobbles, with some silt and sand to silty sand with gravel and some cobbles. The colluvium is typically derived from transported weathered metasedimentary and/or intrusive bedrock. Gravel, cobbles, and boulders were generally observed to be angular to subangular.

The colluvium encountered in the test pits and boreholes ranged in thickness from 0 m to 16.4 m throughout the WRSAs with an average thickness of 2.4 m. This average thickness is likely low, however, since some test holes didn't penetrate the full thickness of the colluvium layer.

A distinct colluvial unit was observed within a lobate landform in the Eagle Pup drainage area (Drawing 4). This unit contained completely weathered rock fragments mixed with excess ice, including frequent inclusions of massive ice. The precise extent of this ice-rich colluvium has not been defined; however, it covers an area of approximately 1 ha and was encountered to the bottom of borehole BH-BGC11-42 at 28.2 m below ground surface (bgs), and to approximately 26.1 m bgs in BH-BGC11-63.

4.1.3. Completely Weathered Bedrock

Colluvium was typically observed to be underlain by a horizon of weathered rock. The weathering profile varies substantially across the site, depending on parent rock type and other local factors. The degree of weathering was classified based on the system proposed by Brown (1981). Weathered rock is considered to be part of the overburden where it is completely weathered (i.e. W5) or residual soil (i.e. W6). Less weathered rock, including highly weathered (i.e. W4) rock, is considered for the purposes of this report to be part of the bedrock.

The metasedimentary rock (e.g. quartzite, schist, and phyllite) nearest the ground surface was often observed to be completely weathered to silt with some to trace gravel or sand and gravel with cobbles and trace to some silt and clay. The gravel and cobble clasts tended to be friable, platy and exhibit a 'soapy' film due to the weathering/alteration. The transition from highly or completely weathered rock to a more competent, unweathered rock mass is highly variable; unweathered rock was generally not observed in test pits, and usually not observed at shallow depths in drill holes.

The near-surface granodiorite intrusive rock was often observed to be either completely weathered to a silty sand, or sandy silt, or highly weathered to a poorly graded sand. The thickness of the weathered horizon was highly variable.

4.2. Bedrock

Two major rock types were encountered below the overburden soils within and adjacent to the footprints of the WRSA: metasediments and intrusives. The metasedimentary bedrock encountered ranges from schist to quartzite and is the most common bedrock type encountered in the subsurface investigations. Intrusive rock (granodiorite) was encountered in boreholes and at outcrops in the upper portions of the Platinum Gulch and Eagle Pup valleys. In general the bedrock was encountered at depths ranging from 0 m to 44 m with an average depth of 6.9 m.

4.3. Permafrost and Excess Ice

Frozen ground is widespread throughout the footprint of the Eagle Pup WRSA, with 59 of 93 observations reporting frozen conditions. The frozen ground frequently contained excess ice, with 21 of the 59 frozen ground observations reporting excess ice. Frozen ground and excess ice observations along cross-sections A and B in the Eagle Pup WRSA are shown on Drawings 5 and 6, respectively. Frozen ground is also locally present in the footprint of the Platinum Gulch WRSA and, where present, typically contains excess ice. Of the 23 observations made in Platinum Gulch frozen ground was noted in 11 times with excess ice observed at every one of these locations. Frozen ground and excess ice observations along cross-section C in the Platinum Gulch WRSA are shown on Drawing 7.

The distribution of the observed frozen ground conditions in the Eagle Pup and Platinum Gulch WRSA footprints are shown on Drawing 8. Frozen ground (where present) was observed to an average depth of approximately 3 m in both of the WRSA areas.

During the 2011 site investigation program two thermistors strings were installed to approximately 25 m bgs in the Eagle Pup WRSA in boreholes BH-BGC11-42 and BH-BGC11-63. This is the area identified as the lobate landform containing ice-rich colluvium in Section 4.1.2. Temperature measurements recorded on August 30, 2011 indicated the presence of low-grade permafrost, with a mean temperature of approximately -0.2°C to 0.3°C. Bedrock was not encountered in either borehole, which were completed to depths of

up to 26.7 m. The overburden encountered generally consisted of ice-rich, sandy silt colluvium.

4.4. Groundwater and Phreatic Conditions

Groundwater was observed in nine test pits in Eagle Pup and two in Platinum Gulch. The depths to groundwater observed ranged from 0.4 m to 8.2 m. Multiple seeps were also observed along road cuts in both Eagle Pup and Platinum Gulch as shown on Drawing 8. It is assumed that the groundwater table forms a subdued replica of the surface topography, with the water table relatively close to the surface.

4.5. Waste Rock Characterization

In general, waste rock to be placed in the WRSAs will consist of a mixture of metasediments from the Hyland Group and intrusives related to the Dublin Gulch granodiorite stock. Based on WRSA sequencing plans provided by Tetra Tech Wardrop the waste rock will be primarily comprised of metasediments. The intact strengths of these rocks have been estimated from laboratory testing of drill core samples, point load testing, and core logging observations completed for the open pit design studies (BGC, 2012b). The laboratory tests provide relatively precise strengths for a small number of samples which can then be used to calibrate the strength estimates from the larger point load testing database. The resulting strength estimates based on the point load testing are then checked against the more general estimates of strength from the core logging observations to arrive at an average strength for each unit. Based on laboratory testing, point load testing, and core logging observations the design uniaxial compressive strengths (UCS) of the metasediments and the intrusives are estimated to be 80 MPa and 135 MPa, respectively.

In-situ fracture spacing of the rocks have been measured as part of open pit design studies (BGC, 2012b) and have been used to estimate average dimensions of the rock block sizes, prior to blasting. The waste rock block size will be heavily influenced by the length of the various discontinuity sets; however, limited information is available on the discontinuity lengths as the majority of the observations are derived from core, which are small in diameter and have a sampling bias due to their orientation. Preliminary estimates indicate that the metasediments and intrusives will have average in-situ block sizes of about 0.1 and 0.2 m in diameter, respectively. Blasting induced fractures during mining operations will also have an impact on block size. Based on their higher strength and mineralogy, the intrusive rocks would be the most desirable construction materials, and will likely be the most durable from the open pit area; however, siliceous metasedimentary rocks (e.g. quartzites) may also be suitable for construction materials.

5.0 WASTE ROCK STORAGE AREA DESIGN

5.1. General Arrangement

The Eagle Gold project requires two WRSAs to accommodate the volume of waste rock expected to be generated from mining the open pit. The Eagle Pup and Platinum Gulch WRSAs will be located to the north and south of the proposed open pit, respectively (Drawing 1). The layout and sequencing of the WRSAs was developed by Tetra Tech Wardrop in conjunction with preliminary recommendations provided by BGC. As noted in Section 1.1, minor adjustments to the WRSA geometries and dump sequencing were made by Tetra Tech Wardrop after February 15, 2012 to optimize the mine plan. These adjustments have not been incorporated into the waste rock volumes and WRSA heights outlined below.

5.1.1. Eagle Pup Waste Rock Storage Area

The Eagle Pup WRSA will contain most of the waste rock generated from the open pit and will be developed as a valley fill using haul trucks. At its ultimate configuration the Eagle Pup WRSA will cover an area of approximately 94 ha and will contain approximately 118.7 million tonnes of waste rock and overburden. The WRSA will be constructed in 45 m lift heights from an elevation of approximately 935 m asl to 1,298 m asl, resulting in an overall height of approximately 363 m. At the end of its construction the waste rock pile will have an overall angle of approximately 2.5H:1V. Within the footprint of the WRSA the valley bottom of the Eagle Pup drainage ranges in slope from approximately 8° to 25°. As a result, the WRSA will obtain a maximum vertical thickness of approximately 140 m. The ultimate configuration of the WRSA is provided in plan on Drawing 2 and in cross-section on Drawings 5 and 6.

Based on the dump sequencing provided to BGC on January 20, 2012, construction of the Eagle Pup WRSA will be initiated part way up the drainage in Year 0 at elevation 983 m asl. Bottom up construction will then be utilized to advance the WRSA upslope to its ultimate height in Year 3 while the lowest lift is progressively pushed out. Following this, nearly all of the lifts will be progressively pushed out until the final toe is established in Year 5. The upper lifts will then continue to be pushed out until the overall angle is increased to a final surface slope of approximately 2.5H:1V in Year 9. A series of plans showing the progression of the WRSA is provided in Appendix A.

5.1.2. Platinum Gulch Waste Rock Storage Area

The Platinum Gulch WRSA will also be developed early in the mine life from Year 0 to Year 3 as a valley fill using haul trucks. At its ultimate configuration the Platinum Gulch WRSA will cover an area of approximately 38 ha and will contain approximately 13.7 million tonnes of waste rock and overburden. The Platinum Gulch WRSA will be constructed in 45 m lift heights from an elevation of approximately 1,020 m asl to 1,388 m asl, resulting in an overall height of approximately 368 m. At the end of its construction the waste rock pile surface will

have an overall slope of approximately 2.4H:1V. The Platinum Gulch drainage is moderately steep with the valley bottom sloping at approximately 21° in the WRSA footprint. As a result, the WRSA will only attain a maximum vertical thickness of approximately 40 m. The ultimate configuration of the WRSA is provided in plan on Drawing 2 and in cross-section on Drawing 7.

Based on the dump sequencing provided to BGC on January 20, 2012, construction of the Platinum Gulch WRSA will be initiated in the upper reaches of the drainage in Year 0 at elevation 1,213 m asl. Independent lifts will then be constructed both above and below this in Year 1. In Year 2 the final toe will be established and the lower lifts expanded outwards. Finally, in Year 3 the upper lifts will be expanded outwards to the final overall surface slope of 2.4H:1V. A series of plans showing the progression of the WRSA is provided in Appendix A.

5.2. Underdrainage Requirements

The Eagle Pup and Platinum Gulch drainages each consist of a single main channel that broadens in the uplands. Seasonal flows are present in the valleys, and springs have been noted along road cuts (Drawing 8). The construction of engineered rock drains in the valley bottoms is required to convey the expected groundwater and runoff flows through the WRSAs. Based on discussions between Victoria, Knight Piesold, and BGC, a 200-year precipitation event was selected for design of the rock drains. The peak instantaneous flows discharging from the Eagle Pup and Platinum Gulch drainages due to the 200-year precipitation event are estimated to be 2.1 m³/s and be 2.3 m³/s, respectively (C. Aurala, 2011, pers. comm.).

In the upper reaches of each rock drain the contributing drainage area decreases and thus the required cross-sectional area of the rock drains also decreases. Utilizing the estimated peak flows for the drainages, the flow at specific locations along the drainages was estimated by pro-rating the total flow based on the total catchment area that reports to that location. This was particularly important in Platinum Gulch as the WRSA is located higher up in the drainage and thus only about 40% of the total drainage catchment reports to the toe of the WRSA resulting in substantially smaller cross-sectional area requirements for the rock drain.

Cross-sectional areas of the rock drains required to convey the flows have been determined at key locations using the Wilkin's equation (1956), as follows:

$$Q = nAWm^{0.5}i^{0.54} \quad [1]$$

where:

Q = flow rate (m³/s)

n = porosity

A = cross-sectional area through which the water flows (m²)

W = Wilkin's empirical constant (5.243)

m = hydraulic mean radius (m)

i = hydraulic gradient

The required cross-sectional area is inversely proportional to the hydraulic gradient. Therefore, for Eagle Pup the approximate hydraulic gradient along the lower portion of the drainage where the slope is less steep (8°) was used in the design. For Platinum Gulch the slope of the valley bottom is relatively consistent at 21° within the footprint of the WRSA and, therefore, this value was used for design.

The hydraulic mean radius of the rock drain materials can be calculated from the following equation:

$$m = \frac{ed}{6r_e} \quad [2]$$

where:

e = void ratio

d = "dominant" particle diameter (m)

r_e = particle surface-area-efficiency

The particle surface area efficiency is typically about 1.3 for coarse angular rock and the porosity of the rock drains is estimated to range from between 30% and 50%. A relatively low porosity of 30% has been assumed for the rock drain design to compensate for degradation of the waste rock, the potential buildup of fine grained materials, and to consider the effects of high confining stress on the rock drains due to the weight of overlying waste rock.

For design purposes it has been assumed that the "dominant" particle diameter is represented by the mean particle size (D_{50}) of the waste rock. Geotechnical drilling conducted within the open pit area (BGC, 2012b) indicates that the average in-situ block size could range from 0.1 m to 0.2 m for the metasedimentary and igneous rocks, respectively. Based on these estimates, it has been assumed that a D_{50} of 0.1 m can be reasonably attained by exercising control over the size and quality of the materials being placed in the rock drains either through selective use of waste rock, segregation by screening, or end dumping of the waste rock.

Using the above equations, the cross-sectional area of the rock drains required to convey the pro-rated design flows has been estimated. In order to provide adequate protection against:

- Potential migration of fine grained materials
- Freezing of the drains
- Possible reduction in the flow capacity due to consolidation
- Potential degradation of the rock drain materials over time.

A cross sectional area of the drains which is four times the value calculated is recommended (i.e. a safety factor of 4) giving maximum rock drain cross-sectional areas of 210 m² and 58 m² for Eagle Pup and Platinum Gulch, respectively.

Recommended cross-sectional areas of the rock drains at various drainage divides are summarized in Table 5-1. Material estimates for construction of the rock drains are provided in Table 5-2. The geometry of the rock drains has been determined assuming a minimum height of 4 m and angle-of-repose side slopes. It is noteworthy that the cross-sectional area of the rock drains is highly dependent on both the D₅₀ and the void ratio of the material used for construction. For this level of study both these parameters have been approximated based on the in-situ block size estimates from geotechnical drilling within the open pit area and engineering judgment. If a D₅₀ of at least 0.1 m and/or a porosity of at least 30% cannot be obtained for this material, the size of the drains will need to be increased. Further steps to quantify the size distribution of the waste rock should be undertaken during detailed design.

The rock drains must maintain their flow capacity and cannot degrade over time. Therefore, it is recommended that the rock drains be constructed of non-metal leaching, non-acid generating, clean, durable intrusive waste rock with a D₅₀ of at least 0.1 m and a maximum particle size of 1 m. The preferred rock type based on strength and block size estimates is the intrusive rocks. However, based on the waste rock production schedule provided by Tetra Tech Wardrop, the volume of intrusive waste rock may be limited early in the mine life and the quantities required for construction of the entire rock drain may not be available. Therefore, it may be necessary to use metasedimentary rocks to construct portions of the rock drains. It is our understanding that these rocks may be sourced from a cut near the primary crusher. A review of the limited subsurface information available in this area indicates that potentially suitable metasediments may be present below a depth of between 10 m and 15 m. The volume of competent metasedimentary rocks available and the durability of these materials in this area have not been confirmed yet and therefore the suitability of this rock drain material source is strongly qualified and should only be considered preliminary at this time. If mine scheduling dictates that the metasediments from the primary crusher area be incorporated into the rock drains, it is recommended that the susceptibility of these materials to mechanical degradation be evaluated to determine if they are suitable for construction material.

It will be necessary to clear and grub organic soils from the footprint of the rock drains to an average depth of 0.3 m in preparation for placement of the drain rock. To minimize the amount of fines migrating into the rock drains, overburden materials and fine-grained waste rock should not be placed directly over top of the drain. If this cannot be avoided a filter material, consisting of either synthetic or natural materials may be required to prevent fines from infiltrating into the rock drains.

As shown in Drawing 1, sediment control ponds are located in the Eagle Pup and Platinum Gulch drainages downstream of the WRSAs. In the case of the Eagle Pup drainage the sediment control pond is located at the toe of the WRSA. The rock drain should be graded into the sediment control pond by extending it from the toe of the WRSA. The details of this interaction should be considered at the next stage of design. For preliminary guidance it can be assumed that the rock drain will grade into the sediment control pond at an angle ranging between 3H:1V and 5H:1V. It can also be assumed that the material used to construct this segment of the drain will need to consist of clean, durable waste rock with a D_{50} of at least 0.3 m in order to provide a non-erodible outlet.

Table 5-1. Recommended Rock Drain Cross-Sectional Areas at Key Locations

Facility	Location ¹	Calculated Rock Drain Area (m ²)	Recommended Rock Drain Area ² (m ²)	Recommended Rock Drain Width (m)
Eagle Pup	925 m elev.	53	210	58
Eagle Pup	950 m elev.	48	193	54
Eagle Pup	1000 m elev.	34	137	40
Eagle Pup	1100 m elev.	15	62	21
Platinum Gulch	1025 m elev.	14	58	20
Platinum Gulch	1150 m elev.	14	58	20

Notes:

- Locations refer to the elevation in the valley bottom. See Drawing 8 for the recommended rock drain widths, assuming a rock drain height of 4 m and side slope angles of 37°.
- A factor of safety of 4.0 has been assumed.

Table 5-2. Material Estimates for Rock Drain Construction

Facility	Description	Average Depth ¹ (m)	Volume (m ³)
Eagle Pup	Clearing and Stripping	0.3	27,000
	Rockfill	-	145,000
Platinum Gulch	Clearing and Stripping	0.3	2,600
	Rockfill	-	25,000

Notes:

- Average depth of stripping to remove organic soils from the footprint of the rock drains.

5.3. Stability Assessment

5.3.1. Design Criteria

Geotechnical design criteria selected for the Eagle Pup and Platinum Gulch WRSAs (Table 5-3) are generally based on those recommended by the Yukon Water Board (2009) and the British Columbia Mine Waste Rock Pile Research Committee (1991). BGC recommends that under static loading conditions a minimum factor of safety of 1.3 be applied to short term

developments (e.g. during mine operations) and that a minimum factor of safety of 1.5 be applied to the long term (e.g. post-closure) of the WRSAs. Under pseudo-static seismic loading conditions BGC recommends that a minimum factor of safety of 1.1 be applied. Based on an evaluation of appropriate seismic design criteria for the project site conducted by BGC (2011b) the recommended seismic design event for the WRSAs is an earthquake with a 1-in-475-year return period that generates a peak horizontal ground acceleration (PGA) of 0.14 g.

Table 5-3. Recommended Geotechnical Design Criteria

Criteria	Description
Static Factor of Safety – short term (mine operations)	1.3
Static Factor of Safety – long term (post-closure)	1.5
Pseudo-static Factor of Safety – short and long term	1.1
Design Earthquake Return Period	1-in-475-year event

5.3.2. Methodology

The stability of the Eagle Pup and Platinum Gulch WRSAs were assessed under static and pseudo-static loading conditions using the two-dimensional, limit equilibrium software package Slope/W (Geostudio, 2007, version 7.17). The minimum factor of safety was estimated using the Morgenstern-Price method. For the pseudo-static assessment the design horizontal ground acceleration was applied to the stability model following methods suggested by Hynes-Griffin and Franklin (1984) where the horizontal seismic coefficient (k_h) applied is equal to half the peak horizontal ground acceleration (PGA) for the design event considered. Hynes-Griffin and Franklin concluded that earth dams and embankments should not develop deformations greater than 1 m if this criterion is satisfied. This method assumes liquefaction does not occur in either the foundation or the waste rock. Separate checks are required to determine the liquefaction potential of these materials.

5.3.3. Material Properties

Material properties used in the stability assessments were based on the site investigation results, laboratory testing, and experience with materials showing similar characteristics. A summary of the relevant material properties is provided in Table 5-4.

Table 5-4. Summary of Material Properties used in Stability Analyses

Material Type	Unit Weight (kN/m ³)	Effective Stress Parameters		Total Stress Parameters	
		Friction Angle (°)	Cohesion (kPa)	Friction Angle (°)	Cohesion (kPa)
Waste Rock	19	Non-linear strength function ¹		Non-linear strength function ¹	
Colluvium – ice-poor	18	34	0	30	0
Colluvium – ice-rich	18	30	0	30	0
Bedrock – completely weathered	20	35	50	35	50
Bedrock – Type 3	27	Hoek-Brown strength function ²		Hoek-Brown strength function ²	
Bedrock – Type 2	27	Hoek-Brown strength function ²		Hoek-Brown strength function ²	
Bedrock – Type 1	27	Hoek-Brown strength function ²		Hoek-Brown strength function ²	

Notes:

1. See Section 5.3.3.1.
2. See Section 5.3.3.4

Effective stress parameters have been used for analyses considering static loading conditions and total stress parameters for pseudo-static loading conditions. It is noteworthy that for the analyses it has been assumed that the waste rock is free draining and will not develop excess pore pressures under seismic loading. Graphic logs of the different material types encountered during the site investigation for selected areas of the Eagle Pup WRSA are shown in cross-section on Drawing 5 and 6 and for the Platinum Gulch WRSA on Drawing 7. These cross-sections have been used for subsequent stability analyses.

5.3.3.1. Waste Rock

The shear strength of the waste rock in both WRSAs was modeled using an empirical approach suggested by Barton and Kjaernsli (1981) for rockfills. In this approach the internal angle of friction is stress-dependent and can be estimated using the following equation:

$$\phi' = R \cdot \log\left(\frac{S}{\sigma_n'}\right) + \phi_r \quad [3]$$

where:

- ϕ' = internal angle of friction
- ϕ_r = the residual friction angle
- σ_n' = effective normal stress
- R = equivalent roughness
- S = equivalent strength

The equivalent strength, S , is a size dependent parameter that accounts for scale effects. The equivalent roughness, R , is a parameter that is dependent on the shape and density of the rockfill. Barton and Kjaernsli (1981) provide plots from which the equivalent roughness and equivalent strength parameters can be estimated for a given material based on the following:

- Uniaxial compressive strength (UCS)
- Average (D_{50}) particle size
- Degree of particle roundness
- Porosity following compaction

Table 5-5 provides a summary of the parameters assumed for the waste rock. Note that in Equation 3 the residual friction angle has been used in place of the basic friction angle (ϕ_b) originally suggested by Barton and Kjaernsli (1981). In subsequent applications of this method it was noted that the residual friction angle (ϕ_r) is more appropriate for conservative, long-term design strengths (Barton, 2008). Therefore, given that the waste rock storage areas will remain in perpetuity, the lower, more conservative residual friction angle was considered more appropriate.

As outlined in Section 4.5, the average UCS of the intact rock for the metasedimentary and intrusive rocks in the pit area is estimated to range from 80 to 135 MPa. Based on the waste rock production schedule provided by Tetra Tech Wardrop the waste rock will primarily consist of metasediments. Therefore, 80 MPa has been used to estimate the equivalent rockfill strength values for stability assessments and design.

Also as outlined in Section 4.5, based on fracture spacing measured from geotechnical drillholes completed in the open pit area, the D_{50} of the waste rock is estimated to range from approximately 100 mm for the metasediments to 200 mm for the intrusives. For design purposes the waste rock was assumed to have a D_{50} of approximately 100 mm to reflect the anticipated composition of the waste rock. The shape / texture of the waste rock has been classified as “angular and rough”. This classification is based on site reconnaissance and is consistent with the shape / texture of blasted rock.

Information provided by Tetra Tech Wardrop indicates the waste rock is estimated to have a density of 1.94 tonnes / m³ (loose) and the average intact waste is estimated to have a specific gravity of 2.62 (T. Hantelmann, 2011, pers. comm.). Based on these values, the waste rock is estimated to have a void ratio of 0.35 which is equivalent to a porosity of approximately 26%. It is recognized that the porosity of the waste rock will vary spatially throughout the WRSAs and will be dependent on multiple factors such as: the dump construction method; the overlying thickness of waste rock; the grain size distribution of the waste rock, the resistance of the materials to particle crushing; and the moisture content. Therefore, a porosity of 30% was used in estimating the strength of the rock fill for stability analyses and design, adding conservatism to account for potentially looser packing of the waste rock than indicated by the density estimate.

Small scale direct shear testing has been completed on drill core samples as part of open pit design studies (BGC, 2012b). Based on testing results from foliation surfaces a residual friction angle of 31° has been selected for design.

The strength curves for the waste rock derived using the Barton and Kjaernsli (1981) method are shown in Figure 5-1, along with strength curves suggested by Leps (1970) for “weak” and

“average” compacted rockfill. Leps defined weak rockfill as having a UCS ranging from 3 to 17 MPa and average rockfill as having a UCS ranging from 17 to 69 MPa. In general, the rockfill strength estimated with the Barton and Kjaernsli method is between the weak and average rockfill strengths suggested by Leps. The rockfill strengths are considered reasonable even though a much higher UCS of 80 MPa is being applied to the waste rock, as the curves suggested by Leps are for compacted rockfill. Given that the waste rock in the WRSAs will be placed in a relatively loose state its shear strength would be expected to be less than that of a compacted rockfill with an equivalent UCS.

Table 5-5. Waste Rock Strength Parameters

Parameter	Value	Source
D ₅₀	100 mm	Estimated from fracture spacing measured geotechnical drillhole in the open pit
UCS	80 MPa	Estimated from UCS and point load testing conducted by BGC (2012b)
R	4	Angular, rough rockfill with a porosity of 30%
S	20 MPa	Based on a UCS of 80 MPa and a D ₅₀ of 100 mm
ϕ_r	31°	Estimated from direct shear testing conducted by BGC (2012b)

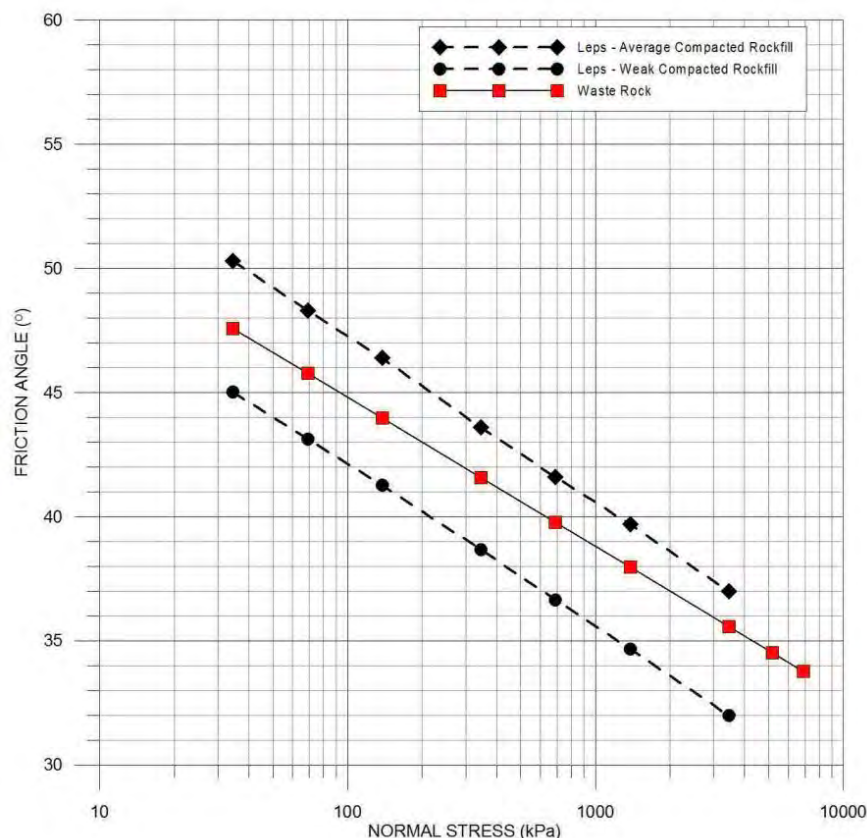


Figure 5-1. Waste Rock Non-linear Strength

5.3.3.2. Colluvium

As part of the FS work that Knight Piesold completed in 1996 a multi-stage consolidated-undrained (CU) triaxial test was conducted on a sample consisting of 45% gravel, 23% sand, 26% silt, and 6% clay. The sample was compacted to 95% Modified Proctor maximum dry density at approximately the natural moisture content and then CU testing was completed with confining stresses ranging from 250 to 1000 kPa. The results of the triaxial testing indicated the following strength parameters:

- Effective stress parameters - $\phi' = 38^\circ$ and $c' = 68$ kPa.
- Total stress parameters - $\phi = 34^\circ$ and $c = 38$ kPa.

The grain size distribution of the sample tested closely approximates those of the colluvium tested by BGC in the Eagle Pup WRSA. For design effective strength parameters of $\phi' = 34^\circ$ and $c' = 0$ kPa and a total strength of $\phi = 30^\circ$ and $c = 0$ kPa were selected and are considered to be conservative strength parameters for the ice-poor colluvium, based on the limited testing results outlined above and BGC's engineering judgment.

As the ice-rich colluvium thaws it will generate water and will likely be less compact than the ice-poor colluvium. Therefore, for short term loading scenarios a friction angle of 30° has been applied to this material for both effective and total strength analyses. The thin layer of organic materials on the ground surface have not been incorporated into the stability analysis models as it is assumed that they are not thick enough to control deep seated failures. In addition, it is anticipated that these materials will be removed and stockpiled for reclamation purposes.

5.3.3.3. Completely Weathered Bedrock

Based on visual classifications, field observations, and limited in-situ penetration testing the completely weathered bedrock was assigned effective strength parameters of $\phi' = 35^\circ$ and $c' = 50$ kPa and a total strength of $\phi = 35^\circ$ and $c = 50$ kPa.

5.3.3.4. Bedrock

Data collected from geomechanical logging of drill core and field observations of the bedrock has been used to classify the bedrock into three categories: Type 1, 2, and 3 (BGC, 2012c). Type 3 bedrock is usually the first "rock-like" material underlying the overburden soil materials, however, sharp contacts between overburden and Type 2 or Type 1 rock have occasionally been observed. Type 3 rock is defined as being rock that is highly weathered or less (i.e. W4 or better), and has intact strength greater than R0 (i.e. minimum UCS strength 1 MPa). Type 2 rock is defined as rock with a Geological Strength Index (GSI, after Hoek and Marinos, 2000) of 30 or greater, and core recovery during drilling of 50% or greater. Type 1 rock is defined as having a GSI exceeding 40.

A rock mass strength envelope was developed for each bedrock category using the Hoek-Brown criteria (Hoek et al., 2002). The parameters required for the Hoek-Brown criteria are outlined below and provided in Table 5-6.

- Geological strength index (GSI) of the rock mass
- Unconfined Compressive Strength (UCS) of the intact rock
- Material constant (m_i) of the intact rock
- An assumed rock mass disturbance factor ("D") which downgrades the rock mass strength based on the type of excavation method and stress relief.

The GSI is approximately equivalent to the Rock Mass Rating (Bieniawski, 1976) for values of RMR_{76} greater than 18. The GSI was estimated for each bedrock category based on median RMR_{76} parameters from geotechnical core logging conducted by BGC throughout the project site.

Initial estimates of the intact rock strength were made by BGC during geotechnical core logging of drillholes based on simple field tests and observations, following the International Society of Rock Mechanics standard (ISRM, 1978). The strength grades were used to estimate the UCS of the rock based on correlations available in literature (Brown, 1981). Point load testing was also conducted on drill core samples to estimate the UCS of the intact rock.

The Hoek-Brown material constant (m_i) reflects the induration, grain or crystal interlocking, and mineralogy of the intact rock sample. The material constant for the bedrock was estimated to be 11 for the Type 1 rock, and 6 for the Type 2 and Type 3 rock.

The rock mass disturbance factor ("D") is a subjective value representing the effects of mining on the rock mass properties. Blast damage, stress relief, and mining induced relaxation will dilate or "loosen" the fabric of the rock mass and may generate new fractures. For design, BGC has assumed that the bedrock within the footprints of the WRSAs will not be affected by blasting or other mine processes and thus a value of $D = 0$ has been applied to the rock mass.

Table 5-6. Hoek-Brown Parameters for Bedrock

Unit	Hoek-Brown Input Parameters ¹			Hoek-Brown Strength Properties		
	GSI ²	UCS ³	m_i	m_b	s	a
Type 1 Rock	51	54	11	1.912	0.0043	0.505
Type 2 Rock	36	33	6	0.610	0.0008	0.515
Type 3 Rock	28	25	6	0.459	0.0003	0.526

Notes:

1. The Hoek-Brown failure criteria have been estimated using a disturbance factor ('D') of 0 for all units.
2. Median RMR_{76} parameters are used for each geotechnical unit.
3. UCS for Type 1 and Type 2 rocks are estimated from point load testing. UCS for Type 3 rock is estimated from median strength grades.

5.3.4. Pore Pressures and the Effects of Ground Thawing

As outlined in Section 4.4, it is assumed that the groundwater table forms a subdued replica of the surface topography. For the stability analyses conducted the groundwater table was generally modeled coincident with the original ground surface for each section to simulate the potential effects of ponding where vertical seepage through the waste rock pile intersects the natural ground. It has been assumed that the waste rock will be free draining and perched water tables will not develop within the WRSAs.

Construction of the WRSAs will involve the placement of lifts of waste rock on potentially frozen ground. Depending on the thickness, initial temperature, and timing of the lift placement, the thermal regime of the initially frozen foundation may be altered, particularly if the lift is placed during the summer. Thawing at a slow rate allows for generated water to flow from the soil at the same rate as melting occurs and therefore it is unlikely that excess pore pressures generated will be sustained. For faster thawing rates, excess pore pressures may be generated which can reduce the effective shear strength of the foundation soils.

The magnitude of excess pore pressures generated due to thaw consolidation was estimated by predicting the rate of thaw and comparing this rate to the estimated coefficient of consolidation for the foundation soil. Assuming that the permafrost is at a temperature close to melting (0°C) the transient thaw penetration can be estimated from the modified Stefan equation (Nixon and McRoberts, 1973) as follows:

$$X = \left(\frac{2k_u T_s}{L} \right)^{1/2} \cdot t^{1/2} \quad [4]$$

where:

X = thaw penetration depth (m)

k_u = unfrozen thermal conductivity (W/(m·°C))

T_s = applied constant surface temperature (°C)

L = volumetric latent heat of the soil (J/m³)

m = hydraulic mean radius (m)

t = time (s)

As Equation 1 shows, the rate of thaw penetration will decrease with increasing latent heat (i.e. ice content). Assuming that the frozen soil has an average dry density of 1350 kg/m³ and an average water content of 40% the unfrozen thermal conductivity and the volumetric latent heat can be estimated using methods described in Andersland and Ladanyi (2004) to be 1.1 W/(m·°C) and 180.2 MJ/m³, respectively. Assuming that placing a lift of waste rock is thermally equivalent to applying a constant surface temperature of +5°C (a conservative assumption over the long-term considering that the project site is in a discontinuous permafrost environment and, as such, the waste rock is expected to cool with time), the estimated rate of thaw penetration is presented in Figure 5-2.

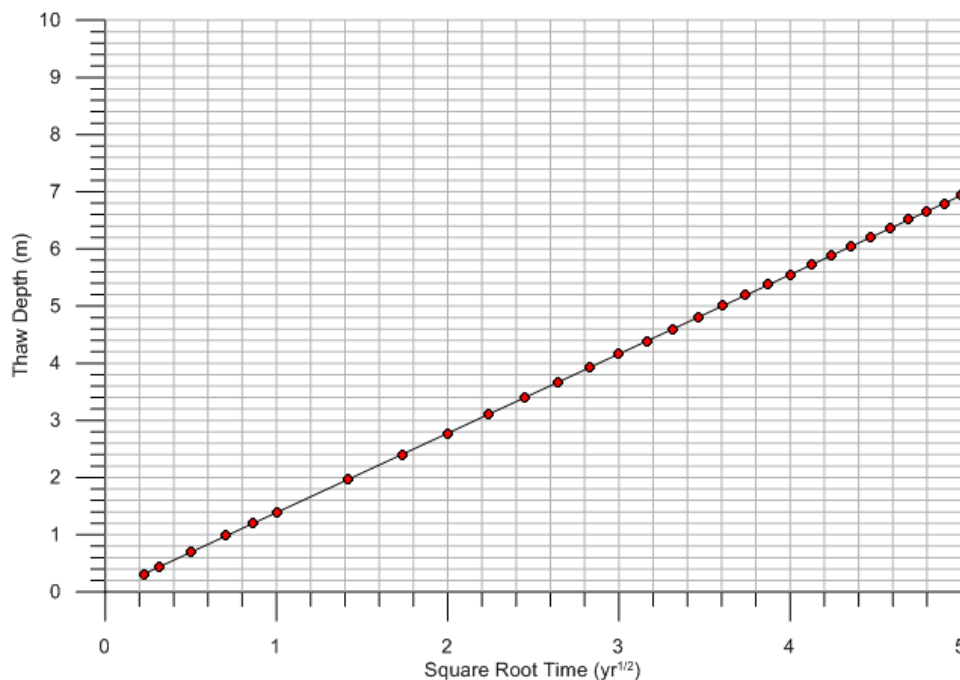


Figure 5-2. Estimated Rate of Thaw Penetration

The thaw coefficient, α , can be determined from best-fit slope of the curve and indicates that thaw will penetrate at an average rate of $1.4 \text{ m/year}^{1/2}$ or $0.25 \text{ mm/s}^{1/2}$.

The thaw consolidation ratio, R , is a dimensionless parameter that provides a measure of the relative rates of generation and expulsion of excess pore water and is expressed by the following equation (Nixon and McRoberts, 1971):

$$R = \frac{\alpha}{2 \cdot \sqrt{c_v}} \quad [5]$$

where:

R = thaw consolidation coefficient

α = thaw coefficient ($\text{mm/s}^{1/2}$)

c_v = coefficient of consolidation (mm^2/s)

Thaw consolidation tests have not been carried out on soil samples from the Eagle Gold project site, but coefficients of consolidation have been reported to range from 10 (sandy silts) to $0.01 \text{ mm}^2/\text{s}$ (clays) (Nixon and McRoberts, 1973). Conservatively assuming a coefficient of consolidation of $1 \text{ mm}^2/\text{s}$ for the silt colluvium and substituting $0.25 \text{ mm/s}^{1/2}$ for α , gives a thaw consolidation coefficient $R = 0.13$.

For slope stability calculations, the thaw consolidation value R is equivalent to the more commonly-used “pore pressure ratio” (R_u). Therefore, slope stability analyses have been carried out by applying a R_u of 0.15 to the thawed soil.

It is noted from Figure 5-2 that even after 25 years, the permafrost in the area of the ice-rich lobate landform is not expected to fully melt, with only the upper 7 m or so of the permafrost expected to thaw. This is based on the assumption that the waste rock will continue to be thermally equivalent to applying a constant surface temperature of +5°C.

5.3.5. Cases Considered

As discussed in Section 4.3, frozen ground frequently containing excess ice was observed in both the Eagle Pup and Platinum Gulch drainages. However, there were many areas observed as either unfrozen or frozen but free of excess ice. Based on the thaw consolidation analysis completed, excess pore pressures are expected to be generated in areas of waste rock placement where the foundation contains excess ice. The distribution of excess ice cannot be confidently determined with the data currently available. Therefore, for the purposes of the stability analyses, two cases were considered:

1. No excess pore pressures are generated in the overburden.
2. Excess pore pressures are generated in the upper 3 m of the overburden throughout the entire footprints of the WRSAs as a result of excess ice thawing from waste rock placement.

Case 1 is considered appropriate for both short term (e.g. during mine operations) and long term (e.g. post-closure) timeframes. Case 2 is only considered appropriate for short term timeframes given that, in general, it is estimated that excess pore pressures generated as a result of excess ice thawing from waste rock placement will have dispersed for the majority of the areas covered with waste rock well before the end of the mine life. As noted earlier, however, it may take longer for this to occur in areas such as the ice-rich lobate landform where excess ice extends to a significant depth.

For each of these cases, scenarios were considered for slip surfaces initiating from the upper, mid, and lower portion of the waste rock pile and exiting near the toe of the overall WRSA. A scenario was also considered for a slip surface initiating along the crest or bench of the lowest lift of both the Eagle Pup and Platinum Gulch WRSA. Applying Case 2 to evaluations of the overall stability of the WRSAs is considered to be a conservative approach given that excess ice is not observed throughout the WRSA footprints. However, the results of these conservative assessments give an indication of the impact of excess ice and highlight the need for additional subsurface investigations.

5.3.6. Results

Stability analyses were initially completed assuming that no excess pore pressures were generated in the overburden. The results of these analyses are provided in Table 5-7. In general, the factors of safety for the Eagle Pup WRSA range from 1.3 to 2.0 under static loading conditions and from 1.2 to 1.6 under pseudo-static loading conditions. For analyses completed for the Eagle Pup that included excess pore pressures in the foundation the

factors of safety range from 1.2 to 1.8 under static loading conditions and from 1.1 to 1.5 under pseudo-static loading conditions.

For the Platinum Gulch WRSA factors of safety ranged from 1.1 to 1.5 under static loading conditions and from 1.0 to 1.2 under pseudo-static loading conditions for analyses with no excess pore pressures generated in the overburden. For analyses that included excess pore pressures in the foundation the factors of safety range from 0.9 to 1.1 under static loading conditions and is approximately 0.9 for pseudo-static loading conditions.

Images from the stability models showing the slip surfaces are included in Appendix B.

Table 5-7. Stability Analysis Results

Facility	Failure Type	Foundation Condition	Factor of Safety	
			Static	Pseudo-static
Eagle Pup	Overall	No excess pore pressure	2.0	1.6
Eagle Pup	Mid slope		1.8	1.5
Eagle Pup	Lower slope		1.5	1.4
Eagle Pup	Lowest lift		1.3	1.2
Eagle Pup	Overall	Excess pore pressure	1.8	1.5
Eagle Pup	Mid slope		1.7	1.4
Eagle Pup	Lower slope		1.5	1.3
Eagle Pup	Lowest lift		1.2	1.1
Platinum Gulch	Overall	No excess pore pressure	1.5	1.2
Platinum Gulch	Lowest lift		1.1	1.0
Platinum Gulch	Overall	Excess pore pressure	1.1	0.9
Platinum Gulch	Lower lift		0.9	0.9

Notes:

1. Factors of safety that do not meet those recommended in Table 5-3 are shown in italicized text.

5.3.7. Discussion

The stability analyses indicate that, in general, the proposed configuration for the Eagle Pup WRSA meets the recommended factors of safety (Table 5-3) for both short term and long term stability. One exception, however, was noted for a scenario where a slip surface initiates along the crest or bench of the lowest lift. For this specific scenario the lowest lift could become unstable if excess pore pressures are generated in the foundation. From Drawing 8 it can be seen that frozen ground with excess ice was observed near the toe of the WRSA. The excess ice in this area was estimated to make up 10-15% of the soil by volume. Prior to placing waste rock in this area it will be necessary to remove this material and replace it with coarse, durable waste rock or pre-load the material to allow the ice to

thaw and the water generated to dissipate prior to constructing the full height of the lift. It will also be necessary to prevent interim toes of the WRSA from being constructed out onto soil that contains excess ice that could generate excess pore pressures as it thaws. Additional investigations should be undertaken to delineate and characterize soils containing excess ice, particularly in areas where final and interim toes of the WRSA may be located.

The stability analyses conducted indicate that the overall stability of the Platinum Gulch WRSA meets the recommended factors of safety for the case where excess pore pressures are not generated in the overburden. However, slip surfaces initiating along the crest of the lowest lift and extending into the soils at the toe of that lift do not meet the recommended factors of safety for this case. Therefore, it will be necessary to re-grade (flatten) or reduce the height of the lowest lift to achieve an acceptable level of stability. In addition, any interim toes or individual lifts which remain in place over the summer season may need to be re-graded or stabilized with lower wrap-around lifts to achieve an acceptable level of stability. This could possibly be included in the reclamation plan for the slopes, if the mine production and dump construction sequencing will accommodate this.

The recommended factors of safety are not met for any of the scenarios considered in Platinum Gulch when excess pore pressures are generated in the foundation. Based on the information collected to date it appears to be unlikely that excess ice is pervasive throughout Platinum Gulch. Applying excess pore pressures to evaluations of the overall stability of the WRSAs is considered to be a conservative approach; however, as can be seen from Drawing 8, additional data over the footprint of the WRSA is needed to confirm this assumption. The results highlight the need for additional subsurface investigations to delineate and characterize soils potentially containing excess ice throughout the footprint of the WRSA. If excess ice is found to be pervasive in the Platinum Gulch WRSA then foundation preparations and/or bottom up construction along with a re-design of the layout may be required. If excess ice is only locally present and not pervasive then, depending on where it is located (e.g. near the toes of individual lifts), procedures may need to be implemented to allow the ice to thaw and the water generated to dissipate prior constructing each lift of the WRSA. These procedures could include pre-loading select areas of the WRSA, as discussed above, or flattening the face of the lowermost lifts.

6.0 ADDITIONAL CONSIDERATIONS

6.1. Water Diversion and Management

Controlling surface runoff and groundwater is an important element in preventing pore pressures from developing within waste rock storage areas and reducing the potential for erosion of the waste rock, thus enhancing overall stability. In general, surface water runoff can be controlled and infiltration can be minimized by expending relatively little effort during mining operations. A water management plan is being developed by Knight Piesold for the WRSAs as part of the FS and therefore will not be discussed in detail in this report. However, the primary means of controlling runoff and infiltration to waste rock piles generally include the following:

- Divert surface water flows away from the WRSAs, wherever possible and practical.
- Grading, crowning, or in-sloping the running surfaces of the operating lifts to divert water away from areas of WRSAs which are important to their overall stability, such as along the outer perimeters.
- Construct swales and/or ditches within the surface of the piles that tie into natural drainage channels which will convey surface water away from the WRSA catchments.
- Preferentially grade all surfaces to avoid ponding.

Control of surface water runoff by these means is recommended and has been assumed in determining the factors of safety presented above.

6.2. Material Placement and Sequencing

6.2.1. General Material Placement

Overburden and fill materials that are not required for reclamation and that are placed in the WRSAs should be mixed with coarse, durable waste rock at a ratio such that the overall strength of the mixture is dictated by the waste rock. A general rule-of-thumb to achieve this is that mixtures should not exceed 20% overburden by volume. In addition, overburden spoil materials should not be concentrated along the foundation or within the final side slopes of the WRSAs. Caution should be taken to prevent large quantities of overburden from being placed in any one area, as these materials will be less likely to drain when subsequent lifts are placed and could generate localized excess pore pressures, which could contribute to slope instability. In addition, if overburden is temporarily stockpiled on the WSRAs for later use as reclamation cover then it should be placed away from the edge of the WRSAs so as not to influence the stability of the waste rock piles.

In general, the waste rock from the open pit area is not anticipated to consist of materials that are prone to weathering and/or degradation. However, if waste rock prone to weathering and/or mechanical degradation is encountered it should be treated as overburden and handled as outlined above.

6.2.2. Seasonal Placement

Seasonal challenges should be anticipated during construction of the WRSAs due to the presence of overburden containing excess ice. During the summer months, as the ground thaws, instabilities may occur near the toes of the WRSAs if they are advanced over thawed or thawing ground that contains excess ice. Seasonal dumping campaigns focusing on advancing the WRSAs out onto native ground during the winter months and building on existing waste rock lifts during the summer months could be considered to limit the advancement of the WRSAs onto thawed or thawing ground.

6.2.3. Ice-rich Lobate Landform

As discussed in Section 4.1.2 a distinct lobate landform comprised of ice-rich colluvium with frequent inclusions of massive ice was encountered in the Eagle Pup drainage (Drawing 4). This ice-rich colluvium is approximately 1 ha in plan area and was encountered to the bottom of borehole BH-BGC11-42 at 28.2 m bgs and to approximately 26.1 m bgs in BH-BGC11-63. Due to the nature and extent of this landform BGC provided recommendations to Tetra Tech Wardrop in an email dated December 13, 2011 summarizing a sequence of waste rock placement that should be implemented so that the ice-rich lobe is buttressed with waste rock prior to advancing the WRSA upslope above it. In the email provided to Tetra Tech Wardrop it was recommended that this be achieved by first constructing a lift of waste rock immediately below the ice-rich lobate landform. The purpose of this lift is to act as a platform for subsequent lifts. Once this platform lift is established, the next lift of waste rock (i.e. the buttressing lift) should be constructed in front of the ice-rich lobate landform such that it extends out a sufficient distance (at least 135 m) from the native ground surface that the ice-rich lobe is supported. The overall angle of the combined lifts at this stage of the WRSA development should not exceed 3H:1V.

Following this initial waste placement sequencing, the WRSA can continue to be developed upwards at an overall angle of 3H:1V. The buttress could also be out from the native ground surface, in which case the buttress would need be widened by approximately 65 m for a total width of at least 200 m. Once the buttress has been extended out to a width of at least 200 m from the native ground surface, the WRSA could be developed upwards at an overall angle of about 2.5H:1V. The WRSA sequencing for the FS was provided by Tetra Tech Wardrop to BGC on January 20, 2012. Our review of the sequencing indicates that the above recommendations have been followed.

6.3. Foundation Preparation

Clearing and stripping of the organic soils will be required throughout the footprint of the rock drains in both the Eagle Pup and Platinum Gulch WRSAs (Drawing 8). An average stripping depth of 0.3 m has been assumed to remove the organic soils. In general, clearing and stripping should be performed in as short a time as possible in advance of waste rock placement to minimize the exposure period of the de-vegetated ground. This will limit the

amount of erosion that occurs in these areas. The organic soils should be stockpiled for re-use in reclamation work.

There are a number of ground-related challenges that may arise with any clearing and stripping of the WRSAs and other earthworks completed in these areas. These include:

- Presence of discontinuous permafrost, including some areas with excess ground ice.
- Relatively short “traditional” (i.e. spring/summer/fall) construction season, with specific challenges and limitations during other parts of the year (e.g. poor trafficability and material workability on hillsides before mid-summer; and long, harsh winter).
- Presence of steep slopes and geological hazards.

Excavation of frozen ground, particularly ice rich permafrost, requires additional effort and care. Well-bonded, ice-rich frozen ground will be difficult to excavate and may require ripping. Further consideration needs to be given to the thaw behaviour of this material, and allowances made for adequate drainage and associated erosion control, as well as additional time and effort for the work. Exposure of ice-rich permafrost and the associated thaw can result in wet, muddy, soft ground, and poor trafficability, along with local slumping and other nuisance effects. Consideration should be given to completing the foundation preparation and rock drain construction in the winter months to reduce the challenges outlined above.

Excavated frozen ground will generally be unsuitable for reuse without substantial effort to thaw and drain, and may be suitable for reuse only for limited applications, depending on the moisture and fines contents. It will be necessary to plan for temporary or permanent stockpiling of the wasted ice-rich frozen soil. These materials will be unstable when thawed and will not stand at steep angles or significant height, so a large footprint or containment berm may be required to store relatively small volumes. The design of these stockpiles was not included in BGC's scope of work.

7.0 CONCLUSIONS AND RECOMMENDATIONS

Key aspects of the geotechnical assessments of the Eagle Pup and Platinum Gulch WRSAs and recommendations for subsequent levels of study are summarized below:

1. Construction of the WRSAs will involve the placement of lifts of waste rock on potentially frozen ground containing excess ice. Depending on the thickness, initial temperature, and timing of the waste rock placement, the thermal regime of the initially frozen foundation may be altered, particularly when a lift is placed during the summer months. Depending on the rate of thaw and the ability of the soils to dissipate the water generated, excess pore pressures could be generated reducing the effective shear strength of the foundation soils. This can result in instabilities of the WRSAs.
2. The stability analyses completed indicate that, in general, the Eagle Pup WRSA meets the recommended factors of safety for the cases considered. The exception to this is for the scenario where a slip surface initiates along the crest or bench of the lowest lift. For this specific scenario the lowest lift is considered unstable if excess pore pressures are generated in the foundation as a result of excess ice thawing from waste rock placement. It is recommended that additional investigations need to be undertaken to delineate and characterize soils containing excess ice in areas where final and interim toes will be located. If it is determined that excess ice is pervasive throughout these areas then mitigation will be required such as: excavating the ice-rich material and replacing it with coarse, durable waste rock. Alternatively, the area could be pre-loaded with waste rock to allow the ice time to thaw and the water generated to dissipate prior to constructing the full height of the lift.
3. The stability analyses completed indicate that the overall stability of the Platinum Gulch WRSA meets the recommended factors of safety as long as excess pore pressures are not generated in the overburden. However, slip surfaces initiating along the crest or bench of the lowest lift do not meet the recommended factors of safety for this case. Therefore, it may be necessary to re-grade the lowest lift to achieve an acceptable level of stability. In addition, any individual lifts (e.g. those detached from other lifts) will also need to be re-graded in order to achieve an acceptable level of stability. This could be implemented as part of the reclamation plan for this area, which will require flatter slopes than the angle of repose slopes which will be in place at the end of the waste placement.
4. The recommended factors of safety are not met for any of the scenarios considered in Platinum Gulch when excess pore pressures are generated in the foundation. Applying excess pore pressures to evaluations of the overall stability of the WRSA is considered to be a conservative approach given that it is unlikely that excess ice is pervasive throughout the footprint. However, the results of these evaluations highlight the need for additional subsurface investigations. Therefore, it is recommended that additional investigations be undertaken to delineate and

characterize soils containing excess ice throughout the footprint of the WRSA. If excess ice is found to be pervasive then mitigation measures will be required such as: excavating the ice-rich material from areas critical for stability and replacing it with coarse, durable waste rock; and/or utilizing bottom-up construction. If excess ice is only locally present and not pervasive then, depending on where it is located (e.g. near the toes of individual lifts), procedures may need to be implemented to allow the ice time to thaw and the water generated to dissipate prior constructing each lift of the WRSA. These procedures could include pre-loading select areas of the WRSA.

5. The pseudo-static seismic stability analyses completed assume that liquefaction does not occur in either the foundation or the waste rock. The resistance of these materials to liquefaction should be assessed at detailed design. This may require additional site investigations including geophysics.
6. A distinct lobate landform comprised of ice-rich colluvium with frequent inclusions of massive ice was encountered in the Eagle Pup. Due to the nature and extent of this landform it is recommended that waste rock placement be sequenced in a manner such that the ice-rich lobe is buttressed with waste rock prior to advancing the WRSA upslope.
7. Construction of engineered rock drains in the valley bottoms of the Eagle Pup and Platinum Gulch drainages is recommended to convey water flows through the WRSAs and prevent a phreatic surface from developing within the waste rock piles. The rock drains must maintain their flow capacity and cannot degrade over time. Therefore, it is recommended that the rock drains be constructed out of non-metal leaching, non-acid generating, clean, durable intrusive waste rock with a D_{50} of at least 0.1 m and a maximum particle size of 1 m. Based on the waste rock production schedule, intrusive waste rock may not be available early in the mine life in the quantities required for the rock drain construction. Therefore, it may be necessary to use metasedimentary rocks to construct the rock drains. It is BGC's understanding these may be sourced from a cut near the primary crusher. A review of subsurface information available in this area indicates that suitable metasediments may be present below a depth of about 10 to 15 m. However, these materials require further evaluations to confirm their suitability for the rock drain. If the mine schedule requires that these metasediments be incorporated into the rock drain it is recommended that the susceptibility of these materials to mechanical degradation be evaluated to determine if they are suitable construction materials.
8. It is also recommended that the particle size distribution of the various waste rock sources be better defined to confirm assumptions regarding the proposed materials for the rock drains. Maximizing block sizes by modifying blasting and excavation techniques could significantly reduce the required size of the rock drains and thus reduce construction costs.
9. Sediment control ponds are located in the Eagle Pup and Platinum Gulch drainages downstream of the WRSAs. In the case of the Eagle Pup drainage the sediment

control pond is located at the toe of the WRSA. It is recommended that the rock drain be graded into the sediment control pond by extending it from the toe of the WRSA. It is recommended that the details of this interaction be considered at the next stage of design.

8.0 CLOSURE

We trust the above satisfies your requirements at this time. Should you have any questions or comments, please do not hesitate to contact us.

Yours sincerely,

BGC ENGINEERING INC.
per:

Brent McAfee, E.I.T.
Geotechnical Engineer

Warren Newcomen, M.S., P.Eng., P.E.
Senior Geotechnical Engineer

Reviewed by:

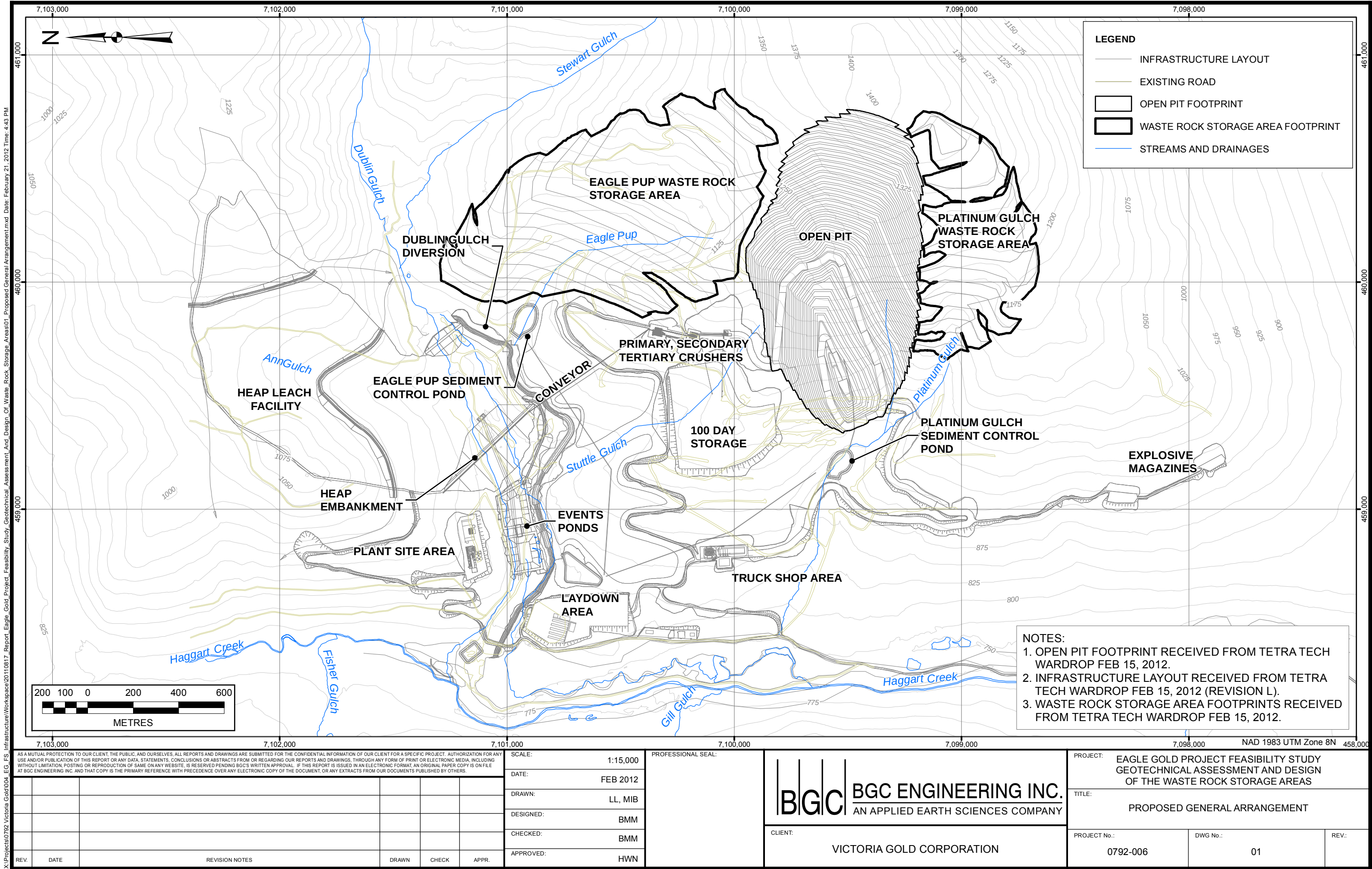
Thomas G. Harper, P.E
Senior Civil Engineer

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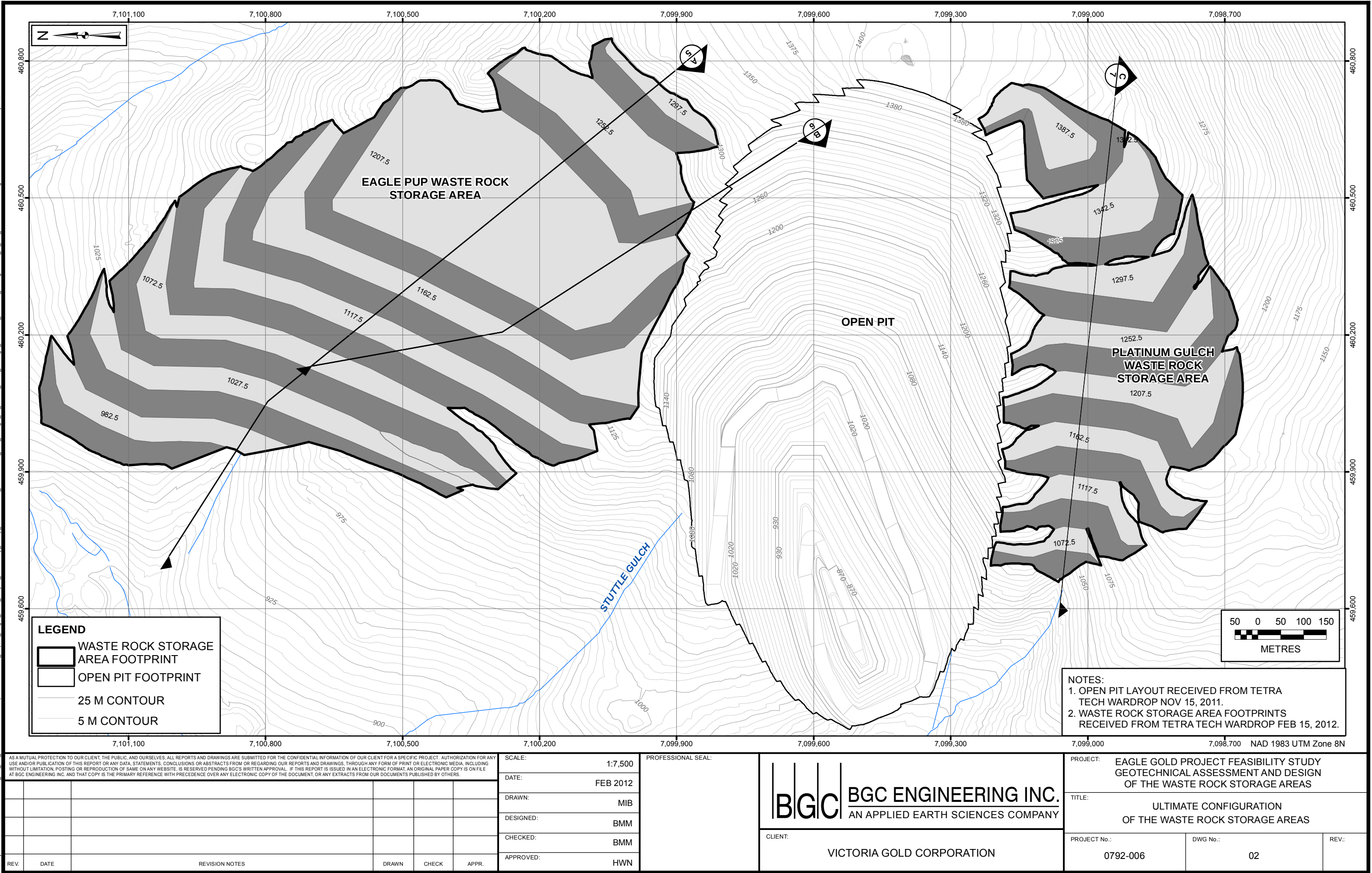
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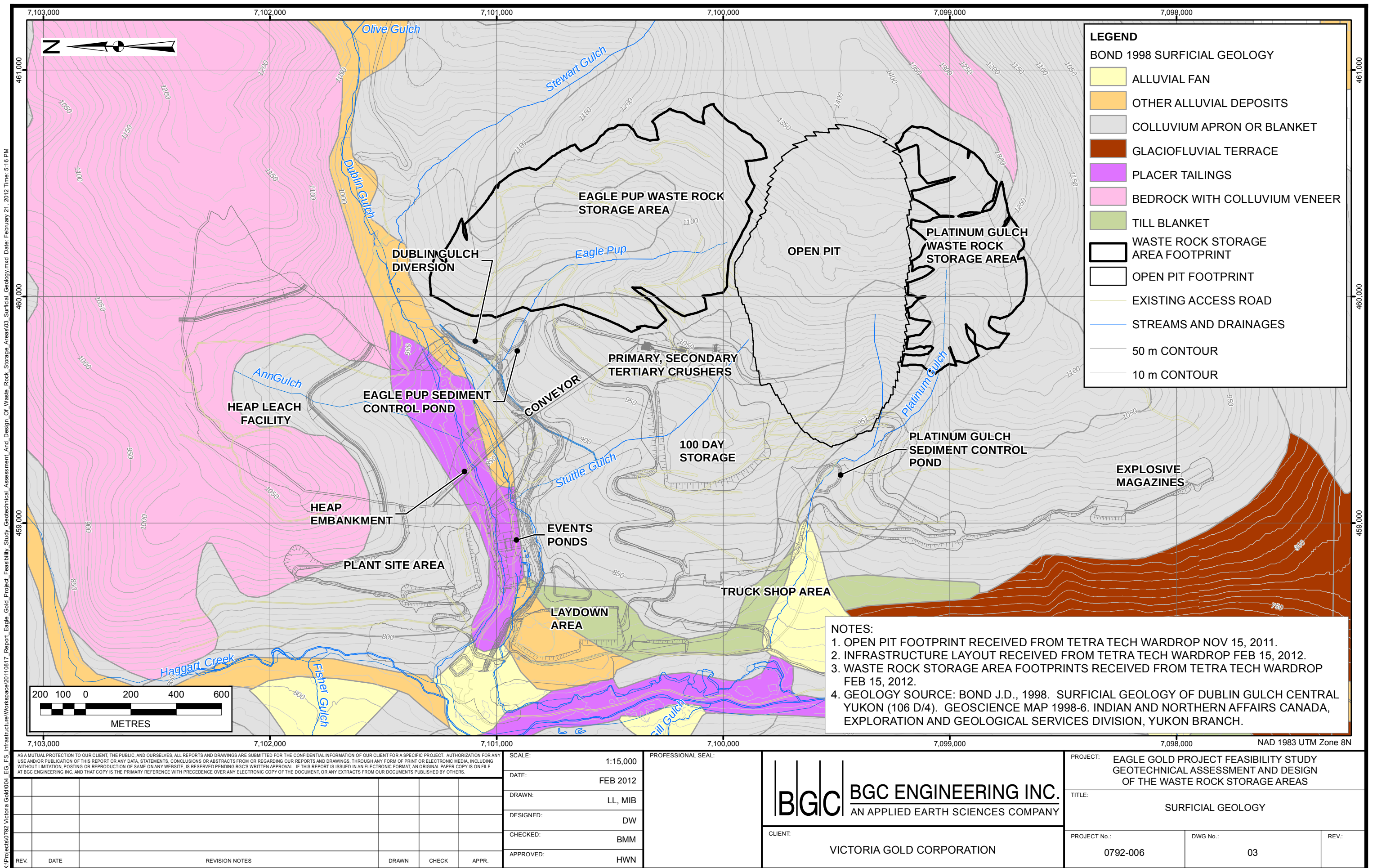
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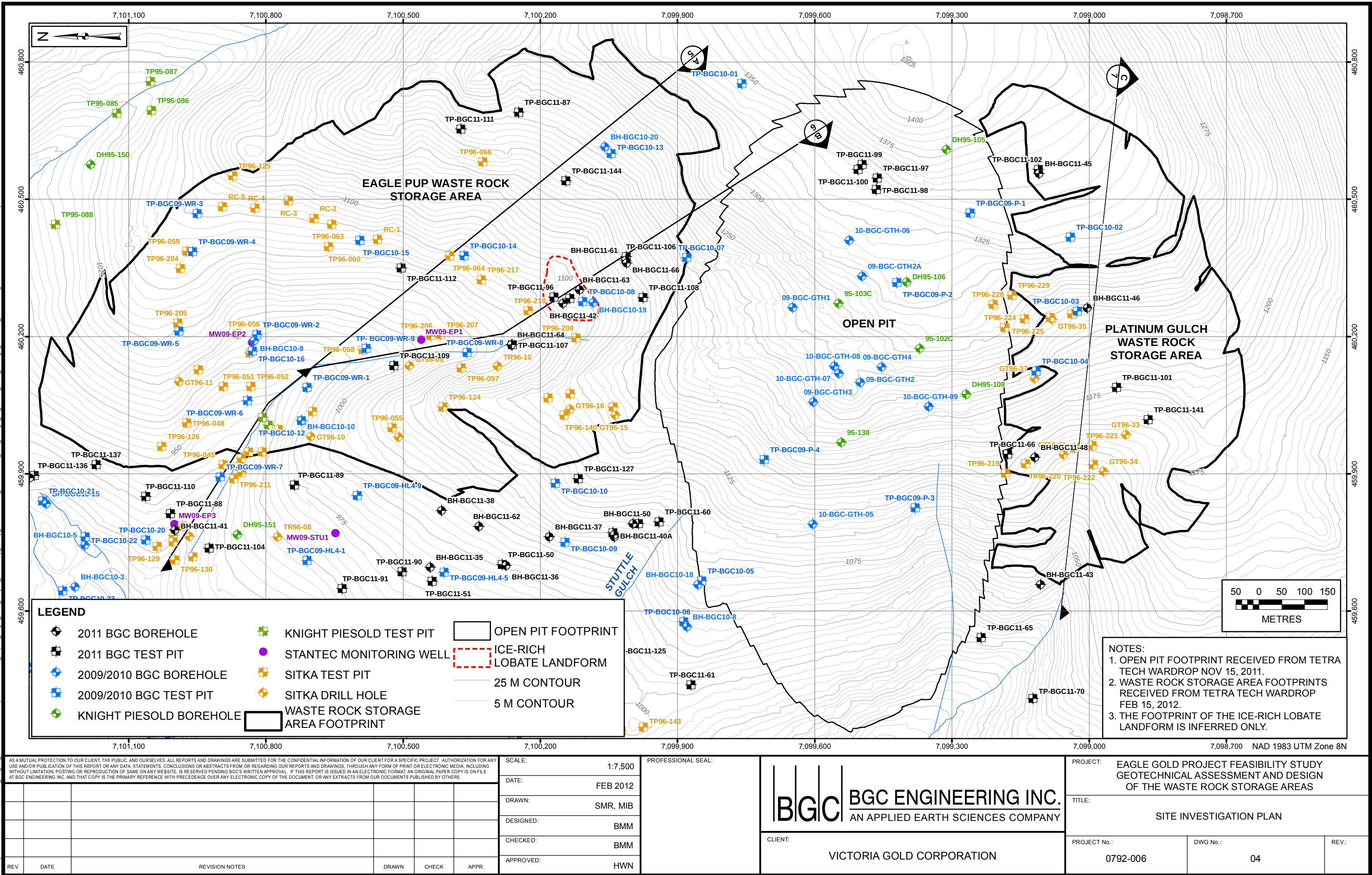
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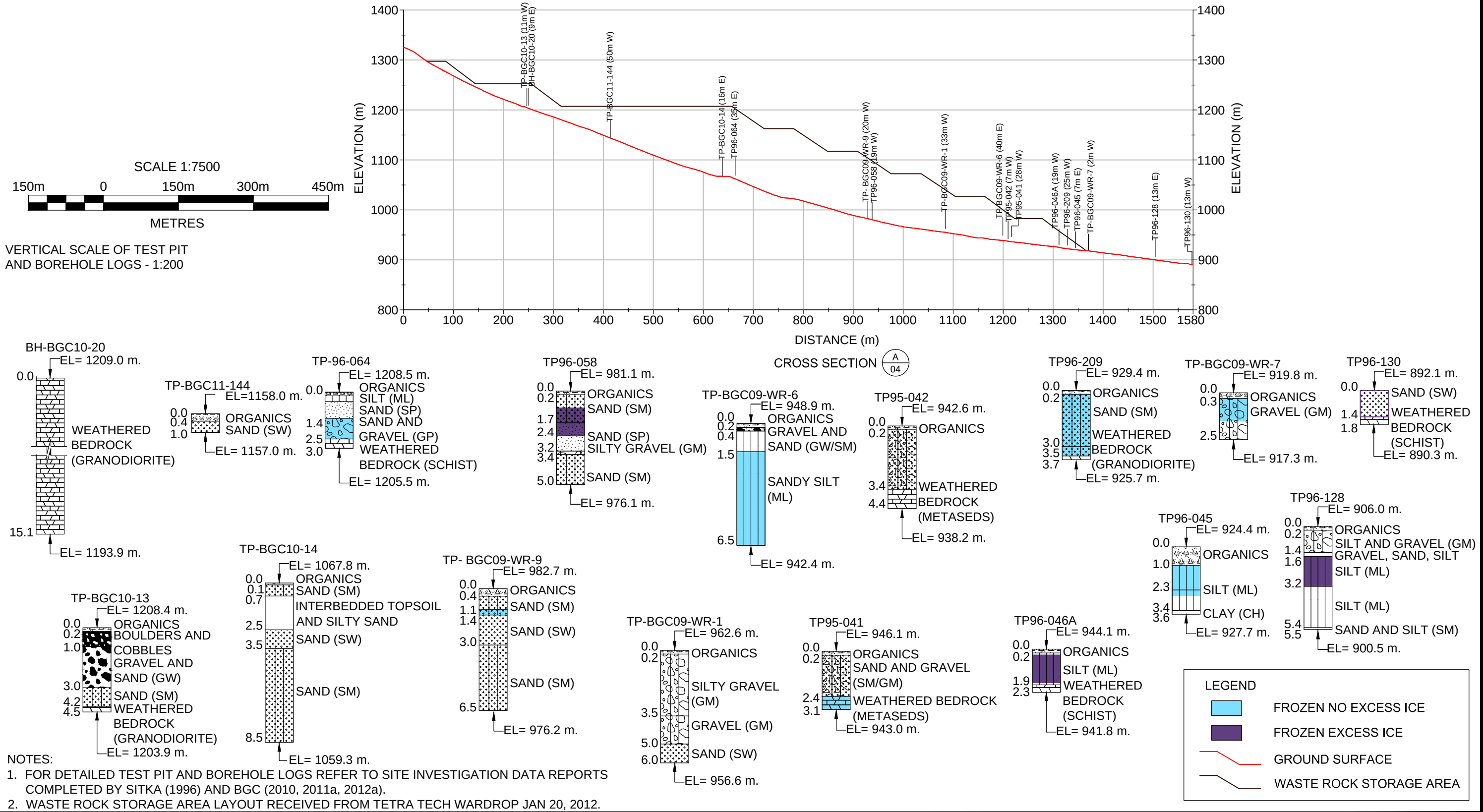




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PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY
GEOTECHNICAL ASSESSMENT AND DESIGN
OF WASTE ROCK STORAGE AREAS

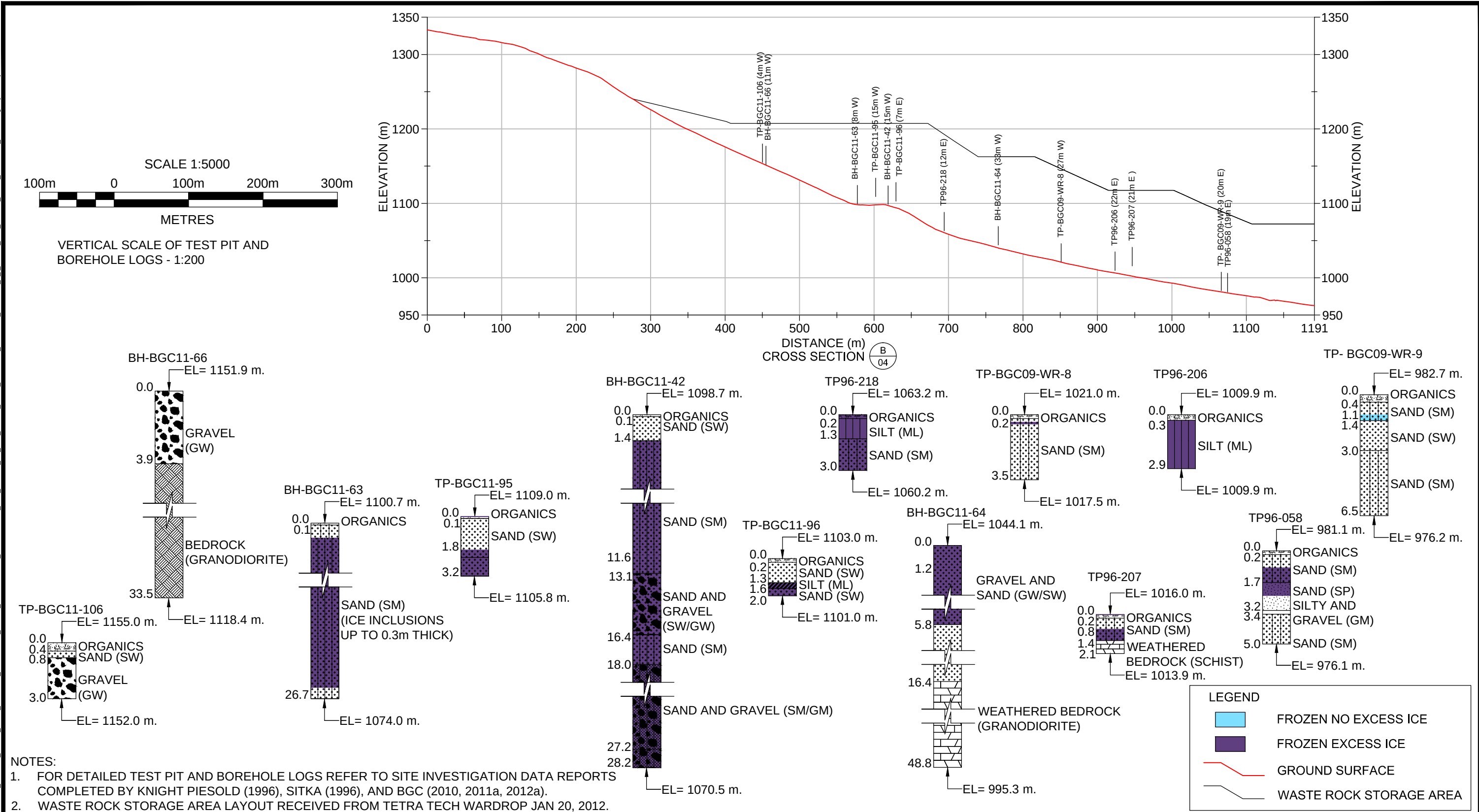
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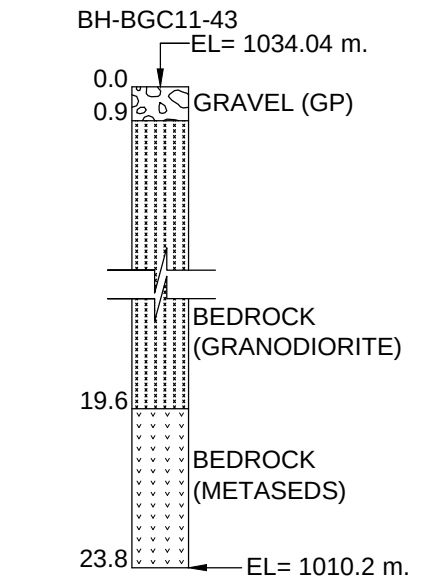
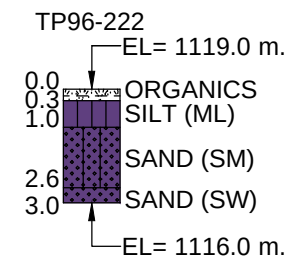
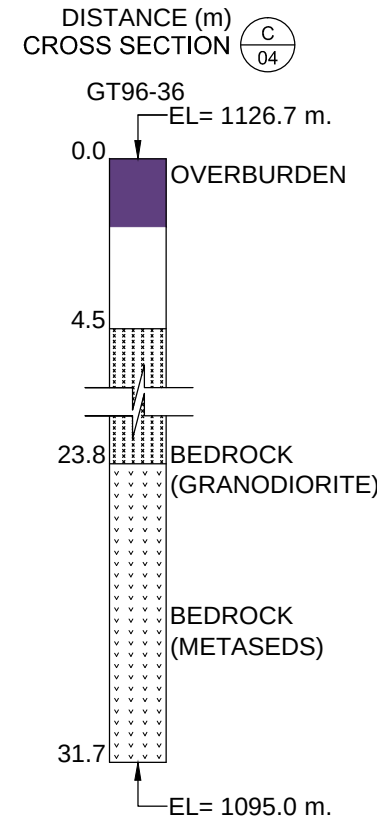
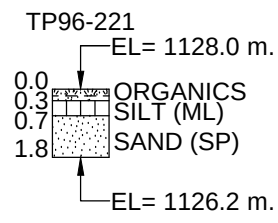
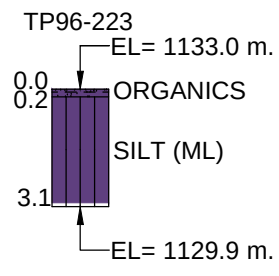
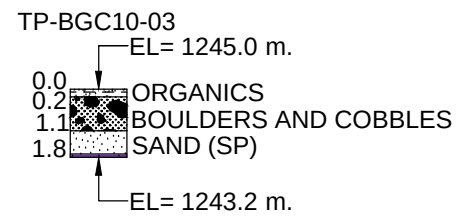
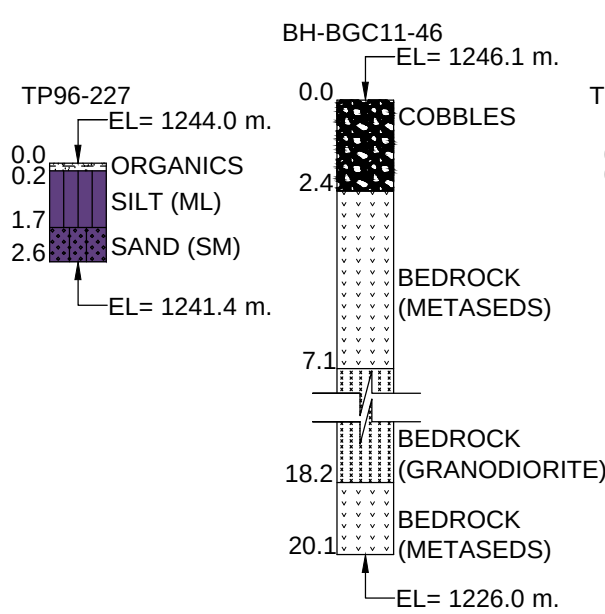
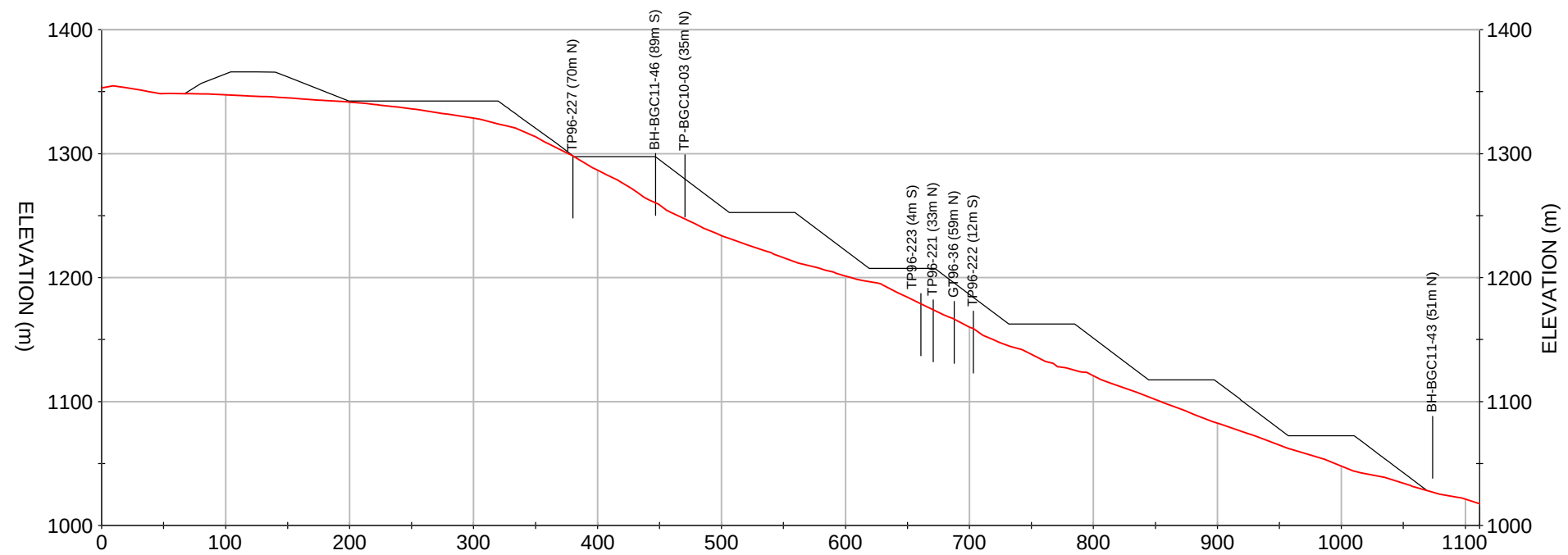
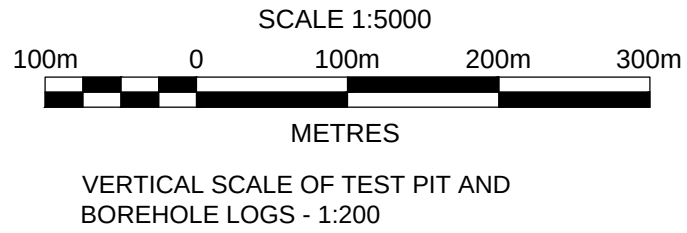
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LEGEND

- FROZEN NO EXCESS ICE
- FROZEN EXCESS ICE
- GROUND SURFACE
- WASTE ROCK STORAGE AREA

- NOTES:
- FOR DETAILED TEST PIT AND BOREHOLE LOGS REFER TO SITE INVESTIGATION DATA REPORTS COMPLETED BY KNIGHT PIESOLD (1996), SITKA (1996), AND BGC (2010, 2011a, 2012a).
 - WASTE ROCK STORAGE AREA LAYOUT RECEIVED FROM TETRA TECH WARDROP JAN 20, 2012.

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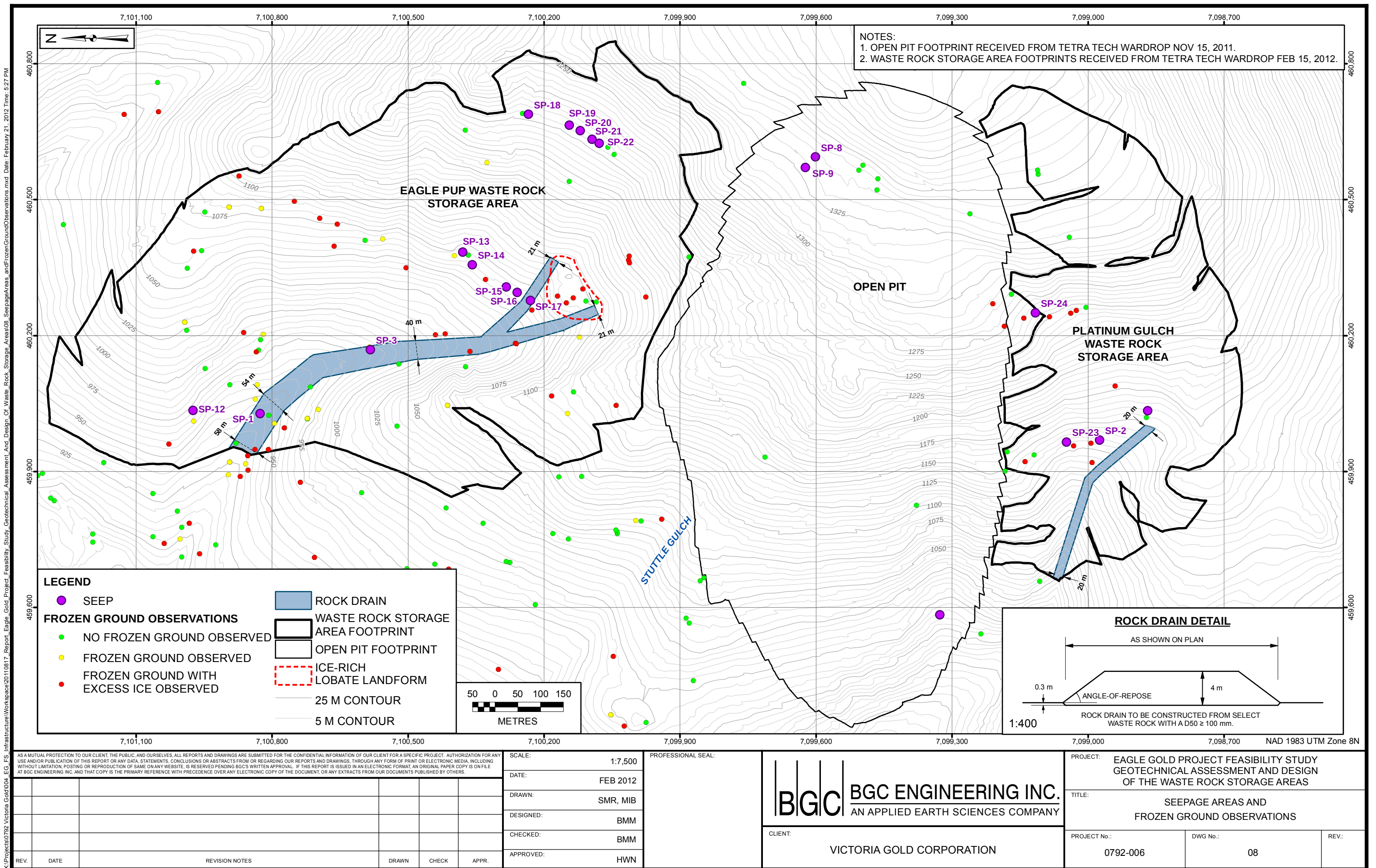
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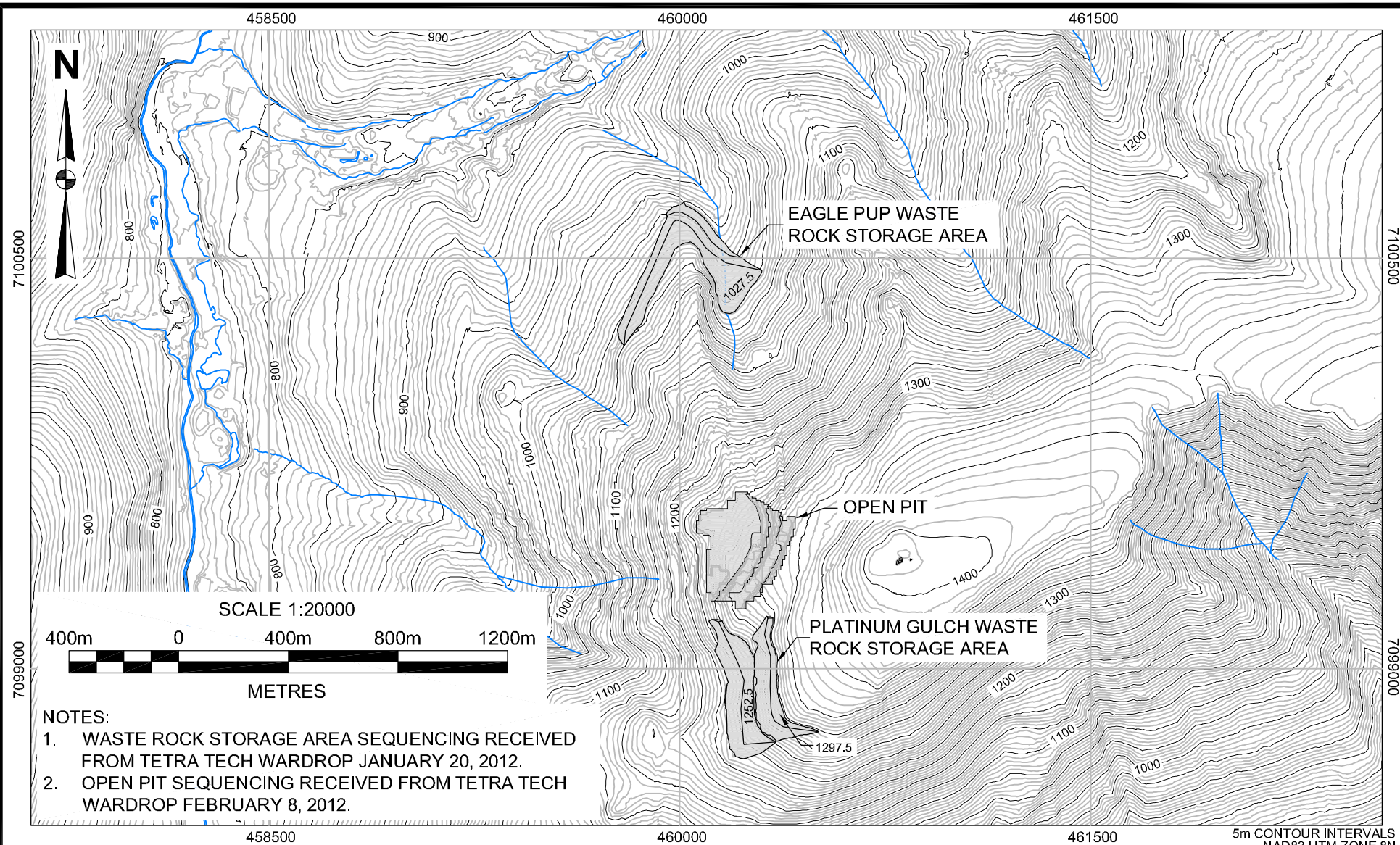
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APPENDIX A

END OF PERIOD PLANS AND WRSA SEQUENCING

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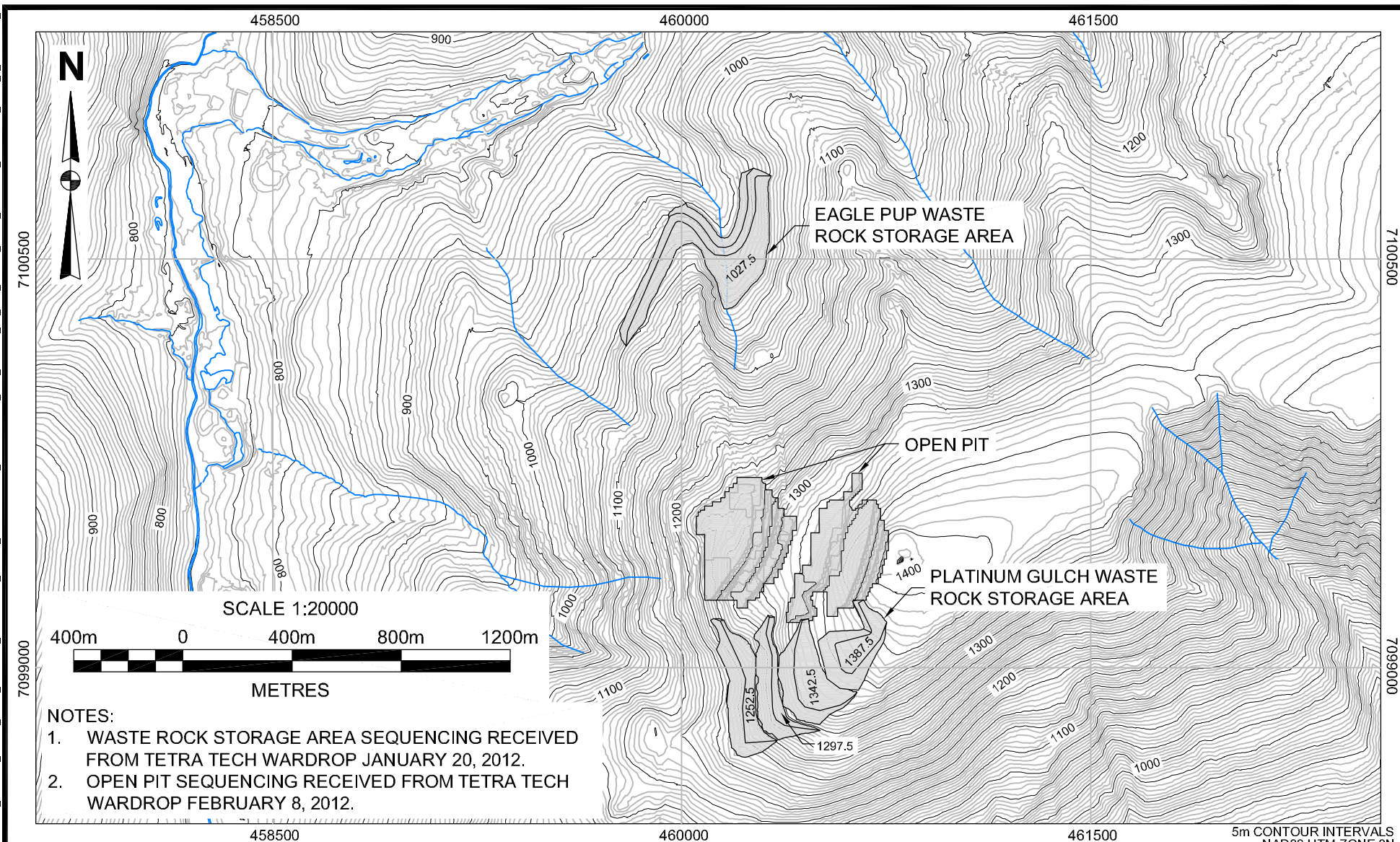
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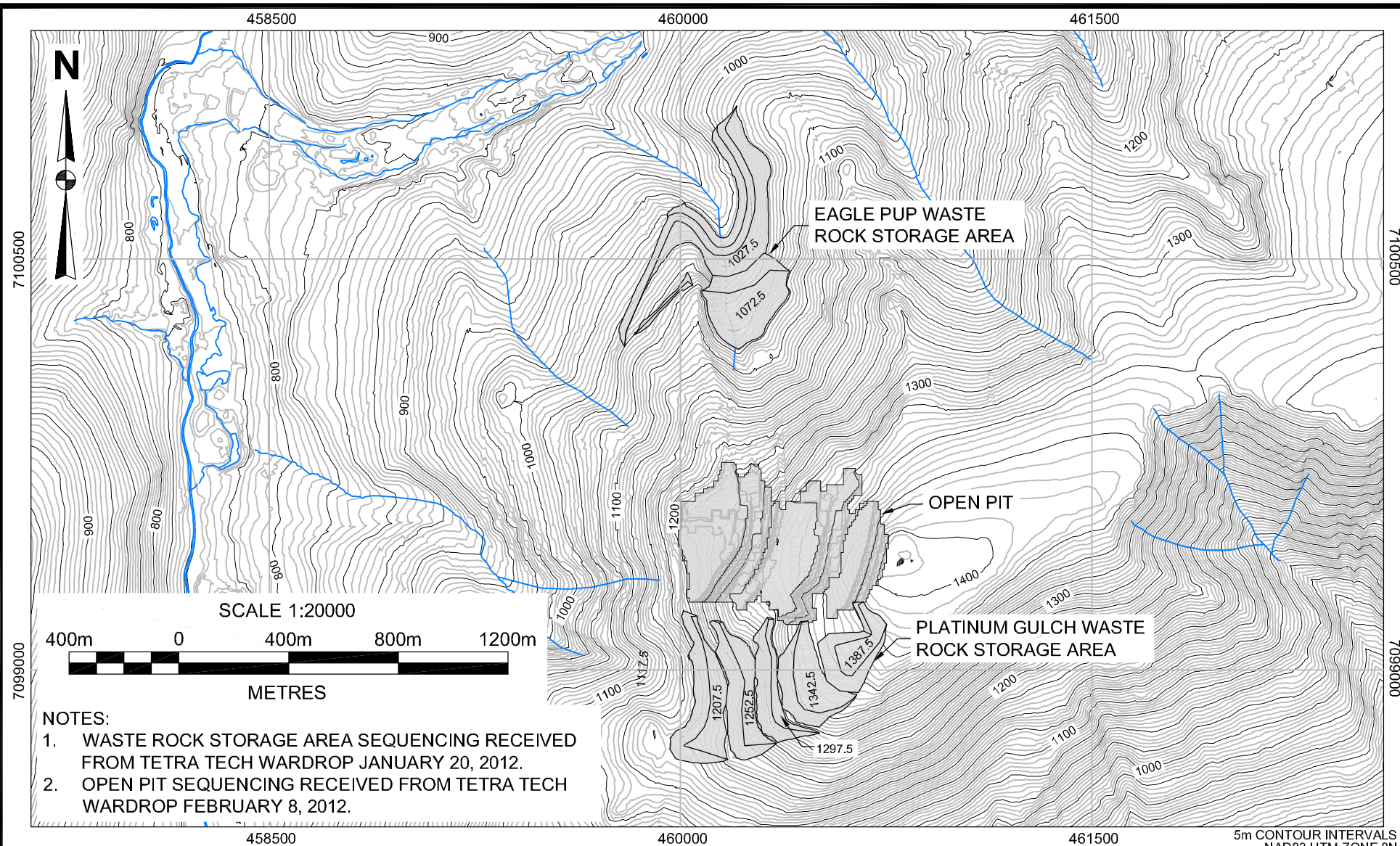


NOTES:

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2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

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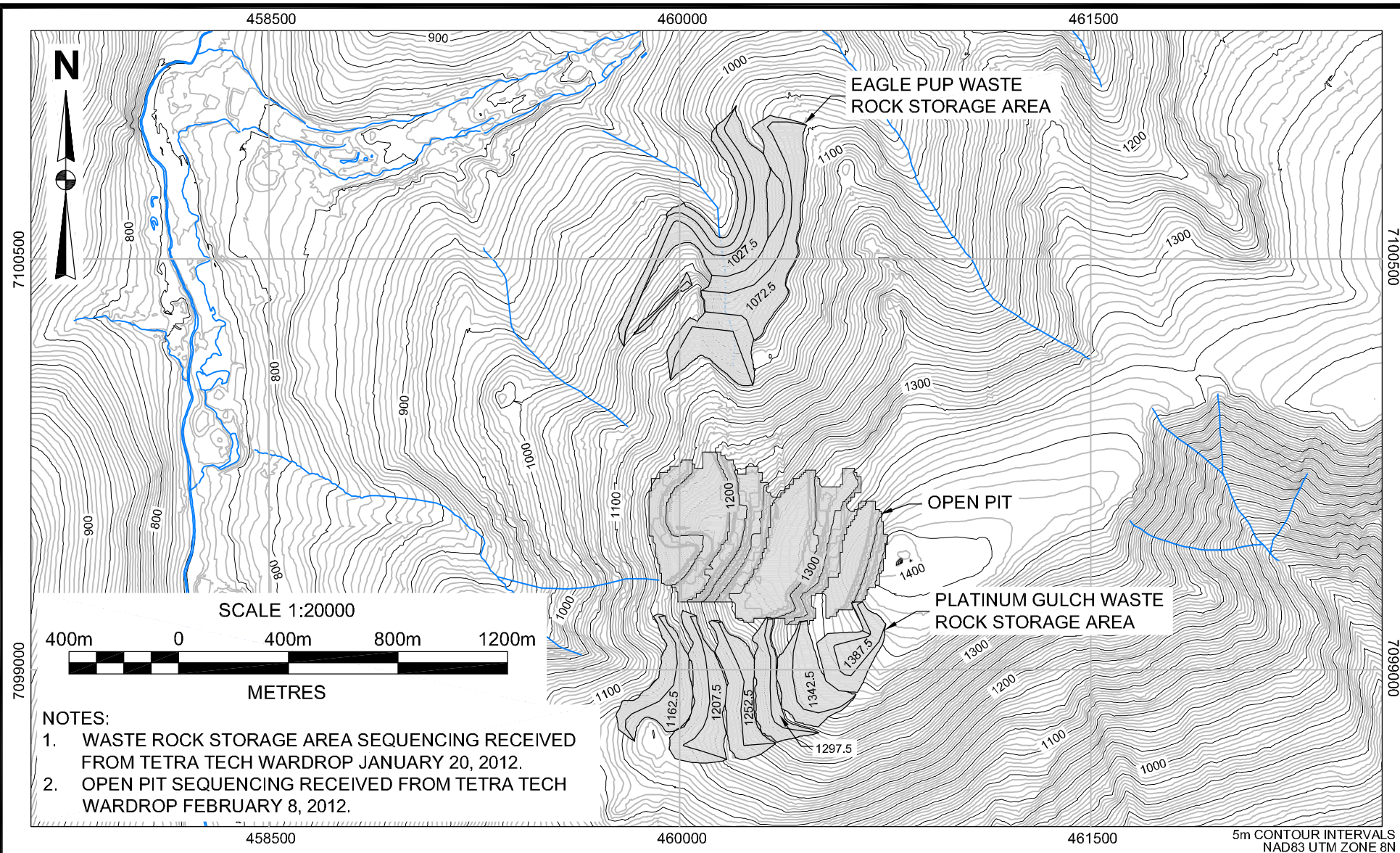
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PROJECT No.:	DWG No.:	REV.:
0792-006	A-3	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

X:\Projects\0792 Victoria Gold\06\Workspace\2012\01 REPORT_EAGLE_GOLD_PROJECT_FEASIBILITY_STUDY_GEOTECHNICAL_ASSESSMENT_AND_DESIGN_OF_THE_WASTE_ROCK_STORAGE_AREAS\A-4_YEAR_1_QUARTER_4.dwg



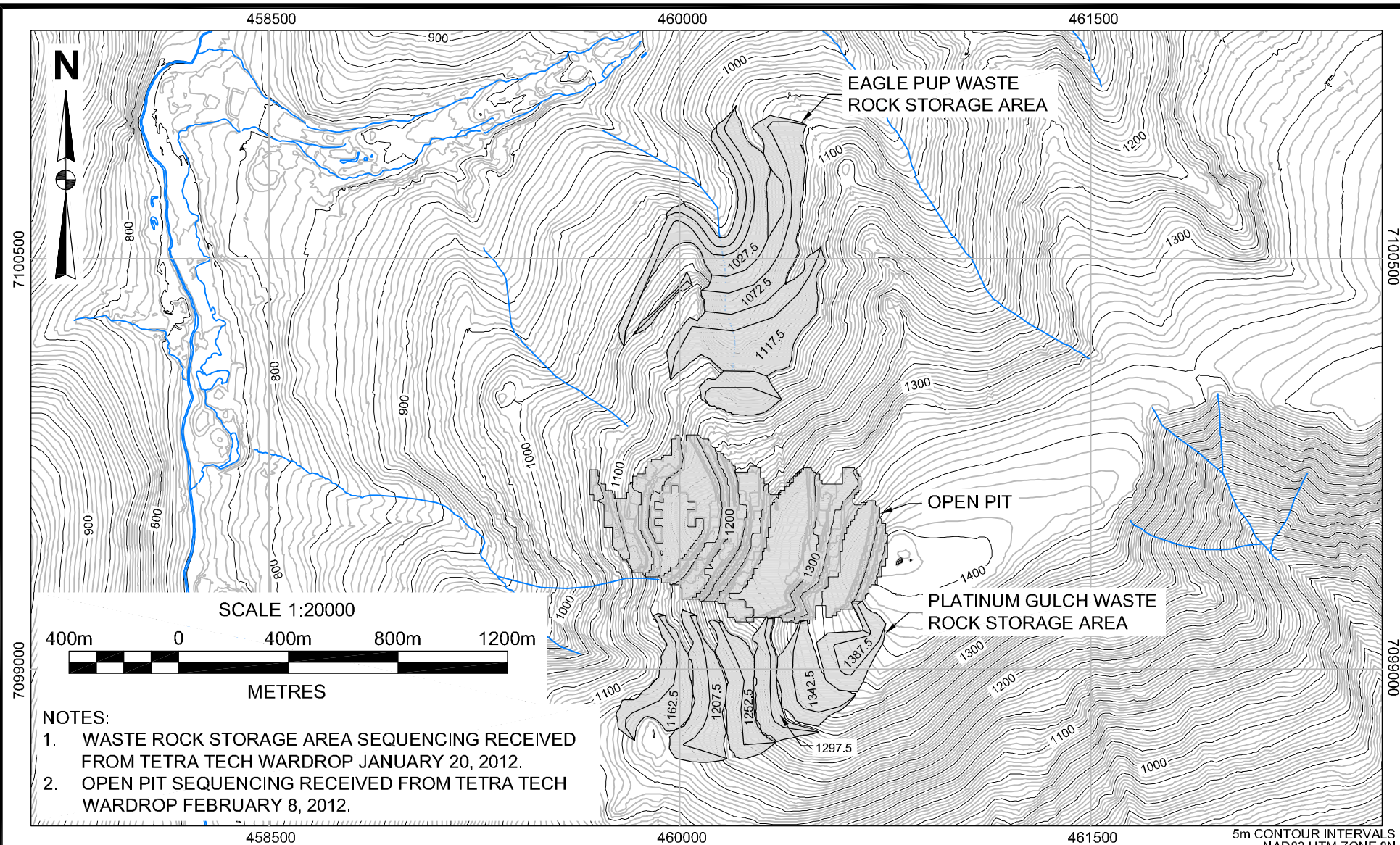
NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE:	1:20,000	DESIGNED:	BMM	 BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS		
DATE:	FEB 2012	CHECKED:	BMM		TITLE: YEAR 1 QUARTER 4		
DRAWN:	DK	APPROVED:	HWN				
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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.				CLIENT: VICTORIA GOLD CORPORATION	PROJECT No.: 0792-006	DWG No.: A-4	REV.:

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

X:\Projects\0792 Victoria Gold\06\Workspace\2012\01 REPORT_EAGLE_GOLD_PROJECT_FEASIBILITY_STUDY_GEOTECHNICAL_ASSESSMENT_AND_DESIGN_OF_THE_WASTE_ROCK_STORAGE_AREAS\A-5_2_QUARTER_1.dwg Layout



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE:	1:20,000	DESIGNED:	BMM
DATE:	FEB 2012	CHECKED:	BMM
DRAWN:	DK	APPROVED:	HWM



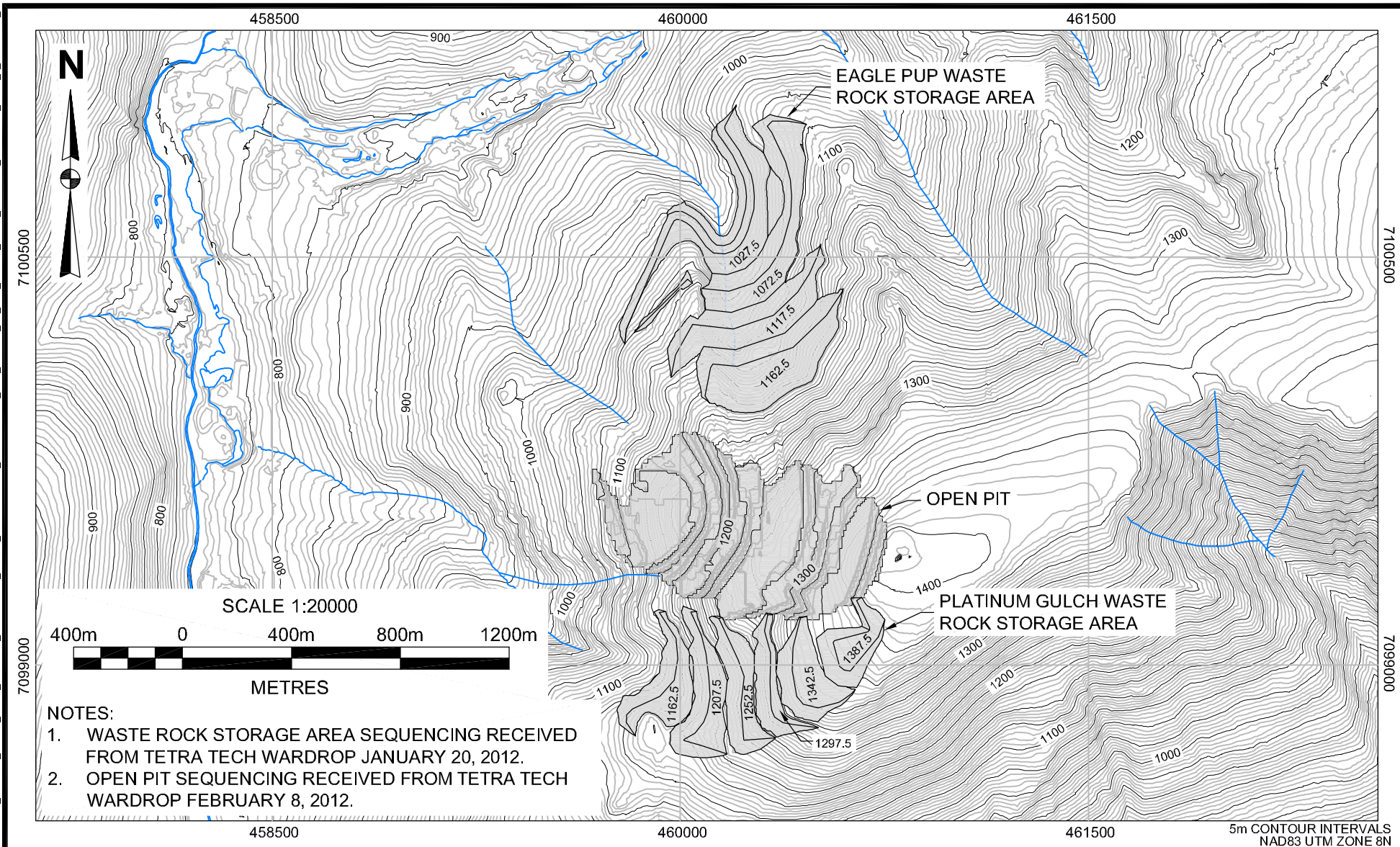
CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
TITLE:
YEAR 2 QUARTER 1

PROJECT No.:	DWG No.:	REV.:
0792-006	A-5	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

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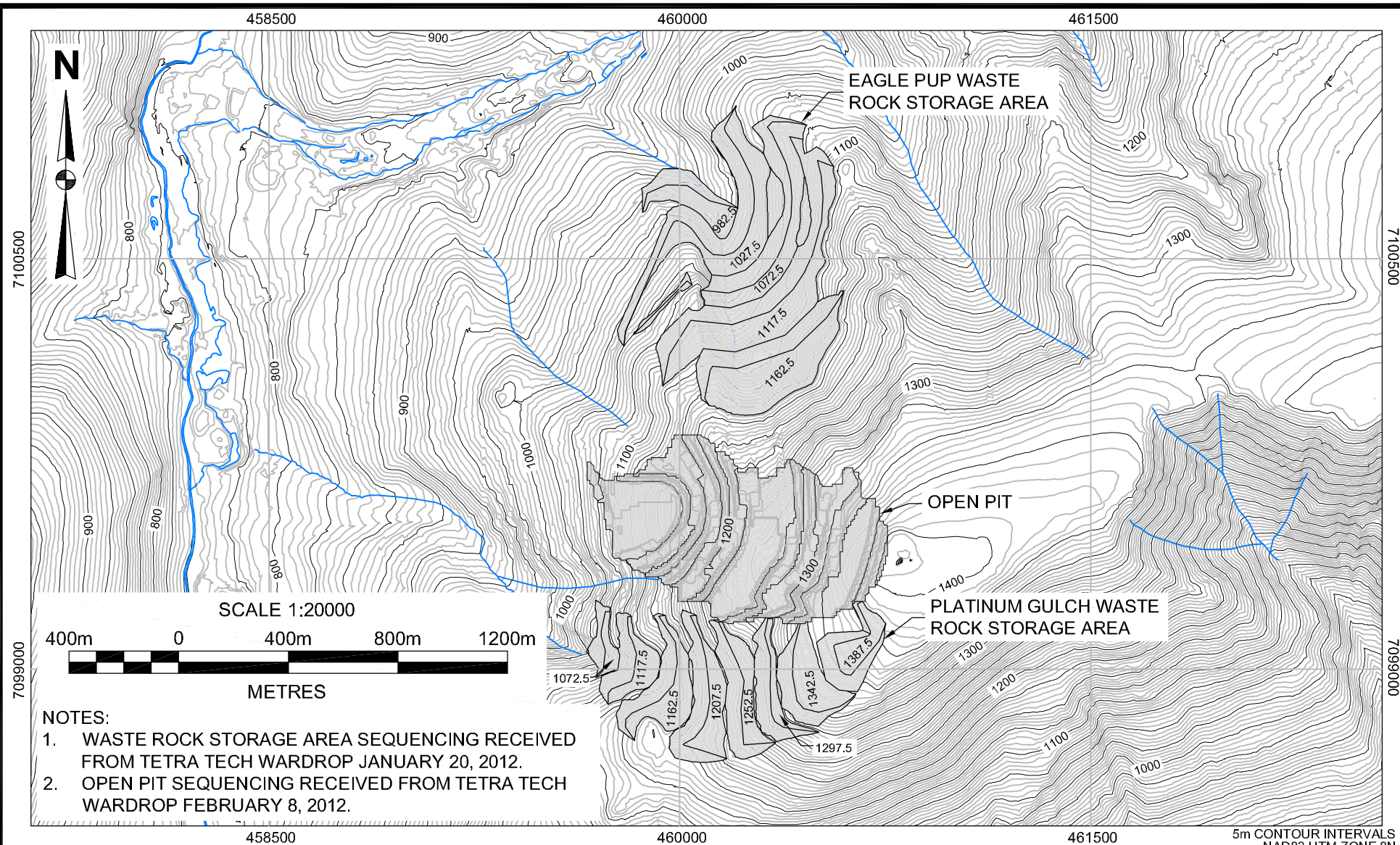
NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE: 1:20,000		DESIGNED: BMM		BGC ENGINEERING INC. AN APPLIED EARTH SCIENCES COMPANY	PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS									
DATE: FEB 2012		CHECKED: BMM			TITLE: YEAR 2 QUARTER 2									
DRAWN: DK		APPROVED: HWN												
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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.					CLIENT: VICTORIA GOLD CORPORATION		PROJECT No.: 0792-006		DWG No.: A-6		REV.:			

DWG TO BE READ WITH BGC REPORT TITLED "EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF THE WASTE ROCK STORAGE AREAS" DATED FEBRUARY 2012

X:\Projects\0792 Victoria Gold\06\Workspace\2012\31 REPORT_EAGLE_GOLD_PROJECT_FEASIBILITY_STUDY_GEOTECHNICAL_ASSESSMENT_AND_DESIGN_OF_THE_WASTE_ROCK_STORAGE_AREAS\A-7_YEAR_2_QUARTER_3.dwg



NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE:	1:20,000	DESIGNED:	BMM
DATE:	FEB 2012	CHECKED:	BMM
DRAWN:	DK	APPROVED:	HWN



CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS

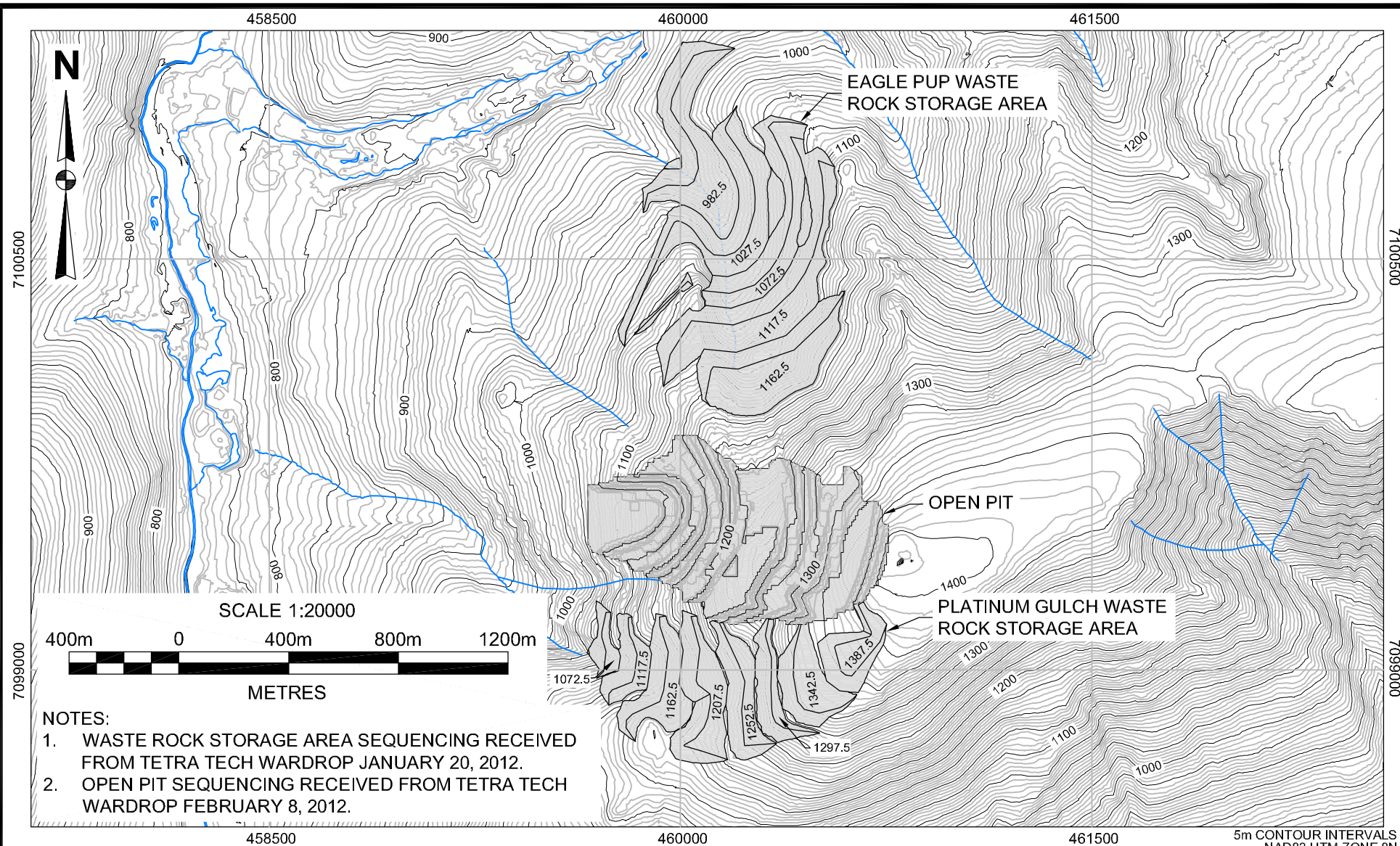
TITLE:
YEAR 2 QUARTER 3

PROJECT No.:
0792-006

DWG No.:
A-7

REV.:

X:\Projects\0792 Victoria Gold\06\Workspace\2012\01 REPORT_EAGLE_GOLD_PROJECT_FEASIBILITY_STUDY_GEOTECHNICAL_ASSESSMENT_AND_DESIGN_OF_THE_WASTE_ROCK_STORAGE_AREAS\A-8_YEAR_2_QUARTER_4.dwg



SCALE:	1:20,000	DESIGNED:	BMM
DATE:	FEB 2012	CHECKED:	BMM
DRAWN:	DK	APPROVED:	HWN



CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS

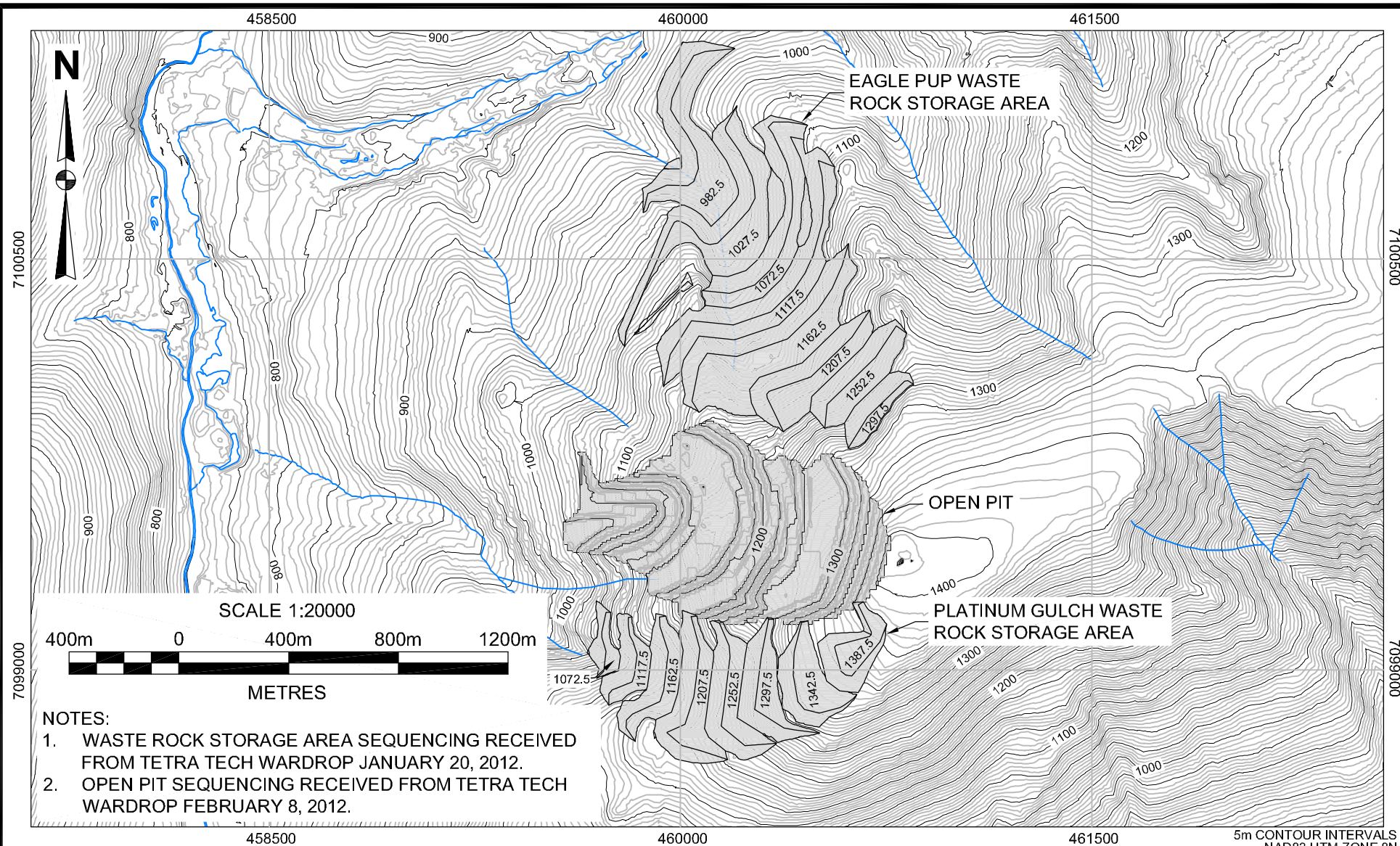
TITLE:
YEAR 2 QUARTER 4

PROJECT No.:
0792-006

DWG No.:
A-8

REV.:

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NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE:	1:20,000	DESIGNED:	BMM
DATE:	FEB 2012	CHECKED:	BMM
DRAWN:	DK	APPROVED:	HWN



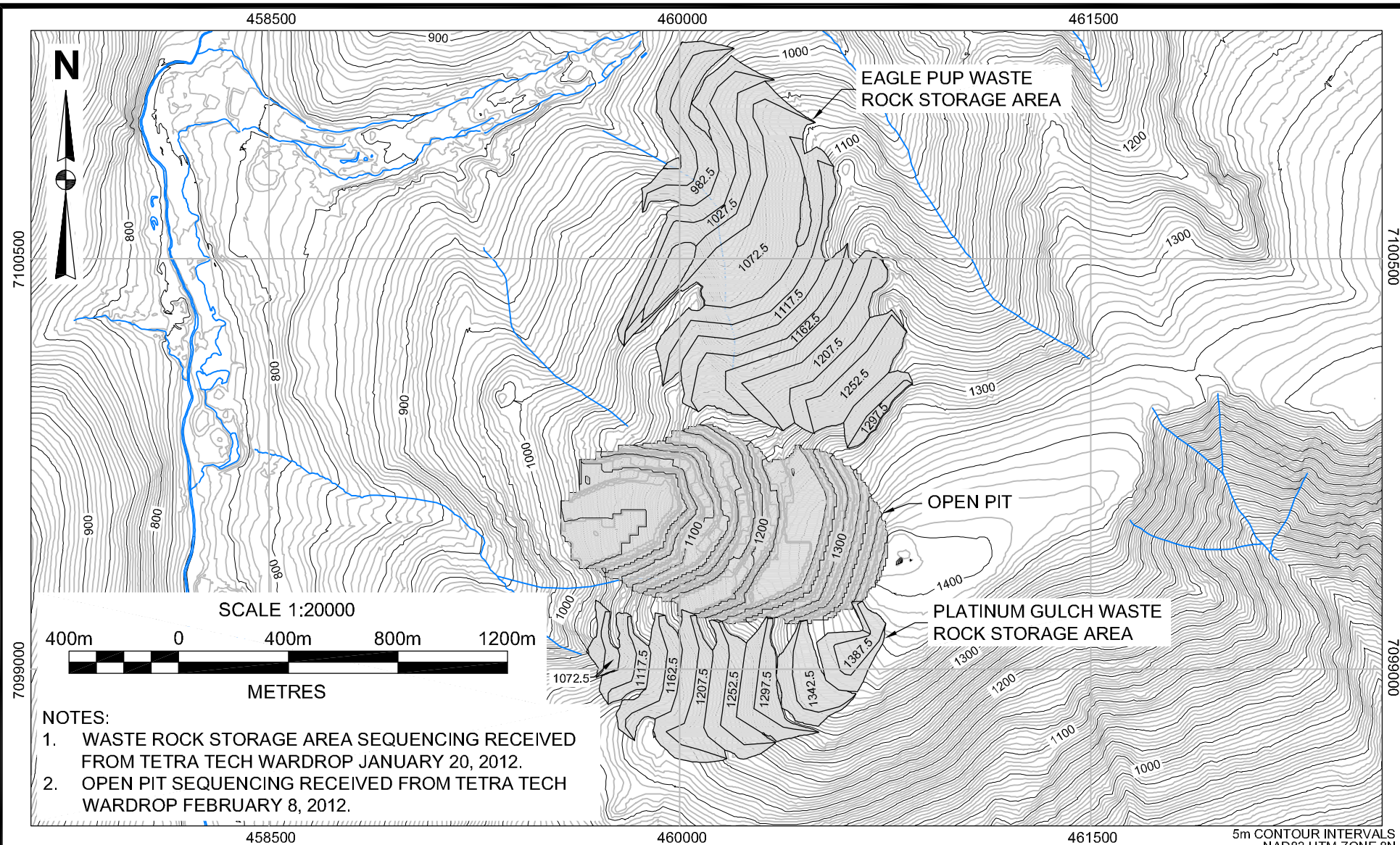
CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
TITLE:
YEAR 3

PROJECT No.:	DWG No.:	REV.:
0792-006	A-9	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

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NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE:	1:20,000	DESIGNED:	BMM
DATE:	FEB 2012	CHECKED:	BMM
DRAWN:	DK	APPROVED:	HWN



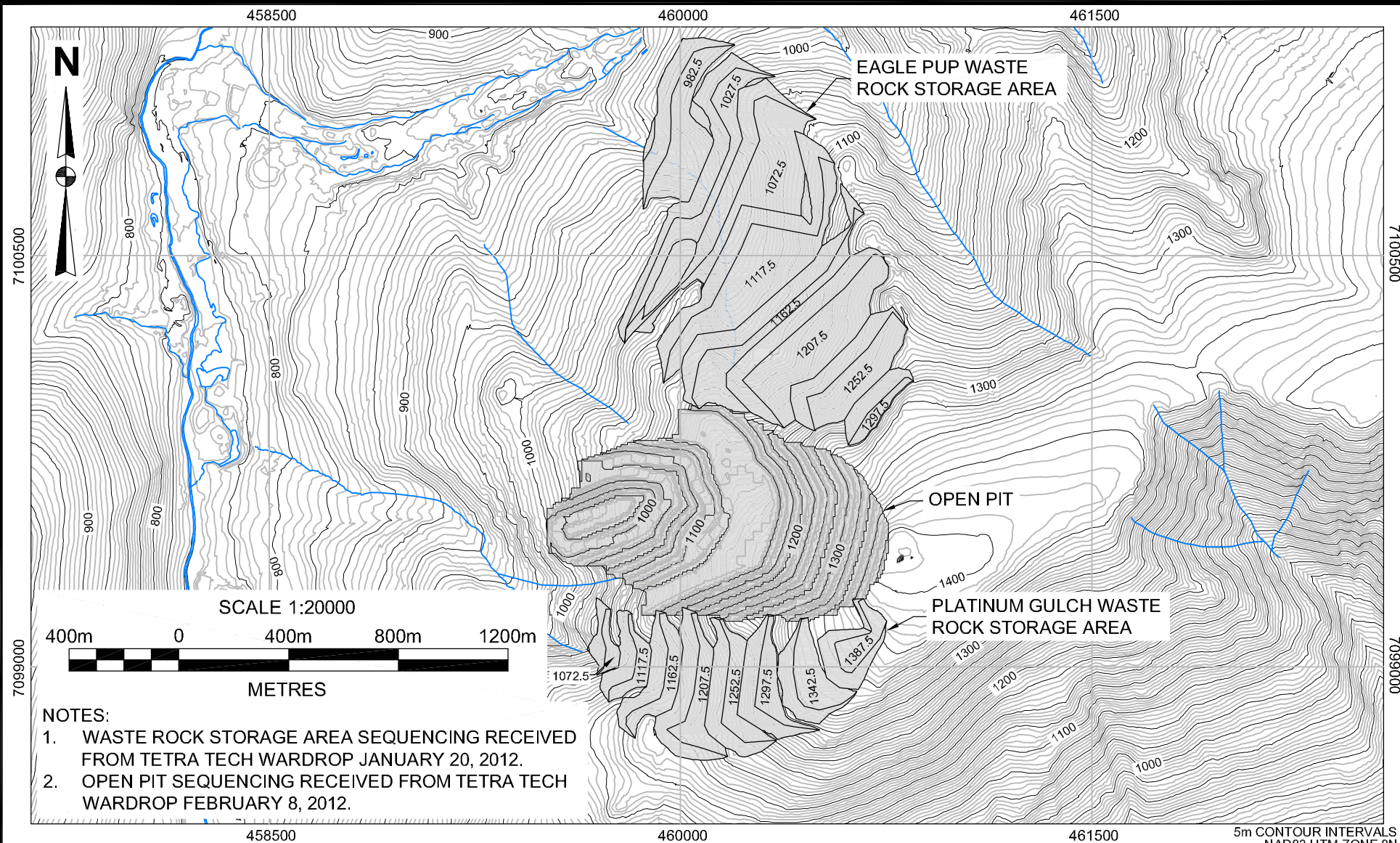
CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
TITLE:
YEAR 4

PROJECT No.:	DWG No.:	REV.:
0792-006	A-10	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

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NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE:	1:20,000	DESIGNED:	BMM
DATE:	FEB 2012	CHECKED:	BMM
DRAWN:	DK	APPROVED:	HWN



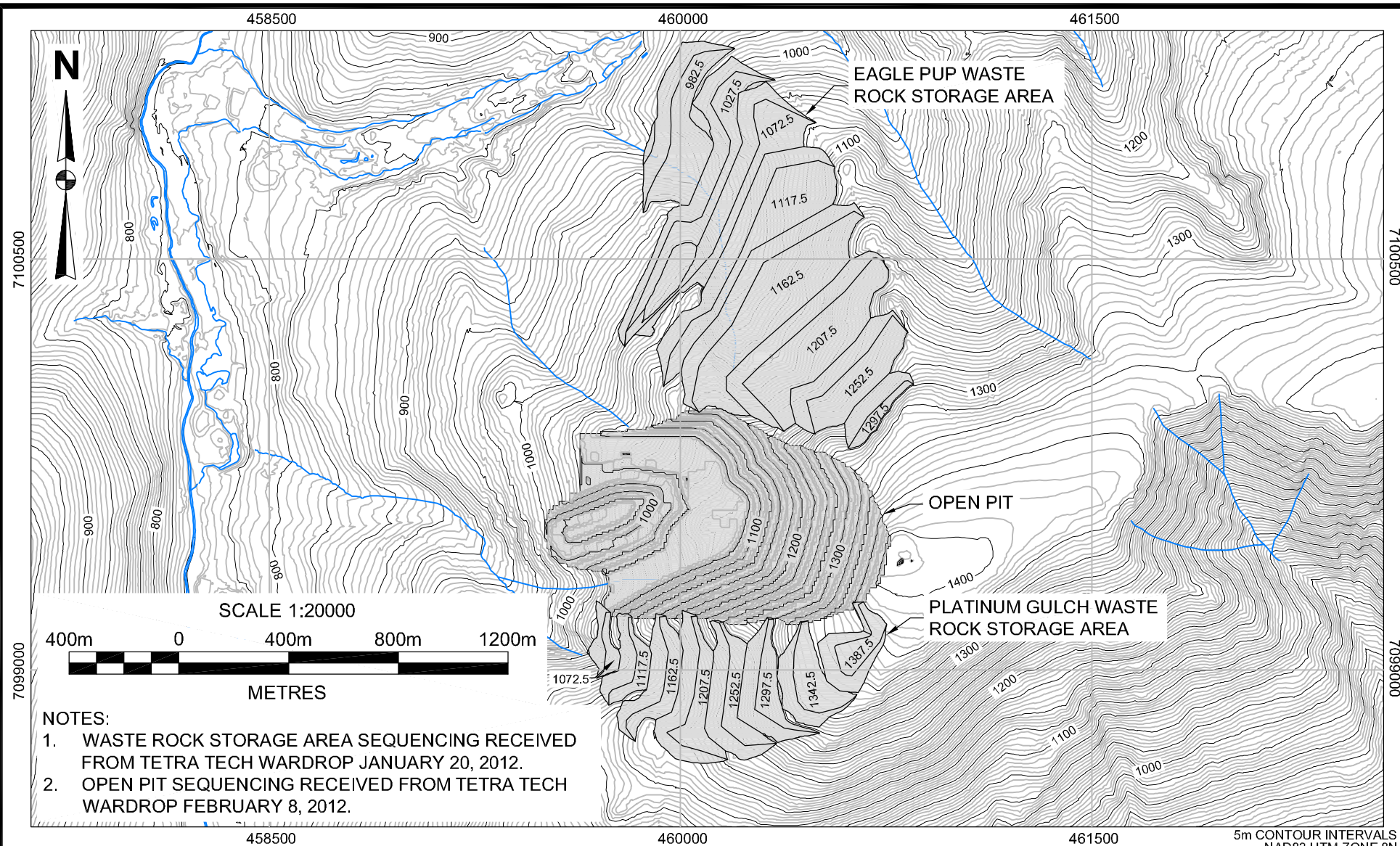
CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
TITLE:
YEAR 5

PROJECT No.:	DWG No.:	REV.:
0792-006	A-11	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

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SCALE:	1:20,000	DESIGNED:	BMM
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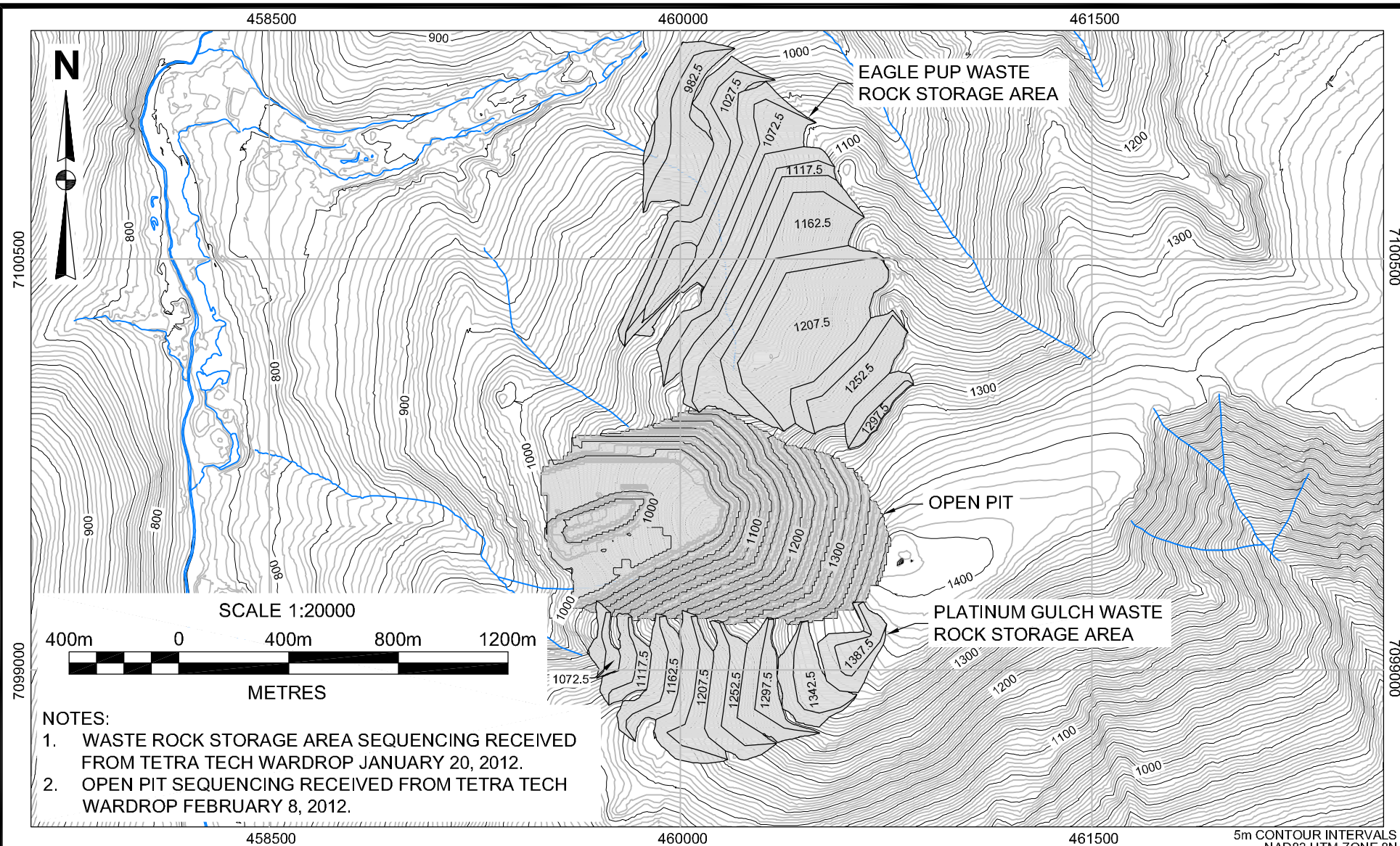
CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
TITLE:
YEAR 6

PROJECT No.:	DWG No.:	REV.:
0792-006	A-12	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

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NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE:	1:20,000	DESIGNED:	BMM
DATE:	FEB 2012	CHECKED:	BMM
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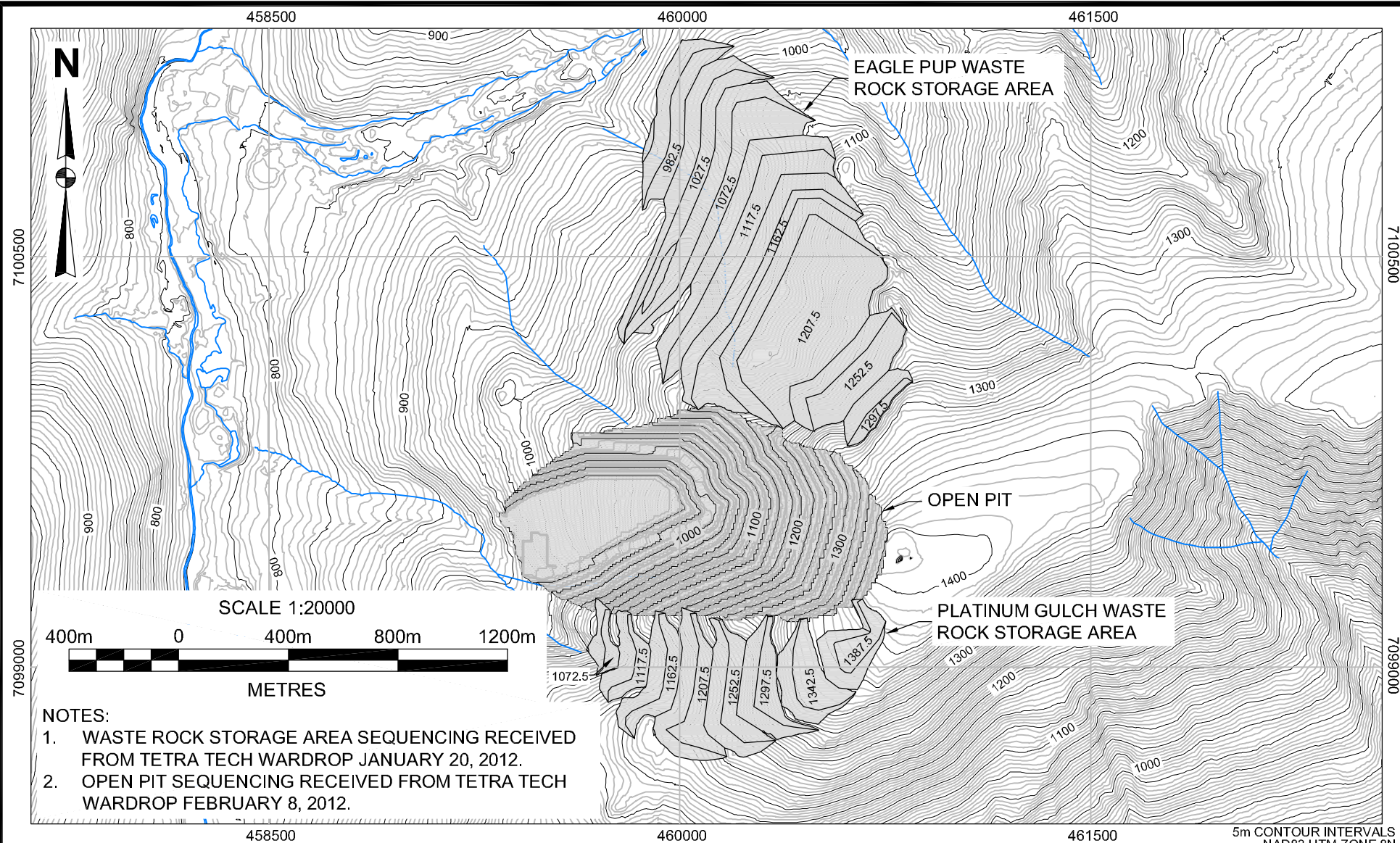
CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
TITLE:
YEAR 7

PROJECT No.:	DWG No.:	REV.:
0792-006	A-13	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

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SCALE:	1:20,000	DESIGNED:	BMM
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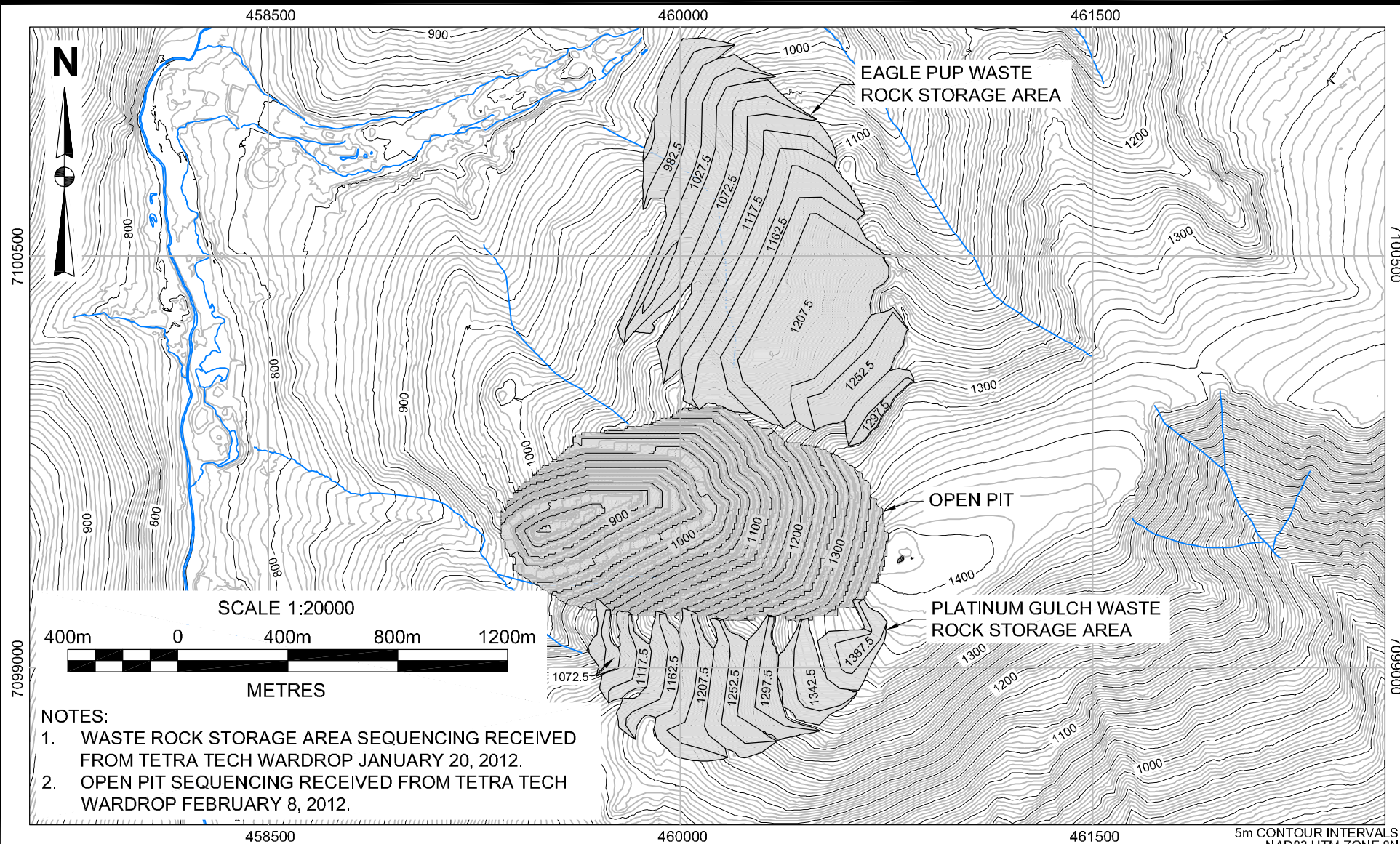
CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
TITLE:
YEAR 8

PROJECT No.:	DWG No.:	REV.:
0792-006	A-14	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

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NOTES:

1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.
2. OPEN PIT SEQUENCING RECEIVED FROM TETRA TECH WARDROP FEBRUARY 8, 2012.

SCALE:	1:20,000	DESIGNED:	BMM
DATE:	FEB 2012	CHECKED:	BMM
DRAWN:	DK	APPROVED:	HWN



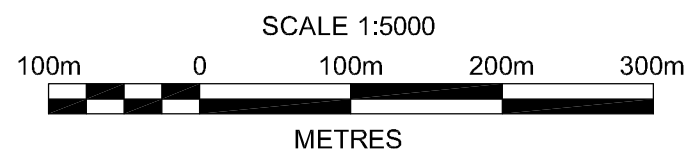
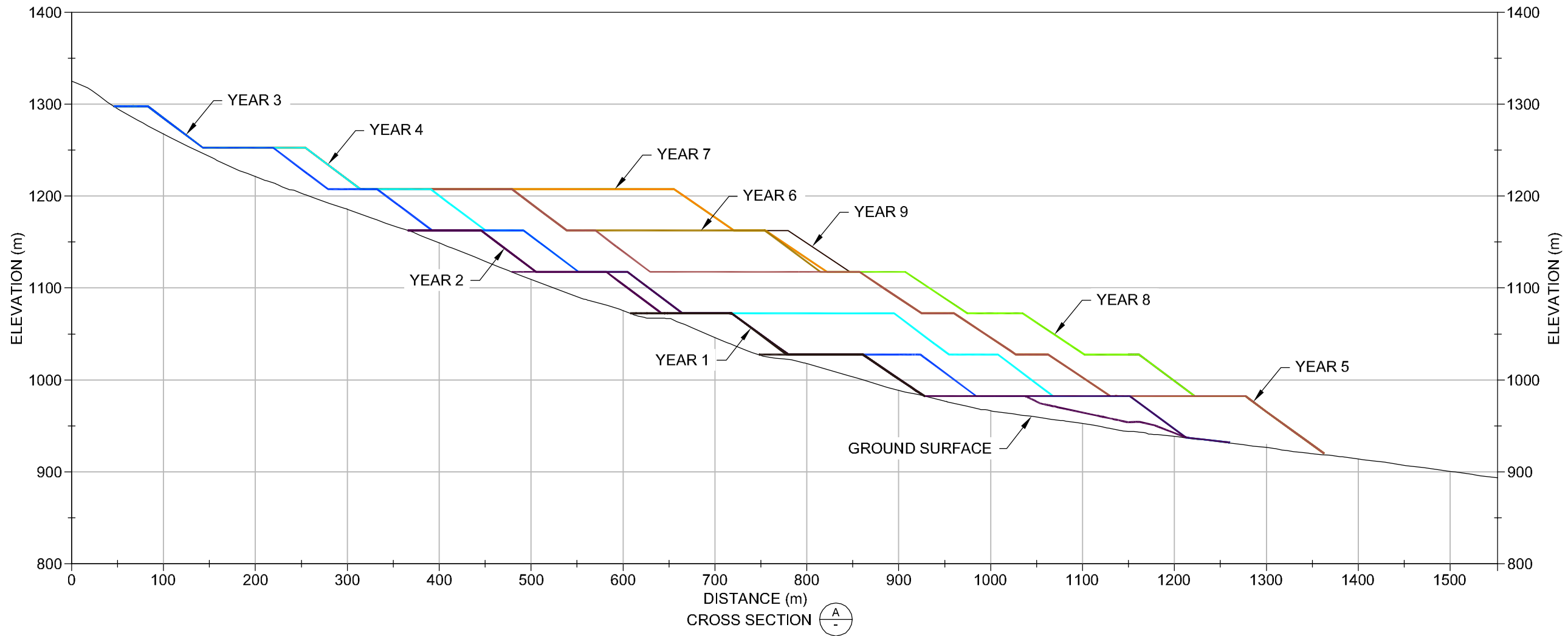
CLIENT:
VICTORIA GOLD CORPORATION

PROJECT:
EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL
ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS
TITLE:
YEAR 9

PROJECT No.:	DWG No.:	REV.:
0792-006	A-15	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THIS REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION, POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THE REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.

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NOTE:
1. WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012.

LEGEND	
— YEAR 1	— YEAR 6
— YEAR 2	— YEAR 7
— YEAR 3	— YEAR 8
— YEAR 4	— YEAR 9
— YEAR 5	

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. AUTHORIZATION FOR ANY USE AND/OR PUBLICATION OF THE REPORT OR ANY DATA, STATEMENTS, CONCLUSIONS OR ABSTRACTS FROM OR REGARDING OUR REPORTS AND DRAWINGS, THROUGH ANY FORM OF PRINT OR ELECTRONIC MEDIA, INCLUDING WITHOUT LIMITATION POSTING OR REPRODUCTION OF SAME ON ANY WEBSITE, IS RESERVED PENDING BGC'S WRITTEN APPROVAL. IF THIS REPORT IS ISSUED IN AN ELECTRONIC FORMAT, AN ORIGINAL PAPER COPY IS ON FILE AT BGC ENGINEERING INC. AND THAT COPY IS THE PRIMARY REFERENCE WITH PRECEDENCE OVER ANY ELECTRONIC COPY OF THE DOCUMENT, OR ANY EXTRACTS FROM OUR DOCUMENTS PUBLISHED BY OTHERS.					
REV.	DATE	REVISION NOTES	DRAWN	CHECK	APPR.

SCALE:	1:5000
DATE:	FEB 2012
DRAWN:	DK
DESIGNED:	BMM
CHECKED:	BMM
APPROVED:	HWN

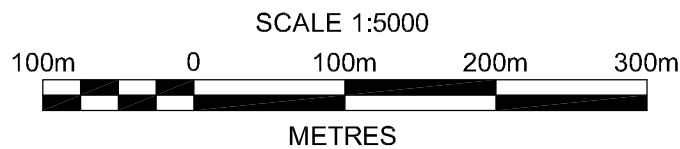
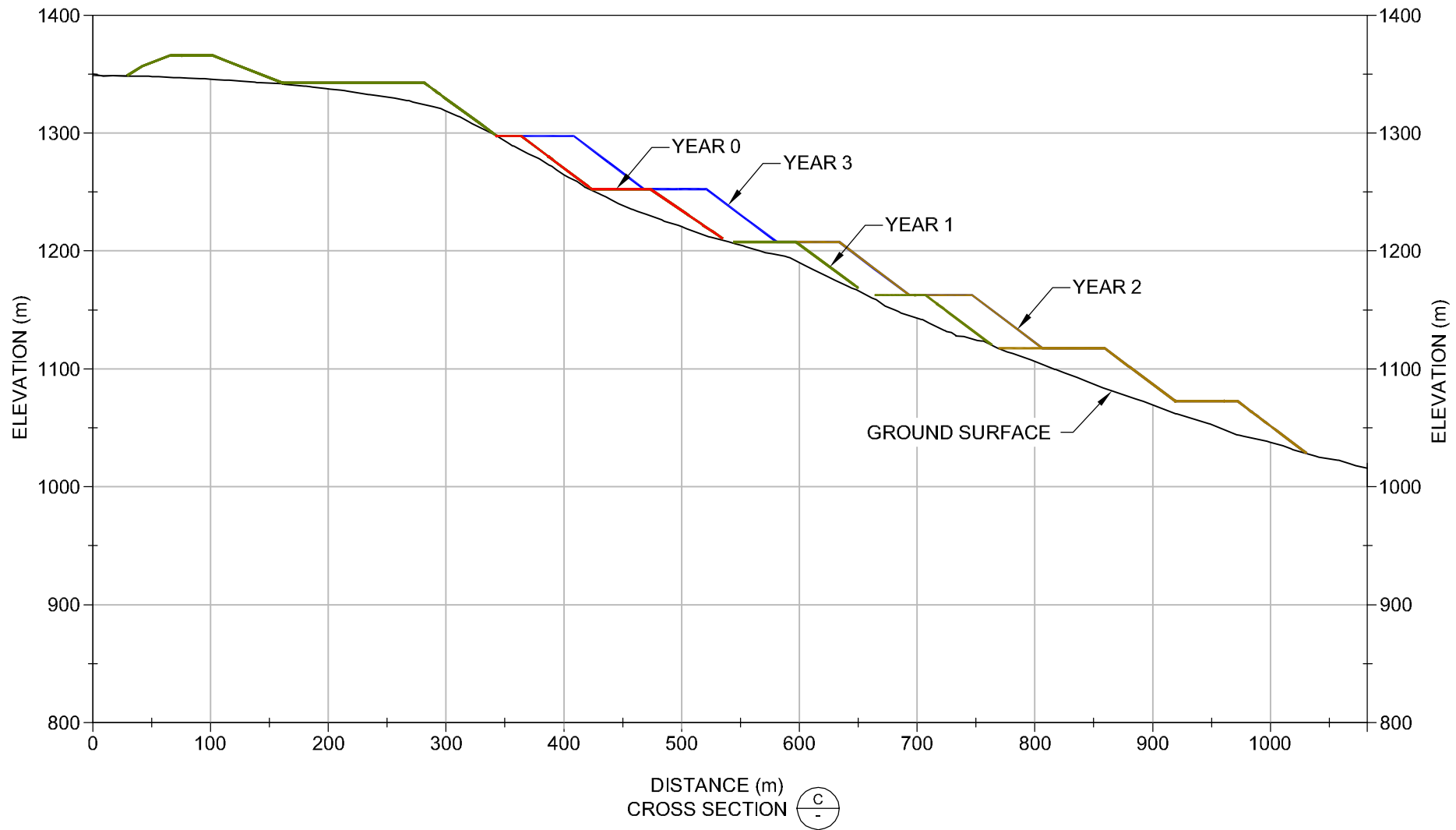
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CLIENT: VICTORIA GOLD CORPORATION

PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY GEOTECHNICAL ASSESSMENT AND DESIGN OF WASTE ROCK STORAGE AREAS		
TITLE: SECTION A - EAGLE PUP SEQUENCING		
PROJECT No.: 0792-006	DWG No.: A-16	REV.:

X:\Projects\0792_Victoria Gold\006\Drawings\A-17_REPORT_EAGLE_GOLD_PROJECT_FEASIBILITY_STUDY_GEOTECHNICAL_ASSESSMENT_AND_DESIGN_OF_THE_WASTE_ROCK_STORAGE_AREAS\A-17_SECTION_C_PLATINUM_GULCH_SEQUENCING.dwg Layout: SUMMARY Plot Date Feb 21 12 Time: 4:12 P



LEGEND	
—	YEAR 0
—	YEAR 1
—	YEAR 2
—	YEAR 3

- NOTE:
- WASTE ROCK STORAGE AREA SEQUENCING RECEIVED FROM TETRA TECH WARDROP JANUARY 20, 2012

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SCALE:	1:5000
DATE:	FEB 2012
DRAWN:	DK
DESIGNED:	BMM
CHECKED:	BMM
APPROVED:	HWN

PROFESSIONAL SEAL:



CLIENT:
VICTORIA GOLD CORPORATION

PROJECT: EAGLE GOLD PROJECT FEASIBILITY STUDY
GEOTECHNICAL ASSESSMENT AND DESIGN
OF WASTE ROCK STORAGE AREAS

TITLE:
SECTION C - PLATINUM GULCH SEQUENCING

PROJECT No.:
0792-006

DWG No.:
A-17

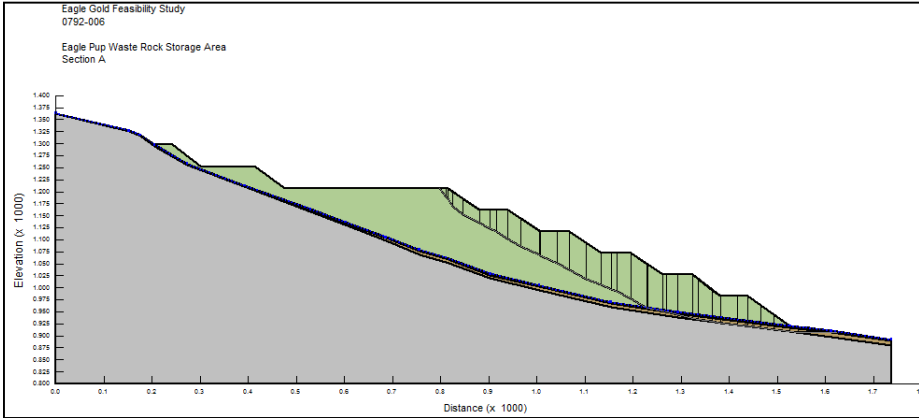
REV.:

APPENDIX B

STABILITY ANALYSIS RESULTS

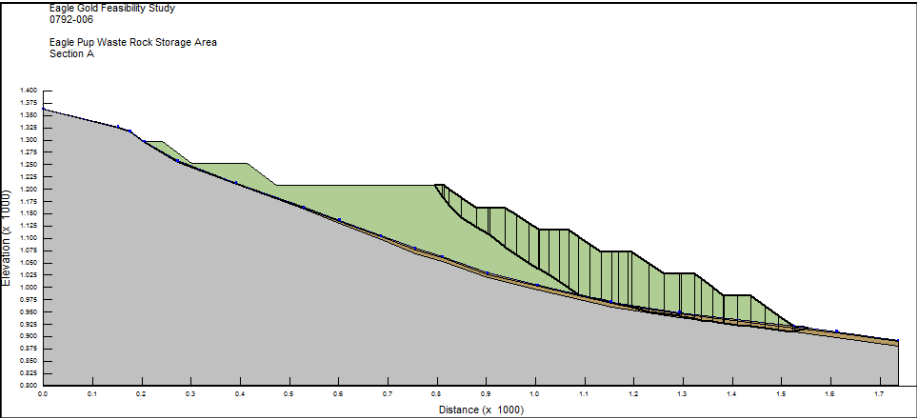
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



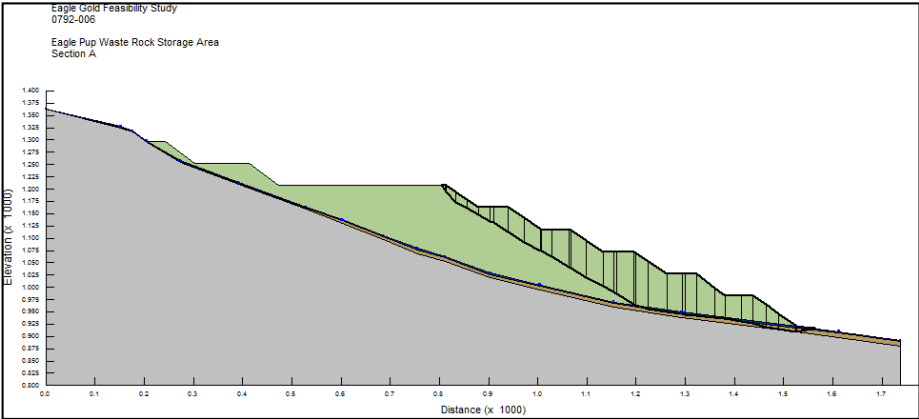
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Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 2.0



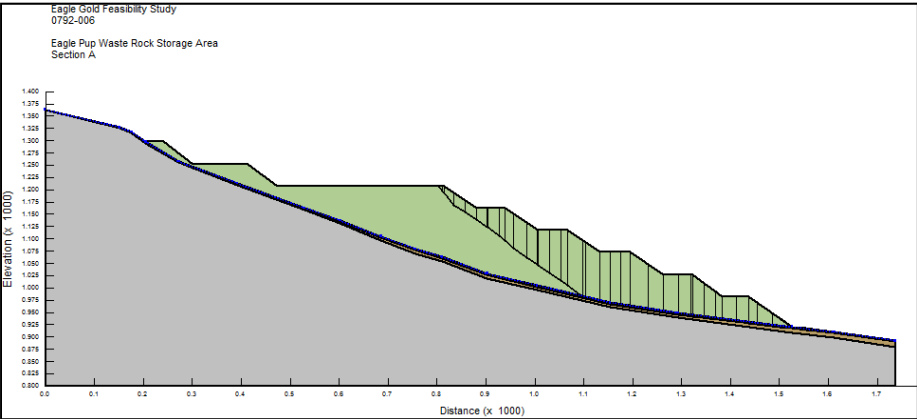
Eagle Pup WRSA - Section A - Overall
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.6



Eagle Pup WRSA - Section A - Overall
Loading Condition: Static
Foundation Condition: Excess PWP

Factor of Safety: 1.8



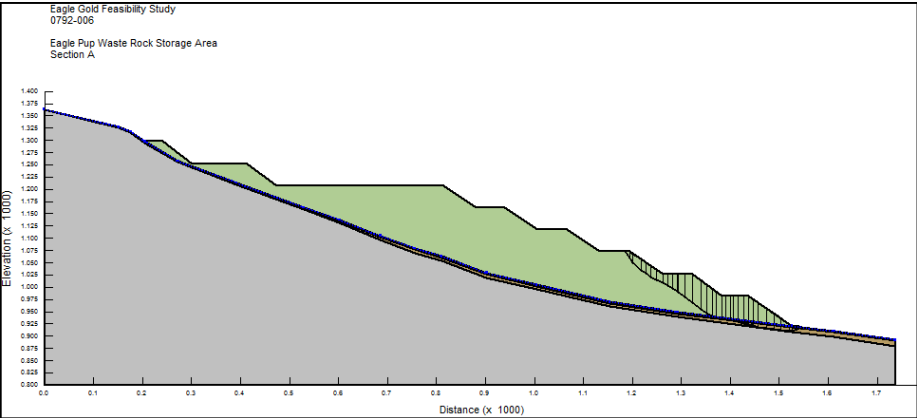
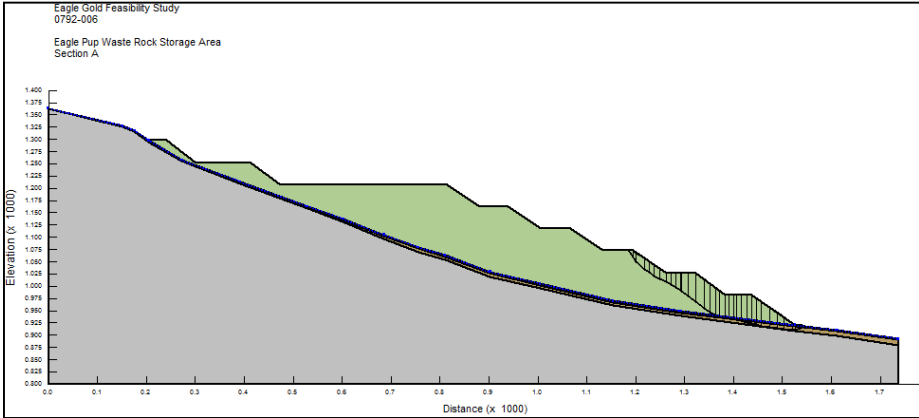
Eagle Pup WRSA - Section A - Overall
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

Factor of Safety: 1.5

Notes:
1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.

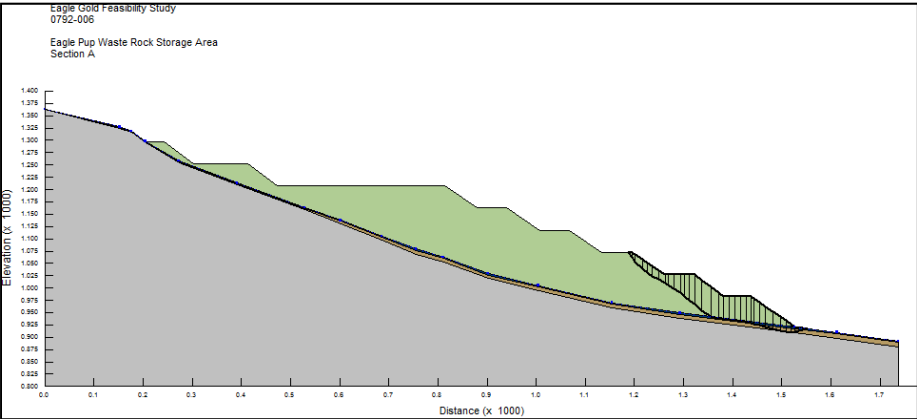
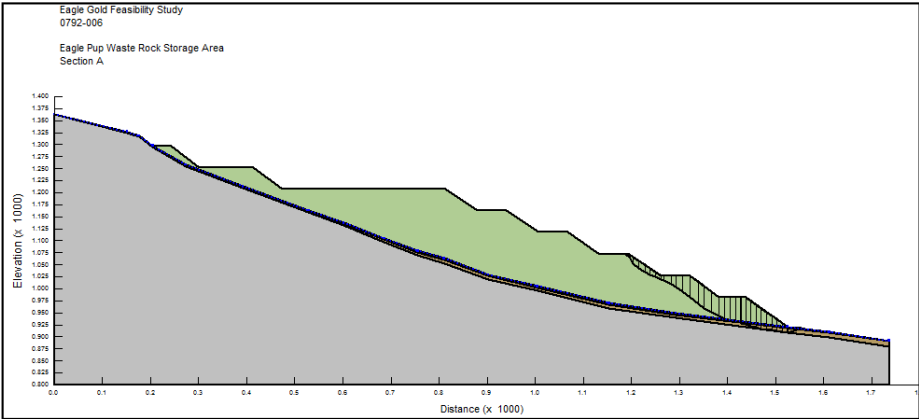
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



Eagle Pup WRSA - Section A - Mid Slope
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.5



Eagle Pup WRSA - Section A - Mid Slope
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

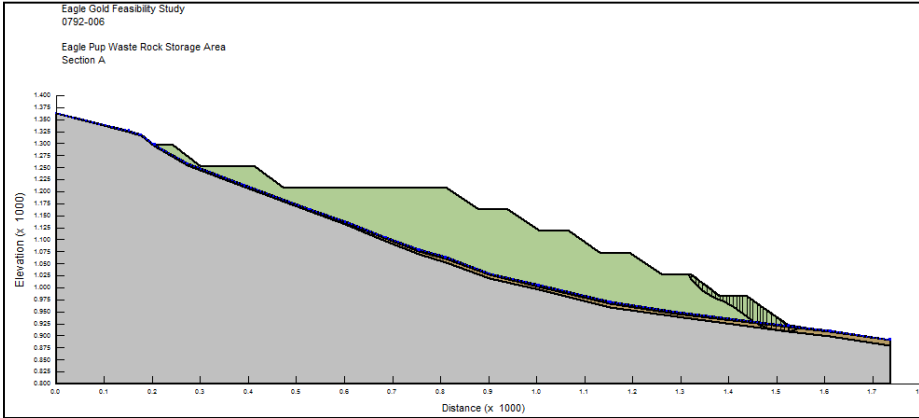
Factor of Safety: 1.4

Notes:

- 1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.

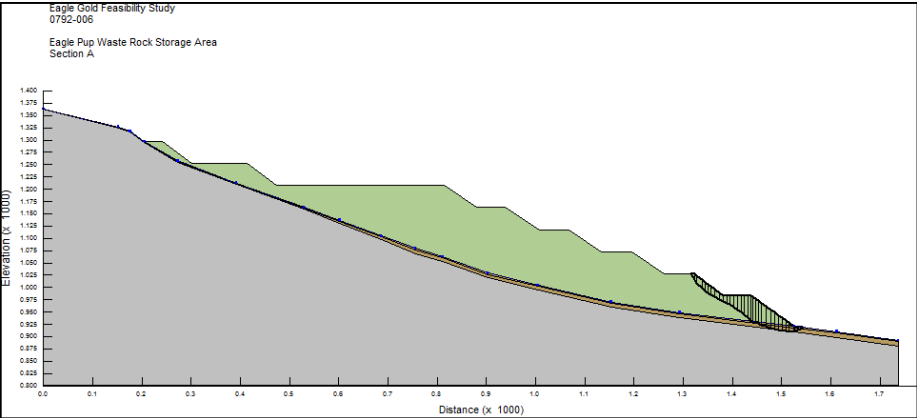
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



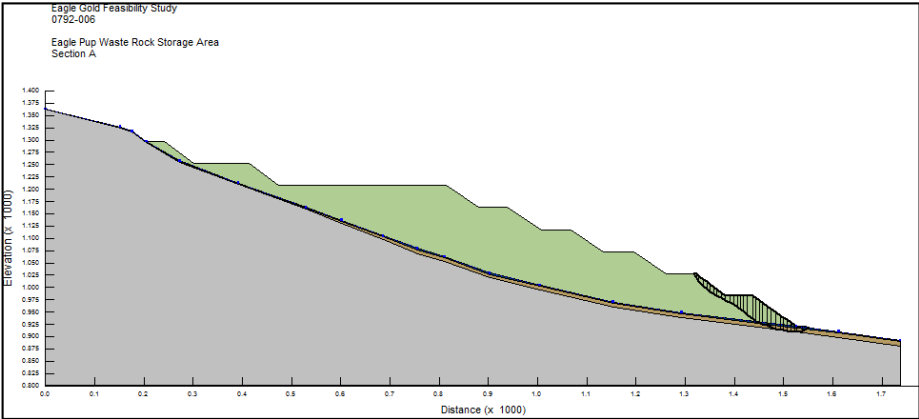
Eagle Pup WRSA - Section A - Lower Slope
Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 1.5



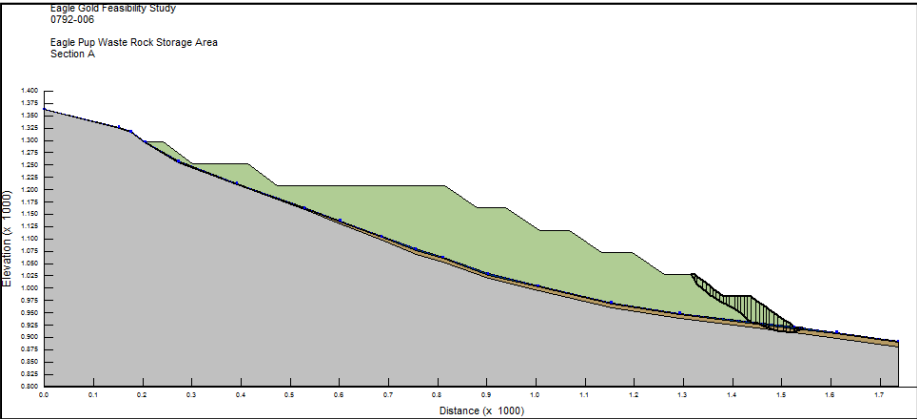
Eagle Pup WRSA - Section A - Lower Slope
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.4



Eagle Pup WRSA - Section A - Lower Slope
Loading Condition: Static
Foundation Condition: Excess PWP

Factor of Safety: 1.5



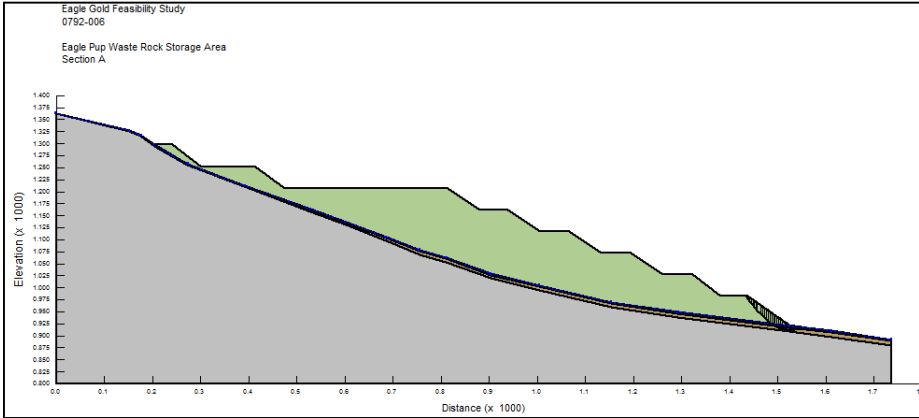
Eagle Pup WRSA - Section A - Lower Slope
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

Factor of Safety: 1.3

Notes:
1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.

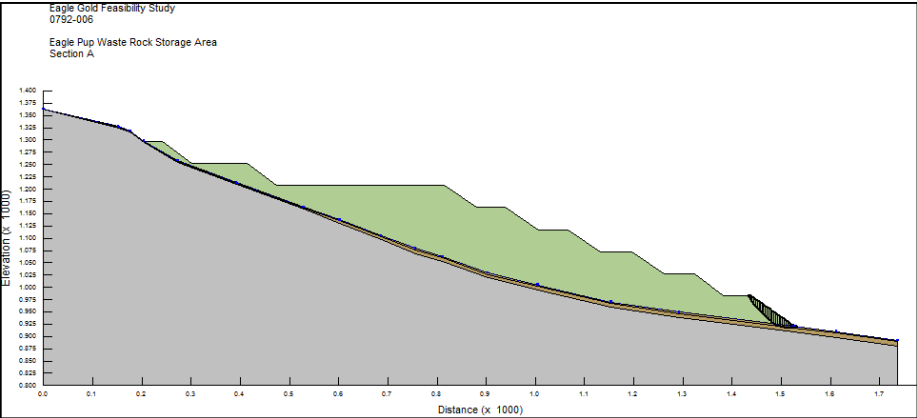
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



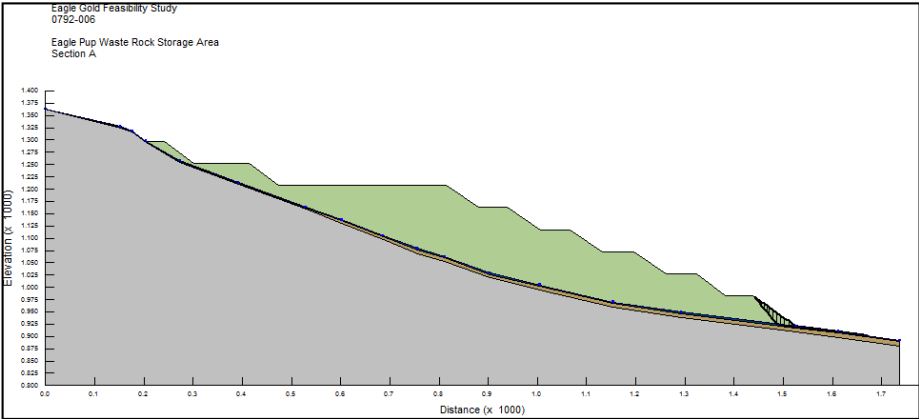
Eagle Pup WRSA - Section A - Lowest Lift
Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 1.3



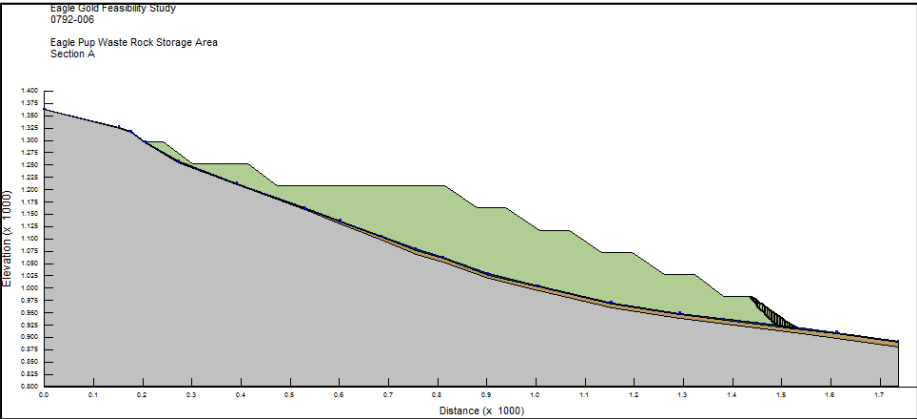
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Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.2



Eagle Pup WRSA - Section A - Lowest Lift
Loading Condition: Static
Foundation Condition: Excess PWP

Factor of Safety: 1.2



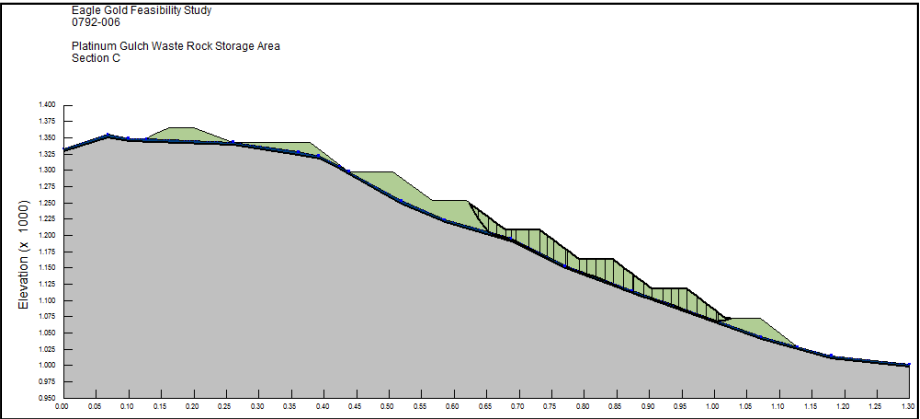
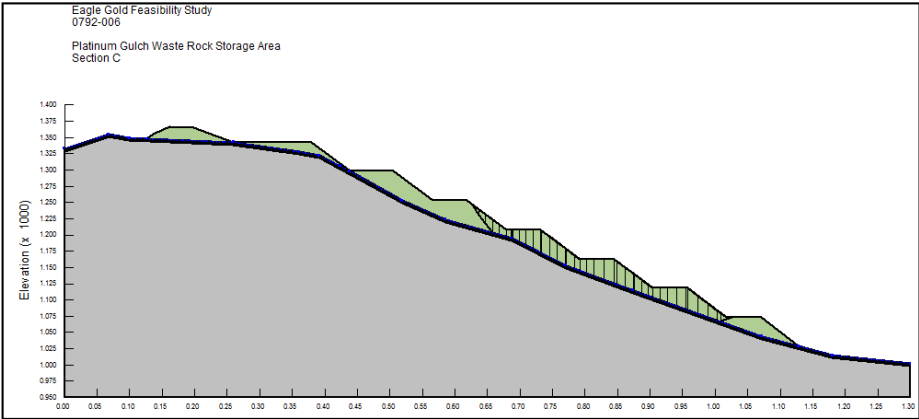
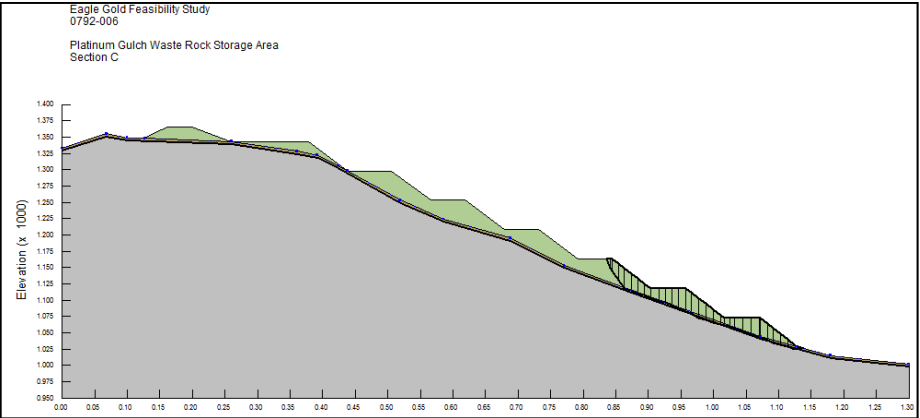
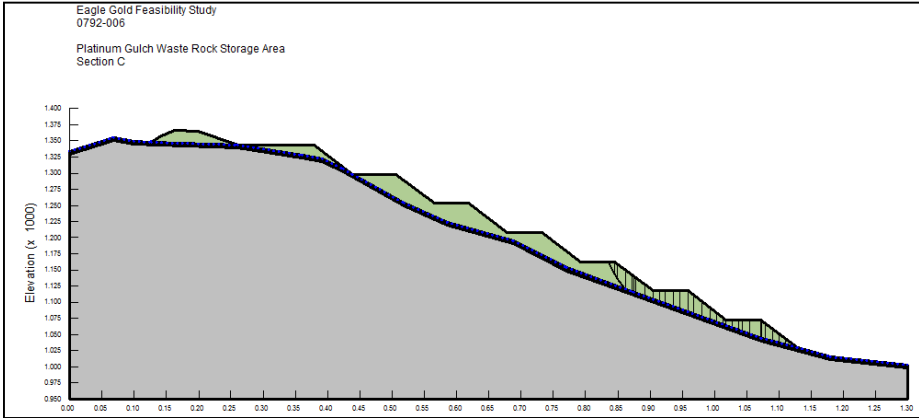
Eagle Pup WRSA - Section A - Lowest Lift
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

Factor of Safety: 1.1

Notes:
1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.

Eagle Gold Project Feasibility Study

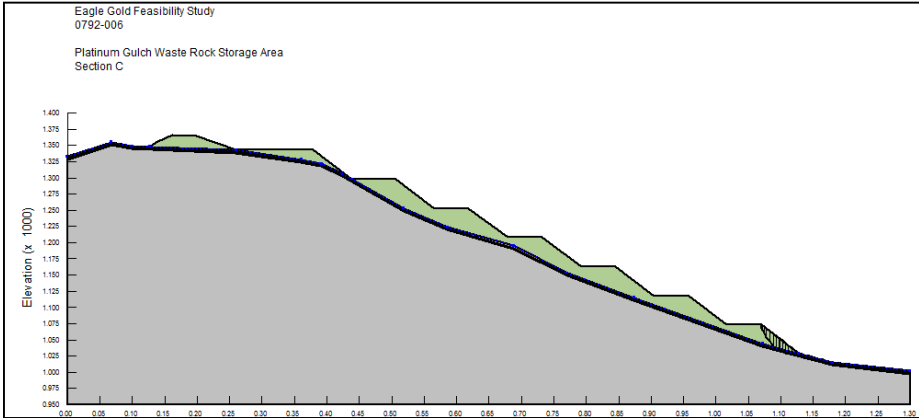
Geotechnical Assessment and Design of the Waste Rock Storage Areas



Notes:
1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.

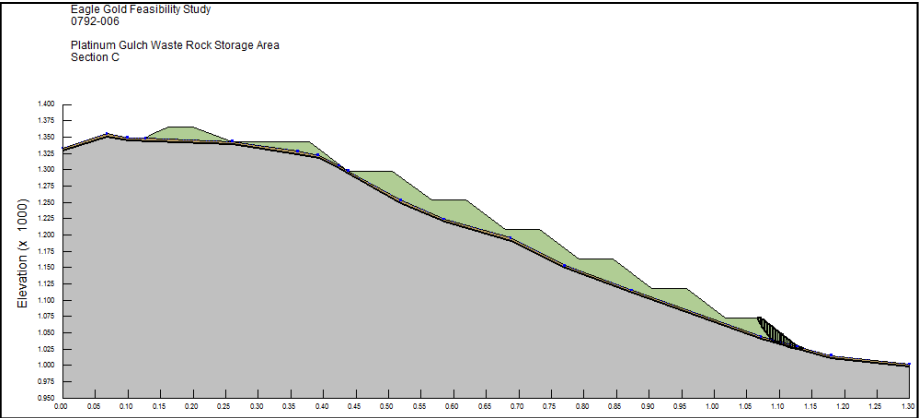
Eagle Gold Project Feasibility Study

Geotechnical Assessment and Design of the Waste Rock Storage Areas



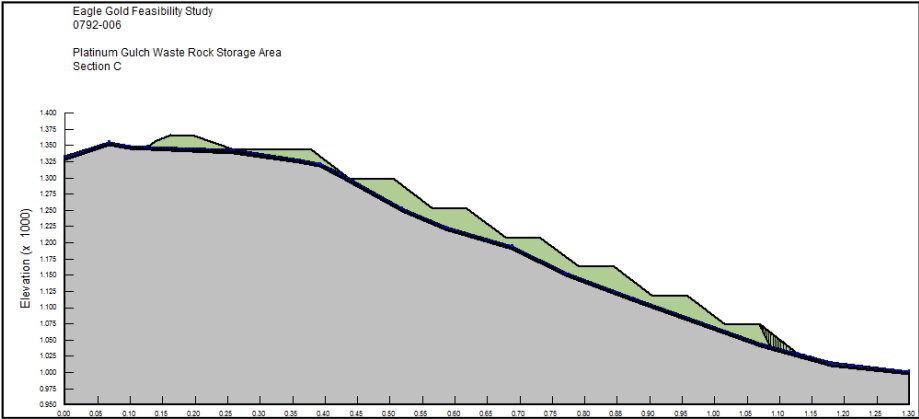
Platinum Gulch WRSA - Section C - Lowest Lift
Loading Condition: Static
Foundation Condition: No excess PWP

Factor of Safety: 1.1



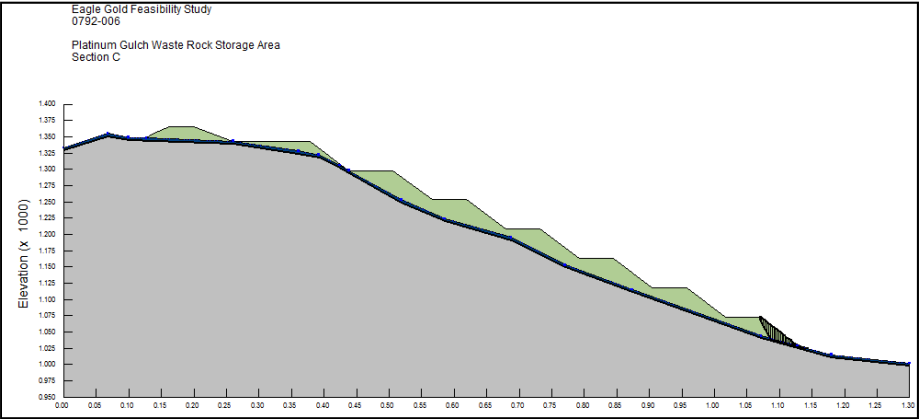
Platinum Gulch WRSA - Section C - Lowest Lift
Loading Condition: Pseudo-Static
Foundation Condition: No excess PWP

Factor of Safety: 1.0



Platinum Gulch WRSA - Section C - Lowest Lift
Loading Condition: Static
Foundation Condition: Excess PWP

Factor of Safety: 0.9



Platinum Gulch WRSA - Section C - Lowest Lift
Loading Condition: Pseudo-Static
Foundation Condition: Excess PWP

Factor of Safety: 0.9

Notes:
1. Sections shown are for the ultimate configuration of the waste rock storage areas based on the layouts received from Tetra Tech Wardrop on January 20, 2012.