FREEPORT-MCMORAN

Tyrone Operations
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August 17, 2022

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Mr. David Ohori
Energy, Minerals and Natural Resources Department
Mining and Minerals Division
Mining Act Reclamation Program
1220 South St. Francis Drive
Santa Fe, NM 87505

Dear Mr. Ohori:

Re: Modification to Tyrone Mine Permit No. GR010RE
Revision 09-1, Request for Approval of Precambrian Granite as a
Reclamation Cover Material and Termination of USNR Test Plot Study

Introduction

Freeport-McMoRan Tyrone Inc. (Tyrone) is applying for a modification to permit GR010RE Revision 09-1 for approval of Precambrian granite, as a reclamation cover material (RCM). Tyrone has fulfilled the conditions for evaluating the cover material and therefore is also requesting to terminate the test plot study given this approval. This change will allow Tyrone the use of an existing cover source that is proximal to future reclamation sites and reduce environmental impacts.

In November 2014, Tyrone provided the Mining and Minerals Division (MMD) and the New Mexico Environment Department (NMED) with a work plan for the USNR test plots to demonstrate the suitability of Precambrian granite excavated at the Little Rock Mine, to support vegetation and material handling techniques. The USNR test plot work plan was conditionally approved in 2014 and modified in a letter dated April 18, 2017, to include five years of vegetation monitoring. The test plots, located in the Copper Mt. Reclamation Area, were seeded in early June 2015. While they are referred to as the USNR Test Plots, in this letter Tyrone will also refer to them as the Precambrian granite test plots.

Table 1 summarizes the timeline and assessment types. Test plot reports prepared by Golder Associates Inc. were submitted by Tyrone annually, in accordance with Revision 09-1 to Permit GR010RE Condition 9.W.1.e.

Table 1. USNR Test Plot Timeline

Year 0	Seeded and mulched in Spring of 2015
Year 1	Qualitative vegetation assessment and erosion monitoring in 2016
Year 2	Qualitative vegetation assessment and erosion monitoring in 2017
Year 3	*Quantitative* vegetation assessment and erosion monitoring in 2018
Year 4	Qualitative vegetation assessment and erosion monitoring in 2019
Year 5	*Quantitative* vegetation assessment and erosion monitoring in 2020

The test plot study measured and evaluated woody plant density, percent canopy cover, plant diversity, and relative erosion rates. A summary of the supporting results is included in this document along with a comparison between sites constructed with the approved RCM (Gila conglomerate (Gila)) and Precambrian granite to the Year 5 standard of 40 percent of the reference area. The comparison to Gila is presented herein to demonstrate that the Precambrian granite test plots are achieving similar success criteria as the approved Gila RCM when it was approved. Figures (photos) illustrating the progression of the test plots and overall reclamation area are included in the Appendix.

Gila was conditionally approved as RCM for Tyrone based on a test plot study completed on the No. 1 Stockpile (Gila test plots) as well as the test plots on the reclaimed 3X Tailing Impoundment. For the comparison presented herein, the Gila test plots on the No. 1 Stockpile that were constructed and seeded in summer of 2005 are considered. Multiple treatments of differing slopes, top surface, and cover depths were evaluated in that study. Tyrone compared the results of the Precambrian test plots to the year 5 test plot study results for Gila. For this comparison, Tyrone used an average of the treatment results because significant differences in vegetation performance among the various treatments were not found. Data collected in 2020 from the approved vegetation reference area for Tyrone is also included in the comparison, using the Year 5 performance standard of 40 percent.

Additional projects that have been completed using Precambrian granite as cover material include the Copper Leach Stockpile and USNR reclamation areas. The Copper Leach Stockpile was seeded in June of 2010. Results from the quantitative vegetation monitoring survey performed in 2016, were included in this comparison (Year 6). The quantitative survey report detailing the progress of the Copper Leach reclamation project was submitted to MMD with the 2016 Annual Report. In addition to the Precambrian granite test plots, the USNR area was seeded in 2016 and a qualitative survey report detailing the progress was submitted to MMD with the 2019 Annual Report. A summary of these reclamation efforts is included below and provides supporting evidence that the Precambrian granite is suitable as an RCM.

Findings from both the tests plots and supplemental reclamation project assessments, support the use of Precambrian granite as a suitable reclamation cover material. Key parameters such as canopy cover and shrub density met or exceeded the Year 5 standard of 40% of the reference area, despite the periods of drought experienced in the past few years. Each site is recruiting native species and soils are resisting erosion to the same or greater degree than the current approved RCM.

Construction of USNR

Tyrone started the reclamation of USNR in 2014. Reclamation involved removing all identified residual leach material in the drainages and near the existing seeps, grading the area to a stable configuration, constructing test plots, placing cover, constructing channels, and installing armoring.

Cover material was loaded and hauled from the Little Rock Mine utilizing equipment that is comparable to the equipment proposed in the Little Rock and Tyrone Closure/Closeout Plans (CCP). Cover material, from Little Rock Mine, was generally end-dumped and spread with a dozer.

Quality Control (QC) was completed at the Little Rock Mine shovel pit (loading area) through visual observation by an RCM technician in direct communication with equipment operators and mine operations. The technician visually determined if the shovel face was in acceptable RCM from a textural perspective. If the material was acceptable based on texture, it was hauled to and dumped at the USNR reclamation site.

At USNR, QC was also completed during regrading of the cover material. Any oversized boulders were pushed off to the side or left as natural topography features. These simple QC steps were very successful and resulted in only a very small portion of the USNR reclamation that did not provide an adequate seed bed because it was too coarse at the surface. To correct the condition, Tyrone hauled in additional fined-grained RCM for a seedbed at an average thickness of 4 inches. The areas requiring this additional treatment step were measured to be approximately 4% of the reclaimed surface surrounding the test plots (which all met suitable textural requirements for a seedbed).

RCM material hauled to the USNR reclamation area and Precambrian granite test plots were also tested in accordance with the approved material handling plan (October 25, 2011) with additional QA testing completed at the test plot and reclamation site after placement (reported in the As-built reports 2017 & 2017b).

Geology

With an approved material handling plan, the USNR Test Plots were primarily constructed of RCM consisting of Precambrian granite and other minor granitoids from the leached cap (overburden) derived from the Little Rock Mine. This overburden RCM is a highly and deeply weathered igneous intrusive rock body that is inert and has no useful mineral value. The acid base account (ABA) data for the RCM predominantly meets criteria to be classified as "not potentially acid generating" meeting geochemical criteria to be used as RCM.

Environmental Opportunity

The approval of Precambrian granite as a cover material would facilitate the closure of nearby leach and waste rock stockpiles (at Tyrone Mine), access roads, and any other disturbances associated with the Little Rock and Tyrone Mines. The existing storage facilities for this material are referred to as the 9A Waste and 9AX Waste stockpiles and are located on the north side of the Tyrone Mine. There are also existing, and proposed waste stockpiles located at the Little Rock Mine and Emma Project that contain the same material and would also be available for use as RCM at Tyrone. Tyrone has shown the Precambrian granite from both sites to be analogous in terms of minerology and soil suitability. A demonstration plot will be conducted to confirm these findings and ensure that the material from the Emma site will support vegetation to the same degree as what has been shown at Little Rock. As stated above, these Precambrian granite stockpiles were constructed using an approved Material Characterization and Handling Plan and the same or similar effective processes will be used for the proposed stockpiles at each site.

Staging the cover material closer to these future reclamation sites reduces the impacts of mining. During closure activities at the Tyrone Mine, the use of Precambrian granite would reduce haul distance from Gila borrows and cover stockpiles (examples: 5A Waste and CSG Waste stockpiles) resulting in less dust and associated emissions. Using Precambrian granite from existing stockpiles, will decrease the stockpile footprints. Possessing an additional cover that is already being mined, carefully segregated and stockpiled, is a sound practice that should be encouraged at Tyrone. This practice could also eliminate or minimize new disturbances of borrow areas for the excavation and use of Gila.

Results

Reclamation Cover Material Suitability

The soil textures produced after mining Precambrian granite are moderately coarse-textured loamy sands, sandy loams, and sandy clay loams and generally contain between 40 and 60% rock fragments by volume. Physical and chemical characteristics were analyzed after placement on the test plots. Chemical properties indicated no inherent chemical limitation for growth of native plants. It is slightly alkaline (pH range of 7.6-7.7) and non-saline (electrical conductivity [EC] < 2 deciSiemens per meter [dS/m]). Organic

matter, phosphorus, and nitrate nitrogen concentrations are considered adequate for the target plant species. Water holding capacity (WHC), corrected for volumetric rock content, ranged from 1.00 to 1.38 in/ft which exceeds the 20.6.7.F (2) Copper Rule requirements (Golder, 2017b). Further analysis of the Precambrian granite in 2018 (Golder, 2019b) found the average WHC for the whole soil to be 1.05 in/ft, well above the 0.88 in/ft threshold WHC to comply with the Copper Rule.

The As-Built report for the No. 1 Stockpile test plots, sent to MMD in a letter dated September 28, 2006, includes a material characterization of the Gila RCM and was evaluated in this comparison. Gila is the predominately moderately coarse-textured, represented primarily by sandy loams and sandy clay loams, much like the Precambrian granite. Rock fragments ranged between 41 and 62%. The pH for the Gila ranged from 6.0 to 7.9 and the soils are non-saline to very slightly saline with EC ranging from 0.4 to 3.3 dS/m. Nitrate nitrogen, phosphorus, and organic matter content was relatively low, but consistent with fertility levels in native soils and the Precambrian granite and are considered sufficient to support native plants (Golder, 2006).

USNR Test Plot Study

Tyrone took advantage of the test plot program not only to evaluate vegetative performance associated with Precambrian granite, but also assess different treatments of seed mixes and mulching applications. The two-acre USNR Test Plot includes four treatments, a control and three treatments, each approximately a half-acre each. The major treatments involve an experimental seed mix and the timing of mulching. The treatments are described below:

- Control (conventional seed mix and mulching (CSMA))
- Mulch prior to seeding with conventional seed mix (CSMB)
- Conventional mulch with experimental seed mix (ESMA)
- Mulch prior to seeding with experimental seed mix (ESMB)

Qualitative vegetation inspections were performed in 2016, 2017 and 2019 and found all the treatments had high levels of seed germination and seedling establishment with average plant density exceeding one plant/square foot and increases in canopy cover levels every year (Golder, 2017b, 2018, & 2020b).

The quantitative studies performed on the Precambrian test plots, in both year 3 (2018) and year 5 (2020), showed no statistical difference in canopy cover between mulching efforts for the conventional and experimental seed mixes based on a 90% confidence interval. Additionally, two seed mixes did not result in statistically different canopy levels (Golder, 2019a & 2021). The results showed an increase in plant diversity and canopy

cover. Mean shrub density decreased slightly when comparing belt transect data, but the 90% confidence intervals overlapped.

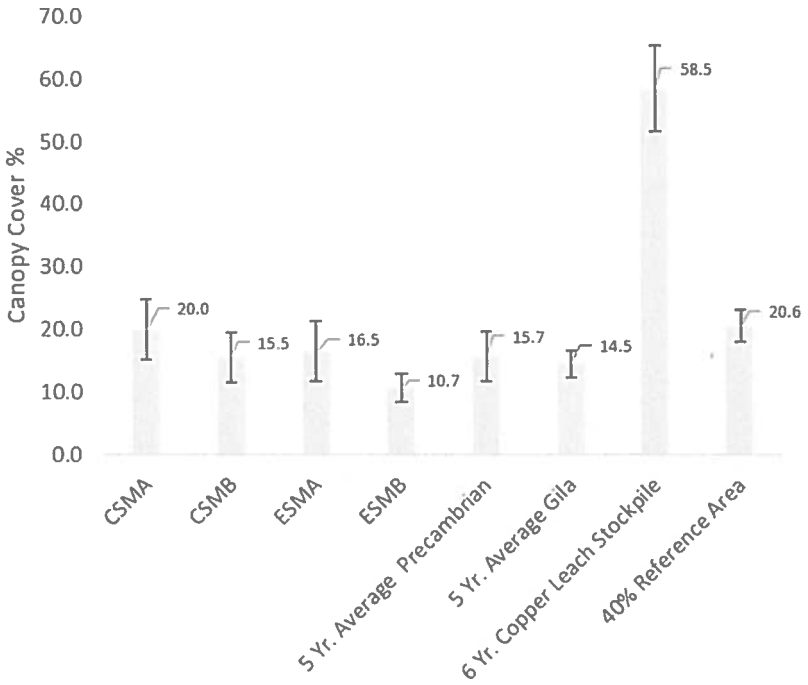
From 2018 to 2020, the total number of plant species documented across the four treatments increased from 33 to 62. Many native species of plants were recruited from the surrounding ecosystem. For example, CSMB recruited 27 voluntary species over the 5-year period (Golder, 2019a & 2021). The reference area for Tyrone was also surveyed in the 2020 study. Those results are included below to evaluate progression towards the vegetation performance standards.

Vegetation Evaluation

To make the comparison between treatments and reclamation projects, Tyrone used the results from the quantitative vegetation surveys performed by Golder Associates, Inc and plotted them using error bars consisting of the 90% Confidence Intervals about the mean (Figure 1 and 2). Data from the reference area was retrieved from the 2020 quantitative assessment and the performance standard was set at 40% for comparison of immature reclamation plots.

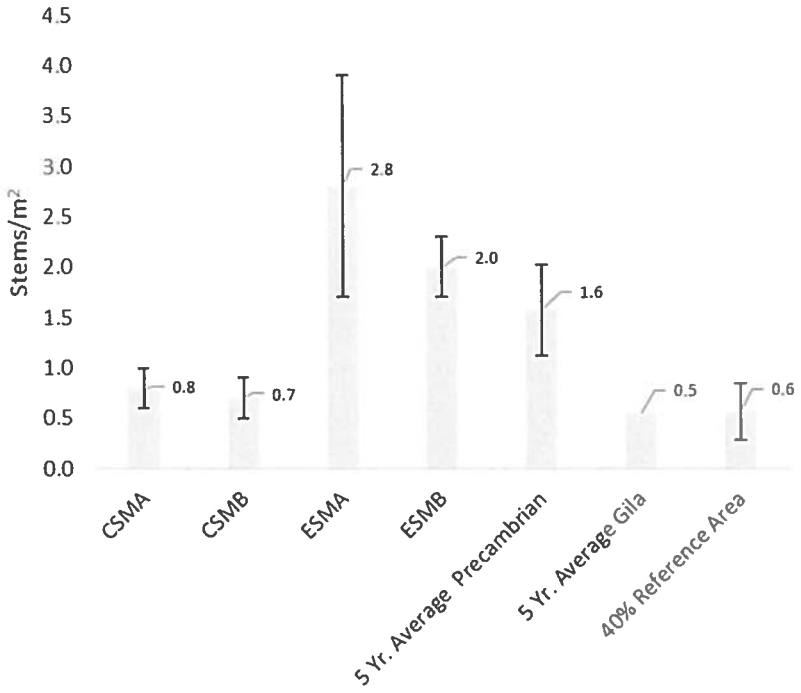
A comparison of the mean canopy covers showed little to no difference between the average of the Precambrian test plots and Gila test plots. Figure 1 illustrates that the Copper Leach Stockpile mean canopy cover at year 6, was more than twice that of both test plots and the reference area standard. The high canopy cover at the Copper Leach Stockpile may be due in part to extremely wet growing season in 2010 after seeding (50% above the regional average) as well as above average growing season precipitation in 2016, prior to the quantitative survey (Golder, 2017a). Canopy cover for the CSMA, CSMB, and ESMA plots were not statistically different than the 40% reference area standard based on the overlap of the 90% confidence intervals.

Figure 1. Mean Canopy Cover Comparison



Mean shrub density (Figure 2) for the Precambrian test plots exceeded the 40% reference area standard but did show high variability between the conventional and experiment seed mixes. Results from the Copper Leach Stockpile area are not included because a different collection technique was used in the 2016 survey (Golder, 2017a). The mean values for the conventional seed mix treatments were equivalent to the 40% reference area mean, but the experimental seed mix treatments exceeded that standard significantly. The confidence interval was not reported for the Gila test plot shrub density.

Figure 2. Mean Shrub Density from Belt Transect Comparison



Seeding operations for both sets of test plots (Gila and Precambrian) were consistent and were seeded using the same methods of drilling and broadcasting used at the mine. The only difference in the construction and seeding of the two test plots studies was testing the sequence of mulching and seeding as well as minor adjustments the conventional seed mix due to seed availability and using an experimental seed mix on the UNSR Test Plots. With respect to the latter, seeding densities (seed per square foot [seeds/ft^2]) were approximately the same as half of Precambrian plots which received an experimental seed mix at a rate of 68 seeds/ft^2 (16.61 pounds per acre [lbs/ac]) with 32 species, while the other half received the conventional seed mix at a rate of 59 seeds/ft^2 (9.12 lbs/ac) with 16 species. In 2005, the Gila test plot seed mix was applied at a rate of 46 seeds/ft^2 (8.9 lbs/ac, 14 species) and included a few different species from the conventional seed mix used on the Precambrian test plots. The differences in the seeding mixes and rates among the test plot treatments are considered relatively minor ecologically, but higher seeding densities with the experimental seed mix used in the Precambrian test plots may have contributed to somewhat lower plant canopy cover and higher shrub density.

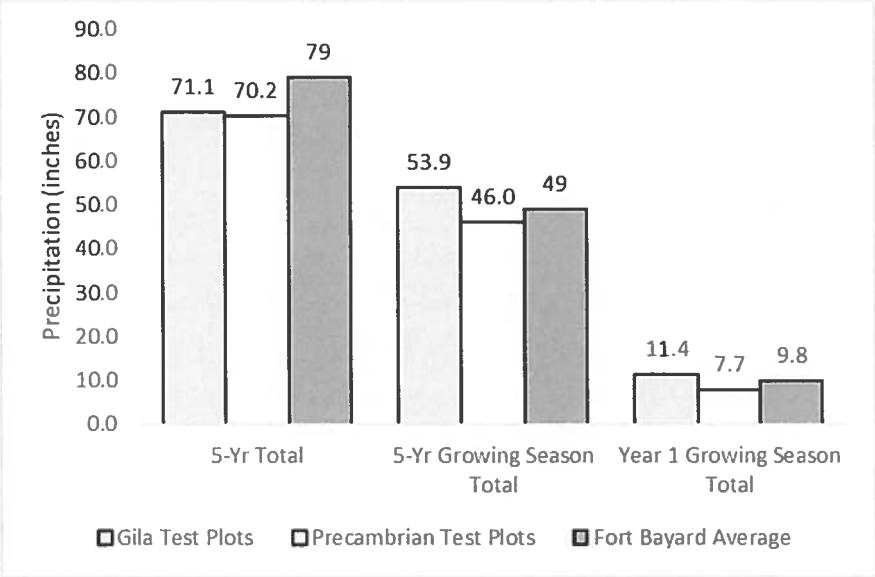
In addition to the data provided above, the qualitative survey results from the USNR reclamation site indicate that efforts have been successful and have resulted in an early-seral stage mixed grass-shrub community across the site. The majority of the seeded areas support a robust and diverse plant community that has also successfully recruited native

plant species from adjacent undisturbed areas. Initial results strongly suggest the Precambrian granite can support a self-sustaining ecosystem, especially considering the dry growing-season conditions that have affected the site since 2017 (Golder, 2020a).

Climate Conditions

Since the physical and chemical characteristics of the Gila and Precambrian granite cover soils and reclamation techniques are similar to one another, a comparison of cumulative precipitation was made to determine if that could contribute to any observed differences. Figure 3 shows the relative amounts of precipitation for each test plot in the first five years of vegetation establishment compared to the regional average measured at Fort Bayard (15.8 inches annually). Both test plots saw about 10% less precipitation in the first five years, but growing season precipitation was higher than average for the Gila test plots where the Precambrian test plots were slightly below average. Year 1 growing season precipitation differed substantially between the two test plots. The Precambrian granite plots received approximately 33% less precipitation in the first growing season and approximately 15% less precipitation than the Gila test plots, for the total 5 year growing seasons. Not shown here, but in 2020 (Year 5) the Precambrian test plots only received 4.59 inches of growing season precipitation, about 46% of normal. From a regional perspective, the USNR test plots experienced persistent drought conditions since seeding with 2020 considered exceptionally dry. Despite the droughty conditions since seeding, vegetation performance on the Precambrian granite was as good or better than the Gila test plots at the early plant establishment stage as measured by canopy cover and shrub density (Figures 1 and 2).

Figure 3. Precipitation Comparison



Soil Stability (Erosion)

Erosion transects were installed on the Precambrian test plots and baseline monitoring was conducted in June 2016, approximately one year following seeding. Subsequent monitoring episodes were conducted in the late fall or early winter through December 2020 to assess changes in surface topography.

The erosion data for the Precambrian test plots indicate the material is stable and has the ability to resist erosion. The erosion monitoring results from Year 5 found the relative changes in ground surface elevation were minimal (Golder, 2021). Examination of the soil surface cross-sections suggested that a very minor rill erosion occurred primarily in mid-slope positions of the reclamation formed during the first and second growing season and has filled in and healed by Year 5. Soil loss was only evident at the foot of the slope, but upgradient accretions were greater than this erosion resulting to average soil accumulation for the entire slope profiles.

The soil accumulation trend in the first five years may be in part due to the lack of high magnitude precipitation events at the site in combination with the armoring of the soil surface.

Conclusion

Tyrone strives to develop the most efficient and cost-effective closure plans using such readily available materials and proactive steps in mine planning. This modification to reclamation plans will not only improve closeout plans, but also help reduce some environmental impacts such as disturbance of Gila borrow areas and associated emissions from long hauling distances. Finding alternative cover materials like the Precambrian granite is one way to optimize the eventual closure of the site.

Based on the results of the vegetation and erosion monitoring discussed herein, Tyrone is confident that Precambrian granite from both the Little Rock Mine and Emma Project will support vegetation and the reclaimed sites will meet the vegetation success requirements listed under Revision 09-1 Appendix A, just as it does as a soil substrate in the natural environment. In summary:

- Standard material handling procedures and conventional seeding operations used on the test plots, the USNR reclamation area, and the Copper Leach stockpile resulted in the placement of suitable materials and the successful revegetation of Precambrian granite cover materials.
- The PCG materials can be managed to meet the Copper Rule criteria for water holding capacity.
- Even under significant drought conditions during the first year and 5 year growing season, the 2018 and 2020 quantitative monitoring events

demonstrate the Precambrian test plot's ability to establish a self-sustaining vegetation community with increasing plant cover and diversity and remain stable with respect to soil erosion.

- The Precambrian test plots performed as well or better than those constructed using Gila and have met the year 5 reference area performance standard of 40%.
- Supplemental data from the Copper Leach Stockpile provides a forecasted progress snapshot of the vegetation potential using the Precambrian granite as a cover material. Within eleven years of seeding and even after experiencing long periods of drought, the Copper Leach Stockpile is very close to meeting the shrub density and diversity standards when compared to the reference area data (Golder, 2022).

Given these findings, Tyrone requests that MMD approve the Precambrian granite as RCM for the Tyrone Mine and terminate the USNR Test Plot program. The time and effort to evaluate this request is much appreciated and Tyrone looks forward to discussing it further and ultimately agency approval. Attached is a check for the $1,000.00 modification fee.

Please contact Ms. Raechel Roberts at (575) 956-3290 if you have questions.

Sincerely,

Thomas L. Shelley
Environmental Manager
Environmental Services

TLS:rmr
20220817-100

c. Holland Shepherd – MMD
Brad Reid – NMED

REFERENCES

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Golder (2022). Vegetation success monitoring, Little Rock Copper Leach stockpile, 2021. Prepared for Freeport-McMoRan Tyrone, Inc. April 2022.

Telesto (2017). USNR site and Copper Mountain South Pit Expansion CQA/CQC Report. Prepared for Freeport-McMoRan Tyrone, Inc. September 2017.

Appendix

Figures

Figure 1. Status of vegetation on the ESMA treatment (October 2016)

Figure 2. Status of vegetation on the ESMA treatment (July 2022)

Figure 3. Status of vegetation on the ESMB treatment (October 2016)

Figure 4. Status of vegetation on the ESMB treatment (July 2022)

Figure 5. Status of the vegetation on the CSMA treatment (June 2016)


Figure 6. Status of the vegetation on the CSMA treatment (July 2022)

Figure 7. Status of the vegetation on the CSMB treatment (June 2016)


Figure 8. Status of the vegetation on the CSMB treatment (July 2022)

Figure 9. Copper Leach Stockpile reclamation top surface (July 2022)

Figure 10. Copper Leach Stockpile reclamation side slope (July 2022)

Figure 11. USNR reclamation site upper north facing slope (July 2022)

Figure 12. USNR reclamation site, upper south facing slope in foreground (August 2020)