Minto Mine
QML-0001

Underground Mine Development and Operating Plan
March 2013

Prepared by:
Minto Mine
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1 Background

This document has been prepared to satisfy the requirements of the Quartz Mining licence (QML-001) for the development and mining of the underground mine for the Minto Mine site owned by Minto Explorations Ltd. (Minto).

Minto Mine has been in operation since 2007 and has been a solely open pit operation since that time. An underground mine was assessed as part of the Phase IV mine plan.

A letter sent to Gregg Bush from Robert Holmes approving the *General Site Plan - Stage II*, dated November 1, 2011 contained the following statement regarding the underground workings:

"After review and consideration, I, in my capacity as Chief, have determined that the "Stage 2 GSP" is approved as a partial fulfillment of the Mine Development and Operations Plan requirements. The portions of this plan pertaining to the underground development are not approved at this time. Further details are required for the underground workings; these requirements are detailed in the plan requirement letter from Tim Smith dated May 24th, 2011."

The QML-0001 Schedule C issued December 6, 2012 authorizes the following with respect to the underground development:

- developing the portal area and up to 500m of decline in non-mineral waste rock;
- depositing overburden from the portal area;
- depositing waste rock from the underground workings; and
- necessary related roads and infrastructure.

These approvals allowed for more detailed information about the underground mining to be compiled and submitted as per the plan requirement letter referenced above.

Several overviews have been presented regarding underground mine development and operations as part of various regulatory applications; however the Underground Mine Development and Operations Plan (UMDOP) seeks to provide information on the following components in relation to the underground workings as per the requirements contained in the May 24th, 2011 plan requirement letter:

(a) a description of the underground geotechnical design factors;

(b) a description of the development plans for the open pit and underground mines, including plans and maps showing all related structures, equipment, works and installations associated with the mines;

(c) a description of methods used to backfill any openings;

(d) a summary of estimated ore reserves, including the grades, dilution and recovery factors for mineable reserves;

(e) a summary of services required to safely operate the underground and open pit mines, including electrical power, communications, ventilation and dewatering;

(I) a strategy and implementation protocol for required dewatering of the underground.

The letter detailing the plan requirements also contains items “f” through “k”; these requirements are largely related to the surface mine operations and have been addressed in various other QML-001 submissions, primarily the "*Mine Development and Operations Plan v1*.”

Some of the information contained in the UMDOP has been presented in varying degrees of detail in other previously approved plans but may be presented at a high level in this document for easier reference.

2 Site Description

2.1 Current Mine Operations

Figure 2-1 shows an aerial overview of the mine site as of August 2012. The site configuration has not changed significantly since the photo was taken; open pit mining continues in the Area 2 pit, with the west wall having been pushed back, and preliminary stripping took place at the Area 118 pit location in November and December. Waste rock from mining operations is being deposited in several locations including the Southwest dump, the South Wall Buttress, and the Mill Valley Fill Extension. Overburden is being deposited in the Reclamation Overburden Dump, or in the Ice-Rich Overburden dump, depending on the ice content of the material.

2.2 Current Underground Development

In mid 2012 an underground contractor, Dumas Mining, secured a mining development contract. In July, clearing of the overburden began at the portal location, as well as construction of a road to the portal which was laid out to also allow for future expansion of the Area 2 pit as part of Phase V/VI. The first blast occurred at the portal in September, and the portal was collared to 15 m with a steel portal access structure. Design drawings for the portal collar can be found in Appendix A. In late December, some services were installed and commissioned and are described in more detail in subsequent sections of this document. Figure 2-2 shows the services installed to date relative to the portal location.

As of the end of February 2013, 244 m of ramp development decline had been established. An as built of the ramp development to date can be found in Appendix B.

Figure 2-1: Site overview as of August 2012 (scale: 1:10000)

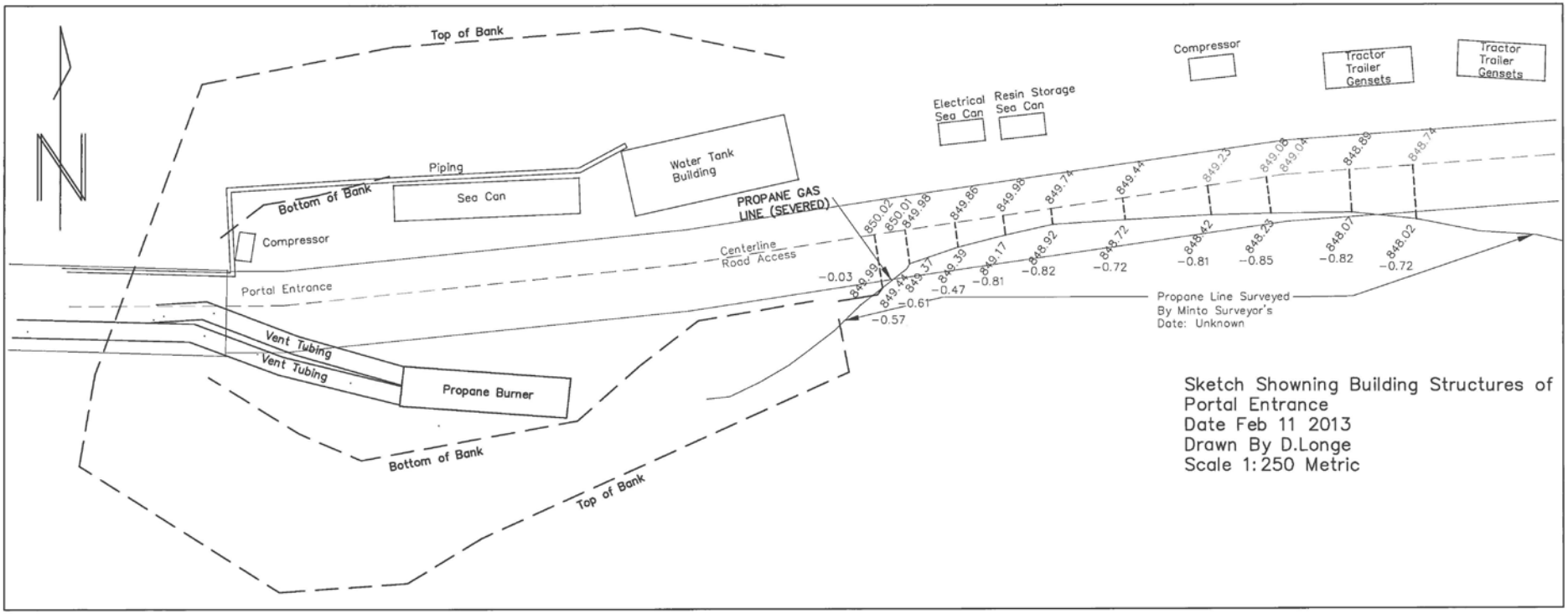


Figure 2-2: Schematic of portal area infrastructure

3 Deposits and Ore Reserves

3.1 Scope of Phase IV underground

The underground mining assessed as part of Phase IV consists of several known deposits in the Area 2/118 zones that have the grade, continuity and volume to be considered mineable from underground. Future expansions are planned and include the mining of the Minto East and Copper Keel zones from the current portal, and the creation of a separate portal to access the Wildfire zone. These future expansions, known as Phase V/VI, are being prepared for environmental and socio-economic assessment. Once assessment has been completed, the mine expansion plans will be subject to licensing approval under Minto's Quartz Mining Licence. Figure 3-1 and Figure 3-2 illustrate the relative location of the ore zones and present a view of the Area 118 and Area 2 deposits.

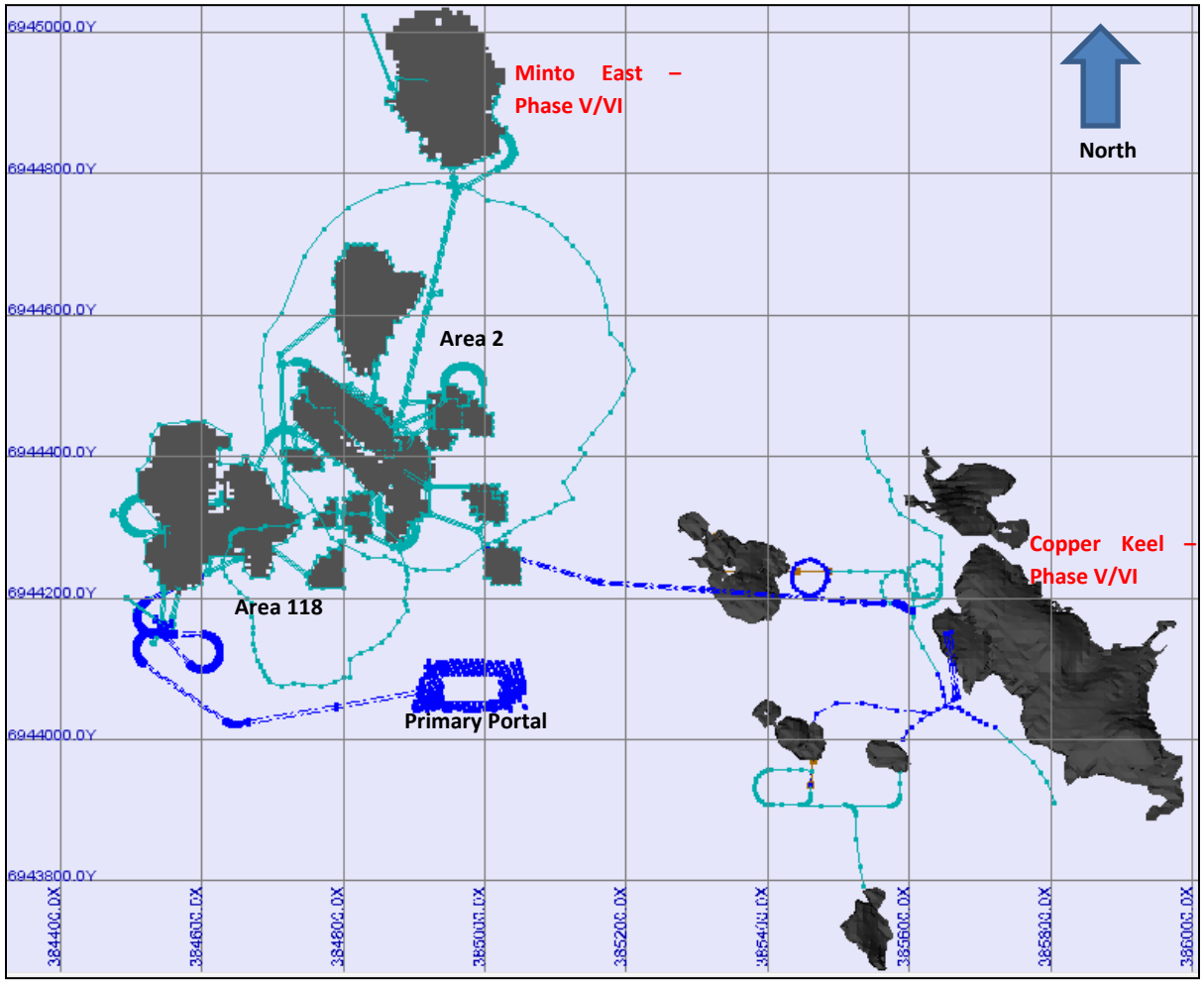


Figure 3-1: Primary Portal Plan View

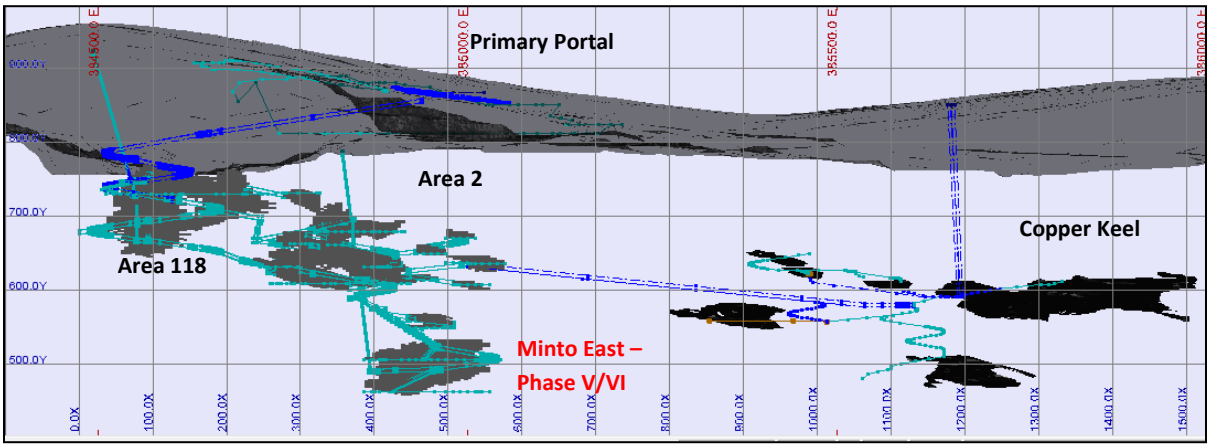


Figure 3-2: Primary Portal Cross Section Looking North

3.2 Phase IV Underground Ore Reserves

Based on the reserves identified to date and the mine designs created around them, the volumes, tonnages, and grades presented in Table 3-1 will be produced over the life of the Phase IV underground operation.

Ore volumes are reported at a cutoff grade of 1.20% and based on the stope designs prepared by SRK for the Phase IV Pre-feasibility Study. Dilution and loss has not been fully characterized; however, the reported tonnages do take into account the achievable extraction ratios for each stope, based on pillar dimensions. The volumes produced by the underground mine will change as detailed stope designs are prepared, taking into account the local ground conditions and optimizing the location of pillars based on in-fill drilling.

The mining rate is currently planned at 2,000 t/d, with first ore scheduled for release in July of 2013. The ramp-up to full production rate will depend upon the successful expansion of the mobile equipment fleet. The underground mining assessed as part of Phase IV results in a mine life of approximately four years.

Table 3-1: Material release for the underground portion of Phase IV

	Volume (kBCM)	Mass (kt)	Cu %	Au g/t	Ag g/t
Ore	904	2,511	1.88	0.81	6.65
Waste	131	349			

4 Underground Geotechnical Assessment

A detailed structural assessment has not been completed for any of the Minto underground mining area. This is a risk that will be considered during mine planning. Based on the review of available core photos, damage zones have been identified within the mining areas. Major structure will be assessed and characterized during mine development and delineation drilling to understand the impact these will have on back and pillar stability. A ground control program is currently being developed by SRK Consulting Ltd. (SRK) and Minto personnel and will be complete mid 2013. As well, Itasca Consulting Canada Inc. has been retained to provide ongoing geotechnical assessment and support programs for current ramp development.

The following points (italicised) are excerpts from the SRK Phase V Prefeasibility Study.

Resource continuity

The (mineralized) *zones bifurcate, which means that a mineralized zone can contain a significant amount of waste, or that thinner ore zones can merge with larger zones. A bifurcating geometry complicates geological modelling and may expect to increase internal dilution.*

The width and dip of mineralized zones are locally variable. The zones therefore appear to pinch-and-swell. The change in thickness might be as much as an order of magnitude over less than 30 m in horizontal distance.

At least some of the irregularity in the geometry and thickness of the mineralized zones is due to small-scale and large-scale structural displacements. No detailed structural model has been completed for either deposit, but at least two faults appear to be present in Area 2, and three possible faults displace the modelled zones in Area 118. Similar structures may be present throughout the deposit, each with displacements of a few metres or less.

Deposit boundaries

The boundary between Area 2 and Area 118 zones has been modelled as a fault. The drill hole intersections are of sufficient density to show the position of the fault accurately. Two additional faults have been modelled in order to explain intersection positions in Area 118, and these faults divide the Area 118 resource into three domains.

No study has been done on the drill core in order to define the characteristics of the faults. There are indications that these faults have the characteristics of high strain shear zones, rather than brittle structures.

The main geotechnical points from this are:

- Mineralization is considered be variable both in thickness, dip, and lateral continuity;
- Displacements occur through mineralization on the meter scale;
- Major boundary fault zones are present in Area 2/118 areas and have been modeled in 3D. A detailed structural model and structural characterization have not been completed, and;
- There is potential for fault zones to be present in the Copper Keel area.

4.1 Hydrogeological Assessment

A hydrogeological assessment has not been completed to define the potential inflows to the underground workings from large and small-scale structures. Minto's experience with open pit mining has been that static groundwater is encountered in blastholes, but that surface runoff is the major driver of pit dewatering requirements. The potential for structure to carry water will be investigated during early mine development to

confirm that water inflows can be managed in a proactive manner. Further information on the management of underground inflows is described in a subsequent section of this document.

4.2 Mining Method – Geotechnical Considerations

Due to the mineralized zone variable continuity SRK has recommended that a 'random room and pillar' mining method is adopted in some areas. This involves driving development size headings through identified mining areas on a contour, and moving left or right (no change in elevation) to keep the hanging wall contact of mineralization in the back of the drive. These headings are completed under geological control only. Infill drilling is then completed from cubbies driven from the headings. Based on these results a standard room and pillar layout can then be established, and extraction is achieved on the retreat under supported ground (slashing out to full span width). The decision on whether to support the full span or not can be made as the headings are advanced.

The advantages of this method allow the definition and understanding of the orebody character and geometry to be established on advance: therefore the mining method defines the orebody. Additionally back and pillar support can be installed on the advance with the understanding that long term access could be required through the development headings. In essence the mineralization and rock mass is characterized on the advance, and the mining spans and level of extraction determined. This is then extracted on the retreat.

Without underground exposures an extraction ratio of around 75% should be anticipated. This would meet the 1:1 pillar height criteria. Extraction ratios in faulted/broken ground areas will need to be reduced locally based on the prevailing rock mass conditions.

4.2.1 Orebody Geometry

Mining shells have been provided to SRK based on a copper cut-off grade ("COG") of 1.3%. These are block model shells, and planned mining layouts have not been provided. Figure 4.1 shows plan, 3D, and section views of the orebody geometries. General characteristics are:

Thickness:	5 to 20m, generally less than 15m.
Span:	50 to 160m, generally less than 100m.
Dip:	0 to 40° from horizontal, generally less than 10°.

These shapes show poor continuity between areas, some of which appear to be based on the result of a single drill hole. It is expected that these could become more continuous once tighter drill hole spacing, underground exposure, and a proper understanding of the orebody geometry is achieved.

4.2.2 Rock Mass Assessment

Underground mining was proposed for deeper zones in Areas 2, and 118 blocks.

Bieniawski Rock Mass Rating (RMR_{89}) and Barton Q values were evaluated for the underground zones. An average RMR_{89} of 65 and Q of 10 were estimated. Mining guidelines have been developed from empirical, analytical, numerical models and practical experience.

4.3 Underground Excavation Design

Excavation design has been completed for man entry spans and pillars on based empirical guidelines adjusted to the anticipated rock mass characteristics. The following is a summary of the findings:

- Development headings: 5 m W x 5 m H arch back
- Rooms: 10 m span limit with pattern support
- Pillars: 5 m W x 5 m H

  5m W x >5 m H support or fill required

A design span limit of 10m has been recommended for mining in areas of good rock mass quality. Without underground exposures an initial conservative extraction ratio of around 75% should be anticipated to account for major structures, adverse small scale structure, or zones of lower rock mass quality. This would meet the 1:1 pillar height criteria. The required ground support systems to increase spans through zones of reduced rock quality should be tested during early mine development.

For most mining areas, superimposed 5m by 5m pillars are planned to limit spans to 10m. These spans would be mined using a cut height of 5m. Pillars over 5m height should be assessed on an individual case basis, and rock support or fill should be utilized.

Man entry design spans have been reviewed based on the critical span curve presented in Ouchi *et al*. (2004), Figure 4-1, and the Q-system unsupported span limits Figure 4-2. The calculated back span for man entry excavations (Ouchi *et al.*) was 9-14m. These spans lie on the boundary between stable and potentially unstable back conditions and should be considered as optimistic. The Q-system shows span limits of 6-11m however these are somewhat conservative based on the selected ESR value of 1.6 (permanent mine openings). A design span limit of 10m is recommended for mining in areas of good rock mass quality. Spans will need to be limited where major structures, adverse small scale structure, or zones of lower rock mass quality are encountered.

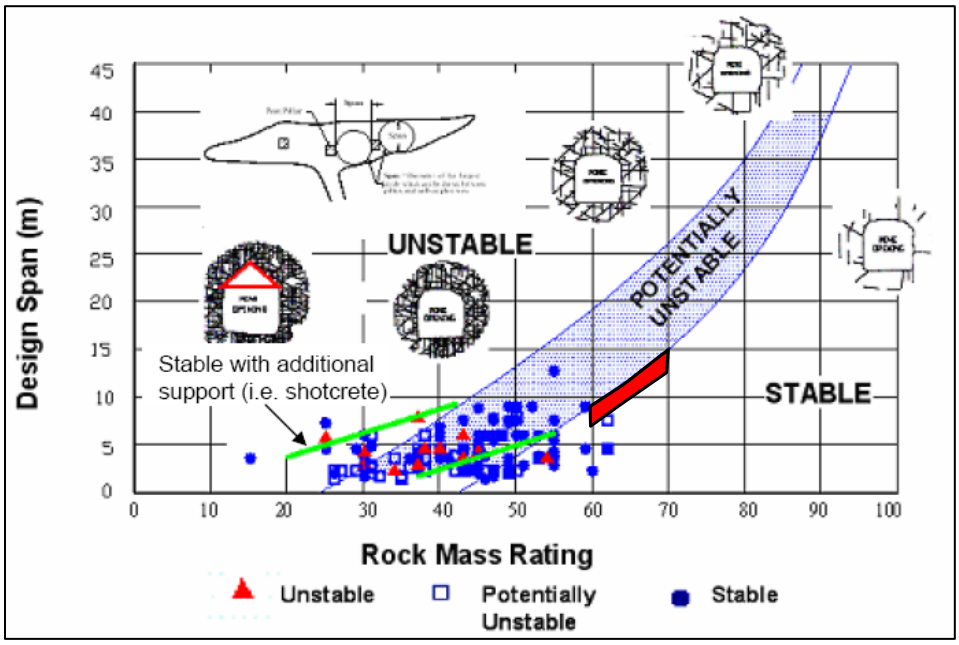


Figure 4-1: Ouchi critical span curve

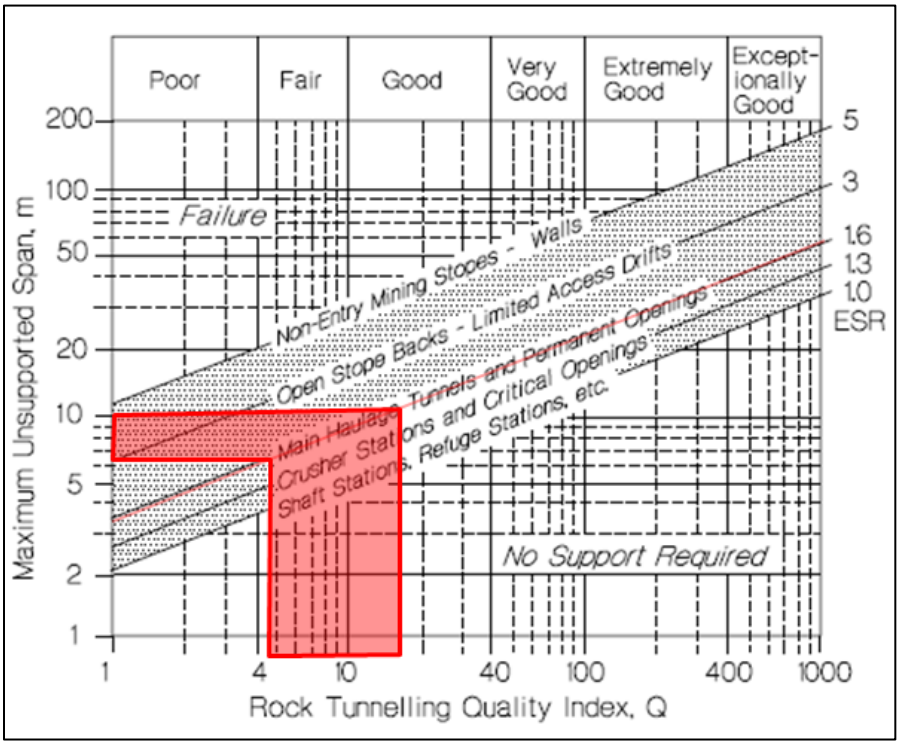


Figure 4-2: Q-system unsupported span limits for permanent openings (ESR=1.6)

4.4 Pillar Design and Stability Assessment

Pillar analyses were conducted using tributary area loads and several pillar equations that incorporate pillar width to height ratios. The Holland equation;

$$Pillar\ Strength = UCS\ (W/H)^{0.5}$$

was used to evaluate 5x5m pillars and 10m rooms (Table 4-1: Pillar Calculations). Practical experience and the factor of safety indicate this configuration to be reasonable for pillars up to about 7m height. Taller pillars will need to be reinforced or supported by fill to maintain stability.

Table 4-1: Pillar Calculations

Depth (m)	Pillar W1 (m)	Room R1 (m)	Pillar Height (m)	W/H Ratio	Pillar Strength (MPa)	Extraction Ratio (%)	Factor of Safety
300	5	10	5	1	120	89	1.7
300	5	10	7	0.7	101	89	1.4
300	5	10	10	0.5	85	89	1.2
300	5	10	15	0.3	69	89	1

For most mining areas, superimposed 5m by 5m pillars are planned to limit spans to 10m. These spans would be mined using a cut height of 5m. Pillars over 5m height should be assessed on an individual case basis, and rock support or fill should be utilized. Based on the empirical evaluations of Holland (1964) and Obert and Duvall (1967), these pillars are considered to provide the required support.

4.5 Fill

In thicker parts mineralization, waste rock backfill will be used to provide support to tall slender pillars (c.f. bolt and shotcrete to floor). Tall slender pillars will be developed following benching of the floor where orebody thicknesses are greater than 5.0m. As the tops of the pillars will no longer be accessible by mining equipment, fill will be required both for support and access reasons through mined areas.

The 5m stope cuts will be filled with waste rock, from underground mine development or waste from the Area 2 pit, to provide the necessary hanging wall and post pillar support. The waste rock will be placed by 40 Tonne trucks in waste storage areas located at the stope access level and then placed in the stopes by LHD equipment. Waste Fill will be pushed tight to the hanging wall and to the back by a push plate attached to the scoop. Stope floor leveling will be established on the next cut and dilution controlled by grade.

4.5.1 Longhole Stoping Opportunities

Longhole stoping may be considered where thicker ore zones are encountered at the Area 2 and 118 mining areas. The following guidelines were developed using the Potvin and Mawdesley empirical Stability Graph methods (see figures 5-3 and 5-5). These, as well as knowledge gained during development, will be used in the event LH stope areas are encountered.

- Overcut and Undercut Support Requirements
  - Support as per minimum standards for man entry access
  - Support at brows includes intersection type support

- Open stope limits
  - Length 50m
  - Height 40m (floor to back)
  - Back unsupported (LH Uppers)
    - 10m moderate risk 50% failure likelihood
    - 15m high risk 70% failure likelihood

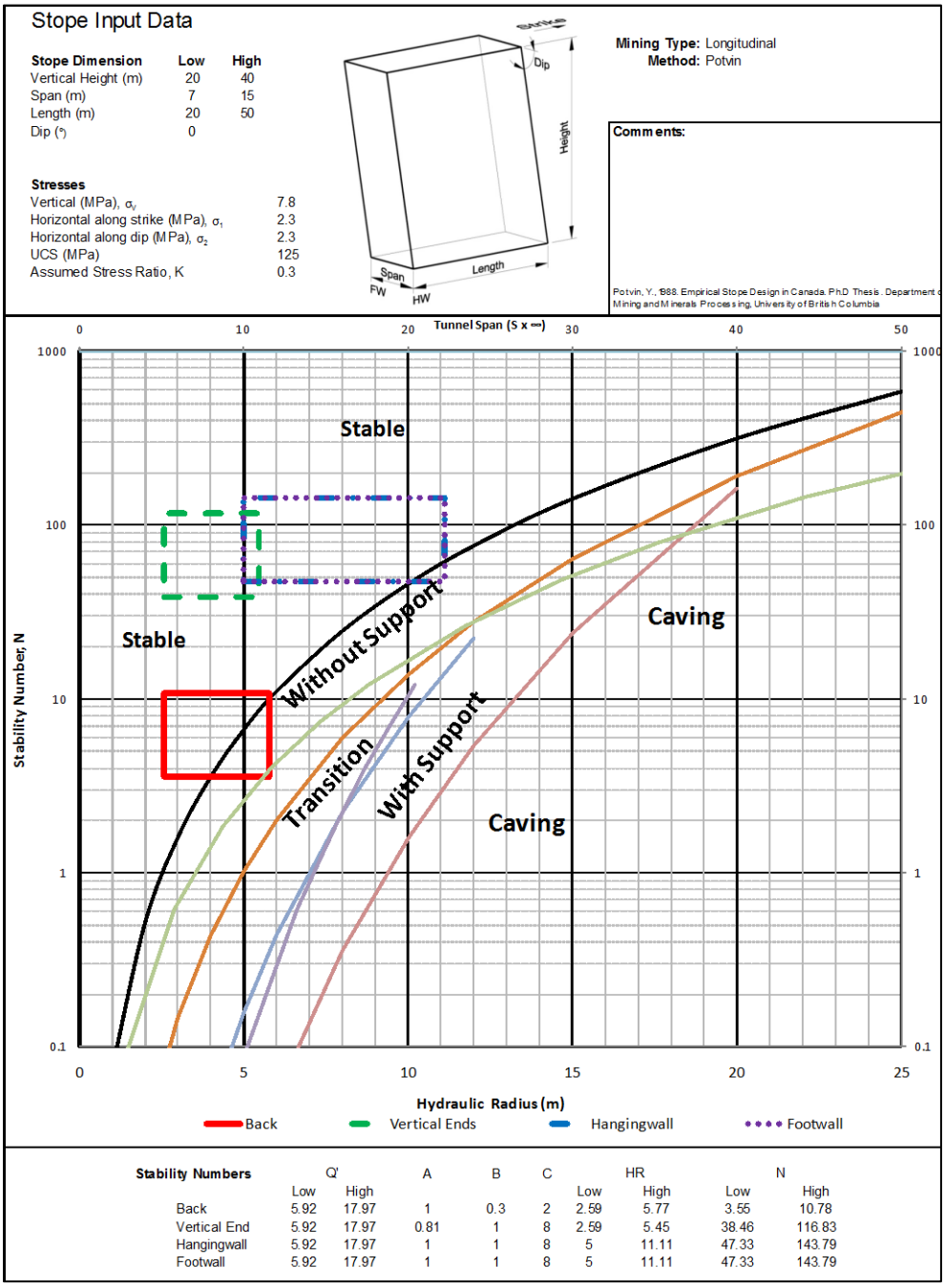


Figure 4-3: Potvin stope stability graph—Area 2, 118 and East mining areas

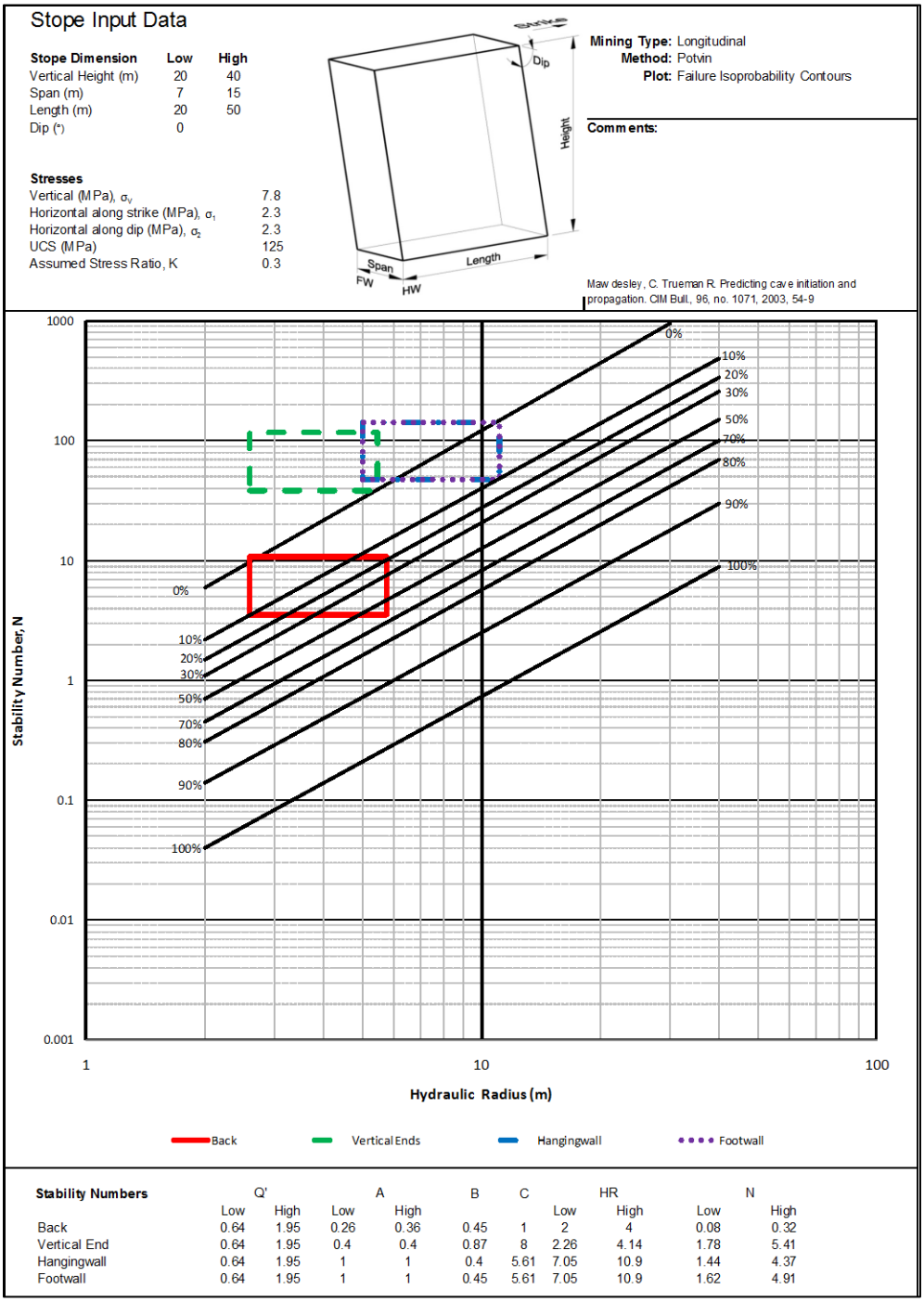


Figure 4-4: Mawdsley stope probability of failure graph—Area 2, and 118 mining areas

4.5.2 Kinematic Wedge Analysis

A wedge analysis has been completed to understand the potential geometries and sizes of blocks formed during mining. The room and pillar mining method means that all headings are essentially 'development' (based on

spans) and as such have been considered in the analysis. A drift size of 5x5m has been used to date in the main ramp with a wider span of 10m also considered.

4.5.3 Lateral Development

Key observations from the analysis are:

- The formation of potentially unstable wedges occurs in the back and sidewalls of the excavation related to the three primary joint sets.
- The least favourable orientation for lateral development occurs between 340° and 40° azimuth.
- The apex height of the identified wedge is controlled by the plunge and span of the development. This height is generally less than 3.0m for a 5m span.
- Larger wedges are generated with an increased span of 10m. These will be identified during mining of the primary heading, and will need to be well supported prior to slashing out on retreat.
- The ground support recommendations will provide sufficient support pressure to prevent the wedges generated from being released. Additional support maybe required dependent on the plunge of infrastructure relative to small scale structures.

4.5.4 Vertical Development

Key observations from the analysis are:

- Large wedges are formed in all the walls and back of the vertical excavations (i.e. vent raises).
- The geometry is the wedge is controlled by the plunge of the infrastructure.
- The apex height of the identified wedges is generally less than 0.8m and support recommendations will provide sufficient support pressure to prevent the wedges identified from being released.

4.6 Ground Support Recommendations

Ground support recommendations are provided in Table 4-2. These support recommendations do not consider weak ground conditions generated by fault structures and highly foliated areas. Additional support will be required in these areas. As well, current ramp ground support requirements are developed in conjunction with Itasca Consulting Group Inc and monitored by Minto personnel. The support standards are being developed for good ground, bad ground and 3 way intersections. Four way intersections will be avoided if at all possible.

Table 4-2: Minimum Support Requirements

Area		Maximum Dimensions (m)	Support Requirements	Comments
Main Infrastructure	Main Decline	5.0Wx5.0H	2.4m threaded rebar (19mm) on a 1.2m diamond spacing (8 or 9 anchors in a ring) Welded wire mesh across back and down walls to 1.8m from floor If required: 25-50mm shotcrete	Shotcrete and spiling may be required where fault zones are intersected. Friction anchors may be subtituted when headings are considered to be open for the short term only.
	Intersections	>7.0m dia. Circle	In addition to standard support: 4.0m cable bolts on a 2m spacing throughout intersection	Final support to be installed prior to taking breakaway.
	Alimak Raise	3.0x5.0	1.8m threaded rebar (19mm) on a 1.2m diamond spacing (14 anchors in a ring) Welded wire mech on all permanent surfaces If required: 25-50mm shotcrete	Raisebore mining is an option. Stability and support should be reviewed once location is selected.
Production Development	Rooms	10.0x5.0	3.0m Swellex on a 1.2m diamond spacing (8 or 9 anchors in a ring) Welded wire mesh across back and down walls to 1.8m from floor Required for fault/broken zones: 25-50mm shotcrete 5m cable bolts on 1.5x1.5m pattern.	It is estimated that 20% of all production areas will require additional support. Spans will likely need to be reduced in localized areas; shotcrete pillars could be considered. Additional longer support may be required to control adverse structure.
	Pillars	5.0x5.0	If required: 2.4m threaded rebar (19mm) installed to floor level Welded wire mesh/straps to floor level 25-50mm shotcrete	It is estimated that 20% of all pillars will require additional support due to adverse structure/broken ground. This can be assessed on an individual basis with good geotechnical mapping.
		5.0x >5.0	Fill room. Or 2.4m threaded rebar (19mm) installed to floor level Welded wire mesh/straps to floor level 25-50mm shotcrete	

4.7 Crown Pillar Design – Area 2

A Map3D numerical model has been constructed to understand the interaction between the Area 2 open pit and underground mining areas. The current mine plan has the open pit and underground areas mined concurrently. It is expected that while the underground will not have an impact on the open pit due to limited extraction, the pit may impact underground workings through ground relaxation, rebound, and blast vibrations.

The model input parameters were based on laboratory testing completed for the Phase V PFS study (Table 4-3). The 3D geometries have been simplified based on pillar and span recommendations provided by SRK.

Table 4-3: Map3D material parameters

Material	IRS (MPa)	Hoek-Brown Criterion		Young's Modulus (GPa)	Poisson's Ratio
		mb	s		
Granite	125	6.4	0.0117	30	0.3

Figure 4-5 shows the initial phase of underground mining (10m spans, 5m pillars), followed by extraction of the open pit. In-situ vertical stresses of approximately 7 MPa are increased to greater than 30 MPa through the pillars following mining of panel 201 closest to the pit. Once the open pit is mined out, a significant reduction in vertical stress is observed through the pillars. Loss of confinement could result in damage to ground support, development of loose, and back- break.

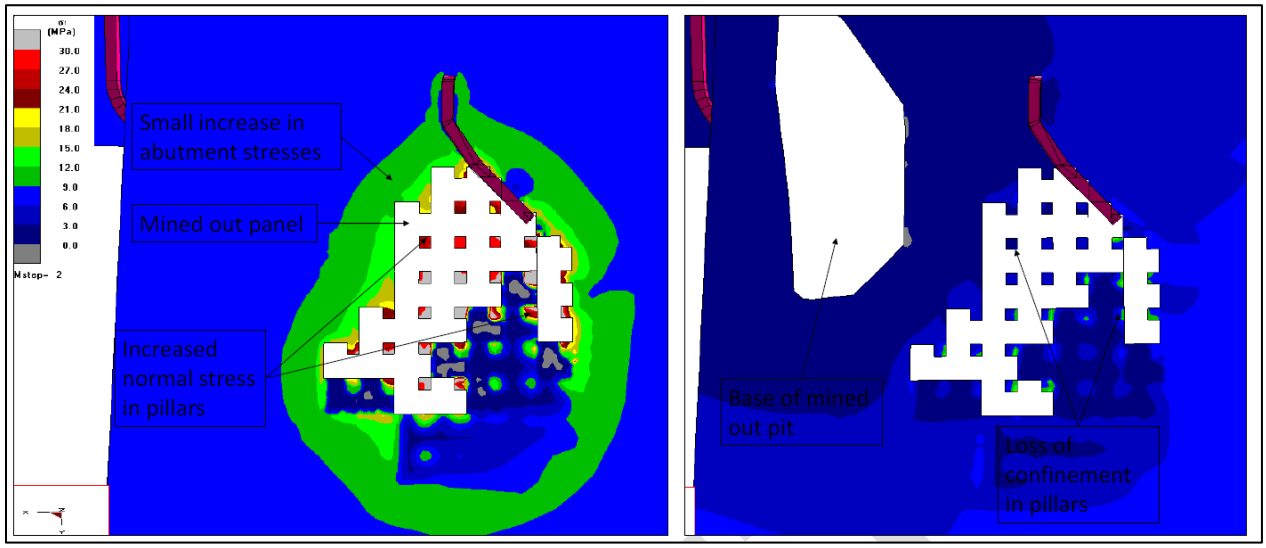


Figure 4-5: Map3D plan stress plan view showing pre (left) and post (right) Area 2 open pit mining. Significant loss of confinement is observed in pillars.

It is considered that the main interaction between the pit and underground will be in the stoping closest to the base of the pit. Any changes to the depth of pit and underground mining areas should be reviewed to assess the impacts of stress change as discussed here.

An OP/UG cross-over study was done to determine the pit limit for the Area 2 mineralized zone. A 50 m crown pillar will be used as a barrier between the pit walls, pit bottom and the proposed underground mine. Area 201 will not be developed, at this time, and left to later in the mine life to reduce the potential water risk as well as to maximize recovery in this area during retreat mining of the Area 2 block.

5 Mine Development and Design

5.1 Mine Access

The main access to the ore body will be via a single decline developed at a -15% gradient. It will be used for ore and waste haulage, access for personnel, equipment, materials, and services. It would also be utilized as an exhaust airway.

The decline will be driven on the footwall side of the deposit and will provide multiple accesses to the ore body through the cross-cuts.

The size of the decline was selected according to the mobile equipment size, required clearances, and ventilation requirements during development and production. It was estimated that a 5.0 m wide by 5.0 m high decline is satisfactory for a 40 t truck (and 50 t trucks in the future, if desired) and ventilation requirements for 2,000 t/d production rate (see Figure 5-1). A 25 m or greater ramp curve radius will be employed for ease of operation of the large mobile equipment as well as improved maintenance costs.

Re-muck bays will be developed every 150 m along the decline to allow efficient use of the drilling equipment and will hold two rounds of development muck. The re-muck bays will be of a similar size as the decline and will be up to 15 m in length. After they are no longer used for development, the bays will be used for equipment storage, pump stations, drill bays, service bays, etc.

Installation of 2.4 m fully grouted resin rebar bolts on the back and the walls of the ramp on 1.2 m x 1.2 m pattern, 100% mesh coverage and an allowance of 50 mm of shotcrete for 5% of the total length of the ramp was assumed for ground support.

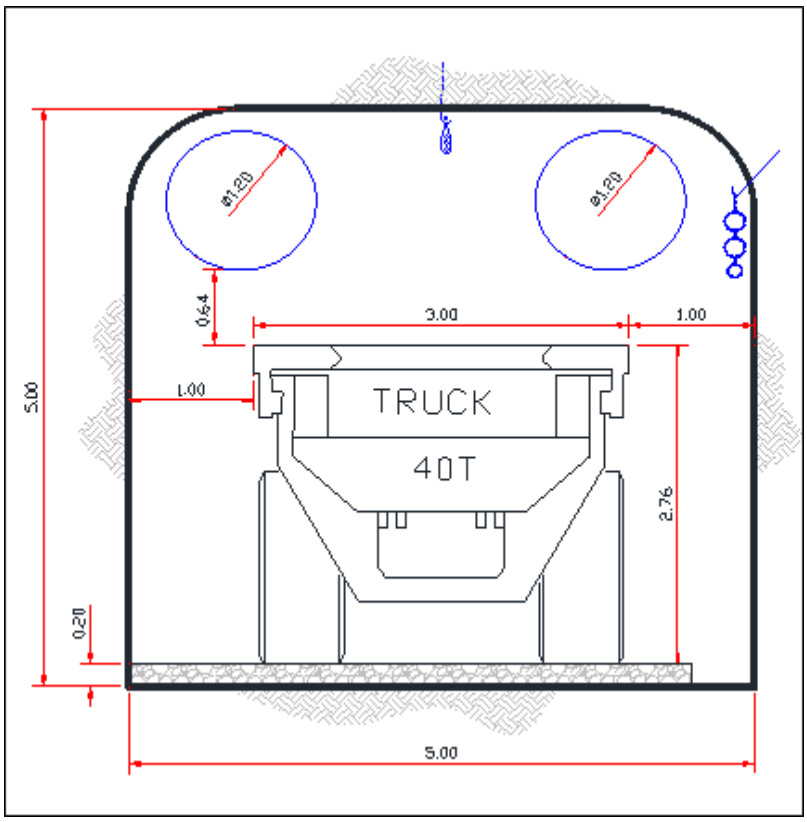


Figure 5-1: Decline Cross Section

5.2 Mine Plans and Design

Figure 5-2 presents a schematic of the current underground mine design, further designs are presented in Appendix C.

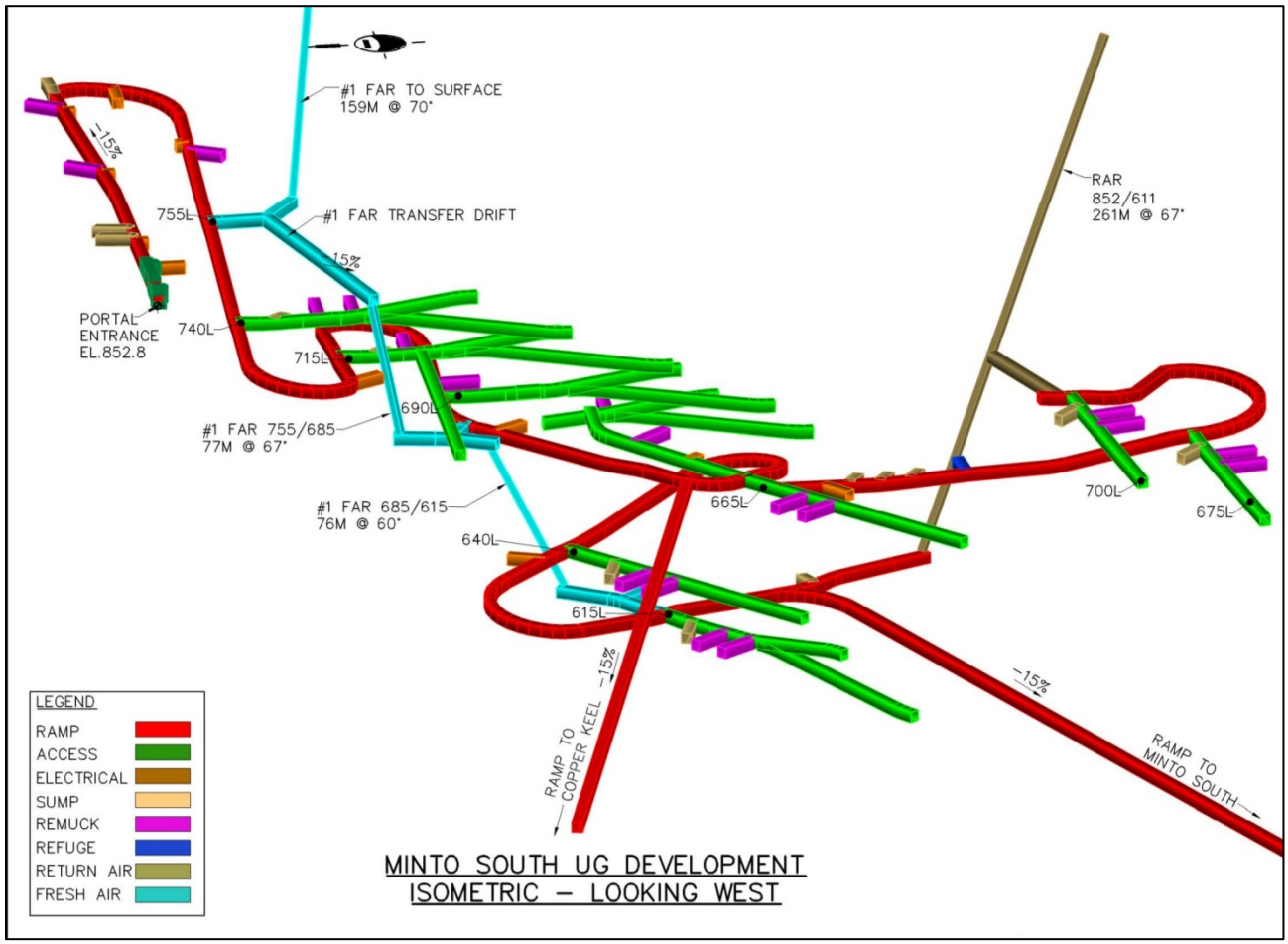


Figure 5-2: Isometric view looking west of underground development

6 Mine Operation

6.1 Handling or ore/waste

A combination of 5.4 m3 (10 t) LHD and 42 T trucks have been selected as being the most economical option for ore and waste haulage at Minto underground mine. The equipment cycle times, productivities, mucking and trucking requirements, equipment operating and capital costs were considered in selecting the optimum equipment combination.

6.1.1 Ore handling

The broken ore from the stopes will be mucked by stope LHDs to remuck bays, or loaded directly onto 42 T underground trucks. The trucks will be used to carry ore from the mine to one of the current open pit stockpiles.

6.1.2 Waste Handling

The waste rock from the development headings will be mucked by LHDs directly to the trucks or to remuck bays located up to 150 m from the face. The waste rock will then be hauled by the trucks to the surface storage pads at the Portal. Upon assaying of the development rounds, the waste will be moved to the appropriate waste dump on surface.

When underground mine production commences, it would be possible to use mine waste rock from development as stope backfill along with the waste rock from the surface.

The average truck haulage distances from the stope to the ramp portal were estimated using the mine design model to estimate trucking productivities and cost. It was assumed that the trucks would travel less than 700 m on surface from the portal to the ore stockpile.

The same trucks are will also be used to bring backfill material from the surface to mined-out stopes. This material will consist of underground waste material that has been temporarily stored on surface due to stope timing issues or waste material from the open pit.

Whereas surface mining operations can use blasthole assays as the means by which ore and waste are classified, underground mining presents unique challenges that necessitate a different approach. Accurate blasthole sampling is not possible, as holes are drilled horizontally and use water to flush out cuttings and control dust. The ore at Minto lacks any distinct property such as magnetism, radioactivity, or fluorescence that would enable electronic sensor-based downhole logging.

Currently, development rounds are mucked from the ramp face to underground remuck bays. These remuck bays hold 2-3 development rounds consisting of approximately 300 tonnes each. The content of the remucks are then taken to surface and placed in an identified pile and assayed. Upon the results of the assay, the material is placed on the appropriate ore piles or waste dumps.

6.2 Equipment

Criteria used in the selection of underground mining equipment include:

- Mining method;
- Orebody geometry and dimensions;
- Mine production rate;
- Ventilation requirements;
- Operating and capital cost.

Table 6-1 lists underground mobile equipment selected for the 2,000 t/d mine production rate, however, additional equipment may be required based on economics, cycle times and ground conditions.

Table 6-1: Underground Mobile Equipment List

Equipment	Quantity
Drilling Equipment	
Development / Production Jumbo (2 boom)	2
Rockbolter	3
Loading & Hauling Equipment	
Production / Development LHD, 5.4 m^3 (10 t)	2
Haulage Truck, 40 t	4
Service Vehicles	
Grader	1
Explosive Truck	1
ANFO Loader	2
Cassette Carrier	2
Personnel Cassette	2
Boom Cassette	1
Fuel / Lube Cassette	1
Mechanics Truck	1
Scissor Lift	1
Supervisor/Engineering Vehicle	3
Electrician Vehicle - Scissor Lift	1
Shotcrete Sprayer	1
Transmixer	1
Forklift	1

Mobile underground equipment will be maintained in a mechanical shop located on the surface. Some small maintenance and emergency repairs would be performed in a service bay underground. A mechanics truck would be used to perform emergency repairs underground.

A maintenance supervisor will provide a daily maintenance work schedule, ensure the availability of spare parts and supplies, and provide management and supervision to maintenance crews. The supervisor would also provide training for the maintenance workforce.

A maintenance planner will schedule maintenance and repair work, as well as provide statistics of equipment availability, utilization and life cycle. A computerized maintenance system will be utilized to facilitate planning.

The equipment operators will provide equipment inspection at the beginning of the shift and perform small maintenance and repairs as required.

6.3 Ventilation

A fresh air system consisting on a mine air heating plant and egress manway will be driven by alimak to surface in the 118 Block. A Return air raise will be driven in the Area 2A block. The sizes of the raises is still under review

however, at this time the Fresh Air Raise will consist of 2, 3mx3m parallel alimak raises capable of delivering 212– 240 m/s (450,000 – 500,000 cfm's) of air. This system would be capable to meet the future needs of underground mining.

The intake raises will be developed on the west side of the Area 2 pit with the raise collar in an area of minimal overburden. The top 150 m of the ventilation raise from the ramp elevation of 740 mL to surface is planned to be developed using an Alimak. It is planned to extend the intake raise down with the main ramp to the Area 2A block

Ventilation access drifts will be developed to connect the level development and ramp to the ventilation raises. Those drifts will be 15 m to 40 m long and will be developed at -15% gradients to reduce length of the raise.

The design basis of the ventilation system at Minto underground operation was to adequately dilute exhaust gases produced by underground diesel equipment. Air volume was calculated on a factor of 0.06 m^3/s per installed kW of diesel engine power (100 cfm per installed hp). The kW rating of each piece of underground equipment was determined and then utilization factors, representing the diesel equipment in use at any time, applied to estimate the amount of air required. The main fresh air raises and heating system will be sized to deliver and heat the 212 – 240 m/s (450,000 - 500,000 cfm) of air. This is more than required to ventilate the 118 block and the Area 2A Block currently estimated at approximately 165 m/s (350,000 cfm's). Stantec Consulting will continue to assist Minto with the vetilation design and optimization.

Air velocity in the main ramp was restricted to a range of 0.25 m/s to 6 m/s. This range was used to determine the size of development. The main intake fan would be installed on surface at the collar of the Area 118 intake ventilation raise (FAR) and the exhaust fan at the collar of the Area 2A exhaust ventilation raise (RAR).

In the first year of production, fresh air was designed to be downcast through the main intake ventilation raise, and exhaust up-cast through the decline. This improves the quality of the ventilation since viceated air from the active stopes would then proceed past the haulage trucks on the main decline and is then exhausted to surface. Once the Area 2A exhaust ventilation raise is developed and equipped with an exhaust fan, about 70% of total air would be exhausted through that raise and the remaining 30% will be viceated air that proceeds up the decline. No ventilation doors or regulators would be installed in the main decline as the exhaust fan will provide an appropriate air distribution between the mining areas.

Air movement to the stopes would be controlled by directing air flow with ventilation curtains and using the auxiliary ventilation fans. Ventilation regulators, doors, and bulkheads would also be used to control airflow in

6.3.1 Ventilation of Headings During Development

At least 44.8 m^3/s (95,000 cfm) of air will be available to dilute and remove exhaust from a 40 t truck, a 5.4 m^3 LHD, and a double-boom jumbo working in development heading as outlined in Table 6-3.

Table 6-2: Ventilation Requirements for Development Heading

Description	Quantity	Diesel (kW)	Utilization (%)	Utilized (kW)	Air Volume (m3/s)
LHD, 5.4 m3	1	220	100	220	13
Truck, 40 t	1	354	100	354	21
Jumbo, two-boom	1	111	10	11	1
Total				**585**	**35**

The requirements for auxiliary ventilation were estimated for the 1,300 m long development heading, the longest decline development distance. The auxiliary ventilation fans and steel ventilation pipe would be used to provide required amount of air at the development face. Only pipe resistance was considered to calculate the pressure loss and power requirements as the resistance of the heading is negligible by comparison. Using Atkinson's equation for air flow in steel pipe, two 112 kW auxiliary fans with two separate 1.2 m diameter steel ventilation pipe were selected for the longest distance of decline development (Table 6-4).

Table 6-3: Atkinson Equation for Air Flow in Ventilation Ducts

Duct Diameter (m)	Duct Area (m^2)	Duct Perimeter (m)	Air Volume (m^3/s)	Duct Air Velocity (m/s)	Friction Factor (kg/m^3)	Duct Length (m)	Pressure Loss (kPa)	Power Required (kW)	Fan Power (kW)
Two Fans and Ducts									
1.0	0.79	3.14	18	22.4	0.003	1,300	7.7	135	181
1.2	1.13	3.77	18	15.5	0.003	1,300	3.1	54	73
1.3	1.33	4.08	18	13.2	0.003	1,300	2.1	36	49
1.4	1.54	4.40	18	11.4	0.003	1,300	1.4	25	34
1.5	1.77	4.71	18	9.9	0.003	1,300	1.0	18	24
Single Fan and Duct									
1.0	0.79	3.14	35	44.7	0.003	1,300	30.9	1,084	1,445
1.2	1.13	3.77	35	31.1	0.003	1,300	12.4	435	581
1.3	1.33	4.08	35	26.5	0.003	1,300	8.3	292	389
1.4	1.54	4.40	35	22.8	0.003	1,300	5.7	201	269
1.5	1.77	4.71	35	19.9	0.003	1,300	4.1	143	190

The 50 kW and 40 kW fans and 1.2 m diameter ducts would be used to provide auxiliary ventilation in other development headings and production stopes.

6.4 Mine Air Heating

The underground operation was designed to use brine instead of heating the mine air. The Yukon Compensation Health and Safety Board expressed concerns about worker exposure on an 11 hour shift in an unheated environment. Therefore, Minto agreed to provide heated ventilation in the mine.

Propane fired Eclipse burners will be employed during the initial development phase as well as in the Life-of-Mine. Underground air will be monitored for temperatures throughout the workplace.

During the initial development, approximately 150 to 200 meters, a 6 M Btu propane fired burner in conjunction with a 122 KW variable frequency drive fan will deliver 21.3 m^3/s (45,000 cfm's) to ventilate the scoop, jumbo and the bolter. As development advances past this initial point, a 10 M MBtu propane fired burner will be installed and the 122 KW fan will be turned up to the designed 44.8 m^3/s (95,000 cfm's). This will provide ventilation for the utilization of a 42 T haulage truck.

Upon completion of the 118 Main Fresh air raise, the temporary heating/ventilation installation, at the portal, will be removed and a permanent plant installed, capable of producing and heating 212 – 241 m^3/s (450,000 – 500,000 cfms).

6.5 Underground Electrical Power

The major electrical power consumption in the mine will be from the following:

- Main and auxiliary ventilation fans;
- Drilling equipment;
- Mine dewatering pumps;
- Air compressors; and
- Maintenance shop

High voltage cable (4160V) would enter the mine via the decline and be distributed to electrical sub-stations located just below the portal collar. The power cables would be suspended from the back of development headings. All equipment and cables would be fully protected to prevent electrical hazards to personnel.

High voltage power would be delivered at 4.16 kV and reduced to 600 V at electrical sub-stations. All power would be three-phase. Lighting and convenience receptacles would be single phase 120 V power.

6.6 Compressed Air

Minto currently has 2 electric and I diesel air compressors. The electric compressors will be used to supply air underground, while the diesel will supply surface air as required..

The underground mobile drilling equipment such as jumbos, rockbolters and Emulsion / ANFO loaders will be equipped with their own compressors. No reticulated compressed air system was envisioned to be required underground.

The electric compressors will be utilized to satisfy compressed air consumption for miscellaneous underground operations, such as: jackleg and stoper drilling, Alimak raise development and pumping with pneumatic pumps.

6.7 Dewatering and Effluent Treatment

6.7.1 Water Supply

The major drilling equipment such as jumbos, rockbolters and exploration drills will use run-of-mine water obtained from the active pit area. Currently, the supply water is placed into a 45,000 liter (10,000gal) heater storage tank just outside the portal. At approximately 125 meters down the ramp from the portal collar, a Supply Water Storage Drift will be excavated to hold approximately 227,000 liters (50,000 gal) of water. Water is currently trucked to the 45,000 liter tank and will be trucked / piped to the 227,000 liter (50,000 Gal) supply water storage drift once the drift has been fully developed.

6.7.2 Mine Dewatering

During initial development, ramp discharge water will be pumped to a surface and then transported with a water truck and discharged into to the main pit. Once water has been moved to the Main Pit, it will be subject to treatment with the existing onsite facilities. A permanent discharge water line, to the main pit, will be investigated to determine the economics of trucking water verses the pipeline.

Development of the main sump is proposed at the bottom of the mine near the Area 2A return air raise. It will be a typical two-bay sump to allow suspended solids to settle out of the water before pumping. Coarse material settled out in the main sump will be removed periodically by LHD and disposed. Old remuck bays will be utilized as temporary sumps during main access ramp development.

Water is planned to be pumped from the main sump by a high-pressure pump through a 150 mm diameter steel pipe located in the ventilation raise to the main pit or pumped to the discharge storage drift for trucking to the main pit. The sump will be equipped with two high-head submersible pumps – one for operation and one on standby.

6.8 Transportation of Personnel and Materials Underground

All mine supplies and personnel will access the underground via the main access decline.

Two personnel vehicles will be used to shuttle employees from surface to the underground workings and back during shift changes. Supervisors, engineers, geologists, and surveyors will use diesel-powered trucks as transportation underground. Mechanics and electricians will use the mechanics' truck and maintenance service vehicles.

A boom truck with a 10 t crane will be used to move supplies, drill parts, and other consumables from surface to active underground workings.

6.9 Mine Personnel

The mining employees at the Minto underground operation were divided into two categories: salaried personnel, and hourly labour.

The personnel requirement estimates were based on the following:

- A 2,000 t/d production rate; and
- A crew rotation as per the Hours of Work Variance from the YWCHSB.

A mining contractor will be used for mine lateral and vertical development. It is planned for company crews to commence stoping in the 2nd half on 2013. Contractor labour and supervisory staff numbers are not included in this section.

The labour and personnel requirements described in this section were estimated for the production stage of the mine life.

Salaried personnel requirements, including engineering, technical, and supervisory staff, are listed in Table 6-5.

Table 6-4: Technical and Supervisory Staff

Staff Mine Operation	**Quantity**
Mine Superintendent	1
Senior Mining Engineer	1
Mine Ventilation/Project Engineer	1
Geotechnical Engineer	1
Geologist	1
Geological Technician	1
Mine Rescue / Safety / Training Officer	2
Surveyor	2
Mine Technical	1
Mine Captain	1
Mine Supervisor / Shift Boss	4
Total Operating Staff	**16**
Staff Mine Maintenance	**Quantity**
Maintenance Superintendent	1
Maintenance Planner	2
Mechanical / Electrical Foreman	1
Maintenance Supervisor/Shift Boss	2
Total Mine Maintenance Staff	**6**
Total Mining Staff	**22**

Hourly personnel were estimated based on production and development rates, operation productivities, and maintenance requirements. Personnel productivities were estimated for all main activities by developing cycle times for each operation.

Hourly labour requirements at full production are listed in Table 6-6.

Table 6-5: Hourly Labour

Labour Description	Personnel per Shift	Personnel per Day	Total Payroll
HOURLY MINE LABOUR			
Production / Development			
Jumbo Operator	2	4	8
Ground Support	2	4	8
Blaster	1	2	4
Haulage			
Scoop-Loader Operator	2	4	8
Truck Drivers	3	6	12
Mine Services & Safety			
General Labourer / Service Crew	1	2	4
Grader Operator	1	1	2
Utility Vehicle Operator/Nipper	1	2	4
General Helper	1	2	4
Sub-total Mine Operating	**14**	**27**	**54**
MINE MAINTENANCE			
Lead Mechanic / Electric	1	1	2
HD Mechanic, mobile	1	2	4
Mechanic, stationary	1	1	2
Electrician	1	2	4
Welder	1	1	2
Tireman / Instrument Man	1	1	2
Mechanic Apprentice	1	1	2
Dry / Lampman / Bitman	1	1	2
Sub-total Mine Maintenance	**8**	**10**	**20**
Total Mine Operating	**22**	**37**	**74**

6.10 Communications

A fiber optic communication system will be used as the communication system for mine and surface operations. The system will be a radio over IP and will provide communications, personal tagging and tracking as well as critical equipment control. Underground personnel (such as mobile mechanics, crew leaders, and shift bosses) and mobile equipment operators (such as loader, truck, and utility vehicle operators) will be supplied with an underground radio for contact with the fiber optics network.

6.11 Explosive Storage and Handling

Explosives would be stored on surface in permanent magazines. Detonation supplies (NONEL, electrical caps, detonating cords, etc.) would be stored in a separate magazine.

Underground powder and cap magazines will be prepared near Area 2 production stopes. Day boxes will be used as temporary storage for daily explosive consumption.

Bulk Emulsion will be used as the major explosive for mine development and production. Packaged emulsion would be used as a primer and for loading lifter holes in the development headings. Smooth blasting techniques may be used as required main access development headings, with the use of trim powder for loading the perimeter holes. Ammonium nitrate (AN) and fuel oil (FO) may be used as conditions warrant.

During the initial decline development, blasting in the development headings will be done at any time during the shift when the face is loaded and ready for blast. All personnel underground would be required to be in a designated Safe Work Area during blasting. During production period, a central blast system would be used to initiate blasts for all loaded development headings and production stopes at the end of the shift. All blasting in the mine would be development-style blasting; no large scale blasts would be undertaken. Safe work procedures that are currently being used at the mine are presented in Appendix D. Safe work procedures will be revised as required by the conditions in the mine.

6.12 Fuel Storage and Distribution

An average fuel consumption rate of approximately 4,900 l/d is estimated for the period of full production.

Haulage trucks, LHDs, and all auxiliary vehicles would be fuelled at fuel stations on surface. The fuel/lube cassette will be used for the fuelling/lubing of drills and rock bolters. A 50,000 liter EnviroTank has been sourced and will be installed when the ground conditions (thawed) allow for the installation of the membrane and berms constructed.

All underground personnel will be trained in site wide spill prevention and spill response protocols outlined in Minto Mine's Spill Contingency Plan.

7 Mine safety

7.1 General Mine Safety

Minto Mine and the development contractor emphasize safety in all duties at the mine; this philosophy is shared by and with senior management, on site supervisors and daily operators.

This project will be undertaken with a dedicated focus on *"Zero Harm".* All non-routine tasks will be assessed for risk to ensure suitable control measures are in place to better achieve *"Zero Harm"*.

All work will be performed within the strict guidelines of both Minto's and Contractor's safety programs. Both programs will comply with all required internal policies and procedures, as well as the Yukon Territory's legislated requirements.

The Contractor will utilize its Safety and Training which includes risk assessments, job observations, workplace inspections and regular program audits. Any new work which is non-routine will be subjected to a full risk

assessment which would then be used to develop new site specific work procedures. The Contractor will maintain detailed training records of every employee, both on-site and at their main office.

A key component of the Contractor's commitment to *"Zero Harm"* is the use of the *Zero Harm Safety System* and associated safety card in the field, which is consistent with current on-site practices.
All safety concerns are documented, assigned responsibility, and tracked until rectified.

7.2 Emergency Response

Initially, when the working face is within 500 metres of the portal, emergency escape will be directly to the surface via the portal. Once the decline reaches 500 metres in length from the portal to the working face, a portable refuge station will be installed underground near the face. If a suitable location is determined before 500 metres, then the refuge station will be installed.

The refuge stations are designed to be equipped with compressed air, potable water, and first aid equipment; they will also be supplied with a fixed telephone line and emergency lighting. During the initial development phase, one refuge station, capable of 36 hours and 15 men will be utilized. As manpower increased a second refuge station will be sourced capable of being sealed to prevent the entry of gases and would provide 72 hour containment for up to 15 men. The portable refuge chambers will be moved to the new locations as the working areas advance, eliminating the need to construct permanent refuge stations.

Fire extinguishers will be provided and maintained in accordance with regulations and best practices at the underground electrical installations, pump stations and other strategic areas. Every vehicle will carry at least one fire extinguisher of adequate size and proper type. Underground heavy equipment will be equipped with automatic fire suppression systems.

As well, all underground personnel will be required to carry self-rescuer devices. The self-rescuers can convert carbon dioxide from the user's breath into oxygen, they will provide 15 – 20 minutes of Performance duration and 32 minutes of Rest duration. In addition to the personal devices, five devices with longer performance durations will also be supplied and kept at the ramp face during development; personal CO detectors will be made available to the development crews.

Fire extinguishers will be provided and maintained in accordance with regulations and best practices at the underground electrical installations, pump stations, fuelling stations, and other strategic areas. Every vehicle will carry at least one fire extinguisher of adequate size and proper type. Underground heavy equipment will be equipped with automatic fire suppression systems.

A mine-wide stench gas warning system will be installed at the main intake raise to alert underground workers in the event of an emergency. During the initial development phase; prior to completion of the main fresh air raise, stench gas warning will be in the temporary fresh air system.

The main access decline would provide primary access and the ventilation raises with dedicated manway would be equipped with ladders and platforms providing the secondary exit in case of emergency. This secondary egress will be completed prior to production stoping.

The Emergency Response Team that is currently at Minto has been focused on surface emergency methods. Minto has ensured that the underground contractor will supply an adequate team with underground specialization to meet the needs beyond surface emergency response.

Further information on mine safety for the underground mine is provided in the Emergency Response Plan in Appendix E.

7.3 Hours of Work

Minto requested and received an hours of work variance (presented in Appendix F), specific to the first 4,500 meters of ramp development and associated ore removal.

The requested hours of work variance for these 4,500 meters of underground development included:

- 11 hours per shift of underground exposure for workers in enclosed cabs of mobile equipment.
- 10.5 hours per shift of underground exposure for all other employees.
- Shift rotation of 3 weeks on and 3 weeks off for the contractor's hourly rated employees.
- Shift rotation of 4 weeks on and 2 weeks off for the contractor's staff employees.

7.4 Industrial Hygiene an Fatigue Management Programs

An industrial hygiene (IH) consultant was engaged to assist Minto in the development of an underground IH plan and management programs (acceptable to YWCHSB) for, but not limited to, air quality, noise and fatigue. The consultant will be involved throughout the development to conduct regular review of the program and testing results. The purpose of this plan is to develop process and procedures to ensure the highest possible air quality is maintained, (TLV levels), manage noise and to develop and implement a Fatigue Management Program. The Fatigue Management Plan has been presented in Appendix F. The IH consultant will also be utilized in the definition and calculation of adjusted TLV values.

Until such times that the IH data confirms that air quality exposure is below the adjusted TLV concentrations, respirators will be a mandatory piece of PPE equipment to all employees entering the underground workings.

The plan is that that prior to the completion of the 4500 meters of development to apply for a permanent variance to the hours of work. The IH data and programs for air quality, noise and fatigue will form the bases of this request.

7.5 Hours of Underground Exposure Monitoring

In order to ensure compliance with the requested hours of underground exposure, Minto Mine will utilize Smart Tags. Smart Tags are long range RFID (Radio Frequency Identification) to track employee's underground exposure hours in real time. This system consists of an active RFID tag located on the employee, whether it is on their hard hat, safety belt pouch or inside the cap lamp; and a networked RFID reader located at the portal

collar. Data is then sent to a central computer system which facilitates system control and monitoring though the Smart Tag software (or similar) in real time by employee.

Minto is also investigating the use of an integrated system offering PED (Personal Emergency Devices), fiber optics communications, radio over IP, and a smart tag tracking system. Although it is Minto's plan to utilize stench in the ventilation system during development, the PED system may be a far better alternative going forward and will be considered.

7.6 First Line Supervisory Training

The Contractor will comply with the Yukon Occupational Health and Safety (OH&S) regulation by obtaining First Line Supervisor's Provisional Certificates and working toward full certification during the development.

7.7 Safety considerations in Underground Equipment / Materials

7.7.1 Diesel Equipment

All diesel equipment used in the underground operation will be permitted and maintained to comply with section 15.58, 15.59, 15.61 and all related sections on the Yukon Occupational Health and Safety Regulation.

7.7.2 Portable Compressors

Underground portable compressors will be electric to avoid addition diesel particulate contamination in the mine air as well as reduce the risk of fire associated with diesel compressors. The current plan calls for only electric compressors underground, however, if the diesel is required, it will be equipped with the necessary fire suppression and shut off requirements.

7.7.3 Shotcrete

Shotcrete used in the underground workings will be restricted to "wet system" process only; this will eliminate the cement dust particulate associated with dry shotcrete application.

7.8 WCHSB Reporting

Quarterly update meetings are scheduled to be held with YWCSHB to review the following:

- IH Program data and Fatigue Management Plan progress
- Updated Mining Plan

The dates of the Quarterly Update Meeting should be set annually, with some latitude for mutually acceptable alternative dates.

Any variances to defined engineering or administrative controls put in place and defined by the IH program will be reported to YWCHSB as soon as reasonable along with corrective actions that Minto will take toward elimination of further variances.

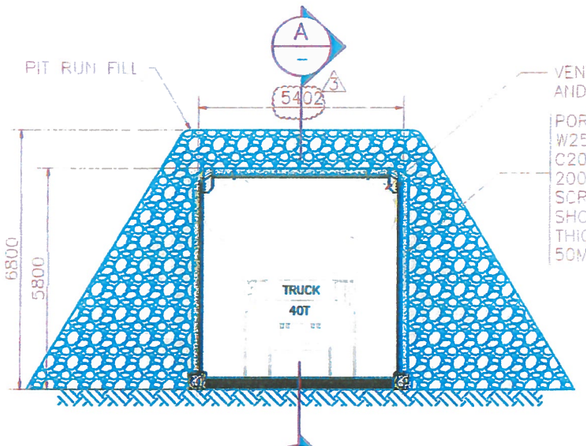
All aspects of the current surface health and safety program and compliment of Safety personnel in place at the Minto Mine will be extended to the underground operations during the initial development in cooperation with the contractor as we are considering this an additional department of our operation.

JOHSC worker representation will be extended to underground operations and will expand in conjunction with the size of the workforce associated to the underground operation.

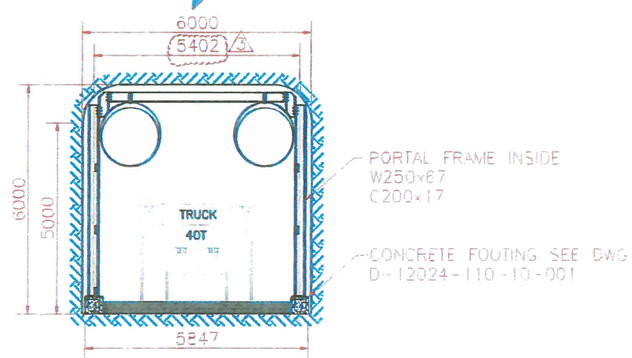
8 Conclusion

This Underground Mine Development and Operating Plan incorporated the requirements outlined by the Quartz Mining Licence. Minto Mine recognizes that some changes to the mine plan and methods are likely as ramp development continues and more is learned about underground activities at the site. This plan will be updated as necessary to reflect newly acquired information and knowledge obtained from initial development.

Appendix A –Underground Portal Collar Design Drawings



SECTION B-B



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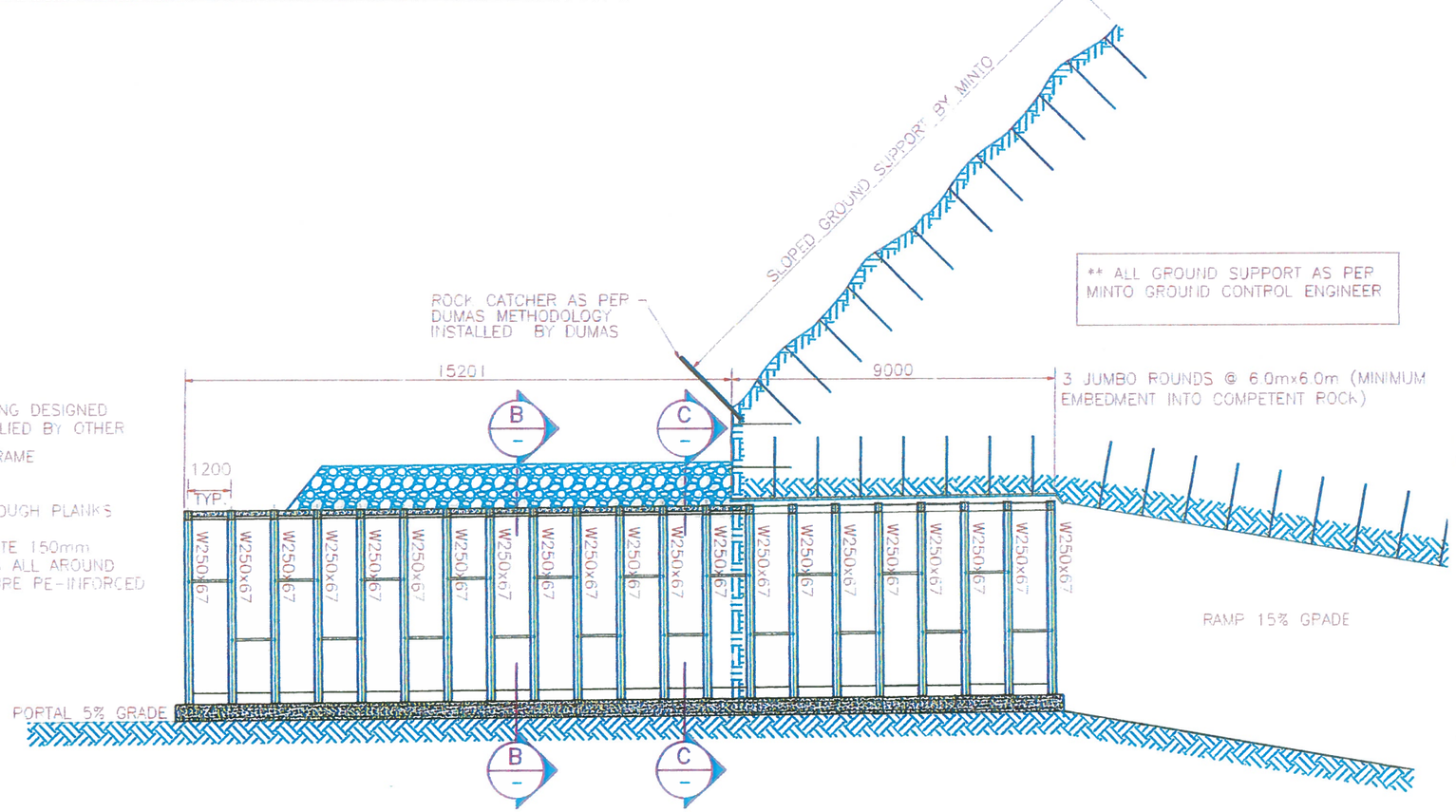

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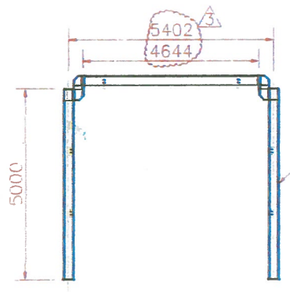


W250x67 FRAME

25 REQ'D

PROFESSIONAL ENGINEER YUKON KAM SOKTAIS TERRITORY

DRAWING NO.	REV	DESCRIPTION
---	X	XXXX

REFERENCES

PERMIT TO PRACTICE
INTEGRAL ENGINEERING INC.
SIGNATURE
Date Oct. 02, 2012
PERMIT NUMBER: PP261
Association of Professional Engineers of Yukon

NO.	DATE	DESCRIPTION	PREPARED BY	VERIFIED BY
3	09/26/2012	CHANGE C/C OF STRUCTURE FROM 5388 TO 5402	RJL	
2	08/22/2012	ISSUED FOR CONSTRUCTION	RJL	KS
1	08/22/2012	APPROVAL	RJL	KS

REVISIONS

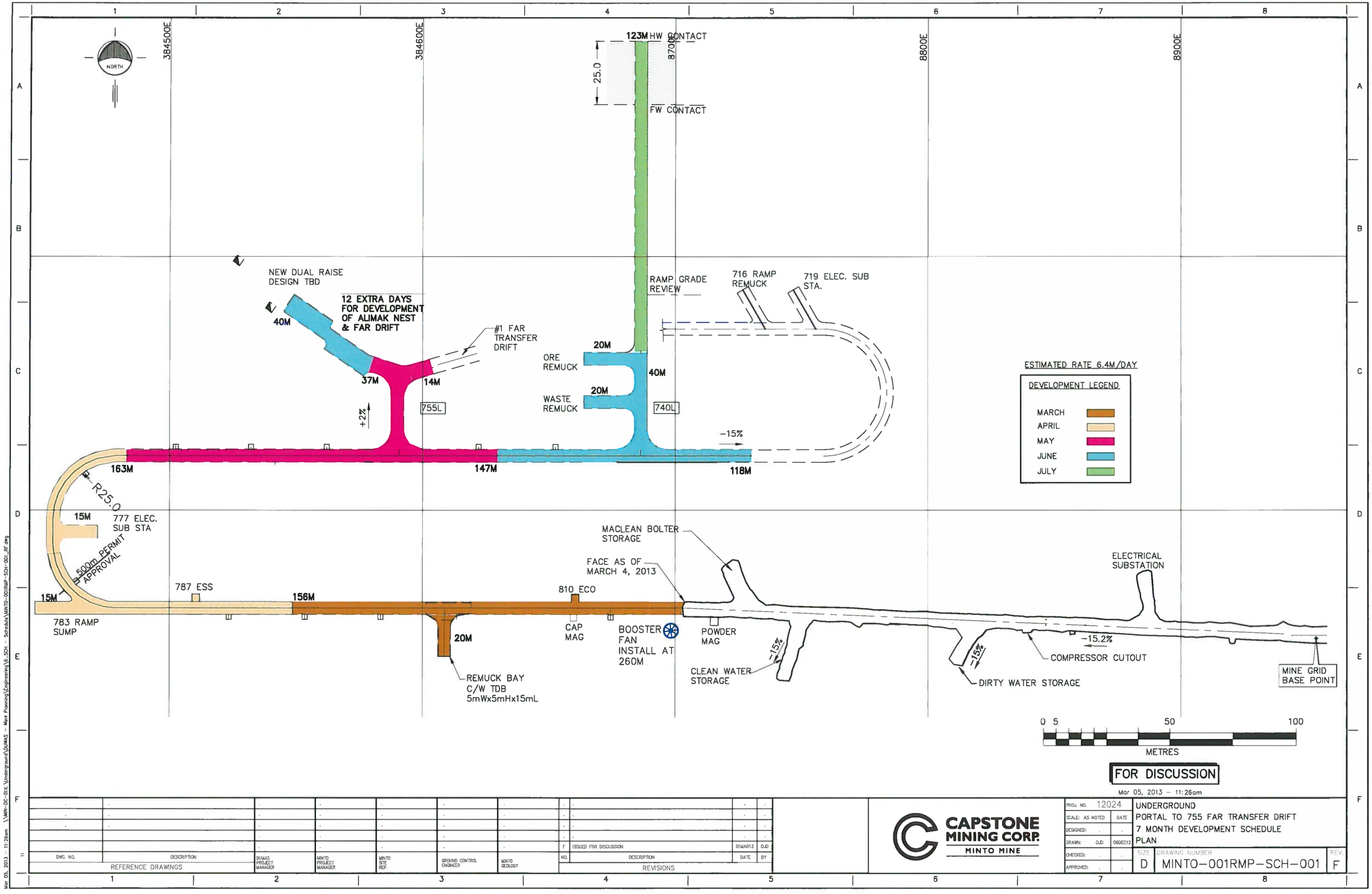
DUMAS

PROJECT TITLE: CAPSTONE MINING MINTO MINE U/G DEVELOPMENT PROJECT

DRAWING NAME: RAMP PORTAL GENERAL ARRANGEMENT

DRAWN BY: RJL	INITIALS:	DATE: AUGUST 15/2012	
CHECKED BY: KS	INITIALS:	PROJECT NUMBER: 12-0024	REV. 3
REVIEWED BY TECHNICAL SUPERVISOR:	INITIALS:	DRAWING NUMBER: B-12024-110-80-001	
REVIEWED BY FIELD SUPERVISOR:	INITIALS:	ISSUED FOR: CONSTRUCTION	
SCALE: 1:150			

Appendix B –As built for Current Ramp Development



FOR DISCUSSION

Mar 05, 2013 - 11:26am

DWG. NO.	DESCRIPTION	DUMAS PROJECT MANAGER	MINTO PROJECT MANAGER	MINTO SITE REP.	GROUND CONTROL ENGINEER	MINTO GEOLOGY
REFERENCE DRAWINGS						

NO.	DESCRIPTION	DATE	BY
F	ISSUED FOR DISCUSSION	01MAR13	DJD

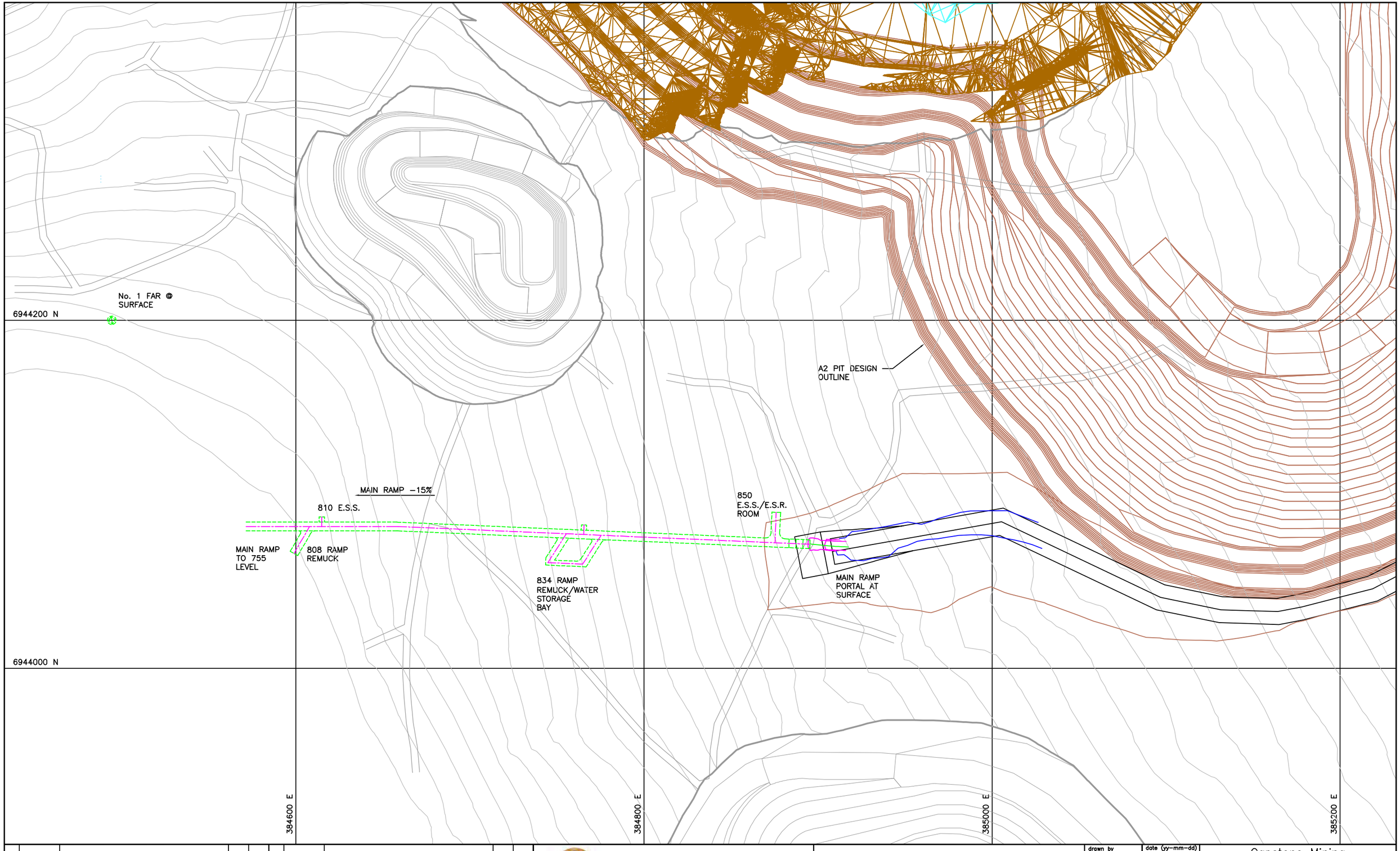
REVISIONS

CAPSTONE MINING CORP.
MINTO MINE

PROJ. NO.	12024		UNDERGROUND
SCALE: AS NOTED	DATE		PORTAL TO 755 FAR TRANSFER DRIFT
DESIGNED:			7 MONTH DEVELOPMENT SCHEDULE
DRAWN: DJD	06DEC12		PLAN
CHECKED:		SIZE: D	DRAWING NUMBER: MINTO-001RMP-SCH-001
APPROVED:			REV.: F

\\MIN-DC-01\Underground\DUMAS - Mine Planning\Engineering\6_SCH - Schedule\MINTO-001RMP-SCH-001_RF.dwg
Mar 05, 2013 - 11:26am

Appendix C – Schematics of the current mine design plan



No.	DATE	DESCRIPTION	BY	APP'D

REVISION

No.	DATE	DESCRIPTION	BY	APP'D

REVISION

CAPSTONE MINING CORP.

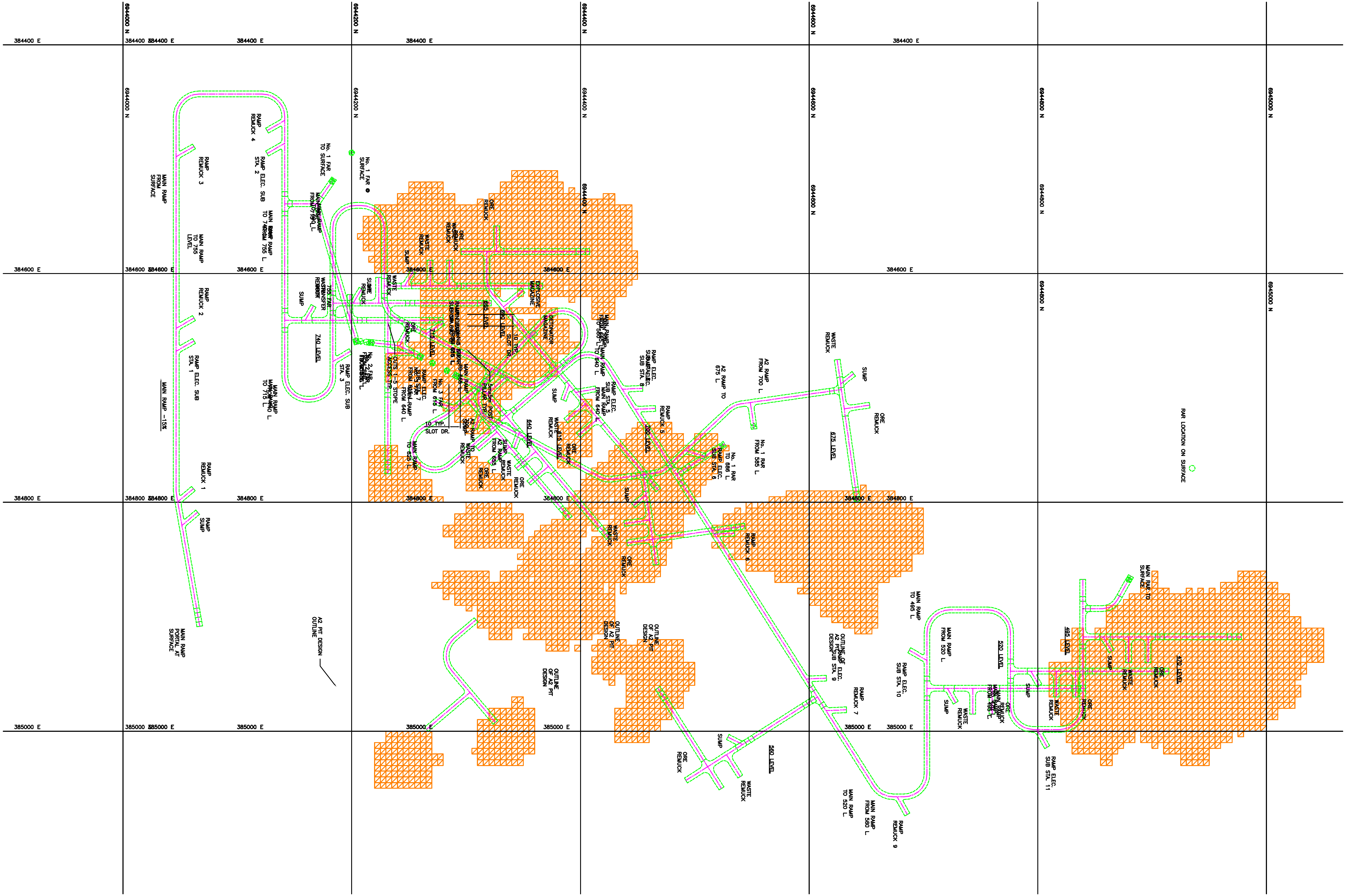
Capstone Mining Corp.
Minto Mine
P.O. Box 33174
Whitehorse, Yukon
Y1A 6S1

drawn by RPV	date (yy-mm-dd) 2012-11-19
checked by	date
approved by	date
scale (u.n.o.) As Shown	

Capstone Mining
Minto Mine
Underground Development
118 Zone and Area 2
Surface Portal Plan

Dwg no. RPV Plan 3

rev 2



6944000 N
6944200 N
6944400 N
6944600 N
6944800 N
6945000 N
384400 E
384600 E
384800 E
385000 E
MAIN RAMP FROM SURFACE
RAMP REMUCK 4
RAMP REMUCK 3
RAMP ELEC. SUB STA. 2
No. 1 FAR TO SURFACE
No. 1 FAR SURFACE
MAIN RAMP TO 755 LEVEL
MAIN RAMP FROM 755 L.
RAMP REMUCK 2
SUMP
740 LEVEL
755 FAR
RAMP ELEC. SUB STA. 1
MAIN RAMP -15%
MAIN RAMP TO 715 L.
RAMP ELEC. SUB STA. 3
RAMP REMUCK 1
RAMP SUMP
MAIN RAMP PORTAL AT SURFACE
A2 PIT DESIGN OUTLINE
ORE REMUCK
WASTE REMUCK
EXPLOSIVE MAGAZINE
DETONATOR MAGAZINE
665 LEVEL
690 LEVEL
715 LEVEL
10 TYP. SLOT DR.
CUTS 1-5 STOPE ACCESS TYP.
No. 3 FAR FROM 615 L.
MAIN RAMP FROM 640 L.
MAIN RAMP TO 625 L.
5mx5m POST PILLAR TYP.
A2 RAMP TO WASTE REMUCK
A2 RAMP FROM 655 L.
640 LEVEL
615 LEVEL
700 LEVEL
RAMP REMUCK 5
RAMP ELEC. SUB STA. 8
RAMP ELEC. SUB STA. 5
MAIN RAMP TO 640 L.
A2 RAMP TO 675 L.
A2 RAMP FROM 700 L.
No. 1 RAR TO 686 L.
No. 1 RAR FROM 585 L.
RAMP ELEC. SUB STA. 6
675 LEVEL
RAMP REMUCK 6
RAR LOCATION ON SURFACE
OUTLINE OF A2 PIT DESIGN
560 LEVEL
RAMP ELEC. SUB STA. 9
RAMP REMUCK 7
MAIN RAMP TO 520 L.
MAIN RAMP FROM 560 L.
RAMP REMUCK 9
MAIN RAMP TO 495 L.
MAIN RAMP FROM 520 L.
RAMP ELEC. SUB STA. 10
520 LEVEL
495 LEVEL
470 LEVEL
MAIN RAR TO SURFACE
MAIN RAMP FROM 495 L.
RAMP ELEC. SUB STA. 11

6944400 N

6944200 N

6944000 N

384400 E

384600 E

384800 E

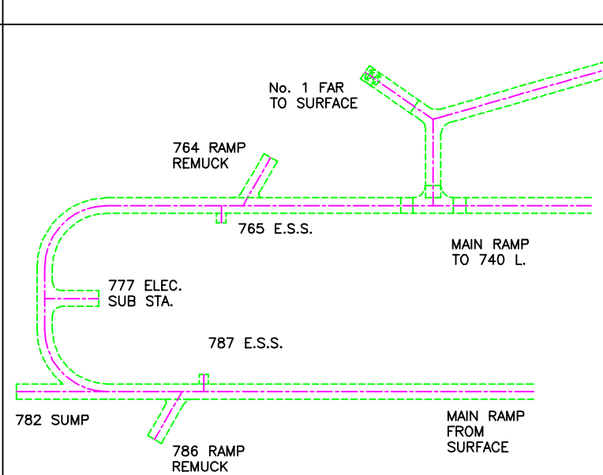
385000 E

118 BLOCK

No. 2 FAR
FROM 686 L.

755 FAR
TRANSFER
DRIFT

OUTLINE
OF A2 PIT
DESIGN



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		REVISION		

No.	DATE	DESCRIPTION	BY	APP'D
		REVISION		

CAPSTONE MINING CORP.

Capstone Mining Corp.
Minto Mine
P.O. Box 33174
Whitehorse, Yukon
Y1A 6S1

drawn by RPV	date (yy-mm-dd) 2012-11-19	Capstone Mining Minto Mine Underground Development 118 Zone and Area 2 755 Level FAR Access Plan
checked by	date	
approved by	date	
scale (u.n.o.) As Shown		Dwg no. RPV Plan 3 rev 2

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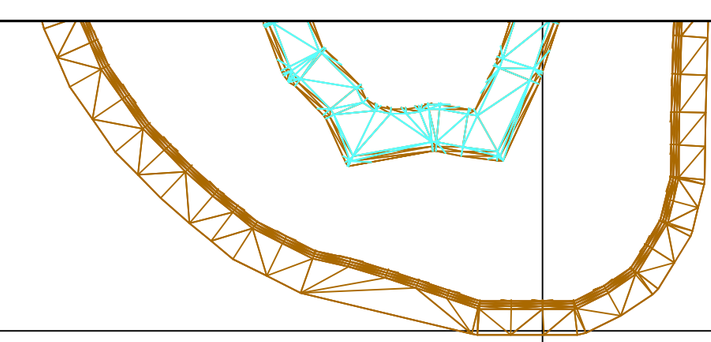
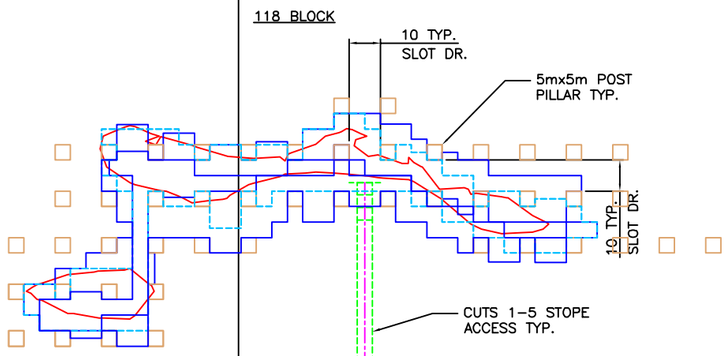


OUTLINE
OF A2 PIT
DESIGN



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		REVISION		

No.	DATE	DESCRIPTION	BY	APP'D
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approved by	date
scale (u.n.o.) As Shown	

Capstone Mining
Minto Mine
Underground Development
118 Zone and Area 2
740 Level Plan

Dwg no. RPV Plan 3 | rev 1

6944400 N

OUTLINE
OF A2 PIT
DESIGN

118 BLOCK

715 LEVEL

ORE
REMUCK

WASTE
REMUCK

SUMP

No. 2 FAR
FROM 686 L.

103 BLOCK

723 ELEC.
SUB STA.

MAIN RAMP
TO 690 L.

MAIN RAMP
FROM 740 L.

6944200 N

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384600 E

384800 E

385000 E

No.	DATE	DESCRIPTION	BY	APP'D
		REVISION		

No.	DATE	DESCRIPTION	BY	APP'D
		REVISION		

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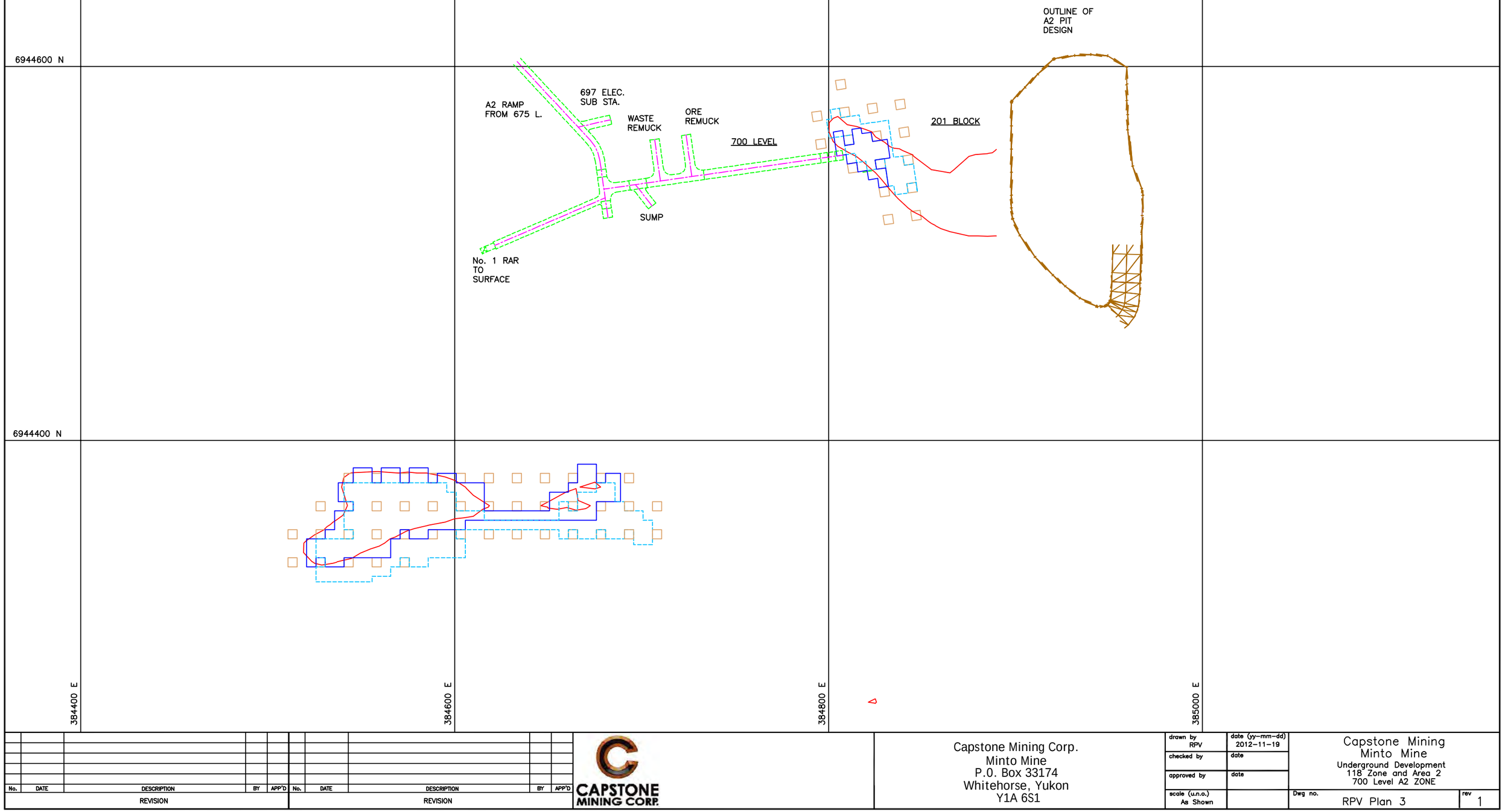

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checked by	date
approved by	date
scale (u.n.o.) As Shown	

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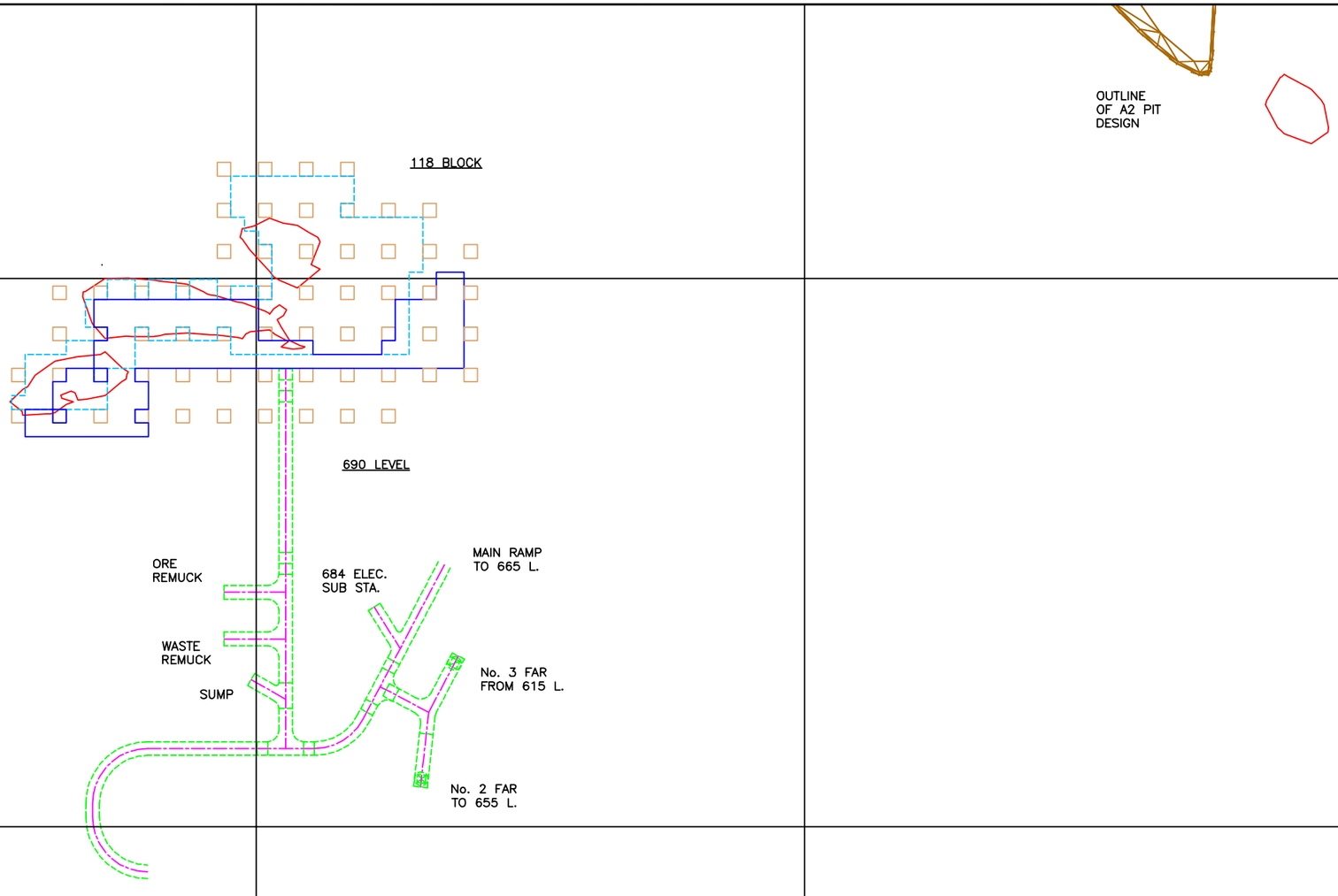
Minto Mine
Underground Development
118 Zone and Area 2
700 Level A2 ZONE

Dwg no. RPV Plan 3

rev 1



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checked by	date
approved by	date
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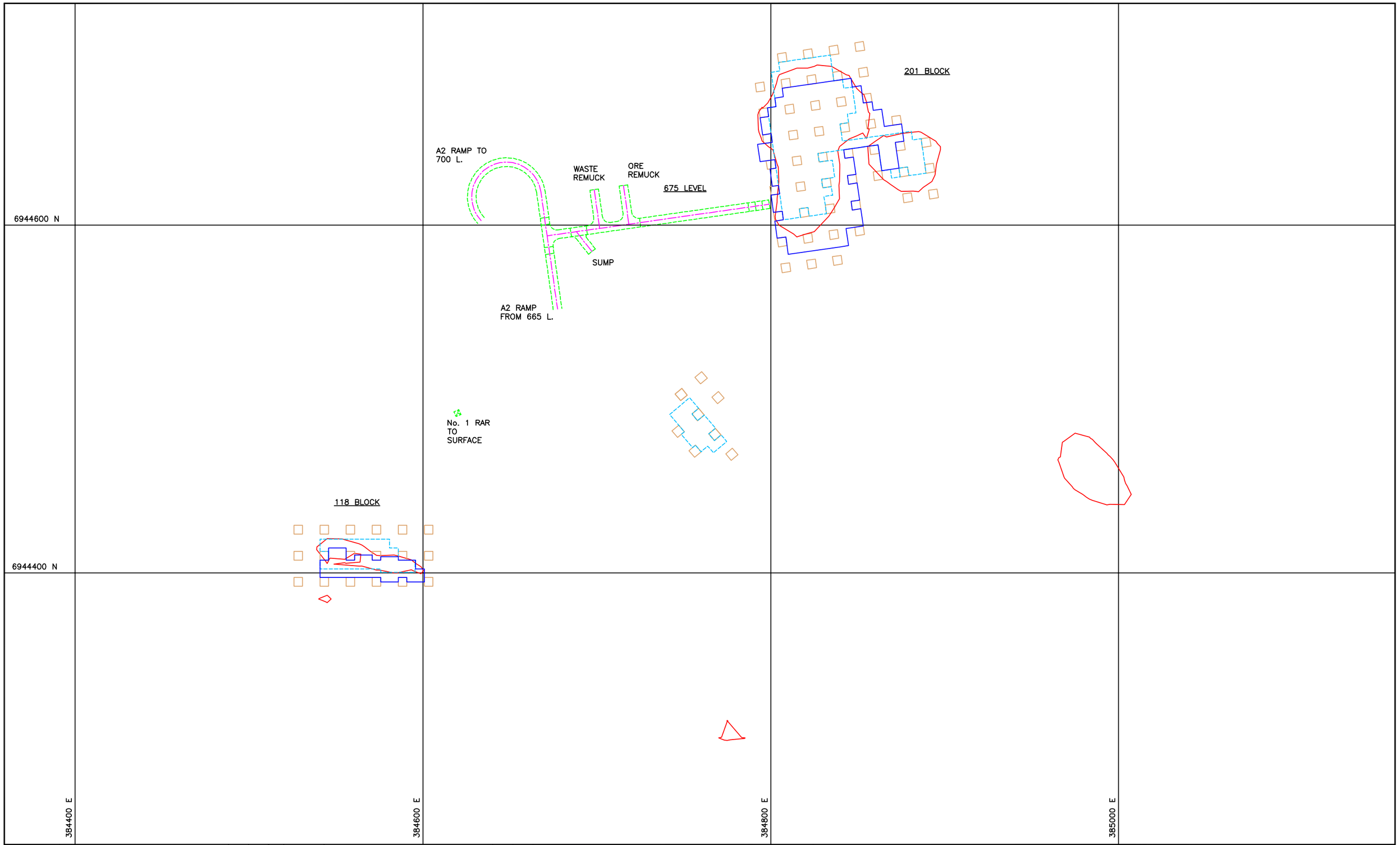
Minto Mine
Underground Development
118 Zone and Area 2
690 Level Plan

Dwg no. RPV Plan 3

rev 1



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checked by	date
approved by	date
scale (u.n.o.) As Shown	

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Minto Mine
Underground Development
118 Zone and Area 2
675 Level A2 ZONE

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rev 1

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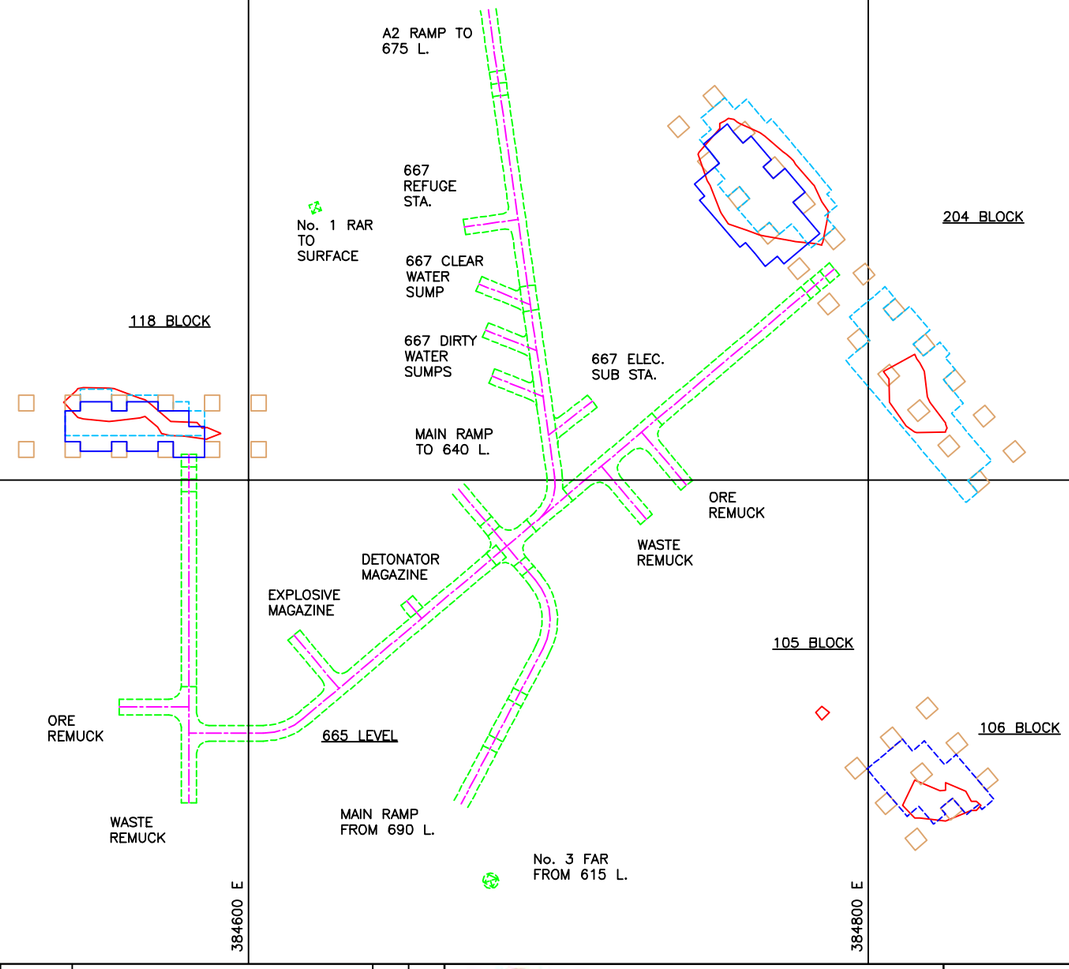
6944400 N



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approved by	date
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Capstone Mining
Minto Mine
Underground Development
118 Zone and Area 2
665 Level Plan

Dwg no. RPV Plan 3

rev 1

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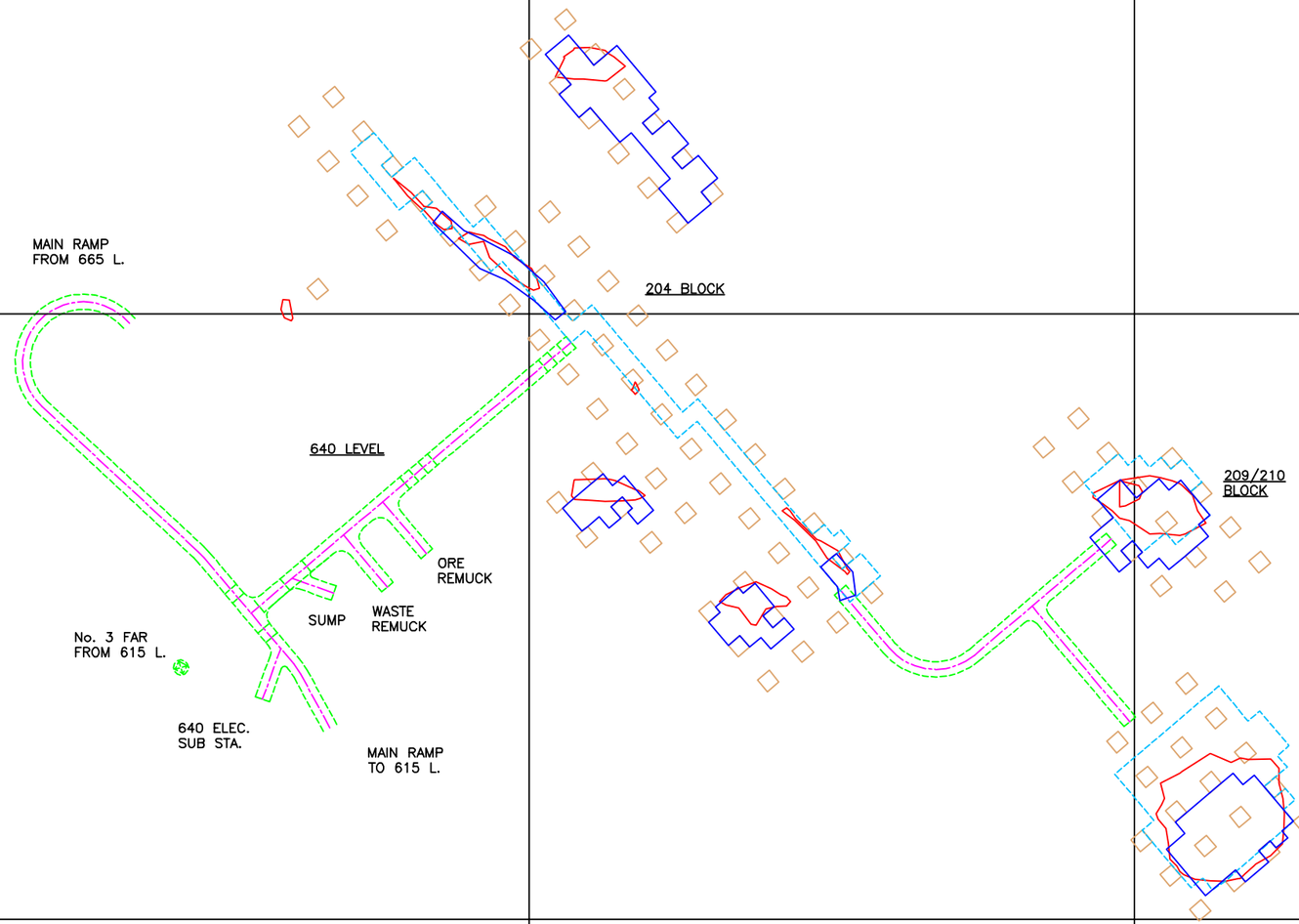

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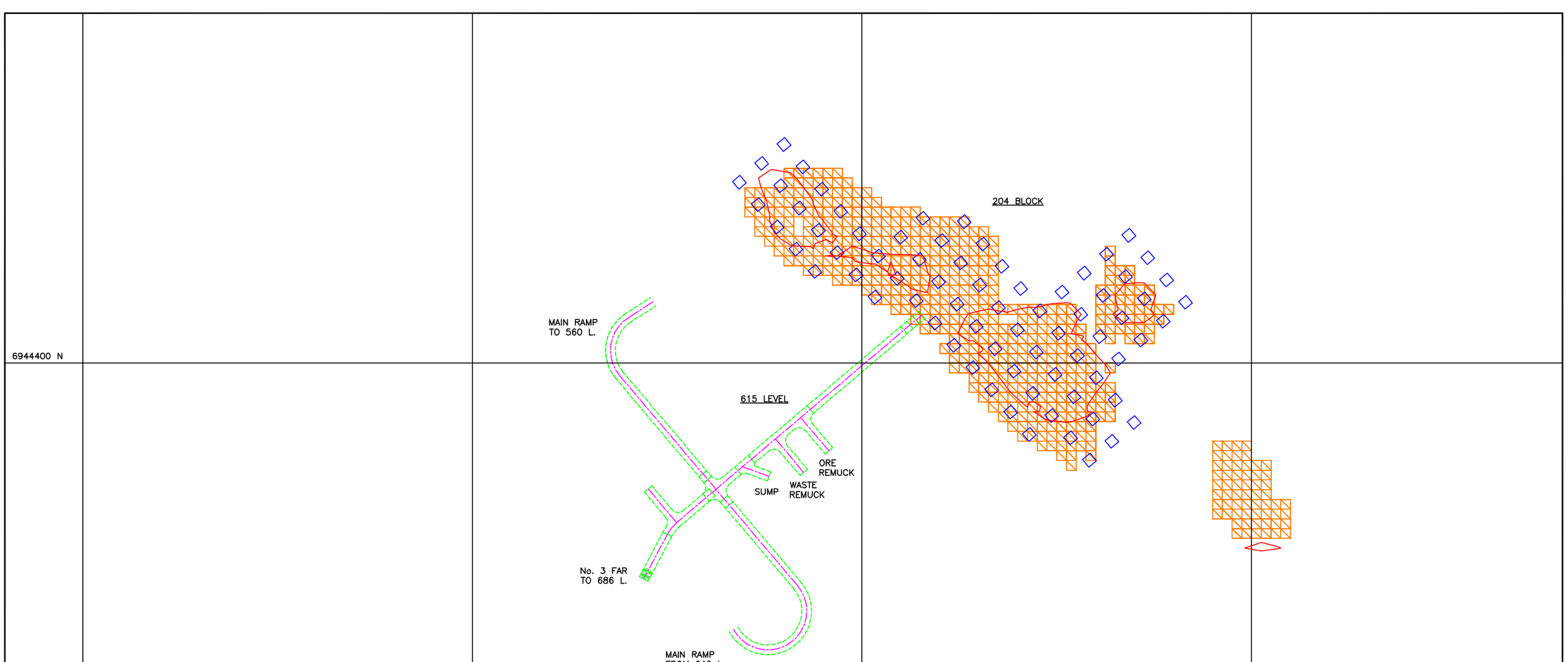
Minto Mine
Underground Development
118 Zone and Area 2
640 Level Plan

Dwg no. RPV Plan 3

rev 1



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checked by	date
approved by	date
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Minto Mine
Underground Development
118 Zone and Area 2
615 Level Plan

Dwg no. RPV Plan 1

rev 1

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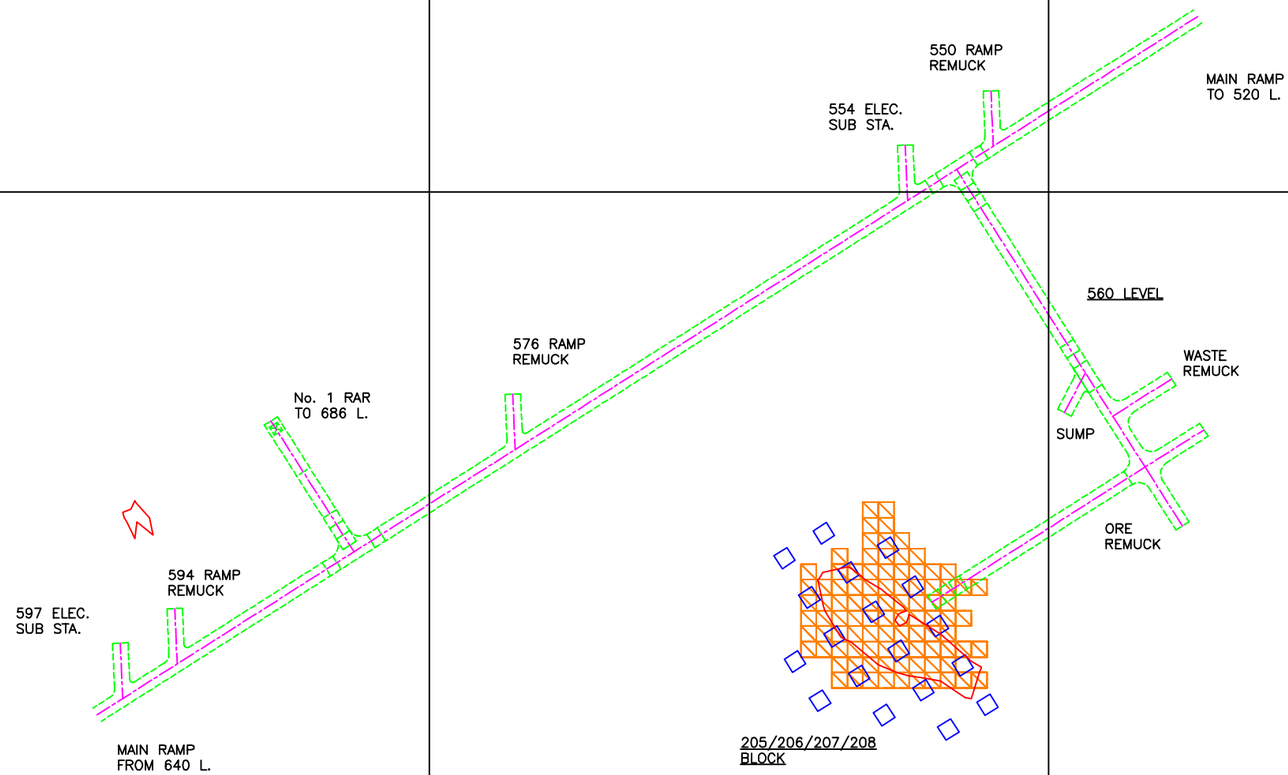

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Minto Mine
Underground Development
118 Zone and Area 2
560 Level Plan

Dwg no. RPV Plan 1 | rev 1

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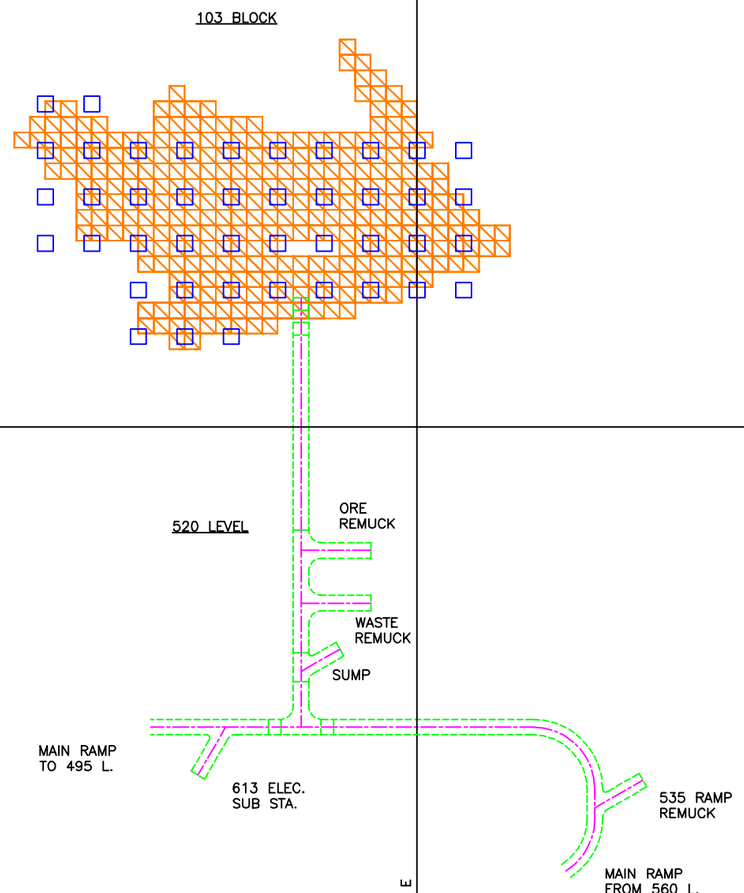

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REVISION

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checked by	date
approved by	date
scale (u.n.o.) As Shown	

Capstone Mining
Minto Mine
Underground Development
118 Zone and Area 2
520 Level Plan

Dwg no. RPV Plan 1

rev 1

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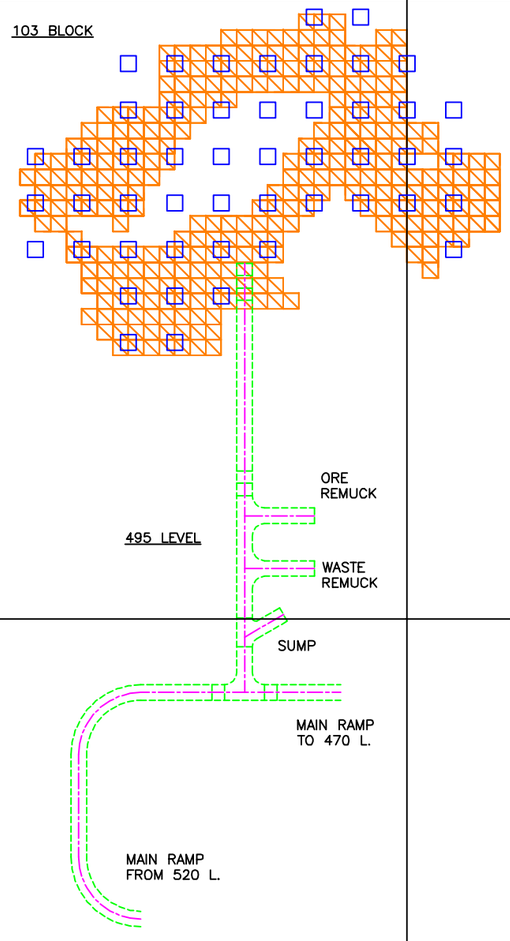

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checked by	date
approved by	date
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Minto Mine
Underground Development
118 Zone and Area 2
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rev 1

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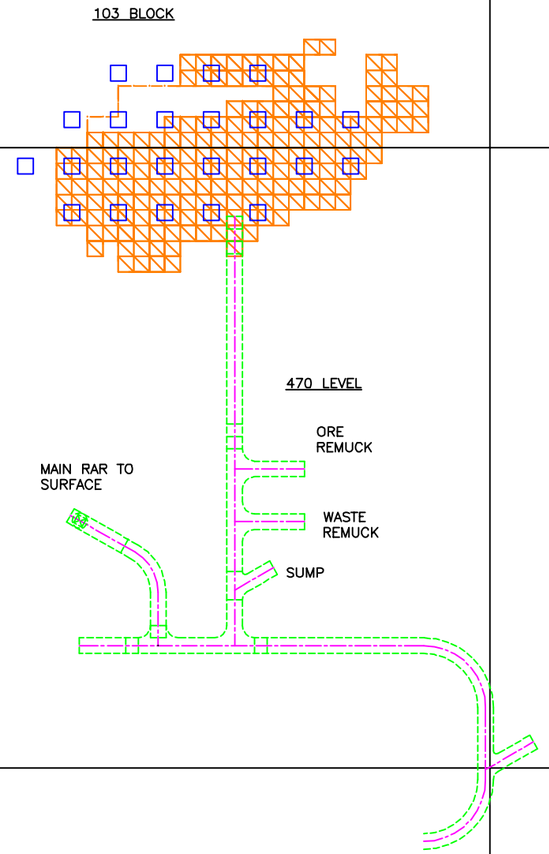

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P.O. Box 33174
Whitehorse, Yukon
Y1A 6S1

drawn by RPV	date (yy-mm-dd) 2012-08-15
checked by	date
approved by	date
scale (u.n.o.) As Shown	

Capstone Mining
Minto Mine
Underground Development
118 Zone and Area 2
470 Level Plan

Dwg no. RPV Plan 1

rev 1

Appendix D – Safe Work Procedure for Underground Blasting

001- UG Blast Clearing - Portal (rev. 2)

SCOPE

This procedure pertains to all employees, client personnel, contractors, and visitors in the vicinity of the portal blast zone at Minto Mine site.

PURPOSE

To set out a safe method by which all personnel may be notified of the scheduled blast time and cleared from the designated blast zone during portal and underground blasting operations. (Once UG to a distance of 50 linear meters, this procedure will be reviewed). The designated blast zone is defined as an area within 150m of the portal entrance. A map prepared by the mine's technical services department indicating the 150m radius of the blast zone will be distributed. Areas within that zone will be evacuated and guards will be positioned to prevent entry into that area during the blast.

RESPONSIBILITIES

Employer/Supervisor Responsibilities

To ensure all workers are accounted for and in a safe location during a blast.

Safety and Training Department Responsibilities

To assist in the blast clearing procedures and notify personnel affected by the blast.

Worker Responsibilities

To ensure they follow all instructions given by their supervisor and the safety department. Also, to notify their supervisor if there are any unsafe conditions present.

Blaster Responsibility

To inspect and review each blast for potential hazards that warrant special precautions to be taken when clearing for the blast. If for any reason there is a concern around the "safe zone", the blaster may call for special consideration in clearing for a blast.

APPLICATION

Regulations pertaining:

- Guards will be posted as necessary to guard all possible access points to the danger area.
- The blaster shall instruct the guards as to their duties and responsibilities.

- Guards shall be posted at locations that are protected from flying material and other hazards resulting from the blast.
- Once assigned to a post by the blaster, guard shall prevent all persons from entering the danger area.
- Guards shall remain at their posts until:
  - The charge is detonated and the “All Clear” signal sounds, or
  - They are personally relieved by the blaster.
- For surface blasts a signalling device, having a distinctive sound audible within the proximity of the danger area, shall be used to sound a warning of a blast. Use a horn to warn people.
- After a blast is detonated no person shall enter a blasted area until:
  - The blaster has given permission for work to proceed, and
  - Any hazards shall be identified by the blaster and controlled before other work resumes in the blasted area.

Specific Procedures:

Notification:

No person, without explicit permission of the blaster, shall be within 150m of the blast.

A standard map showing the outline of the 150m clearance circle of the portal area, updated from time to time if access points change, will be part of the notification process which will be released to all involved parties. Any diamond drill holes within the daily blast plan will be marked on the blast zone map and cleared/guarded appropriately.

The Dumas Safety and Training Coordinator will email the Minto safety coordinator by 08:00 to notify of the number and times of intended blasts for the day. Parties from the Minto blast notification email list can be copied on the email.

Other than Dumas personnel and any contractors within the blast radius, no additional clearing should be required unless indicated by the blaster.

Clearing Procedure:

Dumas personnel and any visitors to the Dumas work area will follow the Dumas check-in procedure and have a tag on the U/G Tag board.

All non-essential personnel will clear the blast zone 30 minutes before scheduled blast time and tag out on the U/G Tag board.

The blaster will place guards on the portal access road and the north hilltop access point.

When guards are in place and have verified to the blaster that their areas are clear of personnel, the blaster will contact the U/G Superintendent by radio on channel 7, stating they are ready to

go. The blaster will state his name, location, the names of his guards, and state that he is ready to blast.

The superintendent will verify that only the names of the blaster and guards remain tagged in and that all other personnel are clear.

If all other personnel are clear, the superintendent will announce to the blaster over the radio that the tag board is clear and he is free to blast.

Prior to blasting and when the blaster now has all systems ready to go for the blast, he will announce separately on each of the following channels: #5, 7, 8, 14 – “Attention All Personnel – Dumas will be firing a blast in 10 minutes”.

The blaster when ready will then give a two minute warning and state that radio silence is in effect and can only be broken to delay the blast if an unsafe condition is observed. Use a horn to warn all personnel also.

When two minutes elapses and 10 seconds before blasting, the blaster will broadcast “Fire in the hole, fire in the hole, fire in the hole” over the radio and then detonate the blast after the 10 seconds have passed.

Radio silence will remain in effect until the blaster verifies successful detonation and signals “All Clear.”

Reviewed by:

Project Manager: _____ Date: _____

U/G Superintendent: _____ Date: _____

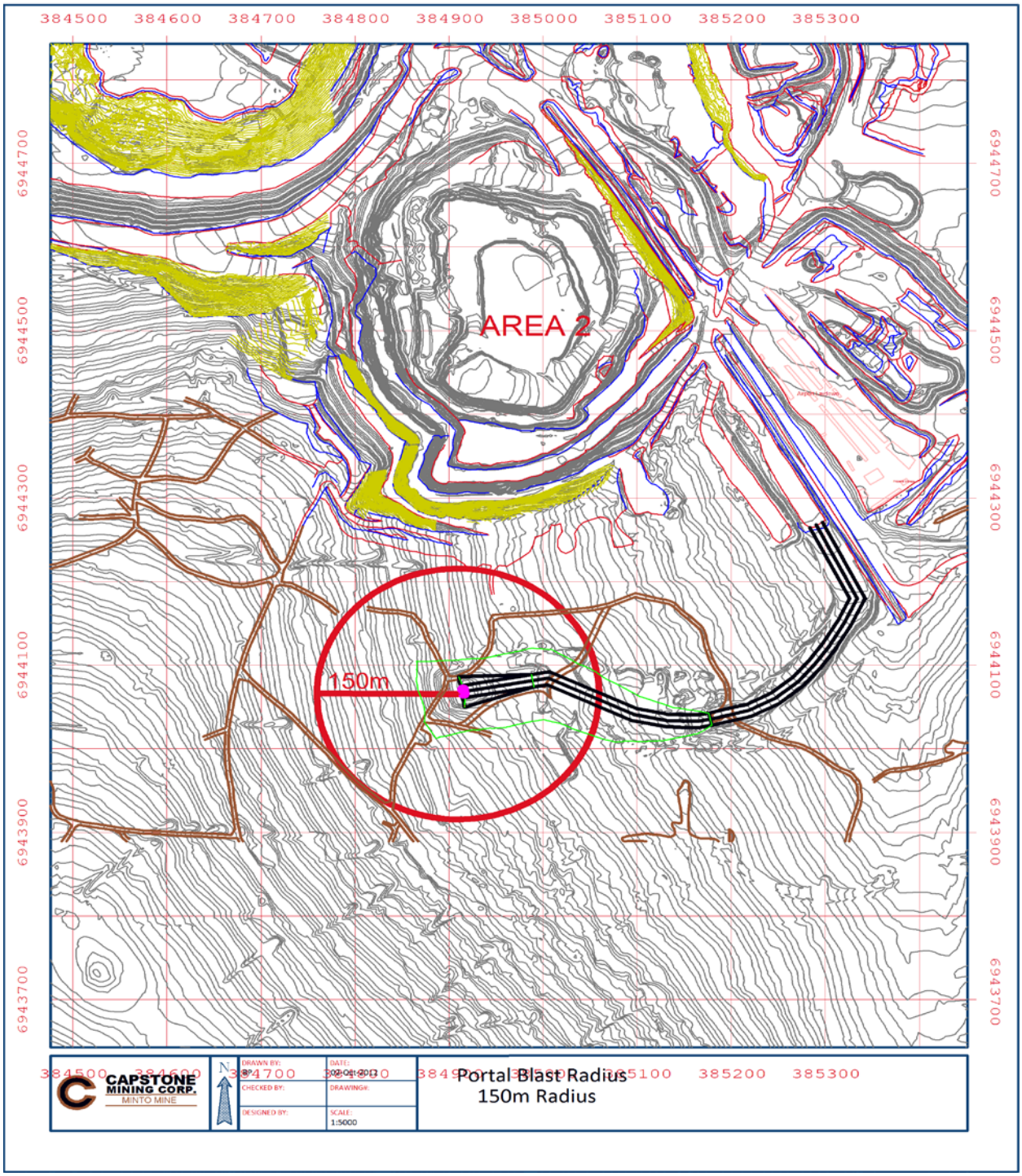
U/G Shifter: _____ Date: _____

Safety Department: _____ Date: _____

Worker Rep. _____ Date: _____

001- Blast Clearing - Portal (rev. 2)

Blast Zone Map



Appendix E – Minto Mine Emergency Response Plan – November 2012

MINTO MINE

EMERGENCY RESPONSE PLAN

November 2012

This controlled document will be regularly updated to reflect revisions.

Next scheduled update – November 2013

- Updated Emergency Response Plan (ERP) documents will be bound and distributed to all authorized personnel.

- All Minto Mine personnel must have ERP training and know where to gain access to the document in the event of an emergency.

Authorized Distribution / Location List

Minto Explorations Ltd. – Minto Mine:

Health and Safety Office
ERT Facility
General Manager Office
First Aid Room
Mill Control Room
Refuge Stations
Muster stations

Capstone Mining Corp

Capstone Mining Corp. Vancouver Office

Community:

Yukon EMS Dispatch Whitehorse
Pelly Nursing Station
Carmacks Nursing Station
Yukon Wildland Fire Management Carmacks

Government:

Yukon Workers Compensation Health and Safety Board

Primary Partners/On-site Contractors:

Selkirk First Nation – Pelly Crossing
Pelly Construction Site Office
Dyno Nobel Site Office
SGS Site Office
Sodexo Site Office
Dumas Mining

Contractor Specific Emergency Response Plans Related to Minto Site

Dyno Nobel
Pelly Construction Ltd

Table of Contents

1. PURPOSE

This guide sets out the response protocol in the event of an Emergency as defined in the following section.

It is intended for use as a quick reference handbook for managers and supervisors. Incident reporting and investigating is also outlined.

In an emergency situation it is imperative that safety and due diligence is exercised as well as discretion. The priorities are the protection of Life, Environment and Property – in that order.

2. DEFINITIONS

2.1. "Emergency"

An "**Emergency**" is defined as any occurrence meeting one or more of the following criteria:

1. Any "serious injury" or "serious accident" as defined in Yukon OH&S 30 (1)
2. Any incident requiring first aid or rescue response to the scene, depleting resources to respond to secondary emergency.
3. Any fire requiring more action that initial suppression deployment
4. Landslide, earthquake, avalanche, forest fire or flooding where injury or property damage results or may result.
5. Major power failure
6. Missing person
7. Loss of life
8. Spill Emergency – Reference Spill Contingency Plan

2.2. "Serious Injury" and "Serious Accident" under OH&S act

(Excerpt from Occupational Health & Safety Act)

"**Serious Injury**" means:

- **a)** an injury that results in death,
- **b)** fracture of a major bone, including the skull, the spine, the pelvis, or the thighbone,
- **c)** amputation other than of a finger or toe,
- **d)** loss of sight of an eye,
- **e)** internal bleeding,
- **f)** full thickness (third degree) burns,
- **g)** dysfunction that results from concussion, electrical contact, lack of oxygen, or poisoning, or
- **h)** an injury that results in paralysis (permanent loss of function);

"**Serious Accident**" means:

- **a)** an uncontrolled explosion,
- **b)** failure of a safety device on a hoist, hoist mechanism, or hoist rope,
- **c)** collapse or upset of a crane
- **d)** collapse or failure of a load-bearing component of a building or structure regardless of whether the building or structure is complete or under construction,
- **e)** collapse or failure of a temporary support structure,
- **f)** an inrush of water in an underground working,
- **g)** fire or explosion in an underground working,
- **h)** collapse or cave-in, of a trench, excavation wall, underground working, or stockpile,
- **i)** accidental release of a controlled product,
- **j)** brake failure on mobile equipment that causes a runaway,
- **k)** any accident that likely would have caused serious injury but for safety precautions, rescue measures, or chance. (As amended by SY 1988, c.22, s. 5; SY 1989, c. 19, s.6)

Reprinted from Yukon Workers' Compensation Health and Safety Board. Occupational Health and Safety Act and Regulations.

3. INITIAL RESPONSE TO EMERGENCY MINTO MINE

All references to Minto personnel by position are defaulted to defined designate if position vacant at time of emergency.

SITE MAP

CAMP, OFFICE and MILL MUSTER LOCATIONS

ACTIVE MINE MUSTER

UNDERGROUND MUSTER (SURFACE)

3.1. Code One Protocol

In the event of an emergency, the following protocol will be followed.

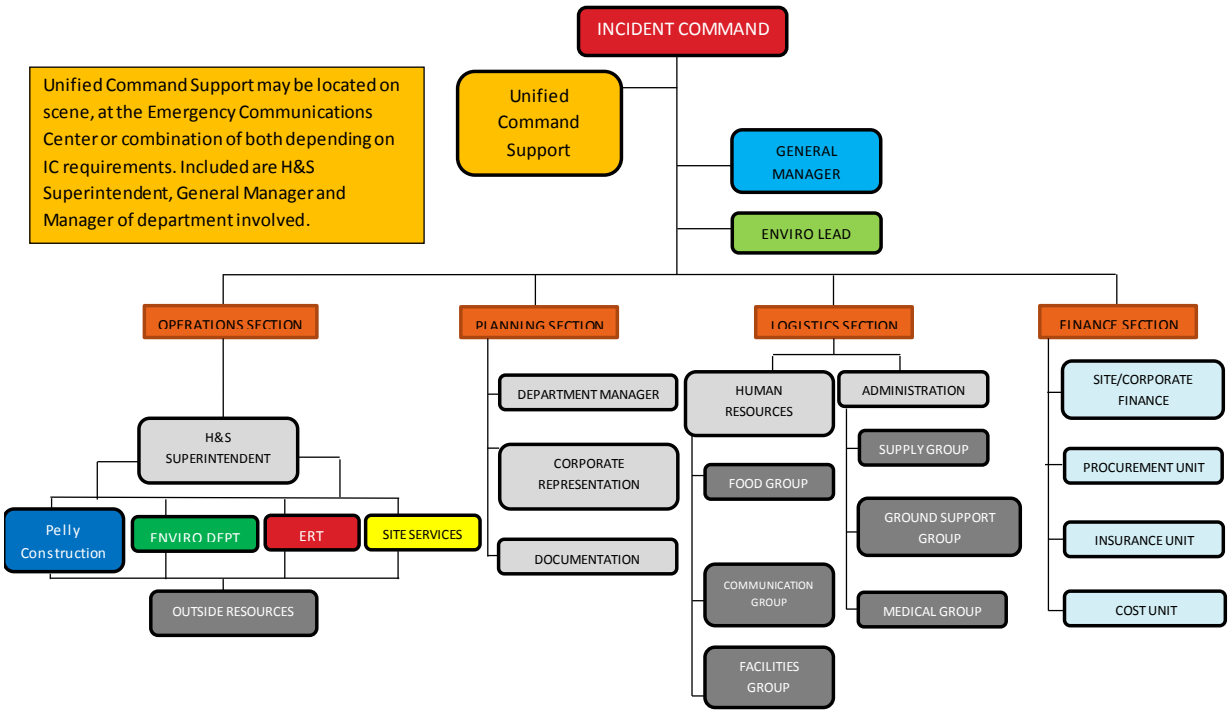
1. Any employee witnessing an emergency will call out on their current radio channel "Code 1, Code 1, Code 1" and state the nature and location of the emergency. (In the event of an injury, first aid certified worker in the area would be alerted to the incident and could respond directly to the scene) The employee immediately changes his radio to channel 1 (Emergency Channel) and calls out "Code1, Code 1, Code 1" and state the nature and location of the emergency. Employee remains on Channel 1 for a response from Site Safety/Medic.
2. Safety Coordinator/Medic will arrange for "Code 1, Code 1, Code 1" to be announced on all radio channels.
3. Upon hearing a Code 1, all personnel will safely stop work, all equipment is to be shut off and all vehicles will safely pull over to the side of the road. Mill and assay lab and water treatment plant personnel will report to control rooms and lunch rooms, while the mill remains operational. Radio silence will be recognized until Code 1 has been cleared.
4. Safety Coordinator/Medic will respond to caller with "What is the nature and location of the Emergency" on channel 1.
5. Employee will then state their name, the nature and location of the emergency.
6. Employee will then offer all available information and follow all instructions given to them by Safety Coordinator/Medic.
7. Safety Coordinator/Medic will coordinate the control room operator to send out a page for the ERT with nature and location of the emergency.
8. The Safety Coordinator/Medic will respond to the scene and conduct an initial assessment and assume command of the scene. Command will be declared on the radio and instructions to response team Captain including staging location. If Safety Coordinator/Medic is required to treat patients, command is transferred to an alternate member of the Health and Safety Department or Mine Rescue Team Captain. **Any transfer of command requires a detailed verbal report of the incident and activities conducted and underway and a formal communication to all responders.**
9. Unified Command Support will be initiated once the Health and Safety Superintendent, General Manager and Area Manager are on scene. Incidents involving an Environmental release will include the Environmental Lead in the Unified Command Support. **Unified Command Support is a cooperative effort for the purpose of support to the Safety Department Incident Command. If Unified Command Support is deemed not to be required on the scene, the support team will report to the Emergency Communications Center (ECC) to monitor radio and provide for support from the EEC location.**
10. An update on the response will be provided to the Mill control room within 30 minutes of initial arrival to the scene and a decision to allow non-hazardous critical work will be made by Incident Command. This may include resumption of crusher feed at half speed or two members of Mill Operations to conduct floor patrol or

operating area. Updates will be provided to the Mill control room every 30 minutes of the response.

11. Only Safety Department personnel can release the Code One by declaring an "all clear" for employees to return to regular work.

3.2. Minto Incident Command Structure

Minto Incident Command Structure



3.3. Code 1 Procedure for Control Room

1. When a Code 1 is called, listen for Site Safety to respond to the Code 1 on channel 1.
2. Once Site Safety has confirmed the details of the Code 1, they will direct the control room operator to activate the ERT pagers and call "Code 1, Code 1, Code1" on channels 5,8,14 &16. Operator will also call Code 1 on the Telephone Paging System. To do so pick up the receiver and dial 499 you will hear one ring then announce the Code 1 as you would on the radio.
3. If no reply heard from Site Safety, activate ERT pagers; announce event and location (if known), e.g.; "Code 1 –Medical emergency in kitchen", call "Code1, Code1, Code1" on channels 5,8,14 & 16, and then attempt to contact Site Safety on channel 1.
4. Confirm that all Mill personal are aware and have moved to the lunchrooms or muster station if mill involved. (Except control room operator who remains if safe, to provide for critical monitoring and controlled equipment shut down as required.)

5. If control room deemed unsafe, control room operator can request permission from IC to relocate to Tailings or Crusher control room to provide for critical monitoring and controlled equipment shut down as required. Must take radio and Satellite phone with him.
6. Confirm on all channels that the Code 1 has been heard by calling Code 1 a second time channels 5,8,14 & 16.
7. Monitor the radio during the Code 1 as emergency crews may use the control room as a communications resource. Have emergency contact list ready in case external resources are required to be contacted.
8. Complete a time and event log of activity on the emergency ground to the best of your ability.
9. Site Safety will take responsibility for instruction to clear the Code 1 on all channels and the telephone paging system.

3.4. ECC detail

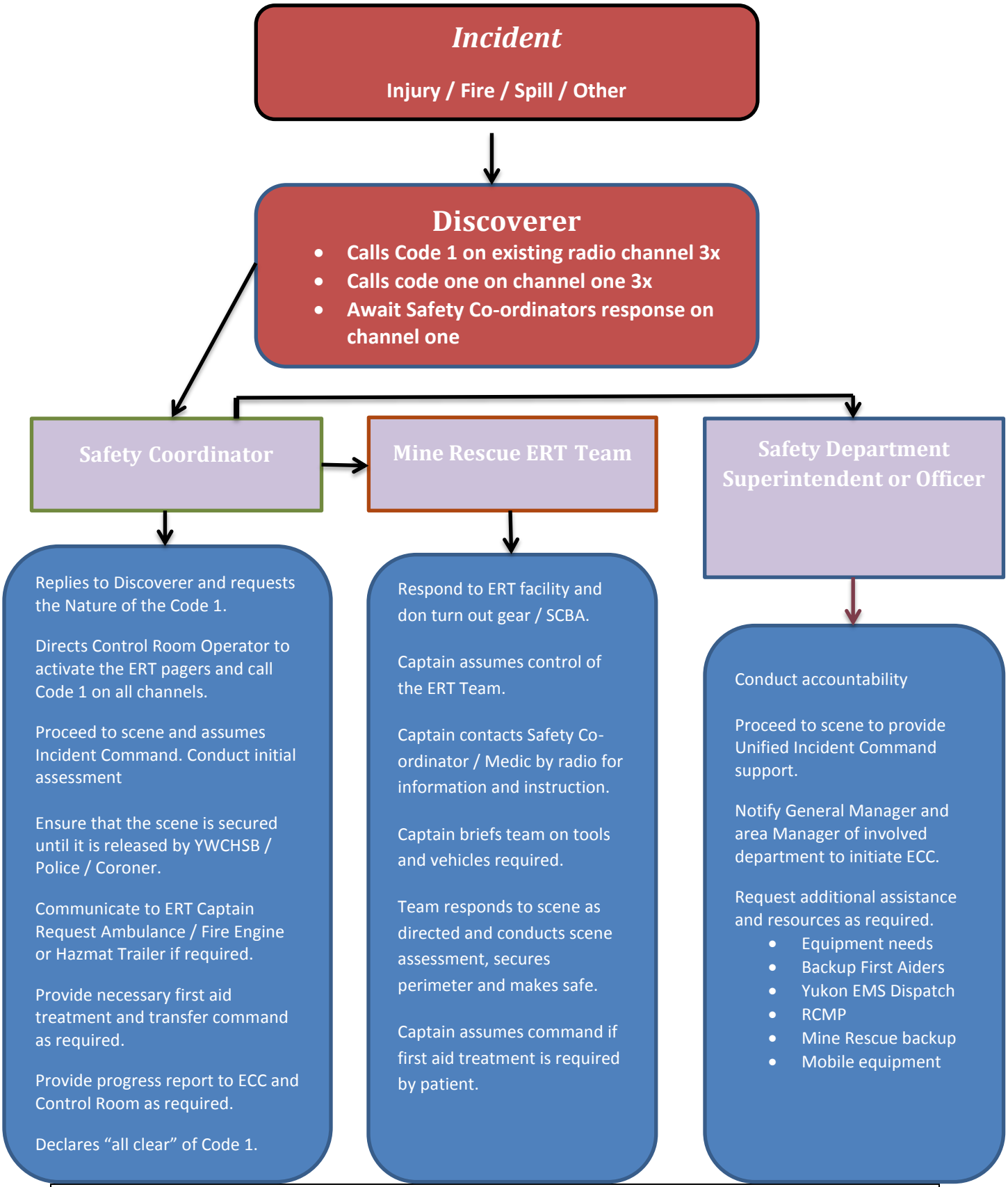
- Where - GM office or Safety Superintendent Office if Mill involved. Phone, Lync, Radio, Sat Phone for use available to these locations.
- Who –GM, H&S Superintendent, Manager of area involved (Planning), HR (Logistics), Manager of Administration (Finance),Manager of Environment (if not on scene)
- What –
    - Control communications off site; maintain communications with IC, communications off site as required such as corporate, regulators, support agencies, media, neighbors, etc.
    - Notify families when warranted.
    - Source materials, supplies, mutual aid, resources.
    - Arrange for evacuation and general transportation and logistics.
    - Develop business continuity plans.
    - Advise and support scene IC as required.
    - Provide updates to site

3.5. Major Power Failure

1. In the event of a major power failure affecting any portion of the operating facilities at the mine, the employees within the working areas need to be aware of the hazards of unexpected loss of power and safely retreat to the nearest control room, lunch room or office to be accounted for by their supervisor.
2. Electrical supervisor needs to be contacted as soon as reasonably possible to assess the reason for the outage, provide alternate power if able and to contact YEC to report outage if applicable. Control room has satellite phone available for this reason.
3. Minimizing radio traffic is essential during a Power failure so the bulk of communication related to accountability should be done face to face.
4. Supervisors will attempt to locate and account for all workers under their control and be available to report the accountability check to Site Safety when requested for it.
5. Ambulance and Fire bay doors need to be manually opened by Safety department personnel.

6. Safety Department Personnel will coordinate a sweep through the affected operating area with a source of light to ensure no workers are trapped in a location they could not safely retreat from or are injured from the power failure event and that there is no sign of fire.
7. Safety Department Personnel will make contact with area supervisor to confirm accountability of the respective workers.
8. Any missing or identified as injured workers will require search and rescue efforts. **This would require initiation of Code 1.**
9. Once all people are accounted for and it has been confirmed that there is no risk to life by the power outage operating supervisors will be advised and work can continue or reassigned depending on the job and the location of power failure.
10. Once the power has been restored safe start up procedures must be followed and all work must be directed by the supervisor in charge of the affected areas.
11. If a major power failure occurs underground, all work stops and workers will report to refuge station or surface and report to the shift boss for accountability purposes.
12. UG workers will remain in the safe refuge locations until instructed to proceed back to work by shift boss.
13. Any coordination of emergency information related to the power failure will be provided to the shift boss by the Safety Department.

3.6. Discovery and Activation of Code 1 Protocol



4. INITIAL INCIDENT RESPONSIBILITY MATRIX

POSITION	RESPONSIBILITIES
Safety Coordinator/Medic	Initial scene assessment and Incident Command Coordinate initial response Provide first aid treatment if necessary Mobilize ambulance to scene, if required E.R.T. and specialized resources mobilization & consultation Attend and coordinate response for all incidents involving "serious injury" and "serious accident", as defined in Sec. 33, OHS Act Notify Area Supervisor, Health and Safety Superintendent, Request additional external resources as necessary and provide history and assessment for medical evacuations
Mine Rescue Team	Maintain team safety as priority Rescue and protect human life Protect and mitigate loss to mine property Assist with rehabilitation of mine property and equipment
Area Supervisor	Coordinate evacuation of work area Account of workers under his/her responsibility Be available to Incident Command for information and assistance requests. Participate with Incident Investigation
Department Manager	Respond to scene and provide Unified Command Support Attend at all incidents involving "serious injury" and "serious accident", as defined in Sec. 33, OHS Act Coordinate and participate in incident investigation process. Ensure follow up action is completed
H&S Superintendent	Notify General Manager and Department Manager and provide follow up report of progress Assist with accountability Provide for unified incident command support Provide direction as required Coordinate recovery and investigative activity Ensure all government reporting has been completed Provide follow up reports to regulatory bodies as required Organize and conduct post-incident debriefings Assist with Incident Investigation
General Manager	Receive briefings on incident details Provide for unified incident command support Provide direction as required Verify notification of regulatory agencies, government and Minto Explorations Ltd. corporate office as required Verify scene remains secure until released by regulators (if applicable) Verify compliance with standards and government regulatory requirements Follow up communication to corporate and media Responsible to authorize all off site communication

5. FOLLOW UP RESPONSIBILTY MATRIX
Incident – Injury / Fire / Spill / Other

Health & Safety Superintendent	Maintain Scene Security at incident. Instruct ERT / Mine rescue of further requirements or stand down / all clear. Notify Authorities. Ensure legislative compliance. Assist with site incident investigation and evidence gathering. Report progress to GM and Department Manager. Co-ordinate plan to get all rescue equipment back to a state of emergency preparedness. Debrief rescue team.
Safety Co-ordinator / Medic	Roll out plan to ERT to get all rescue equipment back to a state of emergency preparedness.
Mine Rescue Team / ERT	Support debrief of incident. Ensure all rescue equipment is back to a state of emergency preparedness. ERT complex clean up. Captain to ensure that all team members are provided the time and assistance needed to recuperate from the response. Captain to release the team upon completion.
General Manager	Ensure necessary notifications are made. Minto Explorations Ltd. Corporate Office / Yukon OH&S Mines Inspector / External Family / Media.
Department Manager	Organise and participate in the incident investigation and gathering of evidence.
Environmental Representative	Ensure necessary notifications are made. Yukon Spill Response Line
Human Resources	Arrange for transportation of site personnel if required.

6. MEDICAL EMERGENCY EVACUATION

Yukon EMS dispatch is a critical resource in the event of a medical evacuation. Safety Coordinator/Medic will inform Yukon EMS dispatch every instance that there is a change to the site access such as barge removal, ice bridge closure, or the initiation of Ice Bridge or barge operation.

1. Minto Explorations Ltd. Medic will control all medical / trauma emergencies.
2. Upon patient assessment, Medic will determine course of action, including return to work or further medical assessment and evacuation.
3. If medical evacuation is deemed necessary, the Medic will contact Yukon EMS Dispatch @ 867-667-3333 and provide history and assessment findings. EMS dispatch call is a two element call and Medic will need to provide history and assessment twice. The first element dictates the triage of the transfer and the second element is directly to a medical professional responsible for the transfer. These two elements should be available back to back. Yukon EMS Dispatch is responsible for transfer method decision.

Yukon EMS Dispatch	(867) 667-3333
Pelly Crossing Nursing Station	(867) 537-4444
Carmacks Nursing Station	(867) 863-4444
Whitehorse General Hospital	(867) 393-8700

4. All Yukon EMS transfer either by road, air or combination is provided with nursing and paramedic personnel. Air transport is provided flight nurse and flight paramedic. Triage decisions will be made based on patient condition and other emergencies taking place in the area. We are a high priority community as deemed by Yukon EMS and all efforts to supply our needs will be made. One hour plus flight time is the mandate for response by EMS so medic needs to consider that as part of his treatment and care. EMS dispatch provides all patch call information to receiving facilities if they are involved in the transfer in any way.
5. In the event that a transport decision is made without or outside of consultation with Yukon EMS Dispatch, they need to be notified as soon as reasonably possible to provide for additional transport from destination and/or to document transfer decisions made.

6.1. Non-Emergency Transfers

Ice Bridge + Minto Barge available

1. Non-critical, stable patients that require further medical assessment and do not require medical attention during transfer will be taken off site by a designated Minto Explorations employee at the first available time.
2. Non-critical, stable patients that require further assessment and medical attention during transfer must be taken off site via Ambulance. EMS dispatch must be contacted prior to departure to coordinate the transfer, receiving facility and the possibility of further transfer requirement. If EMS dispatch will not be involved in the actual transfer operation, a call to the receiving facility by Minto Medic is required (patch). If EMS dispatch is involved in any way with the actual transfer they will make the patch calls.
3. Emergency, unstable patients will be evacuated off site through coordination between Minto Medic and Yukon EMS Dispatch. In cases of extreme weather that does not permit landing at the Minto Air Strip, the government Air Strip may be utilized on the east side of the Yukon River.

Alternate helicopter services if required (500ft ceiling, daylight only), only after exhausting options through Yukon EMS dispatch.

- HeliDynamics: 867-668-3536
- TransNorth Helicopters: 867-668-2177 (Whitehorse) 867-863-5551 (Carmacks)

6.2. Site or Camp Evacuation

In the event of requiring partial or total evacuation of site, several options are available and must be considered depending on the time of year and availability of transport company provision.

With the exception of medical aid incidents, external resources including evacuation arrangements will be authorized by the General Manager or his designate. Travel arrangements should be coordinated through the travel department or HR and Purchasing department should be involved in all decisions that will result in costs being associated. Designated travel coordinator needs to begin arranging connecting flights or hotel accommodations as soon as evacuation is suspected.

Options for evacuation are by road or air, depending on the time of year and availability of barge or Ice Bridge. Air transportation is dependent on weather and availability of aircraft. Early notification of airlines is critical for preparation of staff and aircraft.

Accurate weather assessment from site is critical to incoming aircraft. Designated person to provide must be arranged.

Road accessible

- Transportation by Coach (47passenger/bus) – Whitehorse (Yukon Alaska Charters)
- Transportation by Van – Pelly Crossing (Tom Gill)
- Transportation by onsite bus – Carmacks (on site)
- Transportation by air – Pelly Crossing/Whitehorse (Alkan Air, Air North, Combination)

Staging of people can be accommodated at Yukon Alaska Tours Recreation Facility, Whitehorse airport or local hotels as available. Arrangement for staging needs to be planned and documented to provide a location to communicate further travel or housing options for individuals once arranged by travel coordinator. Consider supplying food and drink to people in staging and ensure communication is available. Documented list of who is where needs to be maintained.

Road not accessible

- Transportation by air – Pelly Crossing/Carmacks/Whitehorse (Alkan Air, Air North, Combination)
- Transportation by air/road combination – Air to Carmacks and Air/Coach to White horse. Fuel may need to be arranged to be delivered to Carmacks to refuel planes for multiple flights. The designated air agency will arrange for fuel transfer. Mackenzie Petroleum -867-668-4441 or 867-332-3755 cell, Pace Setter – 867-633-5908, North of 60 – 867-633-8820.
- Bus to river crossing and helicopter (Trans North Helicopters) transfer across river to Coach (Yukon Alaska Charters).

Staging of people can be accommodated at Carmacks Air Terminal. Consider supplying food and drink to people in staging and ensure communication is available. Documented list of who is where needs to be maintained.

7. MILL/TAILINGS FIRE ALARM PROCEDURE

1. Activation of Code 1by Control Room Personnel
2. All non-control room personnel in Mill/Tailings are to proceed to nearest exit point and proceed to MUSTER STATION located at mine office complex.
3. Control Room will advise Incident Command of Alarm location.
4. Incident Command will advise Control Room personnel on whether or not to evacuate Control Room.
5. Control room operator can request to be repositioned at either Tailings or Crusher Control room to monitor operations on terminal and complete controlled shut down operation. to provide for critical monitoring and controlled equipment shut down as required. Incident Command to allow based on safety of initial scene assessment.
6. Once evacuated from Mill, all personnel are to proceed to MUSTER STATION.
7. All personnel are to remain located at MUSTER STATION unless advised by Safety department designate.
8. ERT will operate under the direction of Incident Command. Team Captain responsible for team tactical operation and direct accountability of team.
9. No personnel are to block Emergency Response vehicles, Ambulance or Equipment.
10. Health and Safety Superintendent will request accountability report from all area supervisors responsible for work within the affected area.
11. Only Incident Command can advise Control Room to disengage Fire Alarm after investigation of cause.
12. No personnel will be allowed back into Mill or Tailings complex without authorization of Incident Command.
13. Failure to evacuate Mill will result in disciplinary action, which may result in termination.

8. CAMP FIRE ALARM PROCEDURE

1. Activation of Code 1 by Kitchen Staff or first person recognizing alarm
2. All personnel in Camp affected by alarm are to proceed to nearest exit point and proceed to Muster Station.
3. Camp unit manager will bring accountability sheets to Muster Station and meet Health and Safety Superintendent/Officer to assist with roll call (roster sheets are updated daily and are located on the board just inside kitchen entrance). Area supervisors will assist as required and directed by camp unit manager or H&S Superintendent/Officer.
4. Employees working in camp (site services, Sodexo, maintenance) will report to muster station and be accounted for by their supervisor or most senior worker on crew. The supervisors will advise H&S Superintendent/Officer of any missing people.
5. H&S Superintendent will relay accountability information to Incident Command (Safety Coordinator or ERT Captain).
6. ERT will respond to the ERT facility and don turnout gear and prepare SCBA. Once sufficient number of team members is prepared, ERT captain will contact Safety Coordinator/Medic on radio Chanel 1 for response and staging instructions.
7. ERT will respond to defined staging area with the fire truck and ambulance in a safe manner.
8. ERT Captain will utilize accountability tag board maintaining control the team. ERT Captain will report to IC the status and location of the alarm.
9. IC will develop plan of action with the ERT captain. ERT captain will direct team in conducting interior search, rescue and firefighting operations.
10. ERT captain will inform IC of standard benchmark fire ground activities such as entering building, time under air, smoke/fire found, victims located, fire stop, etc.
11. IC will delegate the documentation of a time and event log to the best of their ability. (Control room operator, ECC or on scene team member)
12. All employees will remain at Muster Station until “All Clear” is given by Site Safety or instructed to move to alternate location.
13. Failure to evacuate Camp will result in disciplinary action, which may result in termination.

9. "Serious Injury" and "Serious Accident" under OH&S act

(Excerpt from Occupational Health & Safety Act)

"**Serious Injury**" means:

i) an injury that results in death,
j) fracture of a major bone, including the skull, the spine, the pelvis, or the thighbone,
k) amputation other than of a finger or toe,
l) loss of sight of an eye,
m) internal bleeding,
n) full thickness (third degree) burns,
o) dysfunction that results from concussion, electrical contact, lack of oxygen, or poisoning, or
p) an injury that results in paralysis (permanent loss of function);

"**Serious Accident**" means:

(l) an uncontrolled explosion,
(m) failure of a safety device on a hoist, hoist mechanism, or hoist rope,
(n) collapse or upset of a crane
(o) collapse or failure of a load-bearing component of a building or structure regardless of whether the building or structure is complete or under construction,
(p) collapse or failure of a temporary support structure,
(q) an inrush of water in an underground working,
(r) fire or explosion in an underground working,
(s) collapse or cave-in, of a trench, excavation wall, underground working, or stockpile,
(t) accidental release of a controlled product,
(u) brake failure on mobile equipment that causes a runaway,
(v) any accident that likely would have caused serious injury but for safety precautions, rescue measures, or chance. (As amended by SY 1988, c.22, s. 5; SY 1989, c. 19, s.6)

Reprinted from "Occupational Health and Safety with Mine Safety Regulations."
Yukon Workers' Compensation Health and Safety Board. Department of Justice, Government of the Yukon. 1992

10. Reporting the Emergency

Where an EMERGENCY exists that may affect mine personnel, evacuation procedures must be initiated.

10.1. Underground Emergency – Other than Fire

Any person discovering an emergency shall:

1. If safe to do so try to rectify the situation with the tools you have at the scene
2. Perform first aid if safe to do so
3. Rope off or barricade the area if possible
4. Escape to nearest refuge station following up cast ventilation or out of the mine and warn all others along the way.
5. Report the emergency by calling the appropriate numbers from the Emergency Contact Number sheet located in the refuge station
    - When reporting the incident it is of extreme importance that you include the following information.
    - Who is calling and who is involved?
    - What happened and what have you done?
    - When did this happen?
    - Where are you and where is the emergency?
    - Who and what do you need for a response? First aid, rescue stench gas, other assistance?
    - Stand by the phone and wait for further instructions

10.2. Underground Emergency - Fire:

Where a fire exists that may affect other personnel working in the area, evacuation procedures must be initiated:

Anyone discovering a fire shall:

1. Activate fire suppression system if fire is on equipment.
2. If safe to do so, use nearby fire extinguishers to extinguish the fire.
3. Warn all personnel in the immediate area (voice, radio, and phone) to evacuate to a safe location.
4. Initiate the Stench Warning System.
5. Do not expose yourself to unnecessary risk and keep a clear area of retreat behind you.
6. If the fire is too big, do not hesitate, leave the area immediately and evacuate.
7. Proceed in up cast direction to nearest refuge station, fresh air base or out of the mine if safe to do so.
8. Utilize self-rescue device to protect from smoke exposure.
9. If unable to travel safely to refuge station, take refuge in heading and utilize compressed air header and any available material – vent tubing, clothing, etc. to construct a shield around yourself. Remain in the location until mine rescue team arrives.
10. Once you have reached the refuge station or fresh air base follow refuge station protocols and provide for accountability.

10.3. Under Ground Emergency Evacuation

Upon being notified of a mine emergency evacuation either by radio, phone or stench warning system:

1. Stop work immediately,
2. Note the time you received the warning
3. Calmly proceed in an up cast direction to the nearest refuge station or out of the mine
4. Utilize self-rescue device at the first sign of smoke or fire.
5. Once safely at the refuge station or central muster location, follow the refuge station protocol and provide for accountability.
6. Review the refuge station emergency procedures posted inside the refuge chamber.
7. Check the mine phone for operation and call outside the mine. Report the following information:
    - Your name and name of others in refuge.
    - Refuge Chamber location.
    - Outside conditions.
    - That you are safe in refuge.
8. Remain in the refuge station, even if communication is cut off.
9. Stay calm, conserve energy and cap lamps, sit down on benches.
10. Have one person walk around room periodically to stir up the air.
11. Do not be tempted to wander about the mine seeking safe passage out.
12. Remain in the refuge until you are rescued by mine rescue personnel or contact is made declaring it safe to leave the refuge station by mine official in charge of the emergency.

10.4. Refuge Stations

Portable and permanent refuge stations are maintained in locations of mine development to include refuge < 15 minute travel time by foot. All underground personnel will follow fresh air and escape to surface or take refuge in a refuge station during all emergencies that affect the underground. Refuge station posted “code of conduct” must be followed by all in the refuge station.

10.5. Main Ventilation Control in Event of a Fire

In the event of an underground fire, efforts will be undertaken to ensure ventilation to the mine is maintained.

Operation of the main ventilation fans in will be guarded and monitored to ensure continuous operation of the fans at all times.

The effects of the alteration to the main ventilation fans shall be clearly understood before any changes are made.

During a mine fire:

There will be no alteration to the operation of the main fans without the authorization of the Mine Manager or Designate and Notification to YWCHSB Safety Officer as defined under the regulations.

11. Underground Emergency Response

Underground Emergency – System of response

1. Initiate mine rescue/emergency response notification procedures as directed by UG Shift boss or designate.
2. Upon completion of the emergency response notification procedure:
    a) Assign designate to initiate and maintain a log of events.
    b) Establish the EMERGENCY COMMUNICATION CENTER (ECC).
    c) Keep all Communication Equipment on Standby.
    d) Direct operations personnel to ECC.
    e) Confirm Incident Command (IC) has been initiated.
    f) Complete the EMERGENCY DATA SHEET by obtaining the following information:
        - Name of person reporting the emergency
        - Nature and severity of injuries and/or incident
        - Assistance required
        - Location of emergency
        - Number of people involved
3. Operations personnel will delegate a mine official in charge of the rescue operation and develop a preliminary plan.
4. Mine rescue team will respond to the mine rescue room
5. Mine rescue team captain will assume command of the team
6. Team will don all protective gear and bench test SCBA
7. Team will prepare all equipment needed to respond UG
8. Team will await instructions by Mine Rescue Coordinator (Safety Coordinator/Medic/Health and Safety Superintendent)
9. Team will be advised of plan
10. Back up Mine Rescue team respond to mine rescue room for briefing and preparation for back up assistance.
11. Tertiary back up mine rescue team(s) must be considered and depending on the initial assessment of situation contact needs to be made for mutual aid as soon as reasonably possible.

12. Mine Ventilation Action Plan

In the event of fan failure due to a malfunction, accident, power failure, or other such unplanned or unscheduled event, this action plan applies to all underground employees and contractors whose work areas are affected by the temporary interruption of the operation of the main, booster, or auxiliary fans in the mine.

Main Ventilation Interruption Procedure:

Less Than 2 Hours:

1. Diesel mobile equipment, mucking operations, will cease in all active production and development headings supplied by mechanical ventilation until the main ventilation system is restored. ... OR ... The active heading is continually monitored for air quality and is maintained in compliance with the applicable standards.
2. All other work relevant (scaling, clean-up, maintenance, etc.) to the active heading may continue per normal operations provided the air quality remains in compliance with the applicable standards.
3. Diesel mobile equipment for access to, or egress from, the mine will continue per normal mine operations provided air quality remains within compliance of the standards. **If the ventilation is forced the diesel equipment must be shut down until ventilation is re-established.**

Two Hours or More:

1. Air quality testing will be performed by Supervision in all active headings affected by the ventilation interruption. Where air quality is not within compliance of the standards for mine ventilation, all personnel shall be withdrawn from the active heading affected.
2. Ventilation to the affected active headings shall be restored to normal and the air quality in the affected active workings shall be tested by Supervision to ensure the air quality meets the requirements of the standards prior to the return to work in the area.
3. Prolonged ventilation interruption will require air quality testing in the affected active workings at least every four hours until ventilation has been restored.
4. In areas where air quality prevents continued testing, normal ventilation shall be restored for a minimum of two hours before persons enter the area to test air quality ... OR ...Suitable self-contained breathing apparatus and procedures consistent with YWCHSB Regulations will be followed by competent persons to perform air quality testing the affected area.
5. Diesel mobile equipment for access to, or egress from, the mine on the main haulage ways will continue per normal mine operations provided air quality remains within compliance of the standards.
    a. **This is contingent on the mine having flow through exhaust. If the ventilation is forced the diesel equipment must be shut down and the mine evacuated until ventilation is re-established.**

13. MINE RESCUE

Minto Mine will retain a compliment of trained surface and underground mine rescue personnel on site at all times. This will include two full UG teams as a minimum. A required third UG team would consist of a mutual aid response from YWCHSB and neighboring mines with a mutual aid agreement in place.

The mine rescue unit consists of a minimum of three mine rescue teams summoned to a mine disaster; if the operation extends beyond 6 to 8 hours, the additional third team must be called in. In order to reduce fatigue, the teams are rotated to allow one team at work, one team on hand as backup and the third team at rest.

A typical rotation for a three team unit is as follows:

Team Working/Backup Team/ Team at Rest (2 hour maximums)

A team/ B team/ C team

B team/C team/ A team

C team/A team/ B team

Teams have approximately 4 hours rest prior to working for 2 hours.

13.1. Mine Rescue Personnel

Name	Company	Capacity
Bissell, Keith	Minto Mine	Surface Mine Rescue/ERT/ Hazmat Op.
Christian, Tyler	Minto Mine	UG/Surface Mine Rescue/ERT/ Hazmat Op.
Crottey, David	Minto Mine	Surface Mine Rescue/ERT/OFA 3/ EMR / Hazmat Op.
Daley, Mike	Minto Mine	UG/Surface Mine Rescue Instructor/OFA 3
Dunfield, Steve	Minto Mine	ERT / Hazmat Op.
Emerson, Phil	Minto Mine	ERT / OFA3 / Hazmat Op.
Goebel, Mark	Minto Mine	UG/Sur. Mine Rescue Instructor/OFA 3/PCP/Hazmat Tech
Henry, Garth	Minto Mine	Surface Mine Rescue/ERT/EMR / Hazmat Op.
Jimmo-Dixon, Anna	Pelly Construction	ERT
Kerr, Dan	Minto Mine	Surface NWT
Moloney, Brendan	Minto Mine	ERT
Monteith, Tyrone	Minto Mine	Surface Mine Rescue/ERT/ Hazmat Op.
Moretti, Troy	Minto Mine	ERT
Silverfox, Ryan	Minto Mine	Surface Mine Rescue/ERT
Spruit, Arjen	Minto Mine	Surface Mine Rescue/ERT/OFA 3/EMR/ Hazmat Op.
Stewart, Mike	Minto Mine	UG/Surface Mine Rescue/ERT/OFA 3
Sutton, Rob	Minto Mine	UG/Sur. Mine Rescue /ERT/OFA 3 Instr./PCP/ Hazmat Tech
Taylor, Steeve	Minto Mine	UG/ NWT / ERT/ OFA3/ Hazmat Op.
Vandenhoek, Craig	Fountain Tire	ERT/ Hazmat Op.
West, David	Pelly Construction	ERT / Hazmat Op.
Wettstein, Curtis	Minto Mine	Surface Mine Rescue/ERT

13.2. EMERGENCY RESPONSE EQUIPMENT

Emergency Response Equipment	Location	Use Authorized By:
Minto Mine Ambulance	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Minto Mine Fire Engine 8 Emergency / Rescue / Tender	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Minto Mine Hazmat Trailer	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Minto Mine 4 Wheel Drive Tundra	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator

		Safety Superintendent / Officer ERT Captain
Medical Jump Kits	ERT Complex First Aid Room Medics room Ambulance	Safety Coordinator-Medic
2 Automatic External Defibrillators	Minto Ambulance First Aid Room	Safety Coordinator-Medic PCP
Oxygen Airway Adjuncts (OPA) Nasopharyngeal Airway King Extraglottic Airways	First Aid Room Jump Kits Ambulance	Safety Coordinator-Medic PCP ERT Captain
Spinal Precautions Spine Boards & Head Blocks Stiff Collars Spider Straps KED – Vehicle extrication device	Minto Ambulance First Aid Room	Safety Coordinator/Medic PCP ERT Captain
Splints Regular Sager traction splint	Minto Ambulance First Aid Room	Safety Coordinator/Medic PCP ERT Captain
Wound Management Burn Dressings Sterile Water Bandages & Dressings	First Aid Room Jump Kits Ambulance	Safety Coordinator / Medic PCP ERT Captain
EPI Pens Anaphylactic Shock / Allergies Additional Medications Entonox Vent Olin Nitro SL Epi SC Narcan SC, IV D10W IV 0.9% NaCl IV	First Aid Room Jump Kits Ambulance First Aid Room Jump Kits Ambulance	Safety Coordinator/Medic EMR PCP PCP PCP PCP PCP PCP PCP
SCBA 6- Scott 2.2 2 – Scott 4.5 12 – Spare bottles	ERT Complex & Fire Engine 8	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
3 Lifting/Moving Bags & Manifold	Fire Engine 8	Safety Coordinator – Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Chain Saw- Roof Saw –Recipro. Saw	Fire Engine 8	Safety Coordinator – Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Hydraulic Spreaders & Jaws	Fire Engine 8	Safety Coordinator – Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain

Ground Monitor – Piercing Nozzle and PPV Fan	Fire Engine 8	Safety Coordinator – Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Generator and Flood Lights	Fire Engine 8	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Gas Detection 4- BW Gas Alert Micro 5 Multi Gas 1 Draeger Bellows multi gas detector	ERT Complex Electronics Room	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Radios 10 – Motorola Hand Held Radios 1 VHF Air Band Transceiver Radio 2 Satellite Radios	ERT Complex Electronics Room	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Rope Rescue Equipment 2 complete rope rescue bags 8 – Rescue Ropes Compliment of hardware including descending devices, pulleys, mechanical advantages, rope grabs, harnesses, helmets, etc.	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
NFPA Turn Out Gear 16 sets including boots, gloves, Helmets and balaclavas.	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Hazmat Response Equipment Protective clothing, sorbents, booms, Over pack, hand tools.	Minto Mine Hazmat Trailer	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Confined Space Rescue Gear SKED Stretcher /Oregon Spin Splint Rescue Tripod / Ventilation Fan Stokes basket with spider straps / Mule Litter Wheel	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer ERT Captain
Underground Rescue Equipment	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer Mine Rescue Captain
6 Draeger BG 4 SCCBAs and all equipment to clean / test / refill	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer Mine Rescue Captain
6 Ocenco EBA 6.5 Self Rescuers (1 trainer)	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer Mine Rescue Captain
12 MSA W65 Self Rescuers **12 Underground Camp Lamps** **12 Miners Belts**	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer

12 Link Lines		Mine Rescue Captain
1 Stretcher Basket fully equipped	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer Mine Rescue Captain
Rope Rescue Equipment 1 complete rope rescue bag	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer Mine Rescue Captain
1 Multi Gas Detector	ERT Complex	Safety Coordinator - Medic Emergency Response Coordinator Safety Superintendent / Officer Mine Rescue Captain

13.3. BACK UP MINE RESCUE

13.3.1. Back up Mine Rescue Teams

If the operation extends beyond 6 to 8 hours, additional mine rescue teams must be called in. A mutual agreement with other mines will have to be drafted to ensure backup if required. A list of local mine rescue personnel could serve as back up in the event these individuals are on their rotation off and are in fact home.

Minto Mine has in place cooperative agreements with the Alexco Resource Corp. at the Bellekeno Mine as well as divisions of Procon Mining and Tunnelling.

If the incident requires Mine Rescue back up response the YWCHSB Mine Inspector and Alexco Resource Corp must be notified immediately, advised of the situation and to prepare to respond immediately pending available resources.

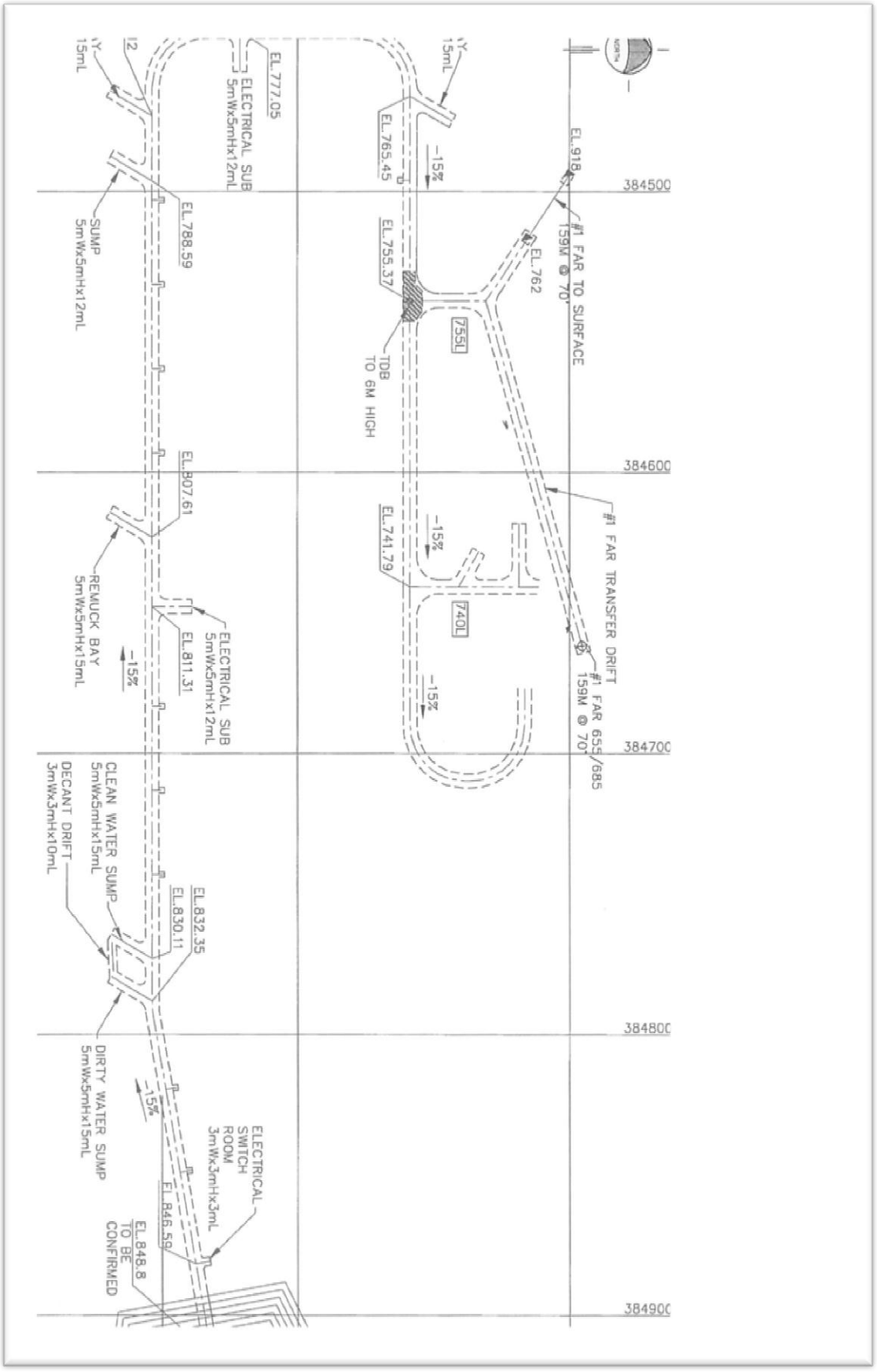
Agency	Contact Personnel	Office Contact Number	Home Contact Number
YWCHSB	Bruce Milligan	867-667-8739	1-800-661-0443 (toll free)
Alexco Resource Corp	formal plan in place	867-996-2330	
Procon Mining	formal plan in place	604-291-8292	

Reference Mutual Assistance Agreement for more details

14. Minto Mine Underground Decline Capital Development

14.1. Mine Safety Plan for first 4500 meters

The Minto Mine Capital Decline will be of a five by five meter dimension by 4500 meters in dept. Safety bays and sumps will be set up on the right side of the drift with all the remucks on the left side. The drift will be driven by an experienced rotating work crew of 16 miners. Work crews will be all ticketed and experienced mine rescue personnel. Each work crew will consist of four men and will have a ticketed shift boss in addition to the four man crew. At any given time there should only be two men working at the face. The target is to advance 100 to 125 meters per month.


384500
384600
384700
384800
384900
EL.918
#1 FAR TO SURFACE
159M @ 70°
EL.762
#1 FAR TRANSFER DRIFT
#1 FAR 655/685
159M @ 70°
755L
740L
EL.765.45
EL.755.37
TDB
TO 6M HIGH
EL.741.79
-15%
EL.777.05
ELECTRICAL SUB
5mWx5mHx12mL
EL.788.59
SUMP
5mWx5mHx12mL
EL.807.61
REMUCK BAY
5mWx5mHx15mL
ELECTRICAL SUB
5mWx5mHx12mL
EL.811.31
CLEAN WATER SUMP
5mWx5mHx15mL
DECANT DRIFT
3mWx3mHx10mL
EL.832.35
EL.830.11
DIRTY WATER SUMP
5mWx5mHx15mL
ELECTRICAL
SWITCH
ROOM
3mWx3mHx3mL
EL.846.59
EL.848.8
TO BE
CONFIRMED

Safety

A single ***vent fan*** set up at the portal entrance a safe distance away will provide adequate ventilation for the first phase of the drift. A standard stench gas warning system will be tied into the surface ventilation system with the ability to manual activate from surface. A back up Alimak vent raise 3 meters by 5 meters will eventually be driven to the surface as development progresses. This vent raise will be equipped with ladders and metal landings and will also serve as the back-up emergency escape route. A firefighting hose station will be set up in proximity of the portal. Safety bays will be located along the drift every 30 meters equipped with reflective signs for identification and scaling bars. The safety bay closest to the working face will be equipped with an industrial sized metal "Job Box "with emergency equipment inside. Basic contents;

- Six Ocenco EBA 6.5 Escape breathing apparatuses good for 8 hours each.
- Six spare MSA W65 Self –Rescuers
- One level 3 first aid kit
- One oxygen therapy unit
- Splints, c-collar, six spare emergency blankets
- Five gallon jug of fresh water
- Mainstay Freeze dried dehydrated food bars (good for 5 years)
- Back up emergency lighting
- Toiletries as required.

Communication will be via Leaky Feeder or Fiber Optics. Upon reaching the 250 meter mark in the drift a **C-CAN Refuge Station** will be stationed to protect miners in the event of dangers. The refuge station will be equipped with posted emergency procedures, telephone emergency communication systems, firefighting equipment, piped‑in fresh air, piped in water, stretcher, spine board, trauma kit, emergency blankets, first aid supplies, emergency breathing apparatus, drinking water and such other emergency supplies as circumstances at the mine may dictate.

Rescue

The contractor responsible for the mining of the decline will provide 6 certified underground mine rescue personnel. In addition six existing Minto Mine employees presently possess valid underground mine rescue certification. This will bring the total to 26 ticketed underground mine rescue personnel. Mine Rescue training and instruction will be conducted in a cooperative effort between the contractor and Minto Mine utilizing underground certified mine rescue instructors.

Rescue Equipment are stored on surface and consist of 6 Draeger BG4 self-contained closed circuit breathing apparatuses, 2 fully equipped stretcher baskets, picks, shovels, scaling bars, rechargeable saws, rope, tackle, mechanical advantage hardware, foam fire suppression equipment, fire hoses, nozzles, axe, hammers, nails, etc.

A firefighting hose station will be set up in proximity to the portal. The design will be that of a 2.5 inch water valve with ability run several lengths of 2.5 inch fire hose off of it to a gated "Y". The gated "Y" reduces from 2.5 inches to 1.5 inches and splits to two 1.5 inch fire lines to the fire, foam nozzles utilized if required. A supply of AFF foam, nozzles, hoses and extinguishers will be stored in the hose station and readily available. A wheeled foam machine will be available for filling a drift in the event of equipment fires underground.

15. MISSING PERSON ACTION PLAN

Potential exists where persons may become lost on or traveling to and from the property. Such incidents can occur under the following circumstance:

- Employee or Contractor personnel engaged in surface exploration, travel or any other activities are overdue and cannot be located or contacted.

Upon notification that personnel are unaccounted for on the property you should:

1. Immediately advise the Area Supervisor, Safety Department Personnel and Area Manager
    - Designate a mine official in charge of the search and communications/planning.
    - Assess and determine the level of response required.
    - Gather all available information about the missing persons including last known location.
    - Advise the RCMP of the circumstances and request further assistance
    - Designate ERT/Mine Rescue to stand-by and assist the RCMP in search efforts as directed
    - Any search activity needs to be coordinated through the mine official in charge of the search. Search by vehicle should be conducted with two people in each vehicle, in coordination with RCMP and have effective communication and plan in place prior to conducting search.
    - Survival gear, rescue tools, tow straps, fuel, etc. should all be considered and taken along during search activities.
2. Stand-by to provide further information and assistance as required.
3. Once search is complete follow up notification to all involved must be conducted including RCMP.
4. Provide for follow up investigation to identify contributing factors and recommend future prevention actions.

16. OUTBREAK OF SICKNESS/GASTROENTERITIS ACTION PLAN

(Yukon Center for Communicable Disease Guideline)

Case Definition for Outbreak:

- At least one of the following must be met: Two or more liquid or watery
- stools above what is normal for the person within a 24-hour period, OR
- Two or more episodes of vomiting in a 24-hour period, OR
- Both of the following: (a) lab confirmation of a known enteric pathogen and (b) At least one symptom compatible with gastrointestinal tract infection (I.e. nausea, vomiting, diarrhea, abdominal pain or tenderness)

Outbreak definition:

- Three or more cases of gastroenteritis infection (as defined above), potentially related, occurring within a four day period, within the facility.

Case characteristics:

- Abrupt onset of diarrhea and vomiting
- Fatigue and occasional low-grade fever
- Average duration 18-24 hours, rapid recovery

Suspected etiology:

- Noro type virus. Confirmation by obtaining sample and sending in for analysis. Sample kit available in first aid and instructions are attached.

Response measures:

1. Sick bay and isolated washroom facilities needs to be provided. Minto Manor and Exterior Wash car need to be readied for service by Sodexo.
2. A second area made available for post-acute, recovering patients.
3. Communication to site informing of the situation and requesting people to report illness and use strict personal hygiene practices.
4. Cleaning of the quarantine areas undertaken by people informed of the risks and trained in the protection required. Food must be delivered, provisions for hydration need to be ensured. Electrolyte replacement fluids should be provided. Squincher is currently being placed into warehouse stock.
5. Cleaning of all other areas using Virox or bleach solution: 3x per day bathrooms and corridors and common rooms.
6. Kitchen and dining areas are cleaned on a continual basis
7. Discontinue communal food dispensing (salads, etc.) All food portions individually wrapped.
8. Contact Yukon Communicable Disease Control to advise of outbreak.
9. Consider notification of offsite personnel that may be scheduled to come into camp during outbreak and decide on travel restrictions, interruptions during the period

16.1. Recommendations for ongoing management of outbreak

If decline in case numbers to sporadic or nil:

- Laundering of all bedding: sheets, pillow cases, and quilts or blankets
- Laundering of all clothes used by or exposed to sick individuals.
- Cleaning of all surfaces with standard veridical disinfectants (bleach or Virox).
- Clothes that have been stored and unexposed to sick persons can be left in place
- Any drawers, shelves, etc. used by sick individuals should be cleaned.

If sporadic new cases (1 to 2 per day):

- Continue use of Sick Bay and isolation area
- Continue food preparation precautions
- Allow new staff in but with briefing on situation and need for vigilant personal hygiene

When no new cases reported for at least 48 hours:

- Terminal cleaning of isolation areas, cleaned as above with Virox or bleach solution. Designate and maintain a smaller isolation area for possible new cases over next 2 to 4 weeks
- Allow new staff to come in for normal tour of duty
- Return to normal food preparation

If continued high numbers (more than 3 new cases per day) or escalation of cases:

- Continue isolation/sick bay area with appropriate cleaning regimen
- Continue daily monitoring of new cases and their origin (bunk house)
- If more than one new case per bunk house, undertake intense cleaning of entire affected bunk.
- Close non-essential common areas
- Allow no in-rotation in of new personnel
- Consider camp closure according to demands on personnel

If continued high or increasing numbers despite measures in B. being followed:

- Close camp with clean out of entire camp: bunkhouses, food preparation and consumption areas, offices, common rooms and all non-industrial sites.
- Allow reopening of site following clean up.

If apparent cessation of outbreak followed by new cases after 48 hours or more:

- Follow recommendations as in B and C above.

17. EMERGENCY CONTACT INFORMATION

CAPSTONE MINING CORP.
MINTO MINE

MINTO MINE – MLU PERMIT #LQ00004

EMERGENCY CONTACT INFORMATIO

LOCATION

LEGAL DESCRIPTION: N 62.37.210 E 137.14.042

NAD 83 EASTING 385371 NORTHING 6945190

DIRECTIONS

FROM WHITEHORSE, HEAD WEST ON ALASKA HIGHWAY, TURN NORTH (RIGHT) ONTO HIGHWAY #2, TRAVEL TO APPROXIMATELY KILOMETRE 430, and TURN WEST (LEFT) ONTO ROAD MARKED BY MINTO MINE SIGN. WAIT FOR RIVER BARGE ENTER ON MINE ROAD AT KM27. BARGE OR BRIDGE CREW WILL PROVIDE ROAD RADIO PROTOCOLS AND FURTHER INSTRUCTIONS.

FREQUENCIES

RADIO FREQUENCY	CHANNEL	RECEIVE	TRANSMIT
Access Road	16	162.075	167.055
Emergency	1	162.03	167.01

Amb Sat Phone 011-881-651-434-147 Control Room Sat Phone – 011-881-641-436-239 Spare Sat Phone – 011-881-622-452-217

ALL EMERGENCIES ANNOUNCE 'CODE 1, CODE 1, CODE 1' ON CHANNEL 1

MEDICAL

DEPARTMENT	PERSONNEL	COMPANY	PHONE #	EXT.	E-MAIL	RADIO
Dispatch	Control Room	Minto Ex.	604-759-0860	458		7
Safety /Medical	Arjen Spruit	Minto Ex.	604-759-0860	444	arjens@mintomine.com	1
Safety/Medical	David Crottey	Minto Ex.	604-759-0860	444	davidc@mintomine.com	1

OFF-SITE MEDICAL CONTACTS

AGENCY	PHONE NUMBER	ALTERNATE PHONE #
Nursing Station - Pelly Crossing	867-537-4444	24 hrs/day
Nursing Station - Carmacks	867-863-4444	After hours call forwarding
Whitehorse General Hospital	867-393-8700	24hrs/day
Yukon Communicable Disease Control	867-667-8178	
Poison Control Centre	867-393-8700	CANUTEC – 613-992-4624 (collect)

EVACUATION / RESCUE

Yukon EMS Dispatch – All medical transfers here	867-667-3333	24hrs/day
Air North	867-456-8300	867-335-1210 24hrs/day
Trans North Helicopter	867-668-2177	
Alkan Air	867-668-2107	24hrs/day
Yukon Alaska Tours – Coach Transportation	867-668-5944	24hrs/day
Search and Rescue (RCMP)	867-537-5555	867-667-5555
RCMP - Pelly Crossing	867-537-5555	867-667-5555
RCMP - Carmacks	867-863-5555	867-667-5555

MINE

DEPARTMENT	PERSONNEL	COMPANY	PHONE #	EXT.	E-MAIL	RADIO
General Manager	Ron Light	Minto Ex.	604-759-0860	439	ronl@capstonemining.com	
Health and Safety	Mark Goebel	Minto Ex.	604-759-0860	441	markg@mintomine.com	1
Mine Manager	Sebastien Tolgyesi	Minto Ex.	604-759-0860	453	SebastienT@mintomine.com	
Mill Manager	Ted Kenney	Minto Ex.	604-759-0860	477	tedk@mintomine.com	
Environmental	Jennie Gjertsen	Minto Ex.	604-759-0860	462	jennieg@mintomine.com	
Mill General Forman	Barrett/Johnston	Minto Ex.	604-759-0860	454	daveb@mintomine.com	8
Maintenance/Project	Martin Mann	Minto Ex.	604-759-0860	457	martinm@mintomine.com	
Site Services	Steven Maunder	Minto Ex.	604-759-0860	224	stephenm@mintomone.com	16/5
Human Resources	TJ Silliker	Minto Ex.	604-759-0860	448	tjs@mintomine.com	
Explorations Group	Brian Willet	Minto Ex.	604-759-0860	228	brianw@mintomine.com	
Pelly Superintendent	Declan McGovern	Pelly Const.	604-759-0860	466	declan@pelly.net	14
Pelly Superintendent	John Garvice	Pelly Const.	778-785-3184	466	john@pelly.net	14
Sodexo Manager	Michel Bourget	Sodexo	604-759-0860	230	Minto.Noram@sodexo.com	
Dyno Supervisor	Dale Wearmouth	Dyno Nobel	403-775-6143		dnns.minto@am.dynonobel.com	14
Dyno Supervisor	Rene Mercereau	Dyno Nobel	403-775-6143		dnns.minto@am.dynonobel.com	14
Assay Lab Manager	Bella Ocampo	SGS	604-759-0860	447	bella.ocampo@sgs.com	
Assay Lab Manager	Erin Slack	SGS	604-759-0860	447	Erin.slack@sgs.com	
Satellite Phones	Ambulance – 011-881-651-434-147		Control Room – 011-881-641-436-239		Spare – 011-881-622-452-217	

OTHER

Superior Propane	867-334-1627	
Yukon Energy	1-800-676-2843	24hrs
Yukon Spill Response Line	867-667-7244	
YTG Disaster and Emergency	867-667-5220	
Yukon WCB	800-661-0443	
Forest Fire Reporting	888-798-3473	Carmacks Duty Officer – 867-332-1989
Conservation Officer	867-996-2202	867-335-2327 cell
Coroner	867-667-5310	
WCB Mines Inspector	867-667-8739	867-334-2002 cell or 867-667-5450 24hr

Appendix F – Hours of Work Variance Request and Approval

CAPSTONE MINING CORP.
MINTO MINE

P.O. Box 33174
Whitehorse, YT, Y1A 6S1, Canada
Tel: 604-759-0860 Fax: 604-759-0861
Toll Free: 866-684-8894
www.capstonemining.com

July 22, 2012

Mr. Kurt Dieckmann
Director of Occupational Health and Safety
Mr. Michael McBride
Interim Director of Occupational Health and Safety
Yukon Workers Compensation Health and Safety Board

Dear Mr. Dieckmann and Mr. McBride,

This letter serves as a follow up to our meeting on May 10th, 2012 regarding additional information in support of our original request for a variance submitted October 18, 2011 as per section 1.03 of the Yukon Occupational Health and Safety Act.

The variance is specifically to modify the hours of scheduled work in an underground mine as referenced in Section 15.13 (2) of the Yukon Occupational Health and Safety Regulations.

Minto Explorations Ltd. confirms that this request remains specific to the first 4500 meters of ramp development and associated ore removal. This development is expected to begin on September 1, 2012 with an expected timeline of approximately 18 months.

The requested hours of work variance for these 4500 meters of underground development is as follows:

- 11 hours per shift of underground exposure for workers in enclosed cabs of mobile equipment.
- 10.5 hours per shift of underground exposure for all other employees.
- Shift rotation of 3 weeks on and 3 weeks off for the contractor's hourly rated employees.
- Shift rotation of 4 weeks on and 2 weeks off for the contractor's staff employees.

The ramp development will be performed by Dumas Contracting Ltd. (Dumas), from Timmins, Ontario. The first 4500 meters will be driven utilizing 48" vent ducting delivering approximately 50,000 cfm of air from the portal face to the underground workings. This air will be heated with propane-fired mine air heaters during the winter months to a minimum temperature of 2 degree Celsius.

A fully equipped and engineered portable refuge station will be maintained as close to the face as practical. This refuge station is equipped for 15 people and rated for 36 hours.

It is Minto Mine's intent that prior to the completion of the 4500 meters of development (approximately 18 months) the data generated will allow Minto Mine to apply for a permanent variance to the extended hours of work.

Dumas is currently recruiting for this project and qualified mine personnel available locally would be an obvious benefit to both the employee and Dumas. Dumas are in the process of developing a Joint Venture Partnership with a member business (Selkirk First Nations) to supplement crews with local personnel, where feasible. Again, through this partnership, Dumas envisions a greater ability to source locally, providing increased business opportunities and economic benefit for the Selkirk First Nations as a whole.

In order to ensure that the Minto Underground Development Project can provide an equal or greater level of worker health and safety the following programs and controls are proposed:

Hours of Underground Exposure Monitoring

In order to ensure compliance with the requested hours of underground exposure, Minto Mine will utilize Smart Tags. Smart Tags are long range RFID (Radio Frequency Identification) to track employee's underground exposure hours in real time. This system consists of an active RFID tag located on the employee, whether it is on their hard hat, safety belt pouch or inside the cap lamp; and a networked RFID reader located at the portal collar. Data is then sent to a central computer system which facilitates system control and monitoring though the Smart Tag software (or similar) in real time by employee.

Minto is also investigating the use of an integrated system offering PED (Personal Emergency Devices), leaky feeder (or similar) communications and a smart tag tracking system. Although it is Minto's plan to utilize stench in the ventilation system during development, the PED system may be a far better alternative going forward.

Safety Program

Minto Mine and Dumas' 'emphasis on the importance of safely, is a philosophy shared by senior management, on site supervisors and daily operators.

This project will be undertaken with a dedicated focus on *"Zero Harm"*. All non-routine tasks will be assessed for risk to ensure suitable control measures are in place to better achieve *"Zero Harm"*.

All work will be performed within the strict guidelines of both Minto's and Dumas' safety programs. Both programs will comply with all required internal policies and procedures, as well as the Yukon Territory's legislated requirements.

Dumas will utilize its Safety and Training program which encompasses over 250 work specific procedures. The Dumas safety program includes risk assessments, job observations, workplace inspections and regular program audits. Any new work which is non-routine will be subjected to a full risk assessment (utilizing PHA-PRO) which would then be used to develop new site specific work

procedures. Dumas will maintain detailed training records of every employee, both on-site and at their main office. We are committed to *"Zero Harm"*.

The Dumas *Health, Safety and Environmental* plan is detailed in Appendix II. A key component of our commitment to *"Zero Harm"* is the use of the *Dumas Zero Harm Safety System* and associated safety card in the field. This system has integrated field level risk assessments as part of the printed *Neil George 5 Point Safety Card* which employees must complete on a daily basis. Should workers identify a risk as "Medium" or "High" they *must* contact their supervisor and actions are then taken to either correct or retreat. All safety concerns are logged and become part of the Site Safety Action Plan where they are documented, assigned responsibility, and tracked until rectified. The Safety Action Plan is continuously updated, monitored and discussed at the weekly safety meeting.

Industrial Hygiene Program

Two Industrial Hygiene Consultant firms have been engaged to assist Minto Mine in the development of an underground IH plan and management programs (acceptable to YWCHSB) for, but not limited to, air quality, noise and fatigue. It is expected that a selection and confirmation of services will be completed within 15 days. The selected provider will be involved throughout the development to conduct regular review of the program and testing results. The purpose of this plan is to develop process and procedures to ensure the highest possible air quality is maintained, (TLV levels), manage noise and to develop and implement a Fatigue Management Program.

Until such times that the IH data confirms that air quality exposure is below the adjusted TLV concentrations, respirators will be a mandatory piece of PPE equipment to all employees entering the underground workings.

The Consultant will also be utilized in the definition and calculation of adjusted TLV values.

As stated above, it is Minto Mine's intent that prior to the completion of the 4500 meters of development to apply for a permanent variance to the hours of work. The IH data and programs for air quality, noise and fatigue will form the bases of this request.

Mine Planning

The current drawings of the Underground Development Project were used to do initial planning and financing. The contractor's mine planer will be on-site in August to provide detailed engineered drawings for the Underground Development Project.

These drawings (including driving layouts) for the first 4500 meters will be forwarded to the YWCHSB upon completion. The drawings will include ground control plans, ventilation / escape way plans, refuge station locations, safety bays, electrical service plans (including panel reset protocol) and mine

services plans. These drawings will be forwarded 3-4 weeks after the contractor's mine planner arrives at the Minto Mine site.

First Line Supervisory Training

Dumas will comply with the Yukon Occupational Health and Safety (OH&S) regulation by obtaining First Line Supervisor's Provisional Certificates and working toward full certification during the development.

Underground Equipment / Materials

- Diesel Equipment

All diesel equipment used in the underground operation will be permitted and maintained to comply with section 15.58, 15.59, 15.61 and all related sections on the Yukon Occupational Health and Safety Regulation. Detailed list of current fleet attached as appendix to this document.

- Portable Compressors

Portable compressors will be equipped with CO (carbon monoxide) monitors, fire suppression and have automatic shutdown capabilities.

- Shotcrete– Shotcrete used in the underground workings will be restricted to "wet system" process only.

WCHSB Reporting

Quarterly update meetings to be held with YWCSHB to review the following:

- IH Program data and Fatigue Management Plan progress
- Update Mining Plan

The dates of the Quarterly Update Meeting should be set annually, with some latitude for mutually acceptable alternative dates. Minto mine proposes the 2nd month of each quarter and the Thursday of the 3rd full week of these months, however, Minto Mine is open to a date proposed by the YWCSHB.

Any variances to defined engineering or administrative controls put in place and defined by the IH program will be reported to YWCHSB as soon as reasonable along with corrective actions that Minto will take toward elimination of further variances.

All aspects of the current surface health and safety program and compliment of Safety personnel in place at the Minto Mine will be extended to the underground operations during the initial development in cooperation with the contractor as we are considering this an additional department of our operation.

JOHSC worker representation will be extended to underground operations and will expand in conjunction with the size of the workforce associated to the underground operation.

Supporting documentation/Additional Information

Accompanying this letter is a hard copy package of information that includes

- Portal engineering
- Portal location map
- Mobile equipment details
- Refuge station details
- Dumas H&S program
- Revised Notice of Project

We appreciate your consideration in this regard and welcome any requests for further information or clarification you may require. We are willing to provide any information we can to allow you the confidence to grant this variance. We also understand that as the mine develops we will continually reassess the risk to our workers regarding their exposure to hazards and the time spent exposed to those hazards.

Thanking you in advance for your time in this regard and looking forward to a response at your earliest convenience,

Ronald K. Light,
General Manager
Capstone Mining Corporation
Minto Mine

William Rogers, P. Eng.
Underground Project Manager
Capstone Mining Corporation
Minto Mine

Mark Goebel, CRSP
Health and Safety Superintendent
Capstone Mining Corporation
Minto Mine

YUKON WORKERS' COMPENSATION HEALTH AND SAFETY BOARD

401 STRICKLAND STREET, WHITEHORSE, YUKON Y1A 5N8 TELEPHONE: (867) 667-5645 FAX: (867) 393-6279 TOLL FREE: 1-800-661-0443

October 3, 2012

Mr. Ron Light
General Mine Manager
Minto Explorations Ltd.
Suite 900-999 W Hastings Street
Vancouver, BC V6C 2W2

Dear Mr. Light:

Re: Underground Hours of Work Variance

I have reviewed the additional information provided by Capstone Mining in the July 22, 2012 letter and the attached report. This information was provided to support your application to vary the hours of work established in section 15.13(1) of the Yukon Occupational Health and Safety Regulations Part 15 Surface and Underground Mines or Projects.

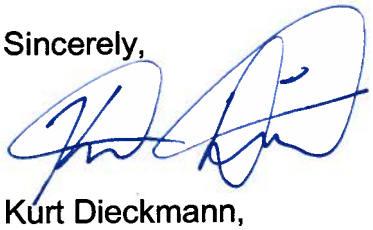
The letter provided accurately reflects the bulk of the discussion held on May 10, 2012. Upon review of my notes there are four additional items from our discussion that were agreed to which are not specified in your July 22 letter:

1) Capstone Mining will use the adjusted 2012 ACGIH TLV's as the exposure limits for workers working extended hours underground.
2) Capstone Mining will use the current Ontario OEL of 400 micrograms per cubic meter for diesel particulate as a baseline and adjust it for workers working extended hours underground.
3) All refuge stations will have a 72 hour capability.
4) Supervisors will receive specific training to identify cognitive impairment (fatigue, substance abuse, etc.) and deal with any issues in an appropriate manner.

Using the July 22, 2012 letter and the additions listed above as the minimum conditions, I am granting Capstone Mining the requested variance for the initial 4500 meters of underground development at the Minto Mine.

This variance will expire on March 31, 2014. A safety officer may establish additional conditions on this variance based on conditions at the mine site or results of industrial hygiene surveys. Failure to comply with the requirements of this variance will result in immediate revocation.

Sincerely,



Kurt Dieckmann,
Director, Occupational
Health and Safety

Appendix G – Fatigue Management Plan

Minto Mine

Capstone Mining Corporation's

Fatigue Risk Management Plan (FRMP) - DRAFT Copy

Table of Contents

Introduction

This policy was developed in consultation with Capstone management, supervisors, workers and contractors. It is reflective of current research and knowledge of fatigue and safety management systems, particularly fatigue risk management systems. It is designed to align closely with the existing safety management systems at Minto mine. It is based upon a five level fatigue risk management strategy that is designed to provide multiple layers of controls to assist in mitigating fatigue risk factors.

Scope of FRMP

This policy and supporting procedures apply to all supervisors and workers in the underground mine operations at Minto including direct Capstone employees, contractors or employees of contractors. Any worker who will, at any time, be spending more than 8 hours underground in the mine, shall comply with this Fatigue Risk Management Plan and procedures contained within to ensure they maintain the capacity to safely perform work.

Objectives

This Fatigue Risk Management Plan seeks to mitigate risk factors associated with fatigue in Minto Mine's underground mining operations.

The key objectives of this Fatigue Risk Management Plan are to ensure a safe and healthy working environment free of fatigue related injury or illness by:

- controlling work related fatigue risk factors to minimize the likelihood of a worker being fatigued;
- minimising the risks of persons presenting for work or conducting work while impaired by fatigue;
- establish appropriate steps to manage persons who are effected by fatigue; and
- reducing the likelihood of a fatigue related error or incident.

Communication Strategies

To ensure a common understanding of Capstone's fatigue risk management plan, a copy of the plan will be made available to all supervisors and workers involved in underground mining operations. The Minto Explorations Fatigue Management Policy Statement will be displayed in a visually accessible place to demonstrate Capstone's commitment to properly mitigating fatigue factors.

Minto Explorations Fatigue Management Policy Statement

Minto Explorations Ltd. believes that the health and safety of its employees is fundamental to its business operations. Work related injury or illness is unacceptable and the company is committed to the identification, elimination, or control of workplace hazards for the protection of all employees. The goal is to have zero lost time accidents. The company is committed to implementing operational improvements that offer superior safety and occupational health management.

The management of fatigue in the underground mines is an integral part of Capstone's "Fit for Duty" Policy and as such, is a shared responsibility between Capstone, its contractors and its employees. All employees in the underground mining operations must undertake their work in accordance with this policy to the best of their ability and to take all reasonable care for their own safety and health, as well as the health and safety of their work colleagues.

Capstone Mining Corp. understands fatigue is a risk factor and as such is committed to the following:

1. Zero harm to personnel due to fatigue related error.
2. Operating in accordance with industry standards, while meeting or exceeding compliance with all relevant legislative requirements.
3. Providing the expertise and resources needed to maintain a fatigue risk management system designed to recognize and manage fatigue risks to create safe systems of work and safe and healthy work environments.
4. Promoting fatigue awareness through appropriate training and education to ensure workers and supervisors are able to effectively manage fatigue and are able to communicate openly about fatigue related issues.
5. Ensuring employees understand their right and obligation to protect themselves from workplace hazards and alter or stop work if they believe fatigue is compromising the safety of themselves or others.
6. Ensuring all underground mine employees, sub-contractors and visitors are informed of, understand their obligations, and comply with this policy.
7. Measuring health and safety performance with regards to fatigue, the effectiveness of this policy in managing fatigue, and making improvements as warranted.
8. Investigating the causes of accidents and incident including reviewing fatigue factors, and developing effective and immediate preventative and remedial actions as needed.

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Definitions

For the purpose of this document, the following definitions apply:

Fatigue: A physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a worker's alertness and ability to safely perform their duties.
(This definition is modified from Aviation IFALPA IATA FRMS for Operators,2011).

A Fatigue Risk Management Plan (FRMP) is an integrated set of management practices, beliefs and procedures for monitoring and managing the risks posed to health and safety by fatigue. It is based in safety management system theory with an emphasis on risk management.

Capstone's FRMP incorporates:

> **The FRMP Document:** The FRMP document defines and details the way that fatigue-related risk is dealt with in the underground mine at Minto, and is the written version of the FRMP.
> **Risk Mitigation Strategies:** Contained within the FRMP are five levels of defenses designed to reduce the likelihood of a fatigue related error occurring. The FRMP includes tools, strategies and control measures for monitoring and managing fatigue-related risk.
> **Education and Training:** All underground mine employees need to be aware of the risks posed by fatigue, understand the importance of controlling fatigue risk factors and understand the individual and organisational strategies that are employed in managing that risk. This is facilitated through both supervisor and worker education and training programs.
> **Revision and Review Functions:** The system must be monitored for continuous improvement and to ensure it is flexible to changing work practices. The review function is essential and is therefore built into the Capstone FRMP framework.

Employee/Worker: Any person who works on the site, regardless of their employer. This includes direct Capstone employees, contractors and their employees.
Manager/Supervisor: Any person who is directly responsible for the supervision and well being of other employees.
Company/Employer: Capstone Mining Corporation or Minto Explorations Ltd.
Contractor: A company hired by Capstone Mining Corp. to complete work on site. Employees of the contractor are referred to as employees/workers or managers/supervisors.
FRMP: Fatigue Risk Management Plan
Shift: The hours between the start and finish of established daily work schedules.
Work Rotations/Cycles: The working period scheduled between any significant break away from work.
Work Schedules/Rosters: The hours to be worked for each day, shift, week, month or year, as scheduled by the employer.

A complete list of definitions and terms related to this document can be found in Appendix B.

Standards and Legislation

The following standards and legislation were consulted in the preparation of this FRMP.

O.I.C. 2006/178
YUKON OCCUPATIONAL HEALTH AND SAFETY ACT

REGULATIONS: PART 15 – SURFACE and UNDERGROUND MINES or PROJECTS

Hours underground 15.13

(1) A worker shall only remain underground in an underground mine or project for more than eight hours in any consecutive 24 hours, measured from the time the worker enters to the time the worker leaves the underground workings

(a) when an emergency causes an extension of the time,
(b) on one day of a week but only for the purpose of changing shift, or
(c) if the worker is a supervisor, pump worker, cage tender, or a person engaged solely in surveying or measuring or in emergency repair work.

(2) The director may consider and approve an application for a modified hours of work schedule in an underground mine if the director is satisfied that the risk to the health or safety of the workers is not increased.

"**underground mine or underground project**" means a mine or project that is not a surface mine and includes any work, undertaking or facility used in connection therewith.

Emergency Response

An Emergency is defined in Capstone's Safety Management System. In the event of an emergency, workers and supervisors may be required to work outside of normal shift hours and fatigue may become a key safety issue. In the case of an emergency, all efforts should be made to properly mitigate fatigue risk factors through risk management strategies contained within this FRMP. Supervisors should be extra diligent in monitoring fatigue and in assisting workers in being aware of and managing fatigue to the best of their abilities. If possible, the emergency response manager should conduct regular fatigue assessments to determine if fatigue will become a safety hazard. When the emergency situation has finalized, all workers should be allowed a sufficient period to rest prior to recommencing work duties.

Training

Improving supervisor and worker competency in understanding, assessing and controlling fatigue risk factors, is an integral component of Capstone's FRMP. Specific training programs have been designed and delivered to key Minto employees involved in the underground mining operations. All new workers who will be involved in the underground mining operations will be trained in fatigue competency as part of their on-boarding process. Training records will be kept up-to-date to ensure fatigue competency.

Roles and Responsibilities

Capstone and all of its underground mining personnel share in the responsibility to minimize and manage the adverse effects of work related fatigue. As with all safety management systems, the FRMP recognizes an integral role played by management, contractors and workers. Broadly, roles and responsibilities are outlined below.

Workers are responsible for:

- Obtaining sufficient sleep to be fit for work.
- Reporting when they have been unable to obtain sufficient sleep or when they feel at risk of making a fatigue related error.
- Complying with implemented Fatigue Risk Management Plans and policies including following all processes and completing all required documentation related to Capstone's FRMP.
- Participating in fatigue related education and training provided by Capstone.
- Participating in fatigue investigations as required.
- Seeking medical or other assistance with fatigue related health issues (such as illness or sleep disorders).
- Addressing any concerns regarding fatigue with a supervisor as required.

Supervisors are responsible for:

- Ensuring new workers are oriented and informed about issues relating to fatigue and the Capstone FRMP.
- Providing ongoing information and awareness to all underground mining workers regarding fatigue risk factors.
- Ensure workers are following procedures and processes outlined in Capstone's FRMP.
- Conducting regular health and safety meetings that periodically discuss fatigue risk management.
- Ensuring all observed and reported fatigue symptoms are properly addressed through consultation with workers and through agreed actions within the Capstone FRMP.
- Taking action if an employee is not fit for work due to fatigue.
- Reviewing and investigating all reports of fatigue related errors and incidents.
- Ensuring Capstone Fatigue Incident Investigation Information is gathered as part of any underground mine incident investigation.
- Setting a good example for workers by properly managing fatigue factors.
- Addressing any concerns regarding fatigue with workers and management as required.

Employer is responsible for:

- Creating and implementing a fatigue risk management plan and control strategies to mitigate fatigue related risk.
- Providing resources necessary for education and training to assist workers in building competency in identifying, assessing and controlling fatigue.
- Scheduling work to ensure adequate sleep opportunities for workers.
- Providing conditions that are conducive to managing fatigue, specifically providing adequately for nutritional, hydration and fitness needs of workers while at Minto camp site.
- Providing a proper sleep environment for workers when not on duty at Minto camp site.
- Ensuring resources are available to maintain and regularly review and revise the FRMP.
- Supporting employees with non-work fatigue related issues through existing health and safety programs.

Understanding Fatigue

Understanding fatigue is a key component of any fatigue risk management plan. It is essential for supervisors and workers to understand fatigue factors to be able to properly identify assess and mitigate fatigue risks.

Information required for understanding fatigue includes: circadian rhythms, sleep cycles, causes of fatigue, effects of fatigue, identifying signs of fatigue, and methods of controlling and managing fatigue. These key understandings are an integral part of the supervisor and worker training programs that are provided to all personnel involved in the underground mining operations. These training programs ensure all personnel involved have the understanding and competencies required to properly manage fatigue risk factors. A very brief summary of fatigue understandings is provided below.

Fatigue is an issue because it can impair a workers abilities and can significantly increase the risk of a safety incident occurring. Fatigue causes an increased risk of incidents because of reduced physical and mental abilities and an overall lack of worker alertness. When workers are fatigued they are more likely to have reduced awareness and reduced abilities to respond to changes in their working environment, to react emotionally and/or to exercise poor judgement. This leads to an increased likelihood of incidents occurring due to human error. Fatigue has also been positively linked to multiple long term health concerns such as: digestive issues, ulcers, obesity, diabetes, heart disease, stroke, and immune system deficiencies.

There are numerous factors that influence an individual's likelihood to become fatigued. Key risk factors include: quality and quantity of previous sleep obtained, disruption of circadian rhythms, time of day, age, overall health and nutrition, individual variations, sleep disorders, poor sleep hygiene, stress, family and social obligations, and drug or alcohol use.

Work factors can also greatly influenced fatigue. Key factors to consider include: shift work particularly length, timing, and frequency of shifts; physical and mental requirements of job tasks; working environment; and inadequate breaks.

There are a number of strategies that can be employed to assist in managing fatigue. These strategies include organizational, individual and team-based countermeasures. All three types of control strategies are employed in this FRMP.

Increased awareness of fatigue factors and increased competency in identifying and managing fatigue will reduce fatigue related risk and the likelihood of fatigue related errors and incidents.

Fatigue Risk Assessments Completed at Minto Mine

Risk management encompasses the identification, assessment, control and evaluation of hazards that pose a meaningful risk to the health and safety of employees/workers (including contractors) and visitors to the workplace.

To properly deal with fatigue risk factors, it is important to:

1. identify where fatigue is a hazard and may pose a risk; and
2. assess the level of risk that a given fatigue hazard represents; and
3. when necessary, put in place controls and mitigation strategies,
4. monitor to make sure that they manage the risk at an acceptable level; and
5. evaluate the implemented controls to ensure they have been successful.

Hazard assessments conducted at the Minto Mine site focused on reviewing hazards associated with fatigue. Assessments were conducted based on observations, consultation and discussions with workers, supervisors and contractors. The following areas were examined: mental and physical work demands; work scheduling and planning; environmental conditions; and individual and non-work factors. Risk assessments were based on both likelihood and severity. Results were graphed and quantified and may be viewed in their entirety in Appendix C. Results were used to create the Capstone 5 Level Fatigue Risk Management Plan. Below is a summary of the quantitative results of the initial hazard assessment conducted.

Table 1.1 Capstone's Minto Mine Fatigue Risk Assessment Results

Factor Grouping	Capstone Risk Points	Total Factor Points	Percent of High Risk Areas
Work Demands	18	30	**60%**
Work Scheduling - Hours	22	50	**44%**
Work Scheduling - Shifts	25	40	**63%**
Work Scheduling - Night Work	40	70	**57%**
Work Environment (listed as high as they are not currently fully assessed)	35	40	**88%**
Off Duty Factors	8	40	**20%**
Totals and Average %	**148**	**270**	**55%**

Fatigue risk factors and assessment have been taken from the following document (Fatigue Management Plan - A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry, 2009)

In the initial hazard assessment a number of high risk factors for fatigue were identified. These have been specifically outlined and addressed in the FRMP. An outline of some specific control measures used to assist in managing high risk areas are outlined below.

Table 1.2 High Risk Factor Contols

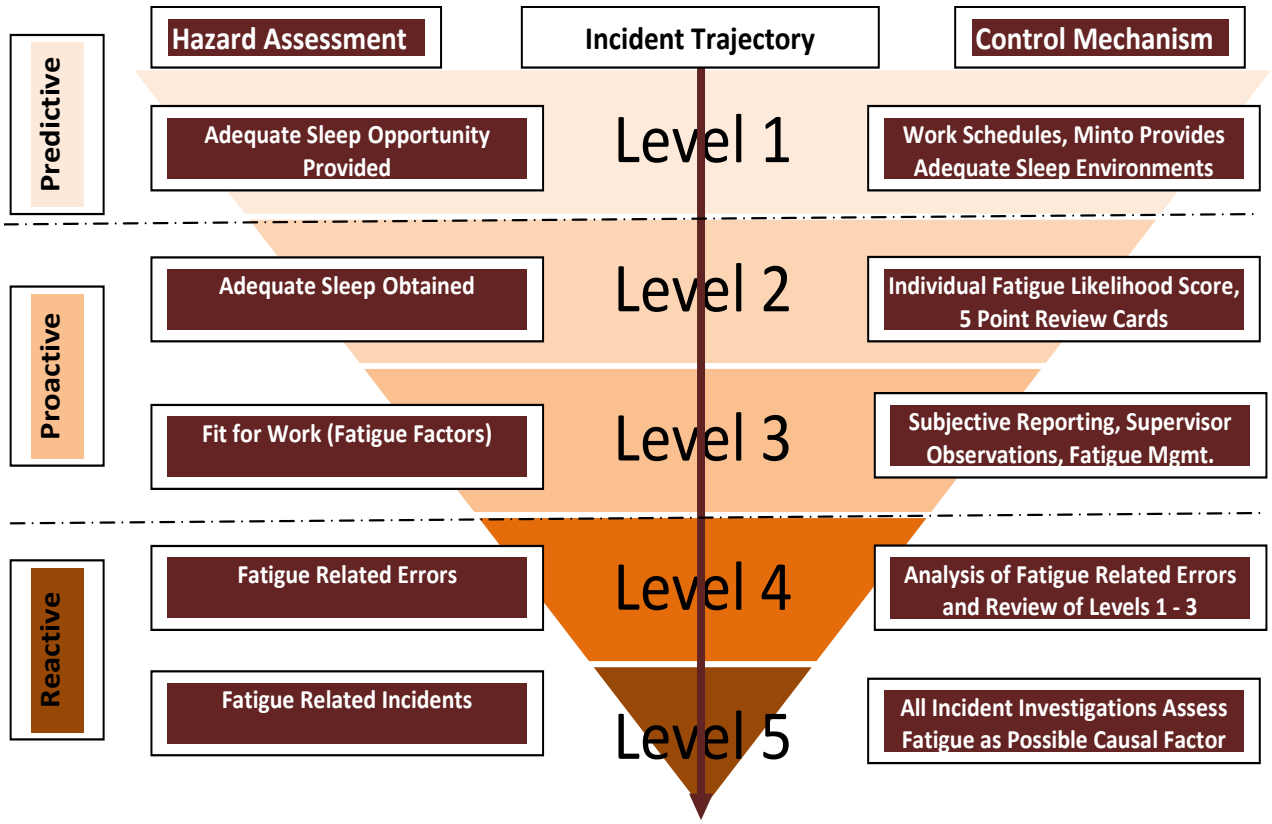
Risk Factor	Control Measures
Work Scheduling	**Increase Sleep Opportunities**
• 12 hour shifts • 14 consecutive shifts • 84 hours in a typical work week • Slow rotations - 2 weeks of day shifts, 2 weeks of night shifts • Night shifts	**Minimize Non-Work/Off Duty Factors to Increase Sleep Opportunities** • Camp provides limited commute and non-work responsibilities to allow for increased sleep opportunities for workers. • Minimal family and social obligations outside of work to reduce fatigue risks. • Food and lodging provided onsite to minimize obligations outside of work. **Ensure worker access to optimal health requirements to reduce fatigue risk** including: overall nutrition, hydration, recreation and exercise. • Camp menus are designed for optimal worker nutrition and health. A gym is onsite for worker fitness needs. A recreation facility is also available onsite for workers. A variety of bottled beverages and water are always available to workers. Drugs and alcohol are strictly forbidden at Minto Mine site. **Provide Proper Sleep Environment:** • Efforts are made to keep sleeping areas secluded and quiet. There are specific quiet areas set aside for night workers to rest during the day. • All rooms have blinds to reduce daylight. • New camp facilities are planned for the spring and sleep hygiene needs have been reviewed for these new facilities.
Start times before 6 AM	• Start times are being adjusted to 7 AM
Work Demands	
Certain job tasks are physically and mentally more demanding (Stoper, Jackleg)	Certain job tasks, such as Stoper and Jackleg Operators, will have mandatory 15 minute breaks after every 2 hours operating equipment.
Work Environment	
Work environmental factors - currently unknown. Possible exposure to hazardous substances, noise, temperatures, vibration, etc.	On-site industrial hygiene testing is being completed to assess work environmental factors. Control measures will be implemented as required.

Fatigue Management Plans

Addressing safety from the point of view of risk management has become an increasingly accepted way of allowing companies to integrate safety systems and reduce worker risk. There is a growing body of research that shows using a strictly prescriptive approach, relying on hours of service alone as a key mitigation factor for fatigue, is not comprehensive enough to fully insulate workers from the risks of fatigue. A worker can be given ample opportunity for sleep, but due to a variety of circumstances (ex. a sleep disorder, a new baby, an illness, etc) not actually obtain the necessary hours of sleep needed to be alert and fit for duty. Ensuring ample opportunities for workers to sleep is seen as only the first level of safety controls in a complete fatigue risk management plan.

Using a multileveled and comprehensive risk management approach allows companies to identify high risk situations, and then put into place countermeasures that can minimize the likelihood of an incident occurring. This type of system relies on hazard identification, assessment and control measures within a comprehensive safety management system. The Fatigue Risk Management Plan (FRMP) is designed to provide multiple opportunities to introduce countermeasures intended to minimize the possibility of a fatigue related error occurring.

Diagram 1.1 Diagram of Capstone's 5 Level Fatigue Risk Management Plan



Adapted from Centre for Sleep Research, University of Southern Australia

A Brief Overview of the 5 Level Fatigue Risk Management Plan

Capstone's FRMP is based on the 5 Level Fatigue Risk Trajectory and focuses on multiple levels of countermeasures, designed to be used in combination to minimize the risks associated with fatigue.

Details regarding the plan are outlined below.

An Overview of the Plan

Controls	Type	Details
Level 1	Organizational	Adequate sleep opportunity provided
Level 2	Individual/Workers	Self reporting (Fatigue Likelihood Scores)
Level 3	Team	Monitoring for fatigue signs
Level 4	All	Fatigue proofing the system
Level 5	Organizational	System review

- **Level 1 Controls** – Management ensures provision of adequate sleep opportunity through scheduling of work and appropriate sleep environments.
- **Level 2 Controls** – Workers verify that adequate sleep has been obtained through Fatigue Likelihood Assessment and self reporting.
- **Level 3 Controls** – Management and workers ensure behavioral indicators of fatigue are identified and managed.
- **Level 4 Controls** – All ensure the likelihood that errors becoming incidents are minimized – fatigue proofing.
- **Level 5 Controls** –Management ensures fatigue-related incidents are prevented from re-occurring unnecessarily. This is done through fatigue specific incident investigation.

Control s are focused in the following way:

i. Predictive - Level 1
ii. Proactive - Level 2 and 3
iii. Reactive - Level 4 and 5

Additionally:

Levels 1 - 3 require education and training for workers and supervisors to understand the need for sleep, the causes and effects of fatigue, the signs of fatigue, and the safety hazards fatigue can create.

Levels 2 - 5 require a culture that understands and accepts fatigue as a safety hazard, not a worker weakness. Workers must know there are no repercussions for self reporting fatigue.

Levels 4 -5 require a strong commitment from management to follow up on fatigue reports and examine any places in the system that are not properly mitigating fatigue related risks. To be effective the plan must be reviewed on a regular basis to ensure risk controls are effective.

Table 1.3 Details of the 5 Control Levels Including: Key Responsibilities, Assessment Strategies, Documentation Processes and Control Actions.

Level	Responsibility	Risk Factor	Initial Strategy	Assessed Through	Documentation Process	Control Actions Required
1	Supervisor	Adequate sleep opportunities for workers	Ensuring adequate sleep opportunity through work scheduling	Review of initial schedules, rosters, hours/types of shifts, etc and a new review conducted for any major changes	Existing shifts signed off by mine manager. New shifts approved by mine manager prior to implementation.	High risk factors in rostering, scheduling and shift lengths are recognized and mitigated through the many layers contained in this comprehensive FRMP
	Supervisor	Specific job tasks may increase fatigue risks	Review of work tasks and breaks scheduled for specific work tasks	Worker feedback, observed signs of fatigue	Specific tasks (scoper, jack lift) require scheduled breaks that are taken and documented each shift.	Scheduled breaks taken. Job task risk factors are also recognized and mitigated through the other layers contained in this comprehensive FRMP
	Employer	Proper nutrition, hydration and fitness needs for workers to maintain health	Ensuring camp conditions are adequate and can serve to reduce fatigue risks	Review of current camp conditions with regards to nutrition, hydration and fitness needs. Ensuring sleep hygiene is considered in current camp and as new camp is built.	Fatigue Factors: Minto Mine Checklist in Appendix D and part of cyclical review.	Specific efforts are made to ensure proper nutrition through camp menus, hydration through access to fluids and exercise through the onsite gym and various recreational opportunities (ex. hockey rink). Sleep hygiene factors are understood and all efforts are made to incorporate them at the camp. This includes, but is not limited to blinds in the rooms, quiet sleep areas, controlled temperatures in the rooms, etc.

Level	Responsibility	Risk Factor	Initial Strategy	Assessed Through	Documentation Process	Control Actions Required
2	Worker	Workers being fit for work in relation to fatigue factors	Obtaining adequate sleep during off hours and accurately reporting sleep obtained	Individual Fatigue Likelihood Assessment	On 5 Point Review	Follow agreed control strategies listed in Level 2
	Supervisor	Workers being fit for work in relation to fatigue factors	Ensuring workers have obtained adequate rest	Review of 5 Point Review Cards for Fatigue Factors	Fatigue scores found in 5 Point Review Cards are reviewed and recorded.	Follow agreed control strategies listed in Level 2
3	Worker	Ability to manage fatigue risk factors at work	Self-reporting and monitoring of any fatigue symptoms or risk factors	Samn-Perelli Scale	On 5 Point Review	Follow agreed control strategies listed in Level 3
	Worker	Ensuring coworkers are not affected adversely by fatigue factors	Observations for fatigue symptoms in co-workers	Fatigue Symptoms Checklist	Verbally report concerns to co-worker and supervisor. Document on 5 Point Review	Follow agreed control strategies listed in Level 3
	Supervisor	Ensuring workers are not affected adversely by fatigue factors	Observations for fatigue symptoms	Fatigue Symptoms Checklist	Document any observed symptoms, conversations regarding fatigue and control measures taken.	Discuss concerns with worker. Follow agreed control strategies listed in Level 3

Level	Responsibility	Risk Factor	Initial Strategy	Assessed Through	Documentation Process	Control Actions Required
4	Worker	Fatigue related error occurring - (indicates system error in levels 1 - 3)	Report fatigue related errors	Self-assessed based on fatigue levels and actions.	No-loss incident reporting form	Stop Work! Discuss with supervisor. Alter work duties to not include any safety sensitive tasks or do not continue until fit for work.
	Supervisor /Employer (Safety Team)	Fatigue related error occurring - (indicates system error in levels 1 - 3)	Follow up on all fatigue related errors reported.	Worker self-reporting, worker reporting of co-worker error, observations made by supervisor.	No-loss incident reporting form	Take seriously and stop worker immediately! Discuss with worker. Alter work duties to not include any safety sensitive tasks or do not allow worker to continue until fit for work. Post incident follow up to discover where Levels 1 - 3 were ineffective.
5	Worker	Fatigue related incident occurring	Report all Incidents	Incident Investigation	Incident Reporting Form	All work is stopped after an incident. Work does not commence until a supervisor deems it safe to continue.
	Supervisor / Employer (Safety Team)	Fatigue related incident occurring	Investigate all Incidents	Incident Investigation	Incident Reporting Form, Incident Investigation Report including Capstone's Fatigue Incident Investigation Information	If fatigue is in any way a causal factor, a thorough review to discover where levels 1 - 3 were ineffective is required. A review of the FRMP may be required.

Level 1 - 5 Supporting Processes and Procedures

Level 1 - Understanding Management Influences on Sleep Opportunities

Primarily level 1 controls involve organizing work to provide adequate sleep opportunities for workers. It also involves scheduling breaks as needed to avoid fatigue.

Key areas this focuses on are:

1. Work Scheduling
    a. Work shifts
    b. Schedules (including start times)
    c. Rotations
2. Camp Environment
    a. Camp nutrition, hydration and exercise opportunities
    b. Quiet, dark sleeping environments
3. Work Environment
    a. Testing underway
4. Work Tasks
    a. Worker Task Break Schedule

Key documents to assist in this are:

1. Fatigue Factors: Minto Camp Checklist (Appendix D)
2. Summary of Minto Mine's Underground Environment Testing

Level 1 Controls Brief Description:

There are a variety of scheduling factors that can be reviewed to reduce fatigue. These focus on applying what is known about human needs for rest and circadian rhythms to existing company needs for work to be scheduled. Where possible, schedules should be examined and altered to accommodate worker needs for proper rest. Where it is not possible to alter schedules for optimal worker alertness, levels 2 - 5 of the FRMP must be implemented to reduce worker risk of fatigue error.

Camp conditions should be designed, as much as possible, to support worker access to nutrition, hydration and exercise. Proper sleep environments should be available to workers.

Current environmental conditions in the underground Minto mine have not been assessed. Processes are under way to begin the testing and assessment. Until assessments have been completed, high-level controls will be put into place to ensure fatigue risk factors are controlled.

Certain work tasks have been identified as increasing a workers likelihood to become fatigued. As such work breaks have been scheduled that are specific to work tasks. The following table outlines work tasks and mandatory minimum breaks to be provided for workers completing those tasks.

Table 1.4 Worker Task Break Schedule

Job Designation and Key Tasks	Minimum Work/Break Schedule Required
Supervisor Jumbo Driller Scoop Operator (Mucker) Maclean Operator (Rock Bolt Machine) Truck Driver Welders, Electricians, Mechanics	Breaks should be taken as required with a minimum 30 minute break (or two 15 minute breaks) every 6 hours.
Stoper Operator Jackleg Drill Operator	Breaks should be taken as required with a minimum 15 minute break taken for every two hours of equipment operation.
Other non designated tasks or workers	Follow typical break schedule of taking breaks as required with a minimum 30 minute break (or two 15 minute breaks) every 6 hours unless work is physically or mentally demanding and/or the worker is experiencing fatigue. Then a minimum 15 minute break every two hours should be taken.

Currently, under the Dumas contracting system, underground miners work the following shifts:

> 14 day shifts of 12 hours each starting at 6 AM and finishing at 6 PM, a 24 hour break, followed by 14 night shifts for 12 hours each starting at 6 PM and finishing at 6 AM, followed by 2 weeks off.

Upon implementation of this FRMS, Dumas shifts will be altered to the following:

> 14 day shifts of 12 hours each starting at 7 AM and finishing at 7 PM, a 24 hour break, followed by 14 night shifts for 12 hours each starting at 7 PM and finishing at 7 AM, followed by 2 weeks off.

When Capstone moves from using Dumas as an independent contractor to having direct Capstone employees work in the underground mine, the following shift schedule is planned:

> 14 day shifts of 12 hours each starting at 7 AM and finishing at 7 PM, followed by 2 weeks off, followed by 14 night shifts for 12 hours each starting at 7 PM and finishing at 7 AM, followed by 2 weeks off.

Additional Level 1 Controls

Review of NSW controls and choosing appropriate ones to suggest and implement.

Level 2 Controls - Worker Self-Reporting of Sleep Obtained

Worker self-reporting of sleep obtained using the Individual Fatigue Likelihood Assessment. Agreed controls based on fatigue likelihood score.

Diagram 1.2 Individual Fatigue Likelihood Wallet Card (side 1)

Capstone Minto Mine

INDIVIDUAL FATIGUE LIKELIHOOD ASSESSMENT

Step 1. Sleep in prior 24 hours

Sleep	≤ 2h	3h	4h	5h+
Points	12	8	4	0

Step 2. Sleep in prior 48 hours

Sleep	≤ 8h	9h	10h	11h	12h+
Points	8	6	4	2	0

Step 3. Hours awake since last sleep

Add one point per hour awake greater than sleep in Step 2

Workers assess likelihood of fatigue based on previous sleep obtained. Score is determined by calculating sleep obtained in the last 48 hours and by assessing how long it has been since the worker last slept.

Scores are calculated by assigning points to sleep obtained in the last 24 hours (any sleep over 5 hours is 0 points) and adding it to sleep obtained in the previous 24 hours (an average of 6 hours a night or 12 hours in total is 0 points). The score is then compared to the number of hours the individual has been awake.

> Example 1: An individual slept 5 hours the night before their shift and 4 hours the night before that. They have been awake for 3 hours. Score (0 + 6 + 0 = 6) They should request supervisor monitoring.
>
> Example 2: An individual slept 6 hours the night before their shift and 5 hours the night before that. They have been awake for 12 hours. Score (0 + 2 + 1 = 3) They should self monitor for signs of fatigue and manage as needed.
>
> Example 3: An individual slept 3 hours the night before their shift and 3 hours the night before that. They have been awake for 8 hours. Score (8 + 8 + 2 = 18) They are not fit for duty and should not commence work. They should speak with their supervisor and obtain rest before starting a shift.

Note: This sleep scale does not accurately account for individual differences in sleep needs. It also does not account for accumulated sleep debt. Level 3 controls should still be used if needed even if a Fatigue Likelihood score is 0.

Diagram 1.3 Individual Fatigue Likelihood Wallet Card (side 2)

Capstone Minto Mine

INDIVIDUAL FATIGUE LIKELIHOOD ASSESSMENT

Step 4. Add all points together to deterimine your score

Score	Agreed Control Strategies
1 to 4	Self Monitoring
5 to 11	Request Supervisor Monitoring
12+	Do NOT Commence Shift Until Fit For Work

Refer to FRMS policy for detailed explanation of controls

Table 1.5 Possible Symptoms and Agreed Controls for Fatigue Likelihood Scores

Score	Possible Signs and Symptoms	Agreed Control Strategies
12+	Difficulty staying awake and possibly experiencing microsleeps. Uncoordinated physically and experiencing difficulty staying focused. Significant impairment evident.	Document and report risk to supervisor. Do not engage in ANY safety critical work or behaviors. Do not recommence until fit for work.
10	Clear evidence of behavior impairment. Difficulty sustaining attention on simple tasks. Uncoordinated p.	Document and report risk to supervisor. Complete Samn Pernelli and Fatigue Symptoms Checklist. Engage in individual and team fatigue management strategies. Organize supervisory checks and work directly with a co-worker if possible. Nap if possible. Should not engage in safety critical work - task reassignment if necessary.
8	Clear loss of motivation and physically weak and listless. Significantly reduced situational awareness. Task performance impaired.	
6	Difficulty concentrating. Occasional lapses of attention. Poor judgement on complex tasks. Physically affected - sagging body posture, slow blinking, etc.	
4	Difficulty in maintaining extended concentration for complex tasks. Low energy levels and weakness apparent.	Document. Complete Samn Pernelli and Fatigue Symptoms Checklist. Take approved individual or team countermeasures. Self-monitor for symptoms, team monitor by co-workers, task rotation or other job alterations as required.
2	Slowed cognition. Occasional minor fatigue behaviors observed. Minor mood changes observable. Low energy levels or hyperactive.	Controls and fatigue management may be necessary. Assess and monitor for fatigue symptoms.
0	Able to perform tasks safely. Unlikely fatigue impairment, but monitor if required.	No controls unless otherwise indicated by other fatigue risk factors

Level 3 Controls - Team Controls to Ensure Fatigue Risks are Controlled.

Workers experiencing fatigue use level 3 checklists (Samn-Perelli Fatigue Checklist, Symptoms of Fatigue Checklist), report to supervisor and co-workers any fatigue concerns, and engage in individual and team controls as needed.

Supervisors check all recorded fatigue data, watch for signs of fatigue, and take all reports of fatigue seriously. Team controls are implemented as needed. Any worker not fit for duty is removed from safety sensitive work, given alternate tasks or removed from duty as required.

Diagram 1.4 Samn-Perelli Fatigue Checklist (side 1)

Samn-Perelli Fatigue Checklist	
1	Fully alert
2	Very lively
3	Okay
4	A little tired
5	Moderatly tired
6	Extremely tired
7	Completely exhausted

Diagram 1.5 Samn-Perelli Fatigue Checklist (side 2)

Samn-Perelli Fatigue Checklist Controls Based on Score	
1 to 3	Proceed with work, monitor if symptoms appear
4 to 5	Supervisor monitoring required, implement individual and team management strategies, alter work duties if needed
6 to 7	Stop work, obtain rest before beginning shift

This checklist can be used throughout a shift, triggered by the following:

- start of shift (routine assessment)
- start of night shift
- following a nap
- if shift is to be extended
- on call-in overnight shift
- if Level 2 assessment places the person in yellow or red zones
- coworker or supervisor notes symptoms
- individual experiences symptoms
- error committed or noticed
- incident

Supervisor Monitoring

The following is a list of fatigue symptoms to assist with monitoring. Workers should also be taught to monitor themselves and each other for signs of fatigue. Workers exhibiting signs should be approached and questioned regarding fatigue likelihood scores and feelings of fatigue. A mitigation strategy should be worked out with the worker. Remember, those who are fatigued often underestimate the level of their fatigue and are less able to make effective decisions. Err on the side of caution.

Diagram 1.6 Symptoms of Fatigue Checklist

Common Symptoms of Fatigue Checklist					
Physical	**Observed**	**Mental**	**Observed**	**Emotional**	Observed
Yawning		Difficulty concentrating		Quiet	
Slow blinking		Laspses in attention		Withdrawn	
Rubbing eyes or face		Memory lapses		Lethargic	
Aching muscles or headache		Difficulty communicating		Bored	
Uncoordinated movements		Lack of situational awareness		Lacking motivation	
Sagging body posture		Making mistakes		Irritable	
Weak and low energy		Confusion		Easily frustrated	

Individual and Team Fatigue Management Strategies

The following are examples of individual and team control measures that can be used depending on the level of fatigue.

Diagram 1.7 Individual Control Examples

Individual Control (Examples)
Controlled use of caffeine
Adequate hydration and food intake
Adjust working temperature
Adjust lighting
Take a break
Change tasks
Remove safety sensitive tasks from work
Take a 20- 30 minute nap
Increase social interaction
Defer to a second opinion
Increase supervision
Stand Down - do not proceed until fit for work

Diagram 1.7 Team Control Examples

Team Control (Examples)
Communicate fatigue status at morning safety meeting
Communicate high Fatigue Likelihood Score to supervisor and coworkers
Document high Fatigue Likelihood Score
Increase cross checking among coworkers (watching out for each other)
Increase supervision
Task reallocation or rotation (trading tasks when needed)
Delay safety sensitive work when possible
Take a collective break (encourage breaks when needed)
Work together with a co-worker where possible (chat to keep alert)
Engage in conversations and social interactions
Fatigue leave - all crew stand down

Level 4 - Fatigue Related Errors - Assessing the System

One of the key factors in Capstones 5 Level Fatigue Risk Management Plan is the reactive measures used to ensure the plan is working appropriately. Any report of fatigue related error should be immediately followed by an informal investigation to determine where levels 1 to 3 were inadequate in properly mitigating fatigue factors.

The following procedures should occur:

1. All fatigue related errors are reported immediately to a supervisor
2. All fatigue related errors are documented within that shift on no loss incident investigation forms.
3. No loss incident investigation forms are to be submitted to the safety committee for informal investigation.
4. Informal investigation will take place within one week of receiving the incident forms.
5. Informal investigation should include the following:
    a. Discussion with the worker to determine causal factors of fatigue
    b. The effectiveness of the reporting process used on the day of the incident
    c. The reasons that levels 1-3 were ineffective in assessing and mitigating the fatigue risk.
6. Formal fatigue incident investigation tools found in level 5 may be reviewed and used if necessary.

Level 5 - Fatigue Related Incidents - Fatigue Incident Investigation Information Required

All incidents investigated in the underground mining operations need to be assessed to determine if fatigue was a risk factor. Normal Capstone SMS incident investigation procedures are used. The addition of the fatigue incident investigation information will assist in determining if fatigue was a causal factor in the incident. Fatigue incident investigation information must be collected on all incidents occurring within the underground mining operations. All data collected as part of all incident investigations shown to have fatigue causal factors must be recorded and used as part of the fatigue risk management plan review process.

Capstone Fatigue Incident Investigation Information

1. **Date, time and place** of the accident. (not the time of the report) _____
_____

Level 1

2. **Work Schedule History (Schedule, Rotation, Shift Length, Breaks)**

Level 1

What was the actual work schedule (regular hours plus overtime) for the **four days** prior to the accident? (Please fill out by date and shift until all four days prior to the accidents are covered).

Work Shift -1:	Start time/Date: _____	End time/Date: _____
Work Shift -2:	Start time/Date: _____	End time/Date: _____
Work Shift -3:	Start time/Date: _____	End time/Date: _____
Work Shift -4:	Start time/Date: _____	End time/Date: _____

How many hours into the shift did the incident occur? (ex. 3 hours in) _____

How far into the work schedule was the individual involved?
Day #/Shift #: (ex. Day 12/28) _____

What shift was the individual working (day or night)? _____

How long from the last scheduled break? _____

How long in duration was the last scheduled break? _____

3. **Work Task and Work Environment**

Level 1

What task was being performed at the time of the incident? What was the work environment like? How mentally or physically stimulating was the task and work environment prior to the accident? (Refer to Capstone's FRMS for details on fatigue risk factors relating to work tasks and work environments).

Job Designation (Title) of individual(s) invlolved, task being preformed, and work environment described: _____
_____
_____
_____

Rate Mental Factors _____
(on a Scale of 1 - 5 with 1 being very stimulating and 5 being fatiguing)

Rate Physical Factors _____
(on a Scale of 1 - 5 with 1 being very stimulating and 5 being fatiguing)

Work Environment Rated: _____
(on a Scale of 1 - 5 with 1 being very stimulating and 5 being fatiguing)

4. **Number of hours of actual sleep** in previous 24, 48 and 72 hours (i.e. 3 days) prior to the accident.

Level 2

Day 1: _____
Day 2: _____
Day 3: _____
Number of hours awake (from previous sleep) when accident occurred. _____

5. **Overall quality of sleep** 24, 48 and 72 hours (i.e. 3 days) prior to the accident.

Level 2

First Day Prior:	Poor □	Fair □	Good □	Excellent □
Second Day Prior:	Poor □	Fair □	Good □	Excellent □
Third Day Prior:	Poor □	Fair □	Good □	Excellent □

6. Did any **health problems** affect the individuals sleep during the month leading up to the accident?

Level 2

Yes □ No □ Uncertain □ If Yes provide details:

_____
_____

7. Any **symptoms of fatigue** during the persons waking hours prior to the accident. (either self reported or observed by others)?

Level 3

Frequent Eye Closure □	Lethargic or Low Energy □	Fixed Gaze □
Distracted or Forgetful □	Excessive Yawning □	Head Nodding □

Other: (refer to Symptoms of Fatigue Checklist found in Capstone FRMS)

_____
_____

8. What **fatigue assessment** and documentation had occurred prior to and during the shift? (ex. Fatigue Likelihood score, self-reporting of fatigue, supervisor noting of symptoms, Samn-Perelli Scale, etc.)

Level 2 & Level 3

_____
_____
_____

9. Any other information relating to the incident or worker relating to fatigue that could be relevant to the investigation.

Level 1 to Level 3

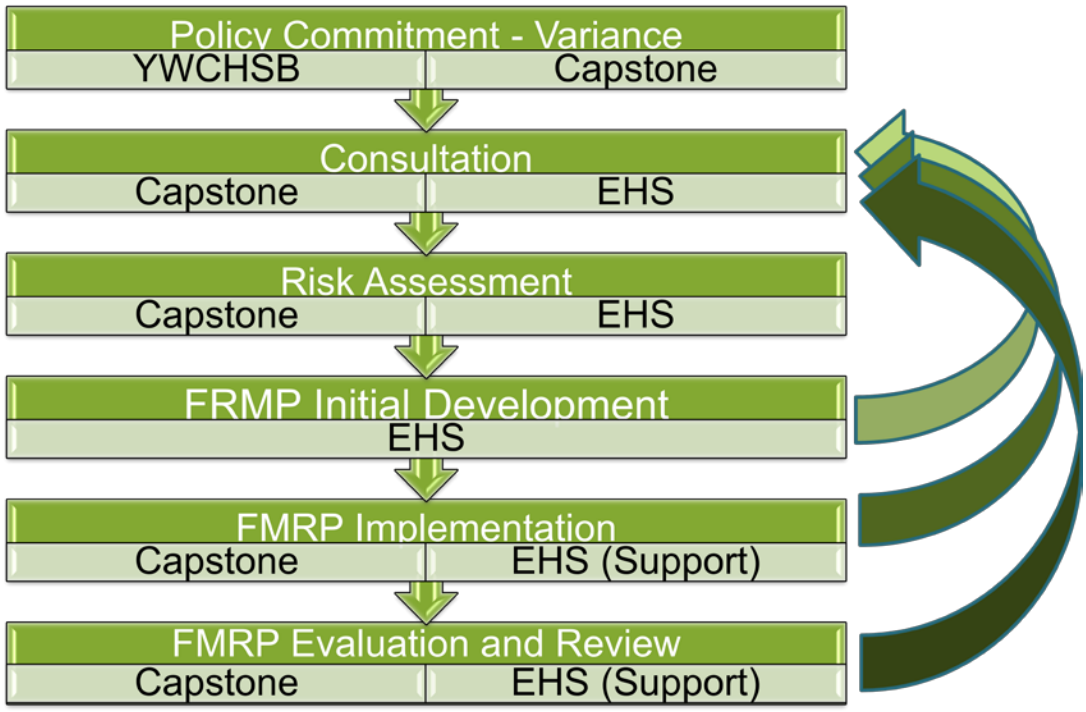
_____
_____
_____

Implementation Strategies

Implementation Role Clarification

Initial policy creation was based upon variance agreements between Capstone Mining Corp. and the Yukon Worker's Compensation Health and Safety Board. EHS Partnerships was brought in as a consultant to assist in identifying, assessing and controlling fatigue risks. The creation of the Fatigue Risk Management Plan has been a process based upon consultation with Capstone and YWCHSB.

Upon completion of the consultation and revision processes, the FRMP implementation process will be completed by the Minto Mine Safety Management Team at the direction of the Capstone Mine Corporation. Consultation and support for the implementation will be available, upon request, from EHS Partnerships.



Suggested Time Frames

Jan 2013

I. Rough Draft of FRMP Completed.
II. Initial consultation process
    a. Review of FRMP by Capstone
    b. Review of FRMP with input from YWCHSB
III. Supervisor Training Initiated

February/March 2013

I. Revisions to FRMP as required.
    a. Final consultation with Capstone.
II. First version FRMP published.
III. Copies of FRMP sent to:
    a. Capstone Corporate
    b. Minto Mine
    c. YWCHSB
IV. Supervisor Training Completed
V. Worker Training Initiated
VI. Communication to Minto Mine employees regarding FRMP.

April 2013

I. Implementation Process Begins
II. Worker Training Completed
III. Provisions made for on-boarding fatigue training of new workers and supervisors.

May/June 2013

I. Review of Implementation process to ensure FRMP is being followed correctly and meeting expectations.

April 2014

I. First annual review of FRMP.

Communication Strategies

To ensure a common understanding of Capstone's underground mining fatigue risk management plan, a copy of the policy will be made available to all supervisors and workers. The Capstone policy statement will be displayed in a visually accessible place to demonstrate capstones commitment to properly mitigating fatigue factors.

When final revisions are complete, a copy of this plan will be sent to the following:

i. YWCHSB
ii. Capstone Corporate
iii. Minto Mine Management
iv. Minto Safety Committee
v. Underground Mine Supervisors
vi. Underground Mine Workers
vii. Other Key Stakeholders (Contractors)

b. Participation Requirements
    i. All Underground mine contractors, supervisors, and workers are required to fully participate in the Capstone FRMP including the training provided and the policies and procedures contained within.
c. Supervision Responsibilities
    i. Overall implementation responsibilities fall to Capstone Mining Corp. These may be designated as required to Minto Mine Management and the Minto Safety Team.

Planned Audit and Review

The fatigue management procedure or plan must be reviewed at regular intervals to ensure the continual effectiveness of the controls. Review of control measures should be undertaken when methods, tasks, equipment, hazards, operations, procedures, rosters or schedules are introduced or the environment changes or there is any indication risks are not being controlled.

d. Specific Review Dates
    i. Capstone's FRMP should be reviewed on an annual basis (minimal standard) to ensure the plan is working to properly mitigate the risks of fatigue.
e. Review Roles and Procedures
    i. Annual review will led by the Minto Mine Safety Team and will include:
        1. Review of the FRMP document.
        2. Completion of the Fatigue Management Self Assessment Worksheet found in Appendix E.
        3. Review of all fatigue data including:
            a. Summary of fatigue information gathered during shifts.
            b. Summary of all fatigue related errors and no loss incidents and a review of the investigation information conducted on these.
            c. Summary of any Incident Investigation that identified fatigue as a causal factor.
            d. Specific review factors to consider include:
                i. have control measures been implemented as planned?
                ii. are they working?
                iii. are there any new problems? and
                iv. incidents, near misses, injuries and other data, such as absenteeism and staff turnover rates.
            e. Further review of control measures should be undertaken when hazards, procedures, rosters or schedules are introduced or there is any indication risks are not being controlled.
        4. Feedback Method (Internal)
            a. Solicitation of formal and/or informal feedback from workers, supervisors, contractors involved in the FRMP should be gathered.
                i. Specifically:
                    1. Do they feel the plan is effectively controlling fatigue risks?
                    2. Any ways they feel the plan could be improved.
        5. Revision Process
            a. If required, necessary revisions and implementation of revisions should take place within 60 days of the annual review process.

Appendices

A. References
B. Definitions and Terms
C. Minto Mine's Initial Risk Assessment Results
D. Fatigue Factors: Minto Camp Checklist
E. FRMP Self Assessment Checklist

Appendix A: References

1. NSW Mine Safety Advisory Council & NSW Government (2009), *Fatigue Management Plan - A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry*
2. NSW Mine Safety Advisory Council & NSW Government (2009), *Fatigue Management Plan - Participants Manual.*
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6. Australian Government & Civil Aviation Authority (2012), *Fatigue Management for the Australian Aviation Industry - Fatigue Management Strategies for Aviation Workers: A Training & Development Workbook,*
7. Transport Canada (2007), *Fatigue Risk Management System for the Canadian Aviation Industry - An Introduction to Managing Fatigue,* Government of Canada.
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11. BMA BHP Billiton Mitsubishi Alliance *(2006), BMA Hours of Work Standard,*
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13. William Davis & Acacia Aguirre, M.D., Ph.D.(2009), *Shift Scheduling & Employee Involvement: The Key to Successful Schedules, Circadian.*
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16. Kirsty McCulloch, Dr Adam Fletcher & Professor Drew Dawson (2003), Moving Towards A Non-Prescriptive Approach To Fatigue Management In Australian Aviation: A Field Validation
17. Drew Dawson (2011), *Managing Fatigue-related Risk: A Safety Management Systems Approach,* Centre for Sleep Research University of South Australia
18. Drew Dawson Ph.D., Kirsty McCulloch, *Managing Fatigue: It's About Sleep - Stupid,*

Appendix B: Terms and Definitions

Term	Definition
Alertness	The opposite state of sleepiness, the state of cognitive and physiological arousal, and responsiveness to environmental/situation conditions.
Circadian Rhythm	A neural pacemaker in the brain that monitors the day/night cycle (via a special light input pathway from the eyes) and determines our preference for sleeping at night. Shift work is problematic because it requires a shift in the sleep/wake pattern that is resisted by the circadian body clock which remains 'locked on' to the day/night cycle.
Contractor	A company hired by Capstone Mining Corp. to complete work on site. Employees of the contractor are referred to as employees/workers or managers/supervisors.
Controls	System-level defensive strategies designed to minimize fatigue risk on an ongoing basis.
Cumulative Sleep Debt	Sleep loss accumulated when sleep is insufficient for multiple nights (or 24-hr days) in a row. As cumulative sleep debt builds up, performance impairment and objective sleepiness increase progressively, and people tend to become less reliable at assessing their own level of impairment
Employee/Worker	Any person who works on the site, regardless of their employer. This includes contractors.
Employer/ Company	Capstone Mining Corporation or Minto Explorations Ltd
Fatigue	Fatigue is a state of impairment. It is a physiological state of reduced mental or physical performance capability resulting from sleep loss or extended wakefulness, circadian phase, or workload (mental and/or physical activity) that can impair a worker's alertness and ability to safely perform their duties.
Fatigue Countermeasures	Organizational, individual and team based fatigue management strategies to reduce the effects of fatigue.

Fatigue Likelihood Assessment	A quantitative measure of the amount of sleep an individual is able to obtain. It is used to determine the likelihood an individual will experience fatigue symptoms or reduced levels of alertness.
Fatigue Risk Management	The management of fatigue in a manner appropriate to the level of risk exposure and the nature of the operation, in order to minimise the adverse effects of fatigue on the safety of operations.
Fatigue Risk Management Plan (FRMP)	is an integrated set of management practices, beliefs and procedures for monitoring and managing the risks posed to health and safety by fatigue. It is based
Fatigue Symptoms Checklist	A list of fatigue symptoms that can be used to assist in identifying when an individual might be experience fatigue.
Five Level Fatigue Trajectory	model utilising multiple layers of defence to manage the occurrence of fatigue-related incidents. It is the major practical or day-to-day aspect of the FRMS and includes tools and controls for monitoring and managing fatigue-related risk. At each level there are opportunities to put in place control strategies to manage the fatiguerelated risk. For an incident to occur, each level must have failed in some part to allow the error to pass through.
FRMS Training	Competency-based training programs designed to ensure that all stakeholders are competent to undertake their responsibilities in the FRMS.
Manager/Supervisor	Any person who is directly responsible for the supervision and well being of other employees.
Micro Sleeps	A short period of time (seconds) when the brain disengages from the environment (it stops processing visual information and sounds) and slips uncontrollably into light non-REM sleep. Microsleeps are a sign of extreme physiological sleepiness.
Mitigations	System-level interventions designed to reduce a specific identified fatigue risk.

Nap	A brief period of sleep, usually defined as less than half of a full night time sleep period. Naps as short as 5 minutes have been shown to provide (temporary) relief from the cumulative effects of sleep loss
Performance	The observable/behavioural manifestation of alertness and sleepiness, and the combination of one's efforts and the results of those efforts.
Prior Sleep	The amount of sleep obtained prior to a specific time (eg. the start or end of a shift).
Prior Wake	The amount of time spent awake prior to a specific period (usually assessedat the start and end of a shift).
Risk	The potential for harm, a concept that denotes a potential negative impact to some characteristic of value that may arise from a future event. Risks are events or conditions that may occur, and whose occurrence, if it does take place, has a harmful or negative effect.
Risk Management	The process of identifying and managing the factors contributing to risk, errors and incidents, at an individual or an organisational level, and determining how to best handle such exposure.
Safety Management System (SMS)	A systematic approach to managing safety, including the necessary organizational structures, accountabilities, policies and procedures.
Samn-Perelli Checklist	A subjective checklist used to measure a worker's fatigue levels.
Shift	The hours between the start and finish of established daily work schedules.
Shift Worker	a person who works rotating shifts, irregular shifts, evening shifts, afternoon shifts, morning shifts or split shifts. Another term for this work is 'non-traditional work hours.'

Sleep Disorders	A range of problems that make it impossible to obtain restorative sleep, even when enough time is spent trying to sleep. More than 80 different sleep disorders have been identified, that can cause varying amounts of sleep disruption. Examples include obstructive sleep apnea, the insomnias, narcolepsy, and periodic limb movements during sleep
Sleep Inertia	Transient disorientation, grogginess and performance impairment that can occur as the brain progresses through the process of waking up. Sleep inertia can occur on waking from any stage of sleep but may be longer and more intense on waking from slow-wave sleep (non-REM stages 3 and 4), or after sleep periods or naps containing a high proportion of slow-wave sleep.
Sleep Need	The amount of sleep that is required on a regular basis to maintain optimal levels of waking alertness and performance. Very difficult to measure in practice because of individual differences.
Sleep Quality	Capacity of sleep to restore waking function. Good quality sleep has minimal disruption to the non-REM/REM cycle. Fragmentation of the non-REM/REM cycle by waking up, or by brief arousals thatmove the brain to a lighter stage of sleep without actually waking up, decreases the restorativevalue of sleep.
Sleep Quantity	The total amount of sleep that an individual is able to obtain. It is usually measured to the nearest hour.
Sleepiness	A state of increased motivation to sleep. Difficulty in maintaining the alert state so that if an individual is not kept active and aroused, they will fall asleep.
Subjective Fatigue	Self-reported levels of feelings of fatigue, assessed on a seven-point scale ranging from ‘fully alert, wide awake’, to ‘completely exhausted, unable to function’.
Work Rotations/Cycles	The working period scheduled between any significant break away from work.
Work Schedules/Rosters	The hours to be worked for each day, shift, week, month or year, as

Appendix C: Fatigue Hazard Assessment at Minto Mine

Hazard assessments conducted at the Minto Mine site focused on reviewing hazards associated with fatigue. Assessments were conducted based on observations, consultation and discussions with workers, supervisors and contractors.

The following areas were examined: mental and physical work demands; work scheduling and planning; environmental conditions; and individual and non-work factors.

Risk assessments were based on both likelihood and severity. Results were graphed and quantified . Below is a summary of the quantitative results of the initial hazard assessment conducted.

Table 1.1 Capstone's Minto Mine Fatigue Risk Assessment Results

Fatigue risk factors and assessment have been taken from the following document (Fatigue Management Plan - A practical guide to developing and implementing a fatigue management plan for the NSW mining and extractives industry, 2009)

Factor Grouping	Capstone Risk Points	Total Factor Points	Percent of High Risk Areas
Work Demands	18	30	60%
Work Scheduling - Hours	22	50	44%
Work Scheduling - Shifts	25	40	63%
Work Scheduling - Night Work	40	70	57%
Work Environment (listed as high as they are not currently fully assessed)	35	40	88%
Off Duty Factors	8	40	20%
Totals and Average %	**148**	**270**	**55%**

Appendix D: Fatigue Factors Minto Mine Checklist

Minto Mine Fatigue Factors Camp Checklist	Check
Accommodations	
Temperature - Rooms should be between 18 - 22 C	
Lighting - Room should be able to be darkened during daylight hours (ex. Effective window blinds, black our curtains, etc.)	
Bed should be firm but comfortable	
Sufficient blankets and comfortable pillow should be provided	
Noise	
Room should be able to block sound. Alternately, quiet areas created for night workers or white noise devices or ear plugs provided.	
Beds	
Matresses and pillows should be comfortable for workers. Adequate blankets provided.	
Nutrition	
Healthy food choices should be available to workers for both day and night shifts.	
Light protien, low fat snacks and meals should be available to night workers.	
Low glycemic index food (low sugar and carbohydrate content) should be available to all workers, especially night shift workers.	
Caffeine should be available at all times if needed.	
Exercise and Recreation	
Recreation opportunities should exist for both day and night workers.	
Exercise facilities should be available for workers on day or night shifts.	
Travel	
Travel to and from work site should be limited if working long night shifts.	
Drivers should be assessed (self checks or other) for signs of fatigue prior to transporting crews.	

Appendix E: Fatigue Management Plan Self Assessment Worksheet

Exercise 3

Fatigue management self assessment worksheet

Individually assess your mine's Fatigue Management Plan. Elements of the self-assessment correspond to elements that need to be addressed in a Fatigue Management Plan.

Mine name:		**Section:**	
Assessment Team Leader:		**Participants (names/positions):**	

QUESTIONNAIRE	RESPONSE						
	Not started	Just started		Progressing		Done	Averaged Score
	0	1	2	3	4	5	
CONSULTATION, COMMITMENT AND RESPONSIBILITES: Everybody is given sufficient opportunity, time and resources to participate in fatigue management and are clear about their roles and responsibilities.							
Fatigue management is reflected in the site's health and safety policy or there is a stand alone fatigue management policy. The policy has been developed in consultation with employees and contractors and is signed by the most appropriate senior person.	☐	☐	☐	☐	☐	☐	☐
Commitment to fatigue management is demonstrated by having fatigue management procedures (or plan) in place and allocating time, money and training resources.	☐	☐	☐	☐	☐	☐	
Roles and responsibilities for fatigue management are allocated to positions within the organisation.	☐	☐	☐	☐	☐	☐	
An education and communication strategy has been agreed.	☐	☐	☐	☐	☐	☐	
A consultative arrangement has been established to develop a joint approach to controlling fatigue risk.	☐	☐	☐	☐	☐	☐	
FATIGUE RISK MANAGEMENT: Everybody works together to identify the FATIGUE hazards and fix problems at the source before exposures occur.							
Workers are provided with necessary information about fatigue hazards and controls to enable meaningful participation in fatigue risk management.	☐	☐	☐	☐	☐	☐	☐
Work- related fatigue risks impacting on the amount and quality of sleep (such as work scheduling and planning) of employees and contractors are considered when carrying out fatigue risk management.	☐	☐	☐	☐	☐	☐	
The risk management process considers how mental and physical demands of the job and the work environment contribute/ impact the effects of fatigue.	☐	☐	☐	☐	☐	☐	
Fatigue related risks are controlled according to the "hierarchy of control" and controls are monitored and reviewed for their continued effectiveness.	☐	☐	☐	☐	☐	☐	
The health and safety reporting system allows employees to report themselves or others as fatigued without criticism.	☐	☐	☐	☐	☐	☐	
Fatigue-related information is captured in the incident reporting process.	☐	☐	☐	☐	☐	☐	
IMPLEMENTING FATIGUE MANAGEMENT: Everybody is competent to manage fatigue risks within their area of responsibility and supervisors are trusted and decisions are supported.							
Supervisors identify when fatigue is an issue and initiate immediate control measures and record concern for further review (as required).	☐	☐	☐	☐	☐	☐	☐
Employees and contractors are provided education and awareness about the site's fatigue management plan and procedures at induction and on a periodic basis. Consideration is given when communicating to those on shift work and contractors to ensure all have been informed on fatigue management issues.	☐	☐	☐	☐	☐	☐	
Unplanned changes to the work schedule (ie. maintenance, break downs, unexpected shortage of staff) are considered in fatigue risk management planning, for employees and contractors.	☐	☐	☐	☐	☐	☐	
Safety-critical tasks are not performed at times when fatigue is likely to be higher? If tasks need to be performed, fatigue related risks have been considered as part of the risk assessment/ work instructions and procedures.	☐	☐	☐	☐	☐	☐	
Sites have a system/ methods for monitoring hours of work of employees and contractors.	☐	☐	☐	☐	☐	☐	
IMPLEMENTING HEALTH MANAGEMENT - EVALUATION AND REVIEW: The fatigue management plan includes ongoing monitoring and evaluation for effectiveness.							
The fatigue management procedure or plan is reviewed at regular intervals to ensure the continual effectiveness of the controls.	☐	☐	☐	☐	☐	☐	☐
Review of control measures are undertaken when methods, tasks, equipment, hazards, operations, procedures, rosters or schedules are introduced or the environment changes or there is any indication risks are not being controlled.	☐	☐	☐	☐	☐	☐	

END PAGE