Sabina
GOLD & SILVER CORP.

BACK RIVER PROJECT
Primary Pond – Goose Site

Design Report and Drawings

1. Introduction

The development of the Back River Project (the Project) will require ponds on the Goose Property as part of the infrastructure design, water management and fish environmental requirements. The ponds are typically used to assist with noncontact water management in the initial years of the mine life (approximately to mining year 2 until the pit location or other water management infrastructure is constructed) and then the ponds typically will be used more as surge ponds for contact water management (downstream of the waste rock storage areas) over the primary mine life. At closure the ponds will then be decommissioned and breached (i.e., will not remain in long term closure).

The design of the various pond was first considered in the Project Feasibility Study, completed in 2015, and since then additional checks and modifications have been done, with the focus in 2020 to look at constructability of past feasibility level designs. The focus in 2021 and 2022 focused to collect more information at the pond sites and advance towards construction.

As part of the 2021 and 2022 work terrain and permafrost considerations at the pond locations, and the alignment of the small dams associated with the ponds was re-examined (and looked at for optimizations). This re-examination was done from desktop studies, from additional drilling, and from site inspections carried out by Sabina site staff and SRK Consulting. Optimizations and design refinements for the ponds were, and are being, completed to support future and current decision and design. The text below describes the Primary Pond location specifically.

The ponds are designed to Canadian Dam Association (CDA) standards, this typically means that the dams are designed for, or to convey, very large inflow design floods (larger than 1-1000 yr event), and also designed (for minimum operational levels when waste rock is within the upstream catchments) to leave space in the dams at all times to mange contact water. Event ponds for Back River were designed to contain the 1 in 100-year inflow volume with snowmelt and climate change considerations without support of pumping systems (i.e. pumps are inactive during the 24-hour event period).

Drawings for the Primary Pond can be found in Appendix A. The construction of this pond is planned to commence at the end of 2022 (percolation hole drilling start as early as November 2021 with construction to follow).

2. Primary Pond

This Primary Pond overview has been laid out to address each of the requirements of Part D, Item 3 of Sabina's Back River Project Type A Water Licence (2AM-BRP1831). For ease of comparison, each subheading corresponds directly with the identically alphabetized subheading of Part D, Item 3 of Water Licence, 2AM-BRP1831.

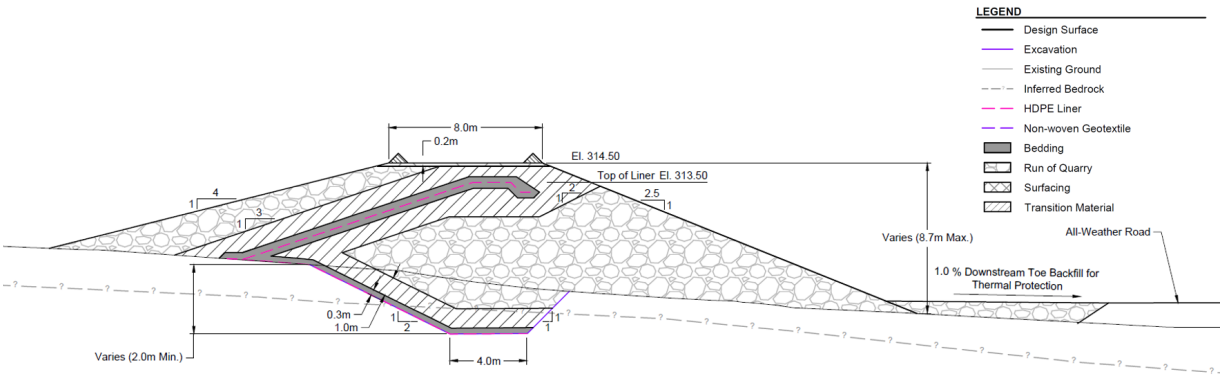
A. DESIGN RATIONAL, REQUIREMENTS, CRITERIA, PARAMETERS, STANDARDS ANALYSIS, METHODS, ASSUMPTIONS AND LIMITATIONS

2.1 DESIGN OVERVIEW

Primary Pond is designed as a water retailing structure with an active water pond for the duration of mine operations. The initial approximately three years of operation the Primary Pond will have a higher

water level. Following this the water level of the pond is expected to be notably reduced (water typically not against the dam slope and mostly in the area where the existing natural pond, Round Pond, exists). Over the majority of the mine life the Primary Pond will be used more as a surge pond for contact water (associated with the Umwelt Waste Rock Storage Area (WRSA) and south portion of Llama WRSA, both located on the upstream of the facility). In the initial years of pre-development and operations the Primary Pond will be used to assist with lake dewatering (to assist with sediment and Total Suspended Solids management if / as needed) and will assist with the initial mill start up (water in Primary Pond to be used until sufficient volume in the pits is established for reclaim). Water retention will be provided by means of installing an HDPE geomembrane liner tied into the foundation permafrost and bedrock. The Primary Pond Dam is designed to have crest elevation of 314.5 masl, with a maximum height of 9 m. This elevation was proposed to maximize capacity of the Primary Pond without going into adjacent catchments. Downstream and und upstream slopes of the dam will have slopes of 2.5H:1V and 4H:1V slopes, respectively. The dam will be built using engineered rockfill. Cross-sections of the Primary Pond and layout drawings for each surface is shown in Appendix A and a typical section is shown in Figure 1 below.

Figure 1: Typical Dam Cross-Section Geometry



For water reclaim purposes and to control of the water levels within the pond, a reclaim road, from the upstream face of the dam, is designed to extend to the low point in the current topography (the existing natural pond, Round Pond area). The location of the reclaim road was specifically selected to go over an existing ephemeral creek flow path to help to provide added thermal protection. The width of the reclaim road is proposed to be three (3) meters, with minimum thickness of three (3) meters (see drawings in Appendix A for additional details).

Additional details on the Primary Pond layouts are provided in Appendix A.

2.2 DESIGN STANDARDS AND GUIDELINES

The design of Primary Pond Dam has been completed in accordance with the following design standards and guidelines:

- CDA Dam Safety Guidelines (2007 and 2013 update)
- CDA Technical Bulletin: Application of Dam Safety Guidelines to Mining Dams (2019a)
- CDA Technical Bulletin: Application of Dam safety Guidelines to Mining Dams, Revised Factor of Safety Guidance, Draft Revision (2019b)

2.3 DAM CLASSIFICATION

The design, construction, operation, and monitoring of dams have to be completed in accordance with appropriate Provincial and Federal regulations and industry Best Management practices. The primary guidance document in this regard is the 2013 and 2019 Canadian Dam Safety Guidelines (CDA 2013, 2019) published by the Canadian Dam Safety Association (CDA), and the dan safety guidelines specific to mining dams (CDA 2019a).

A key component of the guidelines is classifying the dam(s) in question into hazard categories (Dam Class) which establishes appropriate geotechnical and hydrotechnical design criteria. Table 1 is a reproduction of the recommended Dam Classifications as precented in the CDA Guidelines (CDA 2019a). This classification is based on Incremental Consequence of a dam failure (As opposed to Total Consequences). The Incremental Consequence of failure is defined as the total damage from an event with dam failure, less the damage that would have resulted from the same event (i.e., a large earthquake, or a flood event), had the dam not failed.

Determining the appropriate hazard rating is somewhat subjective, dependent on site-specific circumstances. During the dam classification process, each of the four hazard rating components in Table 1 (i.e. population at risk, loss of life, environmental and cultural values, and infrastructure and economics) is considered individually, and the overall dam hazard rating is defined by the component with the highest (i.e. most severe) rating. It is important to note that the hazard rating refers to the downstream consequences in the inundation zone of a dam breach.

Table 1: Dam Hazard Classification Table

Dam Class	Population at risk[1]	Incremental Losses		
		Loss of Life[2]	Environmental and Cultural Values	Infrastructure and Economics
Low	None	0	▪ Minimal short-term loss ▪ No long-term loss	▪ Low economic losses; area contains limited infrastructure or services
Significant	Temporary only	Unspecified	▪ No significant loss or deterioration of fish or wildlife habitat ▪ Loss of marginal habitat only ▪ Restoration or compensation in kind highly possible	▪ Losses to recreational facilities, seasonal workplaces, and infrequently used transportation routes
High	Permanent	10 or fewer	▪ Significant loss or deterioration of *important* fish or wildlife habitat ▪ Restoration or compensation in kind highly possible	▪ High economic losses affecting infrastructure, public transportation, and commercial facilities
Very high	Permanent	100 or fewer	▪ Significant loss or deterioration of *critical* fish or wildlife	▪ Very high economic losses affecting important

Dam Class	Population at		Incremental Losses	
			habitat ■ Restoration or compensation in kind possible but impractical	infrastructure or services (e.g., highway, industrial facility, storage facilities for dangerous substances)
Extreme	Permanent	More than 100	■ Major loss of critical fish or wildlife habitat ■ Restoration or compensation in kind impossible	■ Extreme losses affecting critical infrastructure or services (e.g., hospital, major industrial complex, major storage facilities for dangerous substances)

Sources: Table 3-1 of CDA 2019a

Notes:

[1] Definitions for population at risk:

None - There are no identifiable population at risk, so there is no possibility of loss of life other than through unforeseeable misadventure.

Temporary - People are only temporarily in the dam-breach inundation zone (e.g., seasonal cottage use, passing through on transportation routes, participating in recreational activities).

Permanent - The population at risk is ordinarily located in the dam-breach inundation zone (e.g., as permanent residents); three consequence classes (high, very high, extreme) are proposed to allow for more detailed estimates of potential loss of life (to assist in decision-making if the appropriate analysis is carried out).

[2] Implications for loss of life:

Unspecified - The appropriate level of safety required at a dam where people are temporarily at risk depends on the number of people, the exposure time, the nature of their activity, and other conditions. A higher class could be appropriate, depending on the requirements. However, the design flood requirement, for example, might not be higher if the temporary population is not likely to be present during the flood season.

No general population resides within the Property area or nearby; therefore, the "Population at Risk" category receives a qualifier of "None". By definition of 1, "Loss of Life" is judged to be "Unspecified". This is based on the presumption that once the Primary Pond Dam construction is complete, all activities downstream of the facility will be related to water management. Ongoing repair and maintenance work is anticipated to be carried out by relatively small crews and will be short duration activities. Additionally, there will be crews operating within Umwelt Pit, which is downstream of the facility. So the initial "None" population at risk has been raised to "Unspecified" (people may be at the dam but will be sporadic and typically for short periods).

Loss and/or deterioration of fish habitat is a risk (if the dam was to fail), although the water expected to be stored at Primary Pond will not likely have an acutely toxic effect on fish in the local watershed. Furthermore, restoration and compensation is expected to be possible for the system. This likely would make the classification in this category as "Significant" but there are unknows about what the water quality may be at the time of a breach. Therefore the classification is likely linked to the water quality in the Primary Pond. For these reasons, and due to this uncertainly, Sabina has elected to go the conservative route and adopt a higher classification with respect to Environmental and Cultural Value. The selected the appropriate classification with respect to Environmental and Cultural Values as "High" for design purposes.

Economic activity undertaken directly downstream of the Primary Pond Dam while the facility is actively operating will be very short in duration. Development of the Umwelt Pit, downstream of the facility, is currently scheduled to overlap for approximately two and a half years here for the first six (6) months no discharge is planned from the Primary Pond. For the next two (2) years of the overlap, Primary Pond is panned to be used as a source of reclaim with containment volume, where the water containment at the facility is not expected to reach its maximum capacity. Additionally, there is Goose All-Weather Road (AWR) immediately along the downstream toe of the dam. Therefore, with respect to the Infrastructure and Economics, the classification in this category was seen is "Significant".

The highest (governing) hazard rating is defined by the Environmental and Cultural values category, which means the designated dam hazard rating for the Primary Pond Dam is HIGH. Some argument to adopt a lower dam classification (of Significant) exist, especially early in the Primary Ponds life when only non contact water will be stored in the pond, but Sabina has elected to conservatory increase the dam hazard classification to High for design purposes.

2.4 DESIGN LIFE

In accordance with the mine plan, Primary Pond is expected to be constructed in Year -2 and operated for the entire Life of Mine (LOM). The facility is expected to receive runoff from the south portion of the Llama WRSA and from the Umwelt WRSA through the LOM. Water is expected to be used in processing when available. The facility is expected to operate at low capacity throughout the LOM.

The facility there will have an active design life of approximately 20 years (slightly longer than the current design mine life). The design of the facility will be carefully monitored (proposed monitoring plan shown in the drawings in the back of Appendix A) and the design life reassessed on an annual basis (i.e. extended periods of high water levels against the dam could reduce the design life, where as longer periods where the water is kept away / off from the dam could increase the design life due to the lower thermal loading / forcing).

The facility is planned to be breached at closure (i.e. this facility will not have a dam or retain any significant water at closure).

2.5 STABILITY CRITERIA

Stability criteria for the Primary Pond Dam have been set in accordance with CDA (2019a) and CDA's revised factor of safety guidance draft revision (CDA 2019b). Table 6 summarizes the target factor of safety (FoS_{min}) for slope stability of mining dams under various conditions (static loading, seismic loading, post peak) for construction, operation, and transition phases. These criteria are considered acceptable for Closure – Passive Care Phase as well (CDA 2019a).

Table 1: Screening Level Target Factors of Safety for Slope Stability of Mining Dams

Condition	Loading Condition/ Type of Analysis	Minimum FoS	Applicable Slope
Static Loading	During or at end of construction (prior to commencing tailings deposition or impoundment of water)	1.3	Downstream and Upstream
	During operation of a mining dam when impounding water and/or tailings, and during construction of dam raises	1.5	Downstream and Upstream

	Long-term (steady-state seepage, normal reservoir level)	1.5	Downstream and Upstream
	Full or partial rapid drawdown [1]	1.2 to 1.3	Upstream slope
Seismic Loading	Pseudo-static [2]	1.0	Downstream and Upstream
	Post-seismic [3]	1.2	Downstream and Upstream
Post Peak	Seismic Post-Peak [4]	1.1	Downstream and Upstream
	Static Post-Peak [4]	1.1	Downstream and Upstream

Notes:

[3] CDA (2019a) suggests a range whilst CDA (2019b) recommends a FoS of 1.3.

[4] As noted by CDA (2019b): "*The pseudo-static target of 1.0 is used to support the screening level assessment for potential deformations of concern. A pseudo-static analysis method has no direct correspondence with the physical performance of an earth structure during seismic loading. It is important to note that the pseudo-static factor of safety is intended to provide an indication of the potential for significant deformation of the crest of the dam. Pseudo-static factors of safety less than 1.0 may be acceptable if a deformation assessment shows that the deformations due to seismic loading would be acceptable (provided there is no liquefaction or strain softening causing large deformation)*".

[5] To be used only when there are no elements in the dam or foundation that can experience liquefaction or significant softening because of a seismic event.

[6] Post-peak analysis is applied whenever there are soils present within the dam or its foundation that will contract during undrained shearing, regardless of the loading condition (i.e., either seismic or static loading).

These FOSs have been achieved or exceeded with the current design.

2.6 THERMAL CRITERIA

As the Primary Pond will have key trench that if tie-in to the bedrock and overburden permafrost (frozen foundation dam) the base of key trench, in any permafrost overburden sections, has been set with a design temperature (isotherm) of -2°C or lower, for any periods when water is against the upstream slope of the dam. In the largest (thickest fill portion of the dam where water first goes against the dam) the design key trench location has been shifted to be under the dam centerline to provide a maximum thermal fill cover over the Primary Pond key trench and to help ensure that these base of key trench design temperatures are achieved.

In order to maintain the -2°C isotherm in the key trench, and lock in the colder winter temperatures, the key trench excavation is planned to be constructed in the winter (and when the ambient air temperate on site is typically below -10°C). The winter construction will continue until at least a minimum 2m thick thermal cover is placed over and beyond the entire key trench excavation (to ensure the key trench design thermal conditions are maintained).

The general thermal criteria have been considered and achieved for this dam. The monitoring plan (as shown in Appendix A) includes thermal monitoring that would be frequently reviewed and reported on as part of the annual geotechnical inspections done as part of the water license requirements.

2.7 EMERGENCY OVERFLOW CHANNEL (EMERGENCY SPILLWAY)

An emergency overflow channel has been included at each pond / dam location. The overflow channels are not planned to be used and only act as a passive measure to ensure the dam safety in the event that a very large storm event hits.

Emergency spillways were designed to convey the Inflow Design Flood, as outlined by the CDA. Based on the dam hazard classification of HIGH, the guidelines (CDA 2019a) recommend the use of an inflow design flood (IDF) of 1/3 between the 1/1,000 return period, 24-hour duration precipitation event and the probable maximum precipitation (PMP) for this region. For this facility, the IDF peak flow is estimated to be 19.5 m^3/s with the total event volume of 127,500 m^3.

Spillway sizes were developed by routing the Inflow Design Flood through each pond, widening the spillway base width in order to meet freeboard design criteria. Spillway side slopes through each dam were selected to be 10:1 H:V (horizontal to vertical) to enable trafficability and for ease of maintenance.

At the Primary Pond the location of the emergency overflow channel has been sited so that it would be in bedrock. This helps to reduce the need to riprap protection in the emergency overflow channel itself and help to provide a location for access during construction and helps to ensure long term stability of the channel itself.

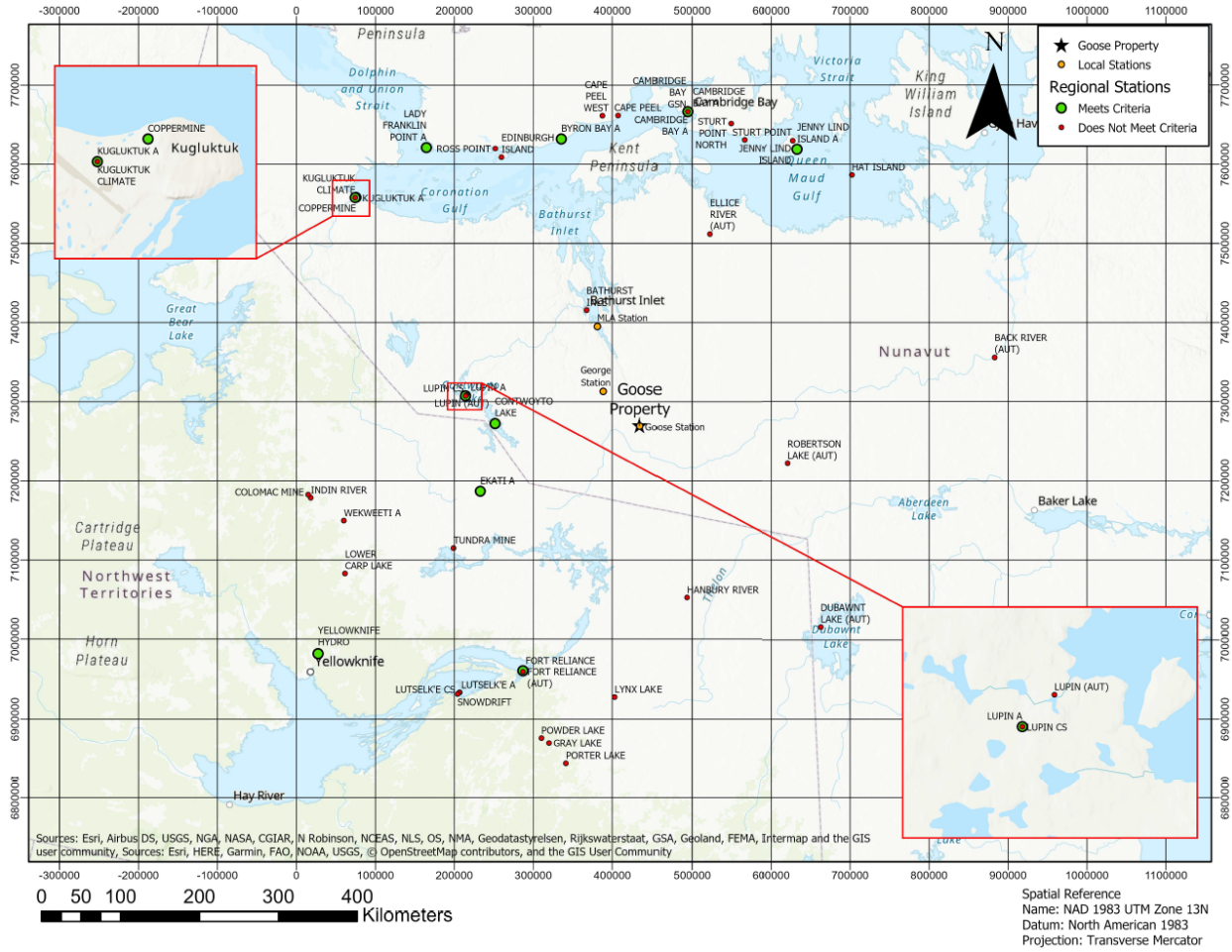
B. SITE SPECIFIC DATA AND ANALYSIS TO SUPPORT THE DESIGN AND MANAGEMENT DECISIONS

2.8 SITE CHARACTERIZATION

i. Climate

The Property is situated in the vicinity of the Arctic Circle climate region in Northern Canada. Review of the Back River Draft Environmental Impact Statement (DEIS) (Rescan, 2013) confirms the site-specific climate data collected from baseline study reflects the regional climate trends from the two closest Environment Canada meteorological stations, Lupin A and Kugluktuk A (EC 2022). Figure 1 present the location of weather stations in relation to the property. Climate norms from 1981 to 2010 for the two identified stations are used to describe the average climatic conditions of the Property.

Figure 1: Regional Meteorological Stations



The climate at the Property follows Arctic regional trends with mean temperatures of -29.9°C and lows of -33.4°C in January, and mean temperatures of 11.5°C and a high of 16.3°C in July. The annual mean temperature is -10.9°C. The winter sub-zero conditions typically last from October to May.

Rainfall periods occur between May and October with the most rainfall experienced in August at 59.8 mm. Snowfall occurs throughout the year, but the heaviest snowfall occurs from September through May while the lightest occurs from June through August. Annual average precipitation shows a relatively even split between rainfall and snowfall at 160.5 mm and 138.0 mm, respectively. Total average precipitation is 298.5 mm. The month with the highest average precipitation, 62.5 mm, is August.

The average wind speed is 15.4 km/h, and monthly average wind speeds are similar for each month. Wind typically blows in a southwest direction from October through April, and in the east direction from May to September. Table 1 summarizes the climate normal for mean daily average temperature, rainfall, snowfall, and average monthly wind speed at the regional Environment Canada meteorological stations.

Monthly evaporation was estimated using local site and regional data. Annual lake surface evaporation was determined to be 324 mm/year.

Table 2: Climate Normals for the Back River Property

Month	LUPIN A (1981-2010)[1]				KUGLUKTUK A (1982-2010)	
	Mean Daily Average Temperature (ºC)	Rainfall (mm)	Snowfall (cm)	Average Daily Total Precipitation (mm)	Wind Speed (km/hr)	Most Frequent Direction
Jan	-29.9	0	9.4	9.4	18.3	SW
Feb	-28.5	0	7.8	7.8	17.0	SW
Mar	-24.8	0	12.2	12.2	15.3	SW
Apr	-15.8	0.4	14.3	14.6	12.9	SW
May	-5.9	5.3	12.5	17.8	13.6	E
Jun	6.4	26.8	3.6	30.4	13.3	E
Jul	11.5	41.1	0.4	41.5	13.7	N
Aug	8.8	59.8	2.6	62.5	14.8	E
Sep	2.1	25.5	17.1	42.6	16.0	E
Oct	-8.4	1.6	27.1	28.7	16.9	SW
Nov	-20.4	0	17.4	17.4	16.6	SW
Dec	-26.2	0	13.7	13.7	17.0	SW
Year	**-10.9**	**160.5**	**138.0**	**298.5**	**15.4**	**SW**

Notes:

[7] Wind data at Lupin A cannot be provided due to low percentage of observations within the collected data. As a result, Kugluktuk A wind data was used to describe the site climate.

The latest updated hydrology and climate change calculations were used for the Primary Pond design (SRK 2021).

ii. Bedrock

The majority of the Property is underlain by clastic meta-sedimentary types consisting of turbidites (greywacke and mudstone) of the Slave Province. The Goose Site is underlain by the folded meta-sedimentary turbidite sequence belonging to the Beechey Lake Group which consists of banded iron formations hosted in greywacke and mudstone country rock. The stratigraphic sequence includes the greywacke, lower iron formation, middle mudstone, upper iron formation, and interbedded sediments.

Regional folding trends to the northwest with associated steeply dipping faults. These formations were then intruded by felsic dykes of the Regan Intrusive Suite and younger gabbro dykes (Rescan 2014, Knight Piésold 2013). The gold mineralization in the Property is the result of this widespread quartz and carbonate veining and sulphidization related to the brittle faulting and subsequent folding (SRK 2012a).

The rock mass characterization for each major lithological unit has been summarized by Knight Piésold (2013) and is provided in Table 2.

Table 3: Summary of Rock Mass Characterization

Lithological Unit	Rock Quality Designation (NGI-Q)	Rock Mass Rating (RMR_{89})	UCS (MPa)
Greywacke	Good	60 to 75	120 (mean)
Lower Iron Formation	Good to Very Good	65 to 85	260 (mean)
Middle Mudstone	Poor to Good	35 to 70	60 (Mean)
Upper Iron Formation	Fair to Good	55 to 80	190 (mean)
Interbedded Sediments	Fair to Good	55 to 75	110 (mean)
Felsic Dykes	Good	60 to 75	130 (mean)
Gabbro Dykes	Fair to Good	55 to 75	120 (mean)

Due to the smaller dam heights (loading) the bedrock strength is not a large driver in the current Primary Ponds designs. Additional characterization of the bedrock is planned to be completed on site as part of the key trench excavation and liner tie-in.

iii. Overburden

Overburden soils on the Property generally consist of silty sands with some clay and gravel (SM, ML and SW) according to the United Soil Classification System (USCS), which are likely the result of the reworked marine and glacial sediments. Pockets of sandy, silty gravel till (GM) underlie these sediments at the Goose and George sites (Knight Piésold 2013, SRK 2011, SRK 2015a, SRK 2018, SRK 2022).

In general, ice content within these overburden soils is low (around 15%); however, visible ice and small zones of higher ice content were observed in some locations in the Goose area (Knight Piésold 2013, SRK 2011, SRK 2015a, SRK 2018, SRK 2022).

Exploration, geotechnical, and overburden drilling around the Primary Pond Dam shows overburden thickness ranges from 0 to 13 m.

Laboratory testing of near-surface soil samples indicated that there are some scattered occurrences of high salinity pore water throughout the Property. Due to a relatively limited set of samples, the high salinity values cannot be attributed to a particular soil terrain unit (Knight Piésold 2013, SRK 2011, SRK 2015a, SRK 2018, SRK 2022). High salinity values have the effect of depressing the freezing point, as well as contributing to high unfrozen water content. These salinity values have been attributed to the relatively long seasonal freezing time of the active layer in some areas of the site (Rescan 2014).

Additional characterization of the overburden and permafrost is planned to be completed immediately before construction (in winter 2022). This will be done through a series of percolation test holes.

iv. Permafrost

Surficial geotechnical investigations on the Property confirm that the Property is within the region of continuous permafrost. Permafrost temperatures below the point of zero amplitude range between -6.4 ˚C and -7.0˚C, with an average of -6.7 ˚C (SRK 2015b). Permafrost temperatures near the depth of annual temperature variation in the ground (i.e, depth of zero annual amplitude) is on average -6.3 ˚C. The base of the permafrost is estimated to range from 490 to 570 m below ground surface (mbgs) using

the 0°C isotherm, with a reported geothermal gradient of 0.013 to 0.014°C/m (SRK 2015b). This gradient results in basal permafrost depths ranging from -190 to -260 masl.

At the Project property, the active layer thickness (ALT) has been measured to range from 1.3 m to 4.1 m, with an average of 2.1 m (SRK 2015b). The ALT can be expected to vary across terrain with variable organic ground cover, soil type, moisture content, and other microclimatic conditions which impact heat transfer in the ground. Overburden soils are generally frozen from mid-October to the beginning of June, with shallow ground temperatures reaching its maximum (warmest) values between the mid-August and mid-September.

v. Seismicity

The property is located in a low seismicity zone. Seismic parameters were obtained from the 2020 National Building Code of Canada seismic hazard tool (NBCC 2022) which provided ground accelerations and probability of occurrences per given site designation. The seismic hazard is described by spectral acceleration (Sa) values at 0.2, 0.5, 1.0, and 2.0 seconds. Spectral acceleration and peak ground acceleration (PGA) values for various site classes are provided in Table 3. Table 4 provides definitions of each site class per Table 4.1.8.4.-B of National Building Code of Canada (specifically the NBCC 2020 version, reference NBCC 2022).

Table 4: Project Seismic Hazard Values

Spectral Acceleration	Ground Motion (g)				
	Site Class A	Site Class B	Site Class C	Site Class D	Site Class E
$Sa_{(0.2)}$	0.0451	0.0638	0.0822	0.1040	0.1130
$Sa_{(0.5)}$	0.0266	0.0333	0.0531	0.0966	0.1120
$Sa_{(1.0)}$	0.0133	0.0159	0.0268	0.0515	0.0614
$Sa_{(2.0)}$	0.0056	0.0065	0.0112	0.0214	0.0257
PGA	0.0297	0.0294	0.0392	0.0615	0.0674

Table 5: Site Classes, S, for Site Designation X_S per NBCC 2020

Site Class, S	Ground Profile	Average Properties for Top 30 m of Profile		
		Average Shear Wave Velocity, V_{s30}, in m/s	Average Standard Penetration Resistance, $\bar{N}_{60}$, in Blows per 0.3 m	Average Undrained Shear Strength, s_u, in kPa
A	Hard rock[2]	$V_{s30} > 1{,}500$	N/A	N/A
B	Rock[2]	$760 < V_{s30} < 1{,}500$	N/A	N/A
C	Very dense soil and soft rock	$360 < V_{s30} < 760$	$\bar{N}_{60} > 50$	$s_u > 100$ kPa
D	Stiff soil	$180 < V_{s30} < 360$	$15 \leq \bar{N}_{60} \leq 50$	50 kPa < $s_u \leq$ 100 kPa
E	Soft soil	$140 < V_{s30} < 180$	$10 \leq \bar{N}_{60} \leq 15$	40 kPa < $s_u \leq$ 50 kPa
		Any ground profile other than Site Class F that contains		

Site Class, S	Ground Profile	Average Properties for Top 30 m of Profile
F	Other soils [1]	more than 3 m of soil with the following characteristics: ■ Plasticity Index: PI ≥ 20 ■ Moisture content: w ≥ 40% ■ Undrained shear strength: s_u < 25 kPa Any ground profile that contains: ■ Liquefiable soil, quick and highly sensitive clay, collapsible weakly cemented soil, and other soil susceptible to failure or collapse under seismic loading, ■ More than 3 m of peat and/or highly organic clay, ■ More than 8 m of highly plastic soil (with PI > 75), or ■ More than 30 m of soft to medium-stiff clay

Notes:

[8] Site-specific geotechnical evaluation is required.

[9] Site designations X_A and X_B, corresponding to Site Classes A and B, are not to be used in cases where the ground profile contains more than 3 m of softer material between rock and underside of footing or mat foundations. The appropriate site designation for such cases is X_{760}.

Based on the dam hazard classification of HIGH, the Dam Safety Guidelines (CDA 2019a) recommend the seismic stability analysis be completed assuming the PGA for ½,475 year event.

Assuming thawed conditions, the overburden foundations under the specified infrastructure are Soft Soils (Site Class E) due to the natural moisture content (>40%). Even if other types of overburden or bedrock are present within the infrastructure foundations, these foundations would be classified as Soft Soils (Site Class E) because the sandy silts are likely more than 3 m thick. Permafrost soils could likely be considered Site Class B or Site Class C (Table 4); however, since the Site Class E soils amplify ground accelerations using Site Class E for all analysis was adopted as a conservative approach. For the facility, this event results in a PGA of around 0.067 g (NBCC 2022).

C. GEOCHEMICAL ANALYSIS OF WASTE ROCK AND FILL, DEMONSTRATING THEIR ACID ROCK DRAINAGE AND METAL LEACHING CHARACTERISTICS

Quarry operations at the Goose Property began with sourcing material from the existing quarry (Airstrip Quarry) for expansion of the Goose Airstrip and some all-weather roads. Once all-weather access to the Goose Plant Site area was established, material will be sourced by cutting bedrock material to create a suitable area for the Goose Plant Site and Goose Fuel Storage area.

Detailed geochemical characterization studies to assess the metal leaching / acid rock drainage (ML/ARD) potential of rock and overburden associated with the Property were carried out and can be found in the Geochemical Characterization Report (SRK 2015). Geochemical characterization was completed on samples of overburden, quarry rock and waste rock. Acid base accounting and trace metal analyses were performed on all samples and short-term leach testing on a subset of samples.

Overburden was found to have negligible ML/ARD potential while quarry rock had variable potential, and an appreciable portion of waste rock was potentially acid generation (PAG) or an un uncertain potential for acid generation.

Only NPAG quarry rock will be used for construction. This will be verified through the quarry rock confirmatory testing and segregation outlined in Sabina's approved Borrow Pits and Quarry Management Plan. In summary, at a minimum, 8 samples will be collected for every 100,000 tonnes of material to be excavated (MEND 2009). For borrow pits, operational monitoring samples will be collected from the excavated material or active pit face. For rock quarries, samples will be collected

from blast holes drilled in the rock quarries prior to quarry excavation. For either quarry type, samples will be as follows:

- Each sample should weigh no less than 1 kg.
- Each sample should be labeled with a unique sample identification number.
- Each sample should be documented in terms of sample depth and location within the quarry, and the blast hole number in the case of rock quarries.
- Composite samples (more than one lithology) should be avoided where possible.

All samples will be submitted for total sulphur and total inorganic carbon analysis at an off-site, accredited laboratory, using LECO furnace analyser or a similar appropriate technique. Analytical methods must achieve a suitable detection limit for classification. Total sulphur will be used to calculate acid potential (AP) and TIC will be used to calculate neutralization potential (NP).

Additional laboratory testing on a subset of the samples collected will include acid base accounting and net acid generation (NAG) testing to confirm geochemical ARD classification. Short term leach testing following the shake flask extraction (SFE) method will also be conducted on a subset of samples to confirm the metal leaching (ML) potential of NPAG material; this testing is not required for PAG samples, as PAG waste rock will not be used for construction.

D. CONSTRUCTION METHODS AND PROCEDURES REGARDING HOW INFRASTRUCTURE WILL BE PUT IN PLACE, INCLUDING QUALITY ASSURANCE AND QUALITY CONTROL MEASURES AND EQUIPMENT TO BE USED

Engineered Drawings for the Back River Project Primary Pond can be found in Appendix A; construction methods and procedures are outlined in the bulleted design consideration section of these drawings. The technical specifications for the project earthworks (which the Primary Pond will follow) are found in Appendix B

E. TECHNICAL SPECIFICATIONS FOR SEDIMENTATION, EROSION CONTROL AND BANK STABILIZATION MEASURES, INCLUDING PROPOSED MATERIALS, LOCATION AND EXTENT, PLACE METHODS AND QUANTITIES REQUIRED

The following management and mitigation measures will be adhered to during the construction of the Primary Pond; refer to the Type A Water Licence Road Management Plan for additional details. The main excavation will be done in the winter and will also allow for any ‘dirty’ snow around the areas immediate of the excavations to be removed and relocated upstream of the dam (i.e. ultimately contained and managed within the pond). Additional details on other sediment and erosion control measures that may be implements (if / as required), include.

<u>Mitigation by Erosion and Sediment Control</u>

- The area of landscape disturbance will be minimized, and restoration will occur as soon as possible in order to minimize erosion potential.
- Silt fences will be used in areas of cuts and excavations, downslope from exposed or erodible areas to prevent sedimentation of waterbodies.
- Effective erosion and sediment control measures will be installed before starting work to prevent sediment from entering the waterbody.
- Site isolation measures (e.g., silt boom or silt curtain) will be used to contain suspended sediment where in-water work is required.

- Regular inspection and maintenance of erosion and sediment control measures and structures will be conducted during the course of construction.

Mitigation by Shoreline/bank re-vegetation and stabilization

- Clearing of riparian vegetation will be kept to a minimum to avoid disturbance to the riparian vegetation and prevent soil compaction.
- If replacement rock reinforcement/armouring is required to stabilize eroding or exposed areas, appropriately-sized, clean rock will be installed at a similar slope to maintain a uniform bank/shoreline and natural stream/shoreline alignment.
- Exposed landscape surfaces will be protected, where possible, by the installation of covering material like riprap, aggregate, or rolled erosion control products.
- Decommissioning of the roads will involve restoring natural drainages, and stabilizing any slopes where there is potential for erosion; stabilization measures may require pulling back of side-cast fills on locally steep slopes or buttressing and/or re-contouring of steepened slopes using non acid generating material.

Mitigation by Operation of Machinery

- All heavy machinery used during construction will stay above the high-water mark to the greatest extent possible.
- Temporary crossings may be utilized if necessary to limit fording of watercourses.
- All machinery will arrive on site in a clean condition and maintained free of fluid leaks, invasive species and noxious weeds.
- All fueling will be done away from watercourses and water bodies, and a spill protocol will be in place.

Following the installation of the crossing structures, inspections and monitoring will be performed prior to, and during the spring freshet. Inspections will include daily visual assessments of ice blockages prior to the spring freshet, followed by visual assessments for erosion and sedimentation for the duration of the spring freshet. For fish-bearing crossings, turbidity levels will be monitored weekly during spring conditions or periods of high flow for the first year of operation of crossing structures.

F. TIMETABLE FOR SUBMISSION, INCLUDING DATE OF CONSTRUCTION AND PROPOSED DATE OF COMMISSIONING OF INFRASTRUCTURE; AND

Construction of the Primary is planned to occur in Q4 of 2022, and potentially go until Q4 of 2023. All of the key trench and minimum thermal cover is expected to result between November 2022 to approximately May 2023 (depend on actual site temperatures and conditions). Then if / as required, baed on construction progress, the remainder of the dam shell material and higher above ground portions of the liner slope may be construed in the warmer months.

Sabina will submit to the NWB for review, within ninety (90) days of completion of the Rascal Diversion, a Construction Summary Report in accordance with Schedule D, Item 1 of the Type A Water Licence (2AM-BRP1831).

G. WHERE REQUIRED, SIGNATURE AND SEAL BY THE APPROPRIATELY QUALIFIED ENGINEER.

Permit drawings for the Back River Project Primary Pond can be found in Appendix A.

3. Appendix Summary

APPENDIX A – ENGINEERING DRAWINGS

APPENDIX B – EARTHWORK TECHNICAL SPECIFICATIONS

4. Additional References

Environment Canada. (2022). Canadian Climate Normals 1981-2010 Station Data for Lupin A and Kugluktuk A. Retrieved September 20, 2022, from Environment Canada: https://climate.weather.gc.ca/climate_normals/

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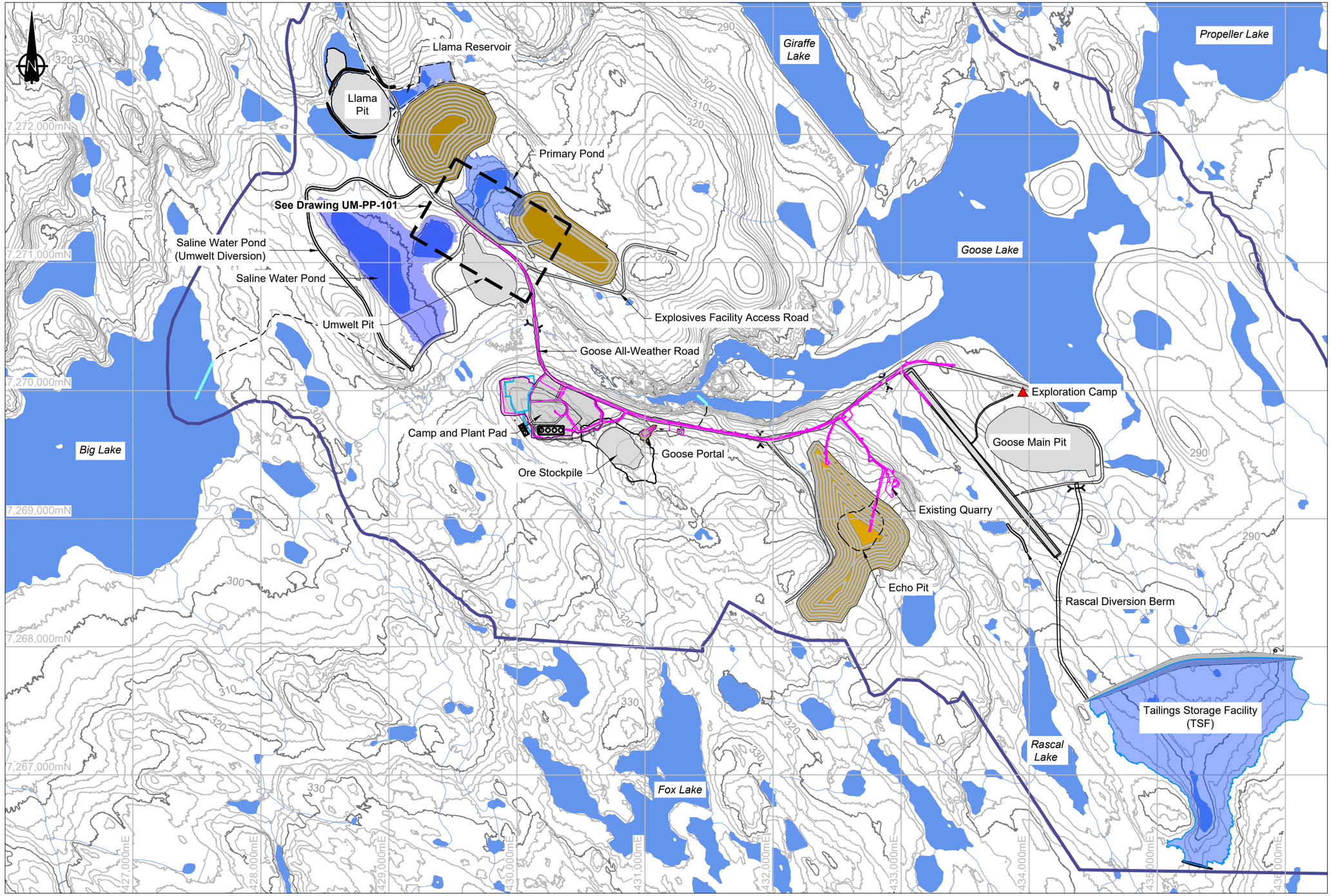
SRK Consulting (Canada) Inc. 2022. Primary Pond Subsurface Memo. Summary memo prepared for Sabina Gold & Silver Corp. Project No. 1CS020.020. September 2022.

APPENDIX A – ENGINEERING DRAWINGS

Engineering Drawings for the Primary Pond Dam, Back River Project, Nunavut, Canada

Drawing Number	Drawing Title	Issue	Date	Revision
UM-PP-100	Project Location General Arrangement	Issued for Permit	2022/09/02	A
UM-PP-101	General Arrangement (Orthophoto)	Issued for Permit	2022/09/02	A
UM-PP-102	General Arrangement	Issued for Permit	2022/09/02	A
UM-PP-103	Existing Foundation Investigation Plan View	Issued for Permit	2022/09/02	A
UM-PP-104	Proposed Percolation Drillhole/Testing Locations	Issued for Permit	2022/09/02	A
UM-PP-200	Primary Pond Dam Key Trench Plan and Profile	Issued for Permit	2022/09/02	A
UM-PP-201	Primary Pond Dam Key Trench Liner Placement Plan and Sections	Issued for Permit	2022/09/02	A
UM-PP-202	Primary Pond Dam Key Trench Bedding Plan and Sections	Issued for Permit	2022/09/02	A
UM-PP-203	Primary Pond Dam Key Trench Transition Plan and Sections	Issued for Permit	2022/09/02	A
UM-PP-204	Primary Pond Dam Downstream ROQ Plan and Sections	Issued for Permit	2022/09/02	A
UM-PP-205	Primary Pond Dam Downstream Transition Plan and Sections	Issued for Permit	2022/09/02	A
UM-PP-206	Primary Pond Dam Downstream Liner and Bedding Plan and Sections	Issued for Permit	2022/09/02	A
UM-PP-207	Primary Pond Dam Overliner Transition Plan and Sections	Issued for Permit	2022/09/02	A
UM-PP-208	Primary Pond Dam Cover Plan and Sections	Issued for Permit	2022/09/02	A
UM-PP-209	Primary Pond Dam Final Configuration Plan and Profile	Issued for Permit	2022/09/02	A
UM-PP-210	Primary Pond Dam Spillway Plan and Profile	Issued for Permit	2022/09/02	A
UM-PP-211	Primary Pond Dam Reclaim Road Plan and Profile	Issued for Permit	2022/09/02	A
UM-PP-300	Typical Dam Cross Sections	Issued for Permit	2022/09/02	A
UM-PP-301	Typical Spillway and Reclaim Road Cross Sections	Issued for Permit	2022/09/02	A
UM-PP-400	Details	Issued for Permit	2022/09/02	A
UM-PP-401	Details	Issued for Permit	2022/09/02	A
UM-PP-500	Primary Pond Dam Instrumentation Plan	Issued for Permit	2022/09/02	A
UM-PP-501	Primary Pond Dam Horizontal and Veritcal GTC Layout	Issued for Permit	2022/09/02	A
UM-PP-502	Primary Pond Dam Instrumentation Details	Issued for Permit	2022/09/02	A
UM-PP-503	Primary Pond Dam Instrumentation Details	Issued for Permit	2022/09/02	A

SRK Job No. 1CS020.020



LEGEND

- Crossing Location
- Pipeline Access
- Water Intake Pipeline
- As-built Infrastructure (2021)
- Design Infrastructure
- Design Stockpile Location
- Project Boundary

NOTES

1. Contours are shown at 2.0m intervals.
2. All units are in meters unless otherwise specified.

REFERENCES

NAD83 UTM Zone 13.

REFERENCE DRAWINGS		REVISIONS									
DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
							A.	Issued for Permit	JD/AT	JBK	2022/09/02

Original Drawings Signed and Stamped

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CHECKED: JD/AT/VB	APPROVED: JBK	DATE: 2022/09/02	
FILE NAME: 1CS020.020 - Siteloc.dwg			

Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

DRAWING TITLE: Primary Pond

Project Location General Arrangement

DRAWING NO. UM-PP-100 REVISION NO. A

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LEGEND

- Contours
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Base of key trench on this profile is based on a section down the centerline of the dam crest. Note that the key trench centerline and the dam crest centerline do not share the exact same alignment and overall the chainages vary in any given location (between the key trench and dam crest shown in these drawings) in the range of ±5m offset, ±50m station chainage.
4. All drawings are scaled appropriately for B-size construction drawings. These drawings can therefore be plotted at double size to fit D-Size. Scales may not be correct if these drawings are reproduced and presented in any other format.
5. All drawings should be read in conjunction with the latest technical specifications document ('Technical Specifications - Earthworks and Geotechnical Engineering - Back River Gold Project, Nunavut Canada - Issue for Construction' prepared by SRK) . The on site engineer representative should be consulted to determine what the latest revision of the technical specifications is.
6. Umwelt Waste Rock Pile to be modified in the future and will be outside of the Primary Pond Dam Spillway footprint.

REFERENCES

NAD83 UTM Zone 13.
Orthophoto provided by Client, July 2013.

0m 30 60 90 120

DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
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Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE:
General Arrangement
(Orthophoto)

DRAWING NO.: UM-PP-101

REVISION NO.: A

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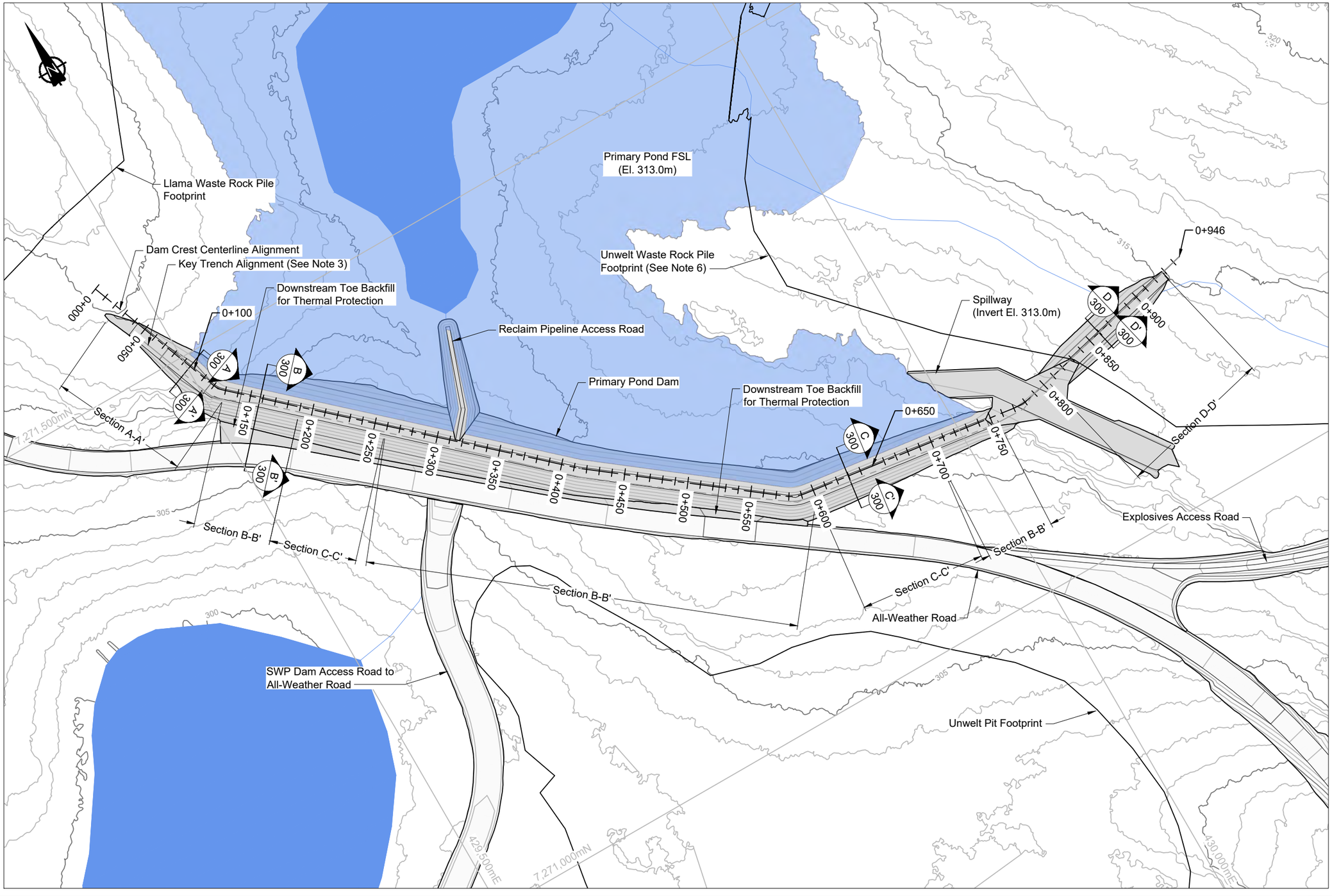

LEGEND

- Contours
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Base of key trench on this profile is based on a section down the centerline of the dam crest. Note that the key trench centerline and the dam crest centerline do not share the exact same alignment and overall the chainages vary in any given location (between the key trench and dam crest shown in these drawings) in the range of ±5m offset, ±50m station chainage.
4. All drawings are scaled appropriately for B-size construction drawings. These drawings can therefore be plotted at double size to fit D-Size. Scales may not be correct if these drawings are reproduced and presented in any other format.
5. All drawings should be read in conjunction with the latest technical specifications document ('Technical Specifications - Earthworks and Geotechnical Engineering - Back River Gold Project, Nunavut Canada - Issue for Construction' prepared by SRK) . The on site engineer representative should be consulted to determine what the latest revision of the technical specifications is.
6. Umwelt Waste Rock Pile to be modified in the future and will be outside of the Primary Pond Dam Spillway footprint.

REFERENCES

NAD83 UTM Zone 13.

0m 30 60 90 120

DRAWING NO.	DRAWING TITLE
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Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE:

General Arrangement

DRAWING NO. UM-PP-102

REVISION NO. A

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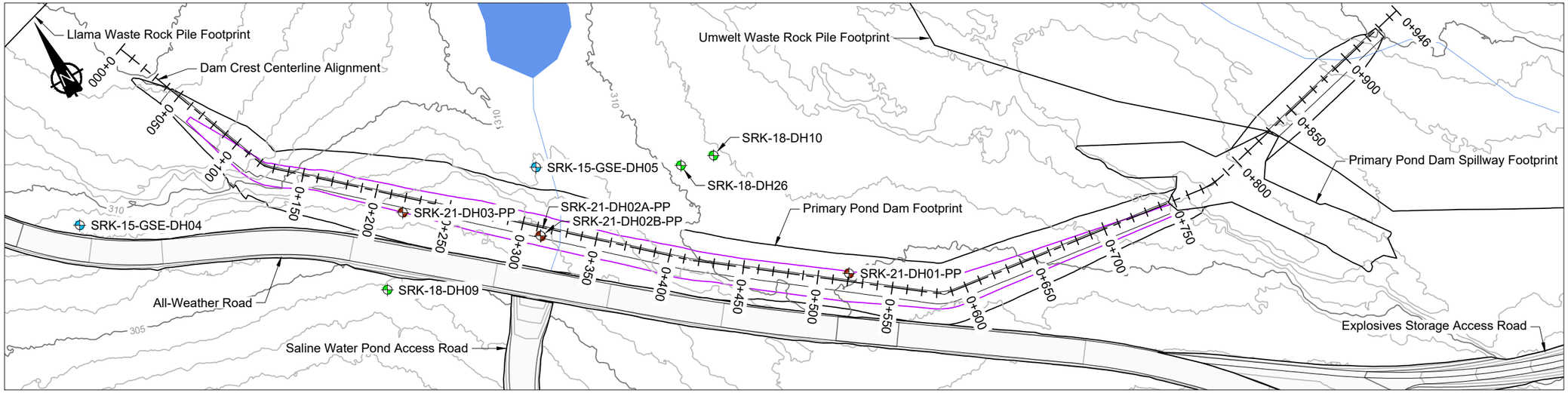
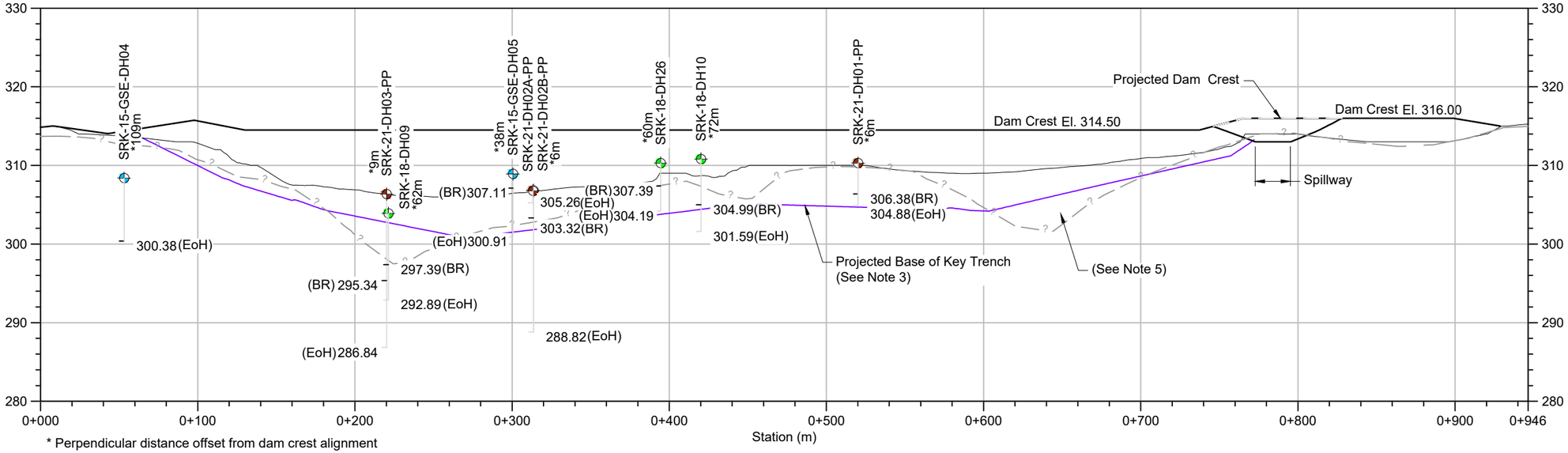


Primary Pond Dam Final Configuration Plan

0m 30 60 90 120



* Perpendicular distance offset from dam crest alignment

Primary Pond Dam Crest Profile

0m 6 12 18 24 Vertical

0m 30 60 90 120 Horizontal

LEGEND

- 2015 Boreholes
- 2018 Boreholes
- 2021 Boreholes
- Contours
- Design Surface
- Excavation
- Existing Ground
- Inferred Bedrock
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure
- Primary Pond Design Key Trench

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Base of key trench on this profile is based on a section down the centerline of the dam crest. Note that the key trench centerline and the dam crest centerline do not share the exact same alignment and overall the chainages vary in any given location (between the key trench and dam crest shown in these drawings) in the range of ±5 offset, ±50 station chainage.
4. Inferred Bedrock surface provided by Client.
5. Secondary deeper overburden area supported by exploration drill hole and the geomorphological interpretations that show the drillholes SRK-18-DH26 and SRK-18-DH10 could be considered more in a SSE projection towards the dam. This area is one of the main target of the percolation testing. As outlined on drawing UM-PP-104 there is a tighter drill hole spacing proposed for this area to help gather additional information before construction.

REFERENCES

NAD83 UTM Zone 13.

DRAWING NO.	DRAWING TITLE
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REFERENCE DRAWINGS

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Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Existing Foundation Investigation Plan View

DRAWING NO. UM-PP-103

REVISION NO. A

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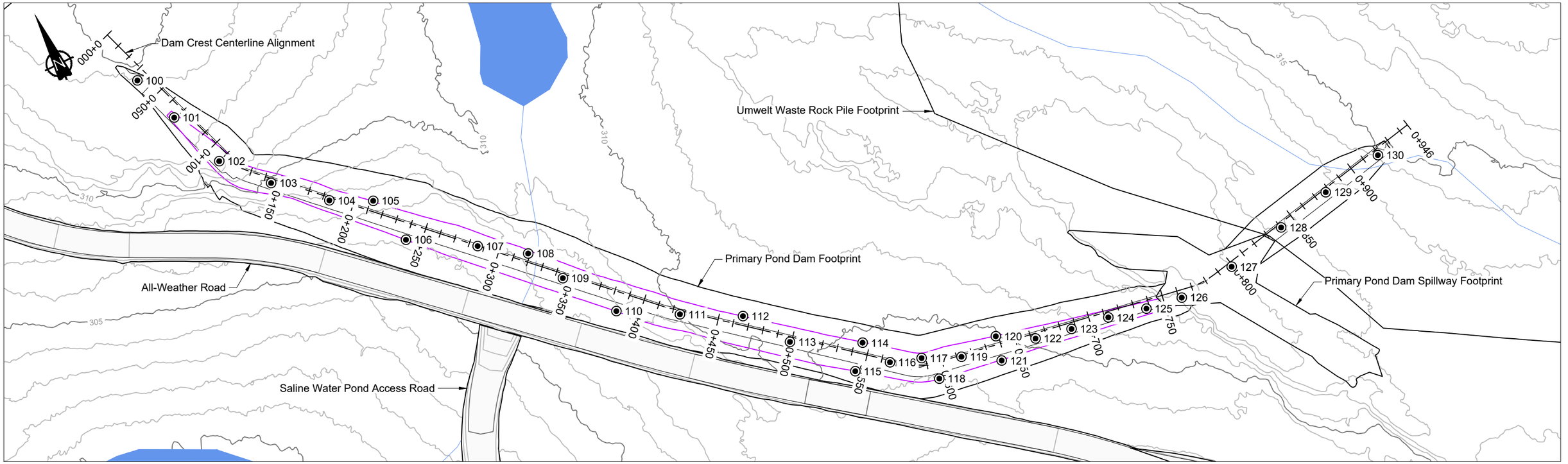

Proposed Percolation Hole Locations

Description	Easting	Northing
100	429474	7271545
101	429486	7271513
102	429501	7271475
103	429526	7271448
104	429556	7271422
105	429582	7271410
106	429591	7271378
107	429632	7271355
108	429660	7271337
109	429674	7271313
110	429697	7271279
111	429734	7271260
112	429771	7271242
113	429792	7271214
114	429835	7271194

Description	Easting	Northing
115	429823	7271179
116	429846	7271175
117	429866	7271169
118	429871	7271152
119	429890	7271159
120	429916	7271162
121	429913	7271146
122	429939	7271150
123	429963	7271146
124	429988	7271143
125	430013	7271138
126	430037	7271135
127	430075	7271140
128	430115	7271150
129	430151	7271159
130	430192	7271167

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. It is suggested that an air-track drill (quarry drill) be used to complete the percolation testing.
4. Percolation holes to be advanced a minimum 2.0m into bedrock.
5. Percolation test boreholes should be a minimum of 4-6 inches (100-150mm) in diameter.
6. Air-track drill cuttings should be sampled every 0.5m for the upper (top) 4.0m below ground surface (bgs), and every 1m thereafter to a depth of 10.0mbgs. Material returned from a depth greater than 10mbgs should be sampled every 2.0m. Photographs should be taken of the collected samples in the field.
7. Observations of massive ground ice and crushed ice cuttings should be logged and sampled based on occurrence.
8. Collected samples should be double bagged, tied, and labeled at the time of field collection. All samples should be maintained in a frozen state until processed by the receiving laboratory to preserve moisture content.
9. Once all percolation test locations are drilled the testing will be completed on site as directed by the Engineer.

LEGEND

- Percolation Drillhole/Testing Location
- Contours
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure
- Primary Pond Key Trench Surface

REFERENCES

NAD83 UTM Zone 13.

0m 20 40 60 80 100

DRAWING NO.	DRAWING TITLE
- -	- -

REFERENCE DRAWINGS

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JD/AT/VB	JBK	2022/09/02

FILE NAME: 1CS020.020 - UM-PP-Sample holes.dwg

Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Proposed Percolation Drillhole/Testing Locations Plan

DRAWING NO. UM-PP-104

REVISION NO. A

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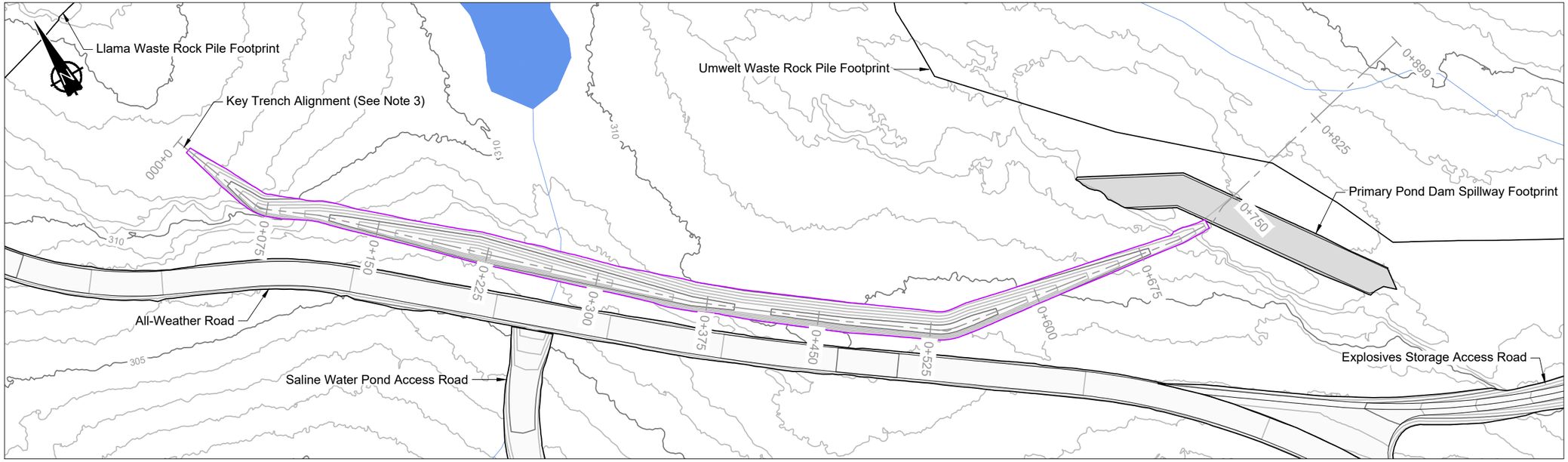
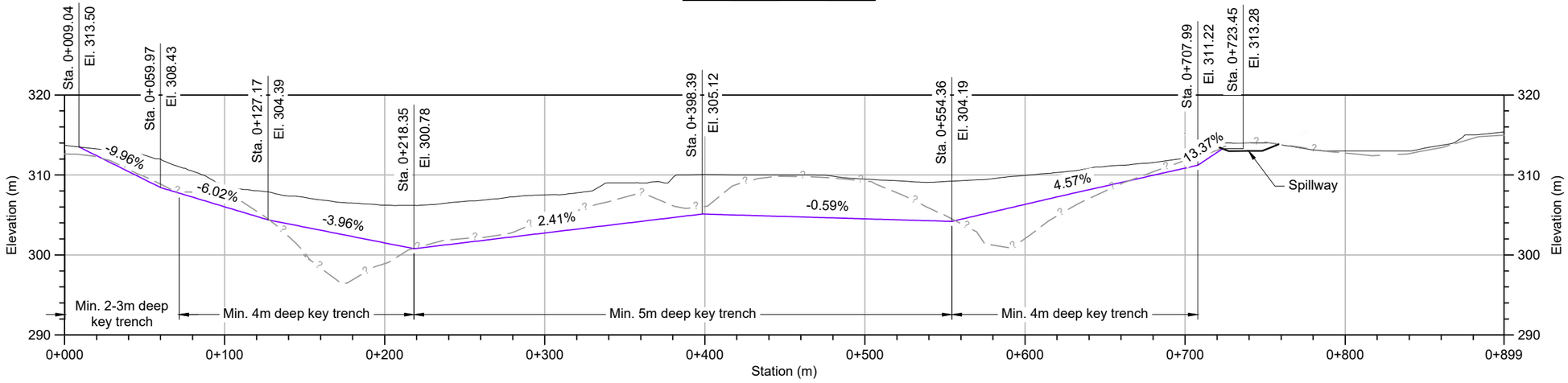


Primary Pond Dam Key Trench Plan

0m 30 60 90 120



Primary Pond Dam Key Trench Centerline Profile

0m 6 12 18 24 Vertical

0m 30 60 90 120 Horizontal

LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- Inferred Bedrock
- Waterbody
- Design Key Trench
- Other Design Infrastructure
- Primary Pond Design Infrastructure

NOTES

1. Contours are shown at 1.0m intervals.
2. All units are in meters unless otherwise specified.
3. Alignment and profile shown correspond to the centerline of the key trench.
4. The final key trench extent and depth will be determined in the field by the Engineer. Minimum excavation depth in overburden is 4.0m, unless massive ice, hypersaline soil or bedrock encountered. The Engineer will inspect all excavations and approve the foundation conditions.
5. If any area of the key trench is over-blasted or over-excavated then the extra excavation will need to be backfilled in thin lifts (see 'Technical Specifications') until the key trench design lines and grades are reached.
6. Overblasting and/or overexcavation of the key trench beyond the design lines (as presented on this figure) should be avoided if at all possible. Extra care should be taken during the key trench excavation to ensure that the excavation can result as close to the design lines as possible. Excavation beyond the key trench design lines may require that the overall Primary Pond dam footprint be enlarged to provide the necessary thermal coverage and to uphold design requirements.

REFERENCES

NAD83 UTM Zone 13.

DRAWING NO.	DRAWING TITLE
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REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
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A	Issued for Permit	JD/AT	JBK	2022/09/02

REVISIONS

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FILE NAME: 1CS020.020 - UM-PP-KT.dwg

Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE:
Primary Pond Dam
Key Trench Plan and Profile

DRAWING NO. UM-PP-200

REVISION NO. A

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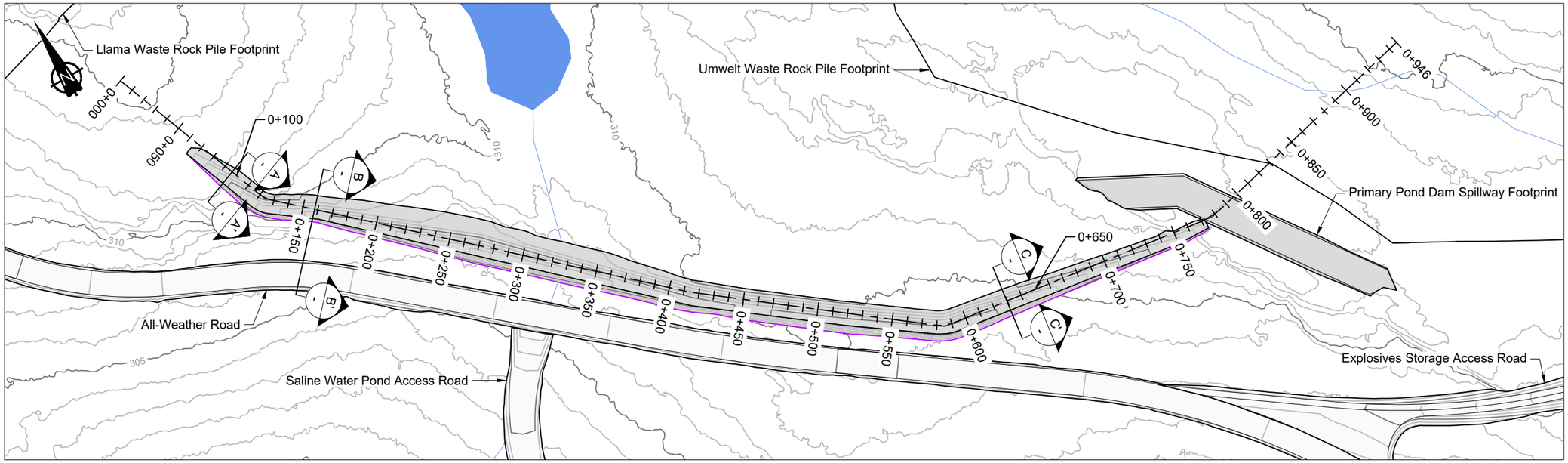
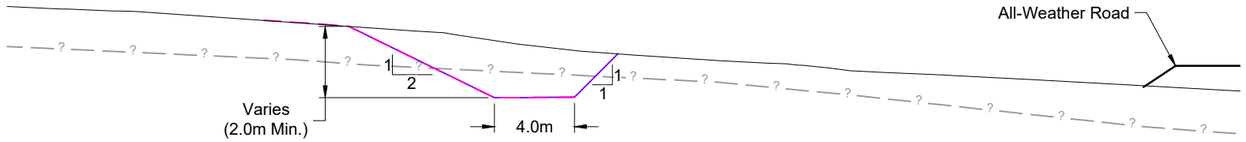


Key Trench Liner Plan

0m 30 60 90 120

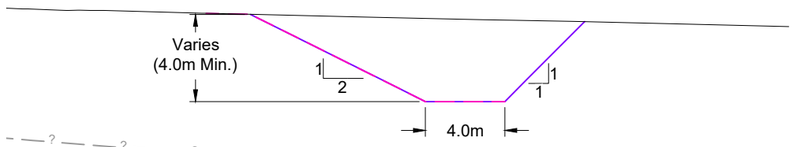
A **Cross Section A-A'**

0m 3 6 9 12



B **Cross Section B-B'**

0m 3 6 9 12



C **Cross Section C-C'**

0m 3 6 9 12

LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- HDPE Liner System
- Inferred Bedrock
- Waterbody
- Design Key Trench
- Other Design Infrastructure
- Primary Pond Design Infrastructure

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Alignment and profile shown correspond to centerline of Primary Pond Dam.
4. The upstream slope of the key trench excavation need to be scraped and smoothed to prepare a suitable subbase for the HDPE liner as determined by field Engineer. If any voids larger than 0.15m or undulation exist then they will need to be smoothed as shown in Details 7 and 9, depending on surface (overburden or bedrock).
5. Non-woven geotextile shall be placed on both sides of HDPE liner, unless otherwise approved /directed by the Engineer.
6. The subgrade surface must be free of vegetation, sharp-edged rocks, stones, sticks, construction debris, and other foreign material that could contact the HDPE liner. Furthermore, all protrusions extending more than 12 mm from the subgrade surface shall either be removed, crushed, or pushed into the surface with a smooth-drum compactor.
7. Liner should not be placed over massive ice or standing water (both need to be removed prior to placement).
8. Liner panels shall have a minimum overlap of 15cm for fusion (hot shoe) welding or according to manufacturer's specifications. upslope panels shall overlap downslope to provide a shingle effect for drainage.
9. At the locations where bedrock is encountered in the key trench then these areas will be required to be ripped down to competent bedrock or scrapped smooth.
10. Depth of key trench and bedrock intersection estimated (see UM-PP-200 for additional details). Actual depth to bedrock may vary in field. Key trench excavation should progress to the design lines, until competent bedrock is encountered, or as directed by Engineer.
11. The HDPE liner system will consist of a HDPE liner that is sandwiched between two 12 oz nonwoven geotextiles.

REFERENCES

NAD83 UTM Zone 13.

REFERENCE DRAWINGS		REVISIONS									
DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
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JD/AT/VB	JBK	2022/09/02

FILE NAME: 1CS020.020 - UM-PP-KT-Liner.dwg

Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Key Trench Liner Plan and Sections

DRAWING NO. UM-PP-201

REVISION NO. A

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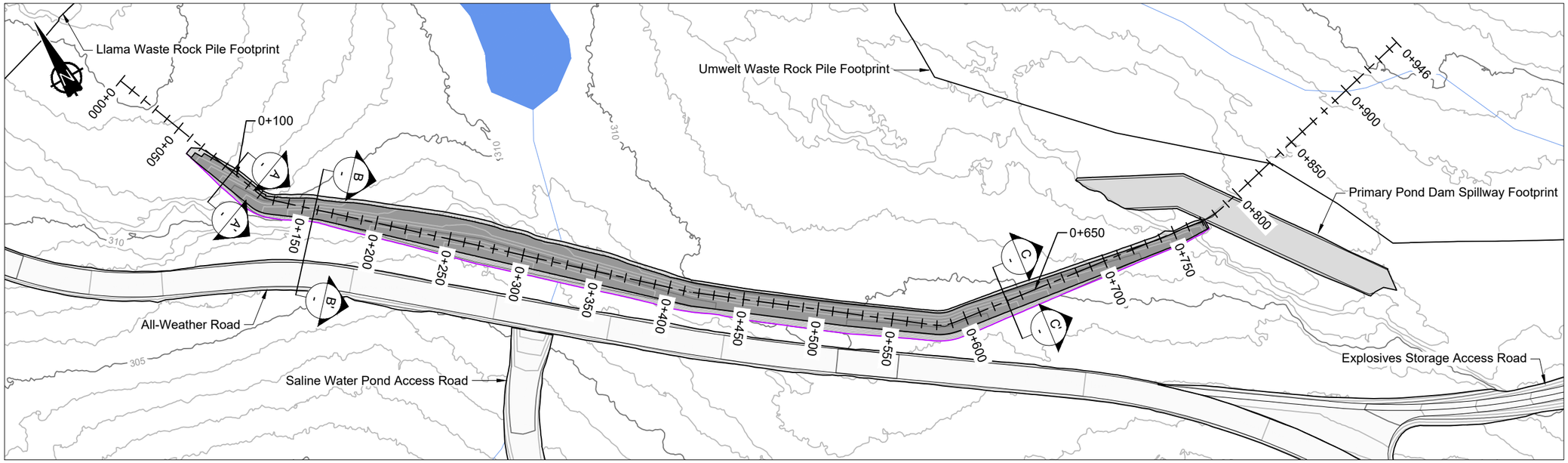
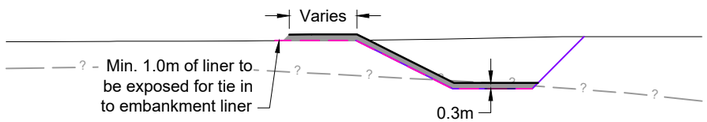


Key Trench Bedding Plan

0m 30 60 90 120



A - Cross Section A-A'

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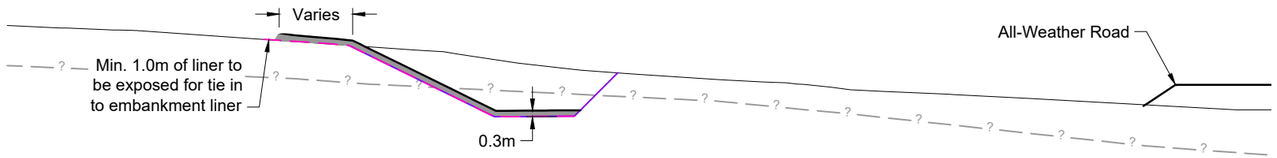

B - Cross Section B-B'

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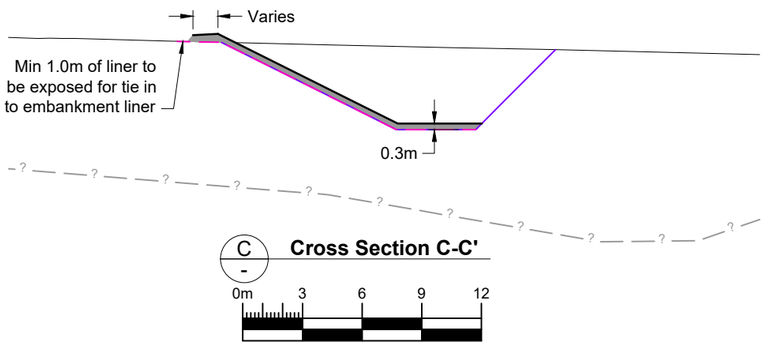

C - Cross Section C-C'

0m 3 6 9 12

LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- HDPE Liner System
- Inferred Bedrock
- Waterbody
- Bedding
- Design Key Trench
- Other Design Infrastructure
- Primary Pond Design Infrastructure

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Alignment and profile shown correspond to centerline of Primary Pond Dam.
4. Bedding layer to be placed in 0.15m lifts.
5. The subsurface below the liner should be free of protrusions or any sharp / angular cobbles or larger size material. See the Technical Specifications document for more details ('Technical Specifications - Earthworks and Geotechnical Engineering - Back River Gold Project, Nunavut Canada - Issue for Construction' prepared by SRK).
6. Bedding material cover shall be placed over the HDPE using construction equipment that minimizes stresses on the liner. Unless otherwise approved /directed by the Engineer a minimum thickness of 600mm or greater is required to be placed over any areas where heavy equipment will be trafficking over the liner. Thickness requirement are related to equipment type. For light equipment (which will have to be directly approved by the Engineer), as an absolute minimum a thickness of 300mm of cover must be maintained between light tracked equipment (e.g. skid-steer or 30 excavator) tracks/tires, and the liner at all times during the covering process.
7. Soil cover should be placed in a manner that prevents the soil from entering/disturbing the liner overlap zones.
8. Depth of key trench and bedrock intersection estimated (see UM-PP-200 for additional details). Actual depth to bedrock may vary in field. Key trench excavation should progress to the design lines, until competent bedrock is encountered, or as directed by Engineer.

REFERENCES

NAD83 UTM Zone 13.

REFERENCE DRAWINGS		REVISIONS								
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FILE NAME: 1CS020.020 - UM-PP-KT-bedding.dwg

Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Key Trench Bedding Plan and Sections

DRAWING NO. UM-PP-202

REVISION NO. A

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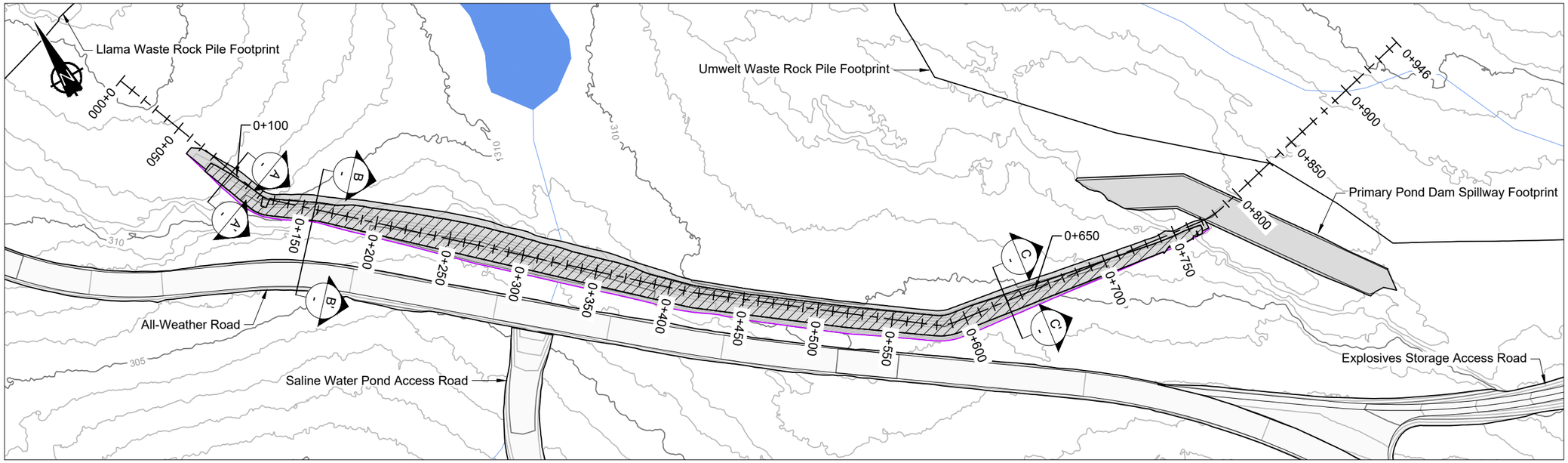
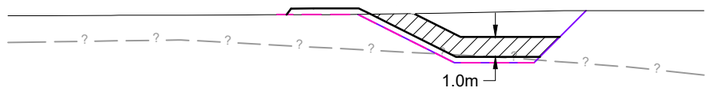


Key Trench Transition Plan

0m 30 60 90 120



A - Cross Section A-A'

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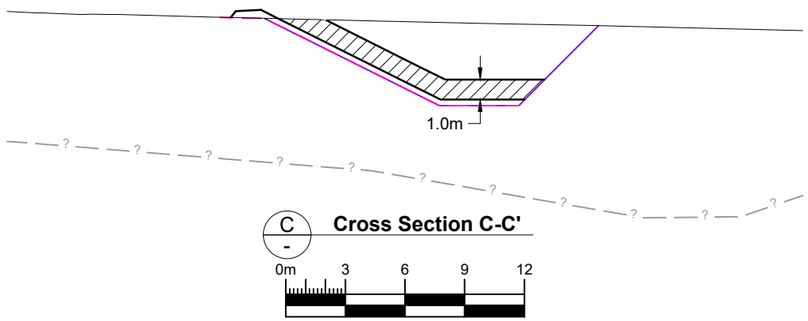
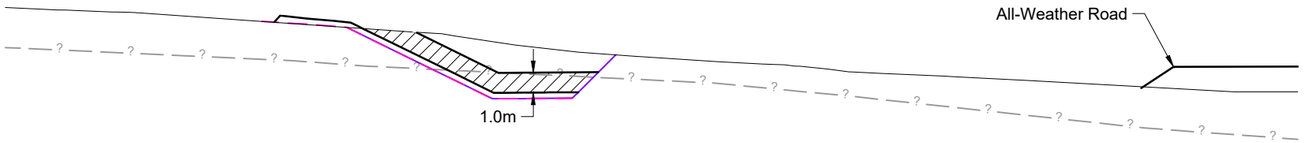


C - Cross Section C-C'

0m 3 6 9 12



B - Cross Section B-B'

0m 3 6 9 12

LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- HDPE Liner System
- Inferred Bedrock
- Waterbody
- Design Key Trench
- Other Design Infrastructure
- Primary Pond Design Infrastructure
- Transition Material

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Alignment and profile shown correspond to centerline of Primary Pond Dam.

REFERENCES

NAD83 UTM Zone 13.

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Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Key Trench Transition Plan and Sections

DRAWING NO. UM-PP-203

REVISION NO. A

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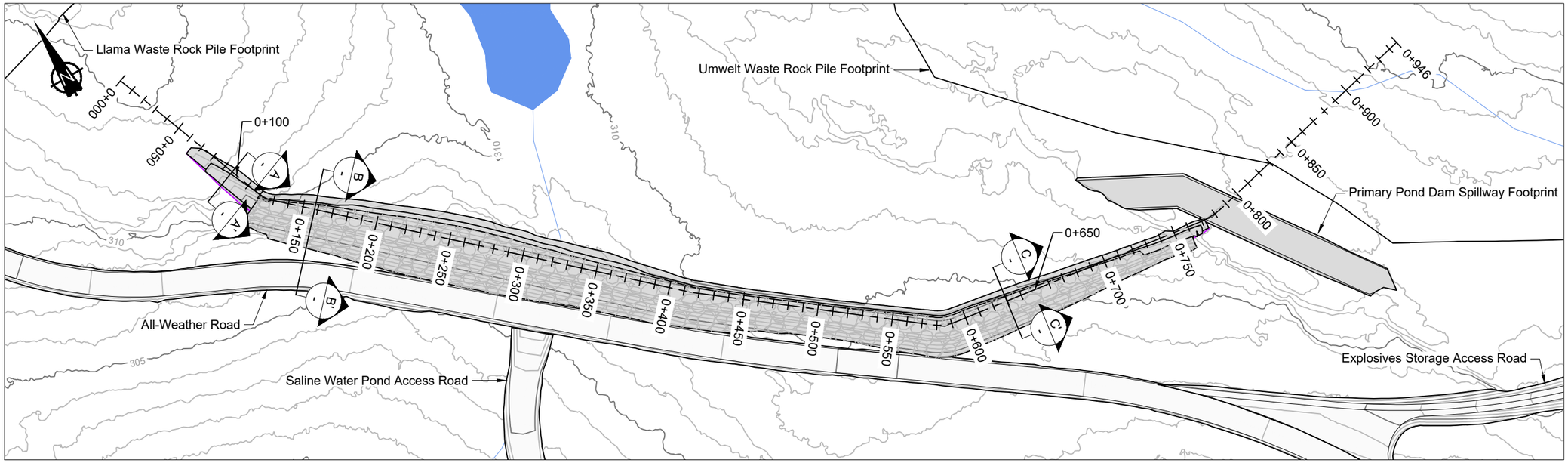
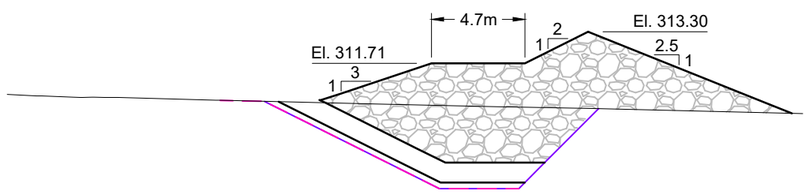


Downstream ROQ Plan

0m 30 60 90 120

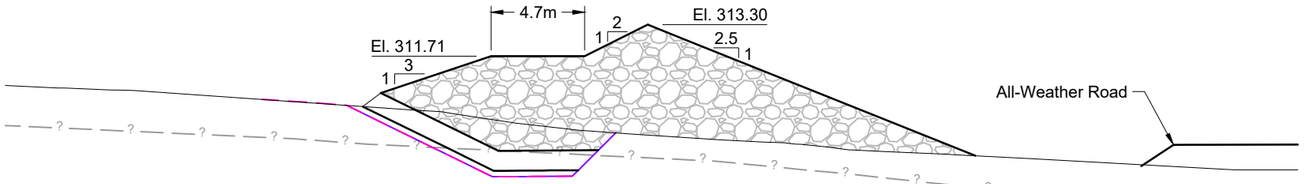
A Cross Section A-A'

0m 3 6 9 12



B Cross Section B-B'

0m 3 6 9 12



C Cross Section C-C'

0m 3 6 9 12

LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- HDPE Liner System
- Inferred Bedrock
- Waterbody
- Design Key Trench
- Other Design Infrastructure
- Primary Pond Design Infrastructure
- Run of Quarry

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.

REFERENCES

NAD83 UTM Zone 13.

DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
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Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Downstream ROQ Plan and Sections

DRAWING NO. UM-PP-204 REVISION NO. A

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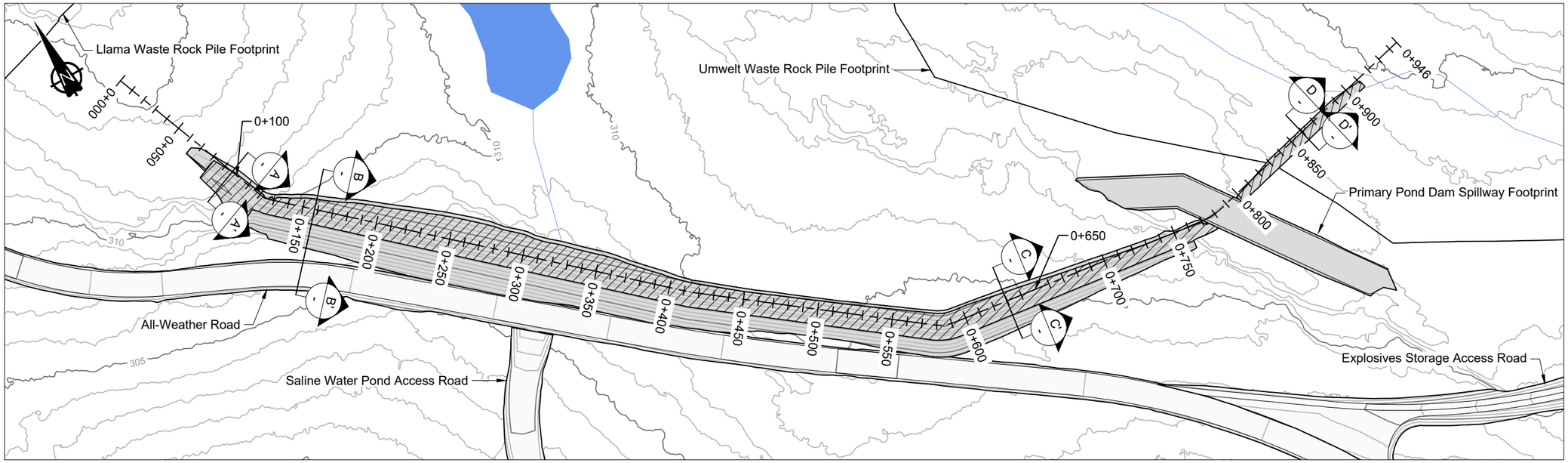


LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- HDPE Liner System
- Inferred Bedrock
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure
- Transition Material

NOTES

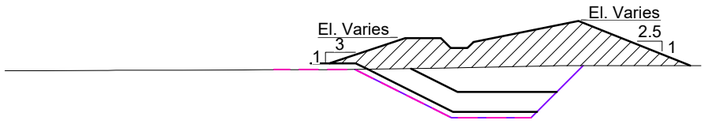
1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Alignment and profile shown correspond to centerline of Primary Pond Dam.

REFERENCES

NAD83 UTM Zone 13.

Downstream Transition Plan

0m 30 60 90 120



A - Cross Section A-A'

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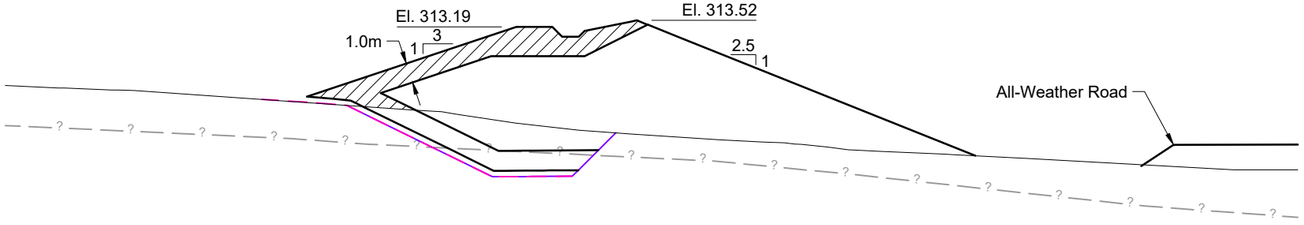

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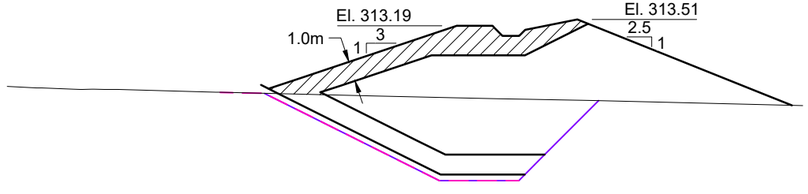

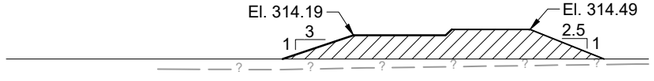

C - Cross Section C-C'

0m 3 6 9 12

D - Cross Section D-D'

0m 3 6 9 12

DRAWING NO.	DRAWING TITLE
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REFERENCE DRAWINGS

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Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Downstream Transition Plan and Sections

DRAWING NO. UM-PP-205

REVISION NO. A

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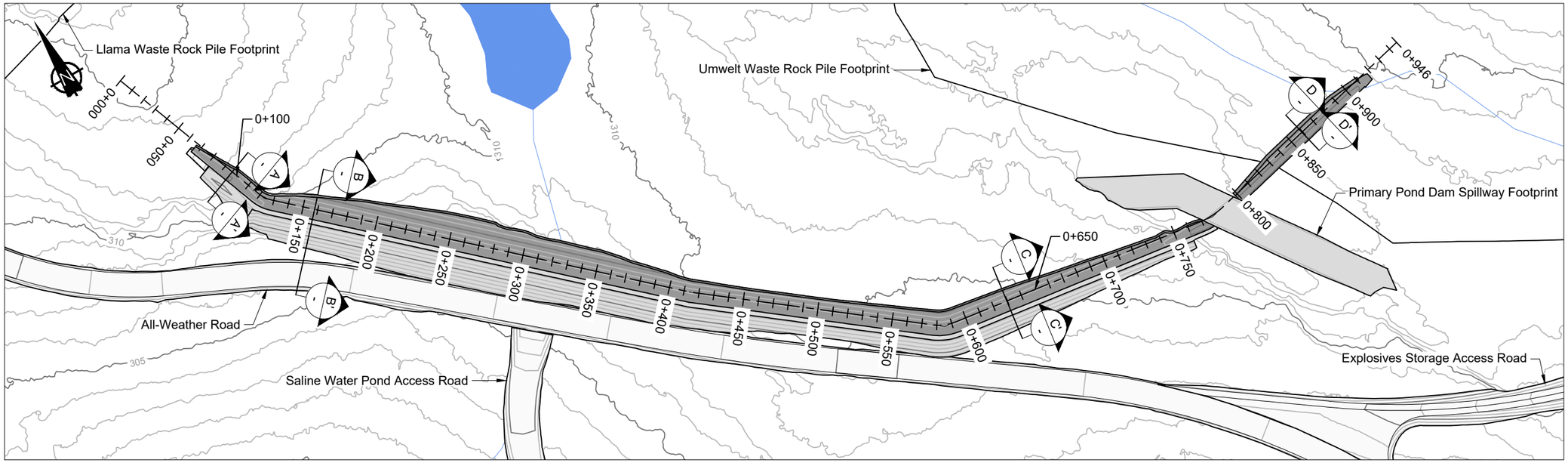


LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- HDPE Liner System
- Non-woven Geotextile
- Inferred Bedrock
- Waterbody
- Bedding
- Other Design Infrastructure
- Primary Pond Design Infrastructure

NOTES

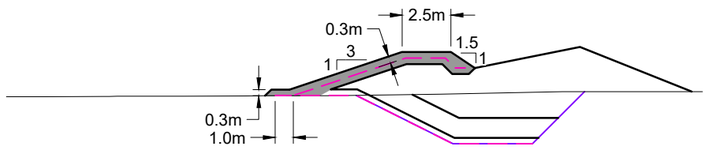
1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Alignment and profile shown correspond to centerline of Primary Pond Dam.
4. Bedding layer to be placed in 0.15m lifts and compacted before liner placement.
5. The subsurface below the liner should be free of protrusions or any sharp / angular cobbles or larger size material. See the Technical Specifications document for more details ('Technical Specifications - Earthworks and Geotechnical Engineering - Back River Gold Project, Nunavut Canada - Issue for Construction' prepared by SRK).
6. Bedding material cover shall be placed over the HDPE using construction equipment that minimizes stresses on the liner. Unless otherwise approved /directed by the Engineer a minimum thickness of 600mm or greater is required to be placed over any areas where heavy equipment will be trafficking over the liner. Thickness requirement are related to equipment type. For light equipment which will have to be directly approved by the Engineer), as an absolute minimum a thickness of 300mm of cover must be maintained between light tracked equipment (e.g. skid-steer or 30 excavator) tracks/tires, and the liner at all times during the covering process.
7. Soil cover should be placed in a manner that prevents the soil from entering/disturbing the liner overlap zones.
8. The bedding (crush) material is required below the geotextile but from chainage 0+800 to 0+920 some of the crush material below the top (horizontal) liner segment may be able to be optimized in the field (i.e more ROQ used and less crush to optimize quantities if / as needed). This small 'field fit' to be done in consultation with the site engineer.

REFERENCES

NAD83 UTM Zone 13.

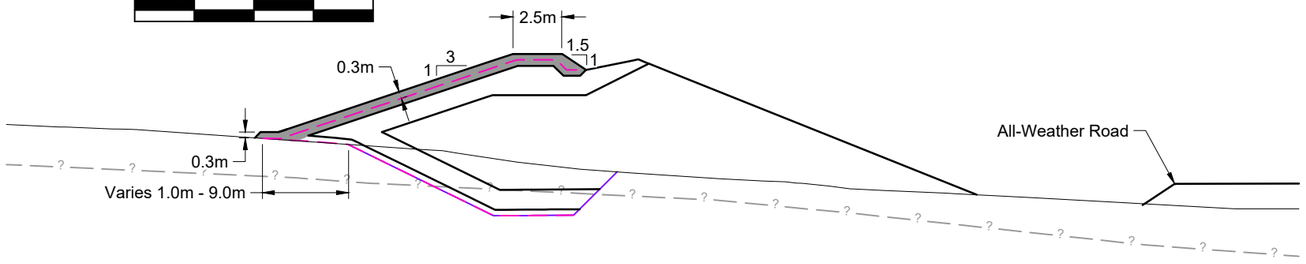
Downstream Bedding Plan

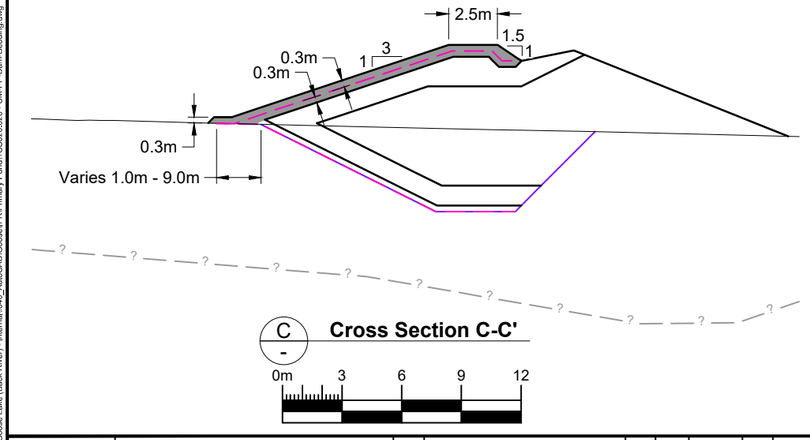
0m 30 60 90 120



A Cross Section A-A'

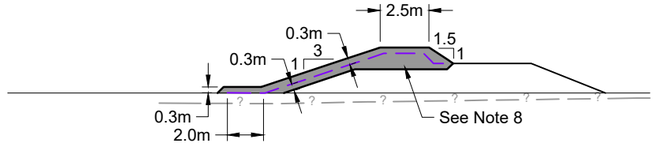
0m 3 6 9 12





B Cross Section B-B'

0m 3 6 9 12



C Cross Section C-C'

0m 3 6 9 12

D Cross Section D-D'

0m 3 6 9 12

DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
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JD/AT/VB	JBK	2022/09/02

FILE NAME: 1CS020.020 - UM-PP-Dam-Bedding.dwg

Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Downstream Liner and Bedding Plan and Sections

DRAWING NO. UM-PP-206

REVISION NO. A

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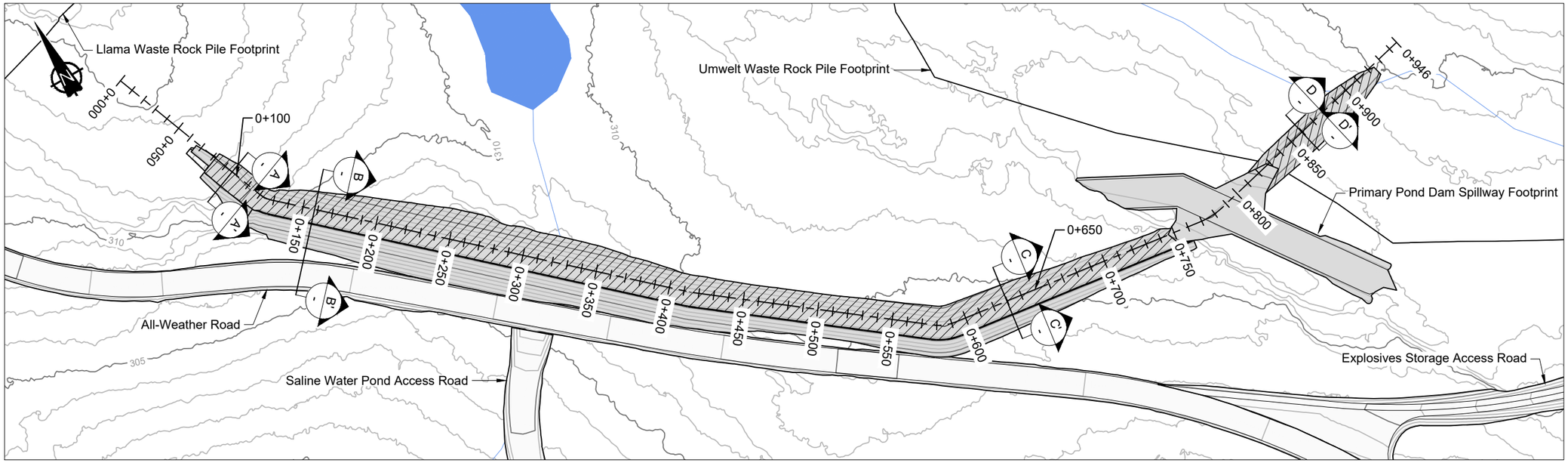


LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- HDPE Liner System
- Non-woven Geotextile
- Inferred Bedrock
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure
- Transition Material

NOTES

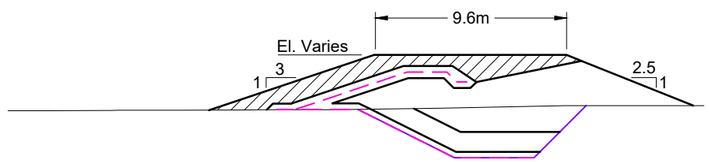
1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Alignment and profile shown correspond to centerline of Primary Pond Dam.

REFERENCES

NAD83 UTM Zone 13.

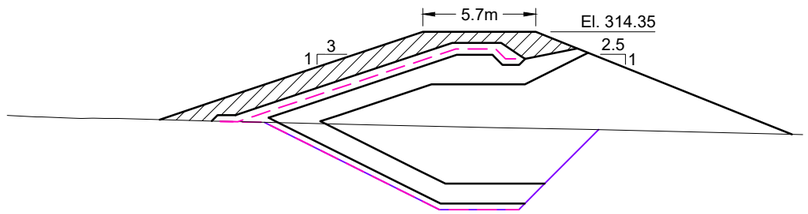
Overliner Transition Plan

0m 30 60 90 120



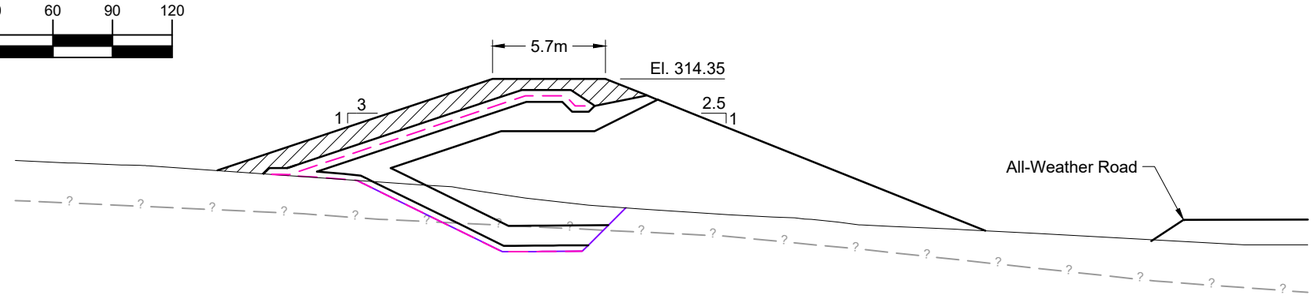
A - Cross Section A-A'

0m 3 6 9 12



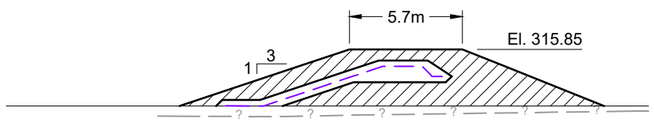
C - Cross Section C-C'

0m 3 6 9 12



B - Cross Section B-B'

0m 3 6 9 12



D - Cross Section D-D'

0m 3 6 9 12

DRAWING NO.	DRAWING TITLE
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FILE NAME: 1CS020.020 - UM-PP-Dam-OL Trans.dwg

Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

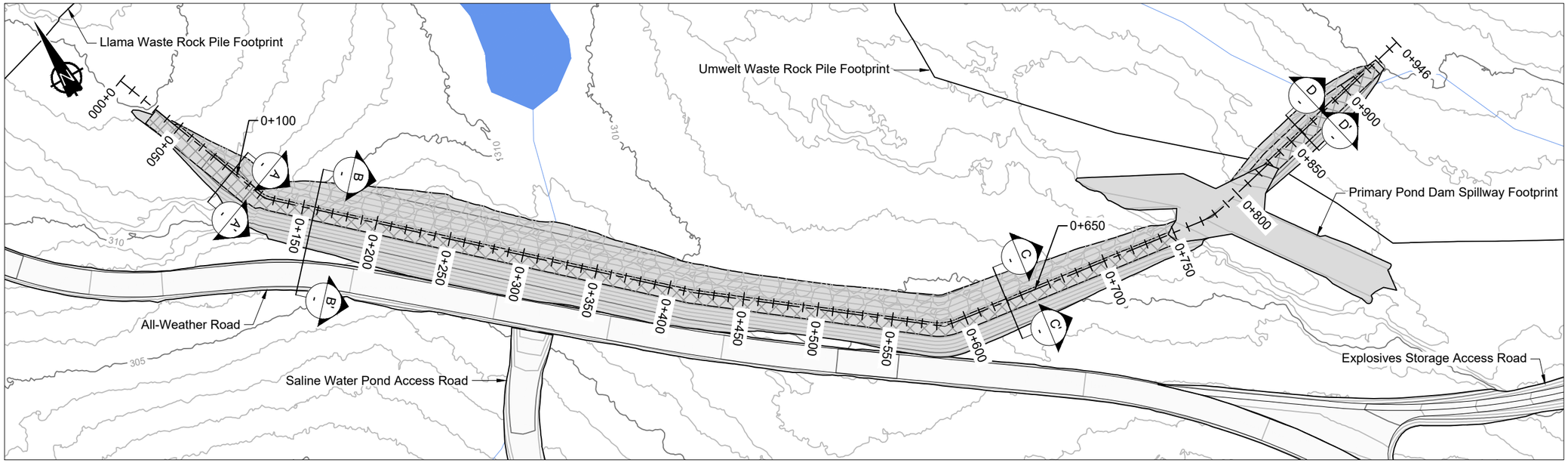
Primary Pond

DRAWING TITLE: Primary Pond Dam Overliner Transition Plan and Sections

DRAWING NO. UM-PP-207

REVISION NO. A

C:\Users\sepp\SRK Consulting\FS203 Goose Lake (Back River) - Internal\1040_AutoCAD\Goose\FR\Primary Pond\1CS020.020 - UM-PP-Dam-OL Trans.dwg



LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- HDPE Liner System
- Non-woven Geotextile
- Inferred Bedrock
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure
- Run of Quarry
- Surfacing

NOTES

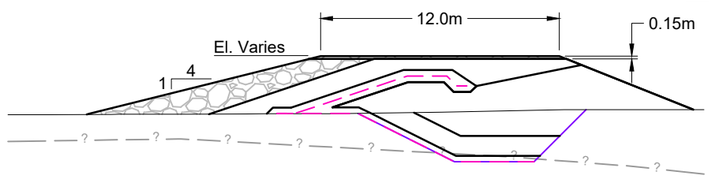
1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Alignment and profile shown correspond to centerline of Primary Pond Dam.
4. The outside upstream dam ROQ should be sloped at 4H:1V or shallower.

REFERENCES

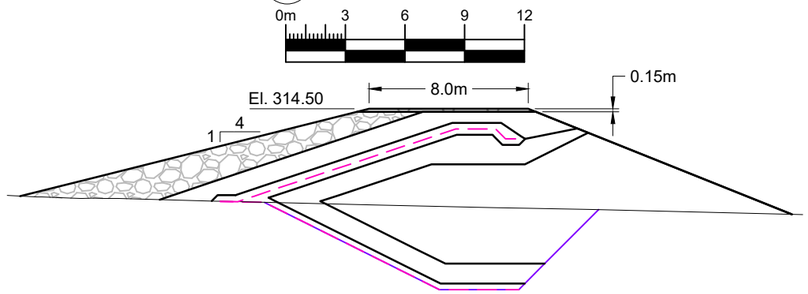
NAD83 UTM Zone 13.

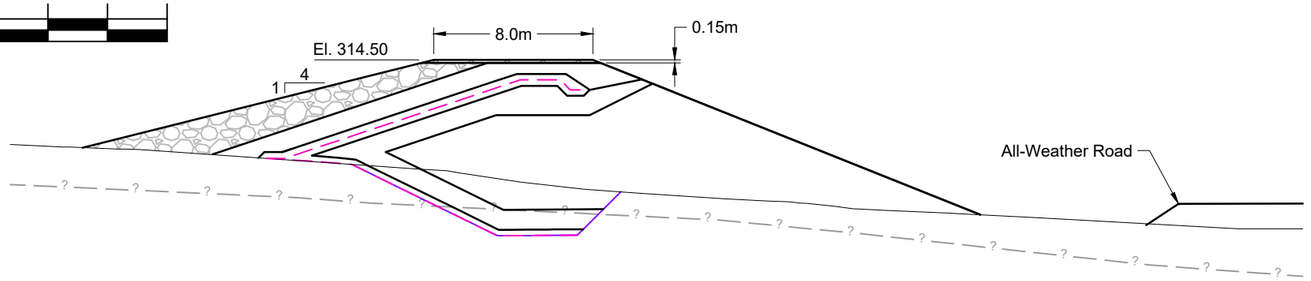
Overliner ROQ and Cover Plan

0m 30 60 90 120

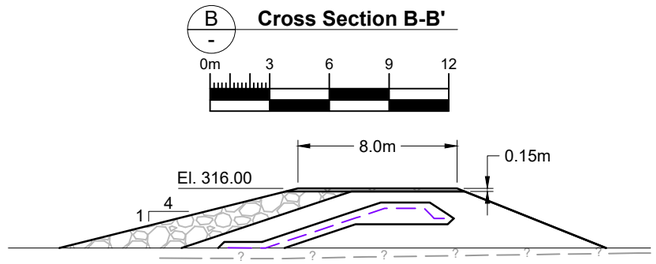


A Cross Section A-A'





B Cross Section B-B'



C Cross Section C-C'

0m 3 6 9 12

D Cross Section D-D'

0m 3 6 9 12

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FILE NAME: 1CS020.020 - UM-PP-Dam-OL ROQ.dwg

Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Cover Plan and Sections

DRAWING NO. UM-PP-208

REVISION NO. A

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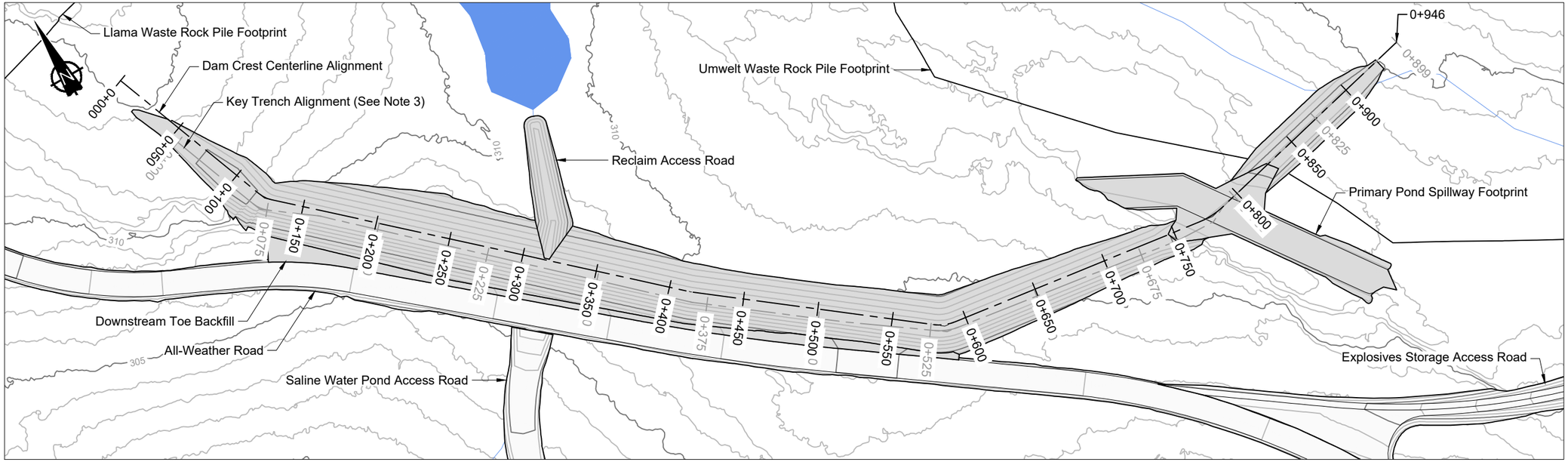
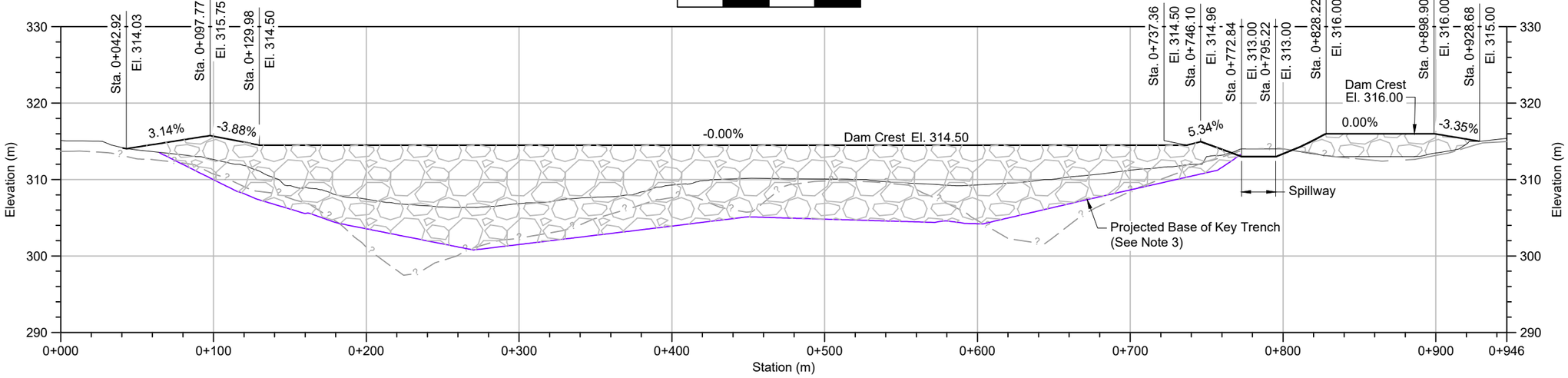


Primary Pond Dam Final Configuration Plan

0m 30 60 90 120



Primary Pond Dam Centerline Profile

0m 6 12 18 24 Vertical

0m 30 60 90 120 Horizontal

LEGEND

- Contours
- Design Surface
- Excavation
- Existing Ground
- Inferred Bedrock
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure
- Run of Quarry

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Base of key trench on this profile is based on a section down the centerline of the dam crest. Note that the key trench centerline and the dam crest centerline do not share the exact same alignment and overall the chainages vary in any given location (between the key trench and dam crest shown in these drawings) in the range of ±5m offset, ±50 chainage station.
4. Volumes presented based on neat-lines only and are approximate. These include no over-excavation or over-blasting allowance of the key trench.

REFERENCES

NAD83 UTM Zone 13.

MATERIAL LIST AND NEAT LINE QUANTITY

Overall Excavation:	34,900m^3
Bedrock Excavation:	12,100m^3
ROQ Fill:	88,600m^3
Transition Fill:	37,000m^3
Bedding Fill:	10,800m^3
Surfacing Fill:	1,300m^3
Geotextile:	48,500m^2
Liner:	23,700m^2

All quantities presented are to neat-lines and do not allow / account for bulking, compaction, overlaps or material losses.

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FILE NAME: 1CS020.020 - UM-PP-Final Config.dwg

Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Final Configuration Plan and Profile

DRAWING NO. UM-PP-209

REVISION NO. A

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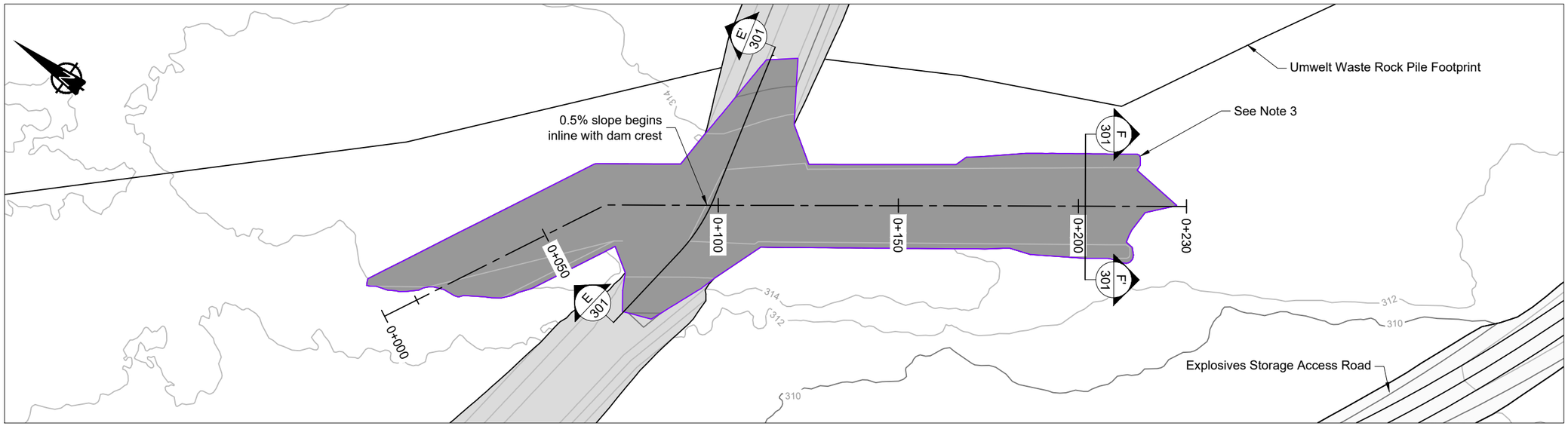


LEGEND

- Inferred Bedrock
- Contours
- Design Surface
- Existing Ground
- Other Design Infrastructure
- Primary Pond Design Spillway
- Primary Pond Design Infrastructure

NOTES

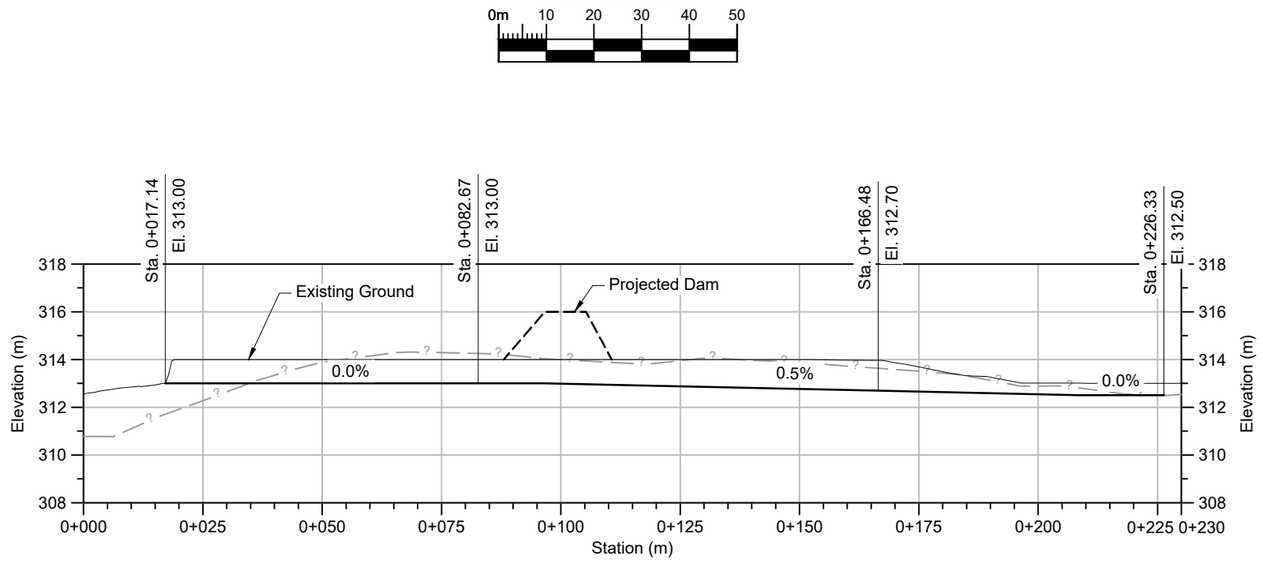
1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.
3. Berm required if cut depth is less than 1.0m.

REFERENCES

NAD83 UTM Zone 13.

Spillway Plan

0m 10 20 30 40 50



Spillway Profile

0m 2 4 6 8 10 Veritcal

0m 10 20 30 40 50 Horizontal

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FILE NAME: 1CS020.020 - UM-PP-Spillway.dwg

Sabina

Back River

SRK JOB NO.: 1CS020.020 | REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE:
Primary Pond Dam
Spillway Plan and Profile

DRAWING NO.: UM-PP-210

REVISION NO.: A

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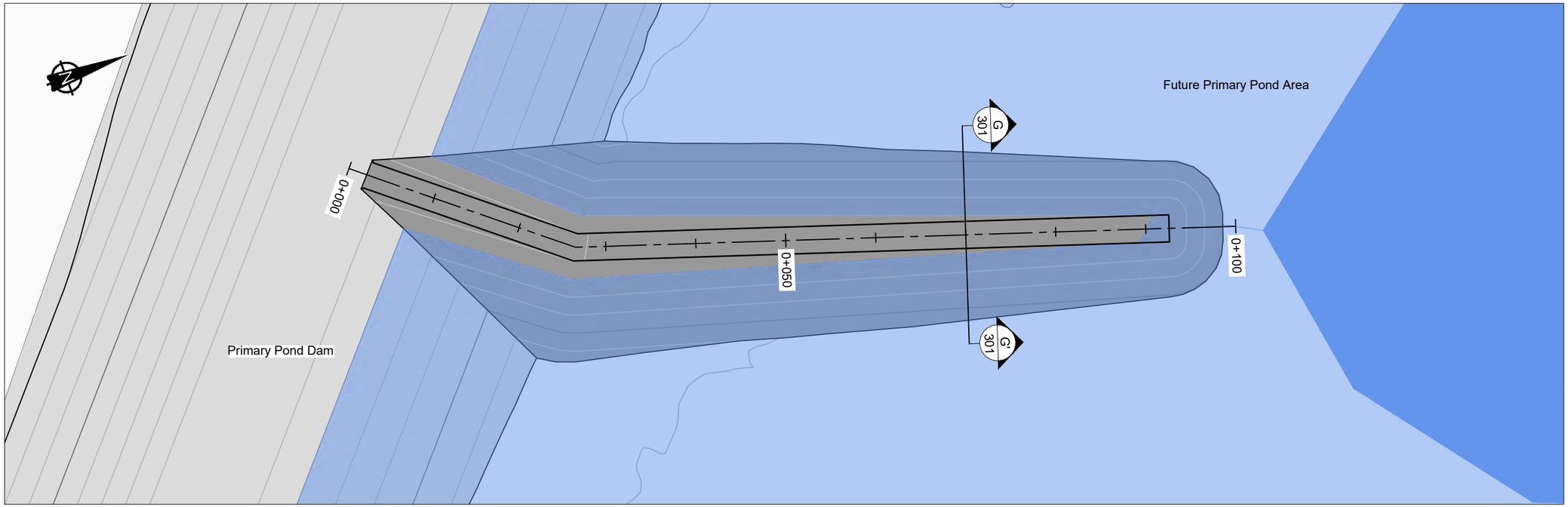
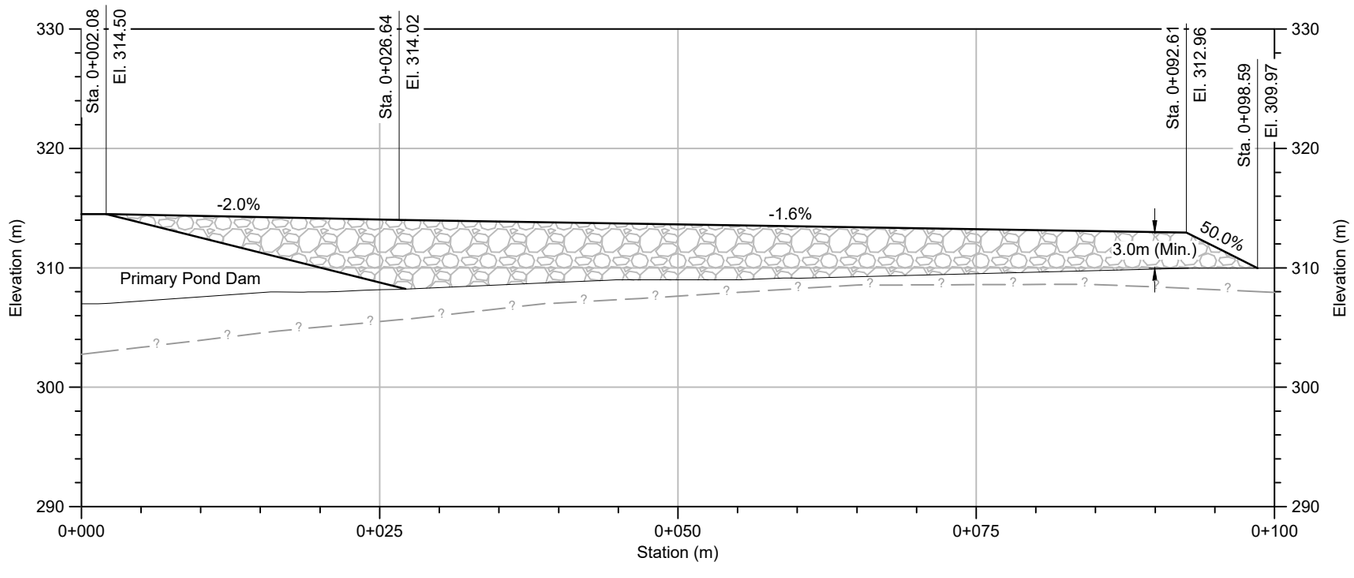


Reclaim Road Plan



Reclaim Road Centerline Profile

LEGEND

- Contours
- Design Surface
- Existing Ground
- Inferred Bedrock
- Waterbody
- Other Design Infrastructure
- Primary Pond Reclaim Road Design
- Primary Pond Design Infrastructure
- Run of Quarry

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.

REFERENCES

NAD83 UTM Zone 13.

0m 5 10 15 20

DRAWING NO.	DRAWING TITLE
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FILE NAME: 1CS020.020 - UM-PP-Reclaim Road.dwg			

Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Reclaim Road Plan and Profile

DRAWING NO. UM-PP-211

REVISION NO. A

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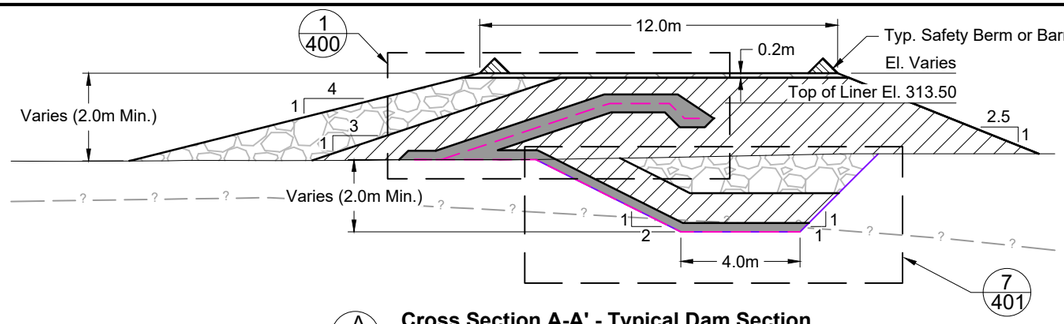
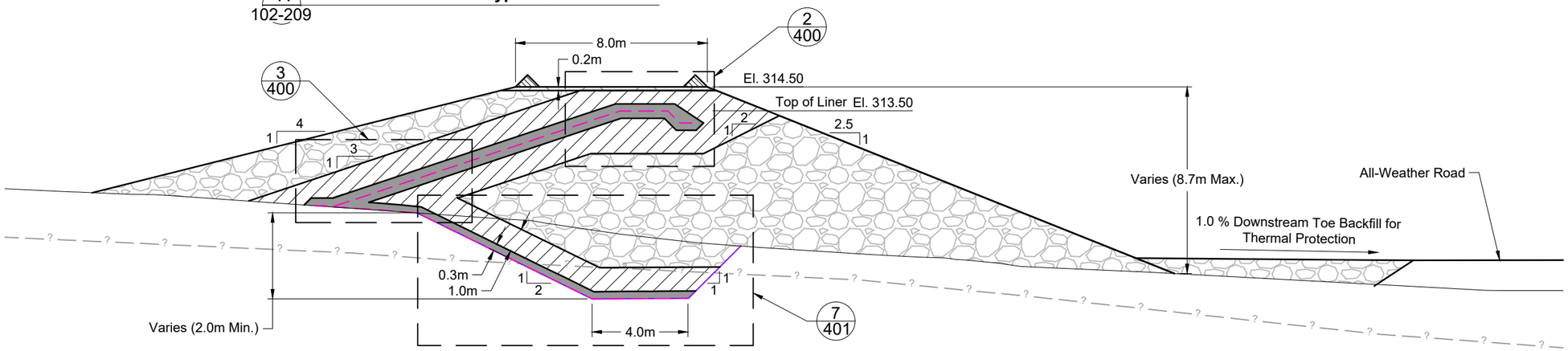
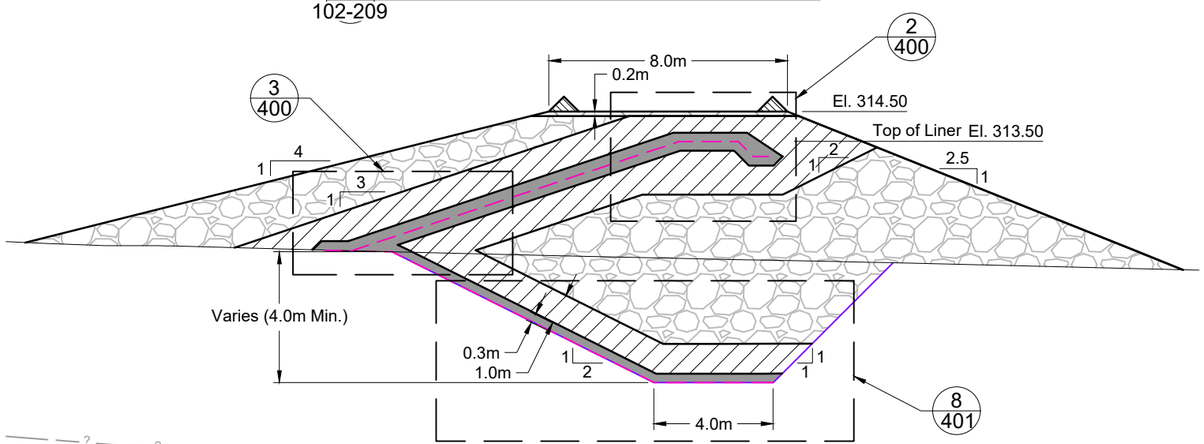


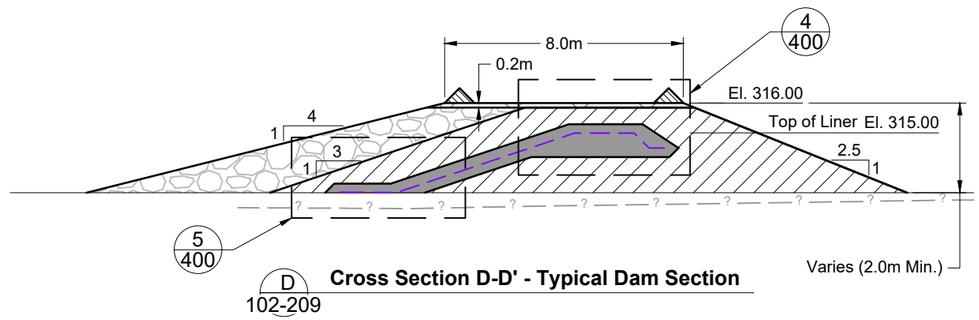
A
102-209
Cross Section A-A' - Typical Dam Section



B
102-209
Cross Section B-B' - Typical Dam Section



C
102-209
Cross Section C-C' - Typical Dam Section



D
102-209
Cross Section D-D' - Typical Dam Section

LEGEND

- Design Surface
- Excavation
- Existing Ground
- Inferred Bedrock
- HDPE Liner
- Non-woven Geotextile
- Bedding
- Run of Quarry
- Surfacing
- Transition Material

NOTES

1. All units are in meters unless otherwise specified.

SECTION LOCATION

Dam Crest Centerline Alignment Station (m)		Section
Start	End	
0+020	0+130	A-A'
0+130	0+190	B-B'
0+190	0+260	C-C'
0+260	0+600	B-B'
0+600	0+700	C-C'
0+700	0+770	B-B'
0+800	0+920	D-D'

0m 2 4 6 8

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Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 | REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Typical Dam Cross Sections

DRAWING NO.: UM-PP-300 | REVISION NO.: A

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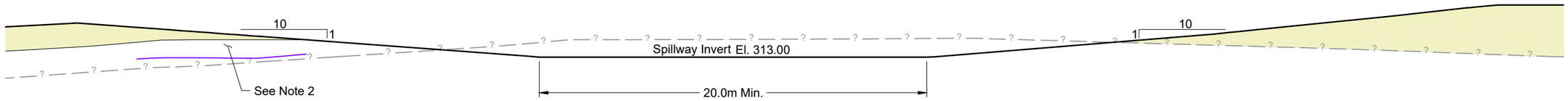
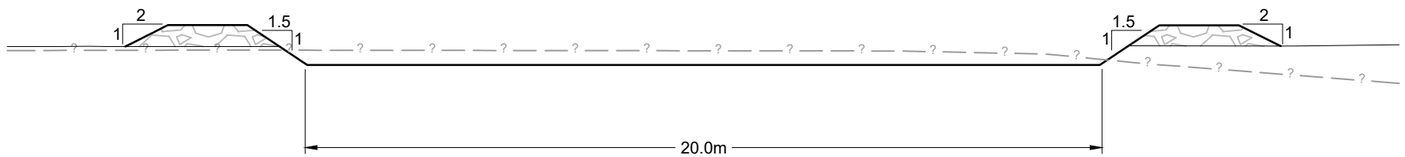


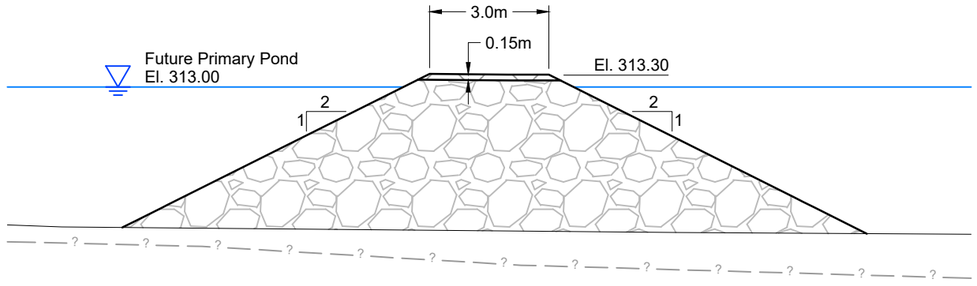
E 210 **Spillway - Section Through Access**

0m 2 4 6 8 10



F 210 **Spillway - Typical Section**

0m 1 2 3 4 5 6



G 211 **Reclaim Road - Typical Section**

0m 1 2 3 4 5 6

LEGEND

- Design Surface
- Excavation
- Existing Ground
- Inferred Bedrock
- Fill Material
- Run of Quarry
- Surfacing

NOTES

1. All units are in meters unless otherwise specified.
2. The transition between the overburden to bedrock cut to be 'field fit' with the approval of the site engineer to ensure that adequate (approx. 2m) of thermal protection is maintained over any exposed overburden or disturbed tundra.

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FILE NAME: 1CS020.020 - UM-PP-Dam-Typ Sect.dwg		

Sabina

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE:

Typical Spillway and Reclaim Road Cross Sections

DRAWING NO. UM-PP-301

REVISION NO. A

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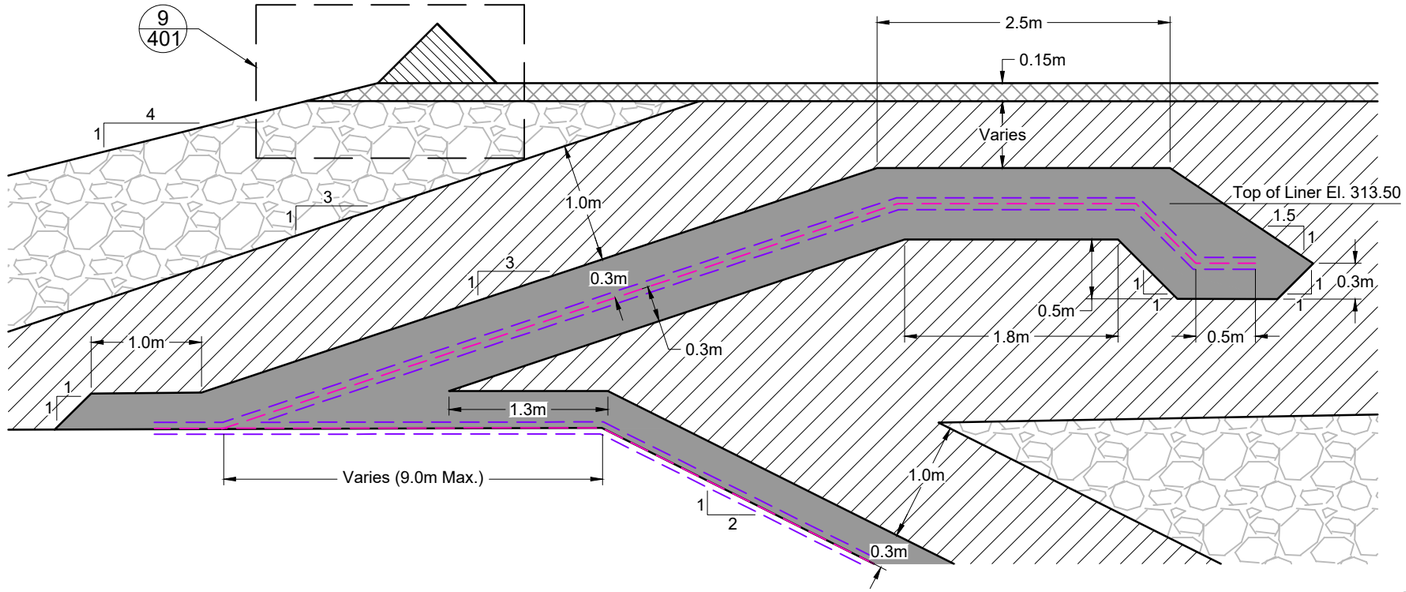
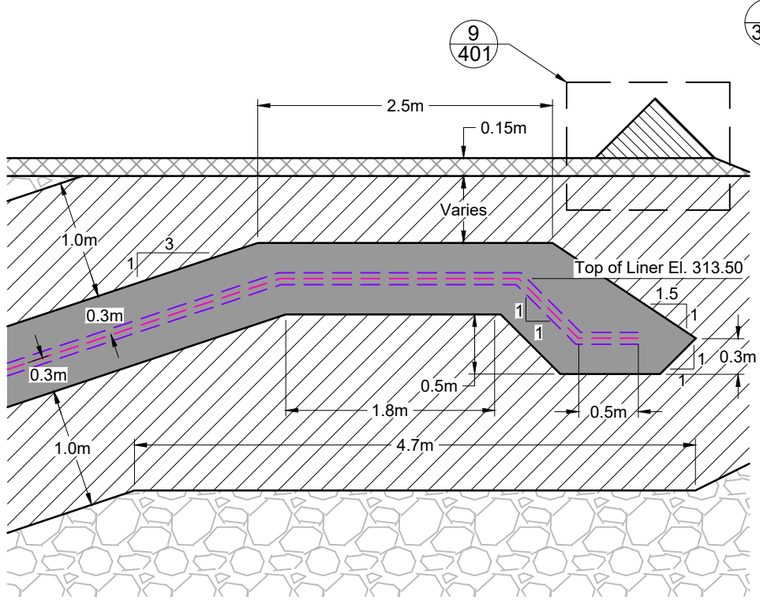
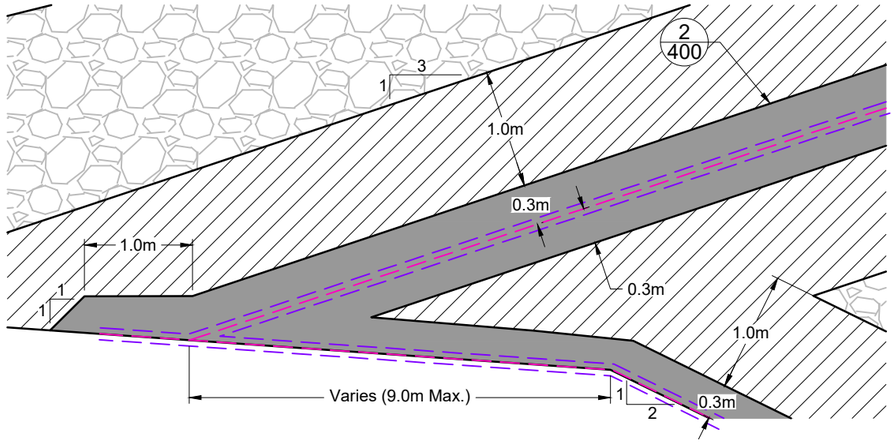


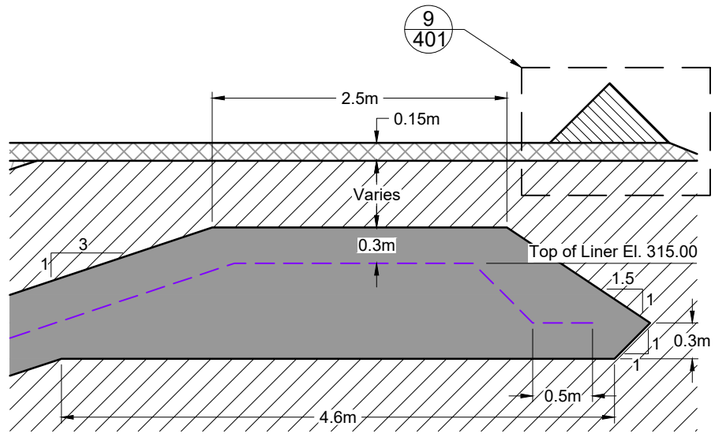
1 300 **Detail 1 - Section A-A' Liner and Bedding Placement**



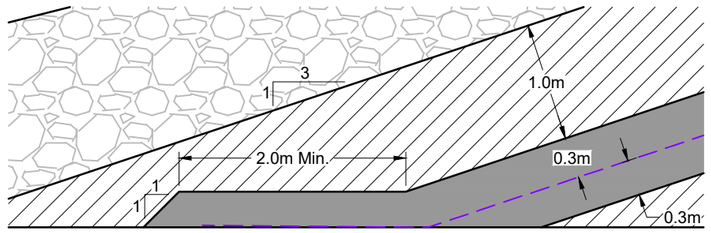
2 300,400 **Detail 2 - Section B-B' and C-C' Crest Liner and Bedding Placement**



3 300 **Detail 3 - Section B-B' and C-C' Toe Liner Overlap**



4 300 **Detail 4 - Section D-D' Crest Geotextile and Bedding Placement**



5 300 **Detail 5 - Section D-D' and C-C' Toe Geotextile Placement**

LEGEND

- Design Surface
- HDPE Liner
- Non-woven Geotextile
- Bedding
- Run of Quarry
- Surfacing
- Transition Material

NOTES

1. All units are in meters unless otherwise specified.

0m 0.5 1.0 1.5 2.0

DRAWING NO.	DRAWING TITLE
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FILE NAME: 1CS020.020 - UM-PP-Dam-Typ Sect.dwg

Sabina

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Details

DRAWING NO. UM-PP-400

REVISION NO. A

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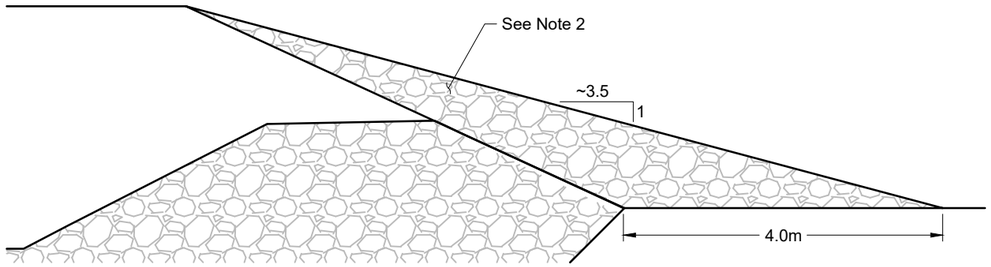
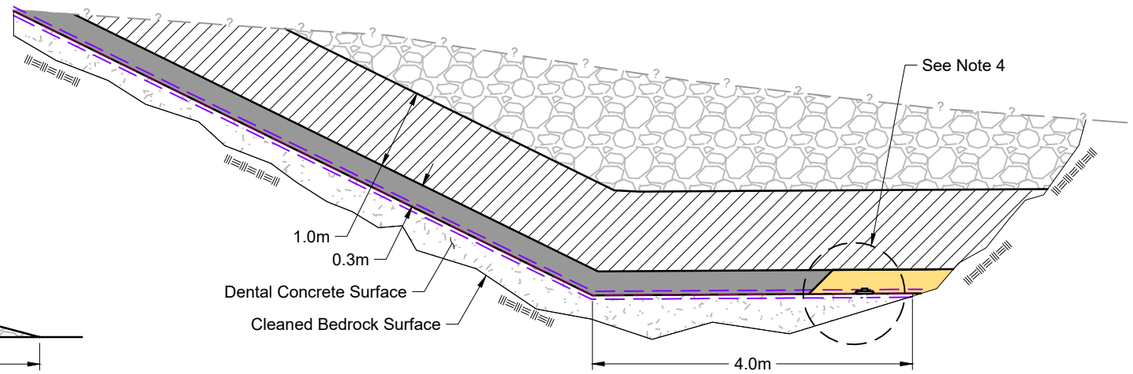


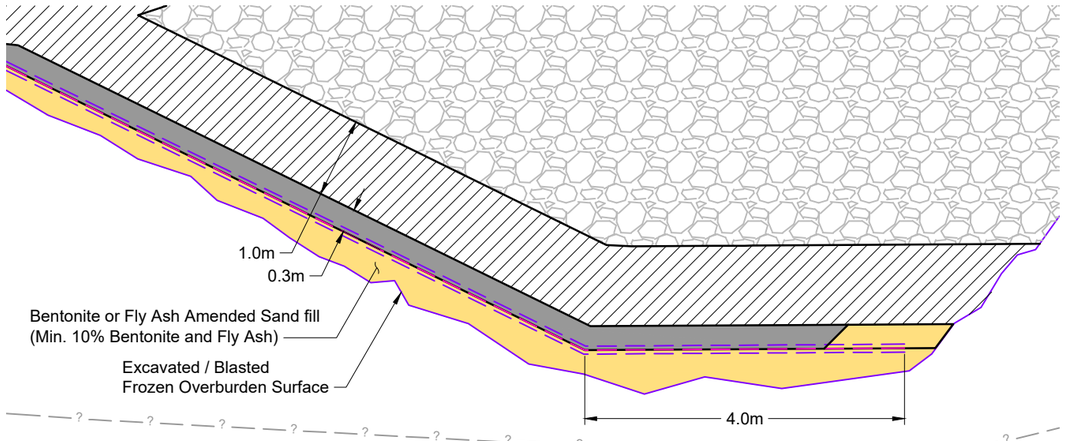
6/300 **Detail 6 - Contingency ROQ Thermal Barrier**

0m 1 2 3 4



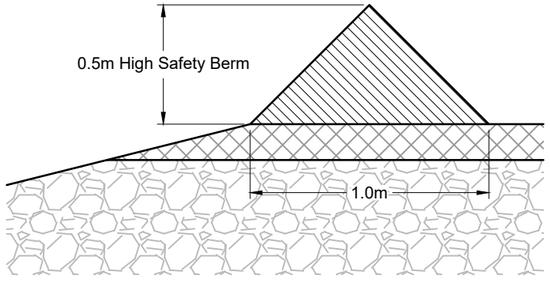
7/300 **Detail 7 - Downstream Liner to Bedrock Tie-in Seepage Cut Off - Plan**

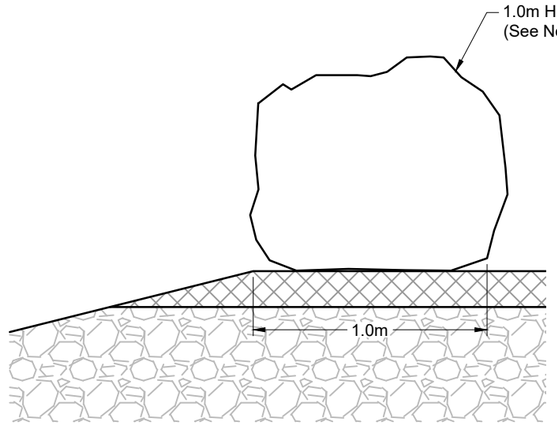
0m 1 2 3 4



8/300 **Detail 8 - Downstream Liner to Overburden Tie-in - Plan**

0m 1 2 3 4





9/400 **Detail 9 - Typical Safety Berm or Barrier Options**

0m 0.25 0.5 0.75 1.0

LEGEND

- Design Surface
- Excavation
- HDPE Liner
- Inferred Bedrock
- Non-woven Geotextile
- Cleaned Bedrock
- Bedding
- Bentonite / Fly Ash Sand Fill
- Concrete
- Run of Quarry
- Surfacing
- Stainless Steel
- Transition Material

NOTES

1. All units are in meters unless otherwise specified.
2. If the key trench is over-blasted or over-excavated, beyond the new design lines presented for the downstream toe of the outside dam shell, then additional ROQ material will be required to be placed in and above the backfill key trench.
3. Barrier required when Primary Pond Dam height exceeds 3.0m.
4. For the bedrock sections at liner anchor, bolt or water stop to be placed to create a better seal between the bedrock and the liner at the back / downstream side of the key trench.

REFERENCE DRAWINGS		REVISIONS									
DRAWING NO.	DRAWING TITLE	NO.	DESCRIPTION	CHK'D	APP'D	DATE	NO.	DESCRIPTION	CHK'D	APP'D	DATE
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CHECKED: JD/AT/VB	APPROVED: JBK	DATE: 2022/09/02
FILE NAME: 1CS020.020 - UM-PP-Dam-Typ Sect.dwg		

Sabina

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Details

DRAWING NO. UM-PP-401

REVISION NO. A

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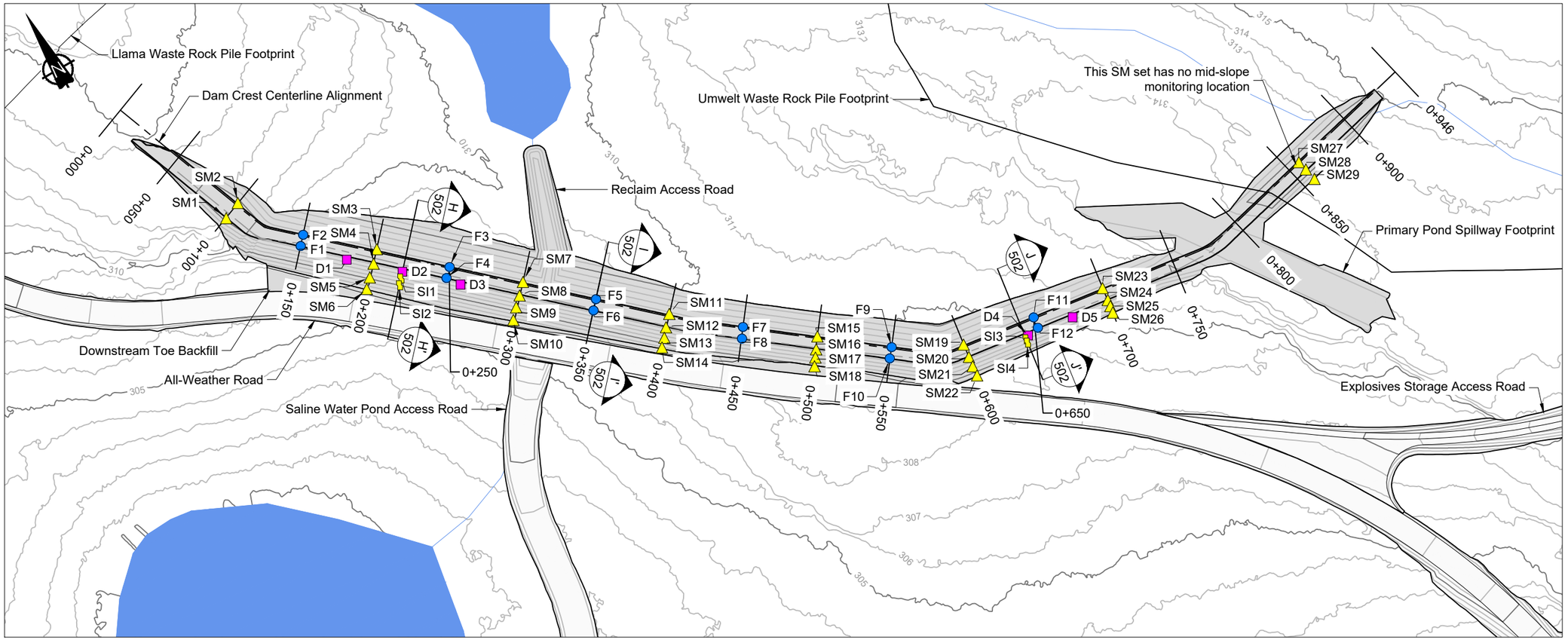

Primary Pond Dam Plan

LEGEND

- Fixed Survey Monitoring Point
- Surficial Survey Monitoring Point
- Deep Monitoring Point
- Slope Inclinometers
- Contours
- Monitoring Section
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.

REFERENCES

NAD83 UTM Zone 13.

Surficial Survey Monitoring Points

Identify	Easting	Northing
SM1	429493.6	7271483
SM2	429505.4	7271487
SM3	429570.2	7271414
SM4	429563.6	7271407
SM5	429556.8	7271400
SM6	429551.1	7271395
SM7	429643.8	7271347
SM8	429637.3	7271340
SM9	429631.4	7271334
SM10	429625.5	7271328
SM11	429717.6	7271279
SM12	429711.3	7271273
SM13	429706.8	7271267
SM14	429702.2	7271262
SM15	429795.7	7271217
SM16	429790.6	7271210
SM17	429787.5	7271206
SM18	429784.1	7271201
SM19	429877.3	7271164
SM20	429876.4	7271155
SM21	429875.5	7271148
SM22	429874.9	7271141
SM23	429976.6	7271150
SM24	429975.6	7271141
SM25	429975	7271137
SM26	429974.4	7271132
SM27	430131.8	7271157
SM28	430133.6	7271151
SM29	430135.3	7271142

Deep Survey Monitoring Points

Identify	Easting	Northing
D1	429549.4	7271418
D2	429577.5	7271393
D3	429606.8	7271366
D4	429917.7	7271147
D5	429949.6	7271143

Slope Inclinometer Monitoring Points

Identify	Easting	Northing
SI1	429574.6	7271390
SI2	429571.5	7271386
SI3	429915.5	7271146
SI4	429915.1	7271144

Fixed Survey Monitoring Points

Identify	Easting	Northing
F1	429527.3	7271442
F2	429532.5	7271447
F3	429606.3	7271380
F4	429600.8	7271374
F5	429680.2	7271312
F6	429675	7271307
F7	429755.8	7271247
F8	429751.3	7271241
F9	429835	7271186
F10	429830.2	7271180
F11	429926.9	7271156
F12	429925.9	7271149

0m 30 60 90 120

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FILE NAME: 1CS020.020 - UM-PP-Instrum plans.dwg

Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 | REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE: Primary Pond Dam Instrumentation Plan

DRAWING NO.: UM-PP-500 | REVISION NO.: A

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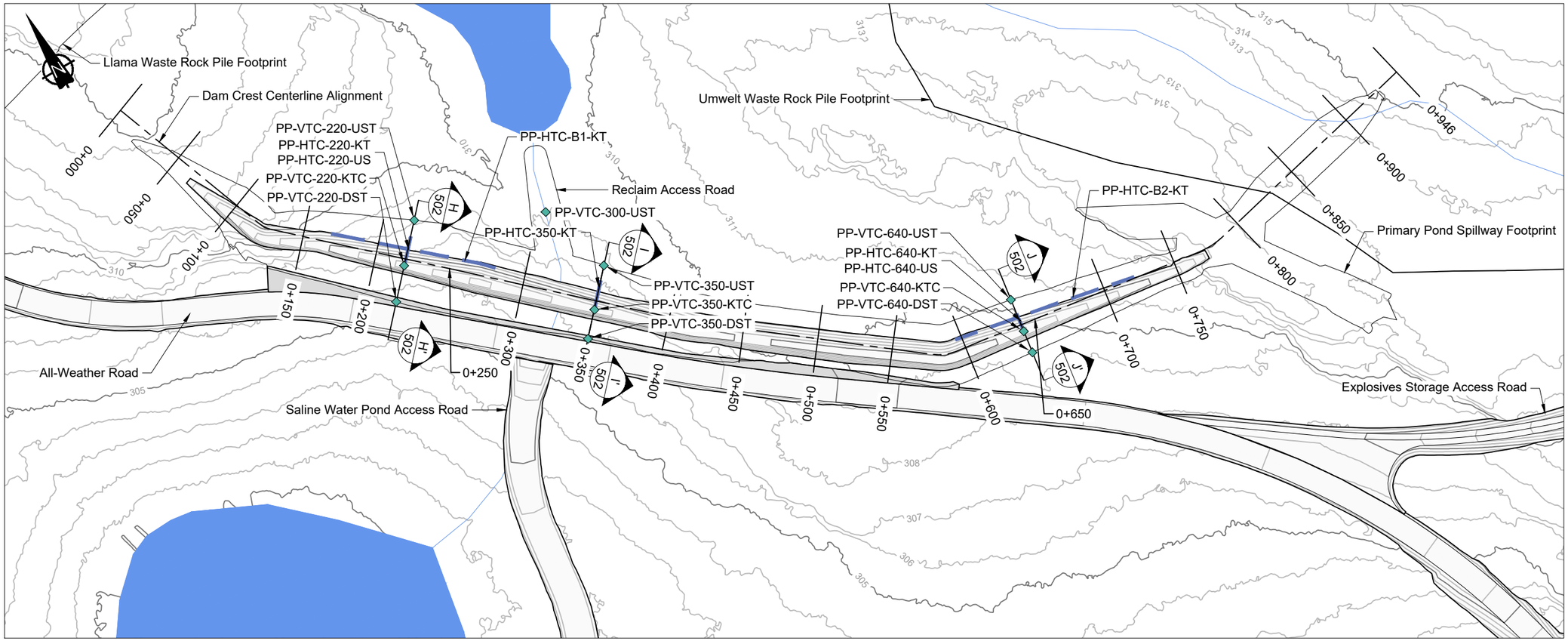

Primary Pond Dam Plan

LEGEND

- Vertical Ground Temperature Cable
- Horizontal Ground Temperature Cable
- Contours
- Monitoring Section
- Waterbody
- Other Design Infrastructure
- Primary Pond Design Infrastructure

NOTES

1. Contours are shown at 1.0 m intervals.
2. All units are in meters unless otherwise specified.

REFERENCES

NAD83 UTM Zone 13.

Vertical Ground Cable Locations

Identify	Easting	Northing
PP-VTC-220-DST	429563.9	7271378
PP-VTC-220-KTC	429580.5	7271396
PP-VTC-220-UST	429601.4	7271419
PP-VTC-300-UST	429680	7271380
PP-VTC-350-DST	429662.2	7271293
PP-VTC-350-KTC	429675.7	7271307
PP-VTC-350-UST	429695.8	7271330
PP-VTC-640-DST	429914.3	7271137
PP-VTC-640-KTC	429916.2	7271152
PP-VTC-640-UST	429919.3	7271174

0m 30 60 90 120

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FILE NAME: 1CS020.020 - UM-PP-Instrum plans.dwg		

Sabina GOLD & SILVER CORP.

Back River

SRK JOB NO.: 1CS020.020 REG. NO.: EGBC 1003655

Primary Pond

DRAWING TITLE:
Primary Pond Dam
Horizontal and Vertical GTC Layout

DRAWING NO. UM-PP-501

REVISION NO. A

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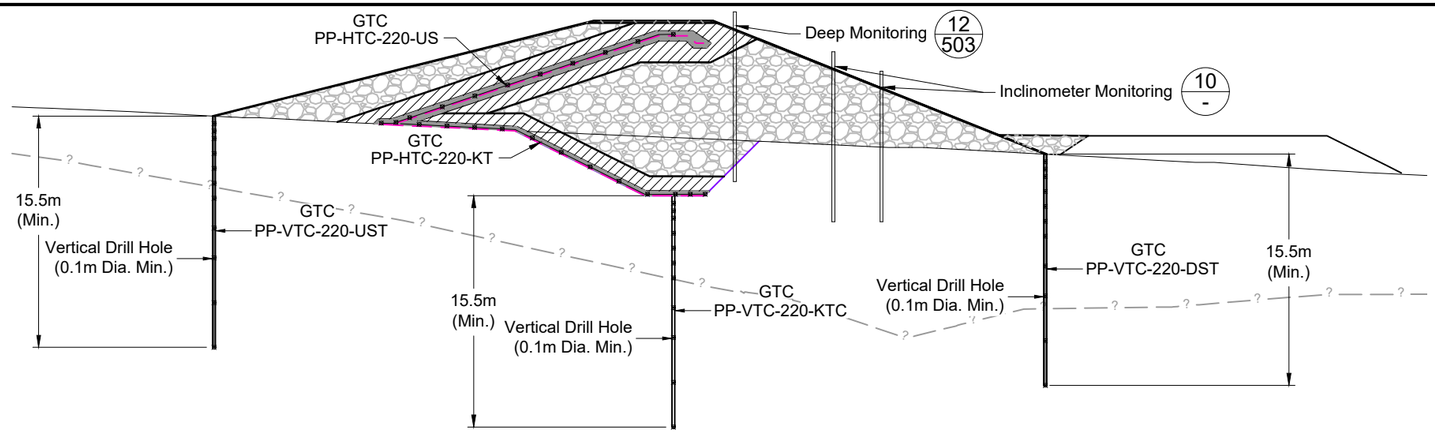

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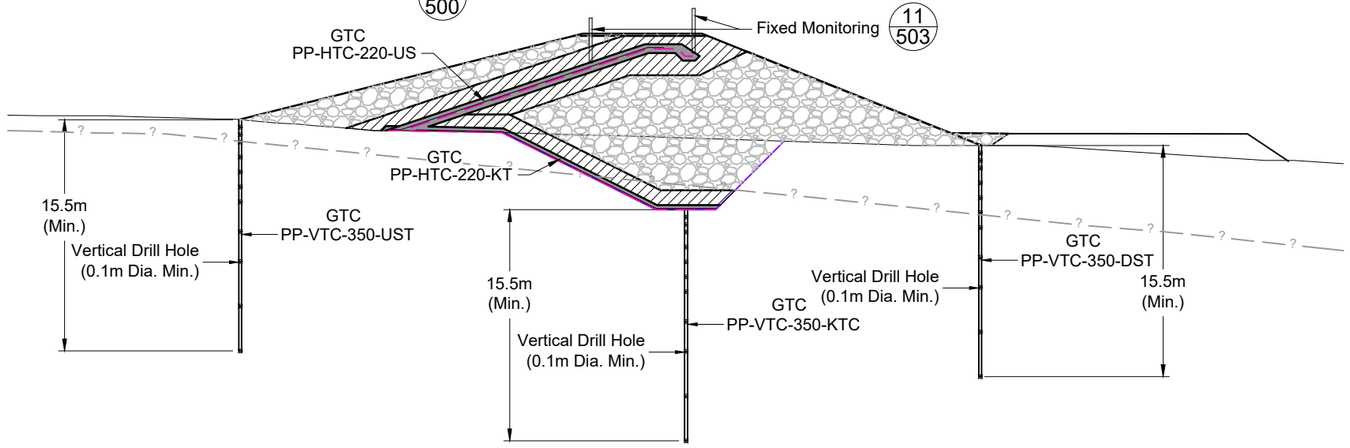
Ground Temperature Cable at Station 0+220



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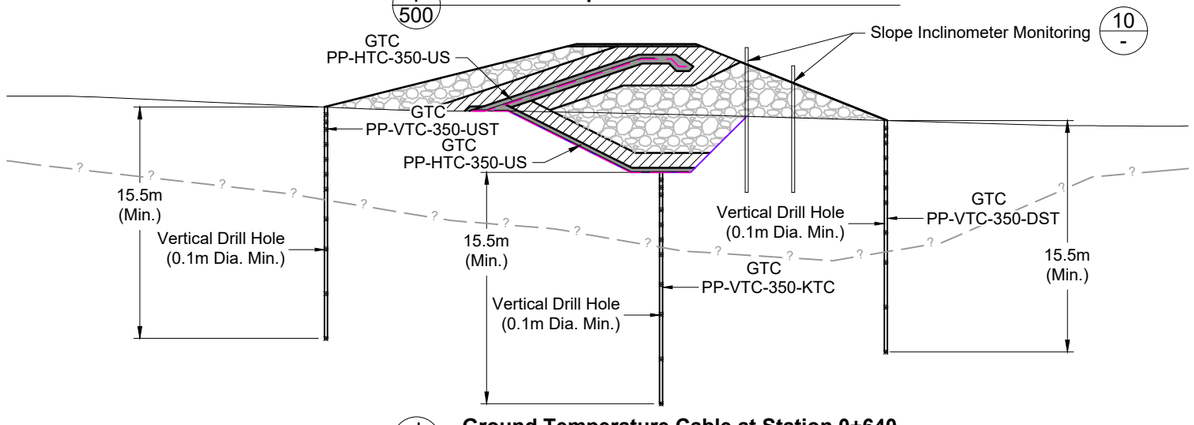
Ground Temperature Cable at Station 0+350



J
500

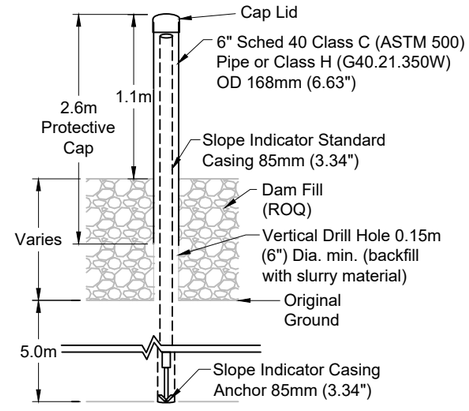
Ground Temperature Cable at Station 0+640

LEGEND

- Design Surface
- Excavation
- Existing Ground
- Inferred Bedrock
- HDPE Liner
- Bedding
- Run of Quarry
- Surfacing
- Transition Material

NOTES

1. All units are in meters unless otherwise specified.
2. Bead spacing is as follows:
   -Vertical Cables (below ground surface): 0.5, 1.0, 1.5, 2.5, 3.5, 4.5, 5.5, 7.5, 9.5, 12.5, 15.5
   -Horizontal cables : at 0, 1, 2, then every 2 m after until the end of cable.
3. GTC = Ground Temperature Table



10
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Inclinometer Installation Detail

Not To Scale

0m 4 8 12 16

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REFERENCE DRAWINGS

NO.	DESCRIPTION	CHK'D	APP'D	DATE
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JD/AT/VB	JBK	2022/09/02

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Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 REG. NO.:

Primary Pond

DRAWING TITLE:

Primary Pond Dam Instrumentation Details

DRAWING NO. UM-PP-502

REVISION NO. A

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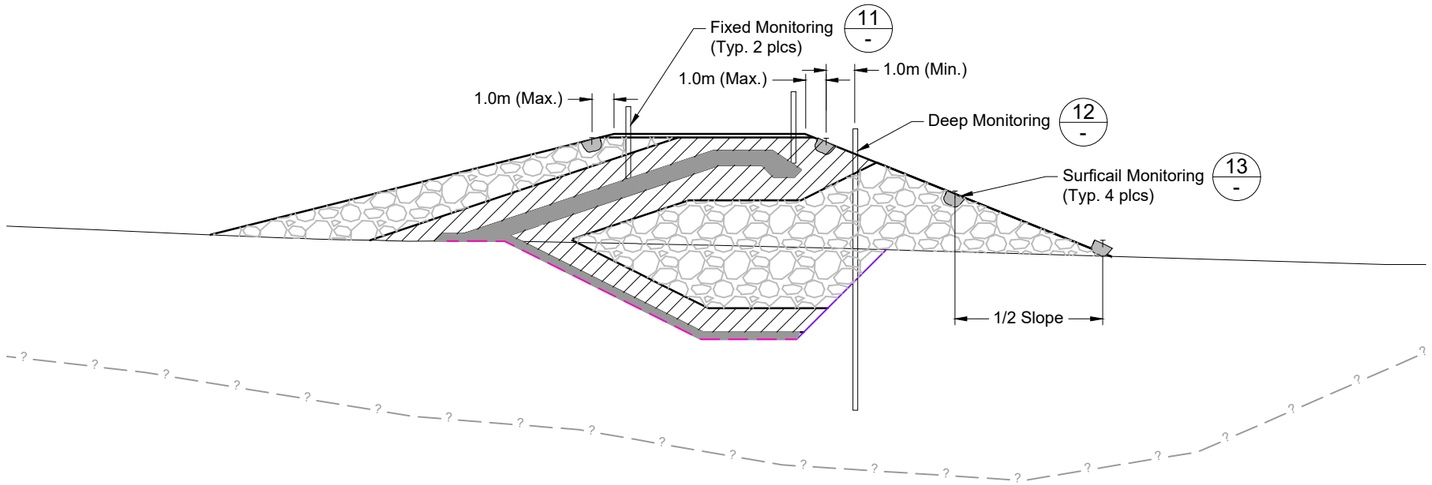
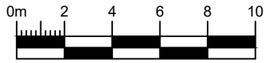
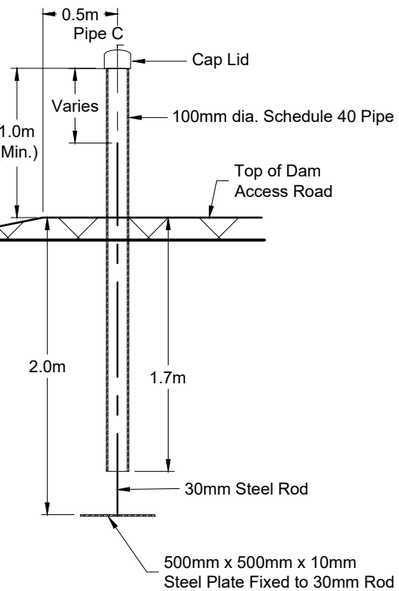
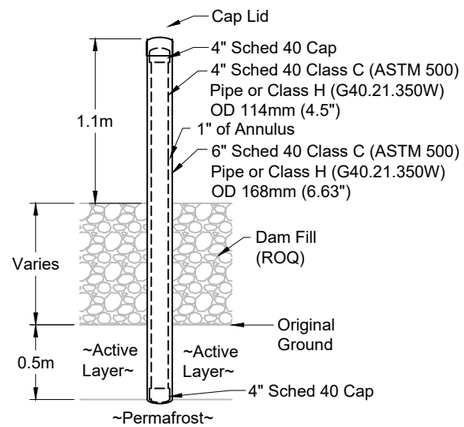


Typical Survey Monitoring Pin Locations

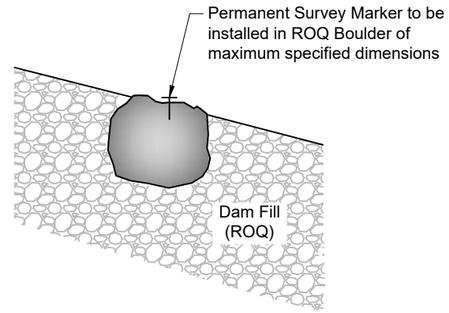




11 - **Fixed Survey Monitoring Point Detail**
Not To Scale



12 - **Deep Settlement Point Installation Detail**
Not To Scale



13 - **Surficial Survey Point Installation Detail**
Not To Scale

LEGEND

- Design Surface
- Excavation
- Existing Ground
- Inferred Bedrock
- HDPE Liner
- Bedding
- Run of Quarry
- Surfacing
- Transition Material

NOTES

1. All units are in meters unless otherwise specified.

DRAWING NO.	DRAWING TITLE
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REFERENCE DRAWINGS

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FILE NAME: 1CS020.020 - UM-PP-Instrum plans.dwg

Sabina GOLD & SILVER CORP

Back River

SRK JOB NO.: 1CS020.020 | REG. NO.:

Primary Pond

DRAWING TITLE:
Primary Pond Dam
Instrumentation Details

DRAWING NO.: UM-PP-503 | REVISION NO.: A

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APPENDIX B – EARTHWORK TECHNICAL SPECIFICATIONS

0Technical Specifications Earthworks and Geotechnical Engineering
Back River Gold Project, Nunavut Canada
Revision 01 – Issue for Construction

Prepared for

Sabina Gold & Silver Corp.

Prepared by

SRK Consulting (Canada) Inc.
1CS020.020
August 2022

0Technical Specifications Earthworks and Geotechnical Engineering
Back River Gold Project, Nunavut Canada
Revision 01 – Issue for Construction

August 2022

Prepared for

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Tel: +1.604.998.3344

Prepared by

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2200–1066 West Hastings Street
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Canada

Tel: +1 604 681 4196

Project No: 1CS020.020

File Name: BackRiver_TechSpecs_1CS020.016_20180328_Rev0.docx

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Table of Contents

1 General Requirements

1.1 Part 1 – General

1.1.1 Documents

1. This section of the Specifications forms part of the Contract Documents and are to be read, interpreted and coordinated with all other parts.

1.1.2 Revision Summary

1. Table 1.1 provides a summary of the revision history of this Technical Specification.

Table 1.1: Revision history of this Technical Specification

Revision	Status	Date	Major Changes
A	2018 Construction – limited scope	March 2018	Initial revision
0	Issued for Construction	April 2018	Minor text edits. Reviewed by Sabina
1	Issued for Construction	Aug 2022	Minor updates, additional checks linked to pond construction.

1.1.3 Definitions

1. The following definitions and interpretations shall apply to these Technical Specifications:

   (1) PROJECT means the total Back River Project Construction contemplated, of which the Works described in this Document may be the whole or part.

   (2) WORKS is defined as the entire completed construction as defined by this Document, or the various separately identifiable parts thereof, required to be furnished under the Contract Documents. Works is the result of performing services, furnishing labour, and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

   (3) CONTRACT DOCUMENTS are defined as the agreement, addenda (which pertain to the Contract Documents), Contractor's bid (including documentation accompanying the bid and any post-bid addenda submitted) when attached as an exhibit to the agreement, the bonds, the general conditions, the supplementary conditions, these Specifications, the Drawings, together with all Modifications issued after the execution of the agreement.

   (4) SPECIFICATIONS are defined as this Document of Specifications prepared by SRK Consulting (Canada) Inc. on behalf of the Owner. These Specifications are to be read, interpreted and coordinated with all Drawings and Modifications, or any other relevant documents produced by the Engineer.

   (5) DRAWINGS are defined as all Engineering Drawings, plans, sketches and maps issued with these Specifications, or subsequently, as deemed necessary by the Engineer.

(6) MODIFICATIONS are defined as changes made to the Specifications and/or Drawings, which have been approved by the Engineer in writing. These modifications can be issued at any time, including after issuance of these Specifications and any accompanying Drawings and/or other Modifications.

(7) SUBMITTALS are defined as any documentation, as outlined in this Document, that are used as formal means of communication during execution of the Works, and originated by any of the Responsible Parties.

(8) Responsible Parties:

a) OWNER is defined as Sabina Gold & Silver Corp., or an authorized representative of the company. Sabina Gold & Silver Corp., Owner, and Sabina shall have common meaning.

b) ENGINEER (also, ENGINEER-OF-RECORD) is defined as a representative appointed and authorized by the Owner for those Works described in this Document. The Engineer shall be a registered Professional Engineer in the Territory of Nunavut, or a designated site representative under direct supervision of the Engineer during construction. At the time of issuing this Document, the Engineer-of-Record is a designated employee of SRK Consulting (Canada) Inc. (SRK). The Engineer has a direct contract with the Owner, and reports to the Owner. The Engineer may not communicate directly with the Contractor and Environmental Monitor, unless approved by the Owner.

c) CONTRACTOR is defined as the party or appointed representative of the party that has an agreement with the Owner to execute the Works defined in this Document. At the time of issuing this Document, the earthworks Contractor is Nuna Logistics Limited (NUNA). The Contractor may not communicate directly with the Engineer or the Environmental Monitor, unless approved by the Owner.

d) SUB-CONTRACTOR is defined as the party or appointed representative of the party that has an agreement with the Contractor or Owner to execute specialized components of the Works defined in this Document that cannot be carried out by the Contractor.

e) ENVIRONMENTAL MONITOR is defined as the party or appointed representative of the party that has an agreement with the Owner to act as Environmental Monitor for the Project, including the Works defined in this Document. At the time of issuing this Document, the Environmental Monitor is the Owner.

f) SURVEYOR is defined as the party or appointed representative of the party that has an agreement with the Contractor and/or Owner to act as Site Surveyor for the execution of the Works defined in this Document. The Surveyor shall have equipment and means on site to carry out horizontal and vertical ground surveys with an accuracy of ±2 mm. The Surveyor shall also have the equipment and means to prepare Digital Terrain Models (DTM) and Drawings on site that is compatible with AutoCAD 2017 or later. The Surveyor reports to the Contractor, but will be available

for use by the Engineer as required, provided the Engineer has requested such needs through the Owner.

g) QUALITY CONTROL TEAM is defined as the individual(s) working under the direction of the Owner and/or Contractor to perform on site Quality Control (QC) for the Works defined in this Document.

h) QUALITY ASSURANCE TEAM is defined as the individual(s) working under the direction of the Engineer to perform on-site Quality Assurance (QA) for the Works defined in this Document.

(9) ON-SITE MATERIAL is defined as borrow materials obtained from within designated on-site facility excavations.

(10) OFF-SITE MATERIAL is defined as material obtained from sources other than on-site.

(11) RECORD DOCUMENTS are defined as the documents prepared and certified by a Land Surveyor, Material Testing Technician, Quality Control and/or Quality Assurance Personnel, Specialist Professionals, or any other parties documenting any aspect of the Works.

(12) PRODUCTS are defined as processed fill material, machines, components, equipment, fixtures, and systems forming the Works. This does not include machinery and equipment used for preparation, fabrication, conveying, and erection of the Works. Products may also include existing material or components required for reuse.

(13) SLOPES are defined in all instances in these Specifications and on Drawings in terms of horizontal distance to vertical distance (i.e., 2H:1V shall be read as 2 Horizontal to 1 Vertical).

(14) PLANT means all the fixed equipment and structures used in fill processing, concrete mixing and explosives production.

(15) EQUIPMENT means all mobile construction equipment that will be used in execution of the Works.

1.1.4 Summary of Works

1. The Contractor, with support from the Owner, will be responsible for ensuring that all the Works defined in this Document will be executed in accordance with all appropriate permits and approvals. Furthermore, the Contractor is responsible for ensuring that all the Works are carried out in accordance with the Owners Environmental Management Plans and Procedures (EMPs).

2. The Works covered by this Specification includes, but is not limited to the following:

(1) Implementation, operation, maintenance and removal of temporary construction runoff management and sediment control measures.

(2) Construction of permanent surface water management structures.

(3) Operation and management of permanent surface water management structures up to the time of complete demobilisation.

(4) Clearing, stripping and excavation in required areas.

(5) Development of borrow areas and borrow access roads. This includes quarry development, management and closure.

(6) Production of construction material specified in the Specifications, and on the Drawings.

(7) Construction of earthworks components of all-weather roads.

(8) Construction of earthworks components of road turnouts and caribou crossings along all-weather roads.

(9) Construction of earthworks components of laydown areas.

(10) Construction of earthworks components of camp/mill pads.

(11) Removal of temporary structures used during construction of the Works and clean-up of the construction areas, borrow areas, and stockpile areas.

Note that once construction is completed, and a handover from the Contractor to Owner has resulted, then operation and management of permanent surface water management structures become part of the Owners responsibility.

3. Electrical, instrumentation (other than specified), mechanical, concrete and structural work are excluded from this scope of work.

1.1.5 Contradictions

1. Should any contradiction, either implied or real, exist between the Specifications and the Drawings, the Contractor shall:

   (1) Notify the Owner and the Engineer.

   (2) Stop all Works that concern the contradiction until the contradiction is remedied or clarified by the Engineer.

2. The decision of the Engineer is final.

1.1.6 Owner Responsibilities

1. The Owner, in the context of the Works defined in this Document, shall:

   (1) Be the formal liaison between all parties.

   (2) Be responsible for overseeing execution of the Works, in accordance with the Engineer's Specifications and Drawings.

   (3) Be responsible for procurement of all materials to execute the Works.

   (4) Become familiar with all relevant permits, approvals and any other administrative matters which may impact the Works. The Engineer will assume that all appropriate approvals

have been obtained and that all conditions have been satisfied when giving technical approvals to proceed with the Works.

(5) Before proceeding with the Works, examine all Drawings and Specifications and report to the Engineer any apparent discrepancies or interferences. The Engineer shall always retain the right to make revisions to the Drawings and the Specifications.

(6) Ensure an appropriate work space, necessary facilities and transportation equipment is available to the Engineer or the Engineer's representatives to perform their duties on site.

(7) Ensure that the Engineer and the Engineer's representatives receive appropriate site-specific health and safety training and/or orientation whilst on site.

1.1.7 Contractor's Responsibilities

1. The Contractor, in the context of the Works defined in this Document shall:

(1) Comply with Nunavut Worker Compensation Board, Northern Canada Mine Safety Act and any other relevant required health and safety regulations.

(2) Comply with Owner's Environmental Management Plan and Procedures (EMPs).

(3) Provide the Owner with a copy of the Health and Safety Plan, which has been specifically prepared for this Project.

(4) Become familiar with the relevant regional and site-specific conditions that deviate from the Specification and Drawings, and inform the Engineer through the Owner when a problem or delay is anticipated.

(5) Be responsible for making independent measurements and installing the Works to fit the conditions encountered.

(6) Before proceeding with the Works, examine all Drawings and Specifications and report to the Engineer via the Owner any apparent discrepancies or interferences. The Engineer shall always retain the right to make revisions to the Drawings and the Specifications.

1.1.8 Engineer's Responsibilities

1. The Engineer, in the context of the Works defined in this Document, shall:

(1) Comply with Owner's Environmental Management Plans and Procedures (EMPs).

(2) Provide the Owner and Contractor with Drawings and Specifications, including Revisions and Modifications, to be able to conduct the Works defined in this Document.

(3) Provide the Owner and Contractor with digital Drawing files to facilitate setting out the Works defined in this Document.

(4) Provide full-time site Engineer(s) during construction of the Works as defined in this Document. The Engineer will monitor construction activities to ensure that the Works are constructed in accordance with the Drawings and Specifications.

(5) Ensure timely response as defined in this Document, to Submittals pertaining to the Drawings or Specifications submitted by the Owner and Contractor.

1.1.9 Codes and Standards

1. The Quality Control and Assurance Program (QA/QC) as described in this Document, shall use testing procedures from, but not limited to the list of American Society of Testing and Materials Standards in Table 1.2.

Table 1.2: List of Codes and Standards

Test	Topic
ASTM D2487	Classification of Soils for Engineering Purposes
ASTM D2216	Water (Moisture) Content in Soil and Rock
ASTM C136	Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
ASTM D854	Specific Gravity of Soils
ASTM D698	Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D2922	Density of Soil in Place by Nuclear Methods

1.1.10 Quality Control

1. The Contractor will carry out Quality Control (QC) for the Works defined in this Document, and will undertake testing at a frequency and at the locations specified in the various sections of these Specifications and Drawings, or as defined in their approved Quality Control program.
2. The Contractor shall submit a copy of the QC program for review by the Engineer and Owner at least seven (7) days prior to commencement of the Works.
3. All QC or other test data, survey data or the like, collected by the Contractor, shall be made available to the Owner and Engineer on request.
4. The Owner and Contractor shall provide all the necessary equipment and technicians for materials and product testing required to execute the QC program.
5. QC shall be done continuously, as specified in this Document, to ensure the quality of products and Works.
6. The Contractor’s QC shall be done independently from the Engineer’s Quality Assurance (QA).

7. QA, or any other form of performance testing by the Engineer or Owner, shall in no way relieve the Contractor of its sole responsibility for completing the Works in accordance with the specified requirements.

8. Geochemical testing of any construction material will be the responsibility of the Owner, and will be controlled by the Owner. The Contractor is however responsible to ensure that any applicable testing has been carried out and that any construction material has been approved for use.

1.1.11 Quality Assurance

1. The Engineer will carry out Quality Assurance (QA) for the Works defined in this Document, and will undertake testing at a frequency and at the locations specified in the various sections of these Specifications and Drawings. The Engineer may undertake any additional testing which is deemed necessary on any part of the Works.

2. This Document, and the Drawings outline the Engineer's QA program, and is subject to review by the Owner and Contractor.

3. All QA or other test data, collected by the Engineer, shall be made available to the Owner and Contractor on request.

4. The Contractor and Owner shall render such assistance as is necessary to enable QA sampling and testing to be carried out expeditiously, and provide all the necessary equipment, including an adequately equipped on-site laboratory.

5. The Engineer's QA shall be done independently from the Contractors QC.

6. QA, or any other form of performance testing by the Engineer or Owner, shall in no way relieve the Contractor of its sole responsibility for completing the Works in accordance with the specified requirements.

7. Geochemical testing of any construction material will be the responsibility of the Owner, and will be controlled by the Owner. The Contractor is however responsible to ensure that any applicable testing has been carried out and that any construction material has been approved for use.

1.1.12 Submittals

1. The Contractor shall submit information as specified and requested from the Engineer through the Owner. All submittals required by the Engineer will be requested through the Owner.

2. The Engineer has the right to request as a Submittal any other information deemed necessary throughout execution of the Works. This includes information not currently defined as Submittal information on the Drawings and Specifications.

1.1.13 Construction Schedule

1. Construction scheduling is the responsibility of the Owner; however, the Contractor and Owner is reminded of the following very important facts:

(1) Access directly over the tundra should be expected to be limited in the summer, and avoided wherever possible, to avoid permafrost damage and degradation

(2) In the winter snow and ice cover over the tundra would be expected to be required on access routes, again to avoid permafrost damage and degradation.

(3) Timelines for instream or near stream works exist for all fish bearing streams. Typically, no construction can result at these crossing (or culvert locations) between May and the end of July (to be confirmed with the Owner and as per all applicable permits).

(4) Any excavations into soil permafrost are typically expected to be required to result in the winter; specifically, when average daily ambient air temperature is below -10^{o}C.

1.1.14 Construction Drawings

1. Drawings will be issued by the Engineer specific to construction needs prior to commencement of the Work. Drawings shall be reviewed by the Owner and Contractor to ensure all aspects of the construction needs are covered, and report to the Engineer any discrepancies and interferences. The Owner shall notify and inform the Engineer of construction progress and Drawing requirements four (4) weeks prior to commencement of any Works.
2. Only Drawings explicitly marked with the following words and without any other stamps or notes in contradiction are considered acceptable for Construction: ISSUED FOR CONSTRUCTION, or IFC.

1.1.15 Construction Specifications

1. Specifications will be issued by the Engineer specific to construction needs prior to commencement of the Work. Specifications shall be reviewed by the Owner and Contractor to ensure all aspects of the construction needs are covered, and report to the Engineer any discrepancies and interferences. The Owner shall notify and inform the Engineer of construction progress and Specification requirements four (4) weeks prior to commencement of any Works.
2. Only Specifications explicitly marked with the following words are considered acceptable for Construction: ISSUED FOR CONSTRUCTION, or IFC.

---------- END OF SECTION 1 ----------

2 Clearing and Stripping

2.1 Part 1 – General

2.1.1 Documents

1. This section of the Specifications forms part of the Contract Documents and are to be read, interpreted and coordinated with all other parts.

2.1.2 Definitions

1. The following words and terms, unless the context otherwise requires, in this Specification, shall have the meanings set out below:

   (1) CLEARING means Works involved in the removal of snow and ice on natural ground or subgrade surface to the satisfaction of the Engineer.

   (2) STRIPPING means Works involving excavation and removal of unsuitable material including but not limited to organics and ice rich materials.

2.1.3 Description

1. The Works covered by this section consists of supplying all labour, materials, and equipment, and performing all Works necessary for clearing and stripping.
2. The Contractor shall clear and/or strip the Works areas as required including, but not limited to borrow areas, disposal areas, stockpile areas, laydown areas, water management areas, foundation zones and between individual lifts of fill placement, as shown on the Drawings, or inferred by these Specifications or as directed by the Owner with explicit approval from the Engineer.
3. Clearing and stripping in all areas shall require approval by the Engineer before such Works begins.
4. It is the Owner’s responsibility to identify and acquire all necessary permits and approvals for stockpiling and storage of materials removed through the process of clearing and/or stripping.

2.1.4 Submittals

1. At least seven (7) days prior to clearing, stripping, or clearing and stripping in any specific area, the Contractor shall submit to the Engineer and Owner, for approval, a Clearing and Stripping Work Plan describing the schedule, locations and extent of the clearing and stripping, and the proposed methods for disposal of clearing and stripping products.
2. Work shall not start until applicable approvals are obtained from the Owner in writing.
3. Approval of submittals shall not relieve the Contractor of its sole responsibility to construct the Works in accordance with specified requirements.

2.1.5 Permits and Regulations

1. The Owner shall conduct all work in accordance with the Owner's and all applicable Federal, Territorial, local or landowner regulations and licences regarding the disposal of materials from clearing and stripping.
2. It is the Owner's responsibility to be familiar with all said regulations, conditions and permits.

2.1.6 Protection

1. Unless otherwise instructed, the Contractor is to take all necessary precautions to prevent damage to natural and man-made features, including, but not limited to survey monuments, survey markers, archaeological sites, monitoring instrumentation and the sensitive tundra landscape.
2. The Contractor may not perform any Works outside of the permitted and approved construction area.

2.2 Part 2 – Execution

2.2.1 Preparation

1. The Contractor shall confirm the clearing or stripping limits by having the Surveyor lay out and flag the extents of all areas of work, prior to commencement of clearing or stripping. The Engineer will inspect these demarcated areas and confirm all clearing or stripping limits before giving approval to proceed to the Owner. The Owner will in turn authorize the Contractor to proceed with the Works.
2. The Contractor shall inspect the Works site and verify with the Engineer and the Owner any restrictions within or adjacent to the clearing limits.
3. Unless specifically instructed otherwise, the Contractor shall locate and protect natural and man-made features, including, but not limited to survey monuments, survey markers, archaeological sites, monitoring instrumentation and sensitive tundra landscape.

2.2.2 Clearing

1. Snow and ice shall be removed from all construction footprint areas, prior to undertaking any work in that area, with a maximum tolerance of 10 cm of uncompacted snow material left above natural ground, or otherwise approved by the Engineer.
2. Should snow fall on previously cleared or stripped surfaces that have been prepared and approved for construction, including between individual lifts of fill placement, the Contractor will carry out any additional clearing as requested by the Engineer.
3. The Contractor shall take all necessary precautions to prevent damage to natural and frozen ground, unless specifically instructed otherwise by the Engineer.

2.2.3 Stripping

1. Where required, and as a minimum in areas to be excavated, areas subjected to clearing shall undergo stripping to the depth necessary to remove all soil, including permafrost and other organic material necessary to expose bedrock, or other suitable foundation conditions as directed by the Engineer.
2. Should blasting be required of permafrost soils, the Contractor will comply to all Specifications associated with blasting, in addition to those listed in this Section.

2.2.4 Finished Surface

1. The Contractor shall leave the cleared and/or stripped surface clear, smooth, debris- and snow-free, in a condition suitable for inspection by the Engineer.

2.2.5 Disposal

1. Snow and ice cleared off the construction area shall be stockpiled downstream and outside of the construction area where it will not affect the construction or any constructed elements during thaw. The stockpile area shall be proposed by the Contractor and approved by the Owner. A Water Management Plan, prepared by the Contractor, and approved by the Owner, must be in place prior to stockpiling snow and ice in the specified area.
2. Soil and organic material stripped off the construction areas shall be stockpiled in designated areas approved by the Owner with proper sediment control as instructed in permit requirements.

2.3 Part 3 – Quality Control

1. Submit a Clearing and Stripping Work Plan as defined in Section 2.1.4 of this Document.
2. Confirm with Owner that all permits and approvals are in place prior to commencing any work.
3. Physically demarcate, for review and approval by the Owner and Engineer, the Works area that will be cleared and/or stripped using appropriate survey control. Within this zone clearly identify natural and man-made features that require protection as defined in this Document.
4. Implement measures, including spotters as needed, to allow visual inspection of clearing and/or stripping activities during execution to ensure it is done in accordance with the Specifications as defined in this Document.
5. Conduct field surveys, and submit As-built Drawings, in electronic format of any cleared and/or stripped areas, as requested by the Engineer or Owner.

2.4 Part 4 – Quality Assurance

1. Review the Contractor’s Clearing and Stripping Work Plan as defined in Section 2.1.4 of this Document and submit review comments back to the Contractor via the Owner.

2. Visually inspect the demarcated zone prepared by the Contractor for clearing and/or stripping and inform the Contractor via the Owner if changes are required.
3. Visually inspect the cleared and/or stripped areas and inform the Contractor via the Owner if changes are required.
4. Review As-built Drawings submitted by the Contractor of cleared and/or stripped areas and inform the Contractor via the Owner if any changes are required.

---------- END OF SECTION 2 ----------

3 Excavation and Water Control

3.1 Part 1 – General

3.1.1 Documents

1. This section of the Specifications forms part of the Contract Documents and are to be read, interpreted and coordinated with all other parts.

3.1.2 Description

1. The excavation Works entails removal of soil and other materials below existing ground surface to neat lines and grades as indicated on the Drawings.
2. The Works to be done under this Section consists of furnishing all labour, material, plant and equipment, and the performance of all Works necessary to carry out rock, soil and permafrost excavation as shown on the Drawings, and as specified herein.
3. The Works shall also include the loading, transportation and permanent disposal of all excavated materials which are deemed by the Engineer to be surplus, or unsuitable for use as construction material, and the loading, transportation and possible temporary stockpiling and re-handling of acceptable materials to locations where they can either be used as part of the temporary or permanent structures, or stockpiled in readiness for future temporary or permanent use.
4. The Owner and Contractor will be responsible to locate suitable stockpile locations for any excavated material, whether temporary or permanent. The Engineer will however have the right to reject any identified sites, if in his opinion it may interfere with any of the Works.

3.1.3 Exclusions

1. The Contractor is responsible for quarry development. The Engineer does however reserve the right to request modifications to the quarry development plan if the materials being produced do not meet Specifications. Any such requests must be submitted through the Owner.

3.1.4 Definitions

1. The following words and terms, unless the context otherwise requires, in this Specification, shall have the meanings set out below:
   (1) SOIL and OVERBURDEN meaning is interchangeable and means general overburden material including glacial marine clays, silty clays, sand, gravel, till and any combination of these materials, which can be used in part for concrete aggregate if they are free of contaminants, snow, ice and organic material, and if approved by the Engineer.
   (2) PERMAFROST means soil that is permanently frozen, in accordance with the appropriate normal geotechnical definitions.

(3) ROCK means quarried material from a designated quarry site, or from a designated foundation excavation.

(4) UNSUITABLE MATERIAL means any soil or rock that does not meet the Specifications for the use of this project.

(5) BLASTED MATERIAL means any material produced by production blasting at all quarry or excavation sites.

(6) NEAT LINE means the final line or grade to which excavation is to be performed.

(7) QUARRY and BORROW AREA meaning is interchangeable and means a designated location from where construction materials can be obtained.

(8) COMMON EXCAVATION means excavation of all materials, including rock, weathered bedrock, soil, permafrost and unsuitable material by mechanical means.

3.1.5 Procedures

1. The details of the surface excavations shown on Drawings represent an engineered design encompassing drainage under particular assumed conditions. Variations in site conditions may require adjustments to the excavation shape, slope reinforcement and drainage under the Engineer's direction.

2. If, in a specific area, a plan that has been previously adopted does not fit the site conditions in accordance with the requirements of these Specifications, the Engineer shall submit a revised plan to the Owner before continuing excavation in identified areas.

3. All earthworks that will potentially disturb original ground shall be constructed during the winter season to prevent damage to the tundra. All construction Works and traffic shall be within the constructed footprint during summer months.

4. Water management measures shall be constructed and implemented during the winter months as directed by the Owner, and only emergency adjustments can be made during the following spring and summer as approved by the Owner.

3.1.6 Submittals

1. The Contractor shall submit a detailed excavation plan to the Owner and the Engineer outlining the intended methods for excavation within a given area at least seven (7) days prior to the commencement of Works including, but not limited to the following details:

   (1) Typical equipment deployment.

   (2) Sediment and runoff control around the intended Works.

   (3) Water control and dewatering plan for Works where inflow of ground water or surface runoff could occur.

   (4) Typical blast method including hole size, depth, spacing, burden and loading details for production, buffer, pre-split holes, if required.

2. The Contractor's excavation plan must be approved by the Owner and the Engineer.
3. Work shall not start until applicable approvals are obtained from the Owner in writing.
4. Approval of submittals shall not relieve the Contractor of its sole responsibility to construct the Works in accordance with specified requirements.

3.2 Part 2 – Execution

3.2.1 Preparation

1. Prior to beginning a grading or excavation operation in any area, all necessary clearing and/or stripping in that area shall have been performed in accordance with the Specifications.
2. The Contractor shall confirm to its satisfaction the character, quantity, and distribution of all the material to be excavated.
3. The Contractor shall have in place a contingency plan for sudden unforeseeable change of weather conditions prior to excavation commencement. The Contractor shall have a daily Works plan in relation to the weather conditions, equipment, operator availability, area of Works, and schedule.
4. The Contractor shall be responsible for sediment and runoff control around the construction area to ensure there is minimal impact on the natural state of the surrounding environment in accordance to all issued regulations, licenses and permits.
5. The Contractor shall be responsible for all dewatering and water control to allow for fill placement in a dry, ice-free environment.

3.2.2 Common Excavation Methods

1. Common excavation of weathered bedrock and soil, including permafrost, shall be performed to the lines, grades, and elevations as indicated on the Drawings, or as directed by the Engineer, and shall be finished to a reasonable smooth and uniform surface.
2. Should the Contractor, through carelessness or other fault, excavate beyond the designated grades, it shall replace the excavation using an approved method, in accordance with the Specification, or any modification thereof as directed by the Engineer.
3. All excavated material determined unsuitable by the Engineer shall be disposed of as directed by the Owner.
4. At all times during construction, the Contractor shall adopt excavation procedures such that at no time shall the stability of any slope be impaired. The Engineer reserves the right to stop work if it deems the conditions to be unsafe.

3.2.3 Excavation in Quarry Areas

1. Borrow excavation shall be performed to the lines, grades, and elevation as indicated on the Drawings or as directed by the Engineer.

2. Borrow development will be the responsibility of the Contractor in accordance with staged plans submitted to the Owner and Engineer for approval prior to undertaking the Works.
3. Methods of access and excavation in the borrow areas will be determined by the Contractor, unless otherwise directed by the Owner or Engineer.
4. The Contractor shall use appropriate blasting methods to control the height of each bench and associated material gradation. The Contractor is responsible for fragmentation and throw of the material to ensure ease of excavation.
5. Excavation in the borrow area should be optimized by the Contractor for safety of equipment operation, water control, and bench stability.
6. Prior to excavation of the material, certified personnel must inspect the blast pattern to ensure all blasting agents were ignited and none were left behind.

3.2.4 Control of Water

1. Surface water flows during the melting seasons shall be directed away from the Works by means of diversion berms, ditches or other acceptable means and, in any case, all surface flows on the Works area shall be satisfactorily controlled, and to the environmental standards specified.
2. Any inflow of ground water or surface runoff water an excavation must be controlled using suitably placed and sized sumps and pumps.
3. Any water collected in the sumps must be discharged in an approved manner to a designated area away from the construction activities. A pumping and discharge contingency plan should be discussed with and submitted to the Engineer and Owner for approval prior to construction.
4. The construction, operation, and maintenance of the sump(s) and pump(s) are the responsibility of the Contractor.

3.2.5 Scaling, Slope Stability and Safety

1. Immediately following excavation and at any time during the Works, all loose material on slopes, which appears to be unsafe or to endanger workmen, structures or equipment, shall be scaled and removed.
2. All slope stability measures will be considered incidental to the Works, and will be the responsibility of the Contractor with inspections done by the Owner and Engineer.

3.3 Part 3 – Quality Control

1. Submit an Excavation Plan (including a water management and dewatering plan, if required) as defined in Section 3.1.6 of this Document.
2. Confirm with Owner that all permits and approvals are in place prior to commencing any Works.

3. Physically demarcate, for review and approval by the Owner and Engineer, the Works area that will be excavated using appropriate survey control.
4. Implement measures, including spotters and frequent survey control as needed, to allow visual inspection of excavation activities during execution to ensure it is done in accordance with the Drawings and Specifications as defined in this Document.
5. Implement measures to ensure adequate water management and dewatering as necessary.
6. Advise the Engineer and Owner when an excavation has been completed and is ready for inspection and/or approval. Interim survey control may be requested by the Engineer via the Owner to confirm lines and grades have been met.
7. Conduct a field survey and submit As-built Drawings, in electronic format, of any excavated area to the Engineer and Owner.

3.4 Part 4 – Quality Assurance

1. Review the Excavation Plan (including a water management and dewatering plan, if required) as defined in Section 3.1.6 of this Document and submit review comments back to the Contractor via the Owner.
2. Visually inspect the demarcated zone, and any associated survey files prepared by the Contractor for excavation, and inform Contractor via the Owner if changes are required.
3. Visually inspect the excavated area, and any associated survey files, and inform the Contractor via the Owner if changes are required.
4. Visually inspect water management and dewatering if required, and inform the Contractor via the Owner if changes are required.
5. Review As-built Drawings submitted by the Contractor of excavated areas and inform the Contractor via the Owner if any changes are required.

---------- END OF SECTION 3 ----------

4 Drilling and Blasting

4.1 Part 1 – General

4.1.1 Documents

1. This section of the Specifications forms part of the Contract Documents and are to be read, interpreted and coordinated with all other parts.

4.1.2 Description

1. All blasting operations must be performed in accordance with the Owners EMPs and all Federal and Territorial Regulations and Licences.
2. Blasting near water bodies frequented by fish will require lower powder factors, as determined by Guidelines issued by the Department of Fisheries and Oceans.
3. The Contractor will be responsible to become familiar with all appropriate conditions and constraints that apply to blasting.
4. The Works to be done under this Section consists of supplying all labour, materials, plant and equipment, and performing all Works necessary to carry out drilling and blasting with certified personnel and chemical agents as shown on Drawings and specified herein.
5. The Works shall include; but are not limited to:

   (1) Provide a typical list of safety protocols, chemical blasting agents, blast patterns and powder factors suitable for carrying out the Works, and for producing the specified construction materials.

   (2) Drilling with appropriate equipment, to appropriate depth and grade to execute the Works, develop rock quarries and any other common excavation as shown on the Drawings, or as directed by the Engineer.

   (3) Provide suitably qualified personnel, with current blasting certificates, to carry out all safety protocols for blasting required by the regulations prior to ignition.

4.1.3 Definitions

1. The following words and terms, unless the context otherwise requires, in this Specification, shall have the meanings set out below:

   (1) CERTIFIED PERSONNEL mean a suitably qualified person holding current blasting certificates issued by the appropriate Territorial and Federal Regulatory agencies with jurisdiction over the Project.

   (2) CHEMICAL BLASTING AGENTS means any form of explosive materials, and components thereof, that are suitable for use in the Project.

   (3) DETONATOR and BLASTING CAP meaning is interchangeable and means any suitable form of explosive charge used to initiate the detonation of the chemical blasting agents.

(4) DETONATOR CORD, DETCORD, and PRIMER CORD meaning is interchangeable and means a waterproof, flexible tube containing a high explosive designed to transmit the detonation wave.

4.1.4 Submittals

1. The Contractor shall submit a Drilling and Blasting Plan to the Engineer and Owner describing the schedule, and proposed methods for borrow development and common excavation, at least seven (7) days prior to the commencement of Works.
2. Work shall not start until applicable approvals are obtained from the Owner in writing.
3. Approval of submittals shall not relieve the Contractor of its sole responsibility to complete the Works in accordance with specified requirements.

4.2 Part 2 – Products and Personnel

1. The Contractor is responsible to procure all necessary supplies and equipment for drilling and blasting operations, excluding the chemical blasting agents, detonators and detonator cords, which will be supplied by the Owner.
2. The Contractor is responsible to acquire all required licenses and notifications from Territorial and Federal Regulatory Agencies.
3. The Contractor is responsible to have appropriately qualified and certified persons to handle all aspects of the drilling and blasting Works, including, but not limited to management of inventory, mixing of explosives, storage of explosives, transportation of explosives, placing of detonators, initiation of blasts, and clearing of explosives after blast.
4. The Contractor is responsible for management, maintenance and security of the Explosives Facility, whether temporary or permanent.

4.3 Part 3 – Execution

4.3.1 Drilling

1. The Contractor will lay out the appropriate blast pattern for the specified material grade required, at appropriate locations.
2. The Contractor will drill the blast holes in accordance with the blast pattern requirements, taking due care to prevent over-breaking.
3. The Contractor will ensure that the appropriate surface water containment and management procedures are followed when drilling.

4.3.2 Blasting

1. The Contractor’s Health and Safety Plan, list of blasting agents, technician’s certificates, and proposed methods of blasting will be provided by the Contractor prior to blasting operation, for Owner’s approval.

2. The Contractor will provide appropriately qualified and certified personnel to manage all aspects of the blasting.
3. The Contractor will be responsible for notifying all air and land traffic of the time and location of any blast at least 24 hours in advance.
4. The Contractor will be responsible for putting in place all protocols and physical barriers to warn and prevent land and air traffic from entering the designated blast zone, according to all applicable Territorial and Federal Regulations and the Contractors Health and Safety Plan.
5. The Contractor should use controlled blasting methods to ensure production of specified materials, ease of excavation and to minimize processing requirements.
6. Certified Personnel must inspect the blast pattern post blasting to ensure there are no unexploded blasting agents and blasting caps left behind prior to excavation. If unexploded material is found in the pattern, Certified Personnel must remove the dangerous material according to normal practice and the Contractor's Health and Safety Plan.

4.4 Part 3 – Quality Control

1. Submit a Drilling and Blasting Plan as defined in Section 4.1.4 of this Document.
2. Confirm with the Owner that all permits and approvals are in place prior to commencing any work.
3. Physically demarcate the Works area that will be drilled and blasted, using proper survey control, for review and approval by the Owner and the Engineer.
4. Implement and follow appropriate established protocols prior to and immediately following any Blast in compliance with all appropriate Rules and Regulations.

4.5 Part 4 – Quality Assurance

1. Review the Drilling and Blasting Plan as defined in Section 4.1.4 of this Document and submit review comments back to the Contractor via the Owner.
2. Visually inspect the demarcated zone, and any associated survey files prepared by the Contractor for drilling and blasting, and inform the Contractor via the Owner if changes are required.

---------- END OF SECTION 4 ----------

5 Fill Material Specifications

5.1 Part 1 – General

5.1.1 Documents

1. This section of the Specification forms part of the Contract Documents and is to be read, interpreted and coordinated with all other parts.

5.1.2 Description

1. The sources and borrow areas of all fill are shown on the Drawings or as designated by the Engineer. For the types of material and related Specifications, refer to the Drawings. The material types required for completion of the Works are labelled as:
   (1) Riprap;
   (2) Run-of-Quarry;
   (3) Transition; and
   (4) Surfacing;
2. All construction materials shall be non-acid generating, free of organic matter or similar impurities, as well as snow and ice.
3. The Contractor is responsible for supplying, installing, operating and maintaining all the necessary plant, equipment, materials, labour and supervision to produce and test the suitability of the specified construction material on site.
4. The Contractor must process all materials to meet the gradations specified herein.

5.1.3 Submittals

1. The Contractor shall submit the information requested in the Quality Control program listed in Section 5.3 to the Engineer and Owner in a timely manner, understanding that approvals to proceed with the Works may be contingent on review and approval of these submittals.
2. Work shall not start until applicable approvals are obtained from the Owner in writing.
3. Approval of submittals shall not relieve the Contractor of its sole responsibility to construct the Works in accordance with specified requirements.

5.2 Part 2 – Product

5.2.1 General

1. Quarry areas
   (1) Fill, required for the Works, shall be obtained and manufactured by the Contractor from designated borrow areas as shown on the Drawings, and from the excavation of select foundations.

(2) The parent rock sources for all fill materials must be inspected by the Engineer throughout the material processing and construction activities to ensure the requirements stated herein are being met.

(3) Excavated material that is unsuitable for the Works shall be disposed of in a designated onsite disposal area as directed by the Owner.

(4) If the Contractor proposes to obtain fill from an area not within the excavations or designated areas shown on the Drawings, it shall communicate its intention to the Owner. The Owner then shall first obtain the necessary approvals and permits to carry out such sub-surface investigation and obtain and submit such samples, as are required, to enable the Engineer to assess the suitability of the fill for the Works.

(5) The Contractor shall keep accurate exploration records of any test pit, trench or drill hole which it makes for the purpose of investigating borrow material, and a copy of such records shall be submitted to the Owner and to the Engineer within seven (7) days of the completion of such exploration Works.

(6) The Contractor shall give the Owner no less than 14 days' notice, of the intention to develop any potential borrow area not shown on the Drawings.

(7) The Contractor shall make its own determination of the adequacy of any borrow source it intends to exploit.

2. Foundation excavation

(1) Fill acquired from foundation excavation shall meet the Specifications; otherwise it will be considered as unsuitable material and disposed of accordingly.

(2) Unsuitable material from the excavation for the Works shall be disposed of in a designated onsite disposal area as directed by the Owner.

(3) Fill shall be used in place with minimum handling to minimize degradation and segregation.

5.2.2 Riprap

1. Riprap material shall be competent non-acid generating rock sourced from the quarries or foundation excavations, and that is free from organic matter, snow and ice.
2. Riprap shall be clean with no fine-grained material and a minimum boulder size of 1,000 mm and maximum boulder size of 1,500 mm or as specified on the Drawings.
3. Basic screening or manual selection may be used to achieve the desired gradation.
4. The Riprap material shall be washed to remove blast residue and/or fines, unless otherwise directed by the Engineer.

5.2.3 Run-of-Quarry Material

1. Run-of-Quarry (ROQ) material shall consist of competent non-acid generating rock sourced from the quarries or foundation excavations, and that is free of organic matter, frozen soil, snow and ice.
2. ROQ material shall be well-graded, containing sufficient quantities of unfrozen gravel, sand and silt sized material to allow the material to be compacted. In areas where the overall ROQ fill thickness is less than 0.85 m, the maximum boulder size shall not exceed 500 mm, as measured in any direction. In areas where the overall ROQ fill thickness is greater than 0.85 m, the maximum boulder size shall not exceed 900 mm as measured in any direction.
3. Basic screening, or crushing and screening may be used to achieve the desired gradation.
4. The ROQ material shall be washed to remove blast residue, unless otherwise directed by the Engineer.

5.2.4 Transition Material

1. The Transition material shall consist of competent non-acid-generating material from the quarries or foundation excavations, and that is free of organic matter, frozen soil, snow and ice.
2. The Transition material shall have a particle size distribution falling within the limits presented in Table 5.1.

Table 5.1: Transition material particle size distribution limits

Particle Size (mm)	% Passing
200	100
100	60-100
50	40-70
20	20-50
10	0-30
5	0-10

3. Crushing and screening may be required to meet the Specification.
4. The Transition material shall be washed to remove blast residue, unless otherwise directed by the Engineer.

5.2.5 Surfacing Material

1. Surfacing material shall consist of competent non-acid-generating rock from the quarries or foundation excavations, and that is free of organic matter, frozen soil, snow and ice.
2. The Surfacing material shall have a particle size distribution falling within the limits presented in Table 5.2.

Table 5.2: Surfacing material particle size distribution limits

Particle Size (mm)	% Passing
38.0	100
25.0	60-100
12.5	25-100
5.0	10-50
0.63	2-20
0.08	1-15

3. Crushing and screening will be required to meet the Specifications.
4. The Surfacing material shall be washed to remove blast residue, unless otherwise directed by the Engineer.

5.3 Part 3 – Quality Control

1. The Contractor shall carry out Quality Control testing during the production of construction materials as outlined in Table 5.3.

Table 5.3: Required QC testing during production of construction materials

Material Type	Sample Location	Sample Type	Test Type	Test Location	Expected Turnaround Time	QC Test Frequency	Submittal
Riprap	At Quarry	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Run-of-Quarry	At Quarry	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Transition	At Crusher	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Surfacing	At Crusher	Grab	Particle Size Analysis (ASTM C136)	On Site	24-hrs	One per 3,000 m^3	Test Certificate

5.4 Part 4 – Quality Assurance

1. The Engineer shall carry out Quality Assurance testing during the production of materials as outlined in Table 5.4.

Table 5.4: Required QA testing during production of construction materials

Material Type	Sample Location	Sample Type	Test Type	Test Location	Expected Turnaround Time	QA Test Frequency	Submittal
Riprap	At Quarry	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Run-of-Quarry	At Quarry	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None

Material Type	Sample Location	Sample Type	Test Type	Test Location	Expected Turnaround Time	QA Test Frequency	Submittal
Transition	At Crusher	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Surfacing	At Crusher	Grab	Particle Size Analysis (ASTM C136)	On Site	24-hrs	One per 6,000 m3	Test Certificate

---------- END OF SECTION 5 ----------

6 Fill Placement

6.1 Part 1 – General

6.1.1 Documents

1. This section of the Specifications forms part of the Contract Documents and are to be read, interpreted and coordinated with all other parts.

6.1.2 Description

1. The Works specified in this section includes furnishing all supervision, labour, materials, tools and equipment for placement of fill material to the lines and grades shown on the Drawings and specified herein.
2. The Works shall include, but are not limited to the following:
   (1) Foundation preparation to receive fill.
   (2) The supply, hauling, placing, and compacting of the specified fill materials as shown on the Drawings.
   (3) All related surveys for layout and control of the Works.
   (4) The Contractor shall assist the Engineer when necessary while Engineer is performing QA testing. In addition, the Contractor shall submit a copy of Contractor's QC results.
   (5) Maintenance of haul roads (as applicable) including snow and ice removal.
   (6) The development, maintenance, and restoration of fill material borrow areas.
   (7) Any other related Works not covered elsewhere.
3. Fill materials required to be placed include, but are not limited to the following:
   (1) Haul, place and compact Run-of-Quarry (ROQ) material as base layer, as a thermal protection layer, as an erosion protection layer, or as a bulk fill material.
   (2) Haul, place and compact Transition material as a transition or filter layer between the ROQ and finer crush material (e.g. surfacing material), to asset in acting as thermal protection layer, to act as a capping layer over overburden, or as a bulk fill material.
   (3) Haul, place, and compact Surfacing material as final trafficking surfaces.
   (4) Haul and place Riprap as an erosion protection or wave energy dissipation layer.

6.1.3 Submittals

1. The Contractor shall submit the information requested in the Quality Control Plan listed below in Section 6.3 to the Engineer and Owner in a timely manner, understanding that approvals to proceed with the Works may be contingent on review and approval of these submittals.
2. Work shall not start until applicable approvals are obtained from the Owner in writing.

3. Approval of submittals shall not relieve the Contractor of its sole responsibility to construct the Works in accordance with specified requirements.

6.2 Part 2 - Execution

6.2.1 Compaction Equipment

1. The compaction equipment shall be the appropriate size and type to achieve the specified densities of the respective fill materials.

2. Where compaction procedures (lift thickness, number of passes, compactor type) are specified the Contractor shall provide compactors that meet or exceed those described in the Specification.

3. A vibratory plate tamper, or other suitable equivalent hand operated compactor will be required for compaction around instrumentation, or in confined spaces. The hand compactor shall be rated to provide sufficient pressure to meet compaction requirements.

4. Notwithstanding the requirements stated above, the equipment and compaction procedures employed by the Contractor shall be subject to approval from the Engineer.

6.2.2 Snow Removal Equipment

1. Care shall be taken when clearing snow above or adjacent to previously placed compacted material to avoid ripping and subsequent damage. Any material, which, in the opinion of the Engineer, has been damaged, shall be removed and replaced.

2. Care shall be taken when clearing snow from original ground to prevent damage to the tundra.

3. If deemed necessary by the Engineer, the Contractor shall use manual labour to clear snow.

6.2.3 Foundation Preparation

1. The Contractor shall prepare an acceptable foundation surface to receive the specified fill material. An acceptable foundation surface is a surface which is clean, sound and firm, and which does not contain any loose, softened or disturbed foundation material as determined by the Engineer.

2. Riprap, ROQ, Transition, and Surfacing materials shall be graded in accordance with the Drawings, compacted in lifts and be free of snow, ice, and any other loose or deleterious material.

3. Dense foundation surfaces to receive fill shall be free from noncompacted fill, snow, ice or other unsuitable materials. The surfaces shall be inspected by the Engineer, who may direct proof rolling with a loaded haul truck, and/or local over excavation and backfilling with approved material. Placement shall be completed as outlined in the applicable sections of these Specifications.

4. Exposed bedrock surfaces shall be reasonably smooth and free of loose or broken rock. Ripping and scraping the fractured bedrock may be required to remove unsuitable rock, as directed by the Engineer.

5. Where depressions or holes exist in the foundation material, acceptable fill shall be placed in depressions, as directed, and compacted as specified herein. Special techniques, handwork and the like shall be required as necessary.

6. Fill shall not be placed on the prepared foundations until they have been inspected and approved by the Engineer.

6.2.4 Fill Placement (General – All Products)

1. Construction must be performed in accordance with the best modern practice and with equipment best adapted to the work being performed. Materials must be placed so that each zone is homogenous, free of stratifications, ice chunks, lenses or pockets, ruts, and layers of material with different texture or grading not conforming to the requirements stated herein.

2. No fill material shall be placed on any part of the foundation until it has been prepared as specified herein and approved by the Engineer. The placement of fill material must conform to the lines, grades and elevations shown on the Drawings, as specified herein or as per the direction of the Engineer. Fill placement must be conducted in such a manner that mixing of fill materials with fill materials in the adjacent zones is avoided.

3. Embankment construction shall not proceed when the work cannot be performed in accordance with the requirements of the Specifications. Any part of the embankment that has been damaged by the action of rain, snow or any other cause must be removed and replaced with the appropriate material conforming to the requirements stated herein before succeeding layers are placed.

4. Stockpiling, loading, transporting, dumping, and spreading of all materials shall be carried out in such a manner to avoid segregation or any other condition that does not meet the requirements stated herein. Segregated materials must be removed and replaced with materials meeting the requirements stated herein and receiving the Engineer's approval.

5. The Contractor must remove all debris, vegetation or any other material not conforming to the requirements stated herein. The Contractor must dispose of these materials in an area approved by the Owner.

6. The compaction operations for fill shall be conducted within the same work day to provide a smooth compact surface. Adjacent individual passes of the compactor shall overlap by approximately 1/3 of the width of the compactor's drum. New fill shall be "keyed" into existing approved fill. Keying in is by placing new fill adjacent to exposed compacted fill. The Contractor is responsible to repair all damages on unfinished work from the previous work day.

7. Unless otherwise specified by the Engineer construction material maximum lift thicknesses and compaction requirements shall be as indicated herein or otherwise specified on the Drawings.

6.2.5 Riprap Material Placement

1. The Riprap material must be placed in accordance with the Drawings, or otherwise as directed by the Engineer.

6.2.6 Run-of-Quarry Material Placement

1. The Run-of-Quarry material must be placed in lifts not exceeding 0.85 m thickness if the total fill thickness is less than 0.85 m. The ROQ material must be placed in lifts not exceeding 1.85 m thickness if the total fill thickness is greater than 1.85 m. The placement method must ensure that segregation and nesting of coarse particles is avoided.
2. Compaction Trials (see Section 6.2.10) shall be used to develop a site-specific Method Specification for compaction of ROQ material.
3. Unless otherwise defined by a Method Specification, the ROQ material (each lift) shall be compacted in accordance with either of the following standards:
   (1) Compacted with a smooth drum vibratory compactor weighing no less than 10 tonnes, with at least eight passes of the compactor (back and forth being two passes). Rolling patterns must be used throughout construction to optimize the number of passes, and vibration frequency for compaction of the ROQ material.
   (2) Compacted by ensuring that loaded haul truck traffic is routed over the entire surface of each lift with a minimum of 4 passes (back and forth being two passes).

6.2.7 Transition Material Placement

1. The Transition material must be placed in lifts not exceeding 500 mm thickness. The placement method used must ensure that segregation and nesting of coarse particles is avoided.
2. Compaction Trials (see Section 6.2.10) shall be used to develop a site-specific Method Specification for compaction of Transition material.
3. Unless otherwise defined by a Method Specification, the Transition material (each lift) shall be compacted in accordance with either of the following standards:
   (1) Compacted with a smooth drum vibratory compactor weighing no less than 10 tonnes, with at least six passes of the compactor (back and forth being two passes). Rolling patterns must be used throughout construction to optimize the number of passes, and vibration frequency for compaction of the Transition material.
   (2) Compacted by ensuring that loaded haul truck traffic is routed over the entire surface of each lift with a minimum of 4 passes (back and forth being two passes).

6.2.8 Surfacing Material Placement

1. The Surfacing material must be placed in lifts not exceeding 200 mm thickness. The placement method used must ensure that segregation and nesting of coarse particles is avoided.

2. Compaction Trials (see Section 6.2.10) shall be used to develop a site-specific Method Specification for compaction of Surfacing material.

3. Unless otherwise defined by a Method Specification, the Surfacing material (each lift) shall be compacted in accordance with either of the following standards:

   (1) Compacted with a smooth drum vibratory compactor weighing no less than 10 tonnes, with at least four passes of the compactor (back and forth being two passes). Rolling patterns must be used throughout construction to optimize the number of passes, and vibration frequency for compaction of the Surfacing material.

   (2) Compacted by ensuring that loaded haul truck traffic is routed over the entire surface of each lift with a minimum of two (2) passes (back and forth being two passes).

6.2.9 Tolerances

1. Fill shall be placed in horizontal lifts to the lines and levels shown on the Drawings, or as directs by the field engineer.

2. Unless specifically detailed on the drawings or from direct communication from the Engineer, then fill and cut surfaces should be completed to an accuracy of ±5 cm or less.

6.2.10 Compaction Trials

1. Compaction trials shall be performed upon production of fill material to determine site specific parameters such as density and compaction standards. The trials shall be carried out as part of the fill placing operation.

2. The Engineer may request through the Owner to periodically conduct field trials to optimize moisture conditioning, lift thickness and compaction effort.

3. The compaction trials on the material in question shall be done using a survey method according to the general procedure detailed below, or as specified by the Engineer:

   (1) A rectangular pad made with the approved material of approximately 7 m width by 20 m length with specified thickness associated with the specified material with placement method according to this Specification.

   (2) A set of survey points with accuracy of ±5 mm shall be laid out as specified by the Engineer in a grid pattern.

   (3) The elevations of each survey points shall be recorded immediately after placement and after each compaction effort.

   (4) The compaction be done upward of 10 passes in accordance with this Specification or otherwise specified by the Engineer and survey recorded after each pass.

   (5) This process shall be repeated to simulate construction as directed by the Engineer.

4. The Owner and or the Contractor shall obtain the Engineer’s approval before implementing any change to the Specifications.

6.2.11 Restrictions Due to Weather and Suspension of Operations

1. The Contractor shall not place any fill when conditions for such operations are unsatisfactory due to heavy snowfall, extraordinarily freezing conditions, or any other reason determined by the Engineer.
2. Where operations have been discontinued by the Contractor or suspended by the Engineer, the effects of adverse conditions shall be assessed by the Engineer and the surficial layers of fill treated or replaced to the satisfaction of the Engineer before resumption of fill placement.
3. In freezing conditions, the Contractor shall:

   (1) Provide satisfactory snow and ice removal from subgrade surface.

6.2.12 Sediment and Runoff Control

1. The Owner is responsible to provide the Contractor the locations and methods to construct facilities such as diversion berms, sediment ponds, and other measures as are required to prevent the discharge of fines from construction areas and from entering any natural water courses downstream of the Works during the spring melt season immediately following construction.
2. In general, when placing fill material, the Contractor shall slope the surfaces toward collection channels for surface water management.
3. The Contractor shall not excavate any ditches in the original ground, especially in permafrost overburden. Diversion berms will be the preferred method to re-route surface water.

6.3 Part 3 – Quality Control

1. The Contractor shall be responsible for the quality of fill as described in Section 5.
2. The Contractor shall conduct regular topographic surveys to demonstrate the placement of fill to the specified lines, levels, grades and tolerances. The Engineer may from time to time witness survey checks. Survey results shall be reported to the Engineer and Owner within 24 hours of the completion of each survey.
3. The Contractor shall carry out Quality Control testing during fill placement as outlined in Table 6.1.

Table 6.1: Required QC testing during placement of construction material

Material Type	Sample Location	Sample Type	Test Type	Test Location	Expected Turnaround Time	QC Test Frequency	Submittal
Riprap	In-Place	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Riprap	In-Place	n/a	Visual and Survey Controlled	n/a	24-hrs	Ongoing	Survey Report
Run-of-Quarry	In-Place	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Run-of-Quarry	In-Place	n/a	Lift Thickness (Survey Control)	n/a	Hold Point - Before Next Lift is Placed	Every Lift	Survey Report
Run-of-Quarry	In-Place	n/a	Compaction (Visual)	n/a	n/a	Ongoing	None
Transition	In-Place	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Transition	In-Place	n/a	Lift Thickness (Survey Control)	n/a	Hold Point - Before Next Lift is Placed	Every Lift	Survey Report
Transition	In-Place	n/a	Compaction (Visual)	n/a	n/a	Ongoing	None
Surfacing	In-Place	Grab	Particle Size Analysis (ASTM C136)	On Site	24-hrs	One per 3,000 m^3	Test Certificate
Surfacing	In-Place	n/a	Lift Thickness (Survey Control)	n/a	Hold Point - Before Next Lift is Placed	Every Lift	Survey Report
Surfacing	In-Place	n/a	Compaction (Visual)	n/a	n/a	Ongoing	None

6.4 Part 4 – Quality Assurance

1. QA testing shall be carried out across the full length, width and depth of the various fill zones so as to fully represent the overall quality of the structure.

2. The Contractor shall conduct regular topographic surveys to demonstrate the placement of fill to the specified lines, levels, grades and tolerances. The Engineer may from time to time conduct survey checks. Survey results shall be reported to the Engineer and Owner within 24 hours of the completion of each survey.

3. Final acceptance of earthworks will be made only after fill materials have been dumped, spread, moisture conditioned, and compacted, as required and tests and surveys have demonstrated compliance with the Specifications.

4. If on the basis of the sampling and testing, or if in the opinion of the Engineer, an area of the fill does not meet the specified requirements; such fill shall be removed and replaced with

conforming material. Rejection of fill material by the Engineer may be made at source, in transporting vehicles, or in place.

5. The Engineer can re-inspect previously approved areas for damages and instruct the Contractor to repair said damages in accordance with the Specifications.

6. The Engineer shall carry out Quality Assurance testing during fill placement as outlined in Table 6.2. Additional testing may be conducted at the discretion of the Engineer.

Table 6.2: Required QA testing during placement of construction materials

Material Type	Sample Location	Sample Type	Test Type	Test Location	Expected Turnaround Time	QA Test Frequency	Submittal
Riprap	In-Place	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Riprap	In-Place	n/a	Visual and Survey Controlled	n/a	24-hrs	Ongoing	Survey Report
Run-of-Quarry	In-Place	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Run-of-Quarry	In-Place	n/a	Lift Thickness (Survey Control)	n/a	Hold Point - Before Next Lift is Placed	Every Lift	Survey Report
Run-of-Quarry	In-Place	n/a	Compaction (Visual)	n/a	n/a	Ongoing	None
Transition	In-Place	n/a	Particle Size Analysis (Visual)	n/a	n/a	Ongoing	None
Transition	In-Place	n/a	Lift Thickness (Survey Control)	n/a	Hold Point - Before Next Lift is Placed	Every Lift	Survey Report
Transition	In-Place	n/a	Compaction (Visual)	n/a	n/a	Ongoing	None
Surfacing	In-Place	Grab	Particle Size Analysis (ASTM C136)	On Site	24-hrs	One per 6,000 m^3	Test Certificate
Surfacing	In-Place	n/a	Lift Thickness (Survey Control)	n/a	Hold Point - Before Next Lift is Placed	Every Lift	Survey Report
Surfacing	In-Place	n/a	Compaction (Visual)	n/a	n/a	Ongoing	None

---------- END OF SECTION 6 ----------