Area 2 Stage 3 Pit - Mine Development and Operations Plan

2016-01

Prepared by:

Minto Explorations Ltd.,

Minto Mine

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1 Introduction

This document supplements the Mine Development and Operations Plan (MDOP) dated June 2014 (Minto Explorations Ltd., 2014) and referenced in *Schedule C* of QML-0001. That document, submitted as part of Phase V/VI licensing, described the addition of several open pits to Minto's mine plan:

1. Minto North
2. Area 2 Stage 3
3. Ridgetop South
4. Ridgetop North

Area 2 Stage 3 has been redesigned based on additional in-fill exploration drilling and geotechnical drilling completed in 2015, resulting in a smaller pit that mines less ore.

This document presents updated reserves, schedules, and designs for the Area 2 Stage 3 pit at Minto. The underground mining component of Phase V/VI is described in a separate Underground Mine Development and Operations Plan (UMDOP) (Minto Explorations Ltd., March 2016).

The content of this MDOP is derived from the Plan Requirement Guidance for Quartz Mining Projects (Yukon Water Board/Yukon Energy, Mines and Resources, 2013).

2 Design Criteria – Surface Mining

The depth and extents of the four pits were determined in the Phase VI Pre-Feasibility Study (Minto Explorations Ltd., 2012) by a Lerchs-Grossman pit optimization of the mine's resource model with the following parameters:

Item	Unit	Value
Metal Prices and Exchange Rate		
Copper	US$ / lb	2.50
Gold	US$ / oz	300.00
Silver	US$ / oz	3.90
Exchange rate	US$ / C$	0.90
Processing		
Copper recovery to concentrate	%	91.0
Sulphide Gold recovery to concentrate	%	70.0
Sulphide Silver recovery to concentrate	%	78.0
Copper grade in concentrate	%	40.0
Gold grade in concentrate	g/t	variable with Cu
Silver grade in concentrate	g/t	variable with Cu
Concentrate moisture content	%	8.0
Smelter Payables		
Payable copper in concentrate	%	96.75
Payable gold in concentrate	%	Per MRI contract
Silver deduction	g/t in conc.	Per MRI contract
Remaining payable silver in concentrate	%	Per MRI contract
Other Parameters		
Pit slope angles		
Minto North	°	52
Area 2 Stage 3 Rock	°	53
Area 2 Stage 3 Overburden	°	30
Dilution	%	6.0
Mining recovery	%	100
Mill throughput	t / year	1,370,000
Costs		
Mining cost	C$ / t mined	3.12
Processing cost	C$ / t milled	16.50
G&A cost	C$ / t milled	11.90
Royalties	%	1.0%
Conc. transportation, marketing, insurance	US$ / dmt conc.	169.54

Table 1: Input parameters used in pit optimization.

The optimum pit shell was selected as the basis for each pit design.

Haul road criteria are detailed in Section 0, and a discussion of wall angles in the final pit designs is presented in Section 2.2.

2.1 Ore Quantities

The Area 2 Stage 3 pit shares similar geology to the deposits previously mined at Minto: copper mineralization is contained in a series of sub-horizontal stacked lenses of foliated granodiorite. These lenses are characterized by sharp contacts with the surrounding host rock.

The foliated granodiorite zones are highly variable in the content of their mineralization: copper grade ranges from undetectable to the highest recorded assay value of 39.6% over 1.0m of core.

The following table summarizes Area 2 Stage 3 pit ore reserves at the mine's cutoff grade of 0.50%.

Area 2 Stage 3 Pit	2017
Ore (Tonnes)	619,622
Cu Grade (%)	1.27
Au Grade (g/t)	0.37
Ag Grade (g/t)	2.06
Cu Mlb, undiluted	17.4

Table 2: Open-pit reserves for Area 2 Stage 3 pit.

2.2 Slope Stability and Geotechnical Assessments

Slope angles for Minto's open pits were evaluated in 2009 as part of a report authored by SRK Consulting in support of the Phase IV Pre-Feasibility Study (SRK Consulting, 2009). A subsequent detailed geotechnical drilling, laboratory testing, geotechnical characterization and stability analysis program was completed in 2015 for Area 2 Stage 3, summarized in the report "Pit Slope Stability Evaluation, Minto Mine, Area 2 Pit – Stage 3" (SRK Consulting, 2015).

A relatively deep soil overburden deposit exists in the south portion of the proposed Area 2 Stage 3 pit, consisting primarily of transported silt and fine sand with occasional lenses of clay and coarse sand to gravel. The soil is high in organic content and contains permafrost. It is considered ice poor and not anticipated to exhibit creep behavior. In April 2013, an inclinometer and a thermistor string were installed at the southeast corner of the proposed pit. The inclinometer has thus far shown no movement, indicating that the overburden layer around the pit is not affected by the creep movement of the nearby Dry Stack Tailings Storage Facility.

The rock mass was separated into three geotechnical units; properties resulting from the 2015 drilling and laboratory testing program are summarized in Table 3 below.

Geotechnical Unit	UCS (MPa)	GSI	mi	D	Unit Wt. (kN/m3)	Phi	C (kPa)
Overburden Soils	-	-	-	-	21.7	30	20
Weathered Rock	20	60	20	0.7	25.4	-	-
Fresh Rock	79	70	25	0.7	26.2	-	-

Table 3: Rock Mass Parameters

Based on the rock mass and rock structure characterization completed, three design sectors were delineated, shown in Figure 1.

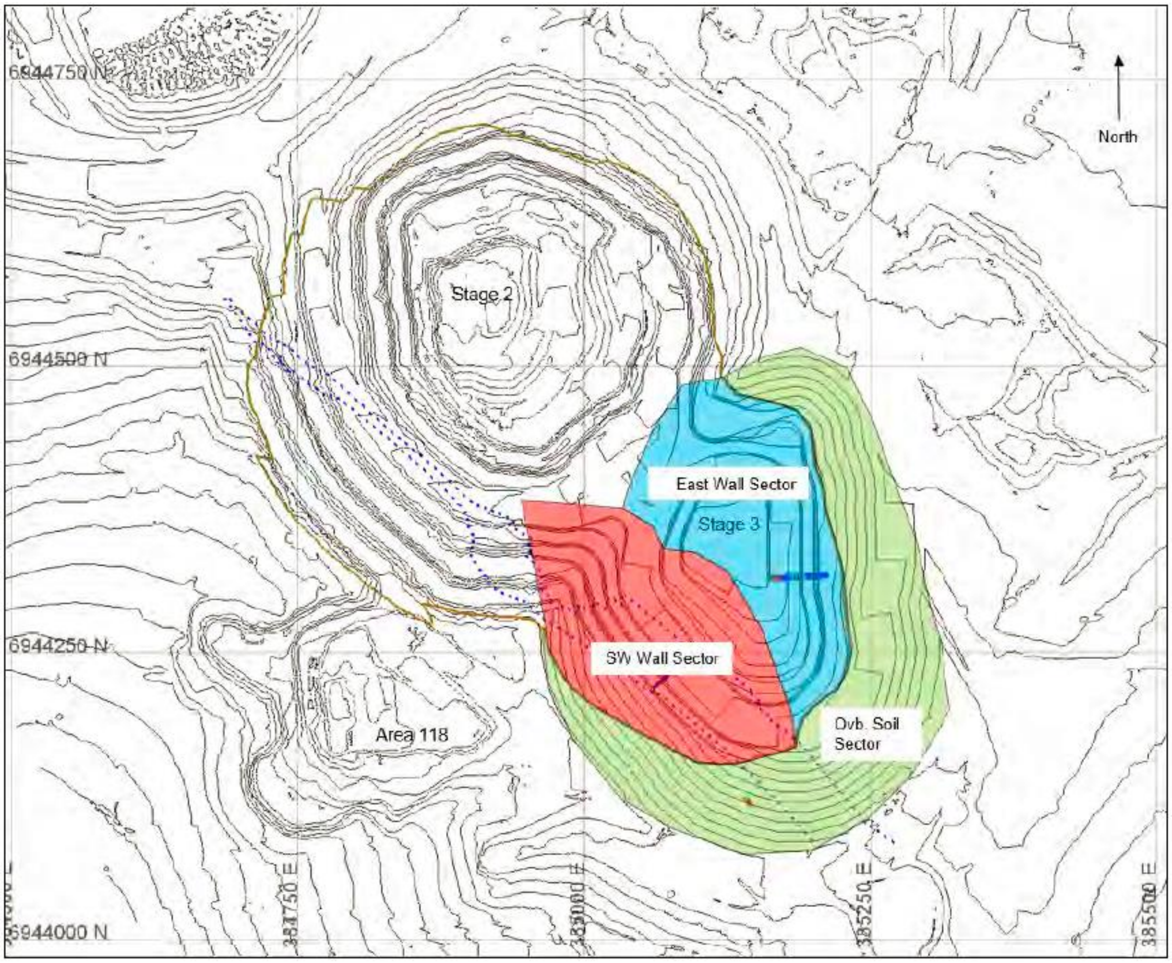

Figure 1: Geotechnical design sectors

Stability analyses indicated the following factors of safety, and final pit slope design criteria summarized in Table 4.

- Stability of soil overburden slope - FOS of 1.55;
- Stability of upper, weathered rock slope - FOS of 2.76; and,
- Global wall stability; FOS of 2.65.

Pit Sector	Wall Dip Dir. (Az)		Interramp Slope Angle	Bench Face Angle	Bench Height (m)	Bench Width (m)
	From	To				
SW Wall	325°	100°	50°	68°	24	10.5
East Wall	100°	325°	53°	72°	24	10
Overburden	-	-	30°	-	-	-

Table 4: Pit Slope Design Parameters

3 Design and Construction

3.1 Site Preparation

The organic-rich topsoil layer from Area 2 Stage 3 will be stripped using the mine's dozer fleet and stockpiled separately on existing dumps, mainly the Main Waste Dump Expansion, Southwest Waste Dump, and Mill Valley Fill Extension Stage 2. This approach, already employed for the topsoil stripped from Minto North and from the footprint of the Mill Valley Fill Extension Stage 2, places topsoil near the location of its final use, minimizing reclamation costs.

Area 2 Stage 3 will not require the construction of new access roads outside the pit footprint, as the pit is bordered by Area 2 Stage 2, Area 118 pit, and the access road to the Minto South Portal.

3.2 Construction QA/QC

No new infrastructure is planned for the site as part of the continuation of Phase V/VI mining.

Geotechnical monitoring of pit highwalls is described in Section 5.1.4, and the monitoring and quality control of waste rock dispatching is described in the site's Waste Rock and Overburden Management Plan (WROMP).

3.3 Stability Analyses

No additional stability analyses were required in addition to the slope stability analysis and monitoring practices summarized in sections 2.2 and 5.1.4, respectively.

3.4 Construction Schedule

Mining of the Area 2 Stage 3 pit will start the first week of January 2017 and is scheduled to be completed in the final weeks of June 2017. A mining rate of 13,000 BCM/day is planned for the first three months of operation, lowering to 7,700 BCM/day for the month of June.

Pit	Start Date	Completion Date	Duration of Mining
Area 2 Stage 3	January 2017	June 2017	6 months

Table 5: Start and completion dates for Area 2 Stage 3 open-pit mining.

3.5 Material Release Schedule

The following figure shows the material releases for the life of the Area 2 Stage 3 mine.

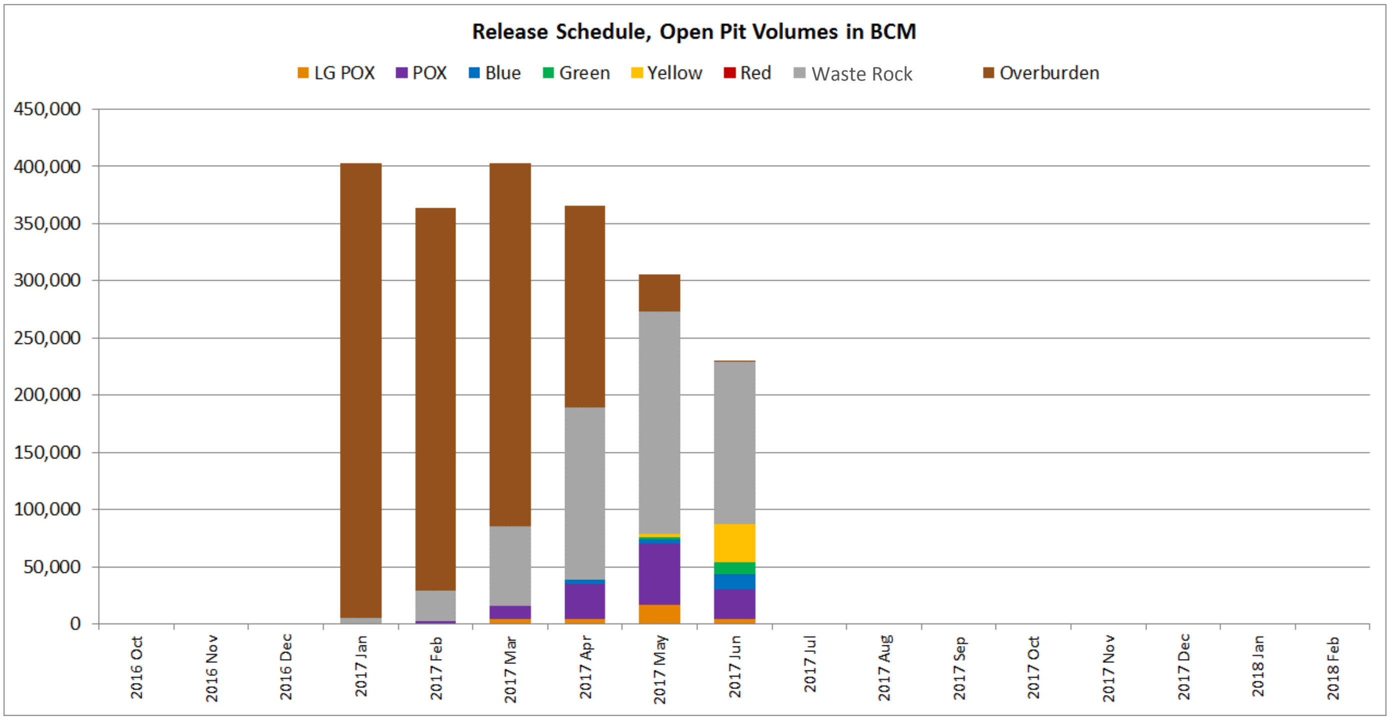

Figure 2: Material release by month.

Of note is the large quantity of overburden released between January and the end of April: this overburden will be hauled around site and used in progressive reclamation projects.

3.6 Ore Handling Procedures

Ore handling practices are unchanged from previous phases of mining. Ore will be classified, based on copper grade, into the material types presented in the table below.

Material Type	Copper Grade Range	Soluble Copper
Blue Ore	0.50 – 1.00% Cu	<15.0%
Green Ore	1.00 – 2.00% Cu	<15.0%
Yellow Ore	2.00 – 4.00% Cu	<15.0%
Red Ore	>4.00% Cu	<15.0%
Partially Oxidized Ore	>1.00% Cu	>15.0%
Low-Grade Partially Oxidized Ore	0.80 – 1.00% Cu	>15.0%

Table 6: Classification of ore by copper grade.

Classification of material as one of the six types of ore (or as waste) is based on blasthole assays. The following is a description of the process.

1. Drill cuttings from every blast hole are sampled, tagged, and sent for assay at the on-site lab prior to blasting;
2. Representative samples of the cuttings are assayed using atomic absorption (AA) to determine the copper and silver content. A separate sample is acid-leached and assayed for copper grade, allowing for a determination of soluble copper;

3. The environmental assay lab tests representative samples for total sulfur and total inorganic carbon content, which are used to calculate an NP/AP ratio;
4. The assay results are sent to the geology department for interpretation;
5. The geology department plots the results spatially, then draws polygons enclosing holes with similar assay results to identify regions of similar average grade (for ore) or similar waste class (for waste);
6. After blasting, the aforementioned polygons are laid out in the field by the mine surveyor working with the production geologist, using stakes and flags of various predefined colours;
7. Mine operations personnel, under the supervision of the pit foreman, excavate and haul material to the destination designated for the material type. Destinations are communicated to foremen and operators by the production geologist.

Material containing more than 15% soluble copper content is classified as partially oxidized.

Waste rock having an NP:AP ratio greater than 3.0 is classified as bulk waste and deposited to one of several rock dumps, while material with a ratio less than 3.0 is deposited either below the final flooded levels of the Area 2 or Main pits.

Stockpile inventory will be drawn down until the Area 2 Stage 3 pit starts producing ore in March 2017. Stockpile volumes will then increase until June 2017 with the completion of the Area 2 Stage 3 pit. Stockpiles will be drawn down over the next approximately 5 months to November 2017, supplemented by ongoing feed from underground operations.

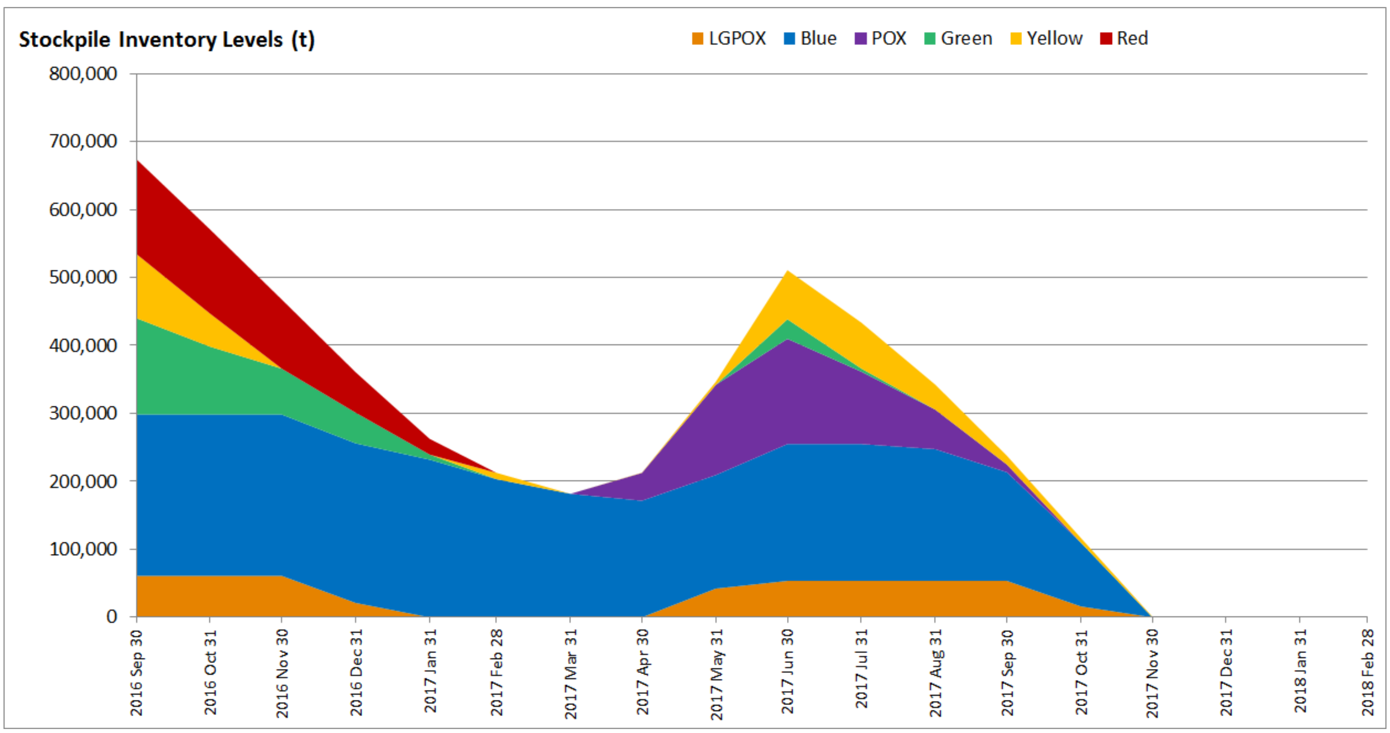

Figure 3: Life-of-mine stockpile inventory levels.

4 Associated Mine Services and Infrastructure

4.1 Ancillary Infrastructure

The surface mining fleet will continue to be diesel-powered. No new electrical infrastructure will be created for the open pit mine.

Two-way VHF radios will continue to be used for communication with the mining fleet. Sixteen channels are available on site, with three available everywhere on the property: one channel dedicated to routine pit traffic, one for extended conversations or other uses, and the site emergency channel.

4.2 Waste Rock Management

A detailed description of waste and overburden dumps, as well as material segregation practices, is presented in the Waste Rock and Overburden Management Plan.

A significant portion of the overburden released from mining Area 2 Stage 3 will be hauled to existing waste dumps, where it will be used in soil covers as described in the mine's Reclamation and Closure Plan (RCP). The RCP specifies a minimum cover thickness of 0.50m. In order to ensure that this requirement is met consistently, mine operations may target a slightly thicker cover layer. The table below presents the distribution of overburden quantities for two cover thicknesses:

Dump	Surface Area (m^2)	0.5m Overburden Cover (m^3)	0.75m Overburden Cover (m^3)
Main Waste Dump Expansion	449,800	224,900	337,350
Southwest Dump	722,000	361,000	541,500
Mill Valley Fill Extension	161,000	80,500	120,750
Low-grade Stockpile Area	60,500	30,250	45,375
Total	1,393,300	696,650	1,044,975

Table 7: Dump cover volumes

Overburden not used to cover existing dumps will be placed in the Area 118 Backfill Dump. The footprint of this dump will be reduced such that it remains entirely within the mined out Area 118 pit, as shown in Figure 4.

The waste rock, totaling 576,000 BCM, will be placed in the Main Pit Dump or the adjacent Area 2 Stage 2 pit (now referred to as the Area 2 Pit Tailings Management Facility), depending on access established at the time of release. The fraction of the waste rock projected to have an NP:AP ratio less than 3.0 will be placed in either the Area 2 Stage 2 pit or co-disposed with tailings in the Main Pit Tailings Management Facility, again depending on when it is released in the sequence and the access established at that time.

4.3 Industrial Complex

Minto's site infrastructure consists of a primary crusher, secondary crusher, coarse ore stacker/conveyor, mill, concentrate storage shed, tailings filtration building, water treatment plant, propane tanks, camp complex, warehouse, and laydown area. No changes to the locations of these structures were planned as part of Phase V/VI, and no further changes are expected as part of remaining mining.

4.4 Fuel Storage

Diesel fuel is stored in a diesel storage facility located north of the process plant. Six large diesel tanks have a combined storage capacity of approximately 3.2 million litres (L). These tanks were sized to store sufficient fuel for two months of operation, under generator power, during the Yukon River freeze and thaw periods when vehicle access to the site is not possible. The mine's connection to the electrical grid has reduced fuel use and the tanks, if filled, now represent a four-month fuel supply. A fuel tank inventory, including the types of products and volumes is presented in the table that follows.

Number of Storage Tanks (#)	Product Type	Volume (L)
6	Diesel	3,267,668
1	Gasoline	8,000
6	Propane	911,000

Table 8: Fuel storage capacity.

5 Mine Design and Methods

5.1 Mine Design

5.1.1 Volumes

Area 2 Stage 3 extends the Area 2 pit to the south with an additional 2.1M BCM of mining. The first two stages of Area 2, for comparison, mined 12.0M BCM. Figure 5 **Error! Reference source not found.**shows a typical long section through the entire Area 2 pit.

Approximately 1.3M BCM of the material to be mined from the pit is overburden, which will be sloped at 30°. The maximum height of the overburden slope is 55m.

5.1.2 Access

The majority of the pit's volume is contained in or above the 805m bench and will therefore be accessed from an existing haul road encircling the pit. The remaining benches will be accessed via the existing Area 2 Stage 2 ramp and a slot cut into the southeast quadrant of the Area 2 Stage 2 pit highwall. The pit finishes at 748m elevation, as compared to the 680m reached in Stage 2.

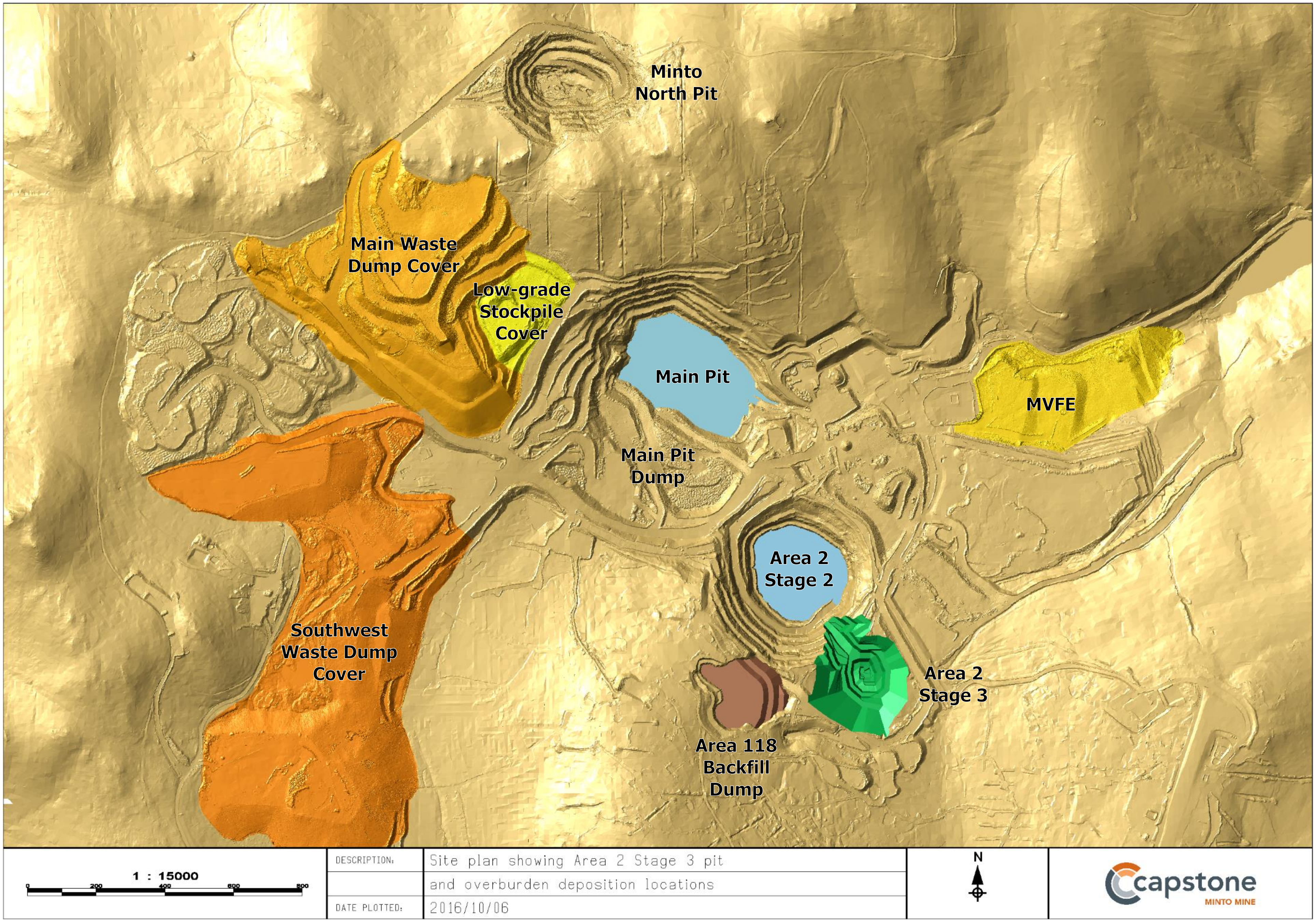

Figure 4: Overview of Area 2 Stage 3 pit and its overburden dump locations.

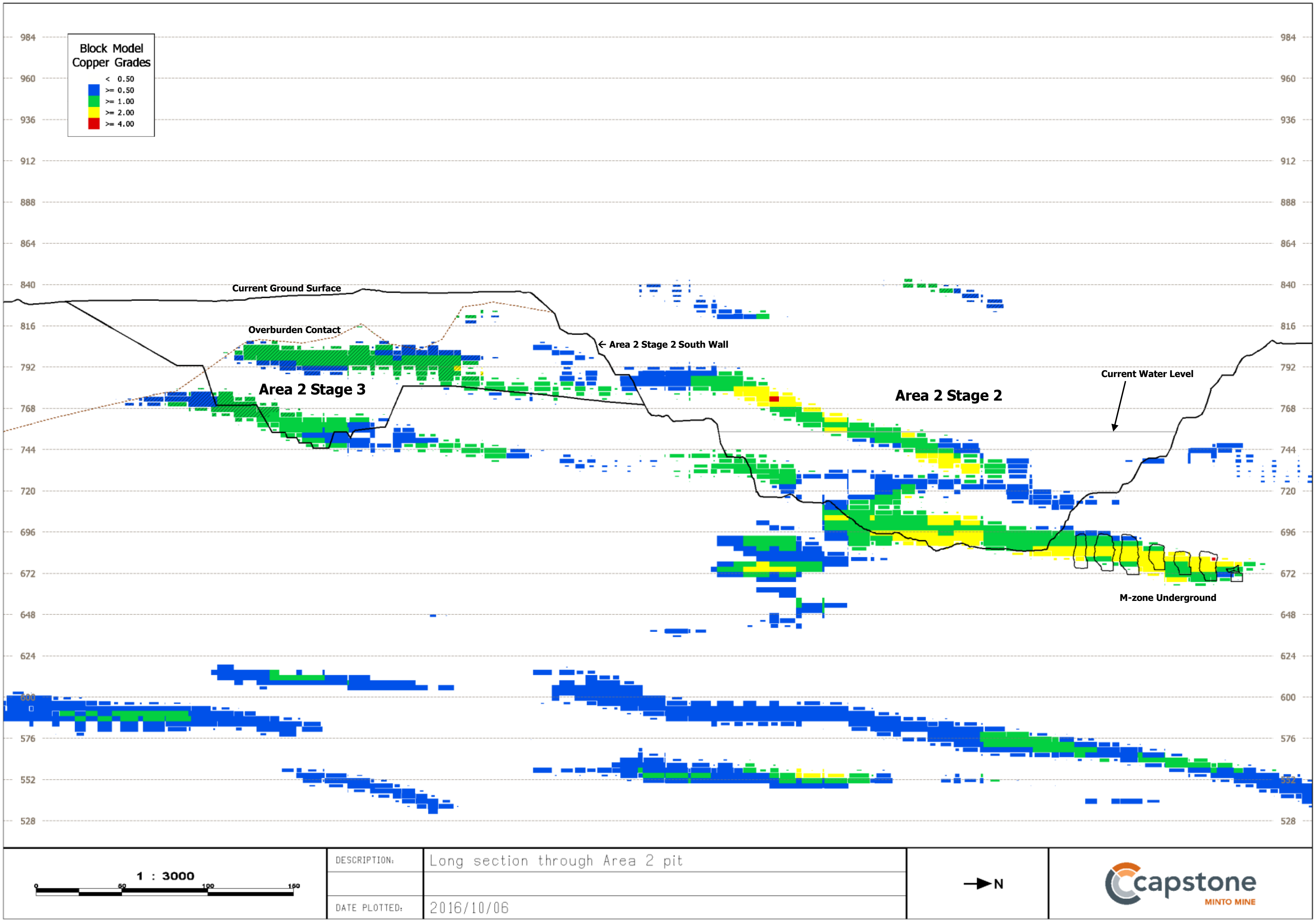

Figure 5: Long section through Area 2 pit.

5.1.3 Wall Design and Overburden Stability

Wall design and stability assessments are summarized in Section 2.2.

5.1.4 Ground Movement Monitoring

Minto uses a radar-based slope monitoring device manufactured and supported by GroundProbe. This provides continuous monitoring of highwalls with sub-millimeter accuracy. The device is limited to scanning the portions of the wall visible from its setup point; therefore, it is typically placed such that it monitors the highest or most critical wall under which personnel are actively working.

In the event of a movement rate increase, the radar issues automated alarms to the mill control room operator, as this position is staffed continuously. The control room operator will communicate with the pit foreman, operation supervisor, and/or geotechnical engineer/EIT, as outlined in the Safe Work Practice, to address the alarm or cease work in the affected area.

All pit walls are inspected during weekly detailed inspections, performed by the Mine Technical Department.These inspections check all exposed walls for signs of instability or changing conditions such as raveling, crack formation, overhangs, and major or unfavorably oriented structures. The reports issue guidelines for safe work and can order corrective actions, if required. These can include:

- More frequent inspections;
- Rockfill berms at bench-level to arrest raveling material;
- Delineators at bench level restricting access to areas;
- Instrumentation such as prisms or survey hubs;
- Mandatory use of a spotter for work underneath certain areas;
- Completion of a Job Hazard Analysis (JHA) process prior to commencing work; and/or
- Highwall redesign and blasting / excavation of structural units that present a risk of failure.

An inspection by an external consulting geotechnical engineer is also performed annually.

5.1.5 Blasting and Wall Control

Wall control is achieved by means of trim blasting and pre-shear.

Trim blasting is the practice of firing dedicated wall control blasts along the perimeter of the pit, no more than five rows deep. This allows material to move freely away from the wall, minimizing the amount of energy transferred into the wall itself. Wall blasts are always fired independently of production blasts and are always shot to free faces; that is, all previously blasted material is mined out along the perimeter of a trim blast. To further minimize the amount of energy transferred into the wall, blasts are tied-in such that the direction of movement is parallel to the wall instead of perpendicular to it.

Minto continues to use pre-shear drilling to further enhance wall control. This is a technique in which closely-spaced small-diameter holes, drilled to follow the final contour of the wall, are loaded with decoupled charges. Groups of holes are fired simultaneously, encouraging the formation of a fracture plane between them. Much of the strain energy from production / buffer blastholes, upon meeting this discontinuity, will be reflected back, instead of continuing into the wall where it would result in back-break.

5.1.5.1 Explosives

For production blasts, the mine uses mini-prill ANFO with a bulk density of 1050 kg/m^3 as its default product; it is used wherever ground conditions are dry or holes can be dewatered and lined. Failing that, a water-resistant

70/30 emulsion/prill product is used. The decision to switch to an emulsion blend is at the blaster's discretion in the field.

Dry product is preferred; however, groundwater conditions are variable and, when high influx of water is encountered, emulsion use can increase to 100% of total bulk product.

5.1.5.2 Typical Wall Design Parameters

The following figure shows Minto's wall drilling standards for 6.0m and 12.0m benches. All of Minto's pit designs have catch benches at 24m intervals. Every fourth bench is therefore shot above a catch bench, and the standards are modified to prevent damage to the crest by eliminating subgrade and laying out the holes such that they do not fall directly over the crest.

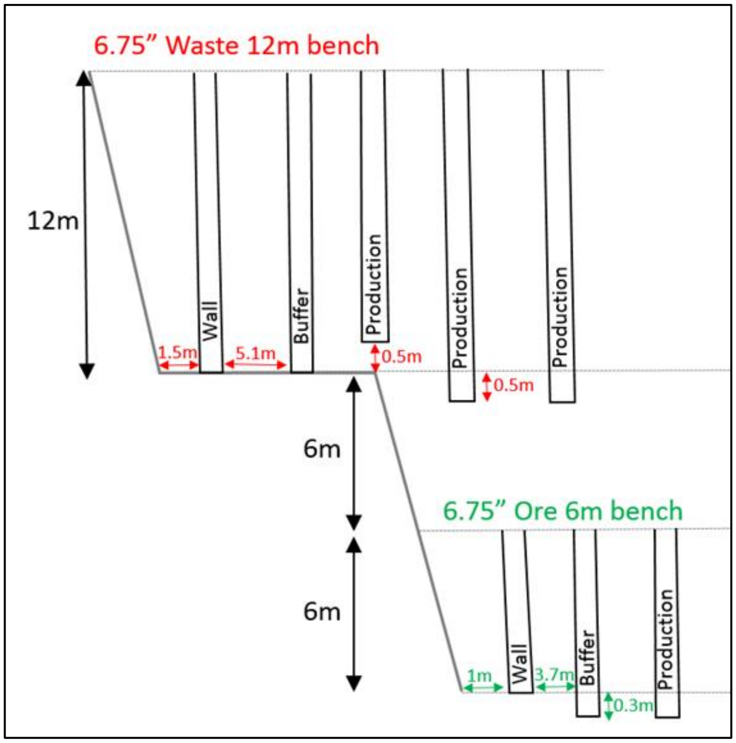

Figure 6: Design constraints for wall shots – both 12.0m and 6.0m.

5.1.6 Haul Roads

Haul roads at Minto are typically designed to accommodate Cat 777 haul trucks in dual or single lane configurations. Road widths are based on the requirements of Yukon WCB regulation 15.43(1)(a):

i. not less than three times the widest haulage vehicle used where dual lane traffic exists, or
ii. not less than two times the widest haulage vehicle used where only single lane traffic exists.

Berms are designed to be 75% of the trucks' tire height, as per Yukon WCB regulation 15.43(1)(b).

Allowance is typically made for an approximately one meter wide ditch on one side of the road, where conditions dictate.

These factors yield the following dual lane road design characteristics:

Parameter	Dual Lane Width	Single Lane Width
Truck width	6.05 m	6.05 m
Road surface width	18.2 m	12.1 m
Tire height	2.7 m	2.7 m
Berm height	2.0 m	2.0 m
Berm width	4.1 m	4.1 m
Total road width, against highwall (one berm, one ditch)	23.3 m	17.2 m
Total road width, two berms, one ditch	27.4 m	21.3 m

Table 9: Haul road design parameters.

Design grade is 10%. Grade limits are applied to the inside corner of a turn.

A speed limit of 50 km/h is in effect on mine roads. Minto has a light-vehicle training and sign-off program intended to ensure that personnel are familiarized with the mine site prior to driving. All personnel and all types of vehicles are required to announce their presence at certain call points, which are marked with roadside signs: these are typically busy intersections or areas with limited visibility.

Minto's Safe Work Procedure for vehicle operation specifies the following priorities for right-of-way:

1. Emergency vehicles;
2. Explosive trucks;
3. Crew busses;
4. Loaded haul trucks;
5. Empty haul trucks;
6. Service equipment (fuel, water, and heavy maintenance trucks);
7. Light vehicles.

Passing of haul trucks is not permitted.

5.2 Fleet

Minto's fleet is largely contractor-owned and operated, with the exception of a blasthole drill used for both production and pre-shear drilling. The following table summarizes the available equipment.

Equipment Type	No. of units
Hitachi EX2500 front shovel	1
Hydraulic Excavators, Hitachi EX1200 or similar	3
100-ton Haul Trucks, Cat 777	10
60-ton Haul Trucks, Cat 773	4
Front-end loaders, Cat 990 / Cat 992	2
Small Hydraulic Excavators, Cat 330 or similar	2
D11-class dozer	2
D10-class dozers	2
Graders, 16' blade	2
Contractor blast hole drills, 9 7/8" hole diameter	2
Contractor blast hole drills, 6 ¾" hole diameter	2
Minto blast hole drill, Sandvik DR560, 4 to7.5" hole diameter	1

Table 10: Open-pit equipment fleet for Phase V/VI mining

6 Closure

This document presents the mine development and operations plan for Area 2 Stage 3 open pit mining at Minto Mine. This plan will be updated as required based on ongoing mine planning and optimization.

Prepared by:

Original Signed By

Dave Stewart, EIT

Mine Engineer-In-Training

Original Signed By

Daniel Avar, P.Eng.

Long Range Planning Engineer

Reviewed by:

Original Signed By

Kevin Cymbalisty, P.Eng.

Chief Engineer

Original Signed By

Pooya Mohseni, P.Eng.

Mine Manager

7 References

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