Appendix H: Red Dog One Year Mine Plan 2017

**Red Dog Operations**

**Alaska, USA**

# ONE YEAR AMENDED MINE PLAN - 2017

**February 2017**

Teck

# ONE YEAR AMENDED MINE PLAN - 2017

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# ONE YEAR AMENDED MINE PLAN - 2017

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# SECTION 1. SUMMARY

## 1.1. Introduction

Utilizing Red Dog Mine's current stockpile blending criteria and equipment capabilities, a monthly mine production plan for 2017 has been prepared under the direction of the 2017 5-Year Mine Plan. The 2017 1-Year Forecast Mine Plan has an estimated production of 1,033 kt of zinc concentrate and 182 kt of lead concentrate. These estimates are based upon mill recovery formulae in the mine block model, with adjustments made by Mill Technical based on projected mill feed grades and mill production for 2016. For 2017, all material will be mined from the Aqqaluk and Qanaiyaq deposits, and the waste will primarily be dumped back into the Main Pit. Mine production total for 2017 is forecast to be 13,762 kt, which is the sum of 4,503 kt ore and 9,259 kt waste. Total production is 6% higher than the 2016 mine plan of 12,992 kt.

## 1.2. Mine Planning Parameters

The mine plan is based on two distinct block models, one for the Aqqaluk deposit and one for the Qanaiyaq deposit. Planning for the Aqqaluk Pit is based on the RED2015-BH-E model, which was issued in December 2016 and uses the Aqq12f pit shell. Planning for the Qanaiyaq Pit is based on the QAN2012-K model, which was issued in December 2016 and uses the Qan12f pit shell

Ore/Waste cutoffs are based on a combination of NSR value per tonne and net value per second. February 2016 Reserve & Resource metal prices of $1.00/lb. Zn, $0.90/lb. Pb and $18.00/ozt. Ag were used to calculate revenue. The breakeven cost of mining, milling, and G&A is $XX.XX/t for the Aqqaluk Pit and $XX.XX/t for the Qanaiyaq Pit. The net value per tonne was converted to net value per second, using throughput formulae from the Teck sponsored AMIRA GeM mineral texture project, to account for ore throughput variability. An operating rather than breakeven cutoff is utilized by Red Dog to determine High Grade ore. This cutoff is determined using a 10% discount rate and thus provides a higher NPV mining schedule than that obtainable on a breakeven cutoff basis. The net value per second operating cutoff used to classify High Grade ore is $X.XX/s. Low Grade ore, from $0.00/s up to $X.XX/s is stockpiled for processing at the end of mine life. However, due to sulfide reactivity, only the fraction of Low Grade ore which is classified as non-reactive (approximately 40%) is stockpiled. Once ore and waste reserves were determined, the ore was scheduled by grade and grade ratios according to the Red Dog Operations stockpile blending criteria.

Total tonnage is considered a function of available truck/loader hours. The first priority was to determine the total fleet hours required to achieve 2017 mill feed and required projects. These hours were subtracted from the total available fleet hours for 2017. For haul trucks, an average Physical Availability of 79.0%, Use of Availability of 90.0% and Operating Efficiency of 87% were used to calculate the total hours available for 2017.

## 1.3. Mine Production

Red Dog is anticipating 13,762 kt of total mine production from the Aqqaluk and Qanaiyaq Pits and stockpiles (STK) as shown in Table 1-1. 4,503 kt of ore at X.XX% Zn and X.X% Pb, and 9,259 kt of waste is forecast. Of the total of ore production, the Aqqaluk Pit contributes 67.7%, Qanaiyaq Pit 16.3% and STK 16.0%.

**Table 1-1 2017 Mine Plan Summary**

| | Aqqaluk Pit | Qanaiyaq Pit | STK | Total |
|---|---|---|---|---|
| Total (tonne) | 7,596,807 | 4,925,710 | 358,593 | 13,761,510 |
| Ore (tonne) | 3,046,238 | 732,872 | 358,593 | 4,502,902 |
| Zn (%) | | | | |
| Pb (%) | | | | |
| Ba (%) | 12.7 | 2.1 | 28.7 | 12.5 |
| SiO2 (%) | 39.2 | 34.2 | 24.4 | 34.0 |
| Total Waste | 4,550,569 | 4,192,838 | 0 | 9,258,608 |
| SR | 1.49 | 5.72 | 0.00 | 2.06 |

## 1.4. Equipment Fleets

The 2017 fleet size will be the same as in 2016. The 2017 equipment schedule is shown in Table 1-2.

**Table 1-2 2017 Equipment Schedule**

| Equipment | Description | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|---|
| Drills | DML | 3 | 3 | 3 | 3 |
| Trucks | 777 | 10 | 10 | 10 | 10 |
| Loaders | 993 | 5 | 5 | 5 | 5 |
| Dozers | D9/D10 | 4 | 4 | 4 | 4 |

## 1.5. Risks and Opportunities

**Risks**

1) Near Surface Block Model Inaccuracy

Due to reduced diamond drill core recovery in the region near the original ground surface, the accuracy of block model ore and waste tonnage and grade estimates during periods of pioneering new pits and pushback phases will be impacted. This lower reliability is expected again in the Qanaiyaq Pit in 2017. The ore and waste tonnage and ore grade estimate accuracy during these periods will be poorer than the historical average.

2) Aqqaluk Pit Highwall Slope Stability

The south wall of Aqqaluk is approximately 75ft from the Red Dog Creek diversion culvert. This wall is currently being excavated within poor quality Siksikpuk and Ikalukrok shales. Buffer shots will be taken in this area to prevent excess damage from blasting. Water infiltration from the flooded Main Pit is also being encountered and mitigation measures are being investigated. The northeast wall is also likely to be adjusted due to geotechnical concerns outlined in the December 2016 Golder Slope Stability Analysis.

3) Main Pit Dump Availability and Stability

Main Pit dump stability will be constantly monitored and evaluated. Efforts to obtain the longest strike length for dumping must be made to ensure constant availability for waste disposal. Proper blending of varying waste materials will be maintained. Additional risk to ongoing dumping in Main Pit exists in the form of unforeseen circumstances such as restrictions on water discharge.

4) Selenium (Se) Leaching

Selenium levels in the Main Pit Lake have been on the rise in recent years. It is hypothesized that this may be as result of mining of weathered overburden, particularly from the Qanaiyaq deposit. The

Environmental Department will continue to monitor the levels of Selenium in the Tailings Storage Facility and Main Pit Lake. In the meantime, efforts will be made to A) limit the amount of Qanaiyaq ore fed to the Mill and B) deposit waste rock from Qanaiyaq above water level in Main Pit whenever possible.

5) Qanaiyaq Ore Processing

The Mill may not able to process the proportion of Qanaiyaq ore scheduled in the 2017 budget due to lack of experience with the metallurgy.

6) Mine Equipment Utilization of Availability

The targets for utilization of availability currently reflect hot-seating of mine production equipment. Shortfall in meeting these targets will have a negative impact of the ability of Mine Operations to meet the productions goals for the year.

**Opportunities**

1) Qanaiyaq Ore Processing

In the event that the Mill is able to process additional quantities of Qanaiyaq ore in stockpiles, there may be opportunity to increase concentrate production to meet stretch targets for 2017.

2) Production Efficiencies

Increasing haulage efficiencies via more effective haul road maintenance has the potential to optimize the productivity of the current fleet. This is of particular benefit to the mining of the Qanaiyaq deposit since the waste haul is measurably longer than that from Aqqaluk.

3) Equipment Modernization

Implementation of Wenco Bench Manager coupled with a high-precision GPS solution for Red Dog could allow Geology to more accurately track material for stockpile building, delivering a more reliable grade forecast to the Mill.

4) Aqqaluk Pit Shape Change

Diamond core drilling is continuing near the Aqqaluk pit in 2017. This data will improve the modeling of several peripheral knobs of high grade exhalite that may lead to local expansions of the ultimate pit. This drilling will also better define mineralization within the sub-lower plate and may lead to a deepening of the ultimate Aqqaluk pit. Expansion or flattening on the west side could cause the pit to intersect Sulfur Creek requiring a realignment of the proposed diversion.

## 1.6. Project List

1) Aqqaluk pit dewatering
2) B-pad construction
3) Pit wall / dump stability monitoring and failure mitigation
4) Exploration drilling
5) Water truck fill station
6) Emulsion plant silo repair
7) Back dam causeway
8) Portable crusher
9) Airport runway re-surfacing

# SECTION 2. MINE PLANNING PARAMETERS

Red Dog's ability to blend its highly variable run-of-mine zinc grade into stockpiles with a consistent feed grade (± 1% Zn) has been essential to optimizing concentrate production and increasing Red Dog's value. The challenge is to create an achievable mine plan utilizing a variety of zinc and lead grades to aid stockpile blending. The following assumptions, standards, and methods have been applied to the 2017 Mine Plan.

## 2.1. Stockpile and Mill Criteria

Experience building blended stockpiles from Red Dog's Main Pit deposit created a workable standard to optimize the deposit's highly rich, highly variable zinc grades. Once the mining cuts are run against the models, the cuts are ordered and sequenced to be both mineable and blended to meet predetermined stockpile criteria. Optimizing mill feed requires blending weathered, baritic and siliceous ore types from around the Aqqaluk and Qanaiyaq deposits into stockpiles that meet the criteria set forth by the mill.

Ore cuts are sequenced and organized into roughly 170 kt stockpiles. Built in five lifts on the crusher pad, the stockpiles are designed so that the lifts, when mined in strips across the face, create a relatively consistent feed. Currently, a stockpile should meet the following requirements to optimize mill throughput and recoveries, listed roughly in order of importance (Revision 19: November 27, 2016):

- Stockpile feed should not exceed
  - average feed grade +/- 1.0% Zn in a 24 hour period and,
  - stockpile average +/- 1.5% Zn quarter average;
- Barium: 7% < %Ba, and as close to the quarter average as possible;
- Type 5 (weathered ore - modelled): < 10%
- Type 8 (fine grained ore): < 10%
- Type 9 (weathered ore - visual): < 15%
- Zn/Fe ratio: >= 2.1; Zn/Pb ratio: >= 3.0; Soluble Pb ratio: < 25%
- TOC: <= 0.50%

Currently, mill throughput for the 2017 mine plan is scheduled from the Aqqaluk and Qanaiyaq deposits.

## 2.2. Equipment Assumptions

Currently Red Dog has a fleet of five 777D and five 777F CAT haul trucks available for haulage duty. These trucks are rated at 91 t (100 short tons); however, empirical data and experience has shown that Red Dog typically averages between 85 to 100 t per load. Truck capacity is based on 2016 Wenco average payload data. See Table 2-1.

**Table 2-1 Truck Capacity by Material (dry tonnes/load)**

| Model | Units | SP Reclaim | | Ore | | Waste | |
|---|---|---|---|---|---|---|---|
| | | Aqqaluk | Qanaiyaq | Aqqaluk | Qanaiyaq | Aqqaluk | Qanaiyaq |
| 777D/F | dmt/load | 100.0 | 100.0 | 95.0 | 95.0 | 88.0 | 88.0 |

Productivities for equipment are based on 2016 average data and are summarized in Table 2-2. As both rock density and hardness in Qanaiyaq are expected to be lower than Aqqaluk, drilling productivity per tonne is expected to be slightly higher in this pit.

**Table 2-2 Loader, Drill, and Dozer Productivities**

| | Productivity (tonnes/operating hour) | | | | |
|---|---|---|---|---|---|
| Equipment | Ore | SP Reclaim | COSP | LG Ore | Waste |
| 777 Haul Truck | 316 | 1,083 | | 373 | 373 |
| 993 Loader | 869 | 869 | - | - | 869 |
| DM-L Drill | 1,078 | - | - | 1,078 | 1,748 |
| D9/D10 Dozer | 8,730 | 2,493 | 5,180 | - | 1,412 |

# SECTION 3. MINE PRODUCTION

## 3.1. Overview

The 2017 mine plan production is divided into eight material classes: High Grade Ore, Non-reactive Low Grade Ore, Possibly Reactive Low Grade Ore, Non-sulphide Ore, Possibly Reactive Waste, Non-reactive Waste, Construction rock, and Cover rock. The plan assumes that all production is from the Aqqaluk and Qanaiyaq Pits. Waste will primarily backfill the Main Pit, though a significant amount will also be stockpiled on the Main Waste Dump for future reclamation. Ore production for the 2017 plan is forecast to meet or exceed the ore required to produce the budgeted 1,248 kt of concentrate. It is assumed that the mill will be capable of maintaining the feed rate outlined by the 2017 mine schedule. The 2017 forecast mine plan has a scheduled production of 1,033 kt of zinc concentrate and 182 kt of lead concentrate.

## 3.2. 2017 Mine Schedule

The 2017 Mine Plan currently schedules 13,762 kt total mine production from Aqqaluk and Qanaiyaq Pits, and STK as shown in Table 3-1. Of the total ore production (4,503 kt at XX.X% Zn and X.X% Pb), the Aqqaluk Pit contributes 67.7%, Qanaiyaq Pit 16.3% and STK 16.0%. Waste production is estimated at 13,762 kt, which includes 1,289 kt of Non-reactive Low Grade Ore, 157 kt of Possibly Reactive Low Grade Ore, 121 kt of Non-sulphide Ore, 242 kt of Possibly Reactive Waste, 6,934 kt of Non-reactive Waste, 0 kt of Construction rock and 0 kt of Cover (reclamation) rock (Table 3-2).

**Table 3-1 2017 Mine Plan Summary**

| | Aqqaluk Pit | Qanaiyaq Pit | STK | Total |
|---|---|---|---|---|
| Total (tonne) | 7,596,807 | 4,925,710 | 358,593 | 13,761,510 |
| Ore (tonne) | 3,046,238 | 732,872 | 358,593 | 4,502,902 |
| Zn (%) | | | | |
| Pb (%) | | 2.1 | | |
| Ba (%) | 12.7 | 34.2 | 28.7 | 12.5 |
| SiO2 (%) | 39.2 | 4,192,838 | 24.4 | 34.0 |
| Total Waste | 4,550,569 | | 0 | 9,258,608 |
| SR | 1.49 | 5.72 | 0.00 | 2.06 |

Overall 2017 production is currently scheduled to achieve the major goals set by the 5 year mine plan (then adjusted by mill throughput capacity) which is X,XXX kt of zinc and lead concentrate.

The average monthly ore production is 378 kt through 2017, which is slightly higher than the 2016 mine plan monthly average of 355 kt. The monthly waste production averages are:

- 700 kt in Quarter 1,
- 790 kt in Quarter 2,
- 850 kt in Quarter 3 and,
- 746 kt in Quarter 4.

The monthly and quarterly mine plan summaries are shown in Table 3-2 and Table 3-3 respectively.

## Table 3-2 2017 Monthly Mine Plan Summary

### 2017 Mine Plan Production Schedule -Total

| Description / Activity | Units | M01 | M02 | M03 | M04 | M05 | M06 | M07 | M08 | M09 | M10 | M11 | M12 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Days | Days | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| **Mine Production Summary** | | | | | | | | | | | | | | |
| **Ore** | t | **365,199** | **353,462** | **422,981** | **410,949** | **378,809** | **416,530** | **336,287** | **422,267** | **373,636** | **331,617** | **359,172** | **331,993** | **4,502,902** |
| **Waste** | | | | | | | | | | | | | | |
| Low Grade - Non-reactive | t | - | 122 | 4,831 | 24,983 | 80,340 | 128,492 | 148,822 | 189,198 | 201,697 | 267,813 | 88,725 | 153,569 | 1,288,592 |
| Low Grade - Possibly Reactive | t | - | 3,414 | 32,754 | 1,424 | 32,854 | 5,644 | 11,333 | 28,025 | 58 | 19,168 | 1,375 | 21,410 | 157,459 |
| Non-sulphide Ore | t | - | - | - | 21,448 | - | 1,968 | 49,001 | - | - | - | 4,481 | 44,458 | 121,356 |
| Waste - Possibly Reactive | t | - | - | 78,779 | 1,102 | 62,906 | - | - | 70,714 | 22,839 | - | 5,421 | - | 241,761 |
| Waste - Non-reactive | t | - | 826,062 | 640,227 | 787,600 | 658,414 | 562,485 | 711,986 | 505,000 | 611,696 | 555,168 | 582,124 | 493,477 | 6,934,239 |
| Waste - Construction | t | - | - | - | - | - | - | - | - | - | - | - | - | - |
| Waste - Cover | t | | - | - | - | - | - | - | - | - | - | - | - | - |
| Total Waste | t | 515,201 | 829,598 | 756,591 | 836,557 | 834,514 | 698,589 | 921,142 | 792,937 | 836,290 | 842,149 | 682,126 | 712,914 | 9,258,608 |
| Waste/Mill Feed Ratio | - | 1.41 | 2.35 | 1.79 | 2.04 | 2.20 | 1.68 | 2.74 | 1.88 | 2.24 | 2.54 | 1.90 | 2.15 | 2.06 |
| **Total Mine Production** | t | **880,400** | **1,183,060** | **1,179,572** | **1,247,506** | **1,213,323** | **1,115,119** | **1,257,429** | **1,215,204** | **1,209,926** | **1,173,766** | **1,041,298** | **1,044,907** | **13,761,510** |
| **Mill Feed Summary** | | | | | | | | | | | | | | |
| Mill Feed | t | 365,199 | 353,462 | 422,981 | 410,949 | 378,809 | 416,530 | 336,287 | 422,267 | 373,636 | 331,617 | 359,172 | 331,993 | 4,502,902 |
| Zinc | % | | | | | | | | | | | | | |
| Lead | % | | | | | | | | | | | | | |
| Soluble Lead | % | 0.0 | 2.1 | 1.1 | 1.2 | 1.5 | 0.6 | 1.1 | 1.5 | 0.9 | 0.6 | 1.2 | 0.7 | 1.0 |
| Silver | g/t | | | | | | | | | | | | | |
| Iron | % | 5.5 | 6.6 | 4.7 | 6.7 | 5.6 | 5.8 | 6.3 | 4.0 | 6.5 | 6.7 | 7.2 | 3.5 | 5.7 |
| Barium | % | 16.3 | 4.1 | 13.7 | 12.8 | 11.7 | 13.2 | 15.0 | 11.9 | 15.8 | 10.6 | 11.3 | 13.7 | 12.5 |
| TOC | % | 0.0 | 0.4 | 0.3 | 0.4 | 0.5 | 0.3 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| SiO2 | % | 0.0 | 45.1 | 37.0 | 33.8 | 38.1 | 39.0 | 36.4 | 37.5 | 33.2 | 35.9 | 31.0 | 41.0 | 34.0 |
| NSR | $/t | 0.0 | 206.0 | 214.4 | 218.0 | 195.6 | 201.6 | 173.1 | 212.1 | 183.2 | 242.4 | 234.5 | 211.4 | 191.5 |
| BMWi | kwh/t | 0.0 | 13.7 | 11.1 | 11.5 | 12.6 | 11.4 | 11.8 | 11.9 | 11.6 | 11.2 | 11.3 | 11.6 | 10.8 |
| A x b | - | 0.0 | 83.7 | 93.8 | 93.5 | 98.7 | 75.0 | 94.6 | 99.0 | 87.6 | 69.6 | 89.6 | 74.4 | 80.5 |
| Grinding Hours | hrs | - | 856 | 788 | 793 | 787 | 805 | 663 | 836 | 723 | 630 | 684 | 645 | 8,208 |
| Throughput | t/hr | 0.0 | 424.4 | 565.2 | 553.3 | 528.1 | 519.3 | 516.6 | 519.8 | 536.0 | 526.8 | 527.3 | 517.0 | 480.1 |
| Ore Type | | | | | | | | | | | | | | |
| Weathered | % | 0.0 | 0.3 | 0.0 | 0.0 | 1.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.1 |
| Baritic | % | 0.0 | 0.7 | 0.0 | 0.0 | 0.4 | 0.0 | 0.0 | 0.3 | 0.4 | 0.0 | 0.0 | 0.0 | 0.1 |
| Pyritic | % | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Oxide | % | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Veined | % | 0.0 | 99.0 | 100.0 | 100.0 | 98.6 | 100.0 | 99.6 | 99.7 | 99.6 | 100.0 | 100.0 | 100.0 | 91.6 |
| Grain Size | | | | | | | | | | | | | | |
| T1 | % | 0.0 | 46.7 | 40.1 | 39.7 | 45.6 | 35.5 | 44.0 | 47.5 | 41.1 | 39.0 | 49.2 | 38.2 | 38.9 |
| T2 | % | 0.0 | 12.9 | 9.8 | 7.4 | 10.1 | 8.1 | 8.2 | 8.1 | 6.3 | 8.1 | 9.3 | 6.4 | 7.9 |
| T6 | % | 0.0 | 40.3 | 50.2 | 52.8 | 44.3 | 56.3 | 47.8 | 44.4 | 52.6 | 52.9 | 41.5 | 55.4 | 45.0 |
| Mill Feed Ratios | | | | | | | | | | | | | | |
| Zn/Fe | - | | | | | | | | | | | | | |
| Zn/Pb | - | | | | | | | | | | | | | |
| sPb/Pb | - | | | | | | | | | | | | | |
| **Concentrate** Zn | | | | | | | | | | | | | | |
| Concentrate Pb | **t** | | | | | | | | | | | | | |
| Concentrate Total | **t** | | | | | | | | | | | | | |
| Concentrate | **t** | | | | | | | | | | | | | |
| **Metal** | | | | | | | | | | | | | | |
| Zinc in Zn concentrate | t t | | | | | | | | | | | | | |
| Lead in Pb concentrate | koz | | | | | | | | | | | | | |
| Silver in both concentrates | | | | | | | | | | | | | | |
| | t | | | | | | | | | | | | | |
| Lead in Zn concentrate | t | | | | | | | | | | | | | |
| Zinc in Pb concentrate | | | | | | | | | | | | | | |
| **Production by Pit Phase** | | | | | | | | | | | | | | |
| A1 | t | - | - | - | - | - | - | - | - | - | - | - | - | - |
| A2 | t | - | 381,953 | 170,401 | 315,423 | 138,722 | 306,197 | 173,892 | 181,933 | 138,287 | 167,752 | 229,156 | 219,883 | 2,423,599 |
| A3 | t | - | 124,168 | 161,773 | 409,431 | 387,386 | 412,684 | 290,449 | 368,216 | 554,104 | 1,006,014 | 344,419 | 431,110 | 4,489,754 |
| A4 | t | - | - | - | - | - | - | - | 68,502 | - | - | 240,896 | 251,277 | 560,675 |
| Q1 | t | | 296,937 | 690,983 | 306,510 | 614,697 | 345,576 | 686,454 | 505,237 | 355,937 | | 226,827 | 142,637 | 4,171,795 |
| Q2 | t | | | | | | | | | | | | | |

**Table 3-3 2017 Quarterly Mine Plan Summary**

| Description / Activity | Q1 | Q2 | Q3 | Q4 | Total |
|---|---|---|---|---|---|
| Days | 90 | 91 | 92 | 92 | 365 |
| **Mine Production Summary** | | | | | |
| **Ore** | **1,141,642** | **1,206,288** | **1,132,190** | **1,022,782** | **4,502,902** |
| **Waste** | | | | | - |
| Low Grade - Non-reactive | 4,953 | 233,815 | 539,717 | 510,107 | 1,288,592 |
| Low Grade - Possibly Reactive | 36,168 | 39,922 | 39,416 | 41,953 | 157,459 |
| Non-sulphide Ore | - | 23,416 | 49,001 | 48,939 | 121,356 |
| Waste - Possibly Reactive | 78,779 | 64,008 | 93,553 | 5,421 | 241,761 |
| Waste - Non-reactive | 1,466,289 | 2,008,499 | 1,828,682 | 1,630,769 | 6,934,239 |
| Waste - Construction | - | - | - | - | - |
| Waster - Cover | - | - | - | - | - |
| **Total Waste** | **2,101,390** | **2,369,660** | **2,550,369** | **2,237,189** | **9,258,608** |
| Waste/Mill Feed Ratio | 1.84 | 1.96 | 2.25 | 2.19 | 2.06 |
| **Total Mine Production** | **3,243,032** | **3,575,948** | **3,682,559** | **3,259,971** | **13,761,510** |
| **Mill Feed Summary** | | | | | - |
| Mill Feed | 1,141,642 | 1,206,288 | 1,132,190 | 1,022,782 | 4,502,902 |
| Zinc | | | | | |
| Lead | | | | | |
| Soluble Lead | | | | | |
| Silver | | | | | |
| Iron | 11.6 | 12.6 | 14.1 | 11.8 | 5.7 |
| Barium | 0.3 | 0.4 | 0.4 | 0.4 | 12.5 |
| TOC | 27.7 | 37.0 | 35.7 | 35.8 | 0.4 |
| SiO2 | 143.2 | 205.3 | 191.0 | 229.6 | 34.0 |
| NSR | 8.4 | 11.8 | 11.8 | 11.4 | 191.5 |
| BMWi | 60.7 | 88.8 | 93.9 | 78.2 | 10.8 |
| A x b | 1,643 | 2,384 | 2,222 | 1,959 | 80.5 |
| Grinding Hours | 340.8 | 533.6 | 524.2 | 523.8 | 8,208 |
| Throughput | | | | | 480.1 |
| Ore Type | 0.1 | 0.3 | 0.0 | 0.0 | 0.0 |
| Weathered | 0.2 | 0.1 | 0.2 | 0.0 | 0.1 |
| Baritic | 0.0 | 0.0 | 0.1 | 0.0 | 0.1 |
| Pyritic | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Oxide | 67.7 | 99.6 | 99.7 | 100.0 | 0.0 |
| Veined | 0.0 | 0.0 | 0.0 | 0.0 | 91.6 |
| Grain Size | 29.3 | 40.1 | 44.3 | 42.3 | 0.0 |
| T1 | 7.6 | 8.5 | 7.6 | 8.0 | 38.9 |
| T2 | 31.1 | 51.4 | 48.1 | 49.7 | 7.9 |
| T6 | | | | | 45.0 |
| Mill Feed Ratios | | | | | |
| Zn/Fe | | | | | |
| Zn/Pb | | | | | |
| sPb/Pb | | | | | |
| **Concentrate** Zn | | | | | - |
| Concentrate Pb | **199,659** | **289,443** | **264,275** | **279,641** | **1,033,018** |
| Concentrate Total | **35,029** | **56,150** | **43,798** | **47,404** | **182,381** |
| Concentrate | **234,688** | **345,593** | **308,073** | **327,045** | **1,215,399** |
| **Metal** | | | | | - |
| Zinc in Zn concentrate | 107,398 | 156,528 | 142,469 | 152,370 | 558,765 |
| Lead in Pb concentrate | 18,587 | 29,928 | 23,286 | 25,410 | 97,211 |
| Silver in both concentrates | 1433.04001 | 2158.918836 | 1750.524532 | 1673.581861 | 7016.065239 |
| Lead in Zn concentrate | 12,679 | 13,213 | 13,548 | 9,464 | 48,903 |
| Zinc in Pb concentrate | 4,254 | 4,384 | 3,000 | 3,854 | 15,493 |
| **Production by Pit Phase** | | | | | |
| AQQ PH1 | - | - | - | - | - |
| AQQ PH2 | 552,354 | 760,342 | 494,112 | 616,791 | 2,423,599 |
| AQQ PH3 | 285,941 | 1,209,501 | 1,212,769 | 1,781,543 | 4,489,754 |
| AQQ PH4 | - | - | 68,502 | 492,173 | 560,675 |
| QAN Q1 | 987,920 | 1,266,783 | 1,547,628 | 369,464 | 4,171,795 |
| QAN Q2 | | | | | |

### 3.2.1. Phases and Benches Mined

There are four phases in the Aqqaluk Pit, starting at the highest grade pit (A1) and ending at the ultimate pit (A4). The Qanaiyaq Pit is comprised of two phases, the starter (Q1) and ultimate pit (Q2).

A summary of the benches mined by month is shown in Table 3-4. A graphical summary of all the phases by material type by month is shown in Figure 3-1.

Total materials mined:

- 0.0% mined from AQQ A1
- 17.6% mined from AQQ A2
- 32.6% mined from AQQ A3
- 4.1% mined from AQQ A4
- 30.2% mined from QAN Q1
- 0.0% mined from QAN Q2

The balance of material is reclaimed from existing run-of-mine ore stockpiles.

**Table 3-4 2017 Monthly Material Mined by Benches**

| Bench | Aqqaluk (kt) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M01 | M02 | M03 | M04 | M05 | M06 | M07 | M08 | M09 | M10 | M11 | M12 | Total |
| 1100 | | | | | | | | | | | | | |
| 1075 | | | | | | | | | | | | | |
| 1050 | | | | | | | | | | | 110 | | 110 |
| 1025 | | | | | | | | | | | | | |
| 1000 | | | | | | | | | | | | | |
| 975 | | | | | | | | 69 | | | | | 69 |
| 950 | | 54 | | 176 | 387 | 94 | | | | | | | 711 |
| 925 | | 70 | 162 | 234 | | 319 | 290 | 368 | 554 | 357 | 100 | | 2,453 |
| 900 | | | | | | | | | | 649 | 245 | 431 | 1,325 |
| 875 | | | | | | | | | | | | | |
| 850 | | | | | | | | | | | | | |
| 825 | | | | | | | | | | | | | |
| 800 | | 182 | 70 | | | | | | | | | | 252 |
| 775 | | 141 | 100 | 165 | 139 | 120 | | | | | | | 665 |
| 750 | | 59 | 44 | 150 | | 150 | 174 | 68 | | | | | 646 |
| 725 | | | | | | 36 | | 113 | 138 | 131 | 168 | 110 | 695 |
| 700 | | | | | | | | | | 37 | 62 | 110 | 209 |
| 675 | | | 59 | | | 20 | | | | | | | 79 |
| 650 | | | | | | | | | | | | | |
| Total | | 506 | 435 | 725 | 526 | 739 | 464 | 619 | 692 | 1,174 | 684 | 651 | 7,215 |

| Bench | Qanaiyaq (kt) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | M01 | M02 | M03 | M04 | M05 | M06 | M07 | M08 | M09 | M10 | M11 | M12 | Total |
| 1525 | | | | | | | | | | | | | |
| 1500 | | | | | | | | | | | | | |
| 1475 | | | | | | | | | | | | | |
| 1450 | | | | | | | | | | | | | |
| 1425 | | | | | | | | | | | | | |
| 1400 | | 229 | | | | | | | | | | | 229 |
| 1375 | | 288 | 358 | | | | | | | | | | 646 |
| 1350 | | 126 | 333 | 453 | | 206 | | | | | | | 1,118 |
| 1325 | | | | | 615 | 140 | 488 | | | | | | 1,242 |
| 1300 | | | | | | | 281 | 571 | 468 | | 227 | 143 | 1,690 |
| 1275 | | | | | | | | | | | | | |
| Total | | 644 | 691 | 453 | 615 | 346 | 769 | 571 | 468 | | 227 | 143 | 4,926 |

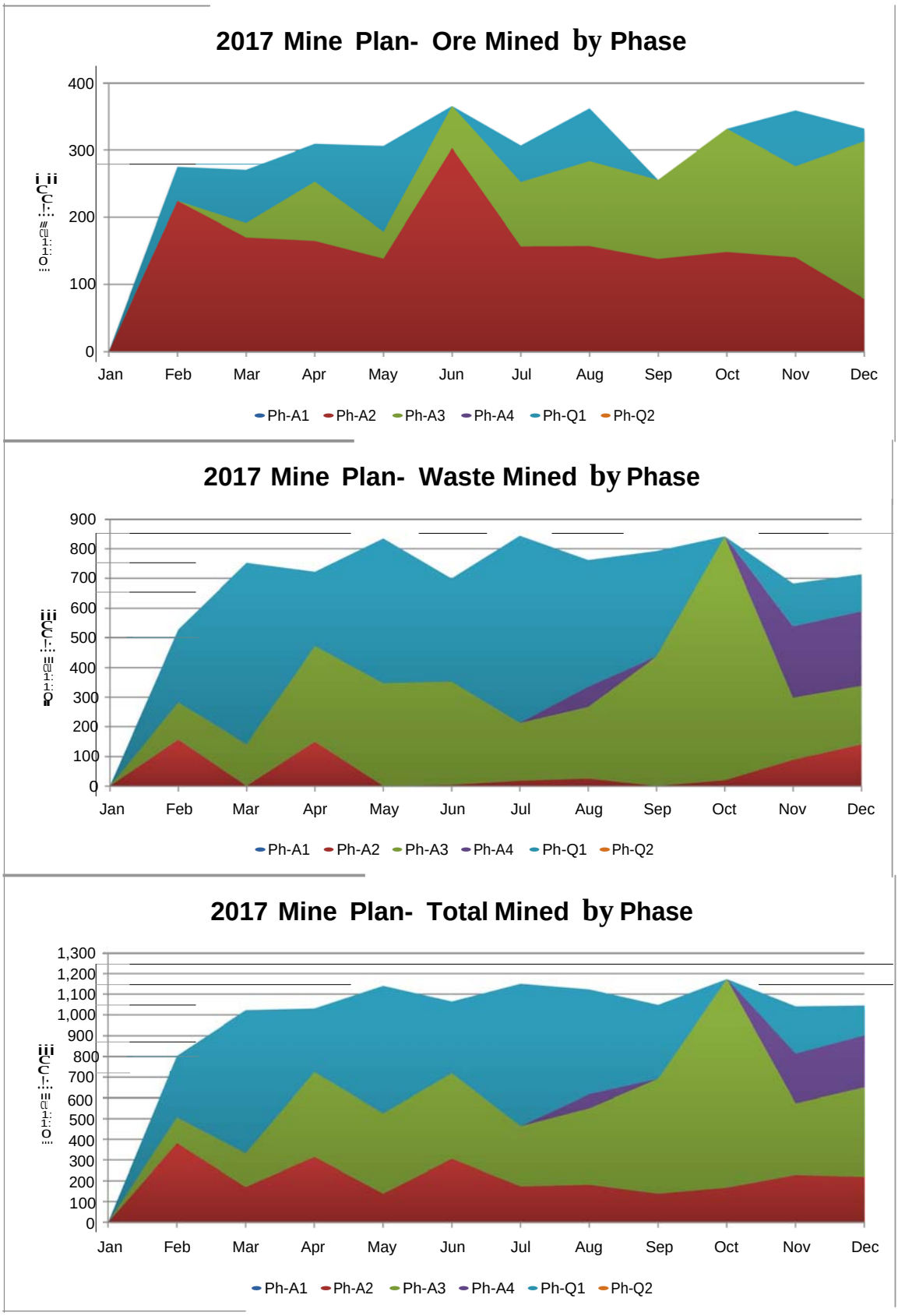


**Figure 3-1 2017 Material Mined by Phase**

### 3.2.2. Material Movement Classification

Material mined is classified as either ore, low grade ore (non-reactive and possibly reactive), non-sulphide ore, possibly reactive waste, non-reactive waste, construction rock, or cover rock. Figure 3-2 shows the material mined by class by month. Figure 3-3 shows the total material moved by destination (stockpile and waste dump) by month.

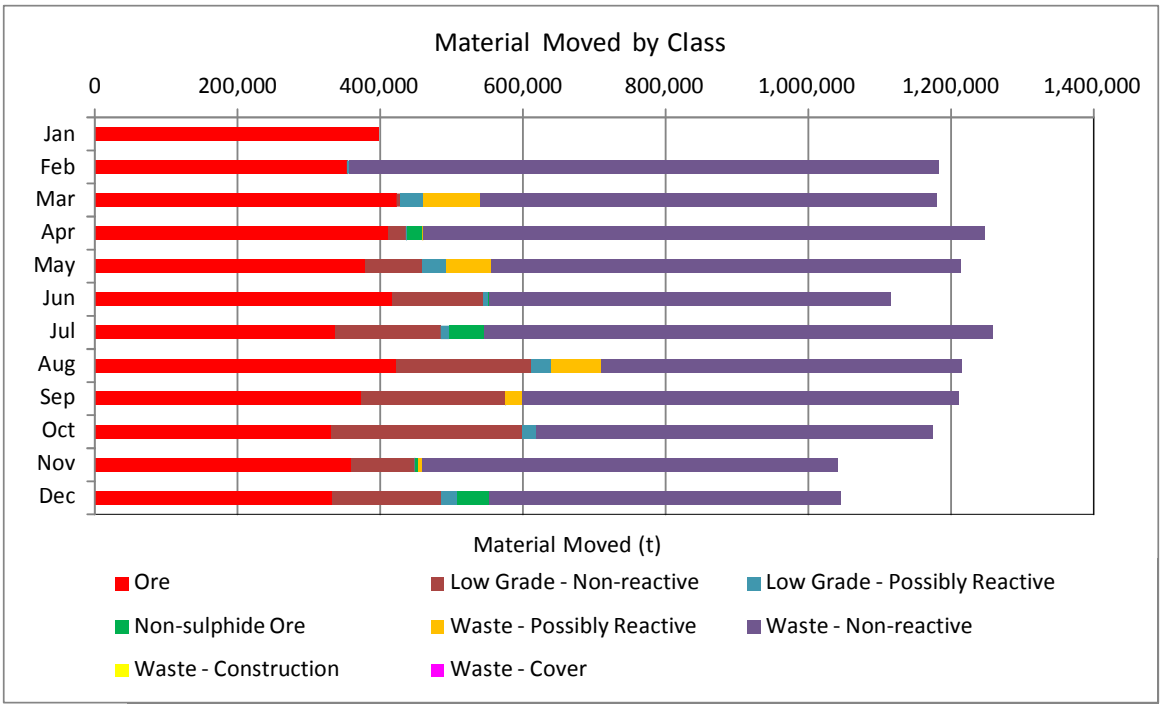


**Figure 3-2 Material Mined by Class**

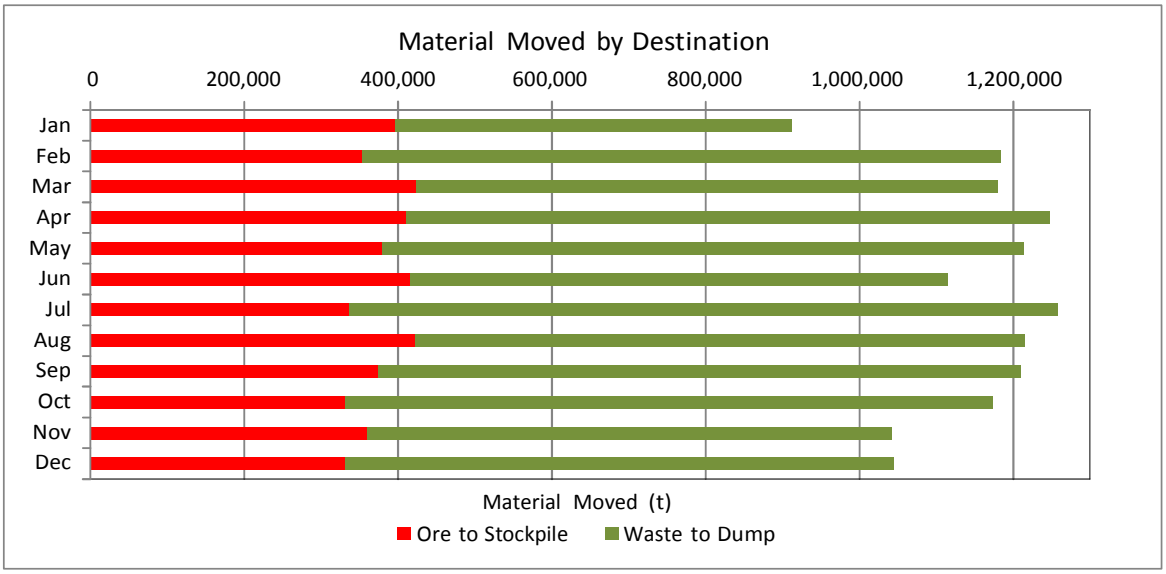


**Figure 3-3 Material Mined by Destination**

### 3.2.3. Monthly Plans

#### 3.2.3.1. 1st Quarter

Total production is 3,243 kt for the 1st Quarter. Ore production is 1,142 kt at XX.X% Zn and X.X% Pb. Table 3-5 gives the 1st Quarter Mine Schedule.

1) January 2017

Total January mine production was 880 kt. Ore production was 365 kt at XX.X% Zn and X.X% Pb.

Waste stripping of the Aqqaluk Pit progressed in the northeast of phase A3 on the 1150 and 950 benches. Mining progressed in phase A2 on the 800 and 750 benches.

Waste stripping of the Qanaiyaq Pit progressed in phase Q1 from the 1400 and 1375 benches.

2) February 2017

Total February mine production is 1,183 kt. Ore production is 353 kt at XX.X% Zn and X.X% Pb.

Waste stripping of the Aqqaluk Pit progresses in phase A2 on the 775 bench and phase A3 on the 950 and 925 benches. Mining progresses in phase A2 on the 800 and 750 benches (Figure 6-1).

Waste stripping of the Qanaiyaq Pit progresses in phase Q1 from the 1400 and 1375 benches. Mining progresses in phase Q1 from the 1400 and 1375 benches (Figure 6-12).

3) March 2017

Total March mine production is 1,180 kt. Ore production is 423 kt at XX.X% Zn and X.X% Pb.

No waste stripping of the Aqqaluk Pit. Mining progresses in phase A2 on the 925, 800, 775 and 750 benches (Figure 6-2).

Waste stripping of the Qanaiyaq Pit progresses in phase Q1 from the 1375 bench. Mining progresses in phase Q1 from the 1375 and 1350 benches (Figure 6-13).

## Table 3-5 2017 1st Quarter Mine Schedule (by Cuts)

| Q1 | Prediction | | | Jan | | | Feb | | | Mar | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ore | Waste | Total | Ore | Waste | Total | Ore | Waste | Total | Ore | Waste | Total |
| Total Production | 1,141,642 | 2,101,390 | 3,243,032 | 0 | 0 | 0 | 353,462 | 829,598 | 1,183,060 | 422,981 | 756,591 | 1,179,572 |
| Q-W-2 | 11,295 | 0 | 11,295 | | | | 11,295 | 0 | 11,295 | | | |
| A-N1-2 | 22,140 | 0 | 22,140 | | | | 22,140 | 0 | 22,140 | | | |
| Q1350-002 | 161 | 125,621 | 125,782 | | | | 161 | 125,621 | 125,782 | | | |
| A800-217 | 62,735 | 0 | 62,735 | | | | 62,735 | 0 | 62,735 | | | |
| Q1375-009 | 32,134 | 39,393 | 71,527 | | | | 32,134 | 39,393 | 71,527 | | | |
| A925-314 | 0 | 70,049 | 70,049 | | | | 0 | 70,049 | 70,049 | | | |
| A775-166 | 0 | 65,963 | 65,963 | | | | 0 | 65,963 | 65,963 | | | |
| Q1375-010 | 12,335 | 33,341 | 45,676 | | | | 12,335 | 33,341 | 45,676 | | | |
| A800-218 | 48,005 | 0 | 48,005 | | | | 48,005 | 0 | 48,005 | | | |
| Q1400-007 | 0 | 108,968 | 108,968 | | | | 0 | 108,968 | 108,968 | | | |
| A775-165 | 0 | 25,137 | 25,137 | | | | 0 | 25,137 | 25,137 | | | |
| Q1375-008 | 44,222 | 396 | 44,618 | | | | 44,222 | 396 | 44,618 | | | |
| Q1400-004 | 0 | 120,396 | 120,396 | | | | 0 | 120,396 | 120,396 | | | |
| A775-167 | 0 | 50,093 | 50,093 | | | | 0 | 50,093 | 50,093 | | | |
| Q1375-002 | 6,562 | 93,802 | 100,364 | | | | 6,562 | 93,802 | 100,364 | | | |
| A800-219 | 28,477 | 0 | 28,477 | | | | 28,477 | 0 | 28,477 | | | |
| A950-320 | 0 | 54,119 | 54,119 | | | | 0 | 54,119 | 54,119 | | | |
| A800-214 | 42,475 | 0 | 42,475 | | | | 42,475 | 0 | 42,475 | | | |
| A750-124 | 42,921 | 16,147 | 59,068 | | | | 42,921 | 16,147 | 59,068 | | | |
| Q1375-001 | 0 | 26,173 | 26,173 | | | | 0 | 26,173 | 26,173 | | | |
| A800-221 | 32,532 | 0 | 32,532 | | | | | | | 32,532 | 0 | 32,532 |
| Q1375-007 | 0 | 97,343 | 97,343 | | | | | | | 0 | 97,343 | 97,343 |
| Q1350-004 | 6,808 | 104,556 | 111,364 | | | | | | | 6,808 | 104,556 | 111,364 |
| A775-168 | 99,970 | 0 | 99,970 | | | | | | | 99,970 | 0 | 99,970 |
| A750-135 | 39,311 | 4,397 | 43,708 | | | | | | | 39,311 | 4,397 | 43,708 |
| Q1375-006 | 49,126 | 211,531 | 260,657 | | | | | | | 49,126 | 211,531 | 260,657 |
| A800-220 | 37,899 | 0 | 37,899 | | | | | | | 37,899 | 0 | 37,899 |
| 675-103 | 59,024 | 0 | 59,024 | | | | | | | 59,024 | 0 | 59,024 |
| A925-315 | 21,106 | 140,667 | 161,773 | | | | | | | 21,106 | 140,667 | 161,773 |
| Q1350-006 | 21,412 | 128,650 | 150,062 | | | | | | | 21,412 | 128,650 | 150,062 |
| Q1350-005 | 2,110 | 69,447 | 71,557 | | | | | | | 2,110 | 69,447 | 71,557 |
| A-BA-2 | 53,683 | 0 | 53,683 | | | | | | | 53,683 | 0 | 53,683 |

#### 3.2.3.2. 2nd Quarter

Total production is 3,576 kt for the 2nd Quarter. Ore production is 1,206 kt at XX.X% Zn and X.X% Pb. Table 3-6 gives the 2nd Quarter Mine Schedule.

1) April 2017

Total April mine production is 1,248 kt. Ore production is 411 kt at XX.X% Zn and X.X% Pb.

Waste stripping of the Aqqaluk Pit progresses in the center of phase A3 on the 750 bench. Mining progresses in phase A2 on the 950, 925 and 775 benches (Figure 6-3).

Waste stripping in the Qanaiyaq Pit progresses in phase Q1 on the 1350 bench. Mining progresses in phase Q1 on the 1350 bench (Figure 6-14).

2) May 2017

Total May mine production is 1,213 kt. Ore production is 379 kt at XX.X% Zn and X.X% Pb.

Waste stripping of the Aqqaluk Pit progresses in the northeast of phase A3 on the 950 bench. Mining progresses in the phase A2 on the 950 and 775 benches (Figure 6-4).

Waste stripping in the Qanaiyaq Pit progresses in phase Q1 on the 1325 bench. Mining progresses in phase Q1 on the 1325 bench (Figure 6-15).

3) June 2017

Total June mine production is 1,115 kt. Ore production is 417 kt at XX.X% Zn and X.X% Pb.

Waste stripping of the Aqqaluk Pit progresses in the center of phase A3 on the 925 bench. Mining progresses in phase A2 on the 775, 725 and 675 benches and in phase A3 on the 925 bench (Figure 6-5).

Waste stripping in the Qanaiyaq Pit progresses in phase Q1 on the 1350 bench. Mining progresses in phase Q1 on the 1375 bench (Figure 6-16).

## Table 3-6 2017 2nd Quarter Mine Schedule (by Cuts)

| Q2 | Prediction | | | Apr | | | May | | | Jun | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ore | Waste | Total | Ore | Waste | Total | Ore | Waste | Total | Ore | Waste | Total |
| Total Production | 1,206,288 | 2,369,660 | 3,575,948 | 410,949 | 836,557 | 1,247,506 | 378,809 | 834,514 | 1,213,323 | 416,530 | 698,589 | 1,115,119 |
| Meth-N-6 | 20,719 | 0 | 20,719 | 20,719 | 0 | 20,719 | | | | | | |
| Meth-N-5 | 19,114 | 0 | 19,114 | 19,114 | 0 | 19,114 | | | | | | |
| Meth-N-4 | 29,366 | 0 | 29,366 | 29,366 | 0 | 29,366 | | | | | | |
| Q1350-003 | 1,130 | 115,102 | 116,232 | 1,130 | 115,102 | 116,232 | | | | | | |
| Q1350-001 | 0 | 134,194 | 134,194 | 0 | 134,194 | 134,194 | | | | | | |
| A750-127 | 0 | 83,977 | 83,977 | 0 | 83,977 | 83,977 | | | | | | |
| A950-317 | 3,139 | 172,734 | 175,873 | 3,139 | 172,734 | 175,873 | | | | | | |
| A925-316 | 49,118 | 51,108 | 100,226 | 49,118 | 51,108 | 100,226 | | | | | | |
| A775-173 | 57,745 | 0 | 57,745 | 57,745 | 0 | 57,745 | | | | | | |
| Q1350-008 | 32,405 | 114,538 | 146,943 | 32,405 | 114,538 | 146,943 | | | | | | |
| A775-174 | 107,472 | 0 | 107,472 | 107,472 | 0 | 107,472 | | | | | | |
| Q1350-007 | 54,748 | 1,336 | 56,084 | 54,748 | 1,336 | 56,084 | | | | | | |
| A750-126 | 0 | 66,229 | 66,229 | 0 | 66,229 | 66,229 | | | | | | |
| A925-317 | 35,993 | 97,339 | 133,332 | 35,993 | 97,339 | 133,332 | | | | | | |
| Meth-N-2 | 54,013 | 0 | 54,013 | | | | 54,013 | 0 | 54,013 | | | |
| Meth-N-3 | 11,463 | 0 | 11,463 | | | | 11,463 | 0 | 11,463 | | | |
| Meth-N-1 | 7,042 | 0 | 7,042 | | | | 7,042 | 0 | 7,042 | | | |
| A950-321 | 23,688 | 46,859 | 70,547 | | | | 23,688 | 46,859 | 70,547 | | | |
| Q1325-002 | 0 | 134,029 | 134,029 | | | | 0 | 134,029 | 134,029 | | | |
| Q1325-004 | 3,238 | 130,170 | 133,408 | | | | 3,238 | 130,170 | 133,408 | | | |
| A950-324 | 9,891 | 65,605 | 75,496 | | | | 9,891 | 65,605 | 75,496 | | | |
| A775-177 | 86,461 | 0 | 86,461 | | | | 86,461 | 0 | 86,461 | | | |
| A775-176 | 52,261 | 0 | 52,261 | | | | 52,261 | 0 | 52,261 | | | |
| Q1325-005 | 79,915 | 32,275 | 112,190 | | | | 79,915 | 32,275 | 112,190 | | | |
| A950-318 | 0 | 93,070 | 93,070 | | | | 0 | 93,070 | 93,070 | | | |
| Q1325-003 | 44,204 | 75,116 | 119,320 | | | | 44,204 | 75,116 | 119,320 | | | |
| Q1325-001 | 0 | 115,750 | 115,750 | | | | 0 | 115,750 | 115,750 | | | |
| A950-323 | 6,633 | 79,605 | 86,238 | | | | 6,633 | 79,605 | 86,238 | | | |
| A950-322 | 0 | 62,035 | 62,035 | | | | 0 | 62,035 | 62,035 | | | |
| Meth-S-1 | 30,615 | 0 | 30,615 | | | | | | | 30,615 | 0 | 30,615 |
| A925-318 | 5,304 | 117,719 | 123,023 | | | | | | | 5,304 | 117,719 | 123,023 |
| A750-130 | 70,095 | 0 | 70,095 | | | | | | | 70,095 | 0 | 70,095 |
| A750-129 | 80,083 | 0 | 80,083 | | | | | | | 80,083 | 0 | 80,083 |
| Q1325-007 | 0 | 140,044 | 140,044 | | | | | | | 0 | 140,044 | 140,044 |
| A950-325 | 7,154 | 86,502 | 93,656 | | | | | | | 7,154 | 86,502 | 93,656 |
| A775-175 | 59,615 | 1,371 | 60,986 | | | | | | | 59,615 | 1,371 | 60,986 |
| A925-319 | 3,387 | 100,264 | 103,651 | | | | | | | 3,387 | 100,264 | 103,651 |
| A725-117 | 34,069 | 1,651 | 35,720 | | | | | | | 34,069 | 1,651 | 35,720 |
| A775-178 | 59,313 | 0 | 59,313 | | | | | | | 59,313 | 0 | 59,313 |
| 675-104 | 20,047 | 0 | 20,047 | | | | | | | 20,047 | 0 | 20,047 |
| A925-330 | 46,848 | 45,506 | 92,354 | | | | | | | 46,848 | 45,506 | 92,354 |
| Q1350-009 | 0 | 205,532 | 205,532 | | | | | | | 0 | 205,532 | 205,532 |

#### 3.2.3.3. 3rd Quarter

Total production is 3,683 kt for the 3rd quarter. Ore production is 1,132 kt at XX.X% Zn and X.X% Pb. Table 3-7 gives the 3rd Quarter Mine Schedule.

1) July 2017

Total July mine production is 1,257 kt. Ore production is 336 kt at 12.7% Zn and 4.5% Pb.

Waste stripping of the Aqqaluk Pit progresses in phase A2 on the 750 bench. Mining progresses in phase A2 on the 925 and 750 benches (Figure 6-6).

Waste stripping in the Qanaiyaq Pit progresses in phase Q1 on the 1325 and 1300 benches. Mining progresses in phase Q1 on the 1325 bench (Figure 6-17).

2) August 2017

Total August mine production is 1,215 kt. Ore production is 422 kt at XX.X% Zn and X.X% Pb.

Waste stripping of the Aqqaluk Pit progresses in the southeast of phase A3 on the 975 bench. Mining progresses in phase A3 on 925 bench and A2 on the 725 bench (Figure 6-7).

Waste stripping in the Qanaiyaq Pit progresses in phase Q1 on the 1350 and 1300 benches. Mining progresses in phase Q1 on the 1325 bench (Figure 6-18).

3) September 2017

Total September mine production is 1,210 kt. Ore production is 374 kt at XX.X% Zn and X.X% Pb.

Waste stripping of the Aqqaluk Pit progresses in the east phase A3 on the 925 bench. Mining progresses in phase A3 on the 925 bench and phase A2 on the 725 bench (Figure 6-8).

Waste stripping scheduled in the Qanaiyaq Pit progresses in phase Q1 on the 1300 bench. Mining progresses in phase Q1 on the 1300 bench (Figure 6-19).

September is the last month scheduled for capital projects and quarrying.

## Table 3-7 2017 3rd Quarter Mine Schedule (by Cuts)

| Q3 | Prediction | | | Jul | | | Aug | | | Sep | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ore | Waste | Total | Ore | Waste | Total | Ore | Waste | Total | Ore | Waste | Total |
| Total Production | 1,132,190 | 2,550,369 | 3,682,559 | 336,287 | 921,142 | 1,257,429 | 422,267 | 792,937 | 1,215,204 | 373,636 | 836,290 | 1,209,926 |
| 1604-02 | 24,012 | 0 | 24,012 | 24,012 | 0 | 24,012 | | | | | | |
| A750-131 | 51,419 | 0 | 51,419 | 51,419 | 0 | 51,419 | | | | | | |
| Q1325-010 | 5,454 | 77,168 | 82,622 | 5,454 | 77,168 | 82,622 | | | | | | |
| Q1300-001 | 0 | 108,839 | 108,839 | 0 | 108,839 | 108,839 | | | | | | |
| A750-132 | 57,979 | 0 | 57,979 | 57,979 | 0 | 57,979 | | | | | | |
| Q1325-006 | 1,255 | 152,651 | 153,906 | 1,255 | 152,651 | 153,906 | | | | | | |
| Q1325-009 | 52,905 | 36,277 | 89,182 | 52,905 | 36,277 | 89,182 | | | | | | |
| A750-128 | 0 | 17,016 | 17,016 | 0 | 17,016 | 17,016 | | | | | | |
| A750-133 | 47,478 | 0 | 47,478 | 47,478 | 0 | 47,478 | | | | | | |
| Q1300-002 | 0 | 172,542 | 172,542 | 0 | 172,542 | 172,542 | | | | | | |
| A925-331 | 44,471 | 131,597 | 176,068 | 44,471 | 131,597 | 176,068 | | | | | | |
| A925-329 | 51,314 | 63,067 | 114,381 | 51,314 | 63,067 | 114,381 | | | | | | |
| Q1325-008 | 0 | 161,985 | 161,985 | 0 | 161,985 | 161,985 | | | | | | |
| 1604-03 | 25,465 | 0 | 25,465 | | | | 25,465 | 0 | 25,465 | | | |
| A925-328 | 15,690 | 64,103 | 79,793 | | | | 15,690 | 64,103 | 79,793 | | | |
| Q1300-011 | 12,747 | 71,912 | 84,659 | | | | 12,747 | 71,912 | 84,659 | | | |
| A725-125 | 48,089 | 0 | 48,089 | | | | 48,089 | 0 | 48,089 | | | |
| A925-332 | 17,911 | 59,616 | 77,527 | | | | 17,911 | 59,616 | 77,527 | | | |
| A975-278 | 0 | 68,502 | 68,502 | | | | 0 | 68,502 | 68,502 | | | |
| A925-327 | 28,512 | 56,272 | 84,784 | | | | 28,512 | 56,272 | 84,784 | | | |
| A750-134 | 68,497 | 0 | 68,497 | | | | 68,497 | 0 | 68,497 | | | |
| Q1300-003 | 0 | 148,437 | 148,437 | | | | 0 | 148,437 | 148,437 | | | |
| Q1300-009 | 34,374 | 31,477 | 65,851 | | | | 34,374 | 31,477 | 65,851 | | | |
| Q1300-010 | 28,461 | 30,005 | 58,466 | | | | 28,461 | 30,005 | 58,466 | | | |
| A725-118 | 41,045 | 24,302 | 65,347 | | | | 41,045 | 24,302 | 65,347 | | | |
| Q1300-008 | 37,299 | 176,376 | 213,675 | | | | 37,299 | 176,376 | 213,675 | | | |
| A925-320 | 64,177 | 61,935 | 126,112 | | | | 64,177 | 61,935 | 126,112 | | | |
| 1604-04 | 28,441 | 0 | 28,441 | | | | | | | 28,441 | 0 | 28,441 |
| 1604-01 | 21,225 | 0 | 21,225 | | | | | | | 21,225 | 0 | 21,225 |
| Q1300-007 | 0 | 143,988 | 143,988 | | | | | | | 0 | 143,988 | 143,988 |
| Q1300-004 | 0 | 211,949 | 211,949 | | | | | | | 0 | 211,949 | 211,949 |
| Q1300-012 | 68,055 | 43,877 | 111,932 | | | | | | | 68,055 | 43,877 | 111,932 |
| A925-335 | 0 | 59,509 | 59,509 | | | | | | | 0 | 59,509 | 59,509 |
| A925-334 | 0 | 63,541 | 63,541 | | | | | | | 0 | 63,541 | 63,541 |
| A925-324 | 43,603 | 45,759 | 89,362 | | | | | | | 43,603 | 45,759 | 89,362 |
| A925-326 | 20,648 | 59,108 | 79,756 | | | | | | | 20,648 | 59,108 | 79,756 |
| A725-127 | 57,454 | 0 | 57,454 | | | | | | | 57,454 | 0 | 57,454 |
| A925-333 | 0 | 59,315 | 59,315 | | | | | | | 0 | 59,315 | 59,315 |
| A725-126 | 39,998 | 0 | 39,998 | | | | | | | 39,998 | 0 | 39,998 |
| A925-321 | 42,430 | 14,234 | 56,664 | | | | | | | 42,430 | 14,234 | 56,664 |
| A925-336 | 9,100 | 43,181 | 52,281 | | | | | | | 9,100 | 43,181 | 52,281 |
| A925-325 | 1,847 | 91,829 | 93,676 | | | | | | | 1,847 | 91,829 | 93,676 |
| A725-128 | 40,835 | 0 | 40,835 | | | | | | | 40,835 | 0 | 40,835 |

#### 3.2.3.4. 4th Quarter

Total production is 3,260 kt for the 4th quarter. Ore production is 1,023 kt at XX.X% Zn and X% Pb. Table 3-8 gives the 4th Quarter Mine Schedule.

1) October 2017

Total October mine production is 1,174 kt. Ore production is 332 kt at XX.X% Zn and X% Pb.

Waste stripping of the Aqqaluk Pit progresses in the northwest of phase A3 on the 1050 bench. Mining progresses in phase A2 on the 725 bench and in phase A3 on the 925 and 900 benches (Figure 6-19).

No waste stripping of the Qanaiyaq Pit (Figure 6-16). No mining of the Qanaiyaq Pit (Figure 6-20).

2) November 2017

Total November mine production is 1,041 kt. Ore production is 359 kt at XX.X% Zn and X% Pb.

Waste stripping of the Aqqaluk Pit progresses in phase A3 on the 1150 and 1050 benches. Mining progresses in phase A3 on the 925 and 900 benches and in phase A2 on the 725 and 700 benches (Figure 6-10).

Waste stripping of the Qanaiyaq Pit progresses in the phase Q1 from the 1300 bench. Mining progresses in phase Q1 from the 1300 bench (Figure 6-21).

3) December 2017

Total December mine production is 1,045kt. Ore production is 332 kt at XX.X% Zn and X% Pb.

Waste stripping of the Aqqaluk Pit progresses in the northeast of phase A3 on the 1150 and 1125 benches and phase A2 on the 725 bench. Mining progresses in phase A2 on 700 bench and in phase A3 on the 900 bench (Figure 6-11).

No waste stripping of the Qanaiyaq Pit (Figure 6-18). Mining progresses in phase Q1 from the 1300 bench (Figure 6-22).

## Table 3-8 2017 4th Quarter Mine Schedule (by Cuts)

| Q4 | Prediction | | | Oct | | | Nov | | | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Ore | Waste | Total | Ore | Waste | Total | Ore | Waste | Total | Ore | Waste | Total |
| Total Production | 1,022,782 | 2,237,189 | 3,259,971 | 331,617 | 842,149 | 1,173,766 | 359,172 | 682,126 | 1,041,298 | 331,993 | 712,914 | 1,044,907 |
| A925-323 | 26,557 | 70,284 | 96,841 | 26,557 | 70,284 | 96,841 | | | | | | |
| A900-359 | 3,222 | 152,213 | 155,435 | 3,222 | 152,213 | 155,435 | | | | | | |
| A725-129 | 33,896 | 0 | 33,896 | 33,896 | 0 | 33,896 | | | | | | |
| A900-361 | 12,046 | 158,206 | 170,252 | 12,046 | 158,206 | 170,252 | | | | | | |
| A925-337 | 13,299 | 73,925 | 87,224 | 13,299 | 73,925 | 87,224 | | | | | | |
| A700-113 | 37,152 | 0 | 37,152 | 37,152 | 0 | 37,152 | | | | | | |
| A725-130 | 43,362 | 0 | 43,362 | 43,362 | 0 | 43,362 | | | | | | |
| A900-362 | 73,676 | 105,791 | 179,467 | 73,676 | 105,791 | 179,467 | | | | | | |
| A925-338 | 11,619 | 42,522 | 54,141 | 11,619 | 42,522 | 54,141 | | | | | | |
| A925-322 | 42,433 | 75,999 | 118,432 | 42,433 | 75,999 | 118,432 | | | | | | |
| A725-119 | 34,290 | 19,052 | 53,342 | 34,290 | 19,052 | 53,342 | | | | | | |
| A900-360 | 65 | 144,157 | 144,222 | 65 | 144,157 | 144,222 | | | | | | |
| A925-339 | 79,188 | 20,427 | 99,615 | | | | 79,188 | 20,427 | 99,615 | | | |
| A1050-220 | 0 | 110,292 | 110,292 | | | | 0 | 110,292 | 110,292 | | | |
| A725-120 | 25,643 | 26,581 | 52,224 | | | | 25,643 | 26,581 | 52,224 | | | |
| A1150-102 | 0 | 63,462 | 63,462 | | | | 0 | 63,462 | 63,462 | | | |
| A700-114 | 61,552 | 0 | 61,552 | | | | 61,552 | 0 | 61,552 | | | |
| Q1300-013 | 82,881 | 41,310 | 124,191 | | | | 82,881 | 41,310 | 124,191 | | | |
| A1150-103 | 0 | 67,142 | 67,142 | | | | 0 | 67,142 | 67,142 | | | |
| A725-121 | 19,055 | 36,456 | 55,511 | | | | 19,055 | 36,456 | 55,511 | | | |
| A900-363 | 56,550 | 188,254 | 244,804 | | | | 56,550 | 188,254 | 244,804 | | | |
| A725-122 | 34,303 | 25,566 | 59,869 | | | | 34,303 | 25,566 | 59,869 | | | |
| Q1300-005 | 0 | 102,636 | 102,636 | | | | 0 | 102,636 | 102,636 | | | |
| A900-366 | 64,805 | 71,514 | 136,319 | | | | | | | 64,805 | 71,514 | 136,319 |
| A725-124 | 0 | 51,745 | 51,745 | | | | | | | 0 | 51,745 | 51,745 |
| A1150-100 | 0 | 70,292 | 70,292 | | | | | | | 0 | 70,292 | 70,292 |
| Q1300-014 | 18,931 | 123,706 | 142,637 | | | | | | | 18,931 | 123,706 | 142,637 |
| A700-109 | 33,375 | 24,298 | 57,673 | | | | | | | 33,375 | 24,298 | 57,673 |
| A1150-105 | 0 | 53,770 | 53,770 | | | | | | | 0 | 53,770 | 53,770 |
| A725-123 | 0 | 57,975 | 57,975 | | | | | | | 0 | 57,975 | 57,975 |
| A700-108 | 45,394 | 7,096 | 52,490 | | | | | | | 45,394 | 7,096 | 52,490 |
| A900-365 | 84,565 | 49,997 | 134,562 | | | | | | | 84,565 | 49,997 | 134,562 |
| A900-364 | 84,923 | 75,306 | 160,229 | | | | | | | 84,923 | 75,306 | 160,229 |
| A1125-125 | 0 | 61,699 | 61,699 | | | | | | | 0 | 61,699 | 61,699 |
| A1150-104 | 0 | 65,516 | 65,516 | | | | | | | 0 | 65,516 | 65,516 |

### 3.3. 2017 Dumping Plan

The waste dumping plan for 2017 follows the long term plan as the 986 ft lift of the Tailings Dam was completed in 2016. All waste rock will be hauled to the south end of the Main Pit Dump, with Possibly Reactive rock dumped only on the MPD_850 Lift and Non-reactive waste rock dumped on the MPD_850, MPD_904, and MPD_1015 Lifts. Subzones 4 and 5 of the MPD_850 Lift, 2 through 4 of the MPD_904 Lift, and 1 through 3 of the MPD_1015 Lift will be filled. Other dumping locations planned for 2017 will be the LGO_1155_02 Lift for Low Grade Non-reactive ore and the OXD_1344 Lift for Oxide ore. These dumping locations are shown in Figure 3-4.

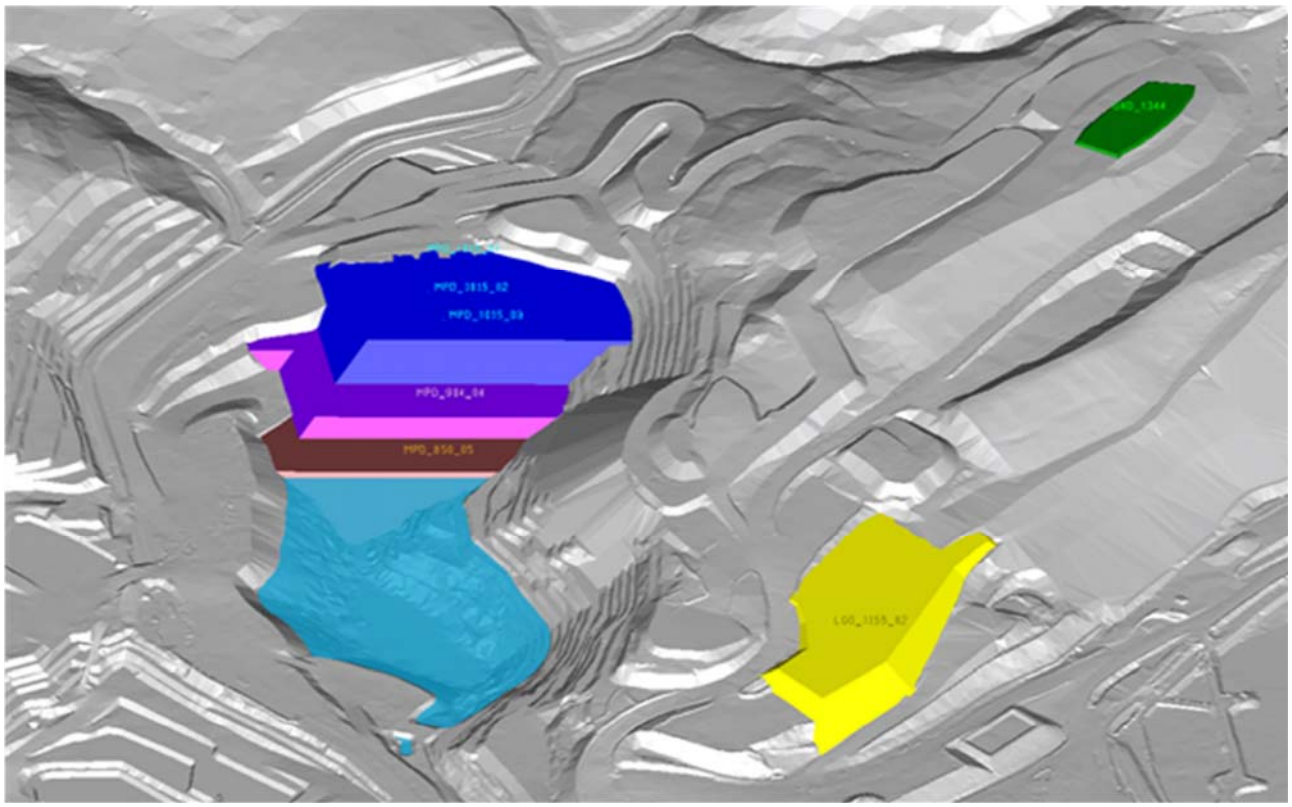


**Figure 3-4 2017 Dumps**

# SECTION 4. EQUIPMENT FLEETS

## 4.1. Summary

Equipment required to achieve the 2017 plan is the same as 2016.

The current major equipment fleets and planned operating metrics are listed in Table 4-1.

**Table 4-1 Current Fleet and Operating Metrics**

| Equipment | Description | Units Available | Physical Availability | Use of Availability | Operating Efficiency | Asset Utilization |
|---|---|---|---|---|---|---|
| Drills | DML | 3 | 79.0% | 66.0% | 85.0% | 45.7% |
| Trucks | 777 | 10 | 79.0% | 90.0% | 87.0% | 61.9% |
| Loaders | 993 | 5 | 80.0% | 90.0% | 85.0% | 61.2% |
| Dozers | D9's & D10 | 4 | 81.0% | 59.0% | 85.0% | 40.6% |

## 4.2. 2017 Equipment Requirements

All planned project hours and forecast production hours were considered when determining the fleet requirements for the 2017 mine plan.

Table 4-2 gives the equipment hours needed for site projects and the tasks for which those hours will be used.

**Table 4-2 Monthly Project Hours**

| Projects | Jan-17 | Feb-17 | Mar-17 | Apr-17 | May-17 | Jun-17 | Jul-17 | Aug-17 | Sep-17 | Oct-17 | Nov-17 | Dec-17 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | 365 |
| Non-Capital Project | | | | | | | | | | | | | |
| Drill hours | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Loader hours | 0 | 0 | 0 | 17 | 32 | 29 | 29 | 47 | 42 | 0 | 0 | 0 | 197 |
| Haultruck hours | 0 | 0 | 0 | 40 | 77 | 70 | 70 | 113 | 100 | 0 | 0 | 0 | 470 |
| Dozer hours | 19 | 17 | 19 | 18 | 19 | 18 | 19 | 19 | 18 | 19 | 18 | 19 | 218 |
| Quarry and Crush (DD2 / MS) | | | | | | | | | | | | | |
| Drill hours | 0 | 25 | 25 | 25 | 100 | 80 | 90 | 50 | 30 | 0 | 0 | 0 | 425 |
| Loader hours | 0 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 10 | 0 | 0 | 0 | 185 |
| Haultruck hours | 0 | 25 | 25 | 100 | 100 | 100 | 100 | 100 | 75 | 0 | 0 | 0 | 625 |
| Dozer hours | 0 | 20 | 20 | 20 | 20 | 20 | 20 | 15 | 15 | 0 | 0 | 0 | 150 |
| MS6 Regrading | | | | | | | | | | | | | |
| Drill hours | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Loader hours | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Haultruck hours | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Dozer hours | 0 | 0 | 0 | 0 | 50 | 90 | 90 | 90 | 45 | 0 | 0 | 0 | 365 |
| Back Dam | | | | | | | | | | | | | |
| Drill hours | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Loader hours | 0 | 0 | 0 | 0 | 30 | 30 | 30 | 0 | 0 | 0 | 0 | 0 | 90 |
| Haultruck hours | 0 | 0 | 0 | 0 | 50 | 50 | 25 | 0 | 0 | 0 | 0 | 0 | 125 |
| Dozer hours | 0 | 0 | 0 | 0 | 35 | 35 | 35 | 0 | 0 | 0 | 0 | 0 | 105 |
| B-Pad | | | | | | | | | | | | | |
| Drill hours | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Loader hours | 0 | 0 | 0 | 0 | 0 | 40 | 40 | 40 | 35 | 0 | 0 | 0 | 155 |
| Haultruck hours | 0 | 0 | 0 | 0 | 0 | 300 | 300 | 300 | 300 | 0 | 0 | 0 | 1200 |
| Dozer hours | 0 | 0 | 0 | 0 | 0 | 60 | 30 | 30 | 30 | 0 | 0 | 0 | 150 |
| Total | | | | | | | | | | | | | |
| Drill hours | 0 | 25 | 25 | 25 | 100 | 80 | 90 | 50 | 30 | 0 | 0 | 0 | 425 |
| Loader hours | 0 | 25 | 25 | 42 | 87 | 124 | 124 | 112 | 87 | 0 | 0 | 0 | 627 |
| Haultruck hours | 0 | 25 | 25 | 140 | 227 | 520 | 495 | 513 | 475 | 0 | 0 | 0 | 2420 |
| Dozer hours | 19 | 37 | 39 | 38 | 124 | 223 | 194 | 154 | 108 | 19 | 18 | 19 | 988 |

Table 4-3 contains details on the number of units required in 2017.

## Table 4-3 2017 Monthly Equipment Forecast

| Drill Summary | Units | M01 | M02 | M03 | M04 | M05 | M06 | M07 | M08 | M09 | M10 | M11 | M12 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **DM-L Drill** | | | | | | | | | | | | | | |
| Units Available | ea | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 |
| Units Required | ea | 3.0 | 2.8 | 2.6 | 2.8 | 3.0 | 3.0 | 3.0 | 3.0 | 3.0 | 2.5 | 3.0 | 2.7 | 2.9 |
| Hours Available per unit | op hrs | 330 | 298 | 330 | 319 | 330 | 324 | 365 | 365 | 338 | 330 | 348 | 330 | 4,005 |
| Hours Used per unit | op hrs | 11 | 276 | 288 | 296 | 330 | 327 | 367 | 362 | 336 | 278 | 345 | 296 | 3,512 |
| Ore Drilling Hours Required | op hrs | 0 | 298 | 352 | 324 | 312 | 392 | 330 | 422 | 351 | 356 | 422 | 312 | 3,872 |
| Low Grade Drilling Hours Required | | 0 | 2 | 16 | 11 | 48 | 57 | 68 | 93 | 86 | 38 | 93 | 48 | |
| Waste Drilling Hours Required | op hrs | 0 | 475 | 439 | 495 | 495 | 421 | 580 | 487 | 510 | 407 | 487 | 495 | 5,290 |
| Redrilling Hours Required | op hrs | 33 | 30 | 33 | 32 | 33 | 32 | 33 | 33 | 32 | 33 | 32 | 33 | 387 |
| Project Hours Required | op hrs | 0 | 25 | 25 | 25 | 100 | 80 | 90 | 50 | 30 | 0 | 0 | 0 | 425 |
| **Drilling Hours Required** | **op hrs** | **33** | **829** | **865** | **887** | **989** | **982** | **1,101** | **1,085** | **1,009** | **834** | **1,034** | **889** | 10,535 |
| Availability | % | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% |
| Use of Availability | % | 66.0% | 66.0% | 66.0% | 66.0% | 66.0% | 67.0% | 73.0% | 73.0% | 70.0% | 66.0% | 72.0% | 66.0% | 68.1% |
| Operating Efficiency | % | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% |
| Asset Utilization | % | 44.3% | 44.3% | 44.3% | 44.3% | 44.3% | 45.0% | 49.0% | 49.0% | 47.0% | 44.3% | 48.3% | 44.3% | 45.7% |
| **993/992G Loader** | | | | | | | | | | | | | | |
| Units Available | ea | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 | 5.0 |
| Units Required | ea | 3.9 | 5.0 | 4.7 | 5.0 | 4.8 | 4.9 | 4.9 | 5.0 | 4.9 | 4.4 | 4.2 | 4.1 | 4.6 |
| Hours Available per unit | op hrs | 447 | 402 | 447 | 432 | 447 | 432 | 447 | 447 | 432 | 447 | 432 | 447 | 5,256 |
| Hours Used per unit | op hrs | 347 | 400 | 420 | 434 | 430 | 422 | 437 | 445 | 426 | 392 | 367 | 363 | 4,882 |
| Ore Hours Required | op hrs | 456 | 407 | 487 | 473 | 436 | 479 | 387 | 486 | 430 | 382 | 413 | 382 | 5,218 |
| Reclaim Hours Required | op hrs | 456 | 407 | 487 | 473 | 436 | 479 | 387 | 486 | 430 | 382 | 413 | 382 | 5,218 |
| Waste Hours Required | op hrs | 593 | 955 | 871 | 963 | 960 | 804 | 1,060 | 912 | 962 | 969 | 785 | 820 | 10,654 |
| Non-pit Hours Required | op hrs | 229 | 207 | 229 | 221 | 229 | 221 | 229 | 229 | 221 | 229 | 221 | 229 | 2,694 |
| Project Hours Required | op hrs | 0 | 25 | 25 | 42 | 87 | 124 | 124 | 112 | 87 | 0 | 0 | 0 | 627 |
| **Loading Hours Required** | **op hrs** | **1,734** | **2,000** | **2,098** | **2,172** | **2,148** | **2,108** | **2,187** | **2,226** | **2,131** | **1,961** | **1,833** | **1,813** | 24,411 |
| Availability | % | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% | 80.0% |
| Use of Availability | % | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% |
| Operating Efficiency | % | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% |
| Asset Utilization | % | 61.2% | 61.2% | 61.2% | 61.2% | 61.2% | 61.2% | 61.2% | 61.2% | 61.2% | 61.2% | 61.2% | 61.2% | 61.2% |
| **777 Haul Trucks** | | | | | | | | | | | | | | |
| Units Available | ea | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 | 10.0 |
| Units Required | ea | 6.9 | 9.2 | 8.5 | 9.3 | 8.9 | 9.5 | 9.8 | 9.8 | 9.8 | 8.2 | 7.8 | 7.5 | 8.8 |
| Hours Available per unit | op hrs | 451 | 407 | 451 | 437 | 451 | 437 | 451 | 451 | 437 | 451 | 437 | 451 | 5,313 |
| Hours Used per unit | op hrs | 311 | 375 | 382 | 408 | 403 | 416 | 441 | 444 | 428 | 372 | 340 | 337 | 4,656 |
| Ore Hours Required | op hrs | 1,255 | 1,077 | 1,272 | 1,215 | 1,109 | 1,280 | 1,034 | 1,305 | 1,121 | 1,049 | 1,137 | 1,051 | 13,904 |
| Reclaim Hours Required | op hrs | 366 | 326 | 391 | 379 | 350 | 385 | 311 | 390 | 345 | 306 | 332 | 307 | 4,187 |
| Waste Hours Required | op hrs | 1,381 | 2,224 | 2,028 | 2,243 | 2,237 | 1,873 | 2,470 | 2,126 | 2,242 | 2,258 | 1,829 | 1,911 | 24,822 |
| Non-pit Hours Required | op hrs | 104 | 94 | 104 | 101 | 104 | 101 | 104 | 104 | 101 | 104 | 101 | 104 | 1,226 |
| Project Hours Required | op hrs | 0 | 25 | 25 | 140 | 227 | 520 | 495 | 513 | 475 | 0 | 0 | 0 | 2,420 |
| **Hauling Hours Required** | **op hrs** | **3,107** | **3,747** | **3,820** | **4,078** | **4,027** | **4,158** | **4,414** | **4,438** | **4,284** | **3,718** | **3,398** | **3,373** | 46,559 |
| Availability | % | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% | 79.0% |
| Use of Availability | % | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% | 90.0% |
| Operating Efficiency | % | 87.0% | 87.0% | 87.0% | 87.0% | 87.0% | 87.0% | 87.0% | 87.0% | 87.0% | 87.0% | 87.0% | 87.0% | 87.0% |
| Asset Utilization | % | **61.9%** | **61.9%** | **61.9%** | **61.9%** | **61.9%** | **61.9%** | **61.9%** | **61.9%** | **61.9%** | **61.9%** | **61.9%** | **61.9%** | **61.9%** |
| **D9 & D10 Dozers** | | | | | | | | | | | | | | |
| Units Available | ea | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 |
| Units Required | ea | 4.0 | 4.0 | 3.9 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 4.0 | 3.8 | 4.0 | 4.0 | 4.0 |
| Hours Available per unit | op hrs | 293 | 278 | 293 | 299 | 293 | 284 | 293 | 319 | 308 | 293 | 284 | 293 | 3,532 |
| Hours Used per unit | op hrs | 235 | 281 | 287 | 297 | 315 | 320 | 340 | 322 | 308 | 281 | 256 | 259 | 3,500 |
| Ore Hours Required | op hrs | 45 | 40 | 48 | 47 | 43 | 48 | 39 | 48 | 43 | 38 | 41 | 38 | 519 |
| Reclaim Hours Required | op hrs | 159 | 142 | 170 | 165 | 152 | 167 | 135 | 169 | 150 | 133 | 144 | 133 | 1,819 |
| COSP Hours Required | op hrs | 77 | 68 | 82 | 79 | 73 | 80 | 65 | 82 | 72 | 64 | 69 | 64 | 875 |
| Waste Hours Required | op hrs | 365 | 588 | 536 | 592 | 591 | 495 | 652 | 562 | 592 | 596 | 483 | 505 | 6,557 |
| Other Mining Hours Required | op hrs | 250 | 226 | 250 | 242 | 250 | 242 | 250 | 250 | 242 | 250 | 242 | 250 | 2,943 |
| Non-pit Hours Required | op hrs | 25 | 23 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 300 |
| Project Hours Required | op hrs | 19 | 37 | 39 | 38 | 124 | 223 | 194 | 154 | 108 | 19 | 18 | 19 | 988 |
| **Dozing Hours Required** | **op hrs** | **940** | **1,124** | **1,150** | **1,188** | **1,258** | **1,279** | **1,360** | **1,290** | **1,232** | **1,125** | **1,022** | **1,034** | 14,002 |
| Availability | % | 81.0% | 81.0% | 81.0% | 81.0% | 81.0% | 81.0% | 81.0% | 81.0% | 81.0% | 81.0% | 81.0% | 81.0% | 81.0% |
| Use of Availability | % | 59.0% | 62.0% | 59.0% | 62.0% | 59.0% | 59.0% | 59.0% | 64.0% | 64.0% | 59.0% | 59.0% | 59.0% | 60.3% |
| Operating Efficiency | % | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% | 85.0% |
| Asset Utilization | % | 40.6% | 42.7% | 40.6% | 42.7% | 40.6% | 40.6% | 40.6% | 44.1% | 44.1% | 40.6% | 40.6% | 40.6% | 41.5% |

# SECTION 5. PROJECTS

## 5.1. Dewatering

### 5.1.1. Main Pit Lake (MPL) Dewatering

The MPL has filled to target level of approximately 840 ft. This level is based on a 10 ft freeboard below the nominal in-pit waste dump elevations. Pumping from the Lake continues to maintain the target water level as run off, seepage, Aqqaluk discharge and displacement from waste dumping work to raise the water level. (Figure 5-1)

Discharge from the pump system is currently sent to the Diversion Ponds, and then pumped to the Tailings Storage Facility (TSF) (Stage I). Long term, pipe will be placed along a more direct route from the Main Pit pumps to the TSF (Stage II). Planning for Stage II is tentatively scheduled for 2017.

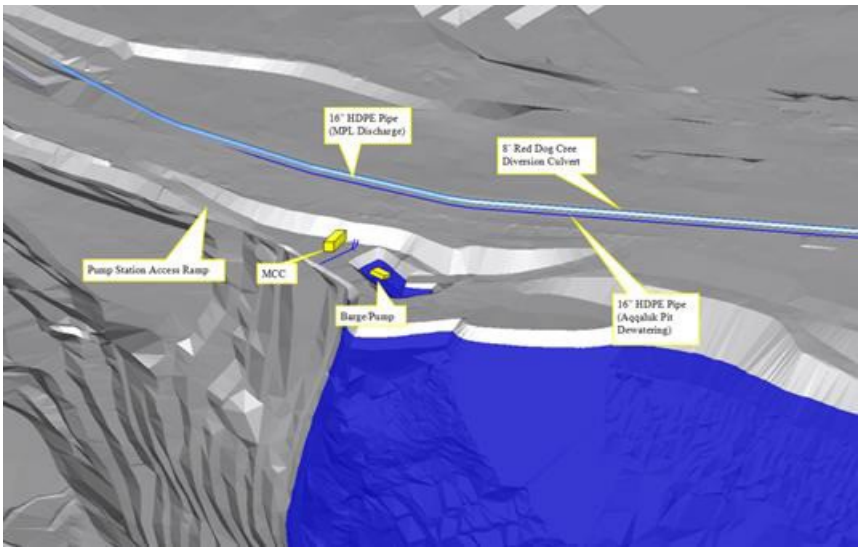


**Figure 5-1 MPL Pumping Station**

### 5.1.2. Aqqaluk Pit Dewatering

Mining activity is taking place in the Aqqaluk and Qanaiyaq pits in 2017. Current pit bottom is at the 700 ft elevation. It will progress to the 675 ft elevation by the end of 2017.

1) Current System (January 2017)

The current system is in Figure 5-2. Water from the lowest bench (700) is pumped by a diesel pump from a blasted sump in the floor of the bench. Water is pumped up a 6" HDPE pipe to the 775 pump-house. Water collects in a sealed sump made of a 6' diameter culvert set on end, and then pumped out of the pit with a submersible electric pump. Currently the 6" insulated and heat traced discharge line is in use. This line discharges into the 16" line on Main Pit Dump 3, which then discharges into MPL near the barge pumps. There is also a 14" line from the pump-house to the 16" line for summer use.

Significant water is seeping from the south wall in Aqqaluk, and creating challenges for drainage of the haul road and blasts along the wall. The source of the water is some combination of MPL, Red Dog Creek Culvert leakage, and hyporheic flow from Red Dog Creek and tributaries. Piezometers were installed in 2016 to measure the water level in the saddle between MPL and Aqqaluk pit, and investigation and planning of mitigations for all three sources are in progress. Some of the possible mitigations are:

- Sealing joints in the Red Dog Creek culvert that are leaking.
- Investigate interception wells or some form of cutoff in the MPL / Aqqaluk saddle.
- Investigate installation of collection ditches and sumps at the toe of the south wall.
- Investigate cutoff walls at the entrances to Red Dog Creek and its tributaries (Shelly, Connie). Drilling may be done this year at the tributaries to measure the hyporheic flow.

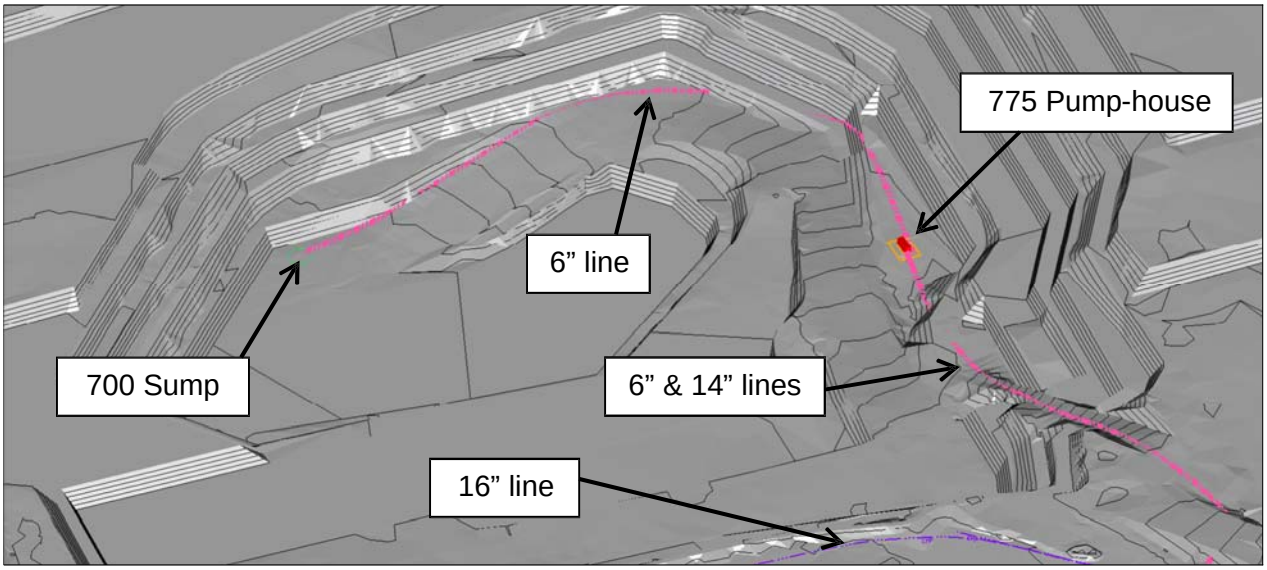


**Figure 5-2 End of Year 2016 Dewatering**

2) South Wall Dewatering (Summer 2017)

The top bench of the current dewatering ramp will be shot in mid-2018. New dewatering pipes will be installed on the south wall of Aqqaluk this year in preparation (Figure 5-3). A 6” insulated winter line and a 14” summer line are planned. The new system will allow both pipes to be used if needed during high flow periods, and will accommodate a second pump if needed.

A contractor will install the 1700’ of 14” pipe required.

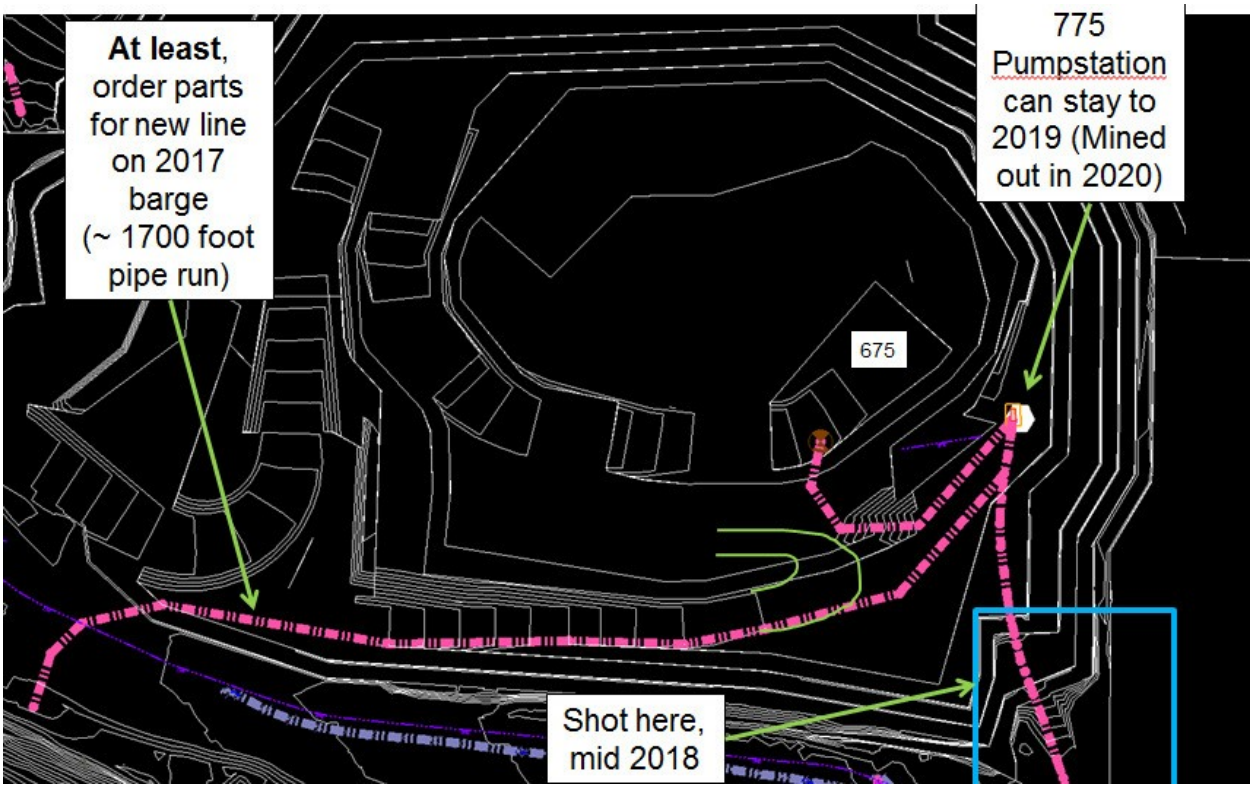


**Figure 5-3 South Wall Dewatering Line**

### 5.1.3. Contact Water Ditch Extension

Ditches and a small dam will be built to a) direct non-contact water into the Shelly Creek diversion culvert and b) direct contact water around the 900 bench and into the sump at the south end of Norm's Knob. The west side of the 900 bench in the Shelly Creek area will need a water collection system, potentially including pumps. The west side of the pit will be inspected to determine if any ditches require extension or adjustment to ensure no contact water is draining into Sulfur Creek. These areas will be evaluated before spring freshet.

### 5.1.4. Qanaiyaq Pit Dewatering

The Qanaiyaq production planned in 2017 will not require any active dewatering, as all mining activity allows water to flow either into the pit or toward existing contact water collection structures. In-pit ditching will be utilized to ensure water is draining in a manner that ensures no impact to surrounding facilities and clean drainages.

## 5.2 Main Waste Stockpile B-Pad

With A-Pad being impacted at a final Tailings Storage facility (TSF) height of 1,006-ft, a new laydown area will be developed on the south end of the Main Waste Stockpile (B-Pad). B-Pad will require stripping of tundra and placement of mine waste. The new footprint will require a revised final location of all utilities and pipes for safe operational use. Permitting for the disturbance of the proposed area is yet to be obtained.

### 5.3 Pit Wall / Dump Stability Monitoring and Failure Mitigation

The following monitoring and mitigation measures are currently in place at Red Dog Mine:

Slope Movement Monitoring

- The Key Creek monitoring hut will be fully functional in January 2017. The Robotic Total Station (RTS) units monitor movement of prisms every 30 minutes and the data is recorded on a screen with alarms set to notify Mine Operations and Mine Technical personnel if prism movement exceeds acceptable rates (At present => 1 foot/day).
- In addition to prisms, RDO has purchased an IBIS-FM, slope stability monitoring radar, to monitor Aqqaluk Pit. The unit was acquired in December 2016 and will be fully implemented in April-May 2017.
- 18 piezometers have been installed in the South Wall of Aqqaluk Pit to monitor seepage from Main Pit Lake. At this time, all the piezometers are showing full saturation (840ft.). Monitoring will continue throughout 2017.
- Additional prisms have been deployed on MPD2, MPD3, MPD4, South East Dump (SED) and West Spur Dump. These prisms are closely monitored for settlement rates and information is disseminated to Mine Operations and Mine Technical departments.

### 5.4 Exploration Drilling

1) Aqqaluk Geotechnical Drilling: Subsequent to drilling within the Aqqaluk pit in 2016, a number of areas have been identified where the rock attributes and geological structures remain insufficiently characterized for mine operational requirements. Additional geotechnical information along the eastern wall of the pit is required by 2018 to determine the ultimate pit slope angle and mitigate the risk of a slope failure. A core drilling and detailed geotechnical core logging program, which includes the use of an acoustic televiewer (ATV), is proposed to address the data gap. The proposed core drilling program consists of drilling 2,765 feet in six holes to get geotechnical information to determine the ultimate pit slope angle in the east wall, but also define shear zones and major structures affecting the wall. Detailed geotechnical data will be sent to Golder Associates for interpretation. Geotechnical drilling is justified given the fact that the eastern area of the pit has already begun to be mined to ultimate pit limits; however, the ultimate pit limits are based on incomplete data and the design will need to be revised as soon as possible. Pit wall slope angles designed without sufficient geotechnical information need to be very conservative and result in an excessively high strip ratio. If they are inadequately designed they pose a risk for a significant slope failure which could result in risk to human life, lost/damaged equipment, extensive production delays, and unnecessary cleanup costs. Obtaining additional geotechnical information for the eastern part of the pit is necessary to avoid these risks.

2) Aqqaluk Extension-East Drilling: Annual follow-up drilling has continued to show the complexity of the orebody in the eastern half of the Aqqaluk pit and highlight that the deposit is insufficiently characterized in that region for mine operational requirements. Additional drilling is required by 2018 to allow classification at the Indicated level and to adequately locate the limits of the eastern pit walls. A core drilling and core logging program is proposed to address the data gap. The proposed core drilling program consists of drilling 2,485 feet in four holes to get information along the eastern pit wall in order to delineate the extent of the Aqqaluk deposit and test the grade continuity of Sub Lower Plate mineralization to ensure the viability of a proposed eastern pit pushback. This subprogram will extend the drilling coverage in the eastern half of the deposit to

convert mineralization from Inferred to Indicated and provide data to evaluate the eastern expansion of the Aqqaluk pit through the Sub Lower Plate mineralization.

3) Aqqaluk Extension-North Drilling: Annual follow-up drilling has continued to show the complexity of the Sub-lower plate in the northeast Aqqaluk pit and to highlight that the deposit is insufficiently characterized in that region to determine beyond a conceptual level if it should be mined by open pit or underground mining methods. Additional drilling is required by 2018 to allow classification at the Indicated level and to adequately locate the limits of the northeastern pit walls. Since road access will be lost after 2017, this drilling is required before the end of 2017 to avoid the significant extra cost of using helicopter support. The proposed core drilling program consists of drilling 13,250 feet in 15 holes to get information along the northeastern pit wall. This subprogram is to extend the drilling coverage to convert mineralization from Inferred to Indicated, delineate the extent of the deposit, and provide data to further evaluate the northeastern expansion of the Aqqaluk pit through the Sub Lower Plate. Due to progressive mining of the Aqqaluk pit, highwalls are being created limiting diamond drill access and eliminating road access to the northern area of the pit. A pit wall pushback to relocate the ultimate pit wall after it has been excavated will substantially increase the amount of waste mining due to minimum mining width considerations.

4) Qanaiyaq Drilling: The proposed drilling program will consist of 155 feet on one geotechnical hole, and 890 feet on five infill holes. The core logging would collect the following geotechnical information from the geotechnical hole: core recovery, rock quality designation, rock strength, degree of weathering, number of fractures per foot, and discontinuity attributes (shape, roughness, infill character, and infill type). In addition, televiewer data will be collected if ground conditions permit, in order to get orientated structural information.

## 5.5 Water Truck Fill Station

Since the mine site fugitive dust contains elevated levels of zinc, lead and cadmium, Red Dog Operations (RDO) is obligated to control the release of these pollutants to wetlands (tundra) and open water bodies under the US Clean Water Act (CWA). Watering the mine roads is the primary method of controlling fugitive dust.

The mine is equipped with a water tanker of 18,000 gallon capacity. Currently the water is refilled by a portable pump at Bon's Creek location, south of the Overburden Pump Back System. Water truck cycle times to the pit area from Bon's Creek fill station are more than 45 minutes and inefficient.

A new fill station is proposed that will significantly reduce the cycle time. The existing white water storage tank will be used. Treated process water from the sand filter building will be the source for the. Routing of pipe and final location for the tank are still being determined.

## 5.6 Emulsion Plant Foundation and Silo Repair

The first stage of this project will involve finalizing the evaluation of the foundation and formulation of a strategy for mitigation.

This project also provides for the demolition of the existing AN silo stairs, walkways and ladders and replacement with new. Included in this project is the addition of the new diverter valve access platform. The silos are located at the emulsion plant, south of the Red Dog Operations facilities. The catwalks, walkways and ladders have been purchased and are on site.

Currently there is limited safe access to the diverter valve if mechanical issues arise. A manlift is the only means to access the valve. Red Dog Operations has a limited number of employees task trained on the man-lift and the demand on the 135-foot manlift on site is high.

This is an improvement project to provide safe access of employees. Current walkways and ladders are showing heavy corrosion and do not meet MSHA codes. According to the Code of Federal Regulations, working platforms shall be of substantial construction, provided with handrails and maintained in good condition. Presently there are no toe boards on the working platforms. The current ladders do not have railed landings every 30 feet or protection cages as required.

## 5.7 Back Dam Causeway

The back dam causeway that began construction in 2016 will be completed in 2017. Much of the material already placed will need to be excavated and replaced in three foot, compacted lifts. This work must take place in summer months when ice is no longer present on the TSF.

## 5.8 Portable Crusher

Crushing operations in the pit and at material sites (DD2, MS-2/9) will continue in 2017 to support material requirements of both Mine Operations and the Surface crew.

## 5.9 Airport Runway Re-surfacing

Results from a 2016 survey show that depressions exceed what is allowed by Federal Aviation Administration (FAA) regulations. Runway deterioration could leave Red Dog without critical air services if this project is delayed.

The settlement dips are the critical driver behind resurfacing in 2017, as they have surpassed the FAA limit of 3” in depth. Recent surveys (2016) indicate depressions of up to 3.9” in the landing area of the runway, and up to 11.5” in the displaced threshold.

In addition, grooving on the runway that promotes drainage is badly worn. A runway survey in 2015 showed that the runway had lost approximately 90% of the pavement grooving at that point. Because of the aforementioned dips and heaves, it is not effective to simply re-groove the runway surface. For further details on the runway settlement and grooving loss, refer to the WH Pacific 2016 Depression Analysis Technical Memorandum in Appendix 3.

The contractor will mobilize paving equipment and a hot mix asphalt batch plant to Seattle where it will be brought to Red Dog via barge. The plant will be set in a location near the runway. The contractor will install edge drains with cleanouts along the perimeter of the project per FAA requirement. Then the existing asphalt will be milled according to designs and specifications. Once milling is completed, a leveling course of asphalt will be placed to bring the existing runway profile to the proper shape. A final course of asphalt will be placed to bring the surface to the design profile. Scheduling will allow for normal aircraft operations on Wednesdays and Saturdays. Crushing of the aggregate for the project will start mid-April, if weather conditions allow. Mobilization of the contractor will begin in May, with supplies and equipment delivered on the first barge. Airport site work will take place from July to September.

# SECTION 6. APPENDICES

## 6.1. 2017 Mine Plan 3D View Maps

**Table 6-1 Legend for Maps**

| Type | Legend | Net Value Cutoff ($/sec) |
|---|---|---|
| Low Grade Ore | | X |
| Ore | | X |
| Ore | | X |
| Ore | | X |

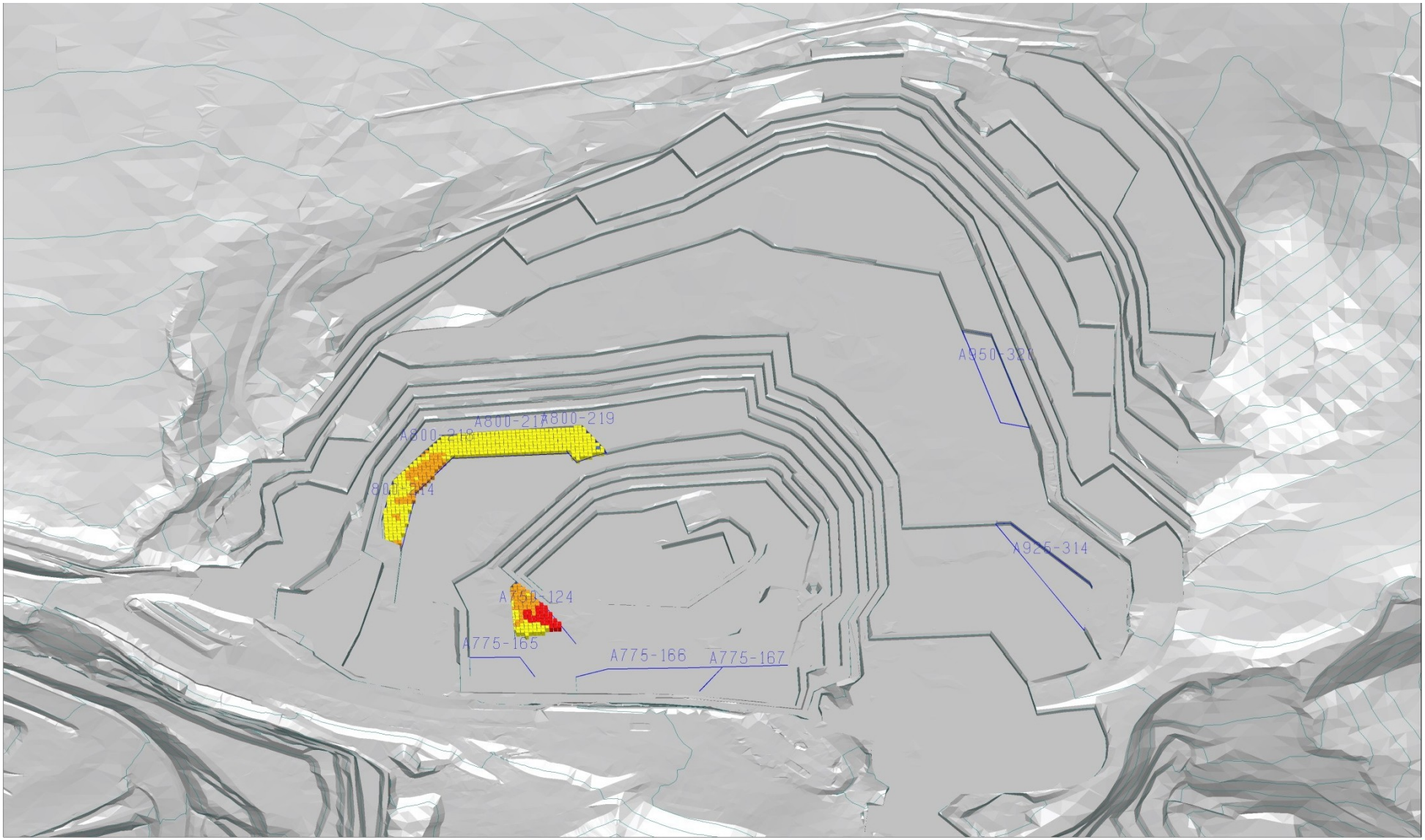


Figure 6-1 February 2017 Mine Plan 30 View (AQQ)

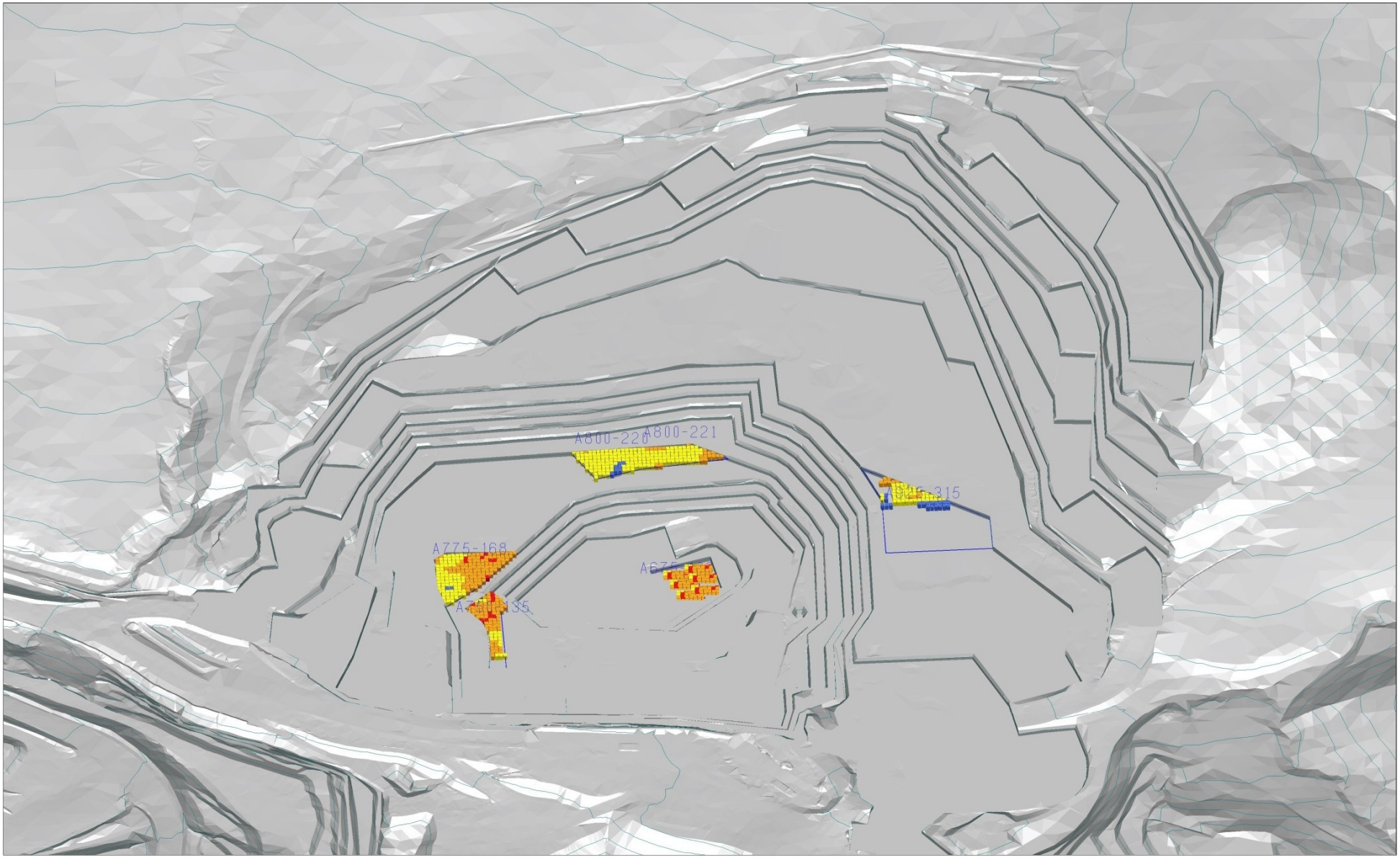


Figure 6-2 March 2017 Mine Plan 30 View (AQQ)

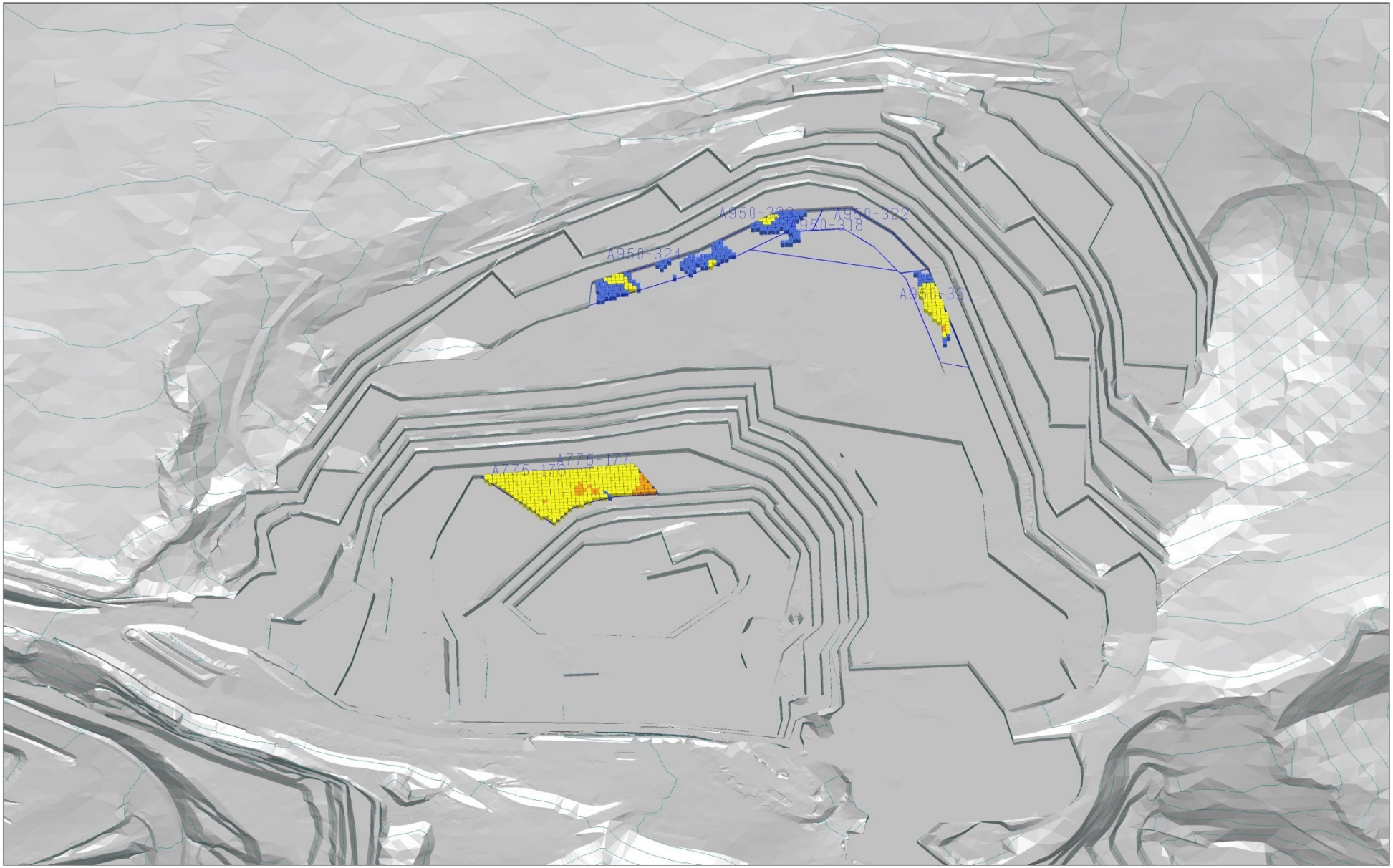


Figure 6-3 April 2017 Mine Plan 30 View (AQQ)

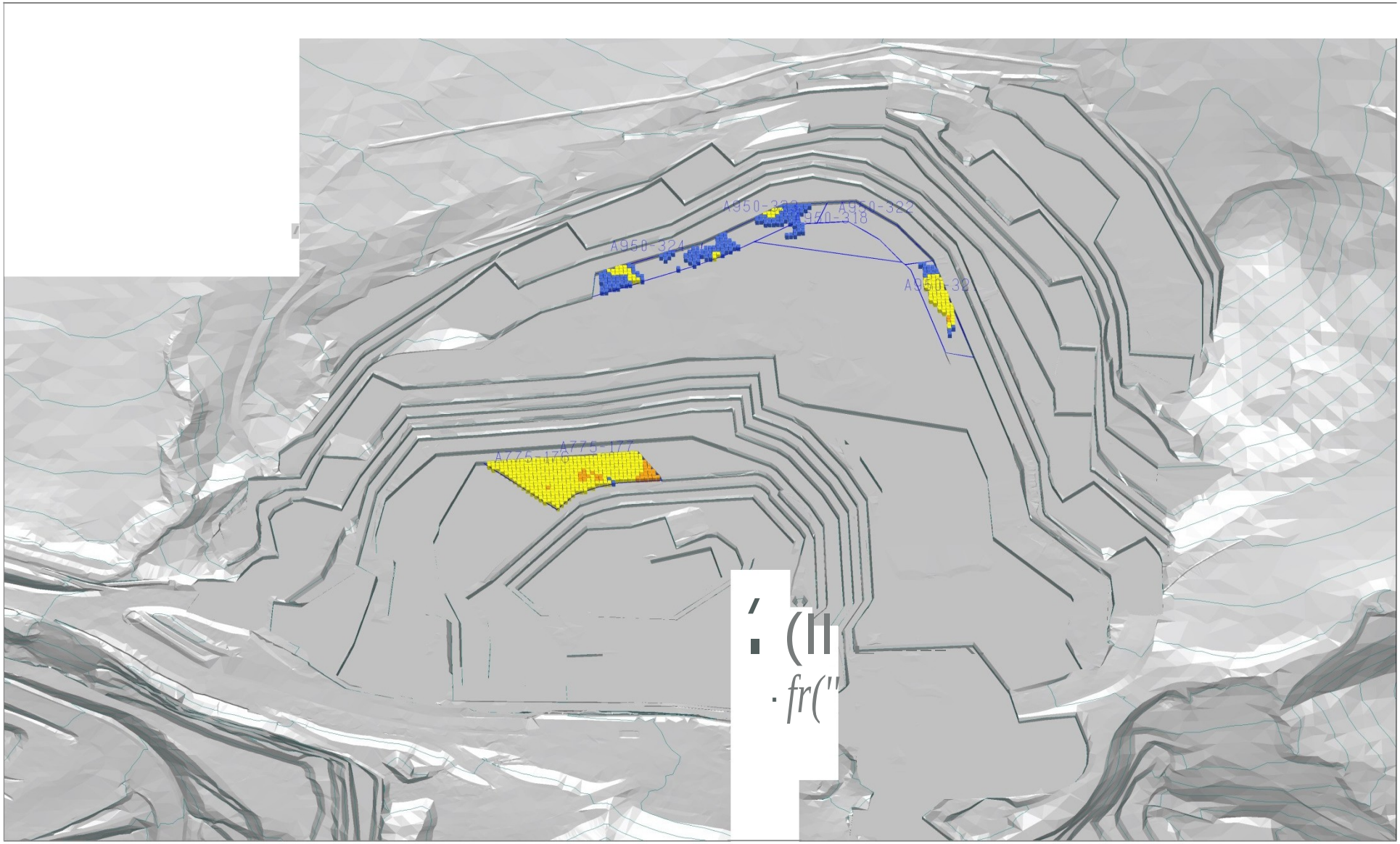


Figure 6-4 May 2017 Mine Plan 30 View (AQQ)

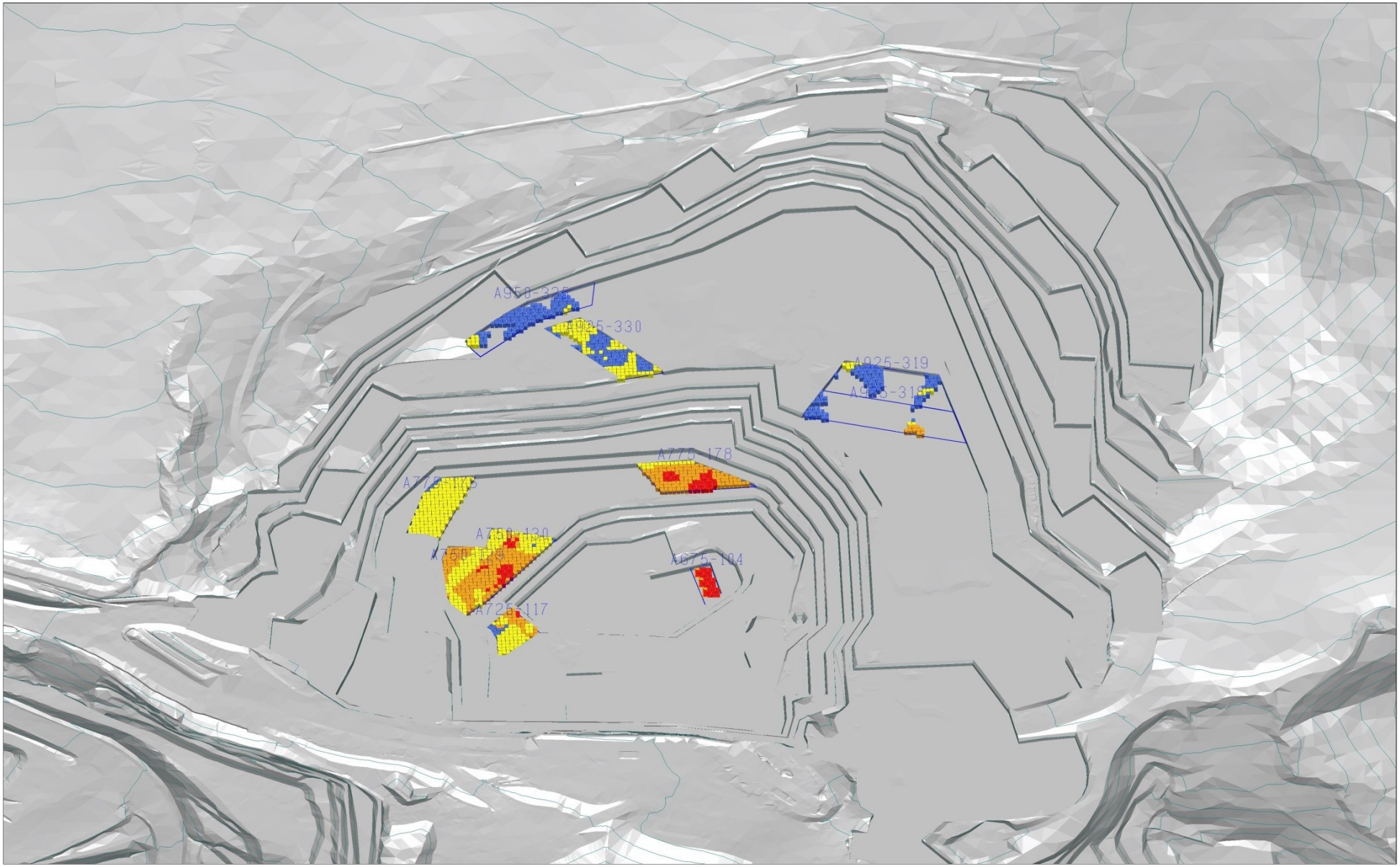


Figure 6-5 June 2017 Mine Plan 30 View (AQQ)

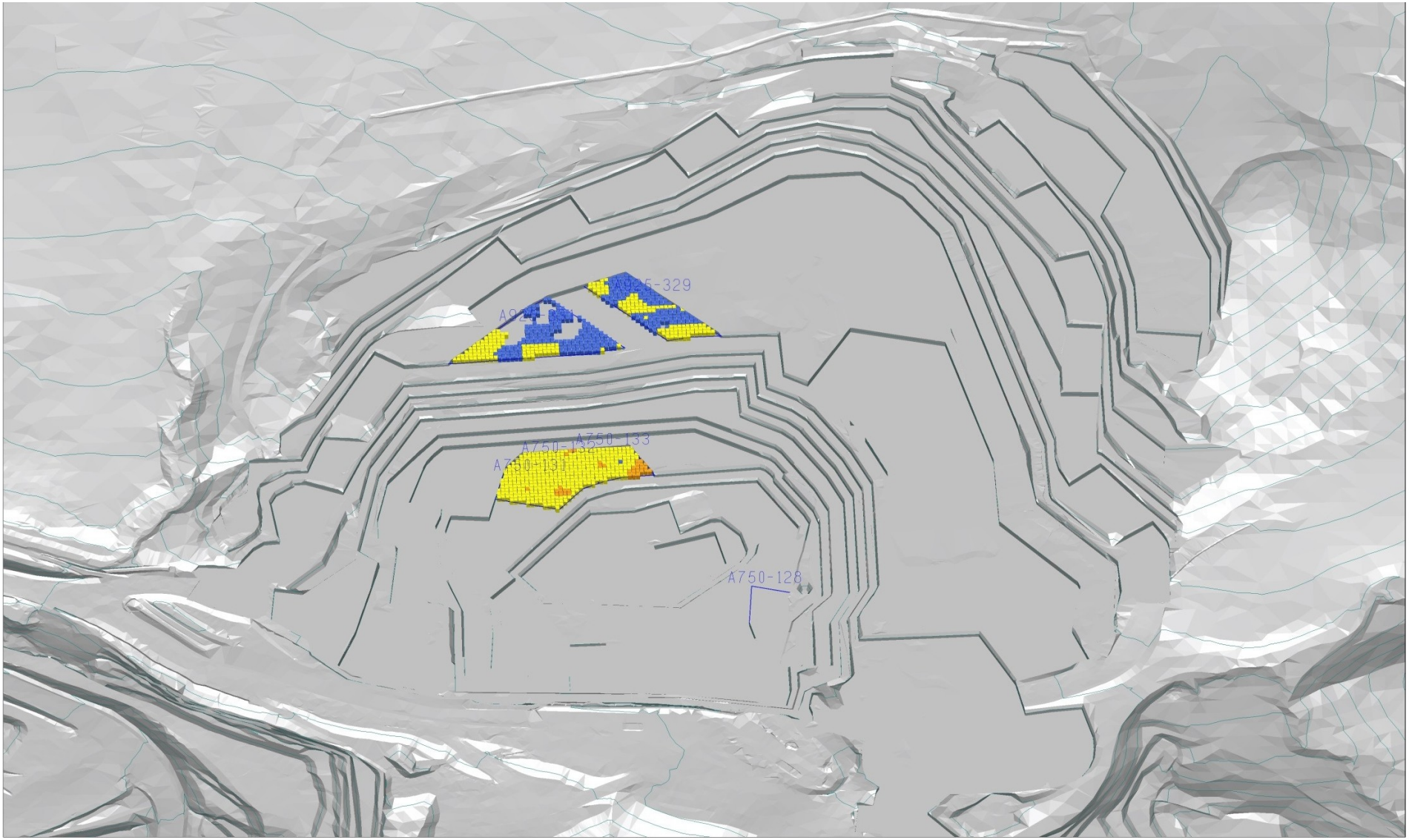


Figure 6-6 July 2017 Mine Plan 30 View (AQQ)

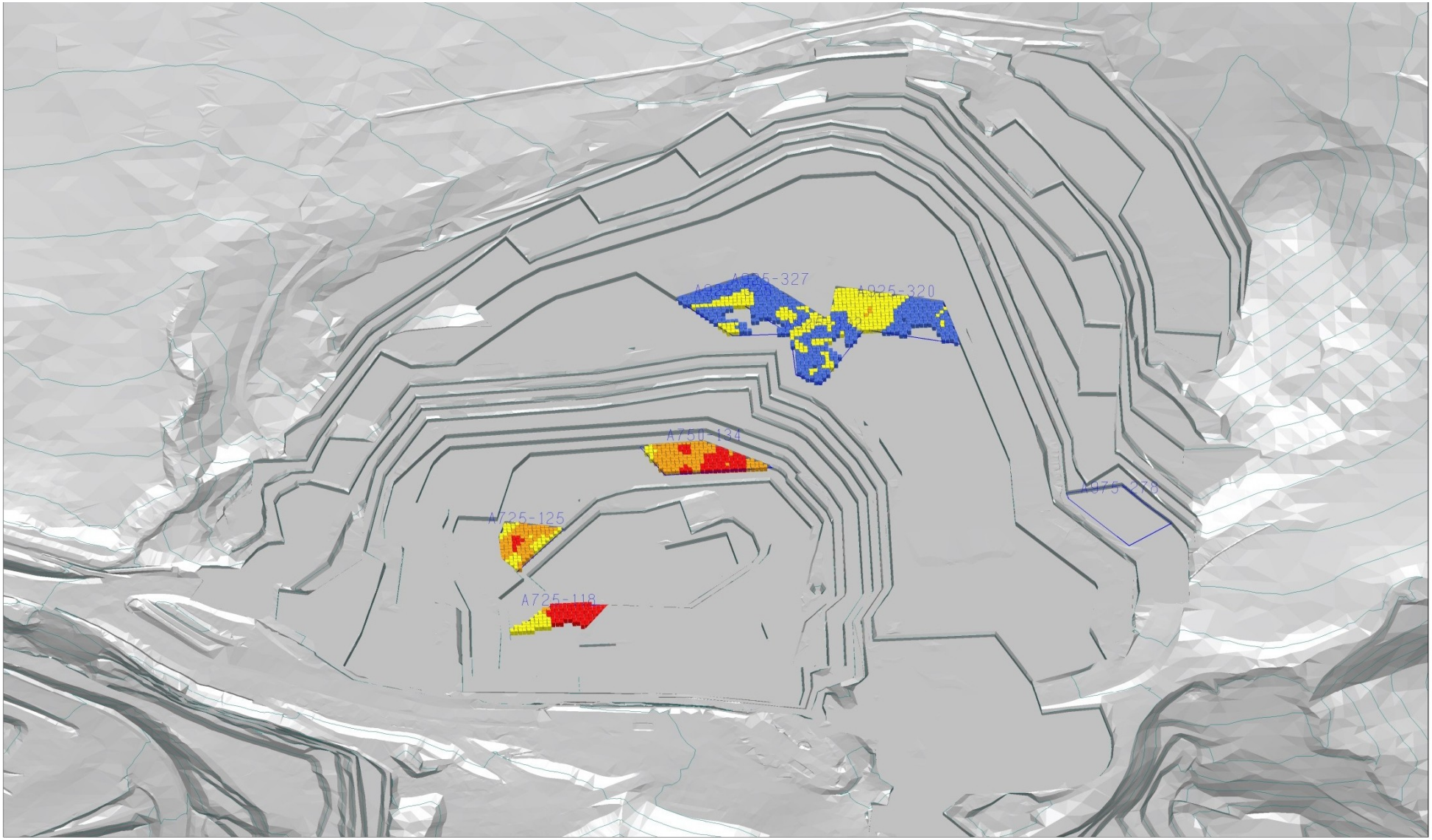


Figure 6-7 August 2017 Mine Plan 30 View (AQQ)

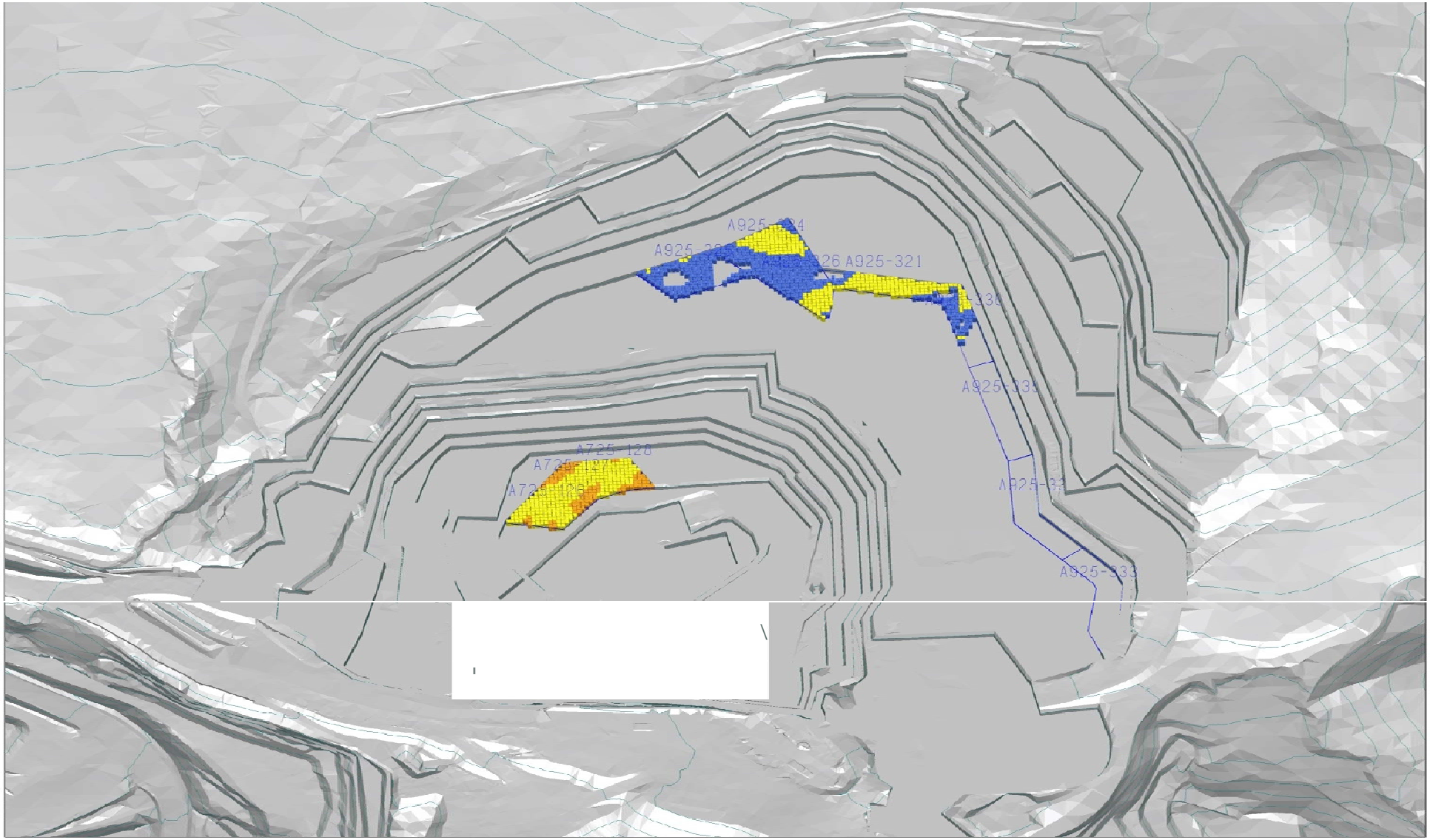


Figure 6-8 September 2017 Mine Plan 30 View (AQQ)

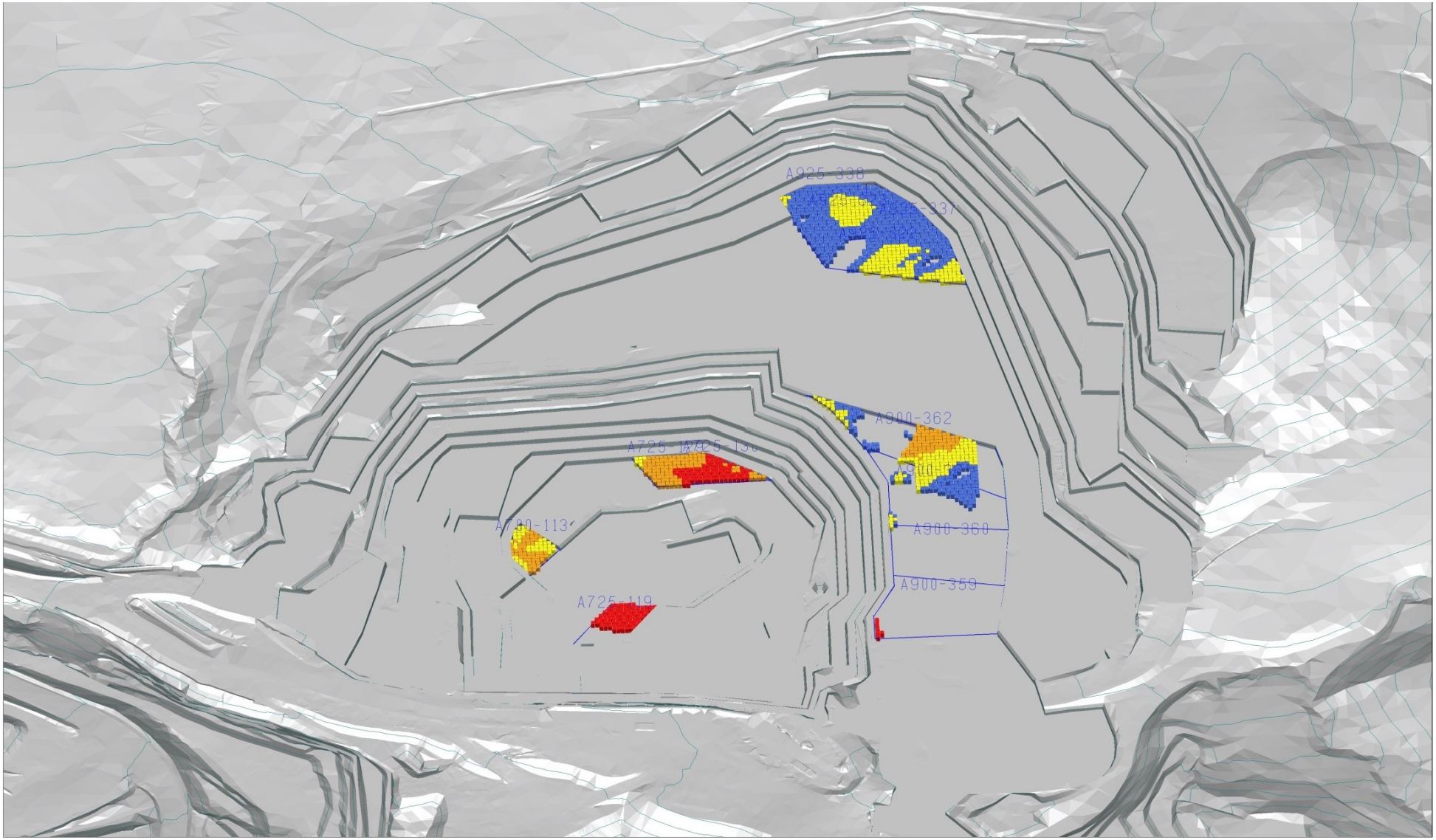


Figure 6-9 October 2017 Mine Plan 30 View (AQQ)

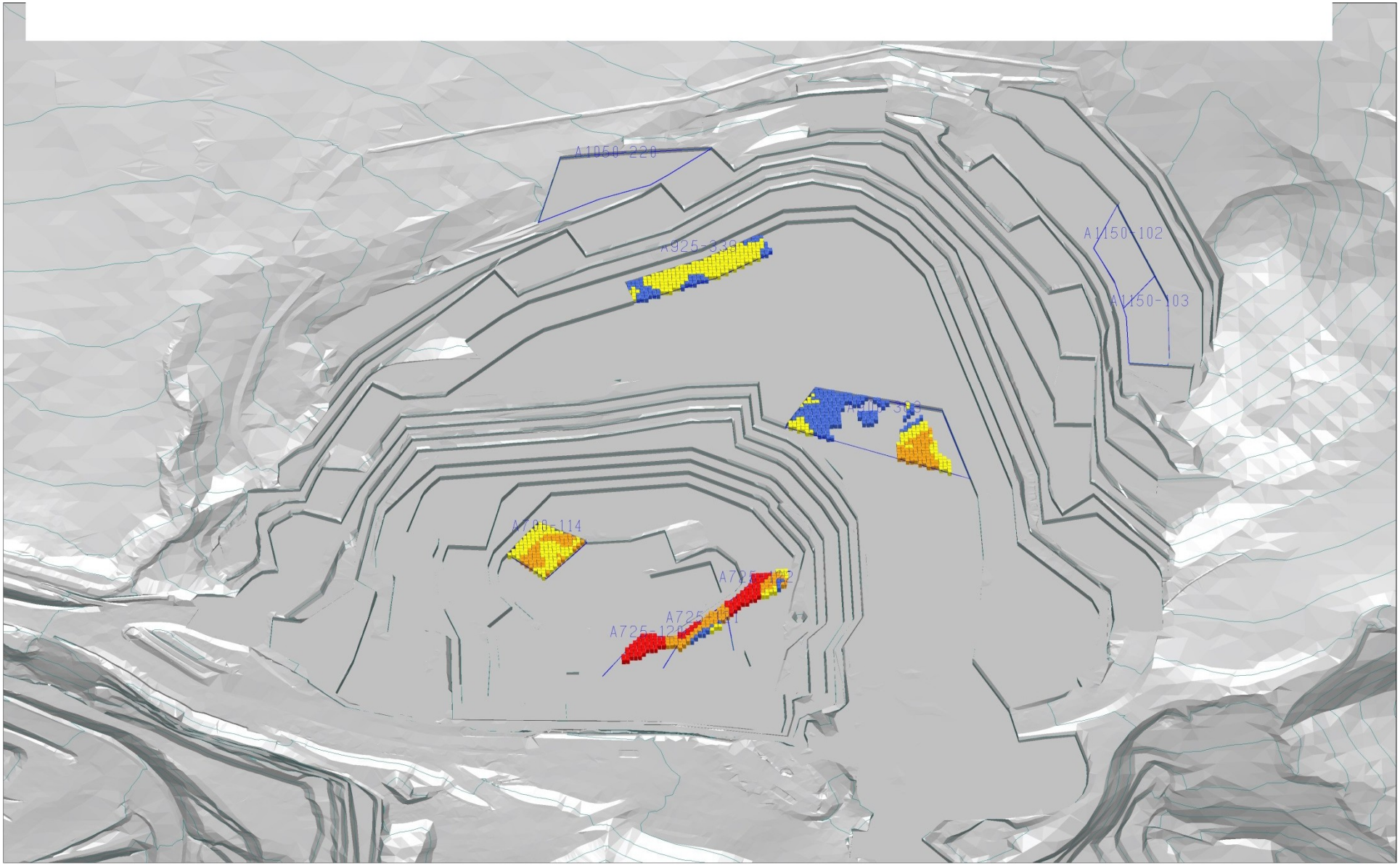


**Figure 6-10** November 2017 Mine Plan 30 View (AQQ)

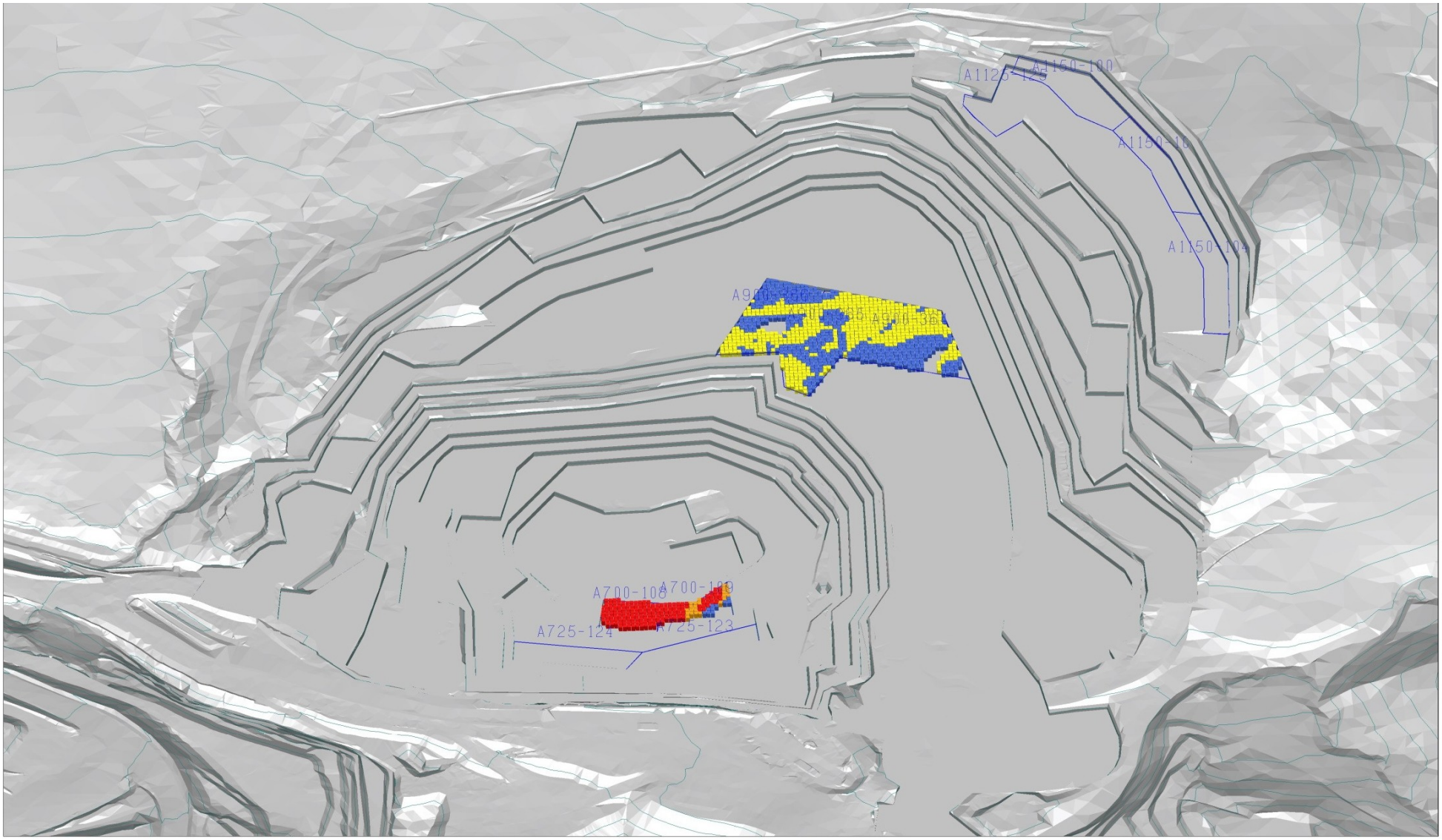


Figure 6-11 December 2017 Mine Plan 30 View (AQQ)

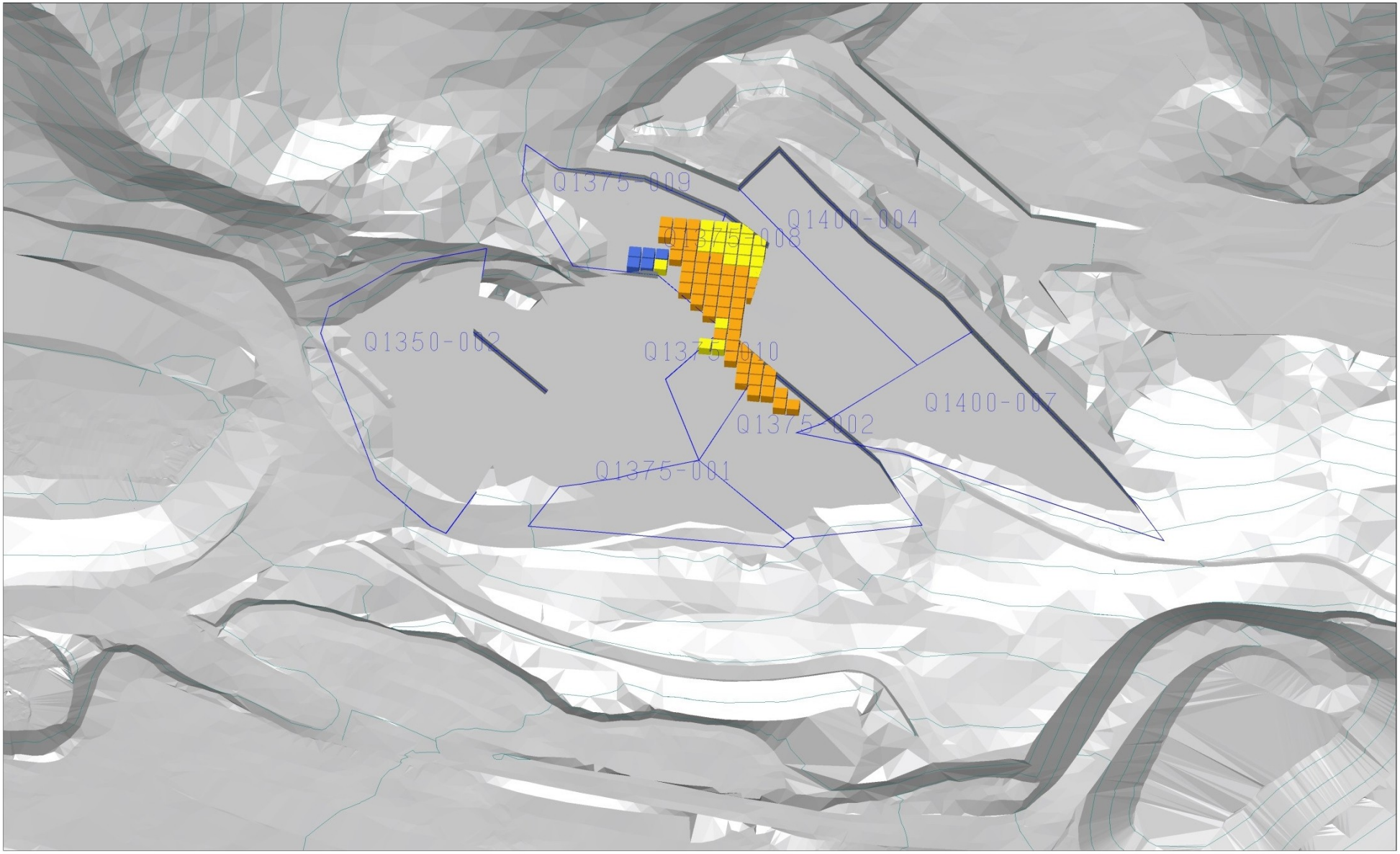


Figure 6-12 February 2017 Mine Plan 30 View (QAN)

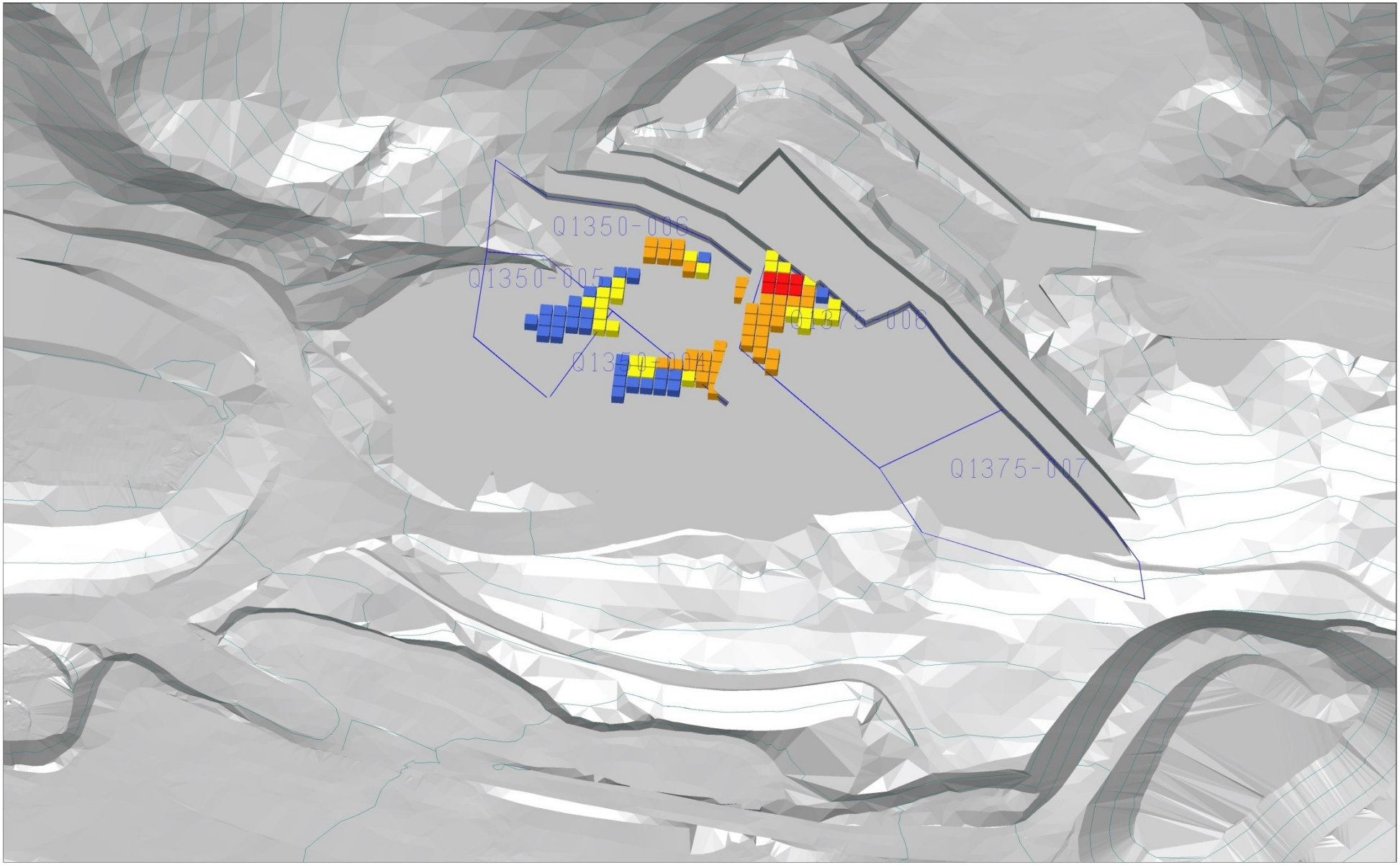


Figure 6-13 March 2017 Mine Plan 30 View (QAN)

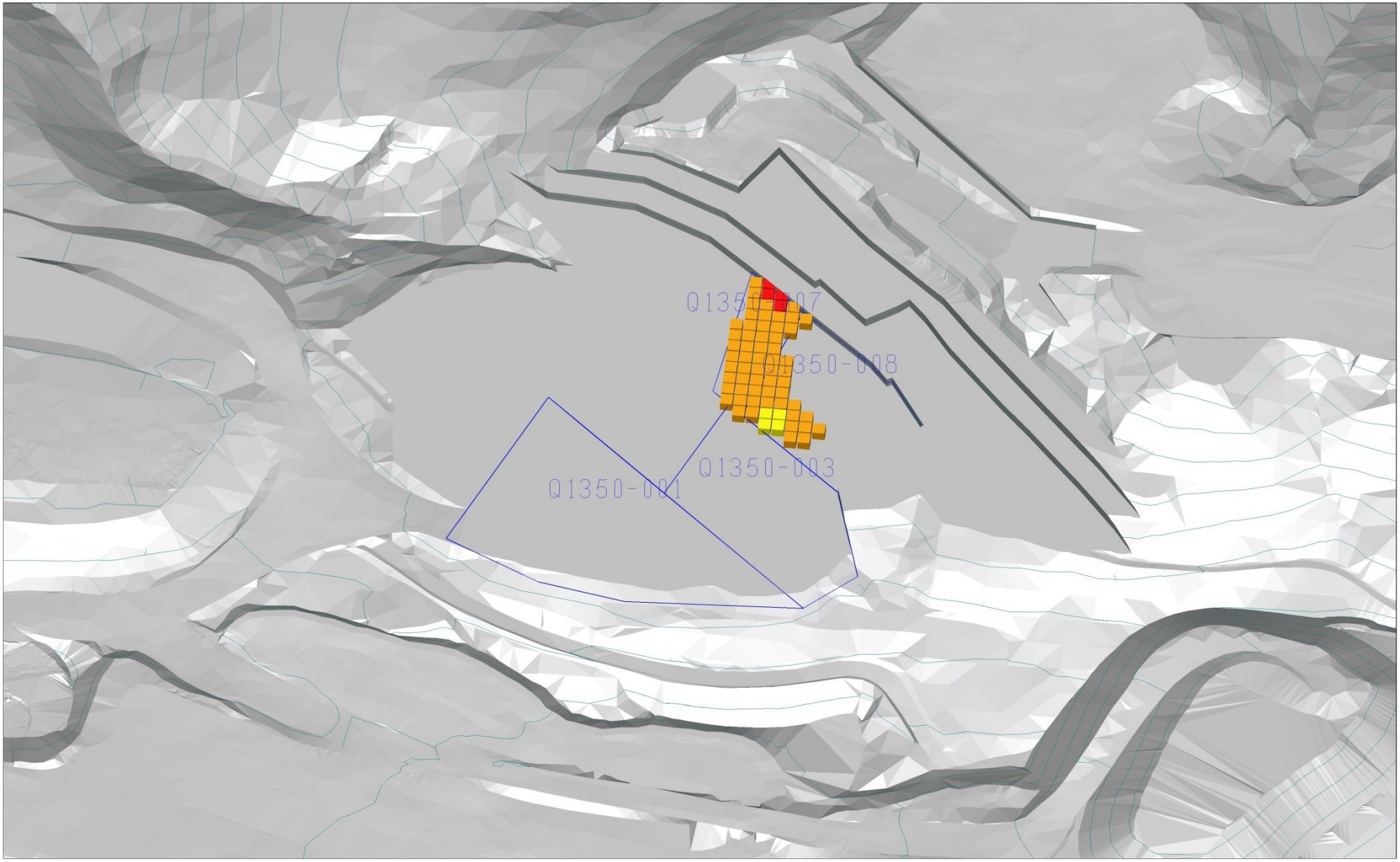


Figure 6-14 April 2017 Mine Plan 30 View (QAN)

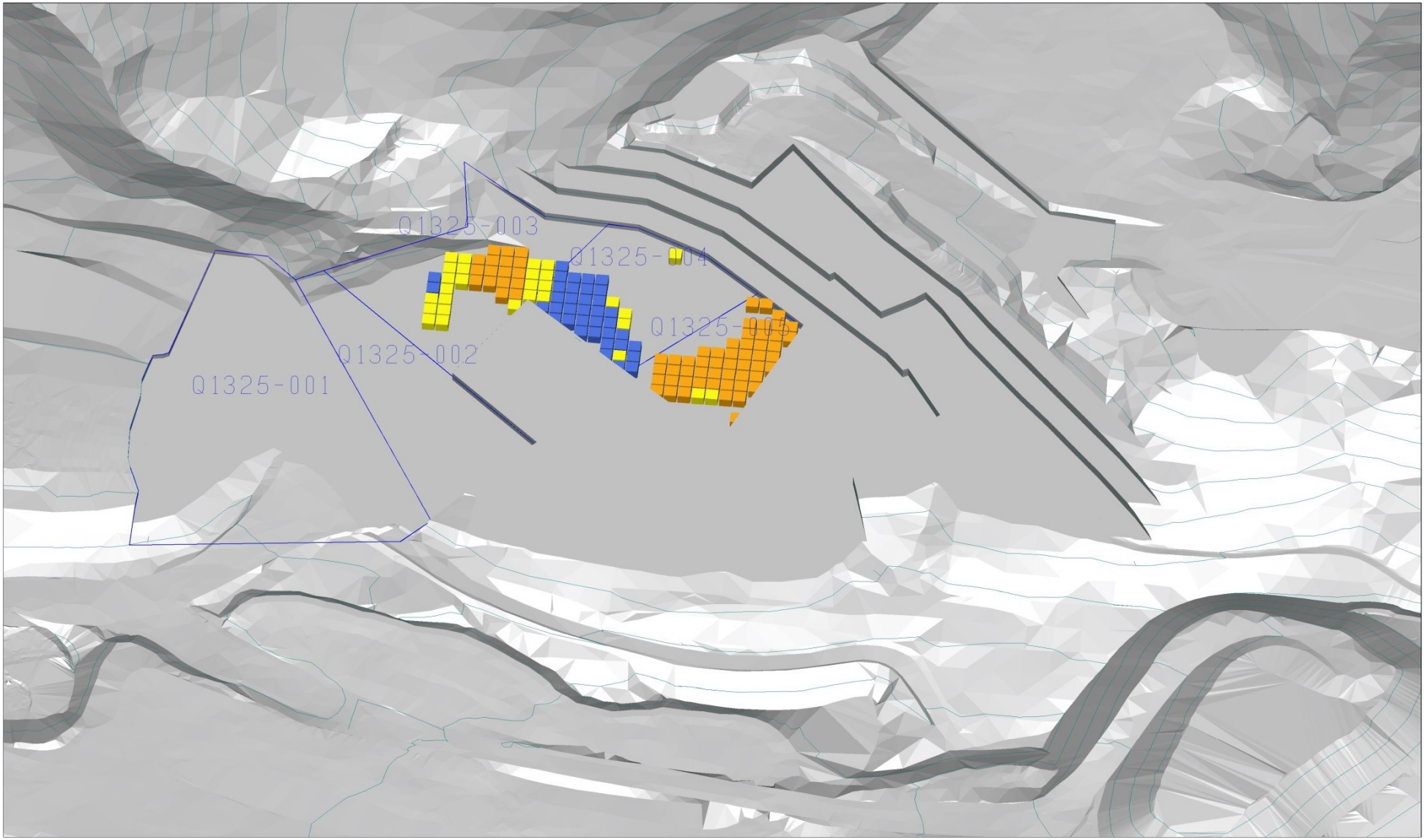


Figure 6-15 May 2017 Mine Plan 30 View (QAN)

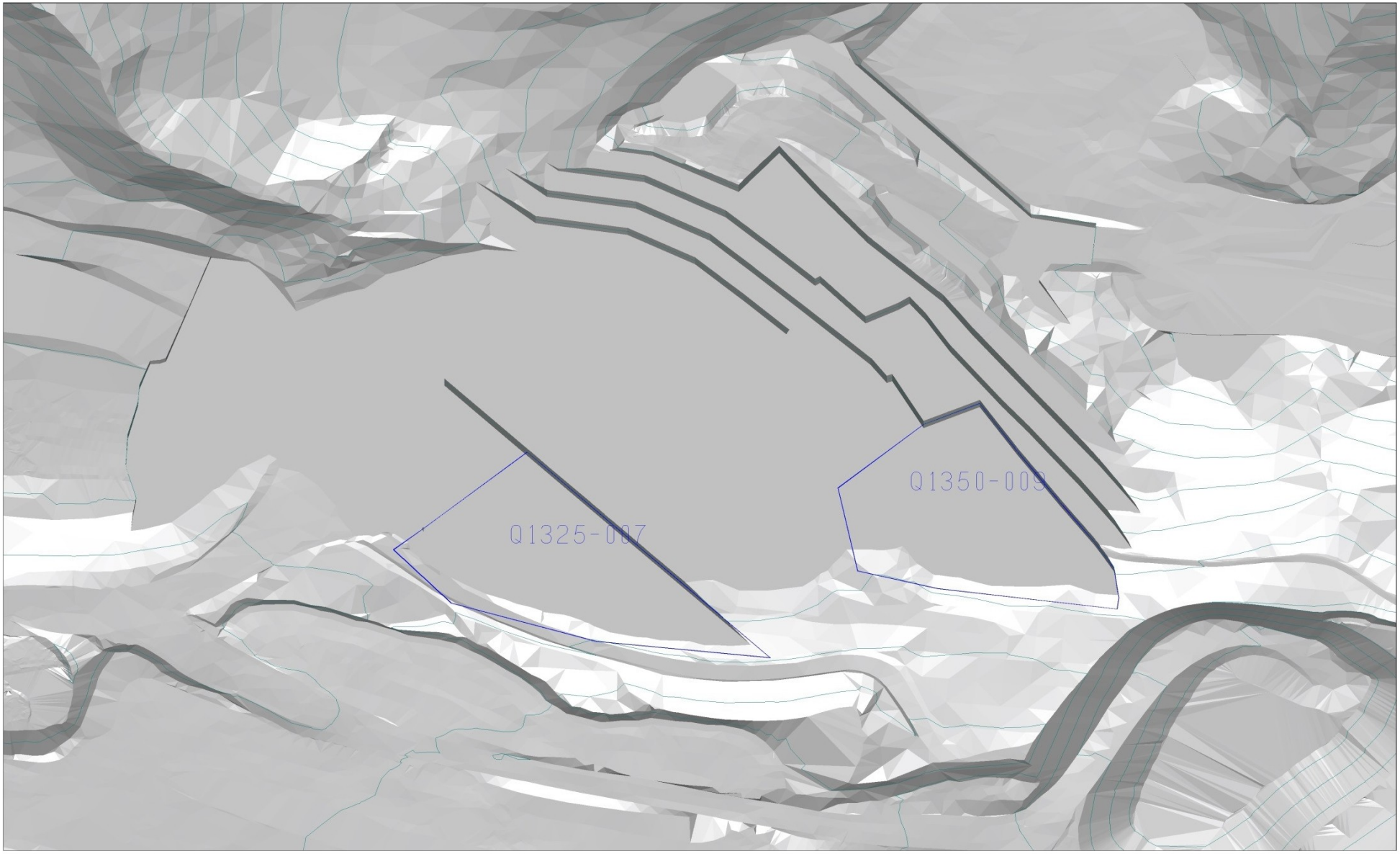


Figure 6-16 June 2017 Mine Plan 30 View (QAN)

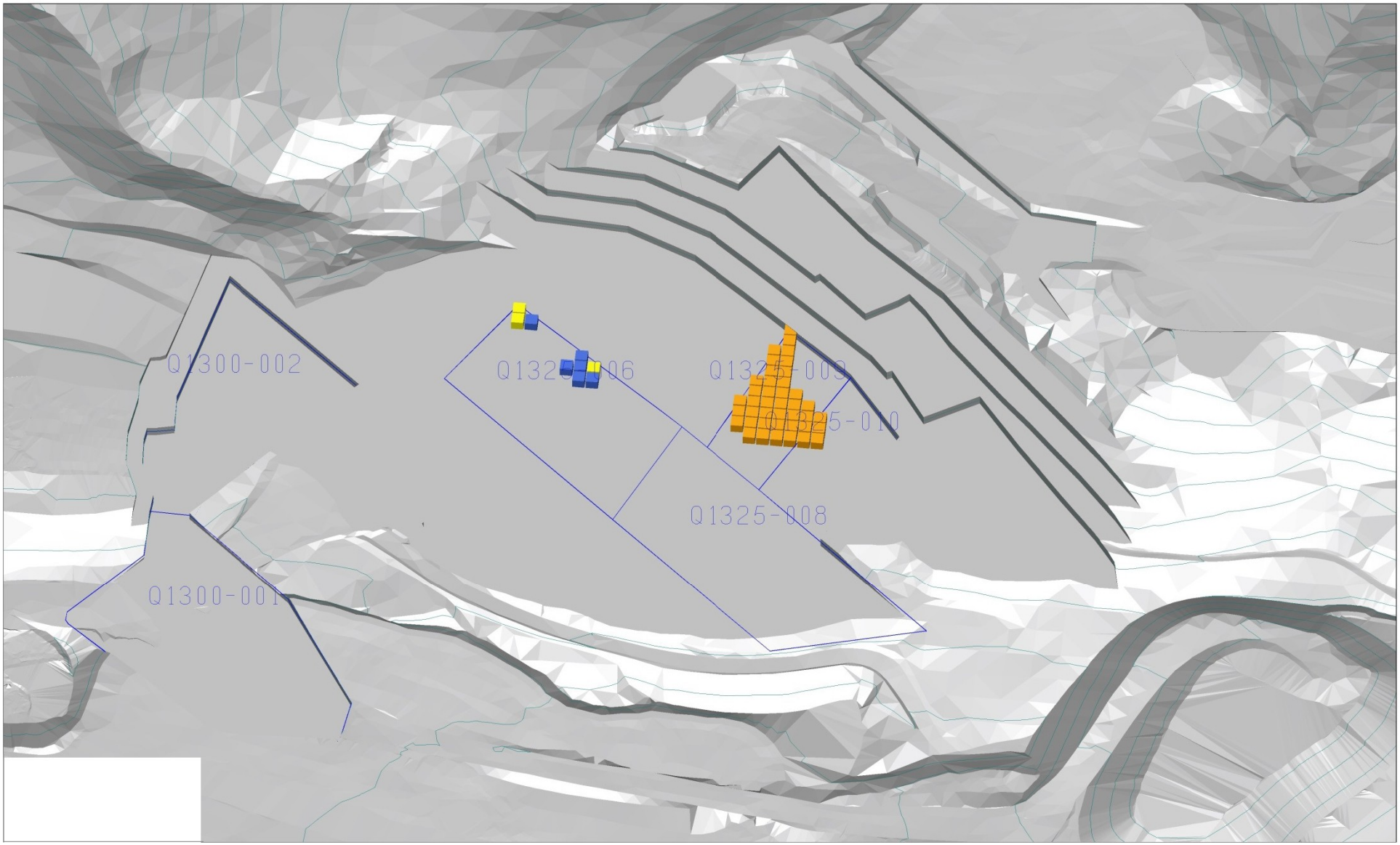


Figure 6-17 July 2017 Mine Plan 30 View (QAN)

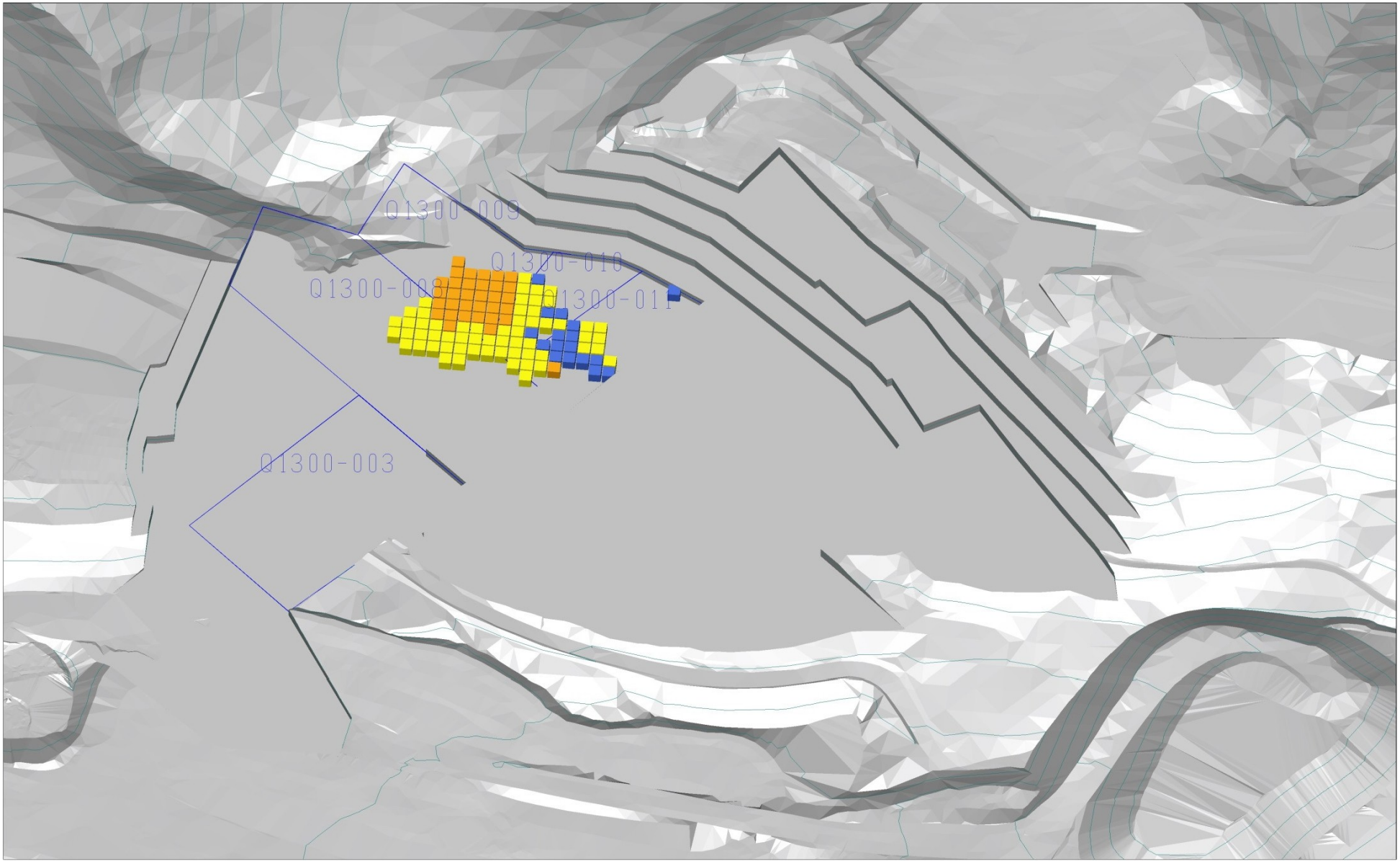


Figure 6-18 August 2017 Mine Plan 30 View (QAN)

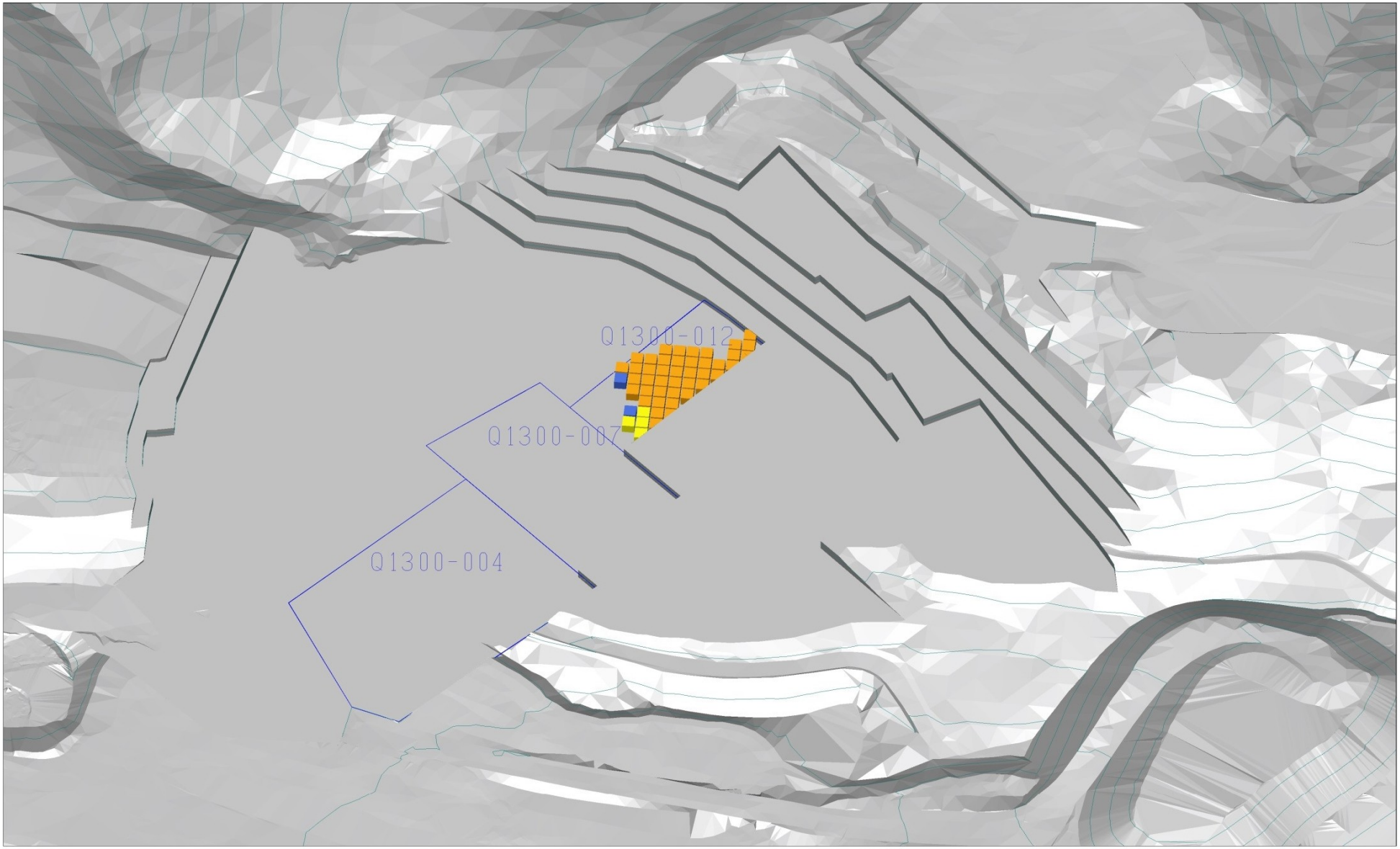


Figure 6-19 September 2017 Mine Plan 30 View (QAN)

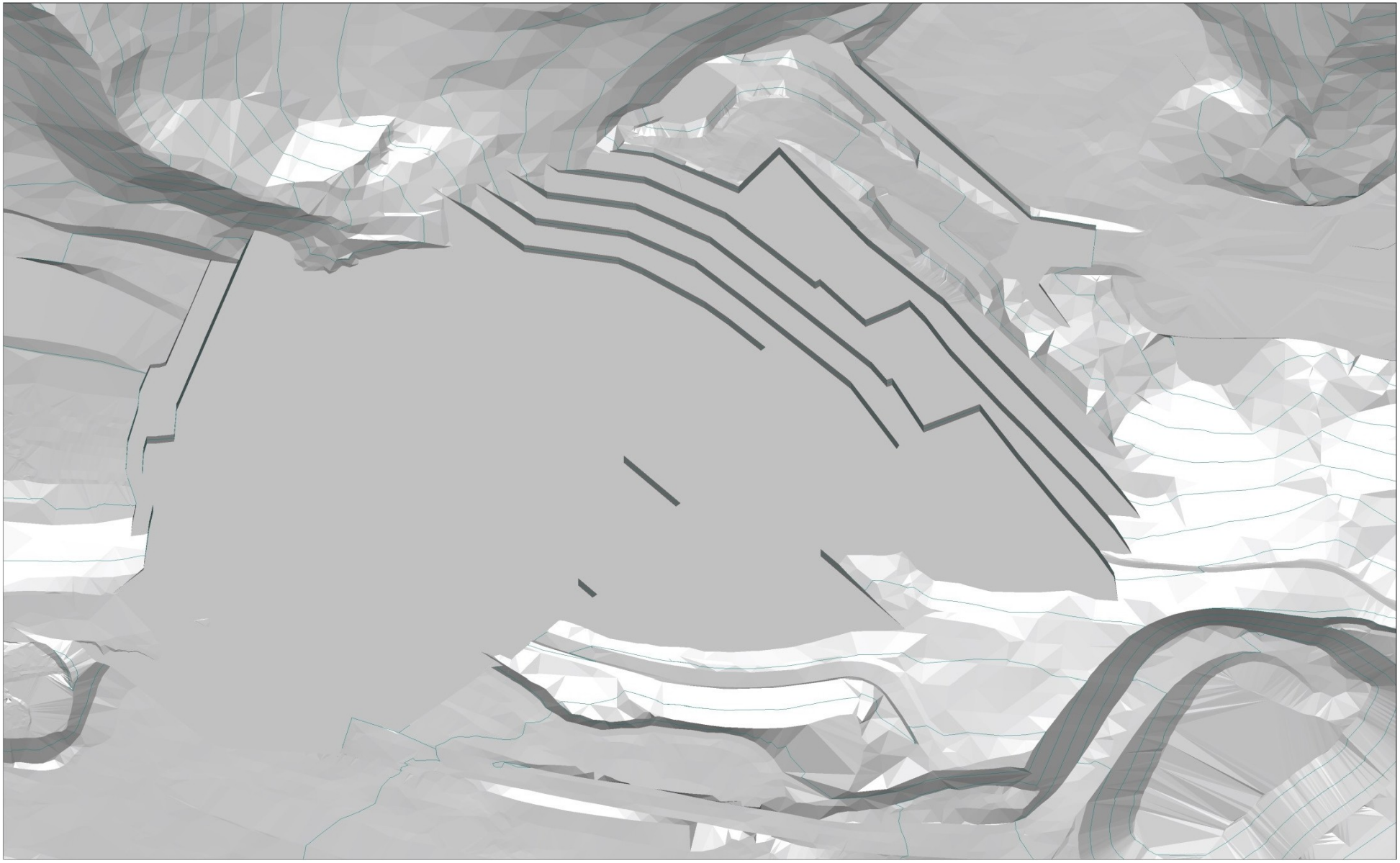

Figure 6-20 October 2017 Mine Plan 30 View (QAN)


Figure 6-21 November 2017 Mine Plan 30 View (QAN)

Figure 6-22 December 2017 Mine Plan 30 View (QAN)