REPORT

UPDATED CLOSURE/CLOSEOUT PLAN FOR THE LITTLE ROCK MINE

Submitted to:

Freeport-McMoRan Tyrone Inc.
P.O. Drawer 571
Tyrone, New Mexico 88065

Submitted by:
Golder Associates Inc.
5200 Pasadena Avenue, N.E. Suite C,
Albuquerque, New Mexico, USA 87113

+1 505 821-3043

20136957

June 11, 2020

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LIST OF ACRONYMS AND ABBREVIATIONS

ABA	Acid-Base Accounting
ac-ft/yr	Acre-Feet per Year
APP	Abatement Plan Proposal
BLM	U.S. Bureau of Land Management
BMP	Best Management Practices
CCP	Closure/Closeout Plan
CDQAP	Construction Design Quality Assurance Plan
CFR	Code of Federal Regulations
CN	Curve Number
Copper Mine Rule	New rules for the copper mining industry adopted in late 2013 under 20.6.7 NMAC
Corps	U.S. Army Corps of Engineers
CQA	Construction Quality Assurance
CQAP	Construction Quality Assurance Plan
CQAR	Construction Quality Assurance Report
CQC	Construction Quality Control
DBS&A	Daniel B. Stephens and Associates, Inc.
DNA	Determination of NEPA Adequacy
DP	Discharge Permit
EA	Environmental Assessment
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
EOY	End of Year
FONSI	Finding of No Significant Impact
ft	Feet
Golder	Golder Associates Inc.
gpm	Gallons Per Minute
Guidelines	Closeout Plan Guidelines

HDPE	High Density Polyethylene
kV	Kilovolt
LOM	Life of Mine
mg/L	Milligrams Per Liter
msl	Mean Sea Level
MMD	Mining and Minerals Division of the New Mexico Energy, Minerals and Natural Resources Department
MPO	Mine Plan of Operations
MSGP	Multi-Sector General Permit
NEPA	National Environmental Policy Act
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
NMMA	New Mexico Mining Act
NMOSE	New Mexico Office of the State Engineer
NMWQA	New Mexico Water Quality Act
NMWQCC	New Mexico Water Quality Control Commission
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	United States Department of Agriculture, Natural Resources Conservation Service
NSR	New Source Review
O&M	Operation and Maintenance
PDTI	Phelps Dodge Tyrone, Inc.
PMLU	Post-Mining Land Use
RCRA	Resource Conservation and Recovery Act
ROD	Record of Decision
Rules	New Mexico Mining Rules
SCS	Soil Conservation Service
SPCC	Spill Prevention Control and Countermeasures
SX/EW	Solution Extraction-Electrowinning

SWPPP	Stormwater Pollution Prevention Plan
su	Standard Unit of Measure for pH
TDS	Total Dissolved Solids
Telesto	Telesto Solutions Incorporated
Tyrone	Freeport-McMoRan Tyrone Inc.
USFS	United States Department of Agriculture, Forest Service

1.0 INTRODUCTION

The Little Rock Mine is approximately 11 miles south of Silver City, New Mexico and 1 mile west of the Tyrone Mine (**Figure 1-1**). The site features at the Little Rock Mine are depicted on **Figure 1-2** and include an existing open pit copper mine, haul road, and associated facilities to support mining operations. The Little Rock Mine also includes lands that were disturbed by earlier operations (1970s) and have since been reclaimed.

The Little Rock Mine is currently permitted with the Mining and Minerals Division of the Energy, Minerals and Natural Resources Department of New Mexico (MMD) as an existing active mining operation (Rev. 14-1 to Permit No. GR007RE). The New Mexico Environment Department (NMED) Ground Water Quality Bureau issued Discharge Permit (DP) 1236 and both Departments approved the 2014 Closure/Closeout Plan (CCP) in 2016.

This CCP is an update of the 2014 Little Rock Mine and renewal application submitted to the NMED and the MMD, which was approved by the agencies in March 2016. In addition, in December 2013 the Water Quality Control Commission adopted the Copper Mine Rule, 20.6.7 New Mexico Administrative Code (NMAC).

Historic discharges at the Little Rock Mine, created by the former operator are subject to the Copper Mine Rule. The waste stockpiles constructed to date and proposed to be constructed are non-discharging units. The proposed road fill across Deadman Canyon will also be a non-discharging unit. These units are subject to the sections of the Copper Mine Rule that require the permittee to provide evidence that these features are and will be non-discharging units. This CCP reflects the applicable requirements of the Copper Rule and includes the current CCP for the Little Rock Mine.

1.1 Purpose of Plan

The purpose of this CCP is to present a reclamation plan (technical scope of work) consistent with all applicable federal and state regulatory requirements and permit conditions so that a financial assurance cost estimate can be calculated to meet the financial assurance requirements of Part 19.10.12 NMAC and DP-1236 once this scope of work is approved by the State and Federal Agencies. The Little Rock Mine CCP has been updated as required by: DP-1236, which was renewed and modified by the NMED on March 8, 2016 (NMED 2016); and Permit Revision 14-1 to Permit GR007RE (MMD 1998), which was issued by the Director of the MMD on March 8, 2016 (MMD 2016), and subsequently modified on February 5, 2018 (MMD 2018). DP-1236 addressed a number of issues regarding site-specific closure requirements at Little Rock, post-closure ground water monitoring and reporting requirements, and general financial assurance requirements. The MMD Permit details general obligations and conditions for mine closure, reclamation, and associated financial assurance requirements.

This CCP Update also incorporates the new requirements of the Copper Mine Rule. In addition, for those portions of the Little Rock Mine on federal public lands that are operated under a Mine Plan of Operations (MPO), the CCP addresses the requirements of the MPO and 43 C.F.R. Part 3809. The land that is planned to be disturbed by future mining is either managed by the Bureau of Land Management (BLM), United States Department of Agriculture Forest Service (USFS), or is owned by Freeport-McMoRan Tyrone Inc. (Tyrone).

1.2 Plan Organization

This section describes the purpose and scope of the CCP Update and its overall organization. The main body of the CCP consists of the following sections:

- **Section 1.0** provides an overview of the updated CCP for the Little Rock Mine;

- **Section 2.0** describes the existing and new facilities and current (2020) environmental setting at the Little Rock Mine including geology, fauna, flora, mine history, current (2020) disturbances, and permits associated with the mine;
- **Section 3.0** describes the proposed reclamation design criteria and performance objectives for surface reclamation and water management;
- **Section 4.0** provides details on the reclamation plans for the major facilities at the Little Rock Mine;
- **Section 5.0** describes the closure and post-closure monitoring plans for Little Rock along with contingency plans and reporting schedules;
- **Section 6.0** provides details of the proposed post-mining land uses and site-specific revegetation success guidelines for the Little Rock Mine;
- **Section 7.0** presents a summary of the material take-offs and factors that will be applied in the capital and operations and maintenance (O&M) cost estimates associated with the proposed reclamation and post-closure monitoring plans presented in Sections 4.0 and 5.0;
- **Section 8.0** presents the proposed reclamation schedule associated with this CCP;
- **Section 9.0** is the signature page for the CCP update; and
- **Section 10.0** lists the references used in preparation of this CCP.

The following appendices are also included in the updated CCP:

- **Appendix A** includes the reclamation design drawings that illustrate the updated CCP;
- **Appendix B** provides the updated facility characteristic forms;
- **Appendix C** includes the updated 2020 earthworks material take-offs; and
- **Appendix D** includes the 2020 Slope Stability Report.

1.3 Regulatory Authority

The New Mexico legislature enacted the New Mexico Mining Act (NMMA) in 1993 requiring that closeout plans be put in place for applicable mines within the State. Rules to implement the requirements of the NMMA were promulgated in 1994. This CCP was prepared to comply with applicable regulations and requirements stipulated in the NMMA and NMAC Title 19, Chapter 10, Part 5, New Mexico Water Quality Act (NMWQA), and the New Mexico Water Quality Control Commission (NMWQCC) Regulations (NMAC Title 20, Chapter 6, Parts 2 and 7).

The requirements of those laws are addressed in the conditions of Tyrone's permits GR007RE and DP-1236 for the Little Rock Mine. In 2013, NMED adopted new rules for the copper mining industry. Applicable conditions of these new rules, the Copper Mine Rule, have been addressed in this CCP. **Table 1-1** provides a summary of the closure and post-closure requirements in the Copper Mine Rule and the associated sections of this CCP Update for which they are addressed.

1.4 History of Closure/Closeout Plan Submittals

The original Little Rock Mine Closeout Plan for the Little Rock Mine was submitted to the MMD on August 29, 1997, and later revised in May 1998 at the request of MMD to reflect the approved Mine Plan of Operations (PDTI 1993). The original CCP was submitted to both agencies (NMED and MMD) on September 30, 1999 and approved by MMD on December 29, 2000 (MMD 2000) and the NMED on December 27, 2000 (NMED 2000). The following list provides a chronology of the more recent progress leading to this updated CCP:

- Tyrone submitted a reclamation cost estimate for the Copper Leach Stockpile, Precipitation Plant, and existing pit area (non-mining scenario) to the NMED and MMED in September 2009, and the non-mining reclamation cost estimate was approved by both agencies in October 2009;
- Tyrone requested that MMD revise the mine permit to return to an operating status in April 2010;
- An updated CCP for the Little Rock Mine was submitted to the agencies on July 21, 2010 (Tyrone et al. 2010) detailing the reclamation plan associated with updated mine development and operational plans;
- Revision 10-1 was approved on December 30, 2010 (MMD 2010), approving the change from standby to operating status, incorporating the 2010 Updated CCP which detailed the CCP under a mining scenario for the Little Rock Mine, and replacing Revision 97-1 to Permit No. GR007RE;
- An updated CCP for the Little Rock Mine was submitted to the agencies on June 19, 2014 (Golder 2014) detailing the reclamation plan associated with updated mine development and operational plans;
- MMD Permit Revision 14-1 and NMED DP-1236 renewal and modification were approved on March 8, 2016 (MMD 2016, NMED 2016), approving the expansion of the Little Rock Mine Permit Area, expansion of the Mining Area Design Limit, and updated 2014 CCP and reclamation cost estimate for the Little Rock Mine; and
- Tyrone requested a modification to Revision 14-1 to change permit condition 8.W from a closeout plan submittal date by June 30, 2018 to a submittal date by June 11, 2020. Modification 18-1 was approved in 2018.

Throughout the development of the CCPs, the naming of individual facilities has changed over time. A summary of the names previously used for individual facilities along with the current facility names used in this CCP Update is provided in **Table 1-2**.

1.5 Description of Updated Plan

The MMD and NMED require that existing mines prepare a CCP and the entity responsible for the mine must post financial assurance "*sufficient to assure the completion of the performance requirements of the permit, including closure and reclamation, if the work had to be performed by the director or a third party contractor.*"

This update to the CCP revises the CCP Update submitted in June 2014 (Golder 2014) with refined closure/closeout conceptual designs that account for changes in site-specific conditions, ongoing and completed reclamation projects, and the five year mine plans. Consistent with the previous Little Rock Mine CCPs, this updated plan is a "snapshot in time" that reflects the most expensive closure scenario within the 5-year period (years 2020 through 2024) covered by this CCP based on the Little Rock Mine plans and site conditions.

Details of facility changes that have occurred since the last CCP and those projected in the subsequent planning period are provided in this CCP. A recent evaluation of the five-year mining sequence (years 2020 through 2024) determined that 2024 is the highest reclamation cost year. The facility characteristics and reclamation designs presented in this CCP are referenced to conditions at Little Rock at the EOY 2024 as well as the projected status of ongoing and planned reclamation projects prior to the EOY 2024, unless otherwise noted. The proposed reclamation and post-closure monitoring plans for the principal mine facilities are described in Sections 4.0 and 5.0.

This updated CCP will support financial assurance cost estimates for closure/closeout based on the EOY 2024 mine plan. Use of the EOY 2024 mine plan is consistent with the snapshot in time philosophy that was adopted by Tyrone and the Agencies early in the closure planning process and represents the year with the greatest volume of regrading and cover placement required for the five year mine plan. If mining activities were to cease before EOY 2024, the highest reclamation cost scenario would be associated with the EOY 2024 conditions.

1.6 Proposed Modifications to Mine Permit Boundary and Open Pit Design Limit

As part of this updated CCP, Tyrone is proposing to modify both the existing Little Rock Mine Permit Boundary and the current Mining Area Design Limit to account for the current life of mine (LOM) plan. Tyrone is proposing to expand the existing Little Rock Mine Permit Boundary by approximately 348 acres to account for the projected expansion of the open pit and associated disturbance areas outside the current permit boundary limits (**Figure 1-3**). Tyrone is making these proposals to comply with NMMA 19.10.5.502 and 19.10.5.505.B. (1) that pertain to permit modifications and revisions.

Tyrone is also proposing to expand the current approved Little Rock Mine Mining Area Design Limit by approximately 558 acres (**Figure 1-3)**. Section 2.0 describes the associated mine facilities within the proposed Mining Area Design Limit. Under this plan, the proposed expanded Little Rock Mine Permit Boundary and the proposed expanded Little Rock Mine Mining Area Design Limit Boundary are consistent with one another. Further details of the proposed mine permit boundary and design limit changes are presented in Section 6.0.

2.0 EXISTING AND NEW FACILITIES AND CONDITIONS

The existing Little Rock Mine Permit Boundary occupies approximately 680 acres in parts of Sections 16, 17 and 20, Township 19 South, Range 15 West, New Mexico Principal Meridian and Baseline. The existing topography, site features, existing and proposed permit boundaries, and section lines are shown on (**Figure 1-2**), and the topography, site features, and permit boundaries that are planned to be in place by the EOY 2024 are shown on (**Figure 2-1**).

The following sections describe the existing and new Little Rock mining facilities and operations, ownership history, past and current (2020) land uses, environmental setting, and mine material characteristics. In addition, pertinent permits and the operational DP for the Little Rock Mine are summarized herein.

2.1 Description of Mining Facilities

Section 2.1 describes the Little Rock mining features as of June 2020. The principal mining features at the site include the Little Rock Mine open pit, historical North and West Canyon waste rock stockpiles, North In-Pit Waste and West In-Pit Waste stockpiles, and the Reclaimed Copper Leach Stockpile (a.k.a. reclaimed leach stockpile) and P-Plant. The existing (June 2019) Little Rock Mine open pit encompasses approximately 196 acres, and the historical North and West Canyon waste rock stockpiles occupy approximately 9.6 acres. Approximately 31 acres are associated with the Reclaimed Copper Leach Stockpile and 1 acre is associated with the reclaimed P-Plant. The existing Little Rock Haul Road that provides access between the Little Rock and Tyrone mines covers an area of approximately 20 acres within the Little Rock Mine Permit Area. In addition to these primary features of the Little Rock Mine, the current permits allow for other operational facilities including a 46-kilovolt (kV) power distribution system, and temporary operations and maintenance facilities that are all projected to be in place by the EOY 2024. The current permits also allow for a secondary dewatering pipeline (dewatering pipeline alignment #2) that is not currently included in the EOY 2024 mine plan. The total existing and approved disturbance at the Little Rock Mine associated with the primary and ancillary facilities is approximately 322 acres.

Figure 2-1 depicts the primary elements of the Little Rock Mine that will be present at the EOY 2024, including the projected EOY 2024 configurations for the existing open pit, waste rock stockpiles, dewatering pipeline, seepage collection pipelines, and western haul road. In addition, **Figure 2-1** shows the EOY 2024 configurations of the planned East In-Pit Waste, CLW Waste, and NRW Waste stockpiles that will be present by the EOY 2024. The Reclaimed Copper Leach Stockpile will be removed and the material transported to a leach stockpile at the Tyrone Mine by the EOY 2020. The new CLW Waste stockpile will then be placed over the former footprint of the former Copper Leach stockpile. For FA purposes it is assumed that the Reclaimed P-Plant area will be disturbed.

2.1.1 Open Pit

The open pit at life of mine (LOM) is anticipated to encompass approximately 448 acres (represented as blue line on **Figure 2-1**), including approximately 275 acres of BLM managed lands and approximately 173 acres of private land. The open pit is currently being mined in 50-foot benches, creating a terraced/benched pit wall that will ultimately have one or more flat bottoms. The anticipated EOY 2024 pit configuration spans California Gulch and portions of Deadman Canyon.

During operation, storm water and ground water will be effectively managed as it is today under the current permit. Storm water from California Gulch and Deadman Canyon will be directed to the main sump at the bottom of the open pit. During operation, storm water, along with ground water inflow, will be pumped to the existing lined 1X1 Pond (lined with high density polyethylene [HDPE]) located near the Reclaimed 1X Tailing Impoundment at

Tyrone via the LR Sump – 1X1 dewatering pipeline (dewatering pipeline). The existing seepage collection pipeline from the Reclaimed Copper Leach Stockpile and P-Plant area also connects to the dewatering pipeline. From the lined 1X1 Pond, the collected water is conveyed through a booster pump station to the SX/EW raffinate tanks and then used in the Tyrone Mine process water management system.

At closure (EOY 2024), a pit lake is expected to begin to form within the Little Rock Mine open pit due to the cessation of dewatering activities. The pit lake is predicted to rise to an elevation of approximately 5,660 feet mean sea level (msl) at 30 years following closure, and then generally stabilizes at an elevation of approximately 5,669 feet msl at approximately 80 years after closure (see Section 3.2.1).

2.1.2 Waste Rock Stockpiles

The waste rock stockpiles consist of Pre-Cambrian Granite, a non-acid generating overburden material and are conditionally exempt from the engineering design, construction, and operational requirements of the Copper Mine Rule and the Water Quality Act during operations and at closure. Tyrone is currently monitoring Pre-Cambrian test plots that are expected to confirm that the material meets suitability criteria for reclamation cover.

There are currently four waste rock stockpiles located within the Little Rock Mine Permit Area, including the historical North and West Canyon waste rock stockpiles, and the North In-Pit Waste and West In-Pit Waste stockpiles. The historical North and West Canyon waste rock stockpiles are located around the perimeter of the open pit (**Figure 1-2**). The historical North waste rock stockpile is located on the northwest side of the existing open pit. The historical West Canyon waste rock stockpile is located approximately 200 feet southwest of the projected EOY 2024 open pit limit. These stockpiles have been colonized by native vegetation and no additional reclamation measures are proposed for the areas that will remain at the EOY 2024 (**Figure 2-1**). Although no additional reclamation measures are proposed for the North and West Canyon waste rock stockpiles, Operations and Maintenance (O&M) costs will be included until financial assurance is released.

Two stockpiles are currently under development within the Little Rock Mine open pit (**Figure 1-2**). The West In-Pit Waste stockpile is located in the western portion of the open pit and is projected to cover an area of approximately 42.9 acres at EOY 2024. The pit lake surface is not projected to cover any of the West In-Pit Waste stockpile after closure. The North In-Pit Waste stockpile is located in the north central portion of the open pit and is projected to cover an area of approximately 13.3 acres at EOY 2024. The North In-Pit Waste stockpile is projected to be completely covered by the stabilized pit lake surface at approximately 80 years after closure.

Three additional new waste rock stockpiles are included in the EOY 2024 mine plan (**Figure 2-1**). The CLW Waste stockpile will be located within the footprint of the Reclaimed Copper Leach stockpile and is projected to cover an area of approximately 31.2 acres by the EOY 2024. The NRW Waste stockpile will adjoin and be located immediately north and east of the historical North stockpile and is projected to cover an area of approximately 40.1 acres by the EOY 2024. The East In-Pit Waste stockpile will be located in the eastern portion of the open pit and is projected to cover an area of approximately 20.4 acres by the EOY 2024. The East In-Pit stockpile facility is projected to cover an area of approximately 9.9 acres above the stabilized pit lake surface after closure.

Topsoil will be salvaged during mining operations where feasible, and the salvaged material will be temporarily stored within the Mining Area Design Limit or the 9A Stockpile for future use as reclamation cover material.

2.1.3 Haul Roads

Two additional haul roads are required during mining and are included in the 5-year mine plan (EOY 2020 through EOY 2024), the Northern Haul Road and Southern Haul Road. The Northern Haul Road crosses Deadman

Canyon and connects to the existing Little Rock Haul Road. The Southern Haul Road crosses Deadman Canyon at the approximate location of the existing spanning arch culvert on the south side of the pit.

2.1.4 Infrastructure and Other Miscellaneous Facilities

In addition to the major mine components identified above, there are a number of key ancillary facilities and infrastructure dispersed across the mine that support the operations at Little Rock. The ancillary facilities at the Little Rock Mine include: electrical power transmission lines and substations; storm water structures for drainage, diversion, and sediment control; and fencing.

2.1.4.1 Monitoring Wells and Exploration Drill Holes

All historical exploration holes were located and abandoned or mined out in first quarter 2010 (Tyrone 2011). All exploration holes drilled since the first quarter of 2010 were closed immediately. There are currently 9 monitoring wells at Little Rock. During the 5 year mine plan, it is projected that 5 monitoring wells with an average depth of 150 feet will be impacted and will need to be replaced.

2.1.4.2 Substation, Concrete Slabs, and Powerlines

Utilities serving structures to be demolished and remaining concrete slabs include:

- 46 kilovolt powerline;
- Substation;
- Pipelines; and
- Concrete slabs.

Power transmission lines and substation will be removed once they are not needed for post-closure purposes. Power poles will be left in place to serve as raptor perches after reclamation.

2.1.4.3 Other Roads and Dewatering System and Conveyance Pipelines

As depicted in **Figure 1-2**, the Little Rock Haul Road provides access between the Little Rock and Tyrone mines, and crosses Deadman Canyon over an existing spanning arch culvert on the south side of the pit. By the EOY 2024, a substantial portion of the existing Little Rock Haul Road will be enveloped by the open pit (including part of the existing spanning arch culvert over Deadman Canyon). The Little Rock Haul Road will be reconfigured and the Northern Haul Road and Southern Haul Road will be constructed, within the proposed Mining Area Design Limit by the EOY 2024 as shown on **Figure 2-1** to provide access for mining operations. Ore from the Little Rock Mine will continue to be hauled to leach stockpiles at Tyrone.

A proposed new haul road, designated as the Western Haul Road, was approved in 2016 as part of Permit Revision 14-1 to Permit GR007RE. To date, this haul road has not been constructed, and the current EOY 2024 mine plan includes the construction of the NRW Waste stockpile over part of the area previously proposed for the haul road. Additionally, as with the ongoing mining operations, haul roads internal to the open pit will be extended or constructed as pit excavation advances. The haul roads located at Little Rock Mine, that will be present at the EOY 2024, are shown in **Figure 2-1**.

The existing dewatering system at Little Rock pumps surface water and ground water that accumulates in a sump located at the bottom of the open pit during operations, which allows the mine to operate during normal activities within the open pit and during rain events. The dewatering system will continue to pump surface water and ground water that accumulates in a sump located at the bottom of the open pit during operations. A series of temporary dewatering sumps will be excavated as the pit is lowered, and water extracted from these sumps will be pumped to a temporary lined pond consisting of two sumps arranged in series that also serve as settling basins for sediments.

The temporary lined pond will continue to receive seepage from the CLDS and CLDS-1 collection trenches. Water from the temporary lined pond is then pumped via a diesel-powered pump through a 12-inch HDPE pipeline (referred to as the LR sump-1x1 pipeline) that extends to an existing 10-inch HDPE pipeline that runs to the existing lined 1X1 Pond (**Figure 2-1**). Post-closure water quality monitoring is addressed in Section 5.3 of this CCP.

2.1.5 Reclaimed and Removed Facilities

A substantial amount of reclamation work has been conducted at the Little Rock Mine since the issuance of DP-1236 and MMD Permit GR007RE. Facilities where reclamation is complete include: the abandoned Copper Leach Stockpile and P-Plant left by former operators (**Figure 1-2**); exploration roads; and all exploration holes located outside of the open pit boundary were plugged and abandoned in the first quarter of 2010 (Tyrone 2011a). Reclamation of the P-Plant and the Copper Leach Stockpile commenced in February 2010 and all work was completed in 2011.

2.2 Past and Current Land Uses

Lands in the vicinity of the mine have historically been used for mining, livestock grazing, timber and fuel wood harvesting, recreation, and wildlife habitat. Ponderosa pine was logged in the Big Burro Mountains south of the Little Rock Mine, and fuel wood has been cut from woodlands in this area for at least a century. Recreation in the area includes camping, picnicking, hunting, off-road vehicle use, hiking, horseback riding, and bicycling.

Current surrounding land uses include grazing, mining, and recreation. Grazing is the predominant land use surrounding the mine. Mining in the area of Little Rock dates back to the mid to late 1800s. During this period, mining and prospecting ranged from small shallow surface excavations to large scale underground workings. In the 1960s and early 1970s, operations at the Little Rock Mine were expanded. Mining during this period was intermittent but included the development of an open pit, leach stockpiles, and precipitation plant used to recover copper. The nearby Tyrone Mine went into large scale open pit production in the late 1960s. In the early 1990s, Tyrone began the process of obtaining the regulatory permits and land leases required to mine at the site.

2.3 Environmental Setting

The following sections present various aspects of the mine site, including its topography, geology, climate, hydrology, soils and vegetation, wildlife, and material characteristics.

2.3.1 Topography

The Little Rock Mine area is just west of the Continental Divide between the Big Burro and Little Burro Mountains. The mine is located on the northeastern slopes of the Big Burro Mountains, a northwest-southeast trending range approximately 22 miles long and 4 to 12 miles wide. The Little Burro Mountains are situated northeast of the Big Burro Mountains and are separated from the Big Burro Mountains by the Tyrone mine and the Mangas Valley (**Figures 2-2 and 2-3**). The Mangas Valley and the Little Burro Mountains are located within a structurally controlled regional topographic feature that trends northwest to southeast.

The topography in the vicinity of the Little Rock Mine reflects the relatively gentle northeastern slopes of the Big Burro Mountains (**Figures 2-2 and 2-3**). Burro Peak, on the Continental Divide, rises to an elevation of 8,035 feet above msl. By contrast, the elevation of the Mangas Valley north of the mine is around 5,800 feet above msl. The Continental Divide traces immediately to the east of the Little Rock Mine; bisecting the Tyrone Mine. The Divide separates Mangas Wash, which drains westerly toward the Gila River, from the southeasterly-draining Brick Kiln Gulch and Oak Grove Wash. The Continental Divide crosses the Little Burro Mountains northwest of Tyrone Peak at a maximum elevation of 6,439 feet above msl.

2.3.2 Geology

The mineral deposits at the Little Rock Mine are hosted in granitic rocks that have been altered by hydrothermal and supergene processes. The ore deposit consists of a copper oxide enrichment zone surrounded by leached cap and underlain by a mineral zone that contains minor amounts of pyrite and lesser amounts of chalcopyrite and chalcocite. Copper oxide ore is mined and then transported to Tyrone for processing by solution extraction and electrowinning (SX/EW). Precambrian Granite is the primary source of waste material at the mine and is the material present in the waste rock stockpiles that surround the existing Little Rock Mine open pit. The majority of the waste rock at the Little Rock Mine is believed to be suitable as a reclamation cover material. Minor amounts of sulfide containing rocks produced during mining will be placed in accordance with the approved NMED material handling plan.

The Big Burro Mountains are primarily composed of Precambrian Burro Mountain Granite. This granite is part of a batholith that was intruded by the Tyrone laccolith nearly 56 million years ago (Kolessar 1982). Both Precambrian Burro Mountain Granite and Tertiary intrusive rocks are exposed in the vicinity of the Little Rock Mine. The surface geology at the Little Rock Mine is predominately Precambrian Burro Mountain Granite, while Tertiary intrusive rocks are present throughout much of the area immediately south of the site (Trauger 1972). Younger geologic units, such as Quaternary-Tertiary Gila Conglomerate and Quaternary alluvium occupy the Mangas Valley north of the Little Rock Mine. Gila Conglomerate was deposited as bolson fill and fan deposits derived from Late Tertiary and older tectonic uplifts. More recent alluvium was deposited unconformably on Gila Conglomerate north of the Little Rock Mine and is also present as valley fill along many present-day drainages including California Gulch and Deadman Canyon.

Several faults have been mapped in the area of the Little Rock and Tyrone mines in association with early geologic mapping (Trauger 1972, Hedlund 1978) and through mining and mineral exploration activities. The predominant geologic structures in the region are sets of northeast- and northwest-trending faults. Some of these faults exhibit hundreds of feet of offset and juxtapose different geologic units. The Austin-Amazon fault is a major northeast-striking fault approximately 0.4 miles northwest of the existing Little Rock Mine open pit. Two east-west trending faults are also located near or within the permit boundary. These include the Southern Star fault located along the northern perimeter of the permit boundary and an unnamed fault that runs through the permit boundary and is located approximately 0.3 miles north of the existing open pit (**Figure 2-4**). A generalized geologic map showing the exposed geology associated with the projected EOY 2024 open pit configuration is presented on **Figure 2-5**, and associated geologic cross sections through the projected EOY 2024 open pit are presented on **Figure 2-6**.

2.3.3 Climate

The Little Rock Mine is located in a semi-arid region in southwestern New Mexico, with elevations ranging from approximately 5,800 to 6,300 feet above msl (**Figure 2-3**). The climate is warm and dry, with mean annual precipitation of approximately 16 inches (400 millimeters [mm]) and a mean annual temperature near 50^{o}F (10^{o}C).

Precipitation falls mainly as rain, but snow may occur from November to March. Most of the precipitation in the area falls during July through October in the form of rain during short, intense, thunderstorms. Approximately 60 percent of the precipitation falls during the summer months. Precipitation is characterized mostly by small magnitude events ranging from less than 0.1 to 0.25 inches (2.5 to 6.4 mm) per day. Larger magnitude rainfall events (greater than 1 inch) also occur in the summer months, but at a much lower frequency. Monthly precipitation is generally less than an inch per month from November through June, peaks in July, August, and September with between 2 and 3 inches per month, and generally falls to approximately 1 inch in October. Evaporative demand in this region is high and annual evaporation far exceeds annual precipitation.

Eight weather stations are located in the vicinity of the Little Rock Mine each with varying periods of record. Of those stations, the Tyrone Mine General Office station has the longest period of record (i.e., 1954 to the present). The Little Rock Mine station has a relatively short period of record, with records starting in 2001. Longer term records (more than 40 years) are available from five weather stations located near the mine. The five stations with the longest periods of record are:

- The Tyrone Mine General Office station, located at the Tyrone Mine at an elevation of 5,960 feet above msl;
- The White Signal station, located approximately 7 miles south at an elevation of 6,066 feet above msl;
- The Hurley station, located approximately 15 miles east at an elevation of 5,700 feet above msl;
- The Santa Rita station, located approximately 20 miles east-northeast at an elevation of 6,312 feet above msl; and
- The Fort Bayard station, located approximately 20 miles northeast at an elevation of 6,149 feet above msl.

These stations are considered fairly representative of the range of climate conditions at Little Rock. Long-term climatic records (spanning more than 100 years) are available for Fort Bayard.

2.3.4 Hydrology

The Continental Divide is located approximately 3 miles south of the Little Rock Mine and runs along the peaks of the Big Burro Mountains. The Continental Divide separates surface water drainages that are tributary to the Gila River from drainages that are tributary to the Mimbres River. The New Mexico Office of the State Engineer (NMOSE) has declared two underground water basins in the region, the Mimbres and Gila-San Francisco. Ground water beneath the Little Rock Mine is in the Gila-San Francisco underground water basin. The following sections further describe surface water and ground water resources in the vicinity of the Little Rock Mine.

2.3.4.1 Surface water

Surface water features in the area of the Little Rock Mine consists of ephemeral washes in California Gulch and Deadman Canyon (**Figure 1-2**). These ephemeral washes flow only in direct response to precipitation events and have channels that are above the regional bedrock aquifer. The washes do not support self-sustaining populations of fish or other aquatic species.

Deadman Canyon and California Gulch flow from south to north and converge at the north end of the site before discharging to a constructed diversion channel, and ultimately to the Mangas Wash. Whitewater Canyon also contributes flows to the constructed diversion channel. Mangas Wash is a tributary to the Gila River, and the drainage is ephemeral in the vicinity of the Little Rock Mine. Both California Gulch and Deadman Canyon cross through the Little Rock Mine Permit Area. Storm water in California Gulch, upgradient of the Little Rock Mine flows to the Little Rock open pit. In response to runoff events, surface water converges with ground water in the open pit bottom. As previously described, water from the open pit is currently pumped to the lined 1X1 Pond via the LR sump-1x1 pipeline.

At the EOY 2024, the open pit is expected to intersect the ephemeral Deadman Canyon drainage, requiring the management of storm water flows. A diversion channel will be constructed during closure to convey surface water flows from Deadman Canyon along the eastern portion of the open pit. The Deadman diversion will be constructed on non-acid generating rocks, including an approximate 704-foot long section adjacent to the East In-Pit Waste stockpile. The Deadman Canyon Diversion will be designed to control erosion and to safely convey storm water for discharge in accordance with 20.6.7.33.A NMAC.

Two ephemeral springs occur outside the Little Rock Mine Permit Area. Sugar Loaf Spring occurs west of the Little Rock Mine Permit Area, and McCain Spring is located to the east of the Little Rock Mine Permit Area (**Figure 2-7**). Flows at these springs are sporadic, and primarily occur in response to precipitation events. The ephemeral nature of these springs and their location compared to the topography suggest that they are fed by infiltration on the upgradient slopes immediately adjacent to the springs and are not discharge points for regional ground water that would be hydraulically connected to the aquifer beneath the Little Rock Mine.

Surface water flow and water quality monitoring data are collected at several locations and the results are reported in accordance with DP-1236 (**Figure 2-7**). These monitoring locations include: seepage collection points CLDS and CLDS-1; flow samplers in California Gulch (LRFS-1 through LRFS-3); the open pit sump; and nearby Sugar Loaf and McCain springs. The three flow samplers are located near mine facilities and collect samples of ephemeral surface water within California Gulch during storm events. At closure (EOY 2024), a pit lake is expected to begin to form within the Little Rock Mine open pit due to the cessation of dewatering activities. Details of the predicted pit lake stage and water quality following closure are provided in Section 3.2.1.

2.3.4.2 Ground Water

Regional ground water exists within intrusive igneous rocks at the Little Rock Mine. These rocks include Precambrian Granite, Tertiary Granodiorite, and Tertiary Quartz-Monzonite (**Figure 2-4**). Precambrian Granite is the most abundant rock type and is intruded by the Tertiary Granodiorite in the area of the southwest portion of the projected EOY 2017 open pit. Several large Tertiary Quartz-Monzonite dikes trend southwest to northeast along the entire south side of the open pit. Ground water occurrence and flow within the igneous rocks is governed by secondary permeability (i.e., joints, fractures, and faults); the direction of ground water flow is predominantly toward the east/northeast and in the direction of the Main Pit at Tyrone (**Figure 2-8**).

During mining operations, ground water flow patterns will continue to change in the vicinity of the Little Rock Mine open pit due to dewatering activities, as the open pit is advanced below the regional water table. In July 2013, ground water began infiltrating into the open pit and dewatering efforts commenced. The extraction rate from the Little Rock Mine open pit was approximately 2.7 gallons per minute (gpm) in July of 2013, and increased to approximately 178 gpm in August 2013 due to increased surface water and ground water inflows, and the advancement of mining within the pit (Tyrone 2013b). Regional water quality generally meets all Section 20.6.2.3103 NMAC standards, but occasionally the standards for fluoride or manganese are exceeded due to natural background conditions.

Several geologic structures also affect ground water flow in the area of the Little Rock Mine. These structures include the Austin-Amazon and Southern Star faults and Tertiary Quartz-Monzonite dikes. The two faults are regionally extensive faults and act as low-permeability barriers to ground water flow (DBS&A 2014). The Austin-Amazon and Southern Star faults are located to the northwest and north of the Little Rock Mine open pit, respectively.

The Tertiary Quartz-Monzonite dikes act as low-permeability features, limiting ground water flow from the south side of the dikes to the north. Mining at the Little Rock Mine will excavate portions of the dikes below the regional water table, allowing ground water from the south to flow more readily to the Little Rock Mine open pit. Due to the presence of these low-permeability features (faults and dikes), the majority of the ground water in the Little Rock Mine area flows toward the Tyrone Main Pit rather than northerly toward the Mangas Valley. At closure (EOY 2024), a pit lake is expected to begin to form within the Little Rock Mine open pit due to the cessation of dewatering activities. Details of the predicted pit lake stage and water quality following closure are provided in Section 3.2.1.

Perched ground water is present in shallow alluvium beneath the California Gulch and Deadman Canyon drainages near the site. These shallow ground water systems are restricted to the alluvial sediments that overlie bedrock in the drainage channels. Saturation within these systems is intermittent, existing primarily during spring and summer runoff.

2.3.5 Soils and Vegetation

Two soil-vegetation associations have been identified within the mine permit area. Vegetation at the Little Rock Mine is characterized by mixed evergreen woodland dominated by pinyon pine (*Pinus edulis*), One-seed juniper (*Juniperus monosperma*), Emory oak (*Quercus emoryi*), and shrubs and scattered warm season grasses. The soils in the mountain slope mixed evergreen woodland association are mostly loamy skeletal Haplustolls. These soils are shallow, noncalcareous, and medium- to coarse textured with moderate to high amounts of coarse fragments. These soils formed in residuum and colluvium from competent igneous rocks composed of quartz monzonite and granite.

Minor areas of bedrock are exposed at the surface. This association occupies the very steep back slopes and ridges of the Big Burro Mountains. Vegetation within the mountain slope mixed evergreen woodland association represents the lower elevation ranges of this community regionally. Ponderosa pine (*Pinus ponderosa*) and Gambel oak (*Quercus gambelii*) are locally important subordinates in this community that may dominate minor sheltered topographic positions. A riparian corridor is associated with portions of the upper reaches of Deadman and Whitewater canyons and California Gulch. Fremont cottonwood (*Populus fremontii*) may occur as an incidental species in the riparian areas.

2.3.6 Wildlife

Wildlife species in the vicinity of the Little Rock Mine are representative of those communities that are found in southwestern New Mexico pinyon-juniper-oak woodlands. Surveys conducted in the area of the Tyrone Mine indicate that there is a healthy diversity and abundance of vertebrate species using the habitat around the mine. At least 18 mammals, 79 bird species, and 5 reptiles have been documented in the vicinity of the Tyrone Mine (DBS&A 1997, Metric Corporation 1993 and 1996, and Dames & Moore 1994).

Surveys to identify Federal and State threatened, endangered, and special status wildlife species, were conducted by Metric Corporation (1993 and 1996) and Tierra Environmental Consultants (2010) in the Little Rock Mine project area.

Existing wildlife habitats associated with the Little Rock Mine are largely upland, terrestrial habitats. No fisheries exist within the immediate vicinity of the proposed mine. The drainages which traverse the site are ephemeral and flow only in response to storm events or spring snowmelt.

2.3.7 Material Characteristics

Tyrone has developed a classification of the mineralization types that occur in the rocks at the Little Rock Mine area. This classification system was developed to characterize the deposit from an ore processing perspective. Mineral type information is routinely used for detailed mine planning and for copper production forecasting. The basic theme of the mineral type designation is to identify the type of copper mineralization and acid neutralizing potential associated with the ore body. This ore body contains a high concentration for calcite veins, which reduce copper leach recovery. The mineral information is used to evaluate the application concentration of leach solution for economic copper recovery.

These sample results also have an environmental application. Acid-base accounting (ABA) and total metals analyses were conducted on an initial group of 90 samples in order to evaluate the metal mobility/reactivity of the rocks for each of the mineral types defined for the area. A supplemental group of 34 samples were submitted for ABA determinations in August 1998. The collective results of the 124 samples from the two sampling campaigns indicate that the mineral types at the Little Rock Mine have very little to no potential to generate acid. There are three primary mineral types found within the Little Rock Mine Permit area in addition to reclamation borrow material. These mineral types are described below.

Precambrian Granite

The distinguishing minerals in Precambrian Granite consist predominantly of goethite and hematite. No sulfide minerals are known to occur in the leach cap; the degree of oxidation is complete. Other accessory minerals identified within leach cap include calcite, montmorillonite, kaolinite, and specularite.

The Precambrian Granite is composed primarily of the minerals quartz, orthoclase, plagioclase and biotite that occur as coarse-grained crystals. The degree of fracturing within leach cap is related to its proximity to oxide copper mineralization. The fractures are more abundant adjacent the oxide zone and diminish outward. Goethite and hematite are present as secondary minerals, which are weathering products of oxidation of the pre-existing pyrite and chalcopyrite grains. Other secondary minerals mentioned above occur in association with the rock forming minerals such as feldspars altered to clay, specularite in veinlets, and calcite that is associated with iron oxides, feldspars, and also as discrete crystals. The ABA data for Precambrian Granite strongly suggest that it will not generate acid and has a moderate potential to neutralize acid. The Precambrian Granite comprises the bulk of the overburden rock mined from the open pit.

Copper Oxide

The distinguishing mineral in copper oxide is chrysocolla, which is the major ore component at the Little Rock Mine. Like leach cap, no sulfide minerals are known to occur in the oxide copper zone and the degree of oxidation is complete. Other accessory minerals include goethite, hematite, calcite, montmorillonite, kaolinite, white mica (sericite), malachite, and azurite.

Masses that contain varying amounts of manganese, iron, and copper in an oxide form are also present in volumetrically minor amounts. The oxide copper mass is entirely hosted by Precambrian Granite. The oxide copper zone is the most fractured of all the rock types at the Little Rock Mine. The ABA data strongly suggest that the oxide copper will not generate acid and has a moderate to strong potential to neutralize acid. The oxide copper rock is the ore being mined at the Little Rock Mine and hauled to Tyrone.

Chalcopyrite-Pyrite

Chalcopyrite and pyrite are the distinguishing minerals for this mineral type. Accessory minerals identified include chalcocite, covellite, montmorillonite, kaolinite, white mica (sericite), specularite, bornite, and calcite. The copper- and iron-bearing minerals are principally in a sulfide form (not including the rock-forming minerals). This sulfide zone does not contain any appreciable amounts of secondary oxide minerals suggesting limited oxidation within this zone.

Precambrian Granite is the host rock to this mineral type. Fractures are present within this zone, but at a lower density than is observed in the oxide copper zone. The presence of veinlets containing chalcopyrite, pyrite, quartz, and calcite is a distinctive feature of this mineral type. The collective ABA data show that the sulfides have a very low potential to generate acid, with sufficient neutralizing capacity to neutralize all of the acid that may potentially be produced. The sulfide zone rocks therefore also can be classified as having a moderate to high potential to neutralize acid. This mineral type is generally considered to be non-ore rock and constitutes a very small amount of the material being mined.

2.3.8 Overburden Materials

Traditional cover/topsoil resources are scarce in the vicinity of the Little Rock Mine. The native soils are thin and contain moderate volumes of rock fragments. In addition, the slopes are steep and limit the practicality of operating equipment for topsoil salvage. However, it is Tyrone’s opinion that the Precambrian Granite has few apparent limitations as a plant growth media when compared to the native soils. This is being proven with Pre-Cambrian Granite Test Plots located at the Reclaimed USNR site. The Pre-Cambrian Granite is composed primarily of the minerals quartz, orthoclase, plagioclase, and biotite that occur as coarse-grained crystals.

Over the past several years, Tyrone has strategically placed Precambrian Granite mined from the Little Rock Mine at several locations around the mine site, including the 9A Waste and 9AX Waste stockpiles in preparation for reclamation activities at the Tyrone Mine. Overall, the Precambrian Granite overburden materials from the Little Rock Mine are net-neutralizing and non-acid generating. Laboratory analyses indicate that the overburden from the Little Rock areas is relatively uniform and has few apparent limitations as a plant growth media when compared to the surrounding native soils. There are no apparent chemical limitations with respect to salinity in either the overburden or the native soils and the pH and extractable nitrate concentrations occur at similar levels in both materials. The overburden is moderately coarse textured and contains moderate volumes of rock fragments. The native soils exhibited similar characteristics and are moderately coarse textured with moderate amounts of rock fragments (PDTI 2000 and 2005a, Golder 2020b). The suitability of Precambrian Granite as reclamation cover material is further supported by observations of the establishment of perennial native vegetation within the pit area and on the historical North Waste and West Canyon waste rock stockpiles.

A test plot study at the United States Natural Resources (USNR) site (Golder 2017) is also currently evaluating the suitability of Precambrian Granite from the Little Rock Mine as reclamation cover material for the Tyrone Mine. Preliminary results indicate that the USNR test plots are on the right trajectory relative to vegetation success and erosional stability. Tyrone believes that the test plot studies will show that the Precambrian Granite from the Little Rock Mine will perform very well as reclamation cover material.

The Little Rock Mine topsoil salvaging plan also calls for the salvaging of identified topsoil resources of greater than 300 cubic yards in volume with a minimum thickness of two feet. These areas will be identified during the clearing and grubbing of undisturbed areas in preparation for mining.

2.4 Permits and Discharge Plans

Tyrone holds the state and federal permits and authorizations necessary to produce copper from the existing facilities at the Little Rock Mine. Current permits include a NMMA permit from the MMD as an existing mining operation (Mining Act Permit No. GR007RE). The Little Rock Mine is also subject to Discharge Permit 1236 (DP-1236), issued by the NMED. Because a portion of the lands at the Little Rock Mine are managed by the BLM, the mine also maintains a Mine Plan of Operations in conformance with the BLM Surface Management Regulations (43 CFR 3809). **Table 2-1** lists the permits under which the Little Rock Mine currently operates. Tyrone maintains a Storm Water Pollution Prevention Plan (SWPPP) that is inclusive of the Little Rock Mine.

The EPA issued the current MSGP on June 4, 2015; Tyrone operates under permit authorization number NMR053073, confirmed by the most recent NOI acknowledgement issued by the EPA on September 27, 2015. The SWPPP identifies pollution prevention procedures for areas of the site that could potentially discharge storm water associated with mining activities and implements best management practices (BMPs) for the management and control of storm water (Tyrone 2018). The SWPPP will be updated to reflect the planned expansion of the Little Rock Mine.

3.0 RECLAMATION PERFORMANCE OBJECTIVES AND DESIGN CRITERIA

This section presents the performance objectives and design criteria for closure/closeout of the Little Rock Mine facilities. The performance objectives presented herein for closure closeout of the facilities were developed based upon the current requirements of Permit GR007RE, DP-1236, and the Copper Mine Rule, with the intent of meeting rules and requirements associated with the NMWQA, NMWQCC Regulations, Copper Mine Rule, NMMA, and, for the mine areas located on federal public lands, applicable elements of 40 CFR Part 3809. This plan ensures that stormwater and sediment are managed appropriately during and following reclamation in accordance with 20.6.7.33.E NMAC. The primary performance objectives for closure closeout of the Tyrone Mine include: reestablishment of a self-sustaining ecosystem, stabilize the reclaimed areas, and to control discharges of process waters.

Descriptions of the facilities covered by the reclamation designs and their design criteria are included in Section 3.1. The performance objectives and reclamation designs for closure/closeout of the facilities are included in Section 3.2. The existing and planned closure/closeout activities for Little Rock Mine are presented in Section 4.0.

3.1 Facility Characteristics and Classification

To standardize the development of the financial assurance cost estimate associated with this CCP, facilities with common characteristics and mine function have been grouped together in this section. Thus, the stockpiles, open pit, haul roads, conveyance pipelines, and infrastructure and other miscellaneous facilities are identified as the primary reclamation facility groups. Sections 3.1 through 3.5 provide general descriptions, estimated areas of disturbance, and reclamation performance standards associated with each of these facility groups.

The reclamation plans for each of the facility groups are presented in Section 4.0. The characteristics of individual stockpiles, open pit, haul roads, conveyance pipelines, and infrastructure and other miscellaneous facilities are summarized on facility characteristics forms (**Appendix B**). The general areas of disturbance and associated major facilities to be reclaimed at Little Rock are summarized in the following sections.

3.1.1 Stockpiles

A total of approximately 159 acres of stockpile surfaces are targeted for reclamation under this (EOY 2024) plan. No additional earthwork reclamation measures are proposed for the North and West Canyon waste rock stockpiles and operations and maintenance costs will be included in the CCP until financial assurance is released. The conditionally exempt North In-Pit Waste and West In-Pit Waste stockpiles are currently under development within the Little Rock Mine open pit (**Figure 1-2**).

As previously described, the Reclaimed Copper Leach Stockpile will be removed and the material transported to leach stockpiles at the Tyrone Mine by the EOY 2020, and the area will be replaced with the CLW Waste stockpile. For this CCP, it is assumed that the associated Reclaimed P-Plant will be disturbed while removing the Reclaimed Copper Leach Stockpile and the construction of the CLW Waste stockpile.

Three new waste stockpiles (East In-Pit Waste, NRW Waste, and CLW Waste) will be constructed by the EOY 2024 and will be composed of Precambrian Granite a non-acid generating material and are projected to be conditionally exempt of the engineering design, construction, and operational requirements of the Copper Mine Rule and the Water Quality Act during operations and at closure (**Figure 1-3**). The reclamation plan for the stockpiles is described in Section 4.1.

3.1.2 Open Pit

Open pit mining is projected to continue at the Little Rock Mine for an additional 10 years, through 2030. The conceptual end of mine life pit configuration, presented in **Figure 1-3**, will enable mining of additional leachable ore, which will be transferred to the adjacent Tyrone facility for copper extraction. Additional waste rock overburden will be mined to access the leachable ores. The pit configuration at the EOY 2024 will encompass approximately 260 acres within the proposed Mining Area Design Limit, with a total of approximately 4.9 acres of accessible flat areas targeted for reclamation (**Figure 2-1**).

Predictive ground water flow and geochemical modeling was completed by Daniel B. Stephens & Associates (DBS&A) for the Little Rock Mine area in 2014 to evaluate the rate of rise of the pit lake following cessation of dewatering and the associated estimated water quality of the pit lake water following closure. The reclamation plan for the Little Rock Mine open pit is described in Section 4.2.

3.1.2.1 Updated Ground Water Flow and Geochemical Modeling

Predictive ground water flow and geochemical modeling was conducted in 2014 to evaluate ground water and pit lake conditions at closure and to satisfy requirements of DP-1236 (DBS&A 2014). The groundwater flow model was also recently updated to evaluate the rate of rise of the pit lake following cessation of dewatering with the EOY 2024 mine plan configuration. Sources of water inflow to the open pit considered in the modeling included the following:

- Ground water inflow;
- Direct precipitation on to the lake surface;
- Runoff within the perimeter of the pit; and
- California Gulch storm water.

Water outflow from the pit lake included evaporation from the lake surface and flow from the pit lake to adjacent ground water in some areas.

3.1.2.2 Ground Water Flow Modeling Results

The ground water flow model was originally developed by DBS&A by extending the existing calibrated model used for the Tyrone Mine Stage II Abatement Plan Proposal (Stage II APP, [DBS&A 2012]), which is a three dimensional MODFLOW-NWT (Niswonger et al. 2011) model. Modifications to the model presented in the Stage II APP include: (1) expansion of the model domain to the west and southwest; (2) addition of 5 model layers to better represent ground water conditions in the vicinity of the Little Rock Mine open pit; (3) extension of the Southern Star Fault (a low-permeability feature) to the west; (4) addition of the Austin-Amazon and Tertiary quartz-monzonite dikes as horizontal flow barriers; and (5) detailed simulation of transient, site-specific recharge for the Little Rock Mine area and upgradient watersheds (i.e. Deadman Canyon and California Gulch) using local climate and soils data. Once these changes were made, the model calibration was updated with an emphasis placed on the Little Rock Mine area.

The expanded ground water flow model was then used to predict the following:

- Drawdown at the end of mining caused by pit dewatering;
- Pit lake area and ground water elevation at closure;

- Ground water levels and ground water flow directions at closure; and
- A water budget for the pit lake, including ground water inflow and outflow rates and losses due to evaporation.

Based on the predictive simulations, drawdown at the open pit at the end of mining (EOY 2024) is estimated to be approximately 112 feet under the EOY 2024 mine plan. Once mining is complete and dewatering is stopped, the pit will begin to fill with water, due primarily to ground water inflow. The ground water inflow rate is estimated at approximately 133 gpm at the end of mining (EOY 2024) and decreases as the lake level rises. The ground water inflow rate is predicted to be approximately 78 gpm once the pit lake water level begins to stabilize at an elevation of 5,669 feet msl. The pit lake is predicted to rise to an elevation of approximately 5,660 feet msl at 30 years following closure, and then generally stabilizes at an elevation of approximately 5,669 feet msl at approximately 80 years after closure. At the 5,669-foot level, the lake will cover approximately 35 acres.

The final simulated pit lake level is 131 feet below the lowest potential surface water outflow point of the Little Rock Mine open pit of 5,800 feet msl. As the lake surface area increases, evaporation is expected to account for a greater proportion of the outflow than ground water outflow. Water is predicted to flow through the lake and into ground water along the northeast portion of the open pit. Ground water derived from the pit lake is expected to flow toward the Tyrone Main Pit, which unlike the Little Rock Mine open pit, will continue to be dewatered during the post-closure period. Further details of the predictive ground water flow and geochemical modeling project completed by DBS&A in 2014 are presented in the Groundwater Flow and Geochemical Modeling Report for the Little Rock Mine (DBS&A 2014). The updated 2020 groundwater flow modeling results are summarized in a technical memorandum by DBS&A (2020).

3.1.2.3 Geochemical Modeling Results

An update to the geochemical model will be completed by DBS&A and the results will be submitted separately to NMED in July 2020. The geochemical modeling platform PHREEQC Interactive (version 3.0) (Parkhurst and Appelo 1999) was used by DBS&A to perform mixing and equilibrium calculations to estimate post-closure Little Rock Mine pit lake water quality in 2014 (DBS&A 2014). The geochemical model has not been updated with the EOY 2024 mine plan configuration, but the predicted pit lake water quality for the EOY 2024 mine plan configuration is not expected to fundamentally change the overall results of the 2014 model simulation results presented herein.

The mixing and equilibrium calculations were performed using relative quantities of water with differing water quality for the individual sources to the Little Rock Mine pit lake. The individual water flow and chemistry inputs in the model included the following:

- Ground water inflow was represented by simulated inflow rates at 30 years and 100 years after closure calculated by the ground water flow model, while ground water quality was characterized by sampling at upgradient monitor wells LRW-4 and LRW-5. The water quality of LRW-5 was represented by averaging the chemistries of samples collected from 2006 to 2014. The quality of the water represented by well LRW-4 sampling results was determined by averaging the data over the period 2006 through 2010. Based on results of the ground water flow model, 98 percent of the water quality input was assigned the water quality consistent with LRW-5, and the remainder was assigned water quality consistent with LRW-4.
- Direct precipitation on to the lake surface was calculated using the simulated pit lake areas at 30 years and 100 years following closure and a mean annual precipitation of 16 inches based on the observed climate

history at National Climatic Data Center (NCDC) Fort Bayard weather station (NCDC Coop 293265). The chemistry of this precipitation was represented by an average of monthly data collected at the Gila Cliff Dwellings National Monument meteorological station between 1985 and 2012.

- Pit wall runoff was estimated by applying the Soil Conservation Service (SCS) curve number (CN) method (NRCS 2004) and using daily precipitation values based on the observed climate history at Fort Bayard. CNs of 80 and 90 were used for the in-pit stockpile areas and exposed pit wall surfaces, respectively. The areas and relative proportions of the exposed materials were determined from the post-mining mineralization map presented in the Amendment to Mine Plan of Operations (Tyrone 2013). Water quality of the pit wall runoff for these geologic materials was determined from the data presented in URS (2009).
- California Gulch storm water, upgradient of the open pit, will continue to be diverted to the Little Rock Mine pit lake. Average annual runoff from this watershed was estimated using HEC-HMS modeling performed by Telesto (2014). Surface water quality in California Gulch upgradient of the Little Rock Mine is monitored at location LRFS-1. Average water quality at this monitor location for the 5-year period between August 2008 and July 2013 was used to represent the chemistry of California Gulch storm water.
- Evaporation is an important contributor to the water balance of the pit lake, and the geochemical modeling includes the effects of evapo-concentration on pit lake water chemistry.

Results of the geochemical modeling are reported in **Table 3-1** for 30 years and 100 years following closure and indicate that applicable surface water and ground water standards are expected to be met with the exception of fluoride. Fluoride and manganese concentrations are naturally elevated in some ground water in the Little Rock and Tyrone areas (DBS&A 2012), and the fluoride concentration is predicted to be above the Section 3103 standard of 1.6 milligrams per liter (mg/L). Predicted fluoride concentrations at 30 and 100 years after closure are 2.23 and 3.01 mg/L, respectively.

The predicted manganese concentration at both 30 and 100 years after closure is 0.11 mg/L; the Section 3103 standard for manganese is 0.2 mg/L. Predicted sulfate and total dissolved solids (TDS) concentrations are relatively low (**Table 3-1**), and the expected pH is slightly alkaline at approximately 7.9 standard units (su). These results are consistent with the geology of the Little Rock Mine deposit and general lack of sulfide bearing rocks expected to be exposed at the end of mining.

3.1.3 Haul Roads

A total of approximately 26.2 acres of haul road surfaces are targeted for reclamation under this (EOY 2024) plan. The Northern Haul Road, Southern Haul Road and Little Rock Haul Road will be the only haul roads present at the EOY 2024. Additional access ramps will also be present at the EOY 2024.

3.1.4 Conveyance Pipelines

Impacted waters (generally flowing between 0 and 5 gpm) from the Reclaimed Copper Leach Stockpile are intercepted in the CLDS and CLDS-1 seepage collection systems. Impacted waters will continue to be collected from these two collection systems after the Reclaimed Copper Leach Stockpile is removed (as long as seepage flows continue) and will continue to be routed through the existing seepage collection pipeline and to the LR sump-1x1 pipeline throughout the post-closure period.

3.1.5 Infrastructure and Other Miscellaneous Facilities

A miscellaneous group of ancillary facilities and infrastructure are present at the Little Rock Mine including: operational and exploration roads; dewatering systems (including booster pump stations, pit dewatering sumps, HDPE pipelines, and power supply); electrical power distribution system and components; storm water structures for drainage, diversion, and sediment control; equipment storage areas; and fencing. The total estimated disturbance area associated with the ancillary facilities and infrastructure is approximately 98.3 acres. Also, an additional 10 acres of area will be included in the reclamation cost estimate for allowance for additional disturbed areas within the Mine Permit area. The additional disturbed areas may include small staging areas, utility corridors, haul roads, pull-offs, stockpile expansions, or other miscellaneous unforeseen changes for operations.

3.2 Performance Objectives and Design Criteria

This section presents the reclamation design criteria in accordance with the rules and requirements. The closure or reclamation designs are depicted in the drawing set provided in **Appendix A**. The designs were developed to provide enough information to calculate the financial assurance cost estimate. The following sections present the performance objectives and reclamation design criteria for the major facilities at the mine. A summary of the key design criteria for the facilities to be closed is presented in **Table 3-2**.

The reclamation practices proposed within this CCP are intended to meet the objectives described below and provide protection of air and water resources consistent with state and federal laws. As previously described in Section 1.5, the conceptual reclamation designs are based on the EOY 2024 mine plan. Final designs, technical specifications, and construction quality assurance plans for each facility will be prepared when mining ceases.

3.2.1 Stockpiles

The performance objectives for closure/closeout of the stockpile facilities include: re-establishment of a self-sustaining ecosystem; stabilize the reclaimed areas to stable landforms; containment of seeps and sediment transport; and control of run on and runoff.

A summary of the key design criteria for the stockpile facilities to be closed is presented in **Table 3-2**. All of the stockpiles to be closed will be composed of non-acid generating material and are projected to be conditionally exempt from the engineering design, construction, and operational requirements of the Copper Mine Rule and the NMWQA during operations and at closure. The reclamation plan for the Little Rock Mine open pit is described in Section 4.2.

Structural Stability

The existing stockpiles at Little Rock are composed of blasted rock placed on 30-to-50-foot high lifts through end-dumping at angle of repose that results in benches with overall slopes less than angle of repose with catch benches on each lift. The portions of the stockpiles to be regraded and covered will be reclaimed in a manner that ensures that the slope stability requirements listed in Section 20.6.7.33.B NMAC (though they are non-discharging units and therefore, not subject to this section) and Permit GR007RE are met. Tyrone recently completed a stockpile stability analysis associated with the current reclamation plan (Golder 2020b) and the report is included in **Appendix D**. The results of this analysis indicate that the stockpiles are stable for long term conditions reflecting the post-closure stockpile configurations and strength conditions (**Table 3-3**).

Stockpile Erosion and Drainage Control

Storm water will be controlled using conventional terrace channels integrated to downdrains for facilities to be reclaimed. Runoff drainage and erosion control for the stockpiles will be achieved by storm water conveyance channels, stable outslopes, suitable cover and stockpile material, and revegetation. Channels, perimeter berms, and hydraulic structures will be designed to control erosion on the outslopes of all stockpiles and safely convey storm water for discharge.

Stockpile Cover and Revegetation

Finish grading of the stockpile subgrade will be performed based on pre-construction surveys. Areas where the seedbed has limited fines and are rocky will receive four (4) inches of additional fine-grained cover material (obtained locally) to improve seedbed conditions. Revegetation of the stockpile top surfaces, and stockpile outslopes will be achieved by seeding with a variety of native and adapted grasses, shrubs, and forbs.

Stockpile Surface Water and Sediment Containment

The existing surface impoundment, berms, sumps, collector pipes, and seepage collection systems will be integrated into a new overall system to manage surface water and seepage flows, and contain sediment deposition within the Mine Permit Area.

3.2.2 Open Pit

The performance objectives for closure/closeout of the Little Rock open pit includes establishment of a self-sustaining ecosystem; containment of sediment; and control of run on where feasible. The pit configuration at the EOY 2024 will encompass approximately 260 acres. Accessible pit flat areas and benches not covered by the ultimate pit lake, will be ripped to a depth of 18 to 24 inches and vegetated by seeding with a variety of native and adapted grasses, shrubs, and forbs in accordance with MMD Permit GR007RE and associated Permit revisions. Temporary erosion control measures will be provided during the construction and early vegetation establishment periods.

This CCP includes the cessation of pit dewatering activities upon closure. The existing pumps, pipelines, aboveground electrical systems, and infrastructure will be removed from the pit upon closure. Site access to the open pit will be controlled by a combination of fences and earthen berms installed around the perimeter of the pit. Signs will be posted on the fencing at 500-foot intervals and at all access points, and warnings of potential hazards present. Pit walls are sufficiently stable that a specific conceptual design is not needed. Any materials eroded from these slopes will be contained within the pit.

3.2.3 Haul Roads

Haul roads and access roads not needed for closure and post-closure access will be reclaimed. The road material will be loosened by ripping to a depth of between 18 and 24 inches and revegetated by seeding with a variety of native and adapted grasses, shrubs, and forbs in accordance with MMD Permit GR007RE and associated Permit revisions. If acid-generating material is encountered, the roads will be ripped, covered with 36 inches of the suitable cover material and revegetated in accordance with MMD Permit GR007RE. All culverts will be removed unless they serve a post-closure purpose. Reclaimed haul roads and access roads will be revegetated by seeding with a variety of native and adapted grasses, shrubs, and forbs.

3.2.4 Conveyance Pipelines

As previously noted, open pit dewatering will be discontinued following cessation of open pit mining at the Little Rock Mine. As such, the sections of the LR sump-1x1 dewatering pipeline located within the open pit will not be required for post-closure conveyance of water from the open pit. These sections of pipeline will be buried or removed and disposed of in an approved manner.

The pipeline corridors will be inspected and characterized for evidence of past spills that could potentially cause exceedances of water quality standards of Section 20.6.1 NMAC and Section 20.6.2.3103 NMAC. If they are shown to constitute a source of contamination (defined as exceedances of applicable standards), the impacted material will be covered with 36 inches of suitable cover material. Disturbed areas along the pipeline corridors will be revegetated by seeding with a variety of native and adapted grasses, shrubs, and forbs.

3.2.5 Infrastructure and Other Miscellaneous Facilities

Reclamation of the disturbed areas associated with the ancillary facilities and infrastructure will be accomplished by removing or burying utility and structure foundations, pipelines, power lines, and temporary buildings and providing erosion and drainage control and revegetation. Utility poles associated with the power line will be left in place as bird perches to support the designated Post Mining Land Use (PMLU). The power line and access road will be reclaimed by ripping and/or covering the disturbed areas and seeding with a variety of native and adapted grasses, shrubs, and forbs in accordance with MMD Permit GR007RE and applicable modifications.

Temporary erosion and drainage control practices may include but are not be limited to rough grading and installation of water bars, minor diversions, sediment containment structures, mulching, straw bales, and silt fences. The need for these practices will be evaluated on a site-specific basis at closure. The seed mix to be used is presented in Section 6.0.

4.0 RECLAMATION PLAN

The CCP that is proposed for the Little Rock Mine is intended to reclaim existing and the newly disturbed areas and achieve compliance with applicable state and federal regulations on mine reclamation and water quality protection. The CCP supplies sufficient detail to estimate financial assurance activities including estimate capital and operating costs in the unlikely scenario that the mine will close under a forfeiture scenario. The reclamation plan and associated design criteria conform to the closure requirements described in DP-1236 (NMED 2000 and 2016) and the Copper Mine Rules, closeout requirements described in MMD Permit GR007RE (MMD 2000, 2010, and 2016), and applicable mine reclamation regulations set forth by the BLM (3809.401(b)(3) and 3809.420(b)(3)). The reclamation will provide for the establishment of a self-sustaining ecosystem consistent with the designated post-mining land uses and life zone of the surrounding area, which for the Little Rock Mine, is wildlife habitat.

The reclamation plan was developed with consideration of the site-specific conditions that will exist at the Little Rock Mine at the EOY 2024. The general setting of the Little Rock Mine area is shown on **Figure 1-2** (existing features) and **Figure 2-1** (EOY 2024 features), and the closure or reclamation designs are depicted in the drawing set provided in **Appendix A**. The reclamation proposed for each of the major facilities is discussed in Sections 4.1 through 4.5. The plans and methods developed herein represent designs for reclamation of the facilities based on an anticipated configuration. More specific plans will be developed and submitted prior to mine closure in accordance with Permit GR007RE. A final construction quality assurance (CQA) plan for reclamation and closure will be prepared by Tyrone for submittal to and approval by the State of New Mexico with joint review by the BLM at least 180 days prior to commencement of reclamation. The CQA plan will provide a detailed description of the work proposed to be performed to close the site. Monitoring and maintenance activities will follow primary reclamation and will continue for approximately thirty years as described in Section 5.0.

As previously described in Section 2.1.5, several facilities have been reclaimed and additional facilities are projected to be removed by the EOY 2024. Erosion and vegetation establishment monitoring will continue at these facilities in accordance with Permit GR007RE and NMED requirements. The following sections describe the specific facilities that will still have components to be closed at the EOY 2024, components that will be retained for further use during the closure/post-closure period, and the design criteria for the facilities to be reclaimed. A summary of the key design criteria for the facilities to be closed is presented in **Table 3-2**.

4.1 Stockpiles

A total of 7 stockpiles will be present at Little Rock at the EOY 2024, including the East In-Pit Waste, North In-Pit Waste, West In-Pit Waste, CLW Waste, NRW Waste, and historical North and West Canyon waste rock stockpiles. All of these stockpiles will (or are) composed of non-acid generating material overburden waste rock. Storm water from the in-pit stockpile areas will be routed to a downdrain and down to the pit sump. The NRW Waste and West Canyon waste stockpiles will require run on controls to direct storm water flows around the perimeters of the facilities. The CLW Waste and historical North stockpiles are constructed above the surrounding terrain therefore run on controls are not required for these facilities. The following sections describe the specific stockpile facilities that will still have components to be closed at the EOY 2024, and the components that will be retained for further use during the closure/post-closure period.

4.1.1 Existing Components That Will Be Used for Post-Closure Purposes

The existing closure components and related engineering controls associated with the Little Rock Mine stockpiles and stockpile areas that will be used for post-closure purposes include:

- Volunteer native vegetation growing on the historical stockpiles (historical North and West Canyon waste stockpiles);
- O&M of existing seepage collection systems CLDS and CLDS-1 at the removed reclaimed Copper Leach Stockpile, and associated pumps, tanks, and the LR sump-1x1 dewatering pipeline extending to the lined 1X1 Pond;
- O&M of existing surface water collection points LRFS-1 in California Gulch, Deadman Flow Sampler North, Deadman Flow Sampler South, and Little Rock Flow Sampler 4;
- O&M of nine existing ground water monitoring wells (LRW-4, LRW-5, 1236-2012-01, and 1236-2016-01 through 1236-2016-06);
- O&M of stormwater and surface water diversion structures constructed to route upland flows around the removed Copper Leach Stockpile and P-Plant reclaimed areas and surrounding impacted areas; and
- O&M of Deadman Canyon surface water diversion structure constructed to route upland flows around the Little Rock Mine open pit (note Deadman Canyon surface water diversion structure will be constructed and operational at closure).

4.1.2 Planned Closure/Closeout Activities

The construction design criteria for the stockpiles and monitoring wells are summarized in **Table 3-2** and the planned approaches for closure of these facilities are described below. Reclamation design drawings for the facilities are presented in **Appendix A**. The planned approaches for closure of the stockpiles include:

- Grading of the in-pit stockpile outslope surfaces in a manner that orients surface water drainage toward the pit bottom and routes storm water to a downdrain;

- Grading of the of the stockpiles outslopes located around the perimeter of the open pit in a manner that orients surface water drainage toward the exterior of the mine;
- Grading of the stockpile outslopes down to interbench slopes of 3.0H:1V;
- Construction of 32-foot wide terrace benches on the outslopes at maximum slope lengths of 200 feet;
- Placement of 4 inches of additional fine-grained cover material (obtained locally) over 10% of the surface areas of the stockpiles to enhance the seedbed, targeting areas with high amounts of rock at the surface;
- Ripping of stockpile top surfaces and outslopes to a depth of 18 to 24 inches;
- Seeding of ripped surfaces of in-pit stockpile to reestablish vegetation in accordance with MMD Permit GR007RE and associated Permit revisions; and
- Plugging and abandonment of exploration drill holes and ground water monitor wells.

4.2 Open Pit

The Little Rock Mine open pit configuration at the EOY 2024 is shown on **Figure 2-1** and reclamation designs are depicted in the drawing set provided in **Appendix A**. The existing closure components and the planned closure activities for the Little Rock Mine open pit are described below.

4.2.1 Components to be used for Post-Closure Purposes

The closure components and related engineering controls associated with the Little Rock Mine open pit that will be used for post-closure purposes include:

- Maintenance of existing pit perimeter fencing and berms;
- Maintenance, sampling and reporting of monitoring wells;
- Monitoring of the open pit lake water quality; and
- Construction and maintenance of haul roads and access ramps within open pit for post-closure reclamation monitoring.

4.2.2 Planned Closure/Closeout Activities

The design criteria for the Little Rock Mine open pit are summarized in **Table 3-2** and the planned approaches for closure are described below. Reclamation design drawings for the Little Rock Mine open pit are presented in **Appendix A**. The planned approaches for closure of the Little Rock Mine open pit include:

- Ripping of accessible open pit flat areas, not covered by the ultimate pit lake that will form after dewatering stops, and accessible benches in the open pit to a depth of 18 to 24 inches. For the purposes of this CCP, accessible pit flat areas are defined as pit haul road driving surfaces and flat areas 50-feet or greater from a highwall;
- Seeding of ripped surfaces to reestablish vegetation in accordance with MMD Permit GR007RE and associated Permit revisions;
- Construction and maintenance of 6-foot chain link fencing and earthen berms approximately 40 feet from the open pit highwalls to limit public access;

- Installation and maintenance of signs on fencing at 500-foot intervals and at access points, warning of potential hazards present;
- Seeding of approximate 25-foot-wide disturbance area used to construct the chain link fencing, and approximate 100-foot-wide disturbance area used to construct the berm to reestablish vegetation in accordance with MMD Permit GR007RE and associated Permit revisions; and
- Removal of aboveground electrical systems and infrastructure within the open pit, including pumps, lighting, and transmission lines not necessary for post-closure site operations and maintenance.

4.3 Haul Roads and Access Roads

The haul roads and access roads that will be present at the EOY 2024 is shown on **Figure 2-1** and reclamation designs are depicted in the drawing set provided in **Appendix A**. The existing closure components and the planned closure activities for the haul roads and access roads are described below.

4.3.1 Existing Components to be used for Post-Closure Purposes

The existing closure components and related engineering controls associated with the haul roads and access roads that will be used for post-closure purposes include:

- O&M on a 30-foot width of the Southern Haul Road within the pit for post-closure access to the pit bottom for pit lake and reclamation monitoring;
- O&M of access roads to reclaimed facilities and post-closure monitoring stations (wells, flow samplers, meteorological station, outfalls, etc.); and
- O&M of storm water control structures located along post-closure haul roads and access roads.

4.3.2 Planned Closure/Closeout Activities

The design criteria for the haul roads and access roads to be closed are summarized in **Table 3-2** and the planned approaches for closure include:

- Removal of portions of the Northern Haul Road to be used as part of the Deadman Canyon Diversion at closure;
- Ripping of roads to a depth of 18 to 24 inches;
- Seeding of ripped and covered areas to reestablish vegetation in accordance with MMD Permit GR007RE and associated Permit revisions; and
- Removal of culverts not needed for post-closure storm water management and disposal of them in an approved manner.

4.4 Pipelines

The pipelines that will be present at the EOY 2024 is shown on **Figure 2-1** and reclamation designs are depicted in the drawing set provided in **Appendix A**. The existing closure components and the planned closure activities for the pipelines are described below.

4.4.1 Existing Components to be used for Post-Closure Purposes

The existing closure components and related engineering controls associated with the pipelines that will be used for post-closure purposes include:

- O&M of the LR sump-1x1 pipeline to convey seepage water to the lined 1X1 Pond; and
- O&M of seepage collection systems.

4.4.2 Planned Closure/Closeout Activities

The design criteria for the pipelines are summarized in **Table 3-2** and the planned approaches for closure include:

- Covering impacted areas with 36 inches of suitable reclamation cover material;
- Flushing of sections of the LR sump-1x1 dewatering pipeline located within the open pit that will not be required for post-closure conveyance of water from the open pit to remove residual solutions. These sections of pipeline will be buried or removed and disposed of in an approved manner;
- Removal of residual sediments and fluids from other miscellaneous pipelines and disposal of materials at an approved location on-site;
- Burial or removal and disposed of miscellaneous pipe in an approved manner; and
- Seeding of disturbed and covered areas to reestablish vegetation in accordance with MMD Permit GR007RE and associated Permit revisions.

4.5 Infrastructure and Other Miscellaneous Facilities

Reclamation of the disturbed areas associated with the ancillary facilities and infrastructure will be accomplished by removing or burying utility and structure foundations, pipelines, power lines, and temporary buildings and providing erosion and drainage control and revegetation. The existing closure components and the planned closure activities for the ancillary facilities and structures are described below.

4.5.1 Existing Components to be used for Post-Closure Purposes

The existing closure components and related engineering controls associated with the ancillary facilities and infrastructure that will be used for post-closure purposes include:

- O&M of existing power poles that will be left in place as bird perching sites.

4.5.2 Planned Closure/Closeout Activities

The design criteria for the ancillary facilities and structures are summarized in **Table 3-2** and the planned approaches for closure include:

- Covering impacted areas with 36 inches of suitable reclamation cover material;
- Ripping of non-impacted disturbed areas to a depth of 18 to 24 inches;
- Seeding of ripped and covered areas to reestablish vegetation in accordance with MMD Permit GR007RE and associated Permit revisions;
- Removal of electrical distribution system, including the substation and transmission lines; and

- Removal of any temporary, portable operations and maintenance facilities used to support mining and not needed for post-closure purposes.

5.0 CLOSURE & POST-CLOSURE MONITORING, REPORTING AND CONTINGENCY PLANS

Closure and post-closure monitoring will be conducted at the Little Rock Mine to ensure that the closed facilities are performing as designed, are protective of water quality, and will allow for the establishment of a self-sustaining ecosystem or approve post-mining land use. Closure and post-closure monitoring, reporting, and contingency planning will be conducted in accordance with the Copper Mine Rule (where applicable), Section 20.6.7.35 NMAC, DP-1236 and the MMD Permit GR007RE. Costs associated with the closure and post-closure monitoring will be included in the CCP financial assurance cost estimate using an assumed third party to complete all the monitoring listed in Sections 5.0 through 6.0.

All the closure and post-closure ground water, surface water, seep, spring, and piezometer monitoring data will be reported in accordance with 20.6.7.35 NMAC and DP-1236. The MMD guidelines require monitoring of revegetation during the bonding period to evaluate revegetation success, and NMWQCC Regulation 3107.A.11 requires the development of post-closure monitoring and contingency plans that are consistent with the terms and conditions of the applicable DP. Additional monitoring and reporting requirements associated with public health and safety, wildlife, meteorology, erosion, and CQA/construction quality control (CQC) plans are specified in MMD Permit GR007RE. The following sections summarize the general approach that will used to meet all of these requirements.

5.1 Erosion and Drainage Control Structures

All closure components requiring a cover system will be visually inspected for signs of excessive erosion and significant erosion features that may compromise the functional integrity of the cover system or drainage channels in accordance with 20.6.7.35 NMAC and Section 8 (14-1).R of the MMD Permit. In accordance with Section 20.6.7.35.C NMAC, a contractor will conduct inspections and submit reports of the reclaimed facilities monthly for the first year following submission of the final CQA/CQC for the unit, and quarterly thereafter until the end of post-closure monitoring, provided the department may approve a schedule allowing less-frequent monitoring.Additional erosion inspections will also be conducted after a one inch or more precipitation event within a 24-hour period.

Evidence of excessive erosion and/or structural failures will be reported to the appropriate agencies (MMD and NMED) in a timely manner. A written report detailing the nature and extent of the problem and a corrective action plan will be developed after the problem is identified in accordance with Section 20.6.7.30.J NMAC.

As specified in 20.6.7.35.C NMAC and Section 8 (14-1).R.1 of the MMD Permit, a contractor will routinely inspect and maintain all drainage channels, diversion structures, retention impoundments, and auxiliary erosion control features in accordance with professionally recognized standards, such as the Natural Resources Conservation Service.

5.2 Ground Water and Surface Water Control Facilities

Tyrone maintains several state and federal permits to protect surface water and ground water and to ensure adherence to applicable water quality standards as mandated by the NMWQA and the NMWQCC regulations (NMAC 20.6), Sections 401 and 404 of the Clean Water Act, and the U.S. Environmental Protection Agency’s (EPA’s) National Pollutant Discharge Elimination System (NPDES) MSGP. DP-1236 has been issued by NMED to address operational, closure and post-closure water quality issues at the Little Rock Mine. In addition, Tyrone maintains a SWPPP and a Spill Prevention, Control, and Countermeasure (SPCC) plan that are inclusive of the Little Rock Mine and serve to protect water quality.

DP-1236 includes an operational plan, corrective action plan, contingency plan, and closure plan. Collectively, these plans provide the mechanisms for the regulatory agencies to collect ongoing and real-time data related to mine operations; continuously monitor, model, and prevent potential impacts to the environment; document compliance; and mitigate these potential impacts where conditions warrant.

In accordance with DP-1236 and 20.6.7.35.A NMAC, a contractor will perform quarterly inspections and annual evaluations of all groundwater abatement systems, including the seepage interceptor systems, and perform maintenance as necessary to ensure that all water contaminants are managed in a manner that is protective of groundwater quality. Monitoring of site water quality will be accomplished through sampling and analysis of potentially impacted water at site locations.

Contingency Plans and Emergency Response Plans have been prepared that present details for addressing potential failures of individual components of the Little Rock Mine closure plan, including an increase in the extent or magnitude of ground water and/or surface water contamination, potential failures associated with collection systems and impoundments, and potential failures of various components of closed lands. The emergency response plan outlines operational parameters and contingencies to address operation failures at the Little Rock Mine associated with pumping water from the open pit, sumps, and other impoundments that may contain affected water. Accordingly, a contractor will verify any potential discharges not approved in DP-1236. If an unapproved discharge is identified, a contractor will perform appropriate corrective actions in accordance with 20.6.7.30 NMAC.

5.3 Post-Closure Monitoring of Seepage, Ground Water, and Surface Water

In accordance with Condition 41 of DP-1236 (NMED 2000), post-closure monitoring of seepage, ground water, and surface water will continue for a minimum of 30 years after completion of final closure construction activities. The monitoring will be conducted in accordance with monitoring and reporting requirements specified in Section C107.C of DP-1236 (NMED 2016).

In addition to surface water monitoring and analyses required in DP-1236, the SWPPP and SPCC Plan serves to protect water quality. Monitoring will be conducted in accordance with 20.6.2.3107 NMAC. Tyrone may request a reduction in monitoring frequency, change in location, and change in analytical parameters for NMED approval after two years of quarterly monitoring. The proposed post-closure monitoring and reporting schedule for the Little Rock Mine includes quarterly monitoring and reporting for the first 2 years after reclamation, semi-annual for the next 8 years, and yearly for the remaining 20 years. Each monitoring report will contain monitoring well laboratory analyses, surface water analyses, water level data, potentiometric surface maps, seepage water analyses, spring and seep discharge rates, and summaries of daily weather data. The monitoring reports will be submitted to NMED in accordance with the approved discharge permit.

5.3.1 Ground Water Monitoring Network:

Groundwater quality will be monitored throughout the post-closure period within the nine existing ground water monitoring wells at the site (LRW-4, LRW-5, 1236-2012-01, and 1236-2016-01 through 1236-2016-06), and in any new monitoring wells installed after closure for compliance monitoring purposes. For FA purposes, it is assumed sample collection will be done under contract by an environmental contractor. The intent of the groundwater monitoring is to evaluate the effectiveness of the closure plan and demonstrate compliance with applicable regulations and standards. The monitoring will be conducted in accordance with monitoring and reporting requirements specified in Section C107.C of DP-1236 (NMED 2016). The analytical results will be reported to the NMED as specified in DP-1236 and 20.6.7.35.B NMAC.

5.3.2 Surface Water and Seep Monitoring Network:

Post-closure surface water monitoring locations within and around the Little Rock Mine include the following points:

- Depth and water quality of the open pit lake;
- Water quality at two surface water collection points in California Gulch (LRFS-1 and LRFS-4 located downgradient of projected LOM pit rim);
- Water quality at two surface water collection points in Deadman Canyon (Deadman Flow Sampler North, Deadman Flow Sampler South;
- Estimated volume of storm water from California Gulch that reports to the open pit;
- Flows and water quality from seepage collection systems CLDS and CLDS-1 at the former reclaimed Copper Leach Stockpile area; and
- Flows at McCain Spring and Sugarloaf Spring.

Surface water monitoring and sampling activities will be performed quarterly at each spring and surface water collection point. In accordance with Section C107.C of DP-1236, the Little Rock Mine open pit water body will be sampled on a semi-annual basis. The surface water collection ports in California Gulch and Deadman Canyon will be checked after each precipitation event of 1.0 inch or greater at the Little Rock Mine site; if a sample is present it will be collected and analyzed. No more than one surface water sample per port will be collected in a 24-hour period, and no more than six surface water samples per port will be collected per quarter. Sample collection will be done by an environmental contractor. Samples will be shipped to an analytical laboratory for analysis. A report will be prepared to document the sampling and analysis in accordance with DP-1236 for review by regulatory authorities.

5.4 Revegetation Success Monitoring

Vegetation establishment monitoring of reseeded areas will be conducted in accordance with 20.6.7.35.C NMAC and Appendix A of Revision 14-1 of the MMD Permit (MMD 2016). Vegetation establishment monitoring will be conducted during the third year after seeding, with the objective of determining the adequacy of reseeding efforts. The vegetation establishment monitoring (Year 3) will be semi-quantitative and the results will be provided to MMD. Quantitative revegetation monitoring will be performed at the 6th year after planting, and for at least 2 years of the last 4 years, starting after the 8th year of the 12-year monitoring period.

Revegetation monitoring will include, at a minimum, canopy cover, plant diversity, and woody stem density. The revegetation monitoring will be conducted to meet statistical adequacy for the monitoring conducted during two of the last four years prior to financial assurance release. The canopy cover and woody stem density surveys will be conducted using vegetation monitoring techniques approved by MMD for the Tyrone Mine. The vegetation monitoring plan is quantitative, using the same techniques for the reclamation area and the reference area for each monitoring event and from year to year during the monitoring period. Any changes to the approved vegetation monitoring plan will be submitted to the MMD for approval at least 90 days prior to a monitoring event. Areas where vegetation has not been successfully established will be reseeded or inter-seeded.

5.5 Wildlife Monitoring

A contractor will document wildlife use of reclaimed areas beginning six years after reseeding is completed in accordance with Sections 8.R.2 of Revision 14-1 of the MMD Permit (MMD 2016). The wildlife monitoring program will include annual deer pellet group counts and bi-annual bird diversity surveys in year 6, and in 2 years of the last 4 years prior to release of financial assurance. Results of the surveys will be evaluated to determine wildlife-use trends during reestablishment of a self-sustaining ecosystem. A contractor will review the 2001 Little Rock Mine wildlife monitoring plan (Tetra Tech EMI 2001), conditionally approved by MMD on September 27, 2001, and submit to MMD for approval, an updated wildlife monitoring plan at least 45 days prior to implementation of the wildlife monitoring surveys. Due to use of the area by wildlife species, particularly birds, the pit lake could be attractive to migratory waterfowl.

5.6 Public Health and Safety

Pursuant to Sections 8.G.2 of Revision 14-1 of the MMD Permit (MMD 2016), a contractor will submit written details and maps showing the locations of berms and fences that will be placed around the pits to restrict access by unauthorized personnel and provide for public safety within 180 days of cessation of operations.

5.7 Construction Quality Assurance Plan

Pursuant to Section 8.F of Revision 14-1 of the MMD Permit, a contractor will submit a Construction Quality Assurance Plan (CQAP) to MMD for approval no less than 180 days prior to proposed commencement of reclamation and will implement the plan after MMD approval. The CQAP will be supplemented with a Final Design (formerly known as a Construction Quality Assurance Report) to be submitted to the MMD within 180 days after completion of construction.

6.0 POST-MINING LAND USE DESIGNATION AND SITE-SPECIFIC REVEGETATION SUCCESS GUIDELINES

This section provides a description of the PMLU for the permit area and the associated site-specific revegetation guidelines based upon the requirements of the MMD Permit, NMMA Section 69-36-11.6, and Subparts 507.A, 507.B, and 508 of the NMMA Rules (MMD 1996). The proposed wildlife habitat PMLU area is shown on **Figure 6-1**.

6.1 Post-Mining Land Use Designation

The wildlife habitat PMLU is specified in Section 3.J of Revision 14-1 of the MMD Permit. The selection of the wildlife habitat PMLU for purposes of the NMMA does not preclude multiple beneficial uses (e.g., grazing, recreation, and watershed) in the post-closure period by the surface landowners (e.g., BLM and USFS). Reclamation of the Little Rock Mine will improve the character of the mined area to achieve the wildlife habitat post-mining land use.

Successful implementation of the proposed reclamation plan will result in the development of an early-stage grass/shrub community within a larger plant community that is dominated by a mixed-evergreen woodland community. The areas of cliffs and talus associated with the pit walls will provide features that are consistent with the local topography in the canyons. The reclaimed area will provide a locally important increase in community level diversity that will benefit the broad range of wildlife adapted to the area. The pit's topographic relief is expected to present desirable nesting and perching sites for birds. Power poles will also remain in place to provide perching spots.

Native vegetation will be established on the reclaimed areas at the Little Rock Mine resulting in increased erosion protection and direct habitat improvement, and reduced percolation of water into the underlying materials relative to current conditions. Proposed reclamation seed mixes and seeding rates for the Little Rock Mine are presented in **Table 6-1**. These species have broad ecological amplitudes and provide structural diversity. **Table 6-2** lists some of the major functional attributes of the primary vegetation selected for use at the Little Rock Mine.

The seed mix was selected to provide early establishment of ground cover, erosion control, and diversity in growth forms. The species selected for the Little Rock Mine have been successfully used in mine reclamation and range improvement projects in many parts of New Mexico, including both the Little Rock and Tyrone mines. The vegetation will provide forage, seeds, and cover for reptiles, small mammals, and birds. The reptiles, small mammals, and birds common to the mine area will benefit from the increased insect populations that are likely to accompany revegetation of the site. The shrubs, grasses, and forbs selected for use at the Little Rock Mine will provide nutritious forage and browse for large mammals (e.g., deer). In addition, the seed mix includes a number of valuable forage grasses that are absent or occur at a low frequency outside the permit area, thus, improving the range condition locally.

The pit lake that is anticipated to form after reclamation is expected to benefit the local wildlife. Access to the pit lake by wildlife will be promoted by low slope gradients in the shoreline area (adjacent to the toe of the in-pit stockpiles), and the development of brush and/or rock piles to provide sheltering cover. Shoreline vegetation may ultimately develop once the pit lake levels stabilize. Specific details of the wildlife features will be presented in the CQAP for this facility.

6.2 Site Specific Revegetation Success Guidelines

As previously noted, Tyrone is proposing to modify both the existing Little Rock Mine Permit Boundary and the current Mining Area Design Limit to account for the change in the mine plan (Section 1.5). The proposed Mining Area Design Limit combines the estimated extent of disturbed areas and the projected LOM open pit configuration as shown on **Figure 2-1**.

New disturbances located outside the current Mining Area Design Limit, and new disturbances identified in Permit Revision 14-1 to MMD Permit GR007RE that are to be backfilled, covered with topdressing, and revegetated will meet the reclamation standards set forth in 19.10.5.507 NMAC and will also comply with the new unit standards set forth in 19.10.5.508.E NMAC. Disturbances located within the current Mining Area Design Limit (excluding new disturbances identified in Permit Revision 14-1 to MMD Permit GR007RE) are considered existing mine units and will meet the reclamation standards set forth in 19.10.5.507 NMAC. The proposed Mining Area Design Limit, proposed changes to the Little Rock mine permit boundary, projected LOM open pit configuration, and associated new unit and existing unit disturbance areas are presented in **Figure 6-2**. Site-specific revegetation success guidelines for each of these areas are described below.

The MMD recognizes that replication of the pre-mining plant communities after mining is not practical (MMD 1996). The intent of the reference area characterization is to provide a site-specific, quantitative basis for determining revegetation success. More importantly, the reference area provides an “ecological barometer” that integrates normal climatic variations to aid in the evaluation of temporal changes or trends in the reclaimed ecosystem. Thus, the reference areas do not represent model plant communities that will be replicated in detail, but rather local indications of the ecological potential of the reclaimed plant communities.

The reclamation success guidelines required by the MMD vary depending on the PMLU and whether the area to be reclaimed is an existing disturbance or an existing mine new unit disturbance. Canopy cover, shrub density, and vegetation diversity are the revegetation success guidelines that are typically used to judge revegetation success on lands designated as wildlife habitat. The vegetation success guidelines include numerical standards to address the canopy cover and shrub density requirements of the NMMA.

The plant diversity guidelines are addressed through a technical standard and are complemented by a qualitative assessment of plant colonization and regeneration to corroborate the establishment of a self-sustaining ecosystem. A detailed description of the vegetation success guidelines for reclaimed existing disturbance areas is included in DBS&A (1999). The guidelines for revegetation success that apply to the Little Rock Mine are discussed in Sections 6.2.1 through 6.2.3.

6.2.1 Canopy Cover

Because of its broad implications for erosion control and ecologically based PMLUs, canopy cover is one of the primary criteria for determining reclamation success. The Little Rock Mine has a proportional success guideline for total canopy cover equal to 70 percent of the measured reference area value for existing unit disturbance areas (**Figure 6-2**). The proportional standard was determined based on the interpretation of the community structure and ecological conditions in the reference area. The proportional standard reflects the view that the typical 12-year bond release period does not allow enough time for full maturation of the reclaimed plant community relative to the native sites. The numerical standard derived from the proportional standard will vary over time to account for temporal differences in canopy cover associated with climatic variations. Thus, the numerical standard may increase or decrease based on reference area measurements, but the proportional standard will remain fixed.

For the new unit disturbance areas (**Figure 6-2**), the proportional success guideline for total canopy cover will be equal to 90 percent of the measured reference area value in accordance with 19.10.5.508E NMAC. The ground cover of living perennial plants shall be adequate in both the existing and new unit disturbance areas to control erosion.

6.2.2 Shrub Density

Shrubs are important components of many reclaimed landscapes. A proportional success guideline of 60 percent (of the reference area) has been accepted by the MMD for shrub density in the reclaimed areas associated with the existing disturbance areas. For the new unit disturbance areas, the proportional success guideline for shrub density will be equal to 90 percent of the measured reference area value in accordance with 19.10.5.508E NMAC. As with canopy cover, the shrub density standards are determined based on the interpretation of the ecological conditions of the reference areas.

6.2.3 Plant Diversity

Species diversity is commonly thought to increase the stability of plant communities. The perceived enhancement of ecological stability is related to the buffering effect that species with different ecological amplitudes provide in response to environmental stresses. A technical, rather than proportional, standard is proposed for plant diversity.

The plant diversity guidelines for the Little Rock Mine are based on the assumption that site stability is improved by establishing plants with different ecological amplitudes to buffer seasonal and annual fluctuations in climate. Tyrone understands that creating a monoculture on the reclaimed lands is not desirable, while at the same time, recognizing that the benefits of increased diversity diminish beyond subjective threshold levels that are defined by the reclamation objectives. Thus, the diversity guideline for the Little Rock Mine was developed from a functional perspective, whereby site stability and erosion control are primary performance objectives. In addition, these guidelines were developed in recognition of the limitations associated with the sampling and statistical evaluation of plant communities whereby minor components are often not represented in the monitoring data.

The numerical diversity guidelines for the Little Rock Mine are listed in **Table 6-3**. To summarize, the diversity guideline would be met if the reclaimed area contains at least three warm season grasses and two shrubs, with individual cover levels of at least 1 percent. In addition, one non-weedy forb species should occur at a minimum cover level of at least 0.1 percent to meet the proposed diversity guideline. The forb guideline is unqualified with respect to seasonality and could include a perennial, biannual, or annual species.

Species diversity on the reclaimed areas is expected to increase with time; however, this process is likely to be slow. Successful colonization depends on the convergence of a seed source and the proper weather conditions; however, even with such an ideal convergence, inter-specific competition, predation, and dispersion mechanisms may limit the establishment of new plants on the reclaimed area. Because of the strong climatic influence on seed production and plant establishment, the rate of colonization is expected to be erratic and potentially slow for many species, with the highest rates of colonization expected to be concentrated in the reclaimed/undisturbed ecotone.

Evidence of colonization will complement the numerical diversity guidelines listed in **Table 6-3**. No numerical guideline is proposed for colonization, which would be demonstrated by increases in the number of species recognized in the reclaimed area. Information on colonization will be collected and reported to provide evidence of the ability of the reclaimed landscape to support native plants from the surrounding communities. Secondarily, observations of colonization provide evidence of regeneration and thus help demonstrate the establishment of a self-sustaining ecosystem required in the NMMA.

The intent of the colonization standard is to provide evidence of the ability of the reclaimed landscape to support plants from the surrounding communities. In addition, observations of colonization provide evidence of regeneration and thus demonstrate the establishment of a self-sustaining ecosystem. Colonization will be demonstrated by increases in the number of species recognized in the reclaimed area. This information will be obtained from the relative cover data or documented observations of volunteer plant species particularly along the margins of the reclaimed areas during periodic inspections and vegetation monitoring events.

7.0 BASIS FOR CAPITAL AND OPERATION AND MAINTENANCE COST ESTIMATES

This section provides a brief description of the of the material take-offs and factors that will be applied in the capital and O&M cost estimates associated with the Little Rock reclamation plan. The cost estimates will be submitted once the Scope of Work is approved and will be budgetary and for the purpose of determining the value of the financial assurance performance bond.

7.1 Basis for Capital Cost Estimates

The material takeoffs for reclamation of the Tyrone Mine were prepared in accordance with standard engineering practice and are included in **Appendix C**. The material takeoffs for the major reclamation earthwork components are summarized in the table below.

Earthwork Material Take-Off Summary		
Item	**Quantity**	**Units**
Earthwork		
Stockpile & Pit Reclamation Stockpile Reclamation Only	163.9 159	acres acres
Stockpile Grading	2.8	million cubic yards
Stockpile Bench Grading	28,030	feet
Stockpile Cover Material	9,155	cubic yards
Stockpile Cover and Revegetate	159	acres
Stockpile Surface Water Conveyance Channels and Downdrains	32,398	feet
Open Pit Grading	NA	million cubic yards
Open Pit Cover Material	NA	cubic yards
Open Pit Revegetate	4.9	acres
Allowance for Other Disturbed Areas	10	acres
Building Demolition	1,614	square feet

Note: NA – Not applicable

It is assumed that indirect costs, for capital, is 30% of the estimated direct capital cost based on the 2018 FA Work Group meetings and agreement and the associated approval letter issued by the State of New Mexico in January 2019.

7.2 Basis for Operation and Maintenance Cost Estimates

The operations and maintenance (O&M) cost basis details and supporting documentation are provided in **Appendix C**. A summary of these details are provided below. O&M costs are assumed to diminish with time and will be allocated as follows:

Erosion Control and Monitoring:

Annual cost estimates after closure will be based on an erosion control crew engaged for 10 days per year for the first year and then 4 days per year for 11 additional years.

Road Maintenance:

Access road and haul road maintenance for post-reclamation years 3 through 30 will be included in the erosion control and monitoring costs. The road maintenance cost for post-reclamation years 3 through 30 will be included for access to all post-closure monitoring points and the power line access road. These consist of access roads for erosion monitoring and open pit slope stability monitoring, and access to all water quality and flow monitoring points (California Gulch flow samplers, seepage collections CLDS and CLDS-1, McCain Spring, Sugarloaf Spring, open pit lake, and the nine compliance monitoring wells). Road maintenance consists of a motor grader engaged for 12 hours prior to each sampling event annually.

Water Quality Monitoring and Reporting:

In accordance with Condition 41 of DP-1236 (NMED 2000), post-closure monitoring of seepage, ground water, and surface water will continue for a minimum of 30 years after completion of final closure construction activities. The monitoring will be conducted in accordance with monitoring and reporting requirements specified in DP-1236. The water quality monitoring and sampling program will include: water quality and water levels at nine ground water monitoring wells; open pit water quality and elevation; CLDS and CLDS-1 seep collection water quality and flow rates; California Gulch surface water quality and flow rates; Deadman Canyon surface water quality and flow rates; flows at McCain Spring and Sugarloaf Spring; and meteorological monitoring from the Little Rock Mine weather station.

For cost estimating purposes, it will be assumed that post-closure monitoring and sampling will be conducted quarterly for the first 2 years after reclamation, semi-annually for the next 8 years, and yearly for the remaining 20 years. Estimated sampling frequencies for California Gulch and Deadman Canyon surface water, and seepage collection water is based on sampling conducted in 2019. The seep collections are assumed to be dry two quarters a year and sampled the other two quarters. The surface water collection ports in California Gulch and Deadman Canyon will be checked after each precipitation event of 1.0 inch or greater at the Little Rock Mine site, and it is assumed that water will be present once a year.

It is assumed that indirect O&M costs in total are 17.5% of the estimated direct O&M cost based on the 2018 FA work group meetings and agreement and the associated approval letter issued by the State of New Mexico in January 2019. **Appendix C** provides the full supporting documentation for the O&M cost estimate

8.0 RECLAMATION SCHEDULE

An update to the reclamation schedule is required pursuant to the MMD Permit and 19.1 0.5.506.B.1 NMAC. The proposed reclamation schedule is an integral component for the development of the financial assurance cost estimate based on a total site-wide mine default scenario. The schedule assumes a walk away scenario and all mining operations are terminated at the EOY 2024. The EOY 2024 was chosen for the development of the CCP in that it represents the most conservative earthwork takeoff volumes and thus the highest reclamation cost estimate for the five-year period under evaluation.

Table 8-1 presents the anticipated schedule for implementation of closure activities based on best available information and mine planning forecasts. The proposed schedule summarizes Tyrone's understanding of the existing near-term mine operation and longer-term mine plan projections. More specifically, the schedule is based on the following considerations:

- Practical phasing of the reclamation projects to account for the anticipated labor, equipment and other resources that would be necessary to complete these projects based on current conditions;
- Sequential closure of facilities in a phased cost efficient manner; and
- Total annual acreages that would be reclaimed over this period.

The anticipated durations for reclamation presented in **Table 8-1** include earthwork and reseeding, but do not include vegetation success/O&M/monitoring that will be conducted throughout the 30-year post-closure monitoring period as described in Section 5. Reclamation of the stockpiles, accessible flat areas within the open pit, haul roads and access roads, pipelines, and ancillary facilities and infrastructure would begin per the approved CCP schedule. All primary reclamation activities as described herein should be essentially completed within approximately seven years (1 year pre-construction work, 5 years for earthwork, and 1 year post-construction work), not including the required post-reclamation monitoring.

For clarity, the financial assurance cost estimate and the proposed reclamation schedule are explicitly linked. Tyrone expects that the planned closure of the facilities represented by the proposed schedule will be conducted in a more cost efficient manner than that reflected in the financial assurance cost estimate, which is predicated on the unlikely condition of forfeiture. As indicated earlier, implementation of the mine-for-closure concepts are expected to result in more efficient reclamation than might be considered in a forfeiture scenario.

9.0 USE OF THIS REPORT

Golder has compiled this CCP Update to present Little Rock Mine's 5-year update of the CCP to the NMED and the MMD of the New Mexico Energy, Minerals and Natural Resources Department. In the compilation of this plan, Golder collaborated with Telesto Solutions, Inc., who designed the closure/closeout configuration of the mine facilities and prepared the cost basis document. The Little Rock Mine CCP has been updated to fulfill the requirements of the following:

- Discharge Permit DP-1236, Little Rock Mine, (DP-1236), issued by the NMED on December 27, 2000 (NMED 2000) and renewed on March 8, 2016 (NMED 2016), and associated amendments;
- Permit GR007RE, Little Rock Mine Existing Mining Operation (MMD Permit), issued by the MMD of the New Mexico Energy, Minerals and Natural Resources Department on December 21, 1998 (MMD 1998) and associated Permit revisions;
- Copper Mine Rule, 20.6.7 NMAC adopted by the New Mexico Water Quality Control Commission on December 1, 2013 (NMWQCC 2013); and
- 43 CFR Subpart 3809, applicable mine reclamation regulations set forth by the U.S. BLM.

Tyrone has completed numerous other studies required by DP-1236 and Mining Act Permit GR007RE. Information from these various studies has also been considered in preparing this CCP Update.

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Signature Page

Please contact the undersigned with any questions or comments on the information contained in this report.

Respectfully submitted,

Golder Associates Inc.

Todd Stein, PG
Project Manager

TELESTO SOLUTIONS, INC.

Walter L. Niccoli, PE
Principal/Senior Engineer

https://golderassociates.sharepoint.com/sites/121812/project files/6 deliverables/001-little rock ccp update/rev0/20136957-001-rev0-little_rock_ccp_update_2020-20200611.docx

Tables

Table 1-1: Copper Rule Section Reference to CCP

Copper Rule Section	Description	Little Rock CCP Update Report Section
20.6.7.30	**CONTINGENCY REQUIREMENTS FOR COPPER MINE FACILITIES**	5.1, 5.6
20.6.7.30.H	Leach Stockpiles, Tailings Impoundment or Waste Rock Stockpiles - Unstable Slopes	5.6
20.6.7.30.I	Erosion of Cover System or Compromised Stormwater Conveyance Structure, Ponding of Stormwater, or Other Conditions	5.1
20.6.7.33	**CLOSURE REQUIREMENTS FOR COPPER MINE FACILITIES**	3.0, 5.0
20.6.7.33.A	Design Storm Event	2.3.4
20.6.7.33.B	Slope Stability	4.2.1
20.6.7.33.C	Surface Re-Grading	3.2.1
20.6.7.33.D	Open Pits	3.2.2
20.6.7.33.E	Surface Water Management	3.0
20.6.7.33.F	Cover Systems	NA
20.6.7.33.G	Process Solution Reduction Plans	NA
20.6.7.33.H	Closure Water Management and Treatment Plan	NA
20.6.7.33.I	Impoundments	NA
20.6.7.33.J	Pipelines, Tanks and Sumps	3.2.3
20.6.7.33.K	Crushing, Milling, Concentrating and Smelting	NA
20.6.7.33.L	Closure Monitoring and Maintenance	NA
20.6.7.33.M	Exceptions to Design Criteria	NA
20.6.7.34	**IMPLEMENTATION OF CLOSURE**	NA
20.6.7.34.A	Notification of Intent to Close	NA
20.6.7.34.B	Initiation of Closure	3.2.1
20.6.7.34.C	Notification of Change in Operational Status	NA
20.6.7.34.D	Department Notice Regarding Suspended Operations and Enforcement Action	NA
20.6.7.34.E	Deferral of Closure	NA
20.6.7.34.F	Final Design	NA
20.6.7.34.G	CQA/CQC Report	NA
20.6.7.35	**POST-CLOSURE REQUIREMENTS**	5.0, 5.1
20.6.7.35.A	Seepage Interceptor System Inspections	5.2
20.6.7.35.B	Water Quality Monitoring and Reporting	5.0, 5.3.1
20.6.7.35.C	Reclamation Monitoring, Maintenance, and Inspections	5.1, 5.4
20.6.7.35.D	Reporting	5.0
20.6.7.35.E	Contingency Requirements	NA

Notes:
NA – Not applicable
All waste rock stockpiles currently existing at the site and all proposed waste rock stockpiles are/will be non-discharging units and therefore may not be subject to the Copper Mine Rule citations above.

Table 1-2: Stockpile, Pit, and Facility Names Reconciliation

Updated Operational Names 2020	Operational Names Used in 2014 CCP Update [1]	Master Document [2]	Other Historic Names [3]
Stockpiles			
Reclaimed Copper Leach Stockpile and P-Plant Area	Reclaimed Copper Leach Stockpile and P-Plant Area	Reclaimed Leach Stockpile and Precipitation Plant	Reclaimed Leach Stockpile and Precipitation Plant, Reclaimed Copper Leach Stockpile and P-Plant Area
Historical North Stockpile	North Stockpile	Historical North Stockpile	North Historical Stockpile, North Stockpile
Historical West Canyon Stockpile	West Canyon Stockpile	Historical West Canyon Stockpile	West Canyon Historical Stockpile, West Canyon Stockpile
North In-Pit Waste	Operational In-Pit Stockpile	NA	In-Pit Stockpile, North In-Pit Stockpile
West In-Pit Waste	Operational In-Pit Stockpile	NA	In-Pit Stockpile, West In-Pit Stockpile
East In-Pit Waste	NA	NA	NA
CLW Waste	NA	NA	NA
NRW Waste	NA	NA	NA
Open Pits			
Little Rock Mine Open Pit	Open Pit, Little Rock Mine Open Pit	Little Rock Pit	Little Rock Mine Open Pit, Open Pit Area
Other Facilities			
Little Rock Haul Road	Existing Haul Road	NA	Existing and Modified Haul Road
Western Haul Road	Western Haul Road	NA	Western Haul Road
Deadman Canyon Diversion	Deadman Canyon Channel Diversion	NA	Constructed Diversion Channel,Deadman Canyon Channel Diversion
Dewatering Pipeline (LR sump-1x1)	Dewatering Pipeline Alignment #1	1x1 Pipeline	Dewatering Pipeline Alignment No. 1
NA	Dewatering Pipeline Alignment #2	NA	NA
1X1 Pond	1X1 Pond	1X1 Pond, 1X1 Lined Pond	1X1 Lined Pond
Northern Haul Road	NA	NA	NA
Southern Haul Road	NA	NA	NA

Notes:

NA - Not applicable

[1] 2014 CCP Update - Updated Closure/Closeout Plan for the Little Rock Mine, June 19, 2014 (Golder, 2014).

[2] Master Document - June 9, 2017 report from Daniel B. Stephens & Associates, Inc. titled Application Requirements for Discharge Permit at a Copper Mine Facility (20.6.7.11 NMAC).

[3] Includes names from permits, master document, and historic submittals to NMED, MMD, and BLM.

Table 2-1: Summary of Applicable Permits and Regulatory Framework for the Little Rock Mine

Environmental Media/ Regulatory Framework	Permit Number	Description	Issuing Agency	Status
Operations on land managed by BLM (43 CFR 3809)	NMNM091644	1993 MPO – approved in 1997 with related EIS/ROD and reevaluated in 2010 DNA 2013 MPO Amendment for an Expansion to Little Rock Mine with related EA/FONSI	BLM	Current 02/26/2016
New Mexico Mining Act	GR007RE	Original permit, effective 12/21/1998	MMD	Current
	Rev 14-1	CCP and financial assurance update		Approved 3/8/2016
Groundwater New Mexico Administrative Code 20 Chapter 6, Water Quality	DP-1236	Groundwater Discharge Permit	NMED	Approved 12/27/2000
	Revised Discharge Permit Amendment	Groundwater Discharge Permit Renewal and Modification		Approved 3/8/2016
Surface Water Quality/ Federal Clean Water Act	NMR053073	National Pollutant Discharge Elimination System (NPDES) Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity (MSGP) - Sector G - Metal Mining (Ore Mining and Dressing) and Sector J - Mineral Mining	EPA	NOI acknowledgement issued by the EPA on 9/27/2015
	Oil Pollution Prevention	Spill Prevention Control and Countermeasures Plan	EPA	Current; maintained on-site
	SPA-2009-0062-8-ELP	Individual section 404 permit	Corps	Current; expires 12/31/2020
Hazardous Waste Management	HW EPA ID NMD035806405	Notification of status as generator of hazardous waste	EPA/ NMED	Acknowledgment of notification from EPA, dated 01/21/1991; no expiration date
Air Quality	PSD2448 M4	Air Quality Construction Permit – Tyrone Mine	NMED	Current; no expiration date
	P147-R2M1	Air Quality Operating Permit – Tyrone Mine		Current; expires 07/18/2021

Table 3-1: Geochemical Modeling Results for Little Rock Pit Lake [1]

Water Quality Parameter	30 Years Following Closure	100 Years Following Closure
pH (su)	7.87	7.90
Aluminum	0.707	0.953
Arsenic	0.030	0.040
Boron	0.039	0.053
Bicarbonate	282	297
Cadmium	0.0035	0.0048
Calcium	69.3	65.8
Carbonate	1.02	1.15
Chloride	28.5	38.3
Chromium	0.0061	0.0082
Cobalt	0.0013	0.0013
Copper	0.12	0.12
Fluoride	**2.23**	**3.01**
Iron	0.00030	0.00030
Lead	0.0038	0.0055
Magnesium	24.5	32.9
Manganese	0.11	0.11
Nickel	0.021	0.028
Potassium	7.01	9.60
Sodium	47.4	63.6
Sulfate	95	128
Total Dissolved Solids	558	641
Zinc	0.22	0.30

Notes:

[1] - Geochemical model results provided in the Little Rock Groundwater Flow and Geochemical Modeling Report (DBS&A, 2014).

Predicted pit lake water quality results are for 30 and 100 years following closure.

Units mg/L unless otherwise noted.

Bold values indicate concentrations above associated 20.6.2 NMAC Section 3103 standards.

Table 3-2: Summary of Key Design Criteria for Facilities to be Closed

Stockpiles – (Applicable to the West In-Pit Waste, East In-Pit Waste, NRW Waste, and CLW Waste stockpiles; applies to in-pit stockpile areas not covered by the ultimate pit lake)

- Outslopes to be graded to a maximum inter-bench slope of 3H:1V.
- Maximum uninterrupted slope length of 200 feet for outslopes.
- Terrace benches will have maximum bench width of 32 feet.
- Bench longitudinal slopes at 2 percent.
- Bench cross slopes and channels at a maximum of 2 percent.
- Top surfaces of non-discharging waste rock stockpiles - minor grading to ensure that stormwater water does not accumulate near or discharge over a crest.
- For the in-pit stockpiles regrading to be done in such a manner that orients surface water drainage toward the pit bottom.
- Construction of downdrains and energy dissipators as needed on all stockpiles requiring reclamation at the EOY 2024. For the in-pit stockpiles energy dissipators are not required.
- For the stockpiles outside of the open pit, regrading to be done in such a manner that orients surface water conveyances to the exterior perimeter of the stockpiles.
- For the stockpiles outside of the open pit, slope channels will be located where possible in natural junctions or drainage chutes, and may contain riprap and energy dissipation structures if engineering designs warrant them.
- Placement of 4 inches of additional fine-grained cover material over 10% of the surface area of the stockpiles to enhance the seed bed over potential rocky areas.
- Top surfaces and outslopes to be ripped to a depth of 18 to 24 inches and vegetated in accordance with MMD Permit GR007RE and associated Permit revisions.

Open Pit – (Little Rock Mine Open Pit)

- Accessible open pit flat areas, not covered by the ultimate pit lake, will be ripped to a depth of 18 to 24 inches and vegetated in accordance with MMD Permit GR007RE and associated Permit revisions. For the purposes of this CCP, accessible pit flat areas are defined as pit haul road driving surfaces and flat areas 50-feet or greater from a highwall.
- A combination of 6-foot chain link fencing and earthen berms will be constructed approximately 40 feet from the open pit highwalls to limit public access.
- Signs will be posted on fencing at 500-ft intervals and at all access points, warning of potential hazards present.
- An approximate 25-foot-wide disturbance area used to construct the chain link fencing, and approximate 100-foot-wide disturbance area used to construct the berm will be vegetated in accordance with MMD Permit GR007RE and associated Permit revisions.
- Removal of aboveground electrical systems and infrastructure, including pumps, lighting and transmission lines not necessary for post-closure site operations and maintenance.

Pipelines (applies to pit dewatering and seepage collection pipelines that will not be used in closure/post closure water management, and pipelines located outside the regrade footprint of stockpiles)

- Removal of residual sediments and fluids from pipelines within the open pit and disposal of materials at an approved location.
- Removal or burial of sections of pipeline within the open pit and dispose of pipe in an approved manner.
- Covering impacted areas with 36 inches of suitable cover material.
- Seeding of disturbed and covered areas to reestablish vegetation in accordance with MMD Permit GR007RE and associated Permit revisions.

Table 3-2: Summary of Key Design Criteria for Facilities to be Closed

Haul Roads (applies to portions of existing haul road not mined out by the expanded pit and accessible haul roads within the open pit not needed for post closure access)
■ Haul roads will be ripped to a depth of 18 to 24 inches and vegetated in accordance with MMD Permit GR007RE and associated Permit revisions. It is not anticipated that any haul roads will be located on acid-generating material, and all fill used for haul road construction will be non-acid generating. ■ Removal of culverts not needed for post-closure storm water management and disposal of them in an approved manner. ■ Acid-generating material (if present) will be graded to direct stormwater off road, covered with 36 inches of suitable cover material, and revegetated in accordance with MMD Permit GR007RE and associated Permit revisions.
Other Ancillary Facilities and Structures (surface impoundments including booster pump stations, electrical power transmission lines and a substation; operational and exploration roads; storm water structures for drainage, diversion, and sediment control; equipment storage areas; and fencing and security systems).
■ Power transmission lines, booster pump stations, and substation will be removed once they are not needed for post-closure purposes. Power poles will be left in place to serve as raptor perches after reclamation. ■ Removal of any temporary, portable operations and maintenance facilities used to support mining and not needed for post-closure purposes. ■ Disturbed areas associated with the construction of the open pit security fencing and earthen berm will be ripped to a depth of 18 to 24 inches and vegetated in accordance with MMD Permit GR007RE and associated Permit revisions. ■ Covering impacted areas with 36 inches of suitable cover material. ■ Ripping of non-impacted disturbed areas to a depth of 18 to 24 inches. ■ Seeding of ripped and covered areas to reestablish vegetation in accordance with MMD Permit GR007RE and associated Permit revisions.

Notes:
MMD = Mining and Minerals Department

Table 3-3: Stability Analysis Results for Little Rock Mine Stockpile Reclamation Plan[1]

Stockpile	Critical Failure Mode	Minimum Static FOS	Minimum Pseudo-Static FOS	Liquefied FOS
West In-Pit Waste[2]	Global failure, circular type	2.55	1.88	No liquefiable soils present
North In-Pit Waste[2]	Global failure, circular type	2.56	1.95	No liquefiable soils present
CLW Waste	Global failure, circular type	3.92	2.88	No liquefiable soils present
NRW Waste	Local toe, circular type	2.29	1.68	1.32
East In-Pit Waste	Closure with pit lake El. 5,670 ft	2.21	1.64	No liquefiable soils present
	Closure without pit lake	1.82	1.54	
	Raised WT to Deadman Canyon Diversion	2.16	1.52	

Notes:
[1] - Golder. 2020b. Tyrone Stockpile Stability Analysis for Little Rock 2020 Closure/Closeout Plan Update (EOY 2024 Mine Configuration). Freeport McMoRan Tyrone Inc. June 11.

[2] - Golder. 2020a. Tyrone Stockpile Stability Analysis for 2019 Closure Close-Out Plan Update Tyrone Rev 1., New Mexico. Freeport McMoRan Tyrone Inc. April 28.

FOS – Factor of safety

Table 6-1: Proposed Interim Seed Mix and Rates for the Little Rock Mine Reclamation Sites

Species[a]		Life-Form	Duration[b]	Seasonality	Rate[a,c]	PLS/ sq ft[d]
Scientific Name	Common Name					
Primary Seed Mix						
Bouteloua curtipendula	Sideoats grama	Grass	Per	Warm	1.50	6.58
Bouteloua eriopoda	Black grama	Grass	Per	Warm	0.10	3.06
Bouteloua gracilis	Blue grama	Grass	Per	Warm	0.50	9.47
Leptochloa dubia	Green sprangletop	Grass	Per	Warm	0.25	3.09
Eragrostis intermedia	Plains lovegrass	Grass	Per	Intermediate	0.05	4.02
Dalea candida	White prairie clover	Forb	Per	NA	0.25	2.03
Linum lewisii	Blue flax	Forb	Per	NA	0.25	0.98
Sphaeralcea spp.	Globemallow spp.	Forb	Per	NA	0.10	1.15
Cercocarpus montanus	Mountain mahogany	Shrub	Per	NA	1.50	1.63
Fallugia paradoxa	Apache plume	Shrub	Per	NA	0.10	0.96
Krascheninnikovia lanata	Winterfat	Shrub	Per	NA	1.00	2.82
				Total	**5.60**	**35.79**
Alternate Seed Mix						
Andropogon gerardii	Big bluestem	Grass	Per	Warm	ND	ND
Andropogon hallii	Sand bluestem	Grass	Per	Warm	ND	ND
Andropogon saccharoides	Silver bluestem	Grass	Per	Warm	ND	ND
Aristida purpurea	Purple three-awn	Grass	Per	Warm	ND	ND
Bothriochloa barbinodis	Cane beardgrass	Grass	Per	Warm	ND	ND
Bothriochloa ischaemum	Yellow bluestem	Grass	Per	Warm	ND	ND
Buchloe dactyloides	Buffalograss	Grass	Per	Warm	ND	ND
Digitaria californica	Arizona cottontop	Grass	Per	Warm	ND	ND
Heterotheca contortus	Tanglehead	Grass	Per	Warm	ND	ND
Hilaria belangeri	Curly mesquite	Grass	Per	Warm	ND	ND
Muhlenbergia montana	Mountain muhly	Grass	Per	Warm	ND	ND
Muhlenbergia porteri	Bush muhly	Grass	Per	Warm	ND	ND
Muhlenbergia rigens	Deergrass	Grass	Per	Warm	ND	ND

Table 6-1: Proposed Interim Seed Mix and Rates for the Little Rock Mine Reclamation Sites

Species[a]		Life-Form	Duration[b]	Seasonality	Rate[a,c]	PLS/ sq ft[d]
Scientific Name	Common Name					
Alternate Seed Mix (cont.)						
Muhlenbergia torreyi	Ring muhly	Grass	Per	Warm	ND	ND
Muhlenbergia wrightii	Spike muhly	Grass	Per	Warm	ND	ND
Panicum obtusum	Vine mesquite	Grass	Per	Warm	ND	ND
Panicum virgatum	Switchgrass	Grass	Per	Warm	ND	ND
Pleuraphis jamesii	Galleta grass	Grass	Per	Warm	ND	ND
Pleuraphis mutica	Tobosa	Grass	Per	Warm	ND	ND
Schizachyrium scoparium	Little bluestem	Grass	Per	Warm	ND	ND
Setaria vulpiseta	Plains bristlegrass	Grass	Per	Warm	ND	ND
Sorgastrum nutans	Indiangrass	Grass	Per	Warm	ND	ND
Sporobolus airoides	Alkali sacaton	Grass	Per	Warm	ND	ND
Sporobolus cryptandrus	Sand dropseed	Grass	Per	Intermediate	ND	ND
Sporobolus giganteus	Giant dropseed	Grass	Per	Warm	ND	ND
Sporobolus wrightii	Sacaton	Grass	Per	Warm	ND	ND
Achillea millefolium	Western yarrow	Forb	Per	NA	ND	ND
Baileya multiradiata	Desert marigold	Forb	Ann	NA	ND	ND
Berlandiera lyrata	Chocolate flower	Forb	Per	NA	ND	ND
Calochortus 20mbiguous	Desert mariposa lily	Forb	Per	NA	ND	ND
Calylophus hartwegii	Lavenderleaf primrose	Forb	Per	NA	ND	ND
Castilleja integra	Indian paintbrush	Forb	Per	NA	ND	ND
Castilleja sessiliflora	Downy paintbrush	Forb	Per	NA	ND	ND
Coreopsis lanceolata	Lanceleaf tickseed	Forb	Per	NA	ND	ND
Coreopsis tinctoria	Plains tickseed	Forb	Per	NA	ND	ND
Dalea candida	White prairie clover	Forb	Per	NA	ND	ND
Dalea jamesii	James' dalea	Forb	Per	NA	ND	ND
Gaillardia aristata	Blanket flower	Forb	Per	NA	ND	ND

Table 6-1: Proposed Interim Seed Mix and Rates for the Little Rock Mine Reclamation Sites

Species[a]		Life-Form	Duration[b]	Seasonality	Rate[a,c]	PLS/ sq ft[d]
Scientific Name	Common Name					
Alternate Seed Mix (cont.)						
Gaillardia pulchella	Firewheel	Forb	Per	NA	ND	ND
Gilia tricolor	Bird's eyes	Forb	Per	NA	ND	ND
Glandularia gooddingii	Desert verbena	Forb	Per	NA	ND	ND
Heliomeris multiflora	Showy goldeneye	Forb	Per	NA	ND	ND
Ipomopsis ambiguous	Scarlet gilia	Forb	Per	NA	ND	ND
Lesquerella gordonii	Gordon bladderpod	Forb	Per	NA	ND	ND
Lupinus arizonicus	Arizona lupine	Forb	Per	NA	ND	ND
Lupinus perennis	Perennial lupine	Forb	Per	NA	ND	ND
Machaeranthera bigelovii var.bigelovii	Bigelow's tansyaster	Forb	Per	NA	ND	ND
Machaeranthera tanacetifolia	Tanseyleaf tansyaster	Forb	Per	NA	ND	ND
Mirabilis multiflora	Wild Four 'O Clock	Forb	Per	NA	ND	ND
Monarda citriodora	Lemon beebalm	Forb	Per	NA	ND	ND
Monarda fistulosa	Wild bergamot	Forb	Per	NA	ND	ND
Oenothera elata	Hooker evening primrose	Forb	Per	NA	ND	ND
Oenothera macrocarpa	Missouri evening primrose	Forb	Per	NA	ND	ND
Penstemon ambiguous	Sand penstemon	Forb	Per	NA	ND	ND
Penstemon barbatus	Scarlet bulger	Forb	Per	NA	ND	ND
Penstemon eatonii	Firecracker penstemon	Forb	Per	NA	ND	ND
Penstemon fendleri	Fendler's penstemon	Forb	Per	NA	ND	ND
Penstemon palmeri	Palmer penstemon	Forb	Per	NA	ND	ND
Penstemon pseudospectabilis	Desert penstemon	Forb	Per	NA	ND	ND
Penstemon superbus	Superb penstemon	Forb	Per	NA	ND	ND
Penstemon virgatus	Wandbloom penstemon	Forb	Per	NA	ND	ND
Phacelia campanularia	Bluebells	Forb	Per	NA	ND	ND

Table 6-1: Proposed Interim Seed Mix and Rates for the Little Rock Mine Reclamation Sites

Species[a]		Life-Form	Duration[b]	Seasonality	Rate[a,c]	PLS/ sq ft[d]
Scientific Name	Common Name					
Alternate Seed Mix (cont.)						
Phacelia crenulata	Desert bluebells	Forb	Per	NA	ND	ND
Ratibida columnifera	Mexican hat	Forb	Per	NA	ND	ND
Rudbeckia hirta	Blackeyed Susan	Forb	Per	NA	ND	ND
Senecio longilobus	Silver groundsel	Forb	Per	NA	ND	ND
Senna covesii	Desert senna	Forb	Per	NA	ND	ND
Solidago canadensis	Canada goldenrod	Forb	Per	NA	ND	ND
Sphaeralcea ambigua	Desert globemallow	Forb	Per	NA	ND	ND
Sphaeralcea coccinea	Scarlet globemallow	Forb	Per	NA	ND	ND
Sphaeralcea grossulariifolia	Gooseberry globemallow	Forb	Per	NA	ND	ND
Thelesperma filifolium	Greenthread	Forb	Per	NA	ND	ND
Agave parryi	Parry's agave	Shrub	Per	NA	ND	ND
Amorpha fruticosa	False indigo-bush	Shrub	Per	NA	ND	ND
Artemisia ludoviciana	White sagebrush	Shrub	Per	NA	ND	ND
Atriplex canescens	Fourwing saltbush	Shrub	Per	NA	ND	ND
Brickellia californica	Canyon bricklebush	Shrub	Per	NA	ND	ND
Calliandra eriphylla	Fairy duster	Shrub	Per	NA	ND	ND
Chilopsis linearis	Desert willow	Shrub	Per	NA	ND	ND
Dalea formosa	Feather dalea	Shrub	Per	NA	ND	ND
Dasylirion wheeleri	Sotol	Shrub	Per	NA	ND	ND
Erimaceria nauseosa	Rubber rabbitbrush	Shrub	Per	NA	ND	ND
Lycium pallidum	Wolfberry	Shrub	Per	NA	ND	ND
Mahonia repens	Creeping Oregon grape	Shrub	Per	NA	ND	ND
Nolina microcarpa	Beargrass	Shrub	Per	NA	ND	ND
Rhus trilobata	Skunkbush sumac	Shrub	Per	NA	ND	ND
Ribes leptanthum	Canyon gooseberry	Shrub	Per	NA	ND	ND

Table 6-1: Proposed Interim Seed Mix and Rates for the Little Rock Mine Reclamation Sites

Species[a]		Life-Form	Duration[b]	Seasonality	Rate[a,c]	PLS/ sq ft[d]
Scientific Name	Common Name					
Alternate Seed Mix (cont.)						
Robinia neomexicana	NM locust	Shrub	Per	NA	ND	ND
Yucca baccata	Broadleaf yucca	Shrub	Per	NA	ND	ND
Yucca elata	Soap tree yucca	Shrub	Per	NA	ND	ND
Yucca glauca	Spanish bayonet	Shrub	Per	NA	ND	ND

Notes:
[a] Seed mix and rates are subject to change based on future investigations
[b] Per – Perennial; Ann = Annual
[c] Rate is in pounds of pure live seed (PLS) per acre; substitutions may change seeding rates
[d] PLS/sq ft = Pure live seed per square foot, estimated based on published values for seeds per pound
lb/ac = pounds per acre
NA = Not applicable
ND = Not determined

Table 6-2: Functions and Attributes of the Primary Plant Species Proposed for the Little Rock Mine Reclamation Sites

Species	Character[a]	Attributes and Function
Blue grama (Bouteloua gracilis)	N,P,W,G	Sod and bunch grass providing ground cover and forage
Side-oats grama (Bouteloua curtipendula)	N,P,W,G	Bunch grass providing ground cover and forage
Black grama (*Bouteloua eriopoda*)	N,P,W,G	Bunch grass providing ground cover and forage
Green sprangletop (*Leptochloa dubia*)	N,P,W,G	Erect bunch grass; aggressive short-lived nurse plant with forage value
Plains lovegrass (*Eragrostis intermedia*)	N,P,I,G	Bunch grass providing ground cover and early spring forage
Apache plume (*Fallugia pardoxa*)	N,P,S	Mid-height shrub providing browse, cover, and erosion control
Mountain mahogany (*Cercocarpus montanus*)	N,P,S	Mid-height to tall shrub providing browse and cover
Winterfat (*Krascheninnikovia lanata*)	N,P,HS	Low shrub providing winter browse
White prairie clover (*Dalea candida*)	N,P,F	Early season legume providing ground cover and forage
Blue flax (*Linum lewisii*)	N,P,F	Persistent forb with a pretty blue flower
Globemallow spp. (*Sphaeralcea spp.*)	N,P,F	Persistent mid-height forb providing browse

Notes:
The seed species list and associated mix will be included in the vegetation monitoring work plan and may be amended with MMD approval. Any proposed changes to the seed mix will be provided to the MMD no less than 60 days before any seeding occurs.
[a] N = Native
P = Perennial
W = Warm season
I = Intermediate season
G = Grass
S = Shrub
HS = Half shrub
F = Forb

Table 6-3: Proposed Plant Diversity Guidelines for the Little Rock Mine

Class	Seasonality	Numbers	Minimum Occurrence (% cover)
Grasses	Warm	3	1
Shrubs	NA	2	0.5
Forbs	NA	2	0.1

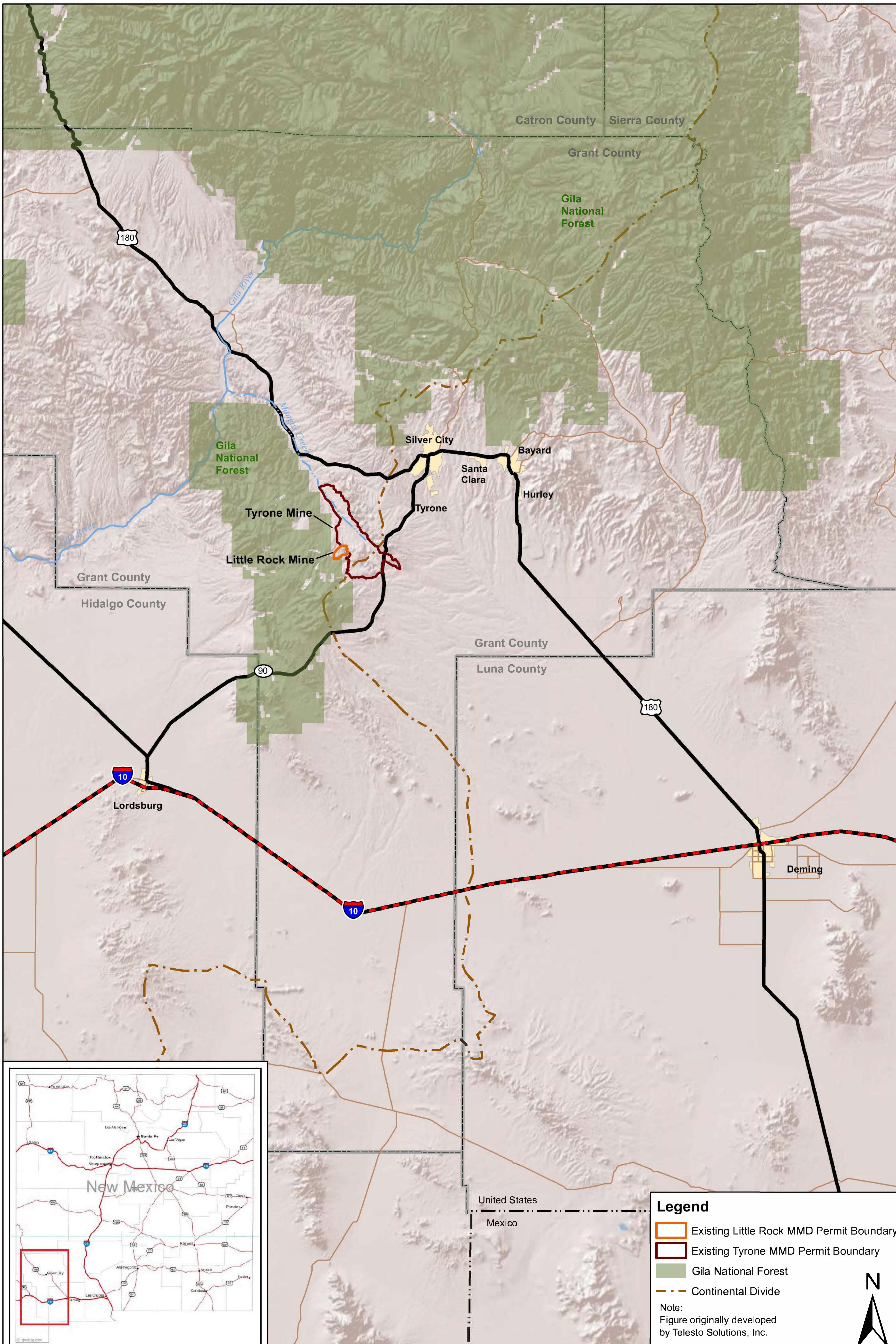
Notes:
NA = Not applicable

Table 8-1: Reclamation Schedule for the Little Rock Mine

Unit	Anticipated or Actual Start Date for Reclamation to Begin[a]	Anticipated Duration of Earthwork (Years)[b] or Earthwork Completion Date
East In-Pit Waste Stockpile	180 days following Cessation of Operation	1
North In-Pit Waste Stockpile	180 days following Cessation of Operation	NA
West In-Pit Waste Stockpile	180 days following Cessation of Operation	2
CLW Waste Stockpile	180 days following Cessation of Operation	1
NRW Waste Stockpile	180 days following Cessation of Operation	2
Open Pit[c]	180 days following Cessation of Operation	1
Haul Roads and Access Roads[d]	180 days following Cessation of Operation	1
Pipelines[e]	180 days following Cessation of Operation	1
Deadman Canyon Diversion	180 days following Cessation of Operation	2
Ancillary Facilities and Infrastructure	180 days following Cessation of Operation	1

Notes:
NA – Not applicable
[a] Anticipated start dates are subject to modification.
[b] Estimated earthwork duration for facility reclamation does not include regulatory design review and approval processes.
[c] Only accessible flat areas within the open pit that are located above the pit lake surface will be reclaimed. For the purposes of this CCP, accessible pit flat areas are defined as pit haul road driving surfaces and flat areas 50-feet or greater from a highwall.
[d] Only haul roads and access roads not required for post-closure monitoring access will be reclaimed.
[e] Applies to portions of the dewatering pipeline that extend from the open pit sump to the crest of the pit. The remaining portions of pipeline located outside the perimeter of the open pit will remain during the post-closure period.

Figures



80,000 40,000 0 Feet

FREEPORT-MCMORAN COPPER & GOLD

PROJECT No. 20136957

FIGURE 1-1

PROJECT/REPORT
FREEPORT MCMORAN TYRONE, INC.
LITTLEROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

TITLE
MINE LOCATION MAP

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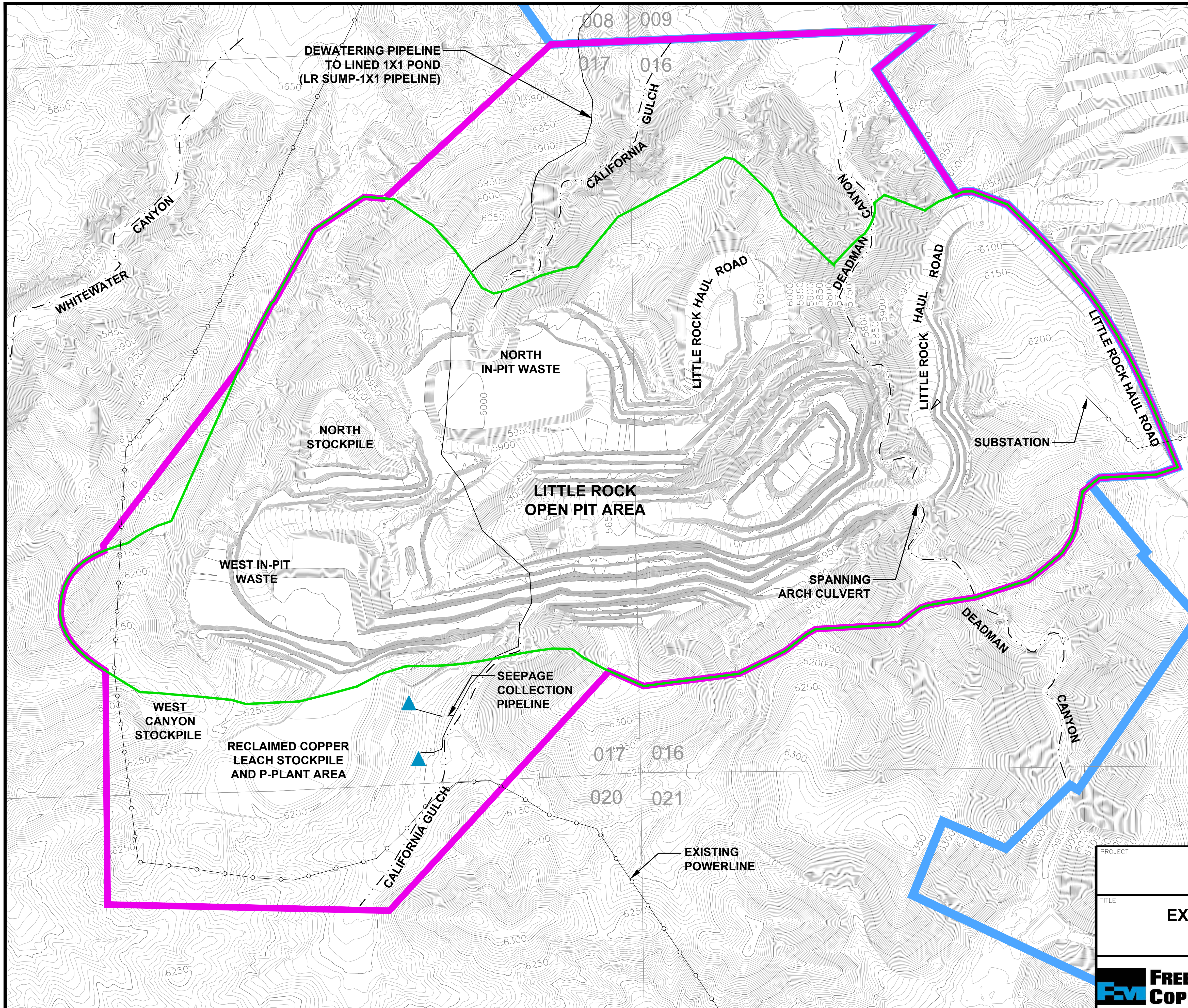

LEGEND

EXISTING LITTLE ROCK MINE PERMIT BOUNDARY

EXISTING TYRONE MINE PERMIT BOUNDARY[5]

SEEPAGE COLLECTION FACILITY

APPROVED MINING AREA DESIGN LIMIT (PERMIT REVISION 14-1 TO MMD PERMIT GR007RE)

NOTES:

1. SOURCE: TOPOGRAPHIC SURFACE FROM JUNE 2019 SURVEY PROVIDED BY FREEPORT MCMORAN TYRONE, INC.
2. CONTOUR INTERVAL AT 10 FEET.
3. COORDINATE SYSTEM IN TYRONE LOCAL MINE.
4. SECTION LINES FROM LITTLE ROCK AREA IN WIND MOUNTAIN, NM QUAD MAP (T19S R16W SECTIONS 8,9,16,17,20 AND 21).
5. PENDING APPROVAL OF PERMIT REVISION 13-1 TO MMD PERMIT GR010RE.
6. THE RECLAIMED COPPER LEACH STOCKPILE WILL BE REMOVED BY THE EOY 2024. ALL THE REMAINING STOCKPILES WITHIN THE LITTLE ROCK MINE PERMIT AREA ARE WASTE ROCK STOCKPILES CONSISTING OF PRE-CAMBRIAN GRANITE, A NON-ACID GENERATING OVERBURDEN MATERIAL, AND ARE CONDITIONALLY EXEMPT FROM THE REQUIREMENTS OF THE COPPER MINE RULE AND THE WATER QUALITY ACT DURING OPERATIONS AND AT CLOSURE.

PROJECT

FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

TITLE

EXISTING LITTLE ROCK MINE FACILITIES AND PERMIT BOUNDARIES

FREEPORT-MCMORAN COPPER & GOLD

PROJECT No.		20136957	FILE No.	113011558001-2	
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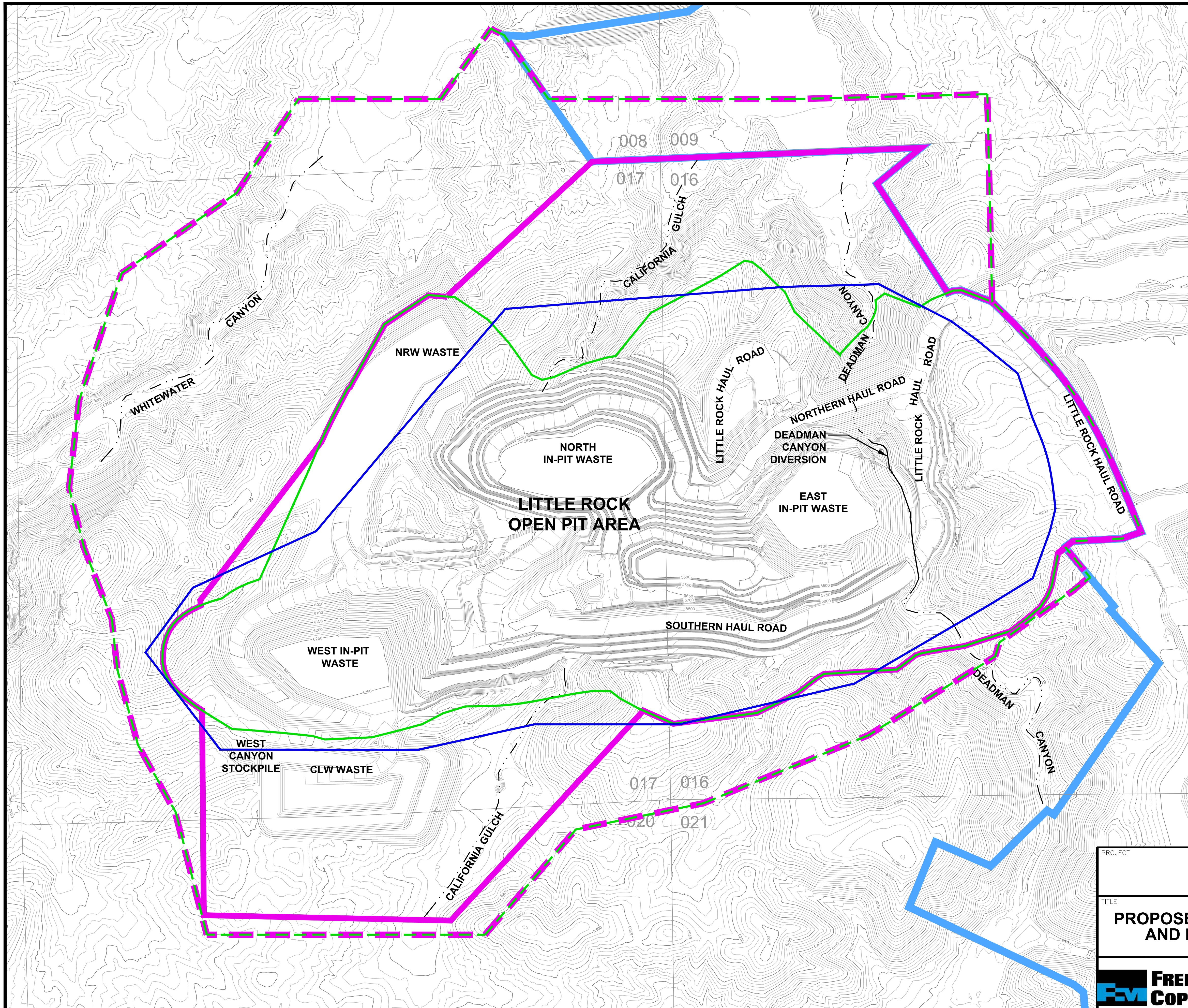
CADD	SIB	05/18/20			
CHECK					
REVIEW					

FIGURE 1-2



LEGEND

- APPROVED MINING AREA DESIGN LIMIT (PERMIT REVISION 14-1 TO MMD PERMIT GR007RE)
- PROPOSED CHANGE TO MINING AREA DESIGN LIMIT BOUNDARY
- PROJECTED EXTENT OF OPEN PIT AT END OF MINE LIFE
- EXISTING LITTLE ROCK MINE PERMIT BOUNDARY
- PROPOSED CHANGE TO LITTLE ROCK MINE PERMIT BOUNDARY
- EXISTING TYRONE MINE PERMIT BOUNDARY [5]

NOTES:

1. SOURCE: TOPOGRAPHIC SURFACE IS END OF YEAR 2024 PROVIDED BY FREEPORT MCMORAN TYRONE INC.
2. CONTOUR INTERVAL AT 10 FEET OUTSIDE OPEN PIT. RECLAIMED CONTOUR INTERVALS AT 10 FEET.
3. COORDINATE SYSTEM IN TYRONE LOCAL MINE.
4. SECTION LINES FROM LITTLE ROCK AREA IN WIND MOUNTAIN, NM QUAD MAP (T19S R15W SECTIONS 8,9,16,17,20 AND 21).
5. PENDING APPROVAL OF PERMIT REVISION 13-1 TO MMD PERMIT GR010RE.
6. ALL STOCKPILES WITHIN THE LITTLE ROCK MINE PERMIT AREA AT THE EOY 2024 ARE WASTE ROCK STOCKPILES CONSISTING OF PRE-CAMBRIAN GRANITE, A NON-ACID GENERATING OVERBURDEN MATERIAL, AND ARE CONDITIONALLY EXEMPT FROM THE REQUIREMENTS OF THE COPPER MINE RULE AND THE WATER QUALITY ACT DURING OPERATIONS AND AT CLOSURE.

800 0 800

SCALE FEET

PROJECT

FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

TITLE

PROPOSED CHANGES TO MINING AREA DESIGN LIMIT AND LITTLE ROCK MINE PERMIT BOUNDARIES

FREEPORT-MCMORAN COPPER & GOLD

PROJECT No.		20136957	FILE No.	11301155B001-3
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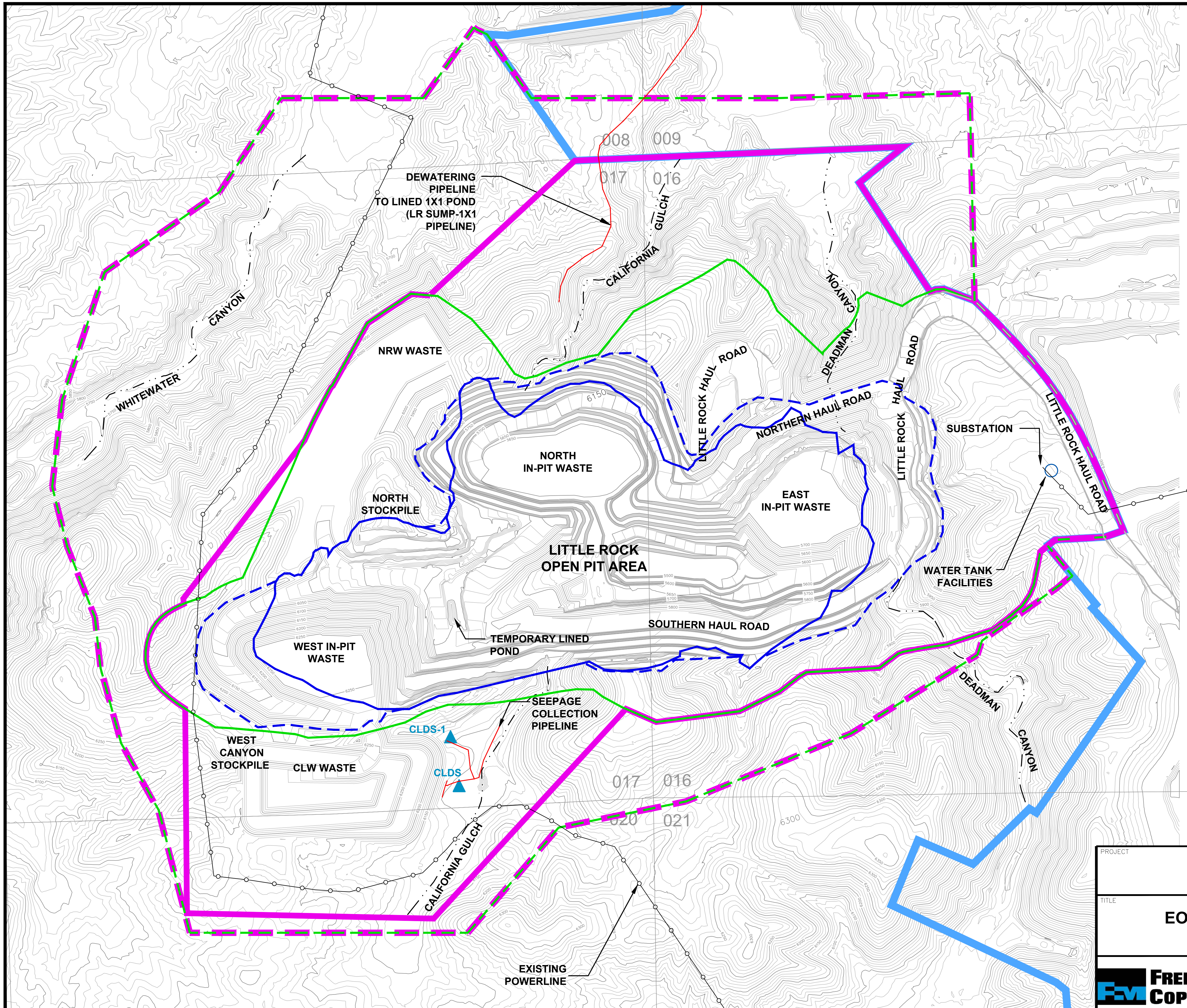
CADD	SIB	05/18/20		
CHECK				
REVIEW				

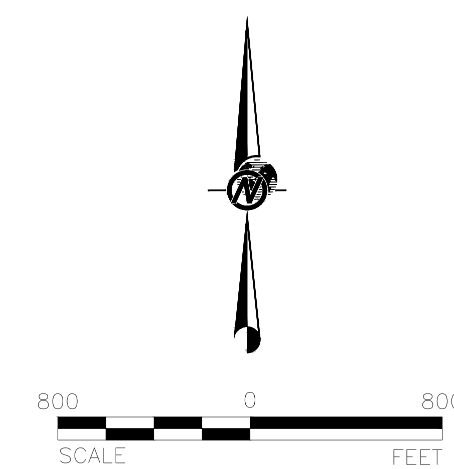
FIGURE 1-3



LEGEND

- APPROVED MINING AREA DESIGN LIMIT (PERMIT REVISION 14-1 TO MMD PERMIT GR007RE)
- PROPOSED CHANGE TO MINING AREA DESIGN LIMIT BOUNDARY
- EXTENT OF OPEN PIT 2019
- PROJECTED EXTENT OF OPEN PIT AT EOY 2024
- EXISTING LITTLE ROCK MINE PERMIT BOUNDARY
- PROPOSED CHANGE TO LITTLE ROCK MINE PERMIT BOUNDARY
- EXISTING TYRONE MINE PERMIT BOUNDARY[5]
- CLDS-1 ▲ SEEPAGE COLLECTION FACILITY

NOTES:
1. SOURCE: TOPOGRAPHY FROM FREEPORT MCMORAN TYRONE, INC. EOY 2024 MINE PLAN.
2. CONTOUR INTERVAL AT 10 FEET.
3. COORDINATE SYSTEM IN TYRONE LOCAL MINE.
4. SECTION LINES FROM LITTLE ROCK AREA IN WIND MOUNTAIN, NM QUAD MAP (T19S R15W SECTIONS 8,9,16,17 20 AND 21).
5. PENDING APPROVAL OF PERMIT REVISION 13-1 TO MMD PERMIT GR010RE.
6. ALL STOCKPILES WITHIN THE LITTLE ROCK MINE PERMIT AREA AT THE EOY 2024 ARE WASTE ROCK STOCKPILES CONSISTING OF PRE-CAMBRIAN GRANITE, A NON-ACID GENERATING OVERBURDEN MATERIAL, AND ARE CONDITIONALLY EXEMPT FROM THE REQUIREMENTS OF THE COPPER MINE RULE AND THE WATER QUALITY ACT DURING OPERATIONS AND AT CLOSURE.



PROJECT

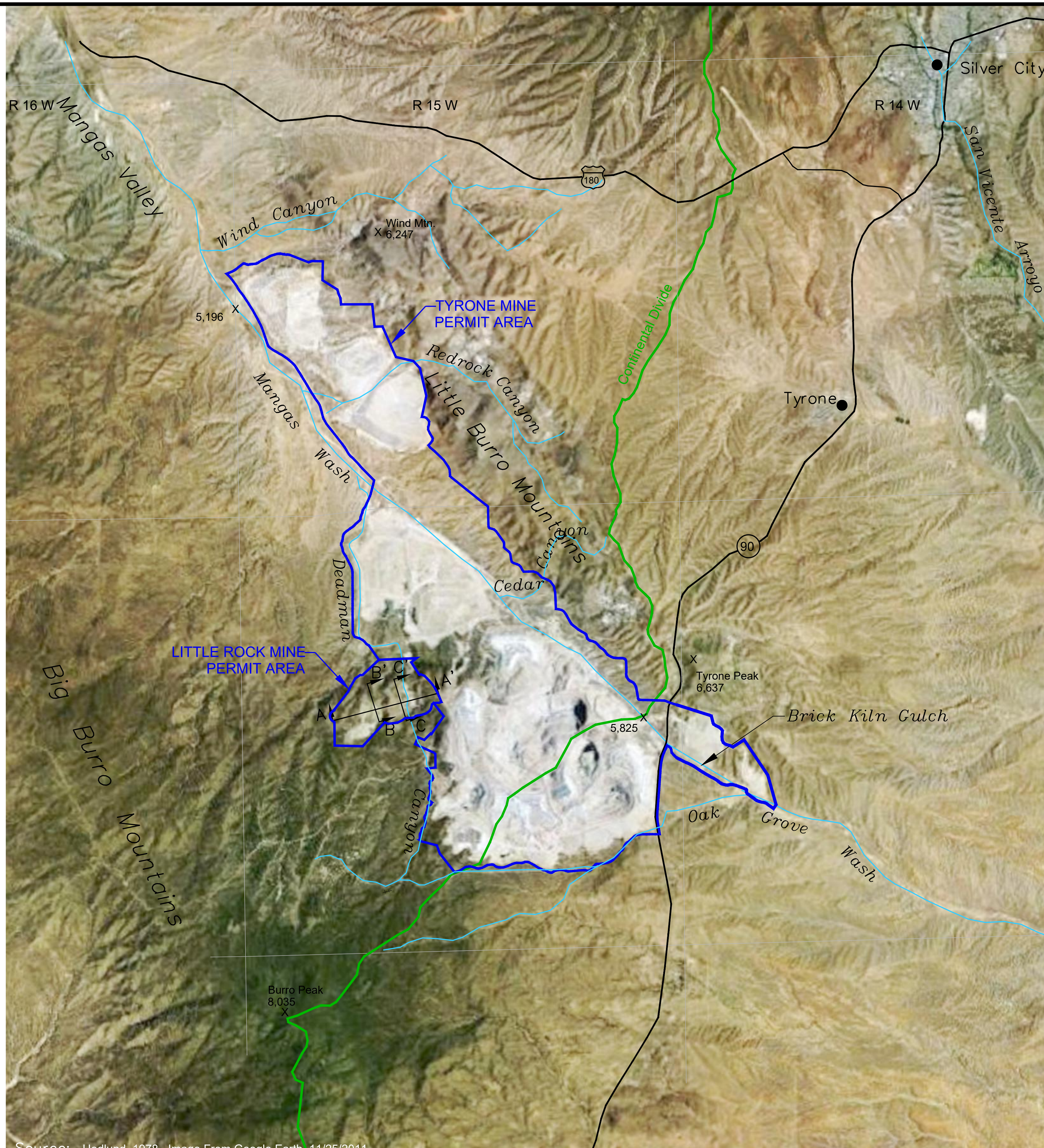
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

TITLE

EOY 2024 LITTLE ROCK MINE FACILITIES AND MINE PERMIT BOUNDARIES

FREEPORT-MCMORAN COPPER & GOLD

PROJECT No.		20136957	FILE No.	11301155B002-1	
DESIGN	TS	05/18/20	SCALE	AS SHOWN	REV. 0
CADD	SIB	05/18/20	FIGURE 2-1		
CHECK					
REVIEW					



LEGEND

- CROSS SECTION LOCATIONS
- MINE PERMIT AREA
- NATURAL DRAINAGE
- CONTINENTAL DIVIDE
- X 5,825 ELEVATION (FEET ABOVE MEAN SEA LEVEL)

NOTES:
1. CROSS SECTION DETAILS SHOWN ON FIGURES 2-5 AND 2-6.
2. SOURCE: FIGURE CREATED BY GOLDER ASSOCIATES

8000 0 8000
SCALE FEET

PROJECT
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

TITLE
REGIONAL PHYSIOGRAPHIC FEATURES AND CROSS SECTION LOCATIONS

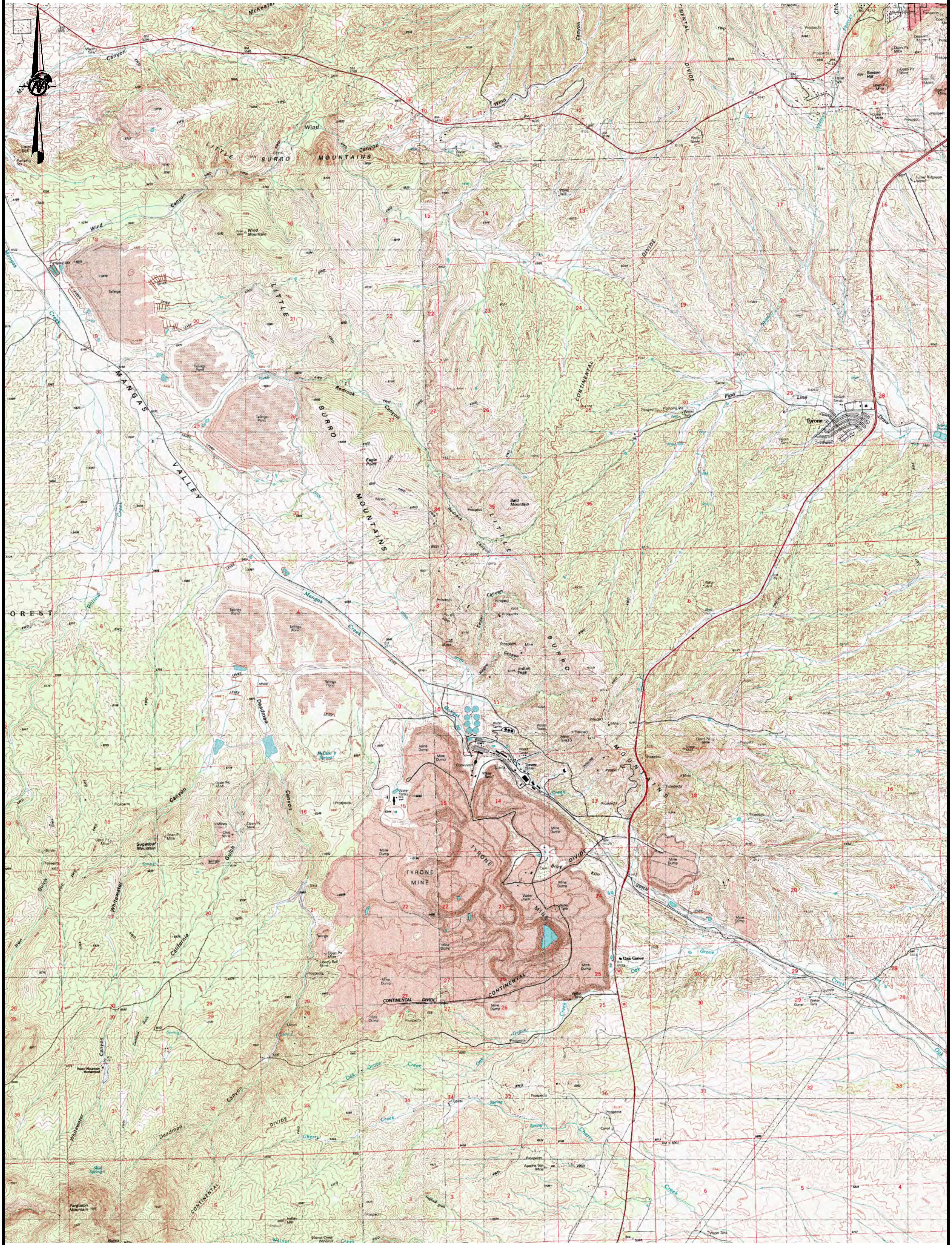
FREEPORT-MCMORAN COPPER & GOLD

PROJECT No.	20136957	FILE No.	11301155B002-2	
DESIGN	TS	05/18/20	SCALE AS SHOWN	REV. 0
CADD	SIB	05/18/20		
CHECK				
REVIEW				

FIGURE 2-2

Drawing file: 11301155B002-2.dwg May 18, 2020 - 4:04pm

Drawing file: 11301155B002-3.dwg   May 18, 2020 - 4:03pm



1500 0 1500
SCALE METERS

NOTES:

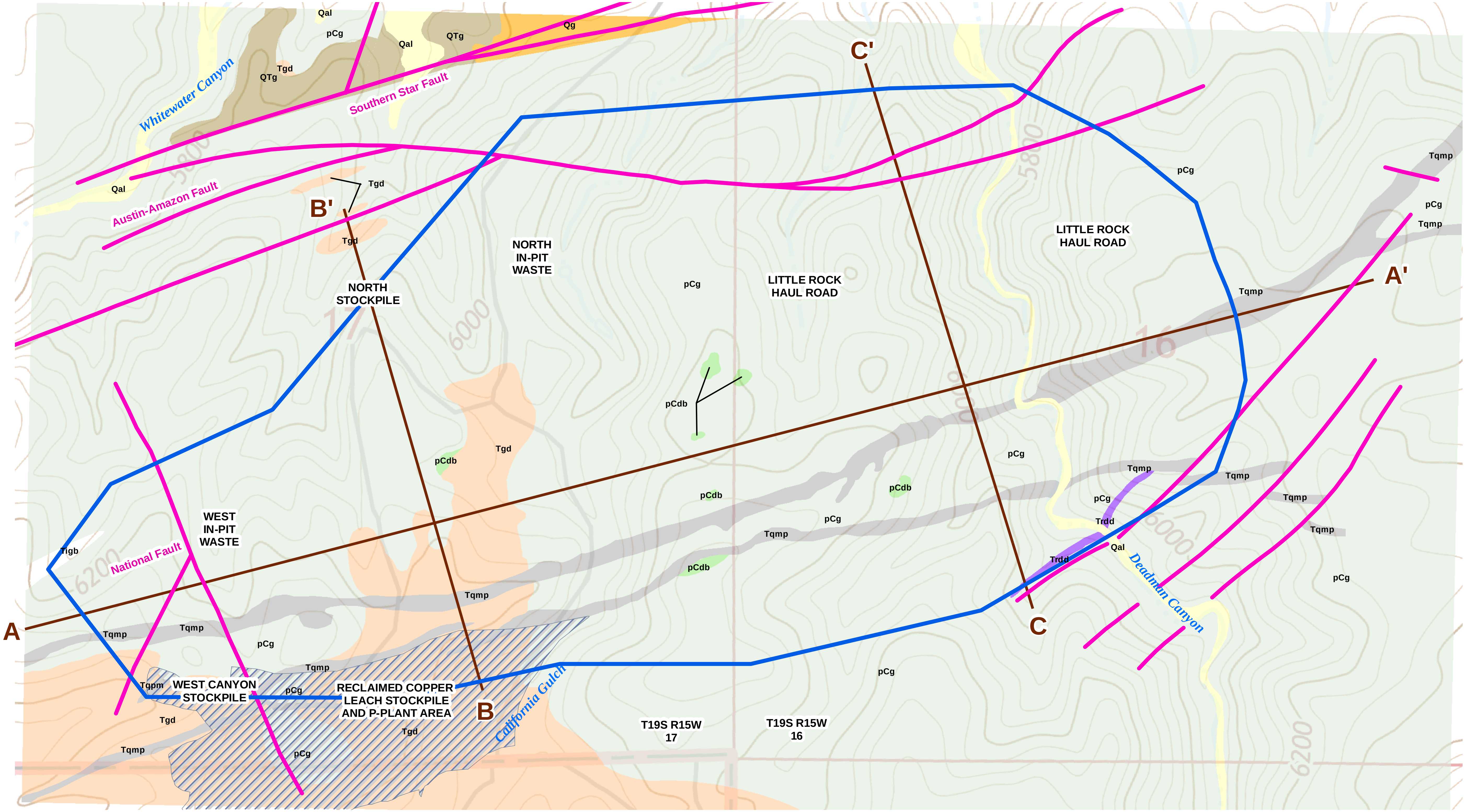
1. TOPOGRAPHIC MAP DETAILS WERE DEVELOPED BETWEEN 1992 AND 1999. SPECIFIC MINE FEATURES MAY VARY FROM THOSE SHOWN ON THIS MAP. FOR SPECIFIC MINE TOPOGRAPHY AND PHYSICAL FEATURES, REFER TO FIGURES 1-2 AND 2-1 OF THIS CCP.
2. SOURCE: ALL TOPO MAPS V7 PROFESSIONAL MAP REFERENCE SET, NEW MEXICO RELEASE 3. INCLUDES QUADS: CIRCLE MESA, SILVER CITY, TYRONE, WIND MOUNTAIN, WHITE SIGNAL AND BURRO PEAK.
3. SOURCE: FIGURE CREATED BY GOLDER ASSOCIATES.

PROJECT
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

TITLE
GENERALIZED REGIONAL TOPOGRAPHIC MAP

FREEPORT-MCMORAN COPPER & GOLD

PROJECT No.		20136957	FILE No.	11301155B002-3
DESIGN	TS	05/18/20	SCALE AS SHOWN	REV. 0
CADD	SIB	05/18/20		
CHECK			FIGURE 2-3	
REVIEW				



Legend

- Conceptual Open Pit Configuration at End of Mine Life
- Faults (Minor faults not shown)
- Cross Section Line

Lithology

Qal	Quaternary Alluvial Deposits
Qg	Mangas Conglomerate
Qtg	Gila Conglomerate
Tgd	Tertiary Granodiorite
Tqmp	Tertiary Quartz Monzonite Porphyry Dike
Trdd	Tertiary Rhyodacite Dike
pCg	Pre-Cambrian Granite
pCbd	Pre-Cambrian Diabase

N

Topography

10 ft contour interval, ft msl

6000 50 ft contour interval, ft msl

Figure modified from Figure 8
Surface Geology Little Rock Mine
(Daniel B Stephens & Associates, Inc., 06/12/2014)

Note:
1. Pre-mining land surface provided by Tyrone (dated 11/9/2007).
2. Surface geology based on Tyrone block model (received 12/16/2013), Tyrone (2003), and Hedlund (1978).
3. Faults within Little Rock conceptual open pit extent provided by Tyrone (received 06/11/2014).

0 1,000
SCALE IN FEET

PREPARED FOR:
FREEPORT-MCMORAN COPPER & GOLD

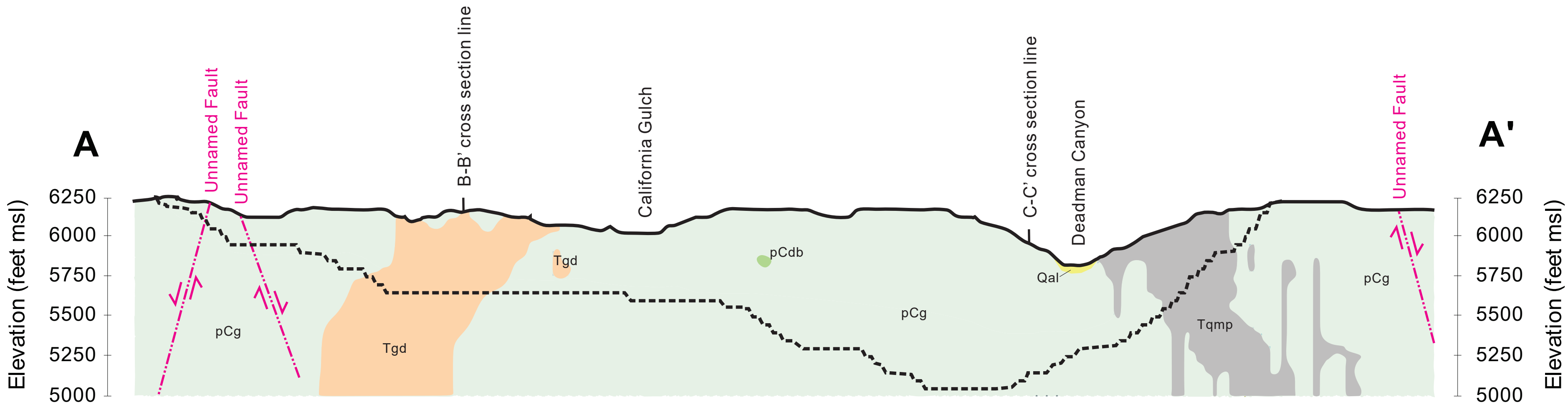
PROJECT No. 113-01155

PROJECT/REPORT
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

FIGURE 2-4

TITLE
GENERALIZED GEOLOGIC MAP OF LITTLE ROCK MINE AREA

S:\Projects\Mine_Tyrone\Projects\DP_Support_2020\VR_Drawings\2020-06_Little_Rock_CS_Update\DB19.1363_A_B_C_cross_sections.ai



0 1000 ft

No vertical exaggeration

Notes:

1. Conceptual open pit at End of Mine Life configuration provided by Golder (received 6/4/2020).
2. Surface geology based on Tyrone block model (received 12/16/2013), Tyrone (2003), and Hedlund (1978)
3. Pre-re-establishment of mining land surface provided by Tyrone (dated 11/9/2007).
4. Faults within Little Rock conceptual pit extent provided by Tyrone (received 1/27/2014).
5. Faults oriented sub-parallel to the cross section line are not shown.

Explanation

- Pre-mining land surface topography
- Conceptual open pit extent at End of Mine Life
- Fault

Lithology

- Qal Quaternary Alluvial Deposits
- Tgd Tertiary Granodiorite
- Tqmp Tertiary Quartz Monzonite Porphyry Dike
- pCg Pre-Cambrian Granite
- pCdb Pre-Cambrian Diabase

FREEPORT-MCMORAN COPPER & GOLD

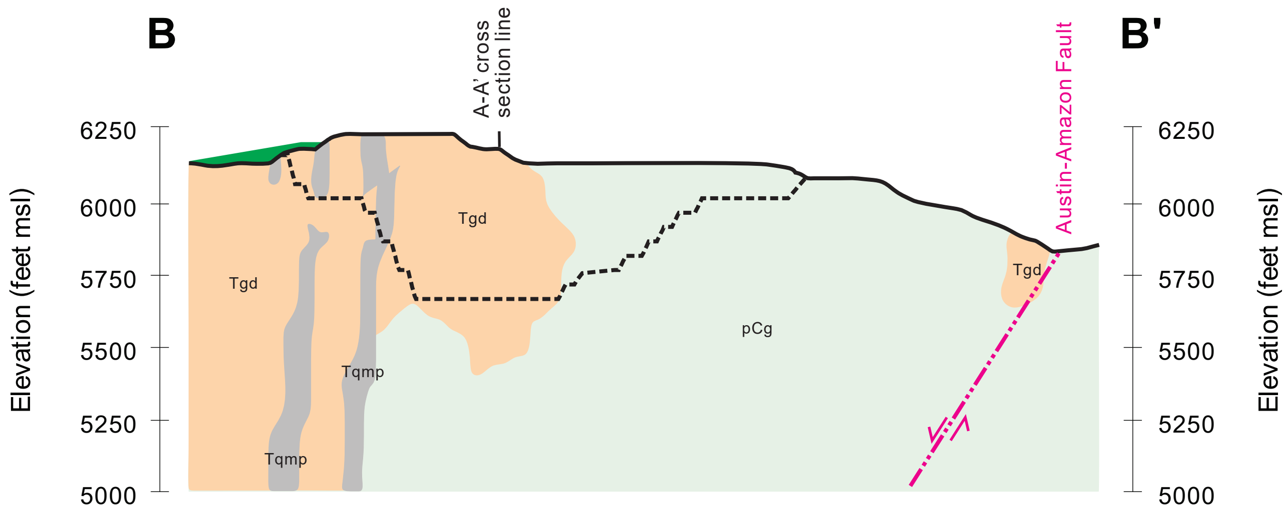
LITTLE ROCK MINE

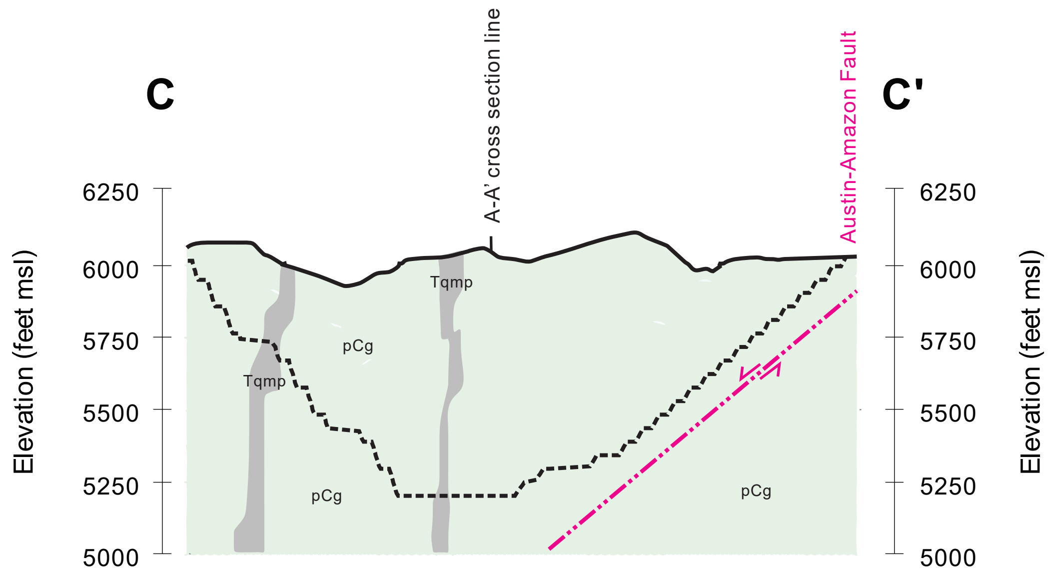
West to East Geologic Cross Section A-A'

Figure 2-5

Daniel B. Stephens & Associates, Inc.
6/9/2020
JN DB19.1363

S:\Projects\Mine_Tyrone\Projects\DP_Support_2020\VR_Drawings\2020-06_Little_Rock_CS_Update\DB19.1363_A_B_C_cross_sections.ai





0 750 ft

No vertical exaggeration

Notes:

1. Conceptual open pit at End of Mine Life configuration provided by Golder (received 6/4/2020).
2. Surface geology based on Tyrone block model (received 12/16/2013), Tyrone (2003), and Hedlund (1978)
3. Pre-re-establishment of mining land surface provided by Tyrone (dated 11/9/2007).
4. Faults within Little Rock conceptual pit extent provided by Tyrone (received 1/27/2014).

Explanation

- Pre-mining land surface topography
- Conceptual open pit extent at End of Mine Life
- Fault

Lithology

- Reclaimed Copper Leach Stockpile (to be removed by EOY 2024) and P-Plant Area
- Tgd Tertiary Granodiorite
- Tqmp Tertiary Quartz Monzonite Porphyry Dike
- pCg Pre-Cambrian Granite

FREEPORT-MCMORAN COPPER & GOLD

LITTLE ROCK MINE

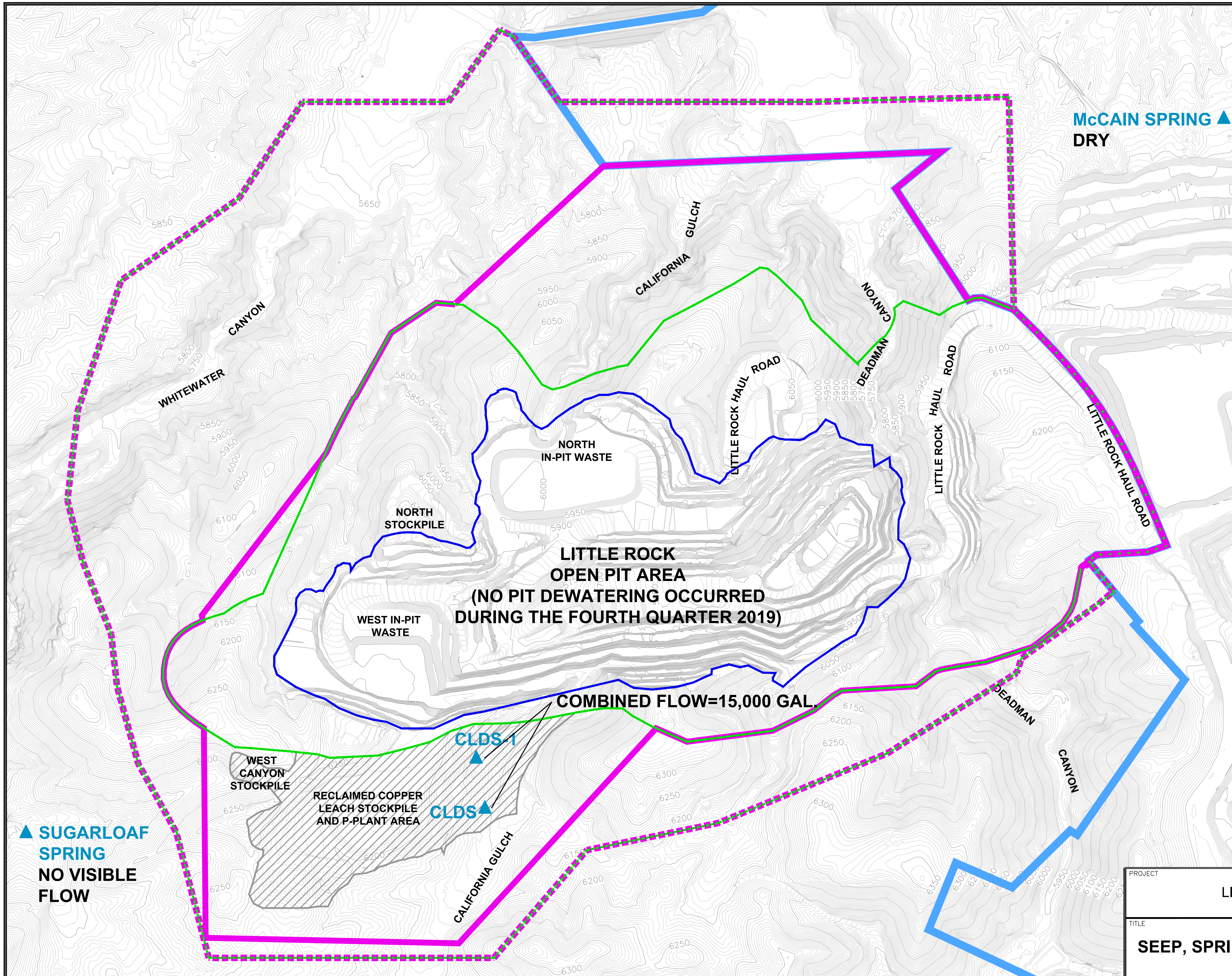
South to North Geologic Cross Section B-B' and C-C'

Figure 2-6

Daniel B. Stephens & Associates, Inc.

6/9/2020

JN DB19.1363



LEGEND

EXISTING LITTLE ROCK MINE PERMIT BOUNDARY

PROPOSED CHANGE TO LITTLE ROCK MINE PERMIT BOUNDARY

EXISTING TYRONE MINE PERMIT BOUNDARY 5

APPROVED MINING AREA DESIGN LIMIT (PERMIT REVISION 14-1 TO MMD PERMIT GR007RE)

PROPOSED CHANGE TO MINING AREA DESIGN LIMIT BOUNDARY

EXTENT OF OPEN PIT 2019

▲ 4 SURFACE WATER LOCATION AND MEASURED FLOW RATE IN GPM

DRY SPRING OR POND DRY

NOTES:

1. SOURCE: TOPOGRAPHIC SURFACE FROM JUNE 2019 FLY-OVER SURVEY PROVIDED BY FREEPORT MCMORAN TYRONE, INC.
2. CONTOUR INTERVAL AT 10 FEET.
3. COORDINATE SYSTEM IN TYRONE LOCAL MINE.
4. VALUES FROM DP-1236 MONITORING REPORT (02/25/2020).
5. PENDING APPROVAL OF PERMIT REVISION 13-1 TO MMD PERMIT GR010RE.
6. THE RECLAIMED COPPER LEACH STOCKPILE WILL BE REMOVED BY THE EOY 2024. ALL THE REMAINING STOCKPILES WITHIN THE LITTLE ROCK MINE PERMIT AREA ARE WASTE ROCK STOCKPILES CONSISTING OF PRE-CAMBRIAN GRANITE, A NON-ACID GENERATING OVERBURDEN MATERIAL, AND ARE CONDITIONALLY EXEMPT FROM THE REQUIREMENTS OF THE COPPER MINE RULE AND THE WATER QUALITY ACT DURING OPERATIONS AND AT CLOSURE.

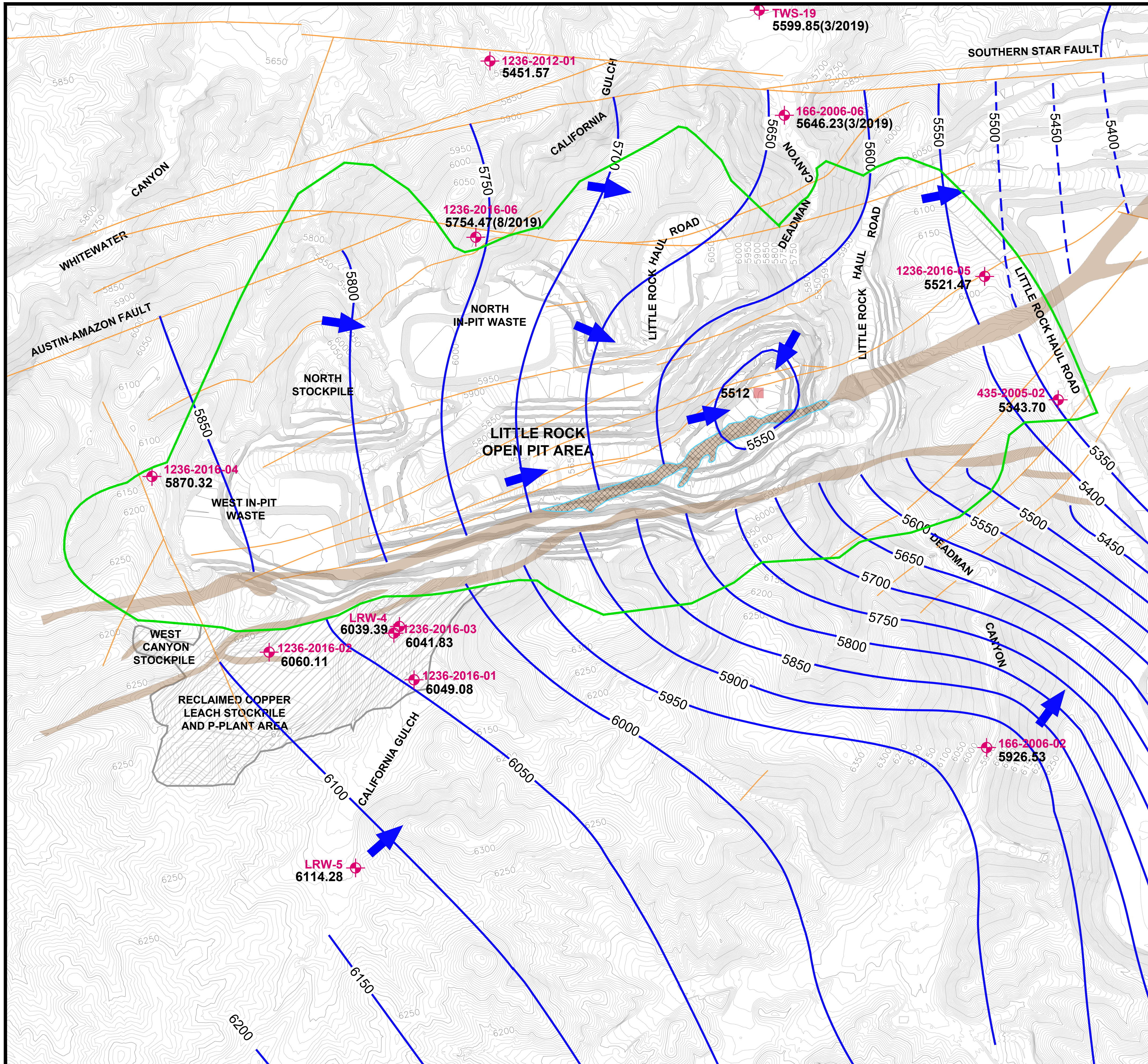
800 0 800
SCALE FEET

PROJECT
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

TITLE
FOURTH QUARTER 2019
SEEP, SPRING, AND POND FLOW VOLUMES AND RATES
FOR LITTLE ROCK MINE AREA

FREEPORT-McMoRAN COPPER & GOLD

PROJECT No.	20136957		FILE No.	11301155B002-7
DESIGN	TS	05/07/20	SCALE AS SHOWN	REV. 0
CADD	SIB	05/07/20		
CHECK			FIGURE 2-7	
REVIEW				



LEGEND

APPROVED MINING AREA DESIGN LIMIT (PERMIT REVISION 14-1 TO MMD PERMIT GR007RE)

FAULTS (MINOR FAULTS ARE NOT SHOWN)

Well GW_Elev — REGIONAL MONITOR WELL WITH WATER LEVEL ELEVATION (ft msl)

5800 — WATER LEVEL ELEVATION CONTOUR (ft msl) DASHED WHERE INFERRED (CONTOUR INTERVAL 50 ft)

APPROXIMATE GROUNDWATER FLOW DIRECTION

PIT WATER ELEVATION (ft msl)

PORTION OF TERTIARY QUARTZ MONZONITE PORPHYRY DIKE EXCAVATED BELOW PRE-MINING GROUNDWATER LEVELS

TERTIARY QUARTZ MONZONITE PORPHYRY DIKE

NOTES:

1. SOURCE: TOPOGRAPHIC SURFACE FROM JUNE 2019 SURVEY PROVIDED BY FREEPORT MCMORAN TYRONE, INC.
2. SOURCE: FAULTS, DIKES AND GROUNDWATER CONTOURS PROVIDED BY DBS&A IN MAY 2020.
3. CONTOUR INTERVAL AT 10 FEET.
4. COORDINATE SYSTEM IN TYRONE LOCAL MINE.
5. VALUES FROM DP-1236 MONITORING REPORT (02/25/2020).
6. THE RECLAIMED COPPER LEACH STOCKPILE WILL BE REMOVED BY THE EOY 2024. ALL THE REMAINING STOCKPILES WITHIN THE LITTLE ROCK MINE PERMIT AREA ARE WASTE ROCK STOCKPILES CONSISTING OF PRE-CAMBRIAN GRANITE, A NON-ACID GENERATING OVERBURDEN MATERIAL, AND ARE CONDITIONALLY EXEMPT FROM THE REQUIREMENTS OF THE COPPER MINE RULE AND THE WATER QUALITY ACT DURING OPERATIONS AND AT CLOSURE.

800 0 800

SCALE FEET

PROJECT

FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

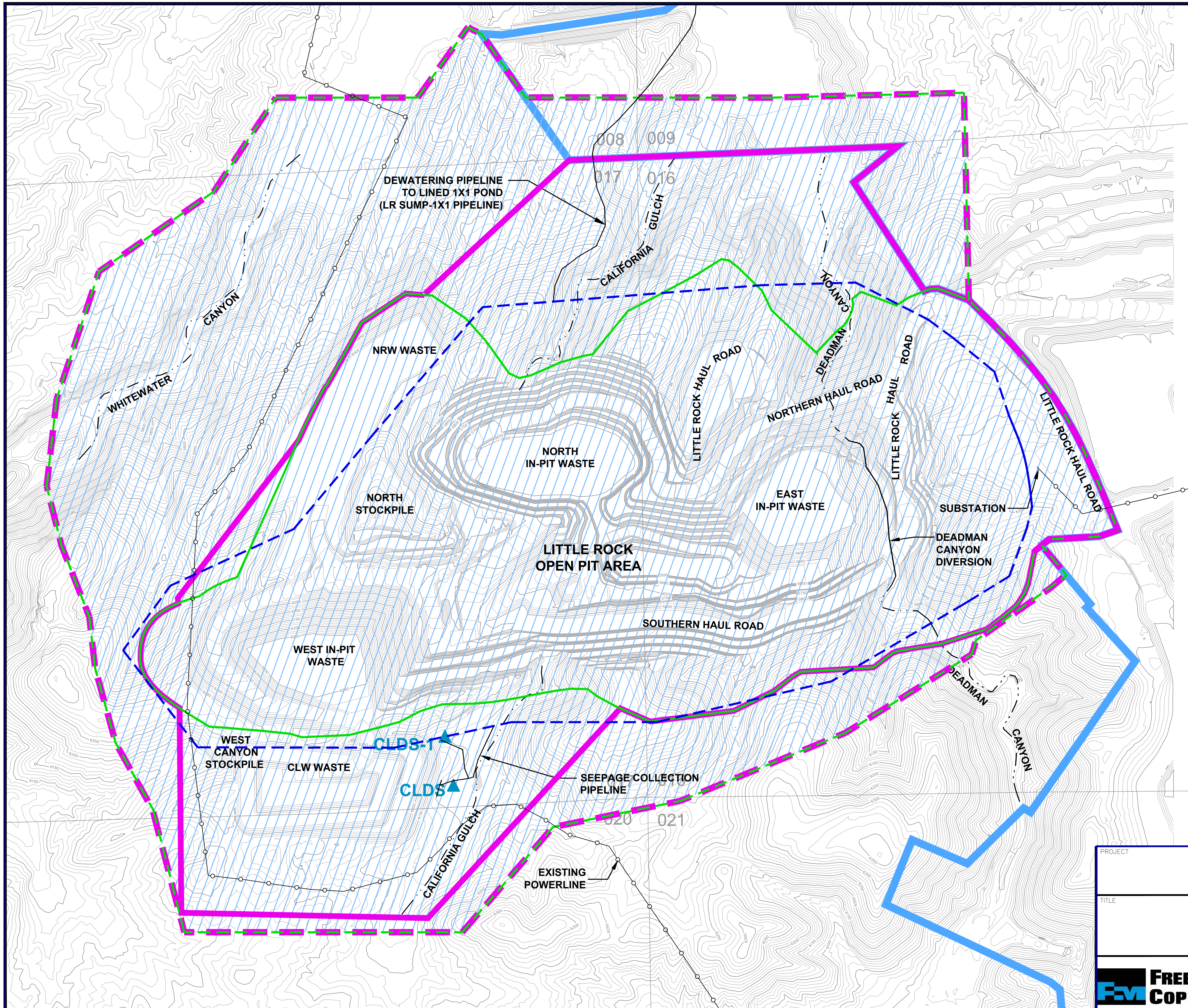
TITLE

FOURTH QUARTER 2019
REGIONAL GROUNDWATER ELEVATIONS
FOR LITTLE ROCK MINE AREA

FREEPORT-MCMORAN COPPER & GOLD

PROJECT No.		20136957	FILE No.	113011558002-8
DESIGN	TS	05/07/20	SCALE AS SHOWN	REV. 0
CADD	SIB	05/07/20		
CHECK				
REVIEW				

FIGURE 2-8



LEGEND

- APPROVED MINING AREA DESIGN LIMIT (PERMIT REVISION 14-1 TO MMD PERMIT GR007RE)
- PROPOSED CHANGE TO MINING AREA DESIGN LIMIT BOUNDARY
- PROJECTED EXTENT OF OPEN PIT AT END OF MINE LIFE
- EXISTING LITTLE ROCK MINE PERMIT BOUNDARY
- PROPOSED CHANGE TO LITTLE ROCK MINE PERMIT BOUNDARY
- EXISTING TYRONE MINE PERMIT BOUNDARY

5

- PROPOSED WILDLIFE HABITAT POST MINING LAND USE AREA
- CLDS-1 SEEPAGE COLLECTION FACILITY

NOTES:
1. SOURCE: TOPOGRAPHY FROM FMI EOY 2024 MINE PLAN.
2. CONTOUR INTERVAL AT 10 FEET
3. COORDINATE SYSTEM IN TYRONE LOCAL MINE.
4. SECTION LINES FROM LITTLE ROCK AREA IN WIND MOUNTAIN, NM QUAD MAP (T19S R15W SECTIONS 8,9,16,17,20 AND 21)
5. PENDING APPROVAL OF PERMIT REVISION 13-1 TO MMD PERMIT GR010RE.
6. ALL STOCKPILES WITHIN THE LITTLE ROCK MINE PERMIT AREA AT THE EOY 2024 ARE WASTE ROCK STOCKPILES CONSISTING OF PRE-CAMBRIAN GRANITE, A NON-ACID GENERATING OVERBURDEN MATERIAL, AND ARE CONDITIONALLY EXEMPT FROM THE REQUIREMENTS OF THE COPPER MINE RULE AND THE WATER QUALITY ACT DURING OPERATIONS AND AT CLOSURE.
7. DEADMAN CANYON DIVERSION WILL BE CONSTRUCTED AS PART OF RECLAMATION.

800 0 800

SCALE FEET

PROJECT

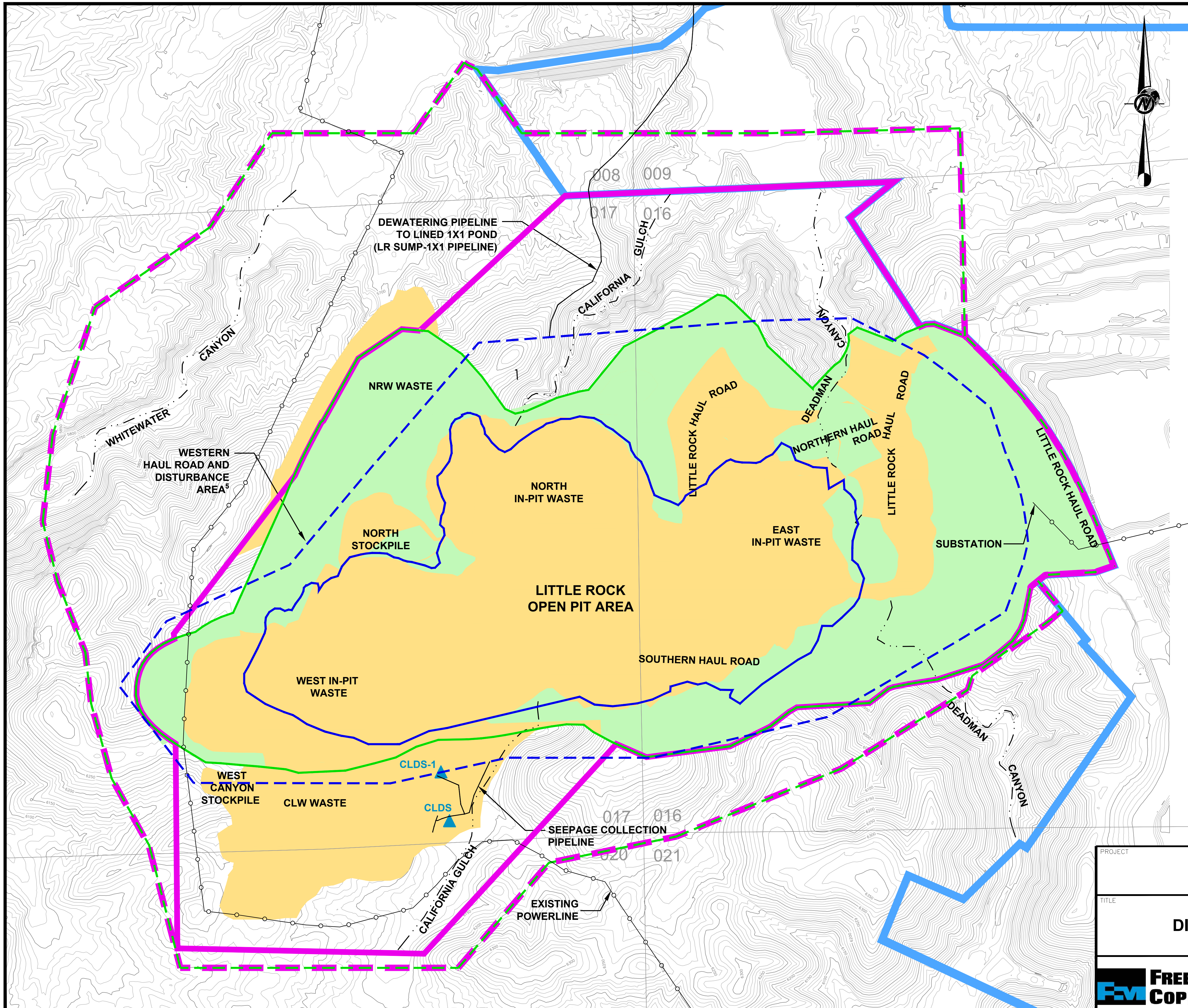
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

TITLE

PROPOSED WILDLIFE HABITAT POST MINE LAND USE AREA

FREEPORT-MCMORAN COPPER & GOLD

PROJECT No.		20136957	FILE No. 11301155B007-1
DESIGN	TS	05/18/20	SCALE AS SHOWN REV. 0
CADD	SIB	05/18/20	**FIGURE 6-1**
CHECK			
REVIEW			



LEGEND

- APPROVED MINING AREA DESIGN LIMIT (PERMIT REVISION 14-1 TO MMD PERMIT GR007RE)
- PROPOSED CHANGE TO MINING AREA DESIGN LIMIT
- EXTENT OF OPEN PIT 2019
- PROJECTED EXTENT OF OPEN PIT AT END OF MINE LIFE
- EXISTING LITTLE ROCK MINE PERMIT BOUNDARY
- PROPOSED CHANGE TO LITTLE ROCK MINE PERMIT BOUNDARY
- EXISTING TYRONE MINE PERMIT BOUNDARY[5]
- EXISTING UNIT AT EOY 2024 (EARLIER, EXISTING, AND APPROVED DISTURBANCE)
- NEW UNIT AT EOY 2024 (INCLUDES NEW DISTURBANCES OUTSIDE THE CURRENT MINING AREA DESIGN LIMIT AND NEW DISTURBANCES IDENTIFIED IN PERMIT REVISION 14-1 TO MMD PERMIT GROO7RE)
- CLDS-1 SEEPAGE COLLECTION FACILITY

NOTES:

1. SOURCE: TOPOGRAPHY FROM FMI EOY 2024 MINE PLAN.
2. CONTOUR INTERVAL AT 10 FEET
3. COORDINATE SYSTEM IN TYRONE LOCAL MINE.
4. SECTION LINES FROM LITTLE ROCK AREA IN WIND MOUNTAIN, NM QUAD MAP (T19S R15W SECTIONS 8,9,16,17,20 AND 21).
5. WESTERN HAUL ROAD AND DISTURBANCE AREA APPROVED IN PERMIT REVISION 14-1 TO MMD PERMIT GR007RE BUT NEVER CONSTRUCTED.
6. PENDING APPROVAL OF PERMIT REVISION 13-1 TO MMD PERMIT GR010RE.
7. ALL STOCKPILES WITHIN THE LITTLE ROCK MINE PERMIT AREA AT THE EOY 2024 ARE WASTE ROCK STOCKPILES CONSISTING OF PRE-CAMBRIAN GRANITE, A NON-ACID GENERATING OVERBURDEN MATERIAL, AND ARE CONDITIONALLY EXEMPT FROM THE REQUIREMENTS OF THE COPPER MINE RULE AND THE WATER QUALITY ACT DURING OPERATIONS AND AT CLOSURE.

800 0 800
SCALE FEET

PROJECT
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

TITLE
DISTURBANCE AREAS AT THE EOY 2024

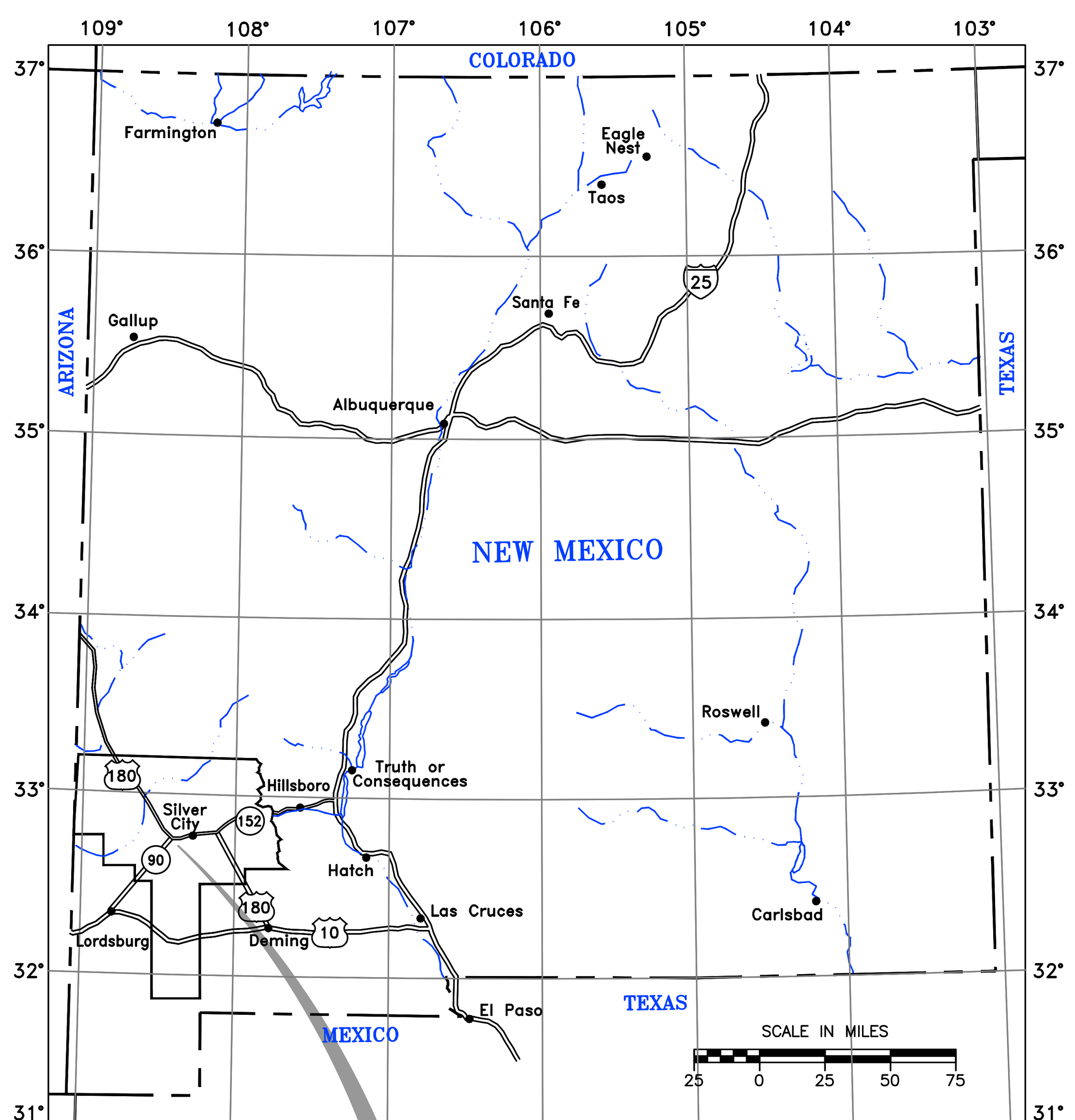
FREEPORT-MCMORAN COPPER & GOLD

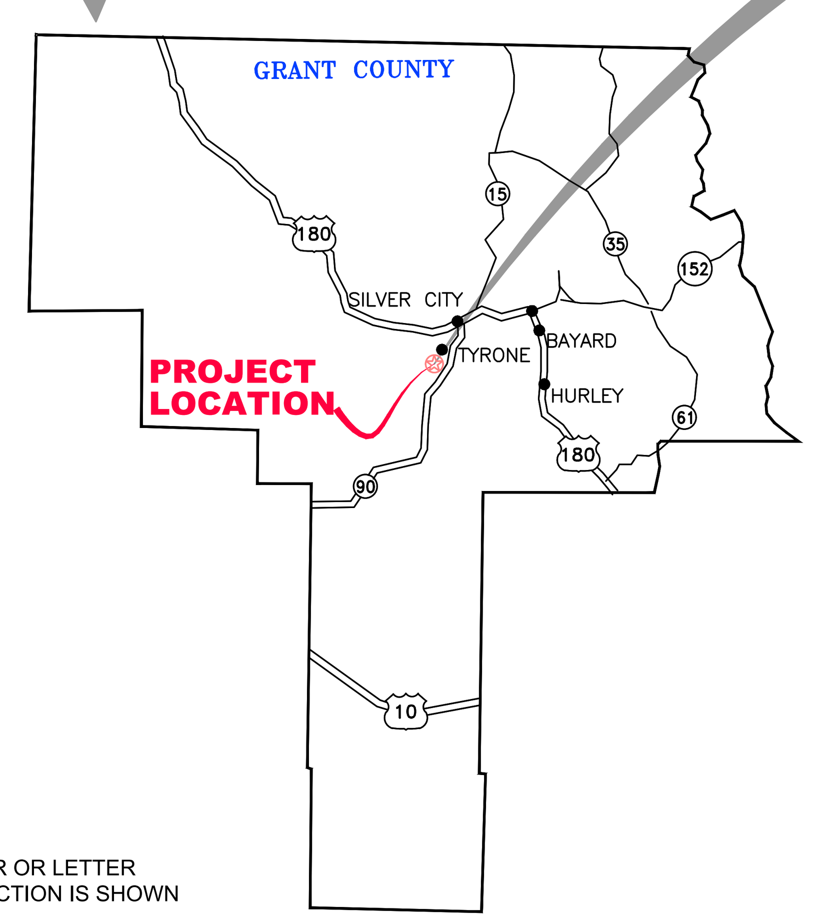
PROJECT No.		20136957	FILE No.	1130115SB007-2	
DESIGN	TS	05/18/20	SCALE	AS SHOWN	REV. 0
CADD	SIB	05/18/20	**FIGURE 6-2**		
CHECK					
REVIEW					

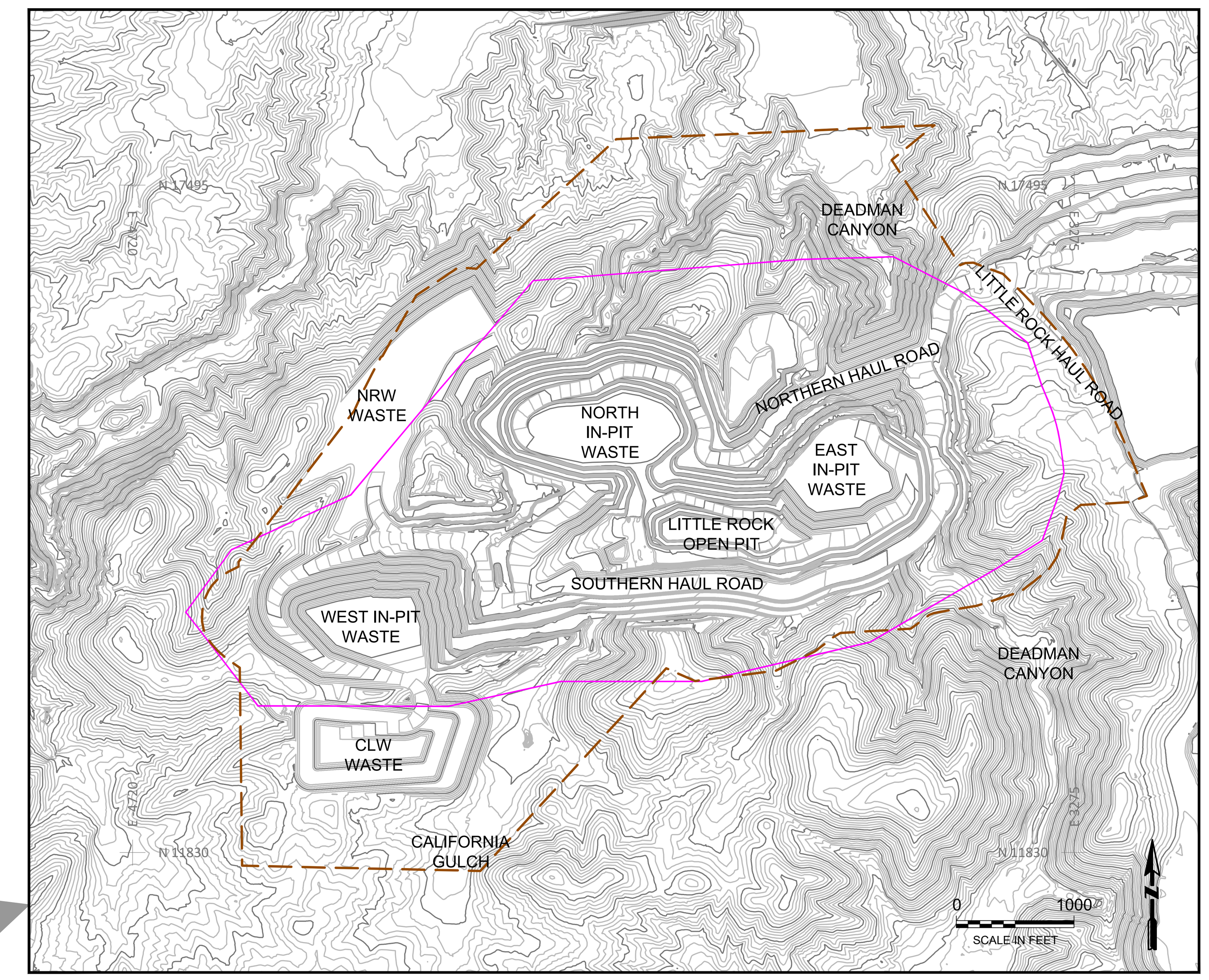
APPENDIX A

RECLAMATION DESIGN DRAWINGS

APPENDIX A UPDATED CLOSURE/CLOSEOUT PLAN FOR THE LITTLE ROCK MINE JUNE 2020
ISSUED FOR FINANCIAL ASSURANCE RECLAMATION COST ESTIMATE







LITTLE ROCK MINE - END-OF-YEAR 2024

SHEET LIST TABLE	
SHEET NUMBER	SHEET TITLE
1	COVER SHEET
2	PROPOSED MINE LAYOUT PRE RECLAMATION (END OF 2024)
3	PROPOSED MINE LAYOUT POST RECLAMATION
4	CLW WASTE CLOSURE PLAN - PLAN VIEWS
5	CLW WASTE CLOSURE PLAN - SECTION VIEWS
6	DEADMAN DIVERSION/ EAST IN-PIT WASTE CLOSURE PLAN - PLAN VIEWS
7	DEADMAN DIVERSION/ EAST IN-PIT WASTE CLOSURE PLAN - SECTION VIEWS
8	NRW WASTE CLOSURE PLAN - PLAN VIEWS
9	NRW WASTE CLOSURE PLAN - SECTION VIEWS
10	WEST IN-PIT WASTE CLOSURE PLAN - PLAN VIEWS
11	WEST IN-PIT WASTE CLOSURE PLAN - SECTION VIEWS
12	REVEGETATION AREAS
13	RECLAMATION HAUL ROUTES
14	STORMWATER MANAGEMENT DETAILS

CROSS SECTION REFERENCE

A / 1 — SECTION IDENTIFICATION NUMBER OR LETTER
— NUMBER OF SHEET ON WHICH SECTION IS SHOWN

LEGEND / NOTES

- EXISTING LITTLE ROCK PERMIT BOUNDARY
- PROPOSED OPEN PIT BOUNDARY
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN

COORDINATE SYSTEM TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

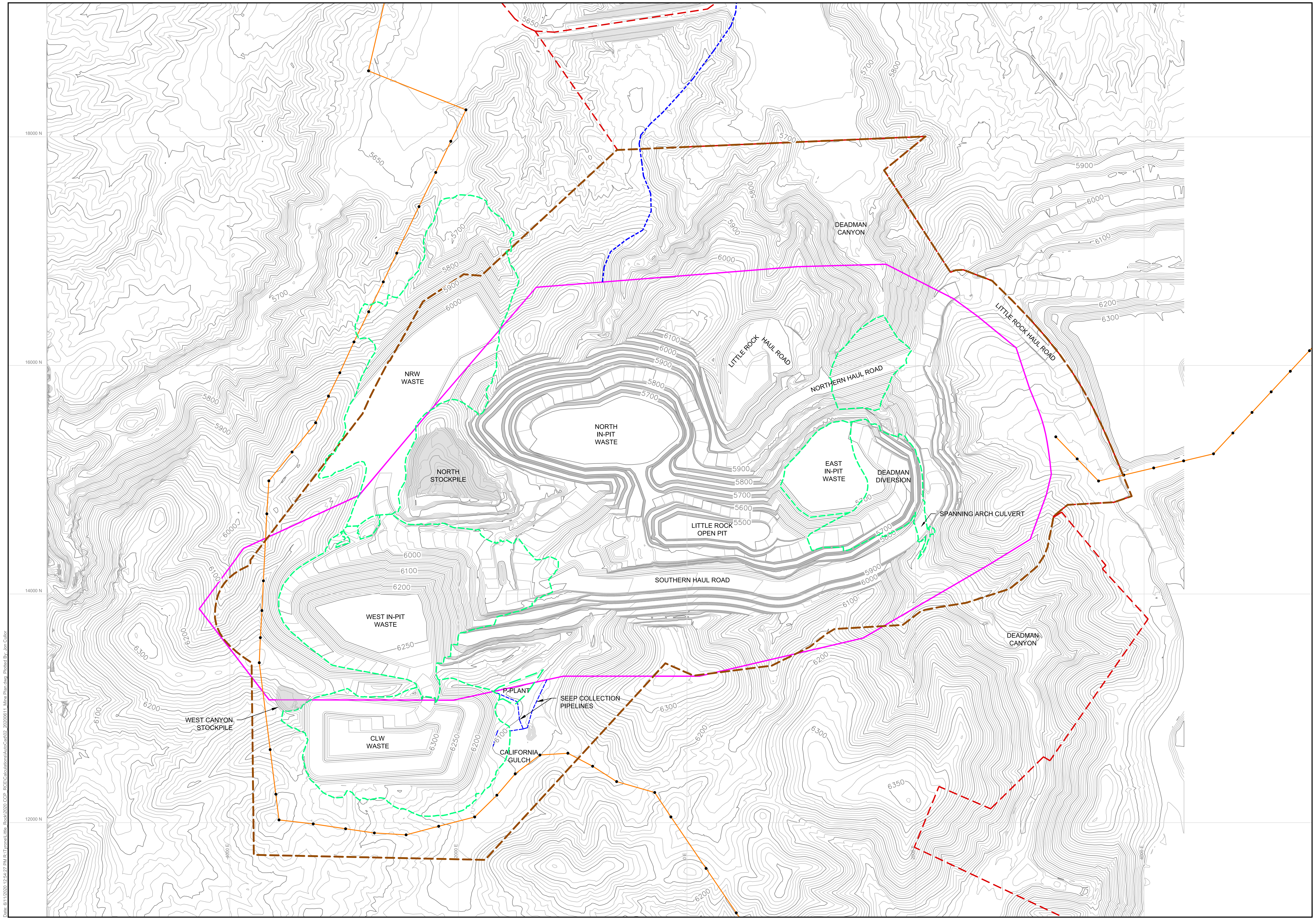
2020 LITTLE ROCK CCP

COVER SHEET

SHEET NUMBER: 1
REVISION NUMBER: 1

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN



LEGEND / NOTES

- EXISTING LITTLE ROCK PERMIT BOUNDARY
- TYRONE PERMIT BOUNDARY
- PROPOSED OPEN PIT BOUNDARY
- FACILITY RECLAMATION BOUNDARY
- MAJOR CONTOUR
- MINOR CONTOUR
- LR SUMP - 1x1 PIPELINE
- EXISTING POWER LINE
- RECLAIMED AREA

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN
2. TYRONE BOUNDARY PENDING APPROVAL OF GR010RE REV. 13-1
3. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR
4. DEADMAN DIVERSION TO BE CONSTRUCTED DURING RECLAMATION

0 400
SCALE IN FEET

COORDINATE SYSTEM TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

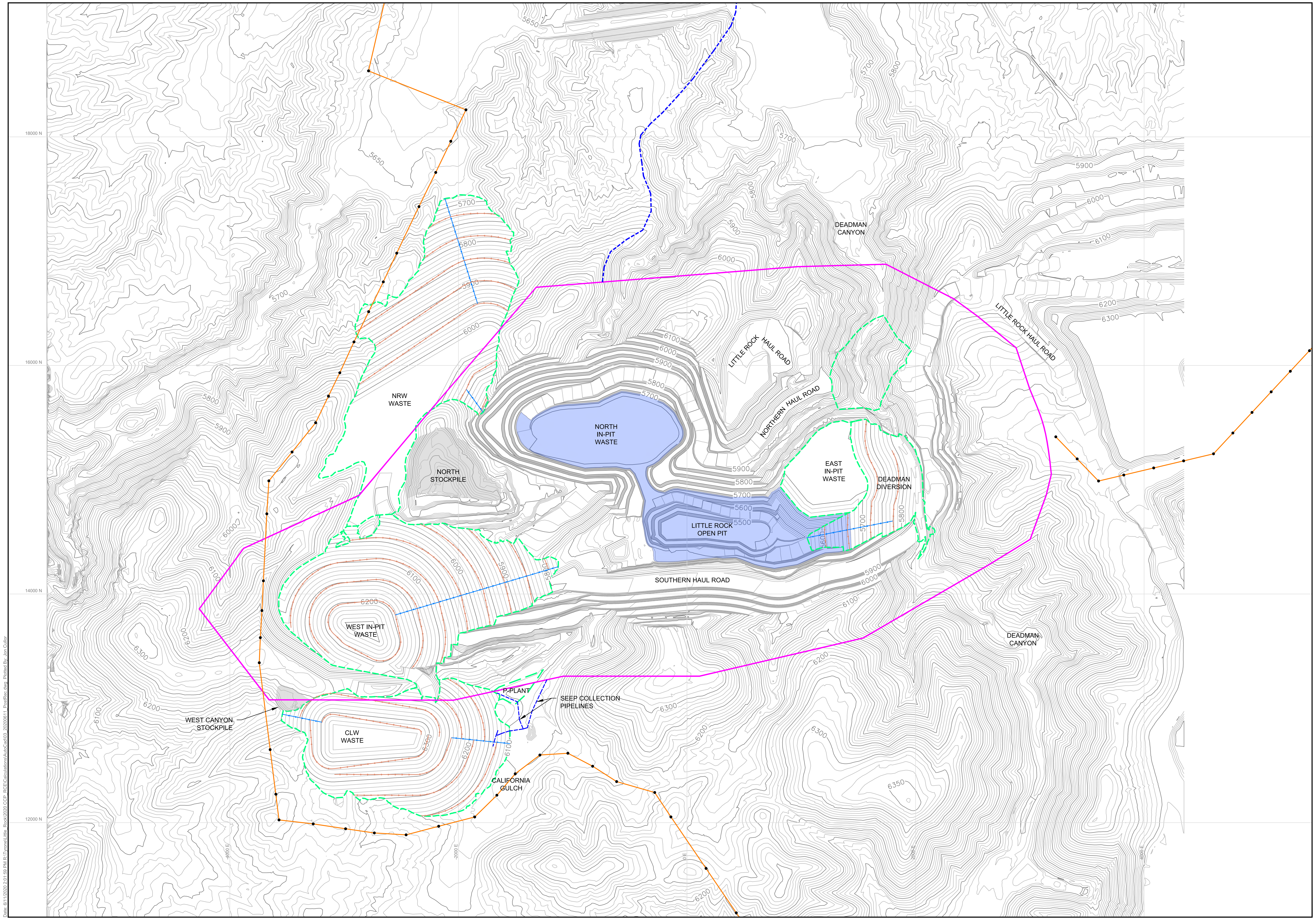
2020 LITTLE ROCK CCP

PROPOSED MINE LAYOUT PRE RECLAMATION (END OF 2024)

SHEET NUMBER: 2
REVISION NUMBER: 1

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-MCMORAN



LEGEND / NOTES

- PROPOSED OPEN PIT BOUNDARY
- FACILITY RECLAMATION BOUNDARY
- MAJOR CONTOUR
- MINOR CONTOUR
- BENCH CHANNEL
- DOWNDRAIN
- LR SUMP - 1x1 PIPELINE
- EXISTING POWER LINE
- RECLAIMED AREA
- PIT LAKE

NOTES:

1. POST-RECLAMATION TOPOGRAPHY FOR END-OF-YEAR 2024 MINE PLAN
2. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR

0 400
SCALE IN FEET

COORDINATE SYSTEM TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

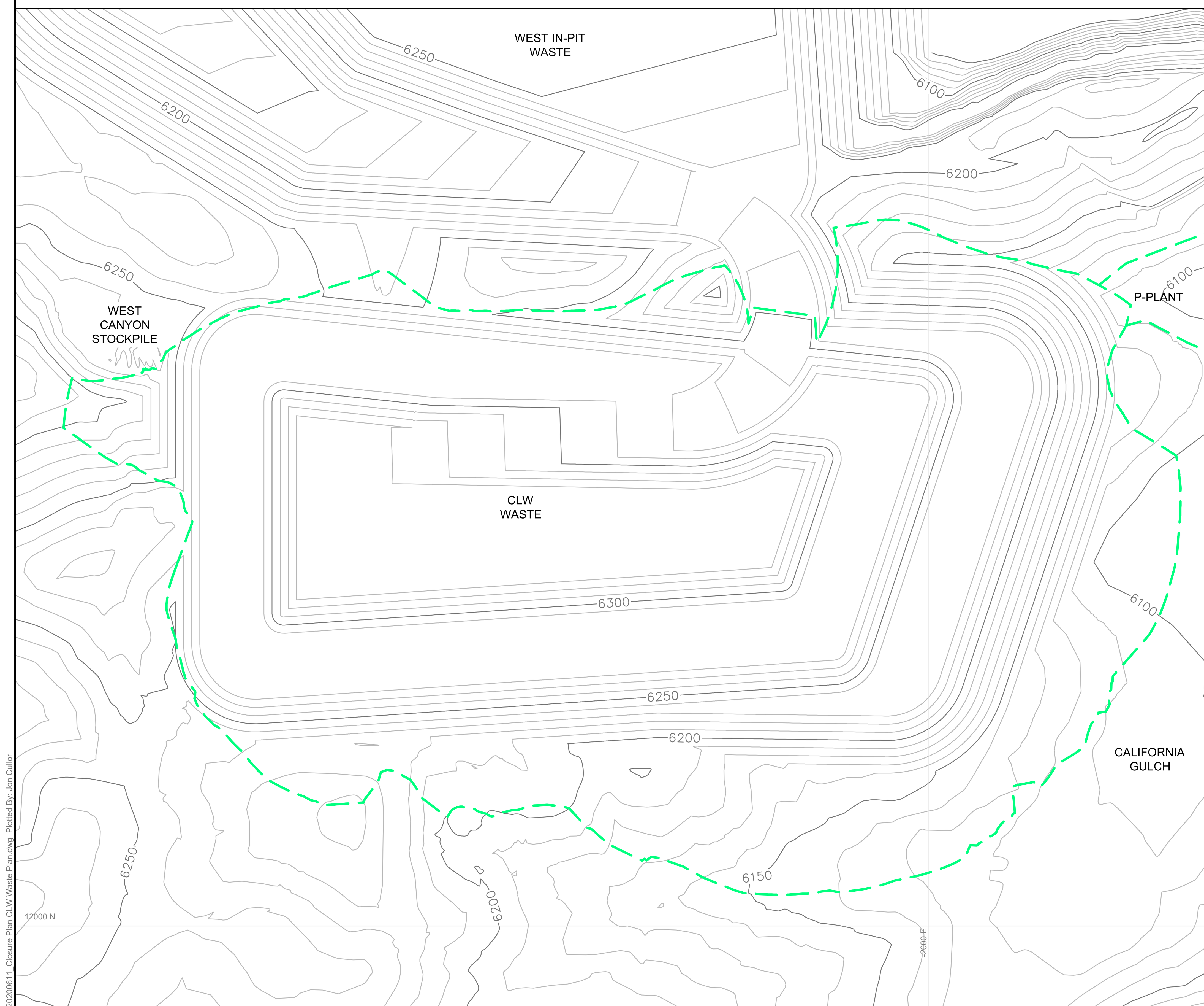
PROPOSED MINE LAYOUT POST RECLAMATION

SHEET NUMBER: 3

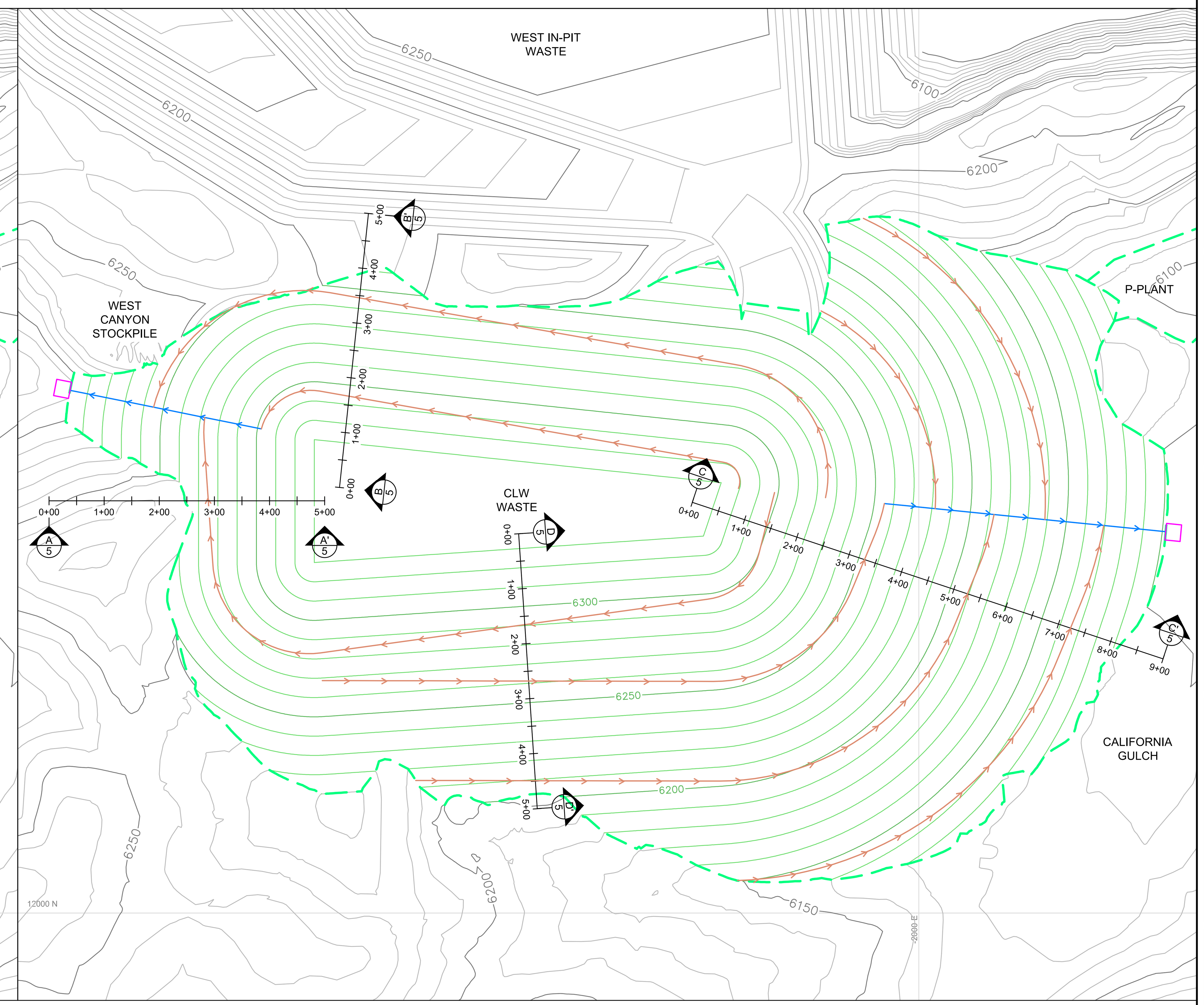
REVISION NUMBER: 1

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN



PLAN VIEW - PRE RECLAMATION



PLAN VIEW - POST RECLAMATION

LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- POST REC. MAJ. CONTOUR
- POST REC. MIN. CONTOUR
- BENCH CHANNEL
- DOWNDRAIN
- ENERGY DISSIPATOR

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN

0 150 SCALE IN FEET

COORDINATE SYSTEM TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

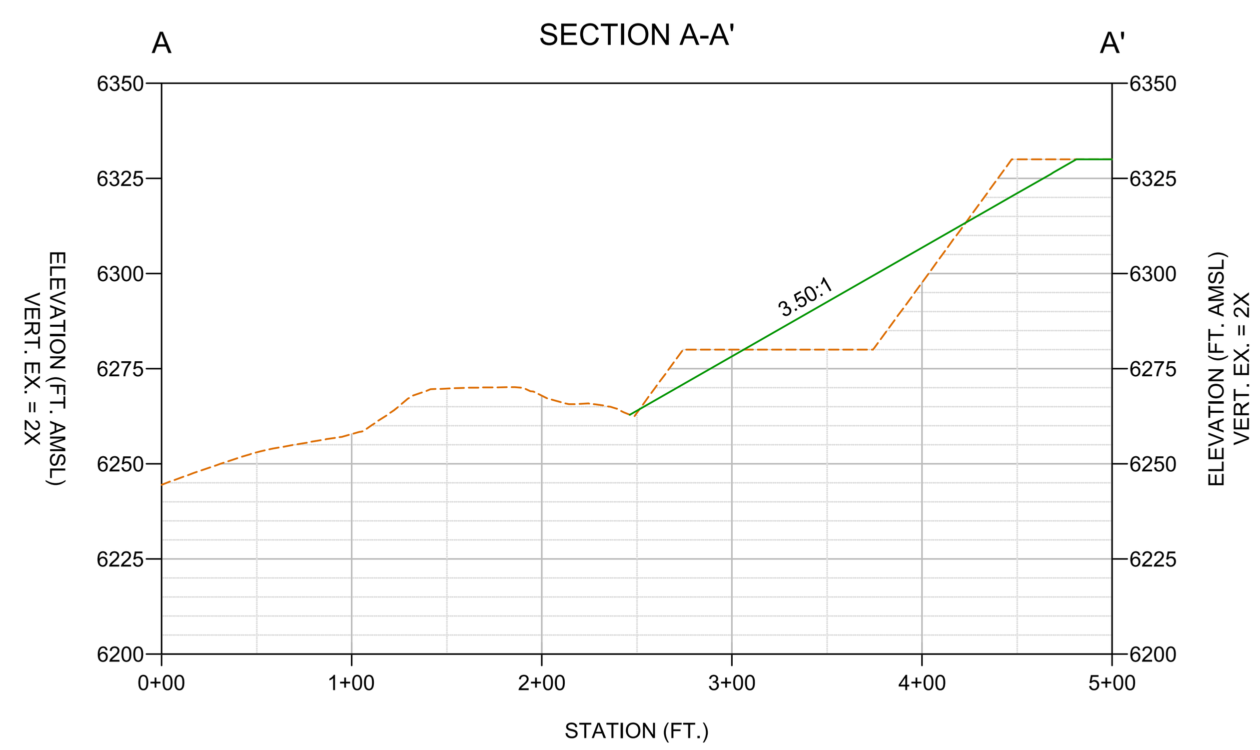
CLW WASTE CLOSURE PLAN - PLAN VIEWS

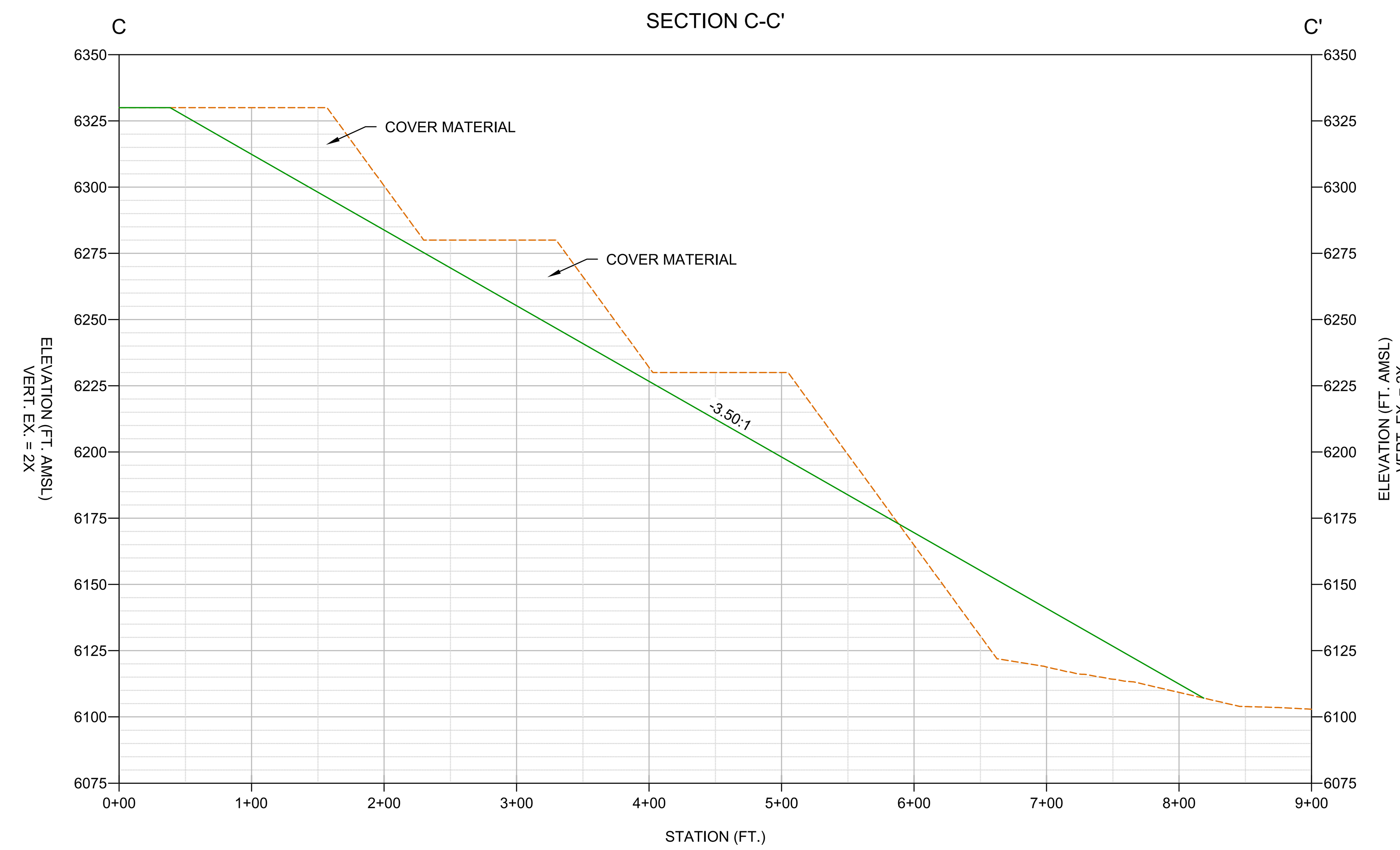
SHEET NUMBER: 4

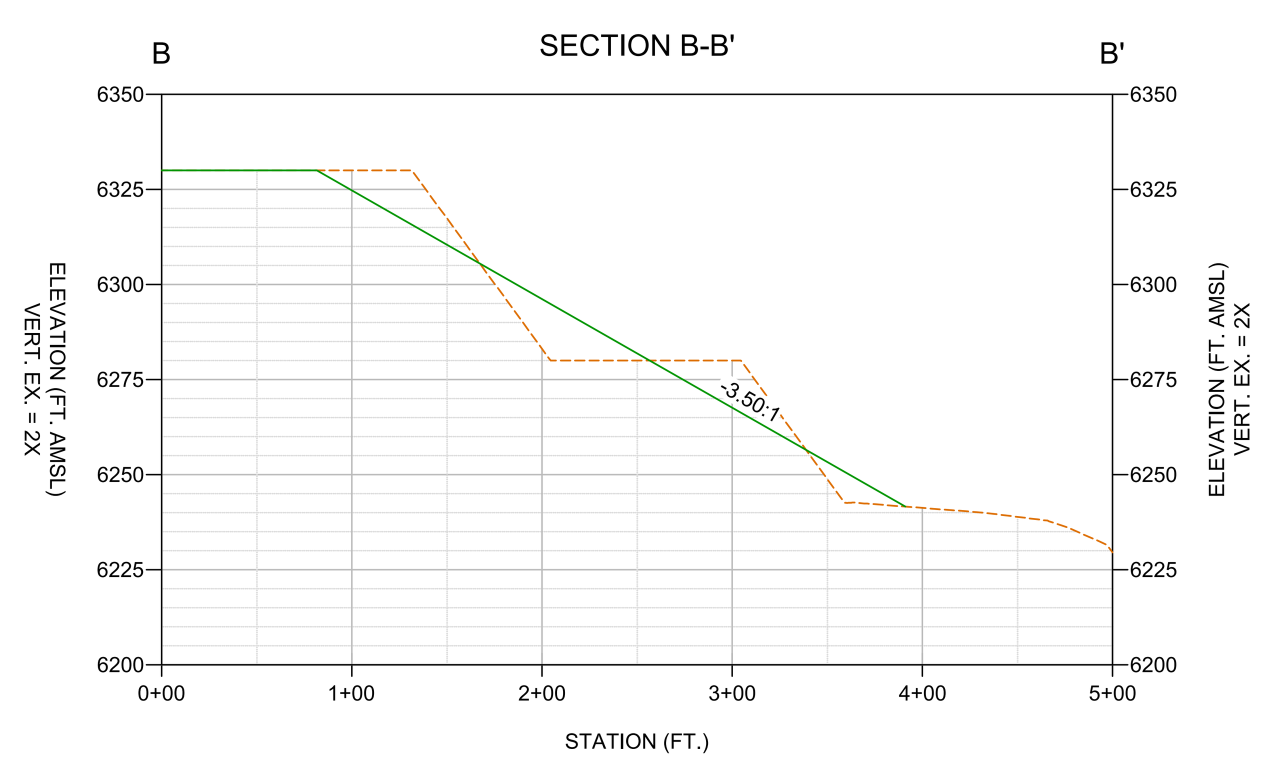
REVISION NUMBER: 1

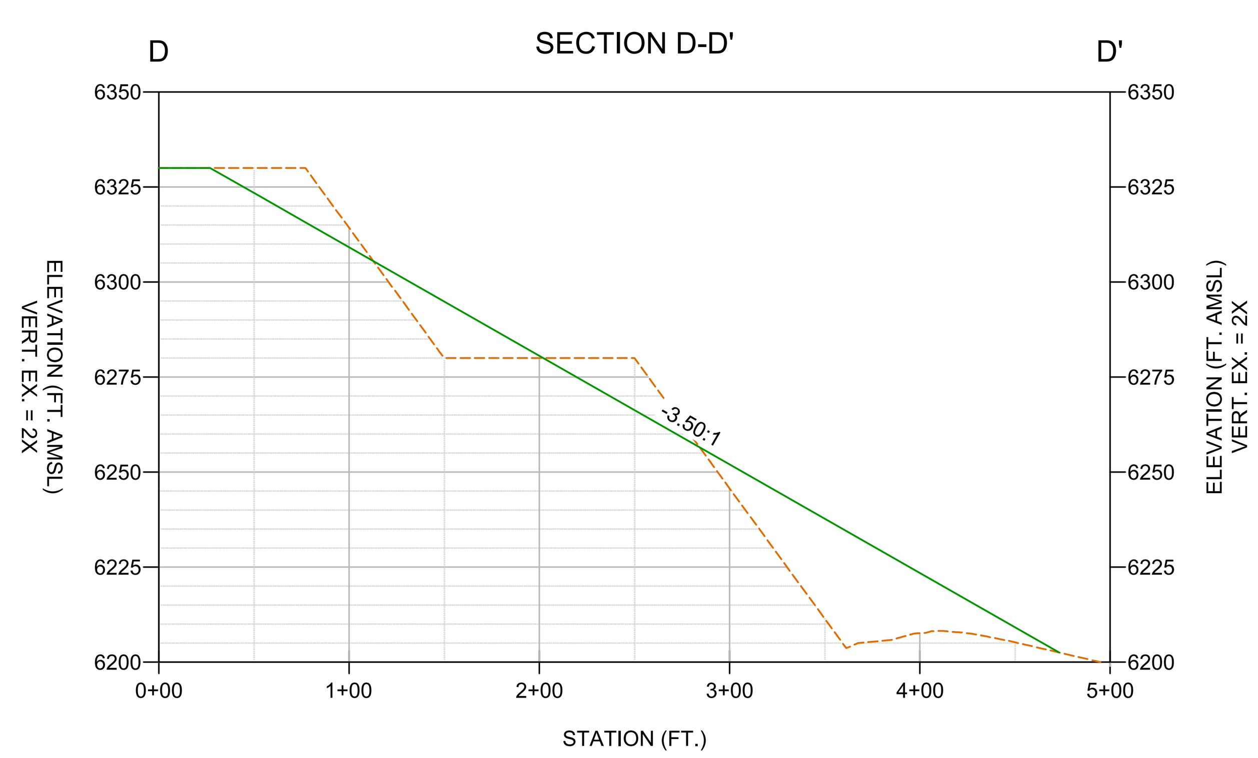
PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-MCMORAN









LEGEND / NOTES

PRE-RECLAMATION SURFACE

POST-RECLAMATION SURFACE

COORDINATE SYSTEM
TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

CLW WASTE CLOSURE PLAN - SECTION VIEWS

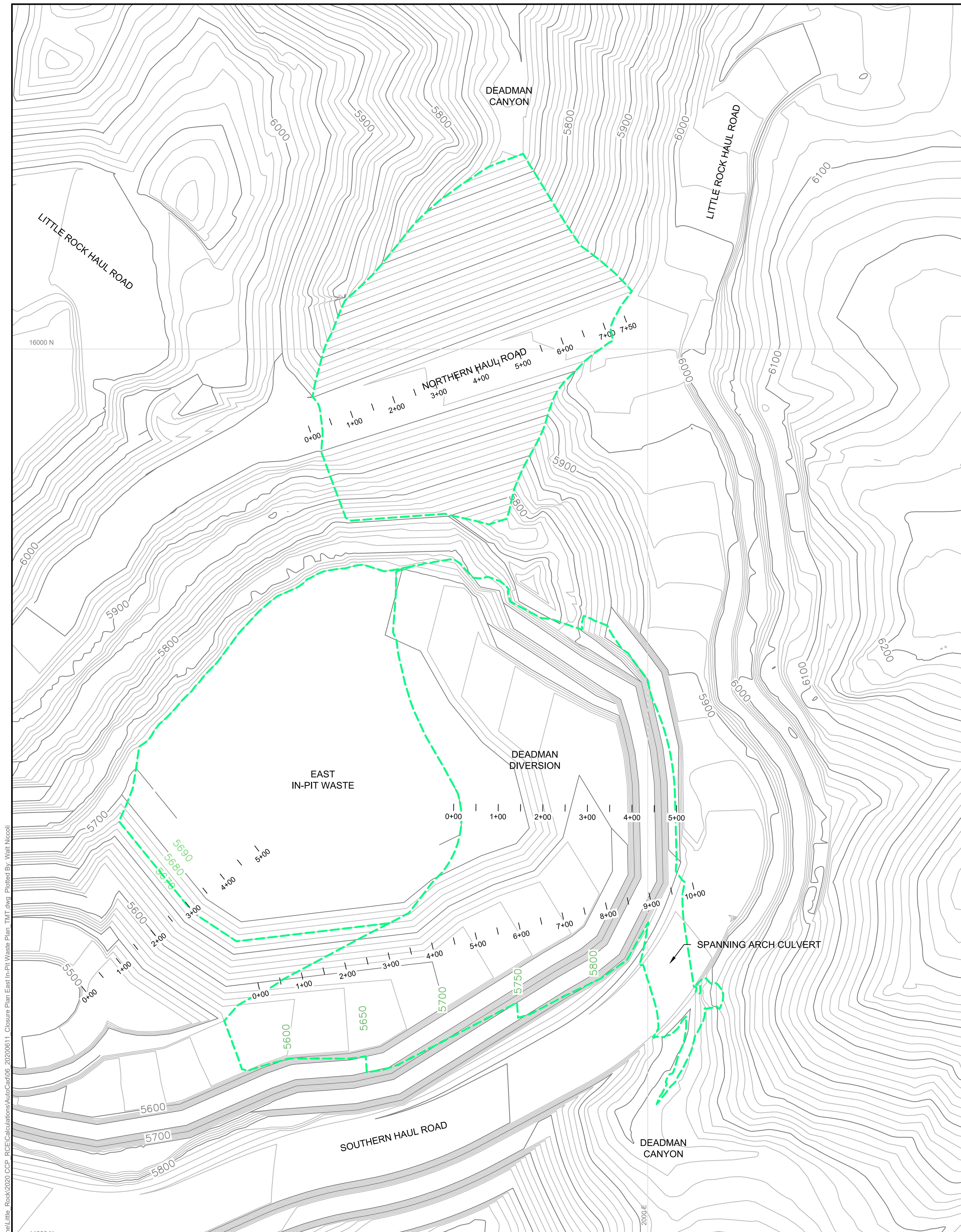
SHEET NUMBER:	REVISION NUMBER:
5	1

PREPARED BY:

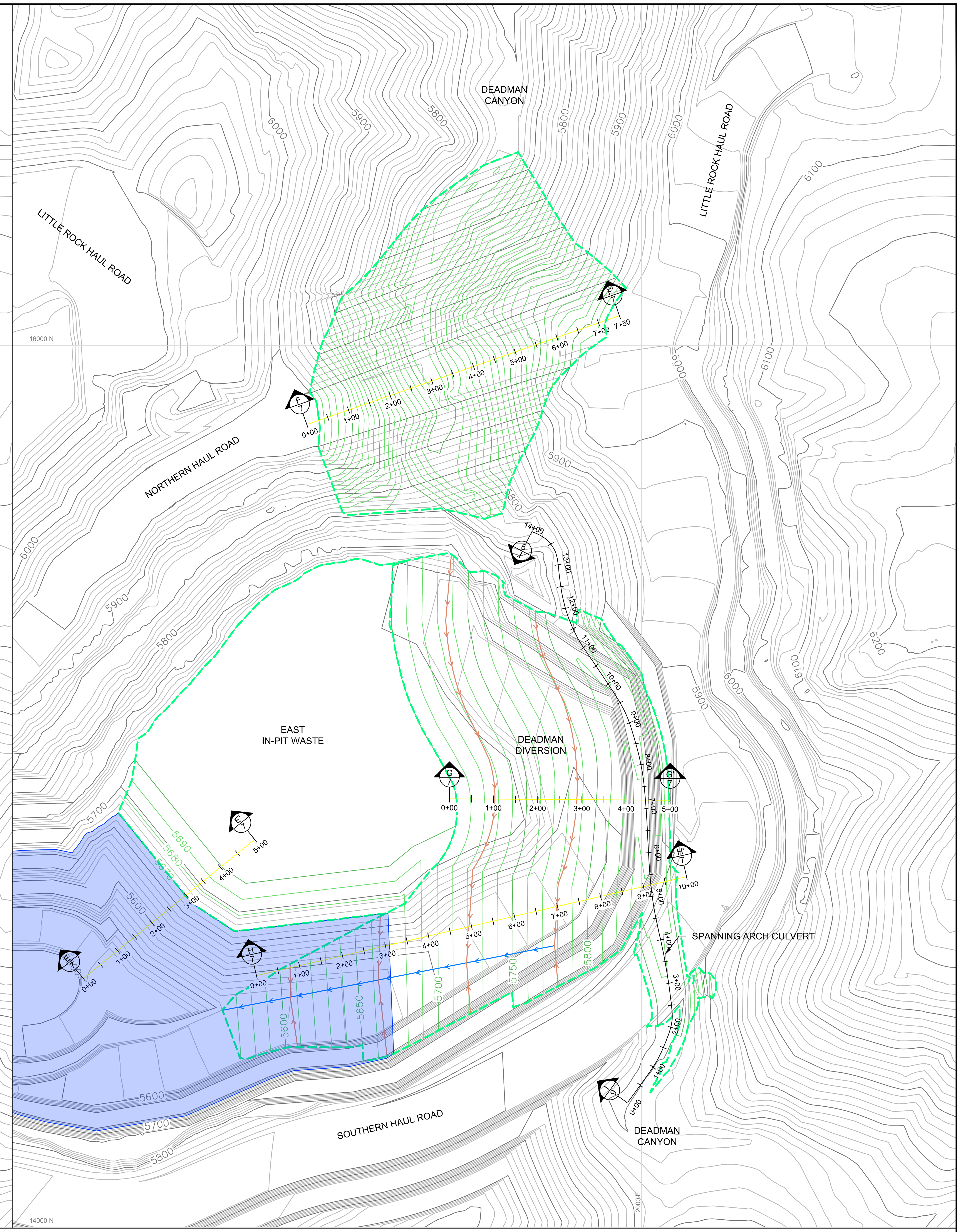
TELESTO SOLUTIONS INCORPORATED

PREPARED FOR:

FREEPORT-McMoRAN



PLAN VIEW - PRE RECLAMATION



PLAN VIEW - POST RECLAMATION

LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- POST REC. MAJ. CONTOUR
- POST REC. MIN. CONTOUR
- BENCH CHANNEL
- DOWNDRAIN
- PIT LAKE

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN
2. DEADMAN DIVERSION TO BE CONSTRUCTED DURING RECLAMATION

0 150
SCALE IN FEET

COORDINATE SYSTEM TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
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2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

DEADMAN DIVERSION/ EAST IN-PIT WASTE CLOSURE PLAN - PLAN VIEWS

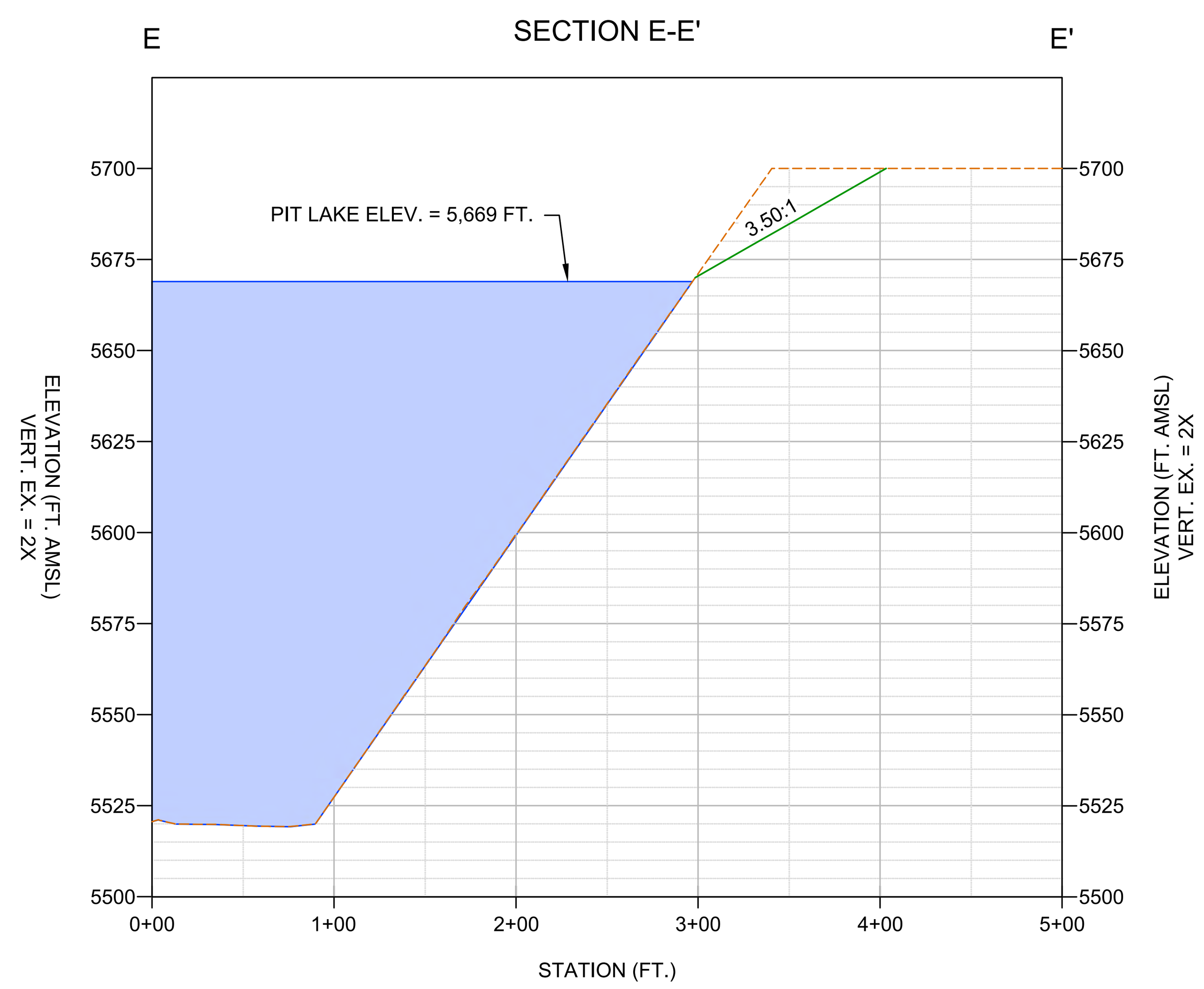
SHEET NUMBER: 6

REVISION NUMBER: 1

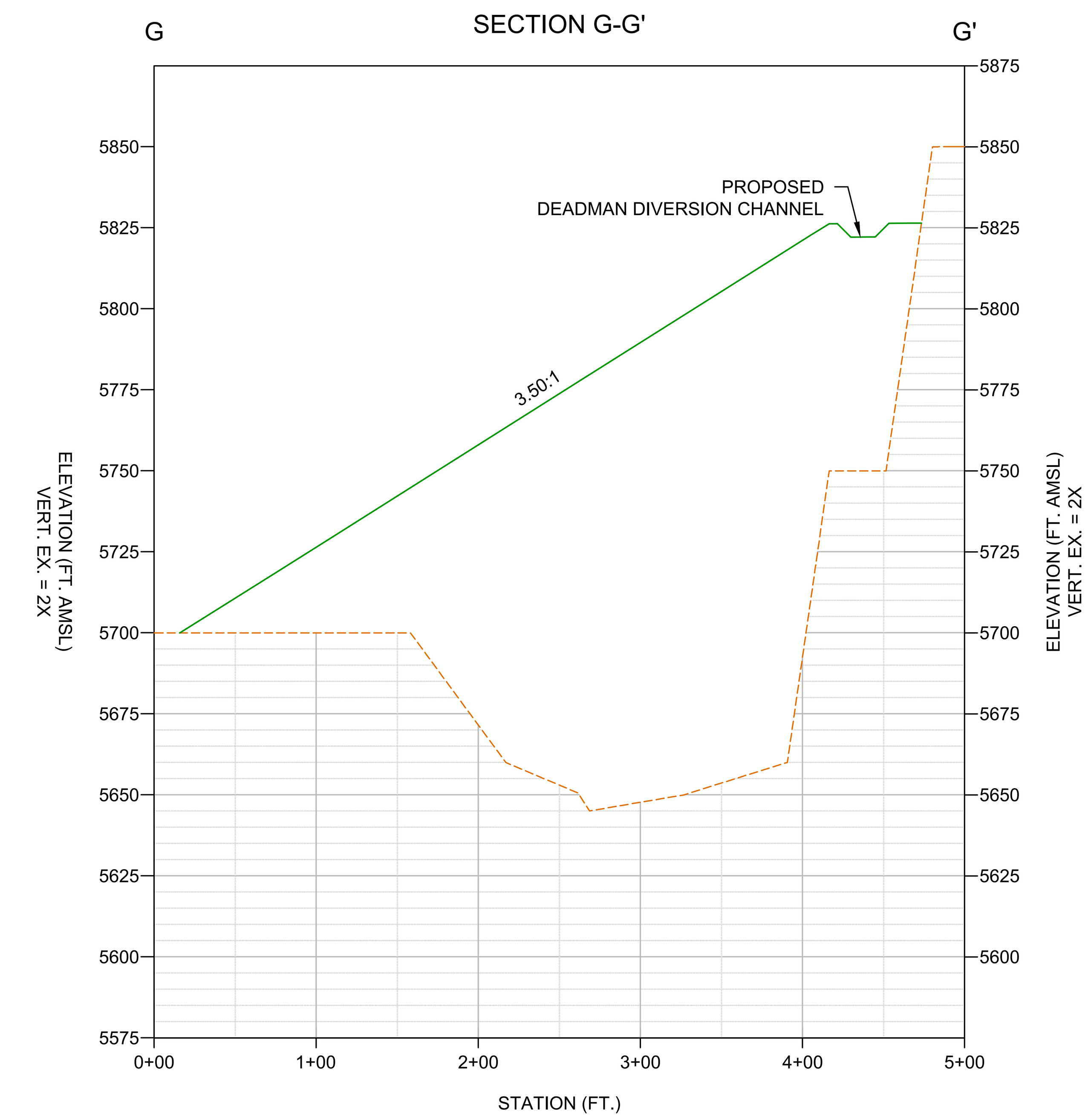
PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN

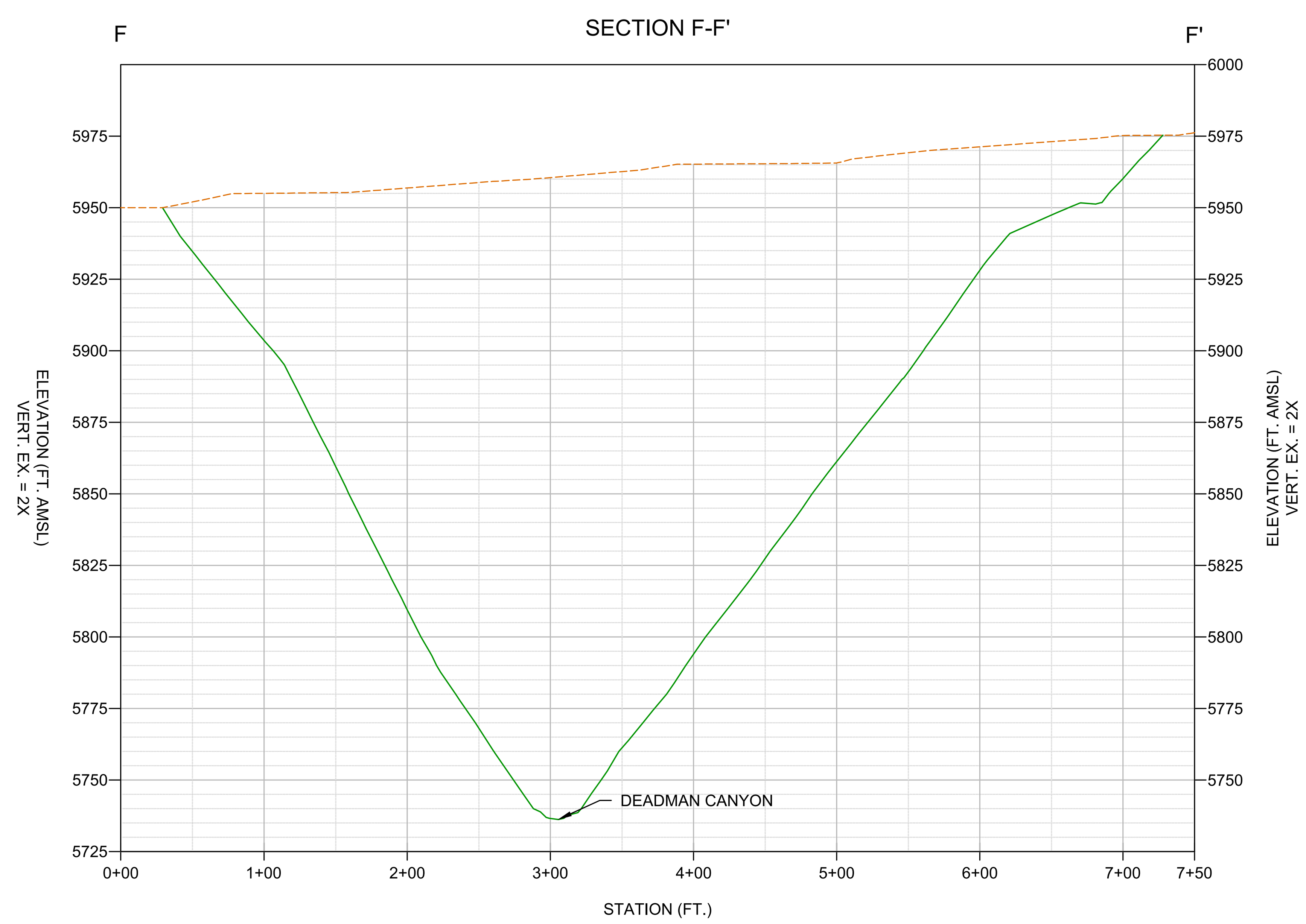
SECTION E-E'



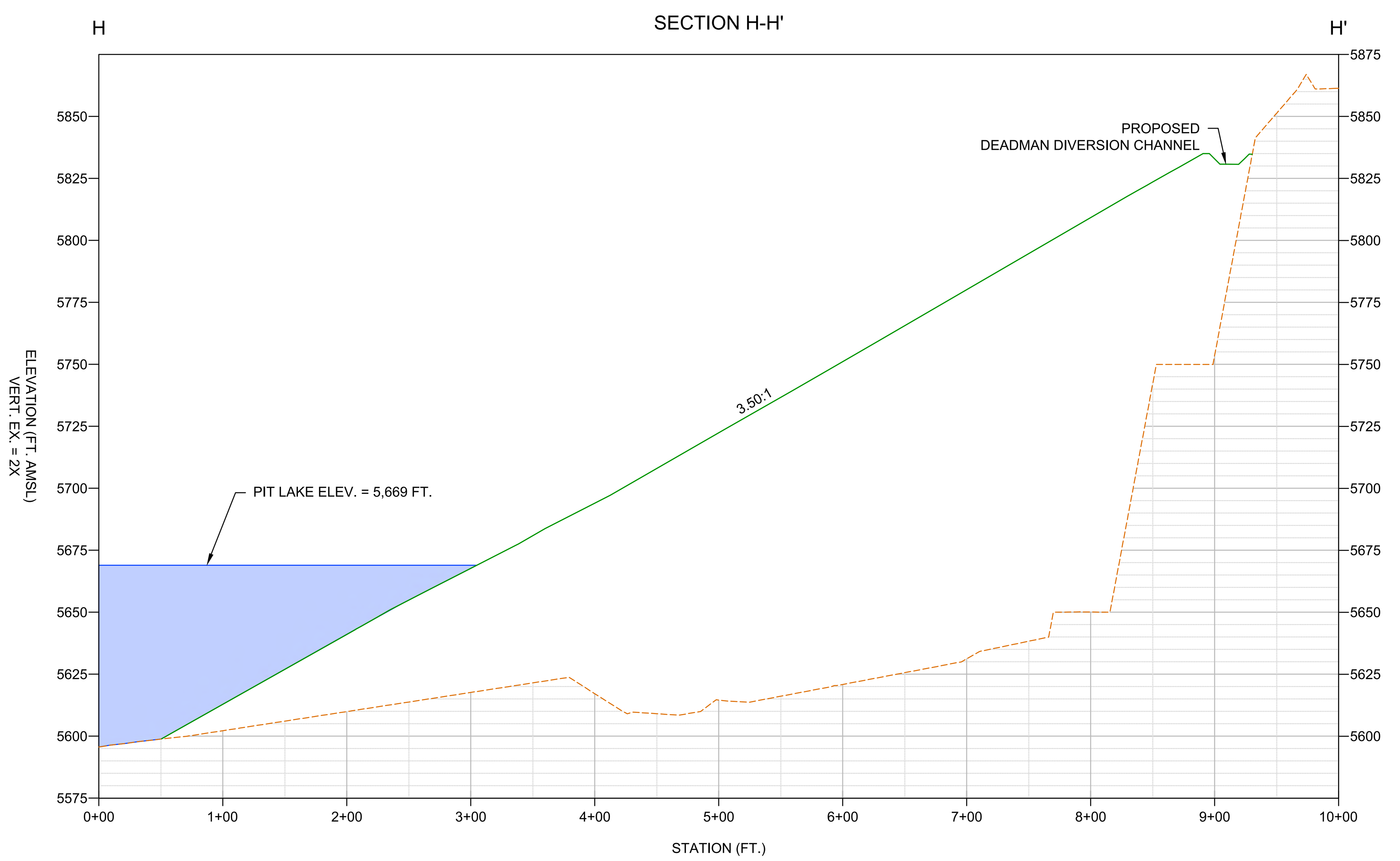
SECTION G-G'



SECTION F-F'



SECTION H-H'



LEGEND / NOTES

- PRE-RECLAMATION SURFACE
- POST-RECLAMATION SURFACE
- PIT LAKE

COORDINATE SYSTEM
TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

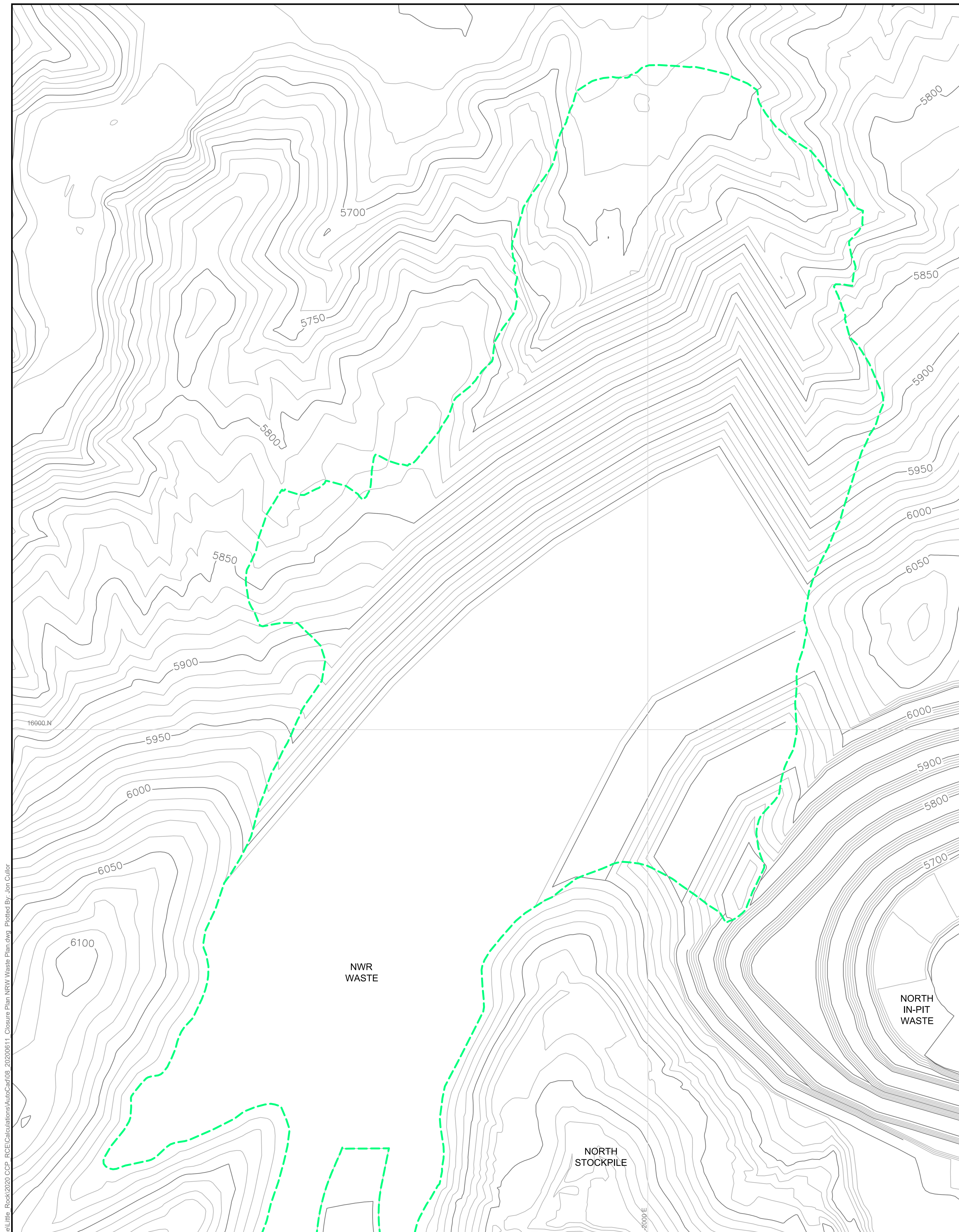
2020 LITTLE ROCK CCP

DEADMAN DIVERSION/ EAST IN-PIT WASTE CLOSURE PLAN - SECTION VIEWS

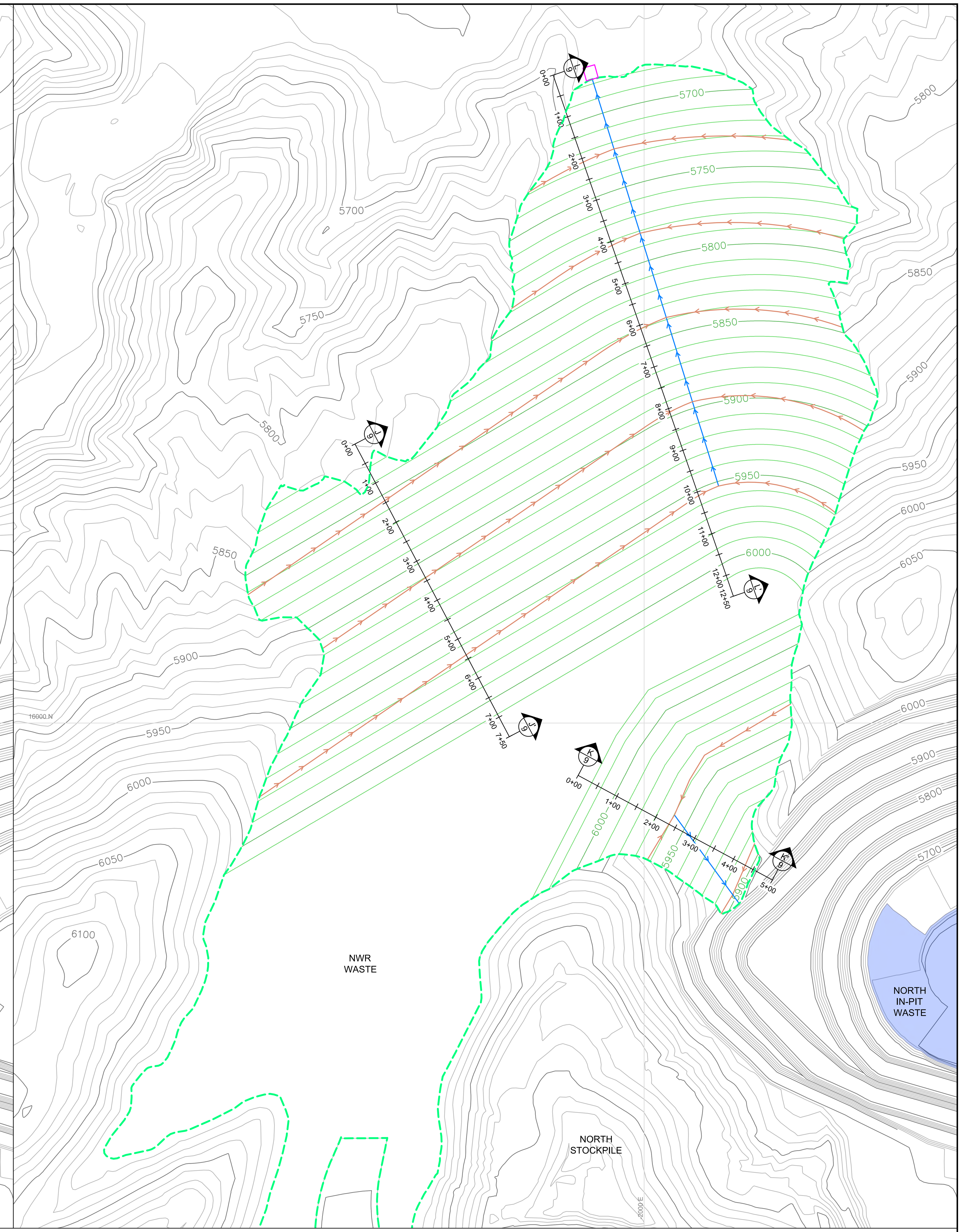
SHEET NUMBER: 7
REVISION NUMBER: 1

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN



PLAN VIEW - PRE RECLAMATION



PLAN VIEW - POST RECLAMATION

LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- POST REC. MAJ. CONTOUR
- POST REC. MIN. CONTOUR
- BENCH CHANNEL
- DOWNDRAIN
- ENERGY DISSIPATOR
- PIT LAKE

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN

0 150
SCALE IN FEET

N

COORDINATE SYSTEM
TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

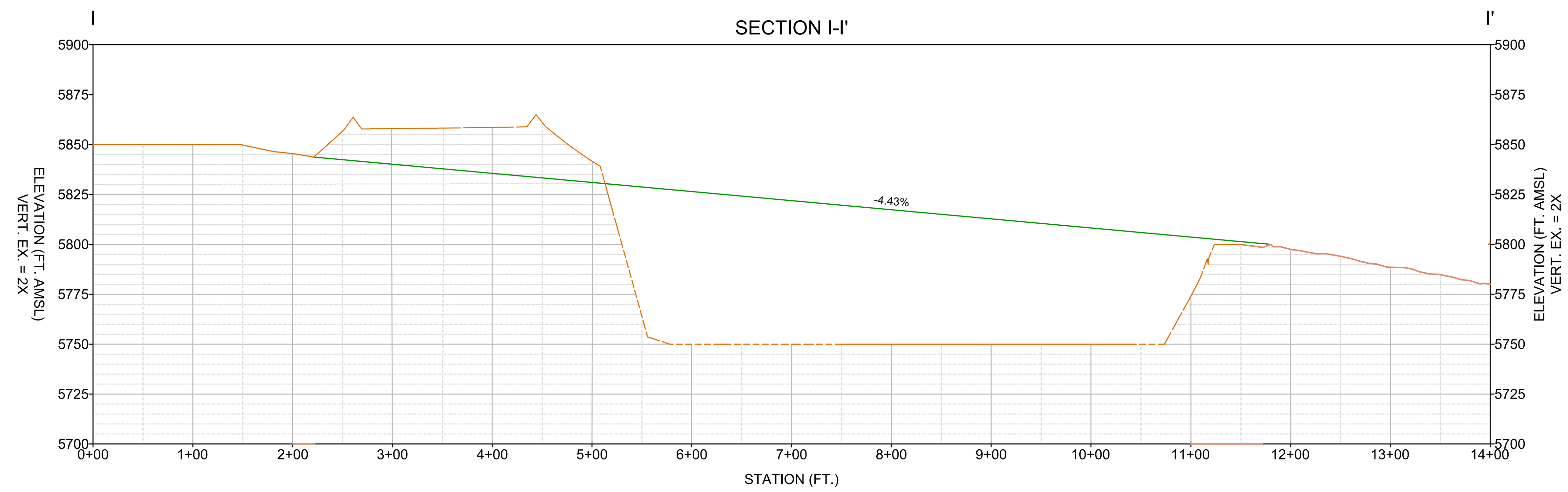
NRW WASTE CLOSURE PLAN - PLAN VIEWS

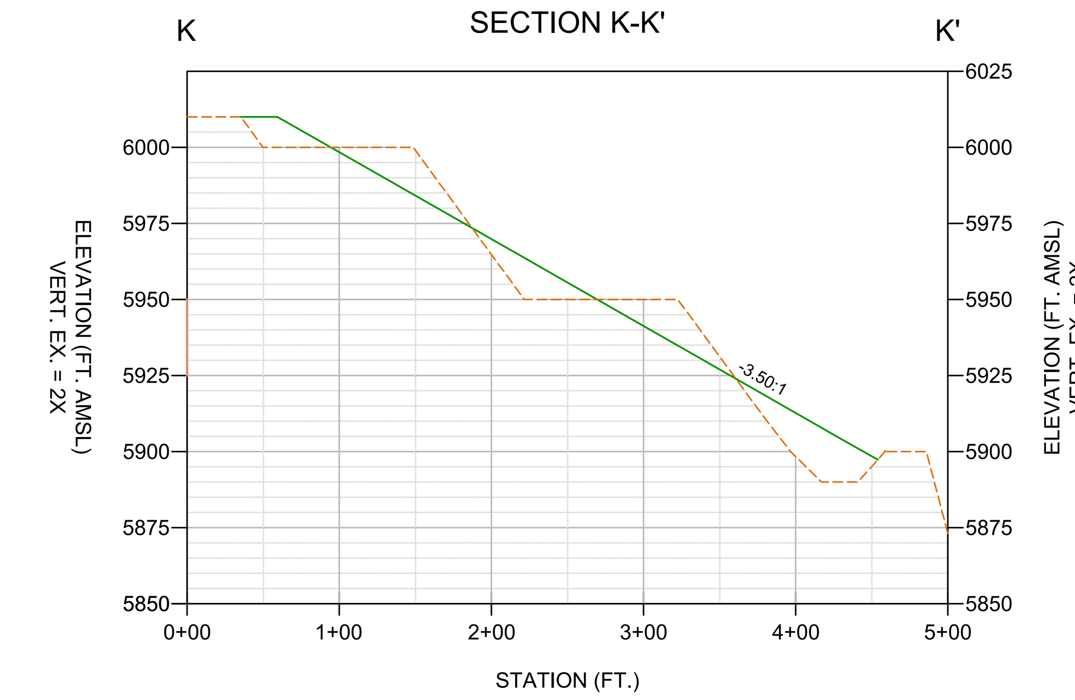
SHEET NUMBER: 8

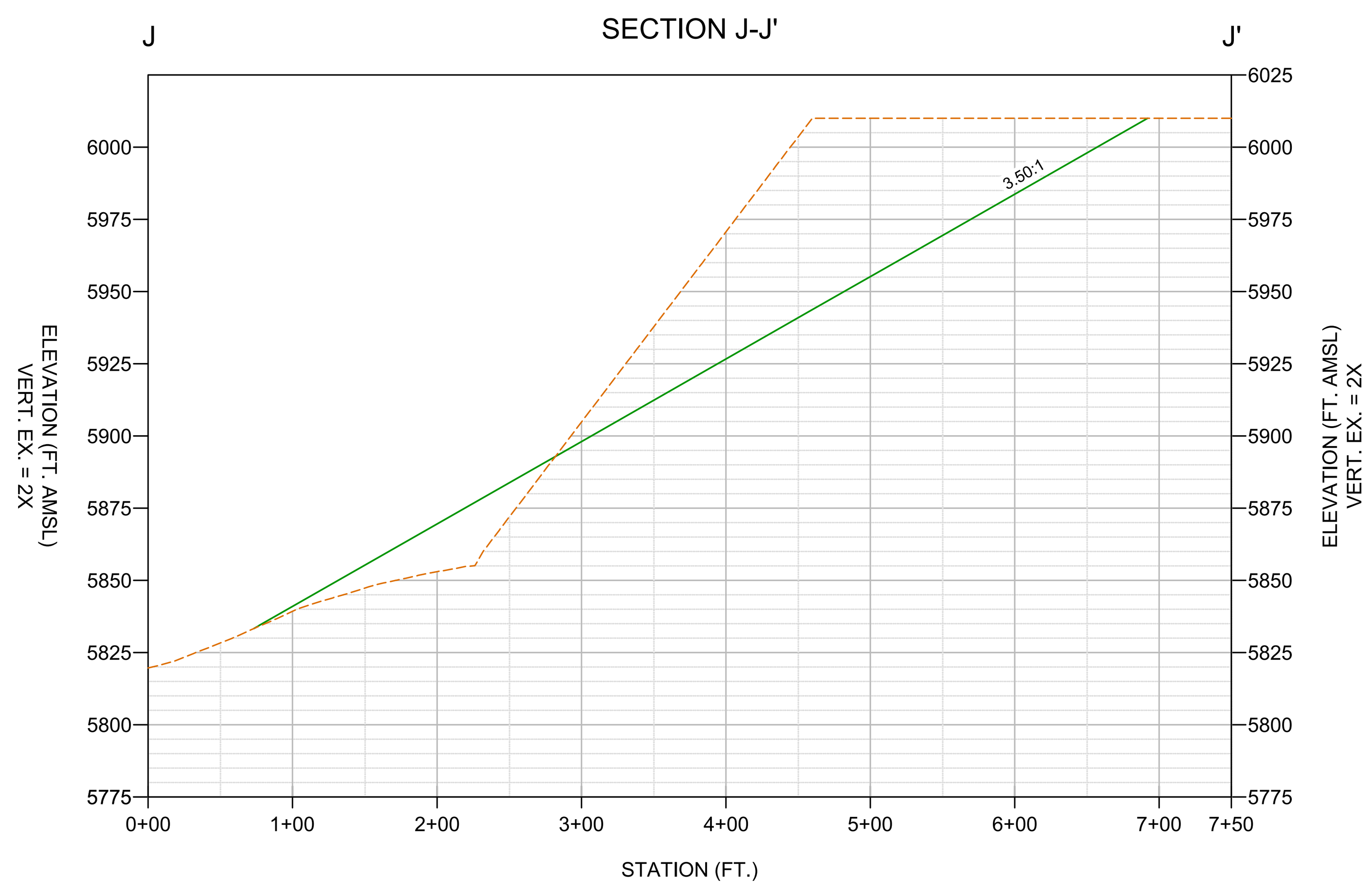
REVISION NUMBER: 1

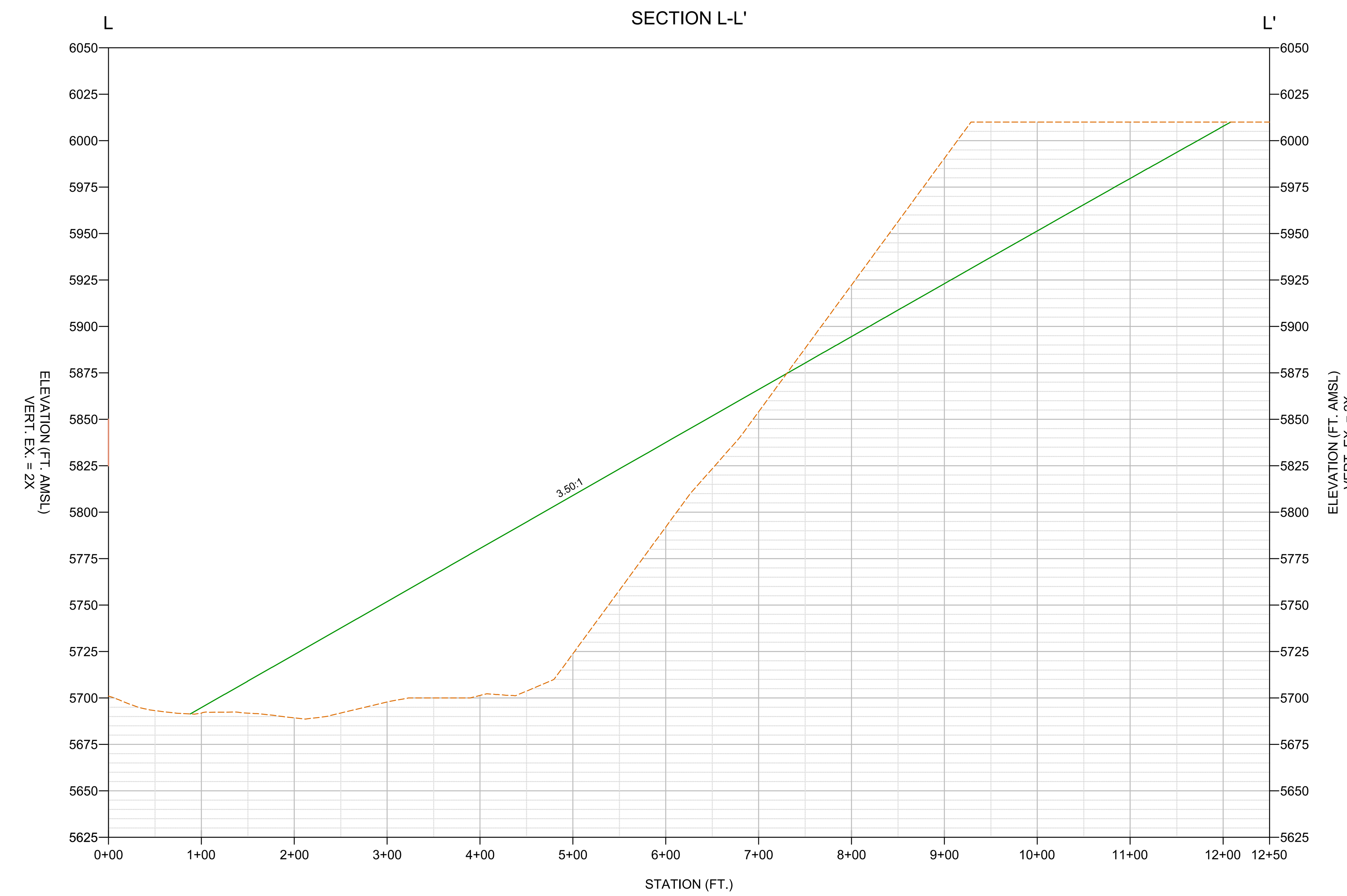
PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN









LEGEND / NOTES

PRE-RECLAMATION SURFACE

POST-RECLAMATION SURFACE

COORDINATE SYSTEM
TYRONE LOCAL

REVISIONS				
#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

NRW WASTE CLOSURE PLAN - SECTION VIEWS

SHEET NUMBER: 9

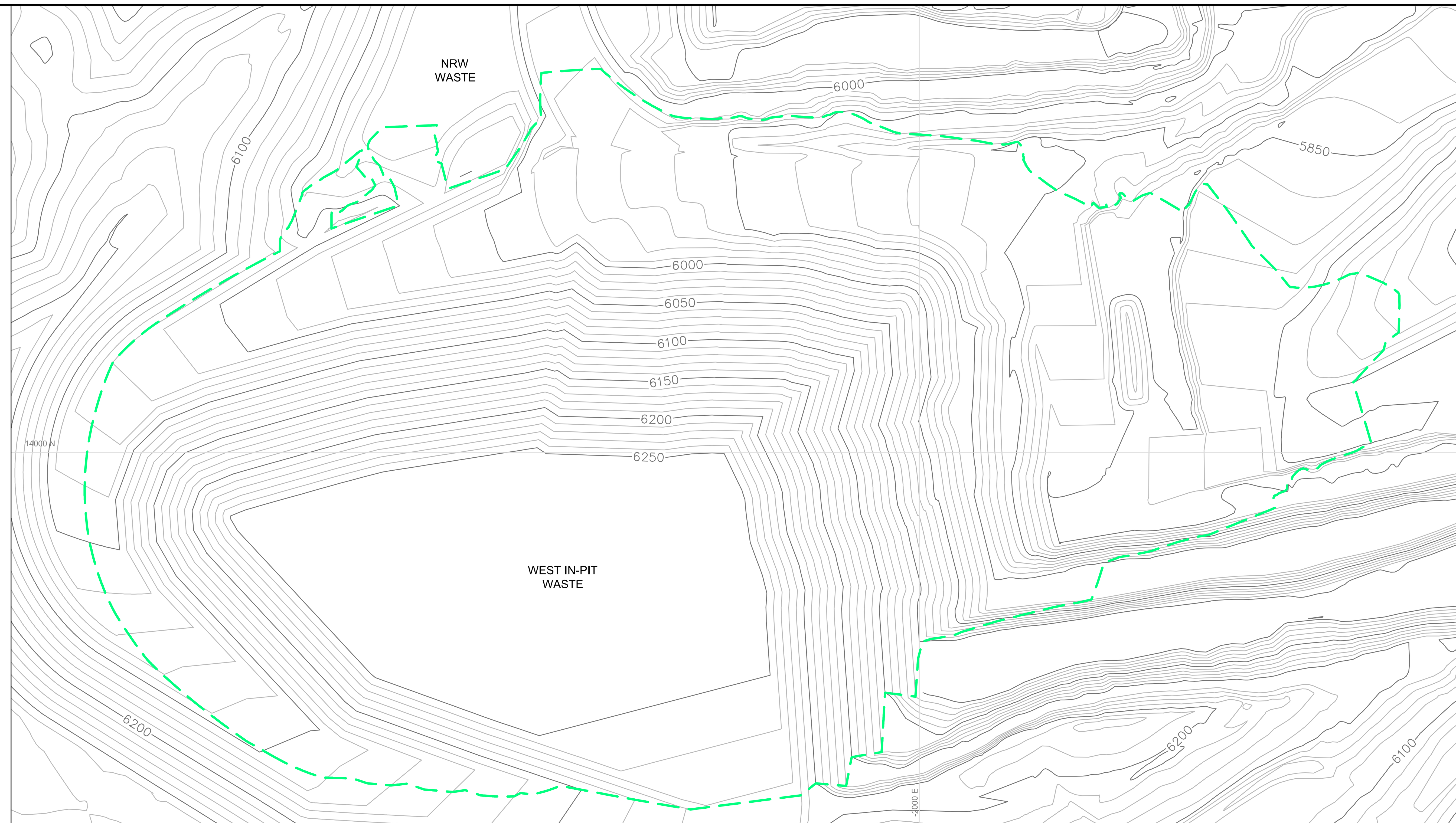
REVISION NUMBER: 1

PREPARED BY:

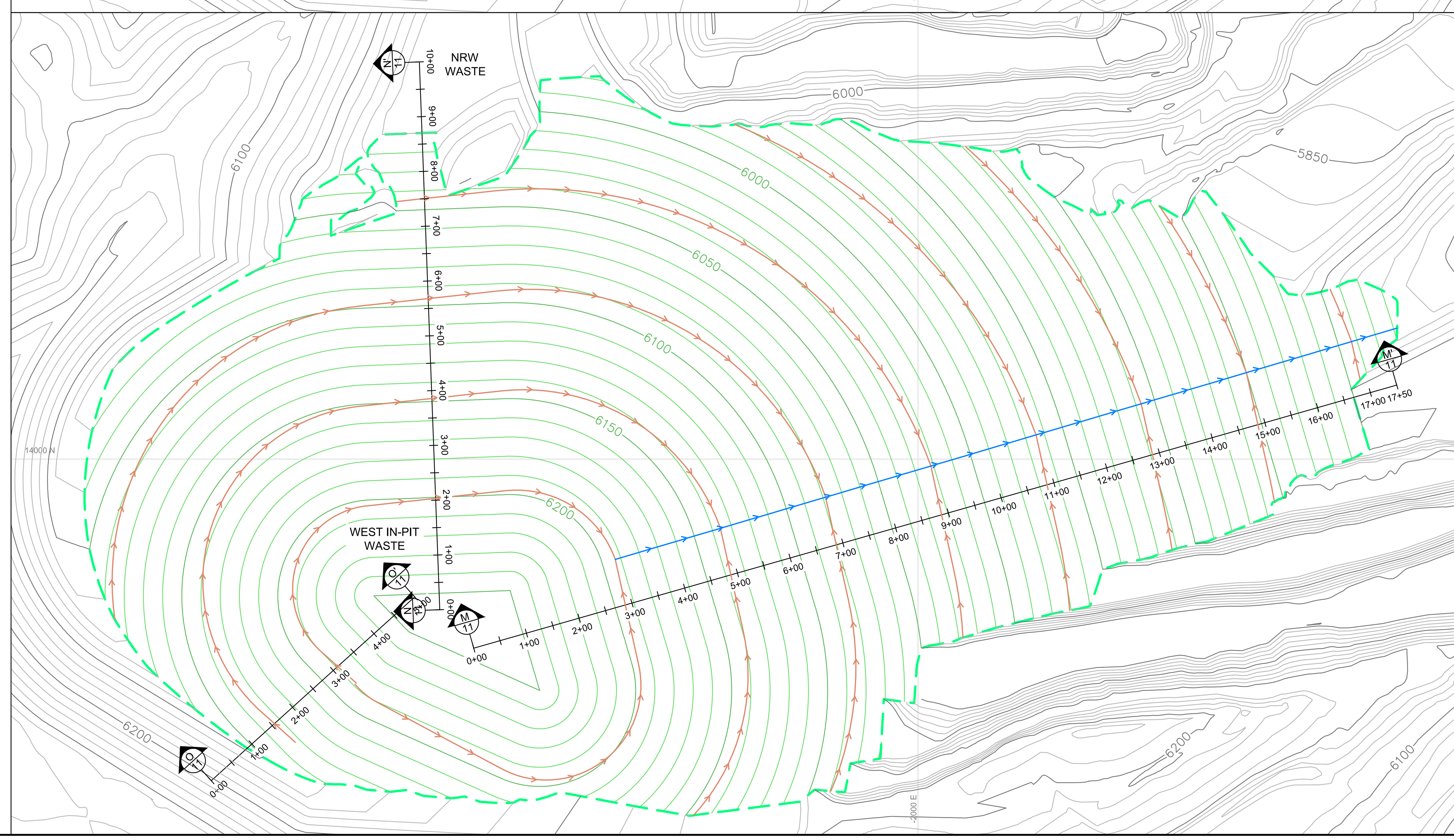
TELESTO

PREPARED FOR:

FREEPORT-McMoRAN



PLAN VIEW - PRE RECLAMATION



PLAN VIEW - POST RECLAMATION

LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- POST REC. MAJ. CONTOUR
- POST REC. MIN. CONTOUR
- BENCH CHANNEL
- DOWNDRAIN

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN

0 150
SCALE IN FEET

COORDINATE SYSTEM
TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

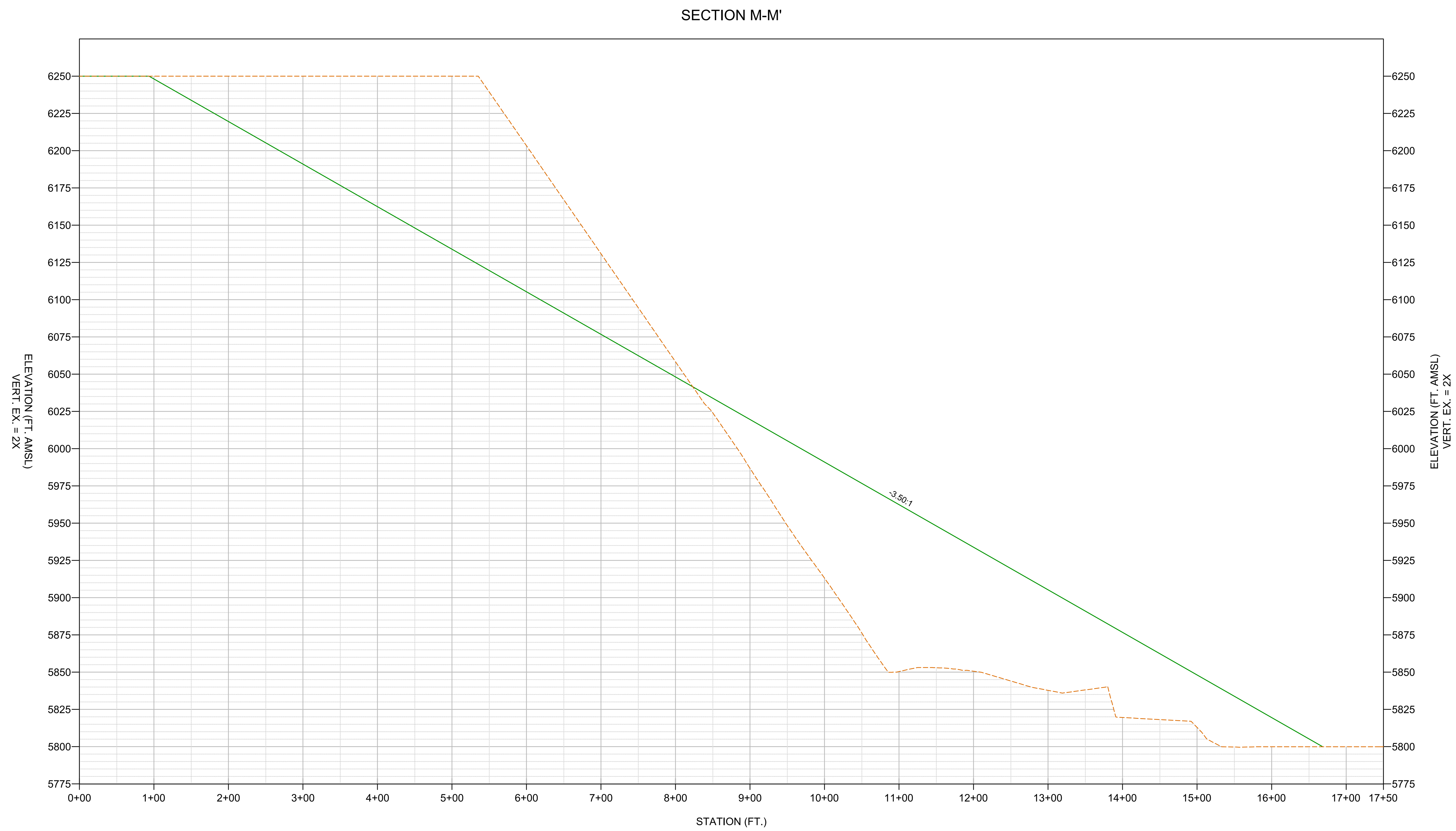
2020 LITTLE ROCK CCP

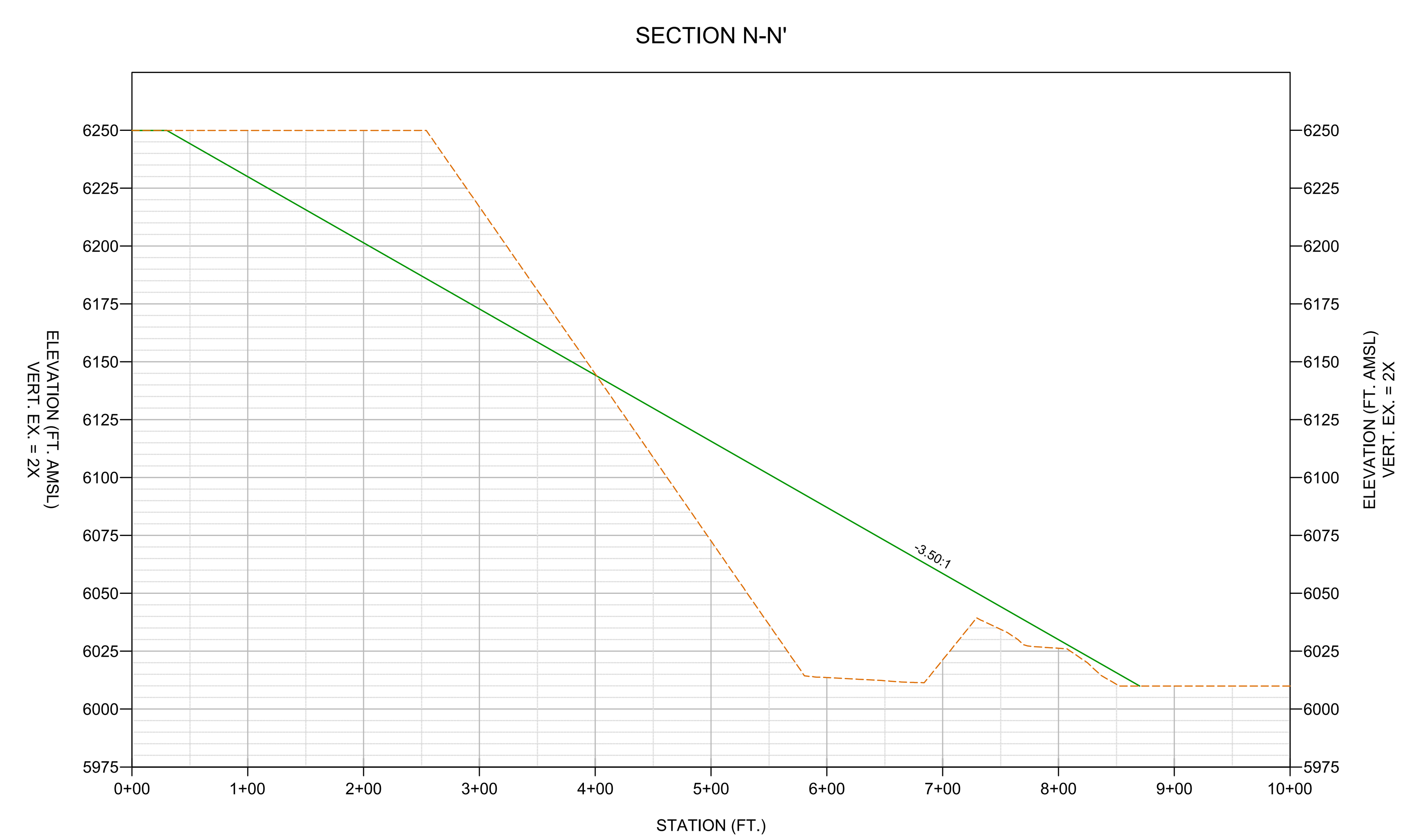
WEST IN-PIT WASTE CLOSURE PLAN - PLAN VIEWS

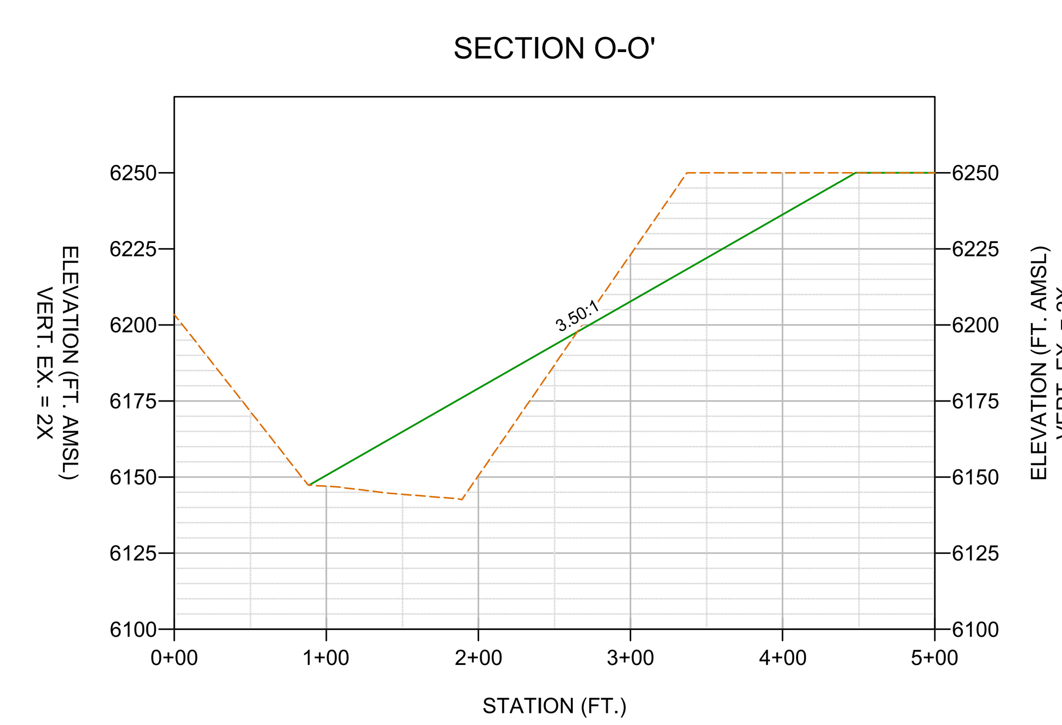
SHEET NUMBER: 10
REVISION NUMBER: 1

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN







LEGEND / NOTES

PRE-RECLAMATION SURFACE

POST-RECLAMATION SURFACE

COORDINATE SYSTEM
TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
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2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

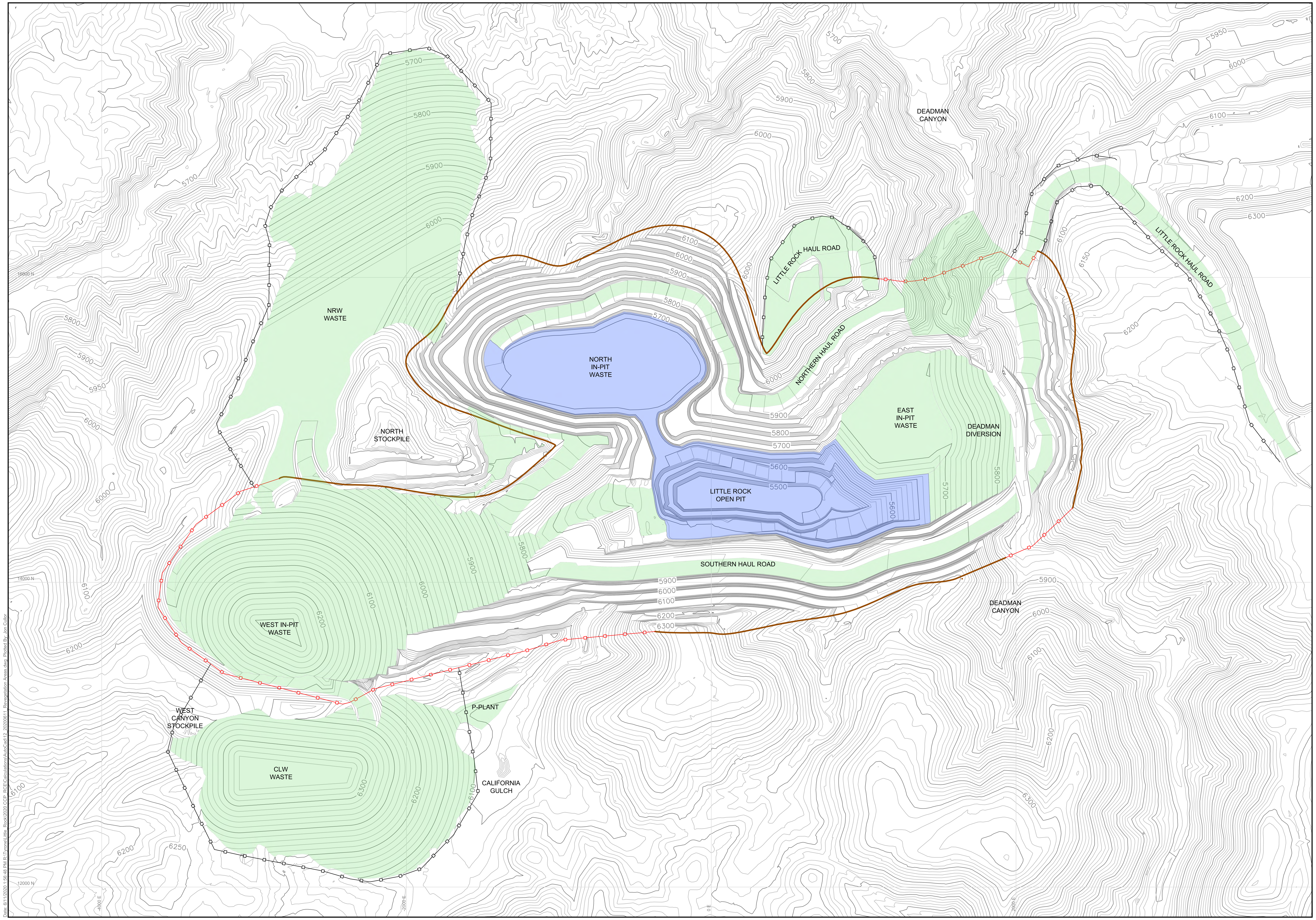
WEST IN-PIT WASTE CLOSURE PLAN - SECTION VIEWS

SHEET NUMBER: 11

REVISION NUMBER: 1

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN



LEGEND / NOTES

- MAJOR CONTOUR
- MINOR CONTOUR
- PERMANENT FENCE
- BERM
- LIVESTOCK FENCE
- REVEGETATED AREA
- PIT LAKE

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN
2. TYRONE BOUNDARY PENDING APPROVAL

0 300
SCALE IN FEET

COORDINATE SYSTEM
TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
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DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

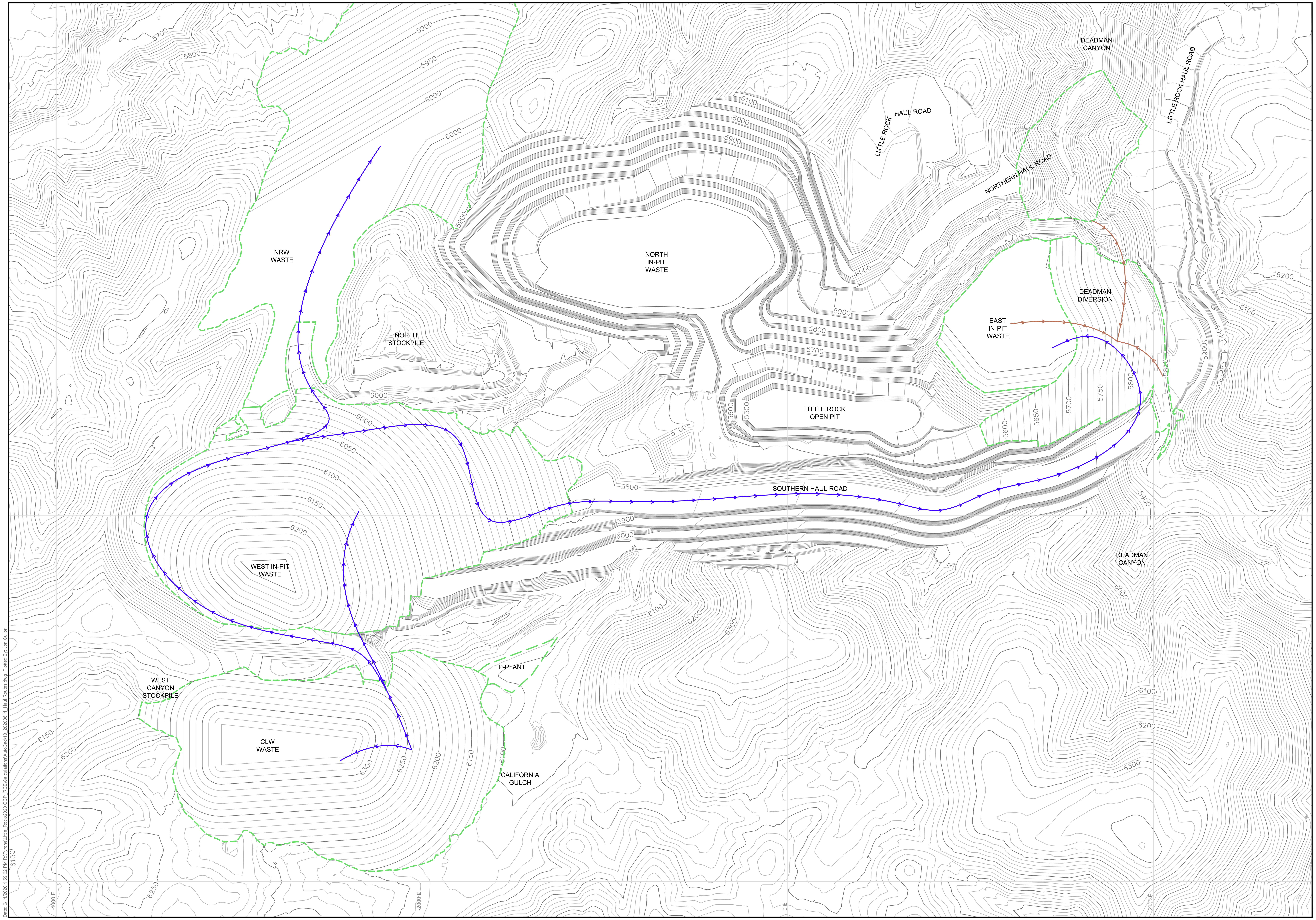
2020 LITTLE ROCK CCP

REVEGETATION AREAS

SHEET NUMBER: 12
REVISION NUMBER: 1

PREPARED BY:
TELESTO SOLUTIONS INCORPORATED

PREPARED FOR:
FREEPORT-MCMORAN



LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- MAJOR CONTOUR
- MINOR CONTOUR
- COVER HAUL ROUTE
- REGRADING HAUL ROUTE

0 250
SCALE IN FEET

COORDINATE SYSTEM
TYRONE LOCAL

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT

DATE	6/11/2020
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

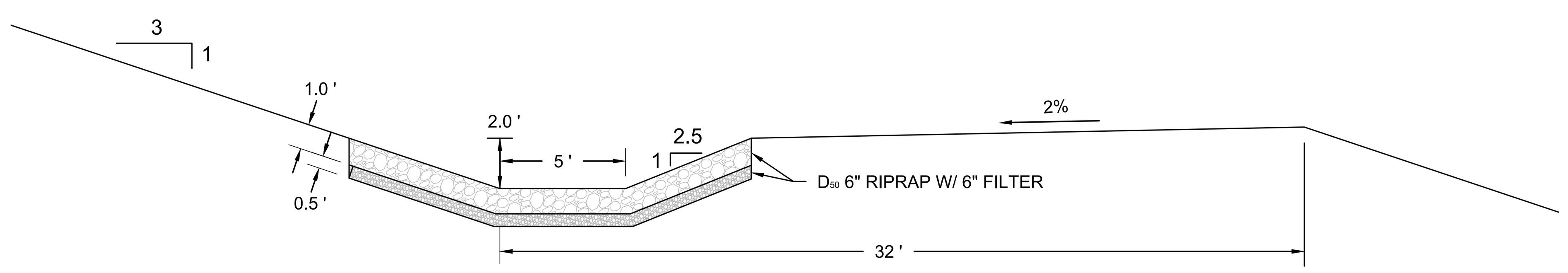
RECLAMATION HAUL ROUTES

SHEET NUMBER: 13

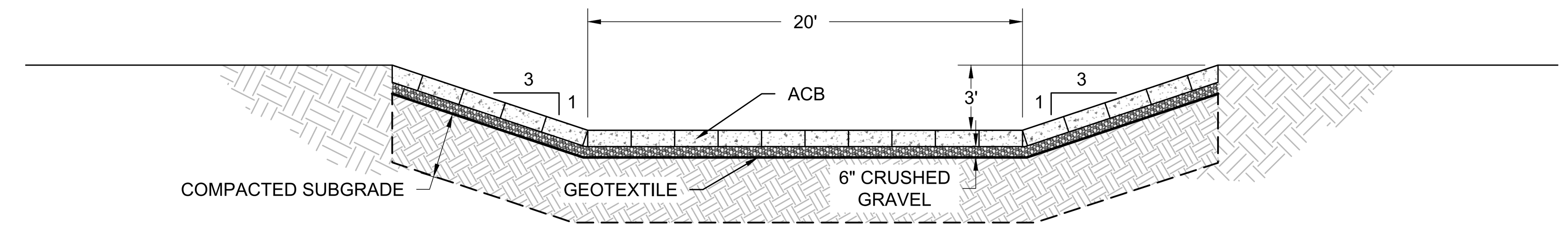
REVISION NUMBER: 1

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

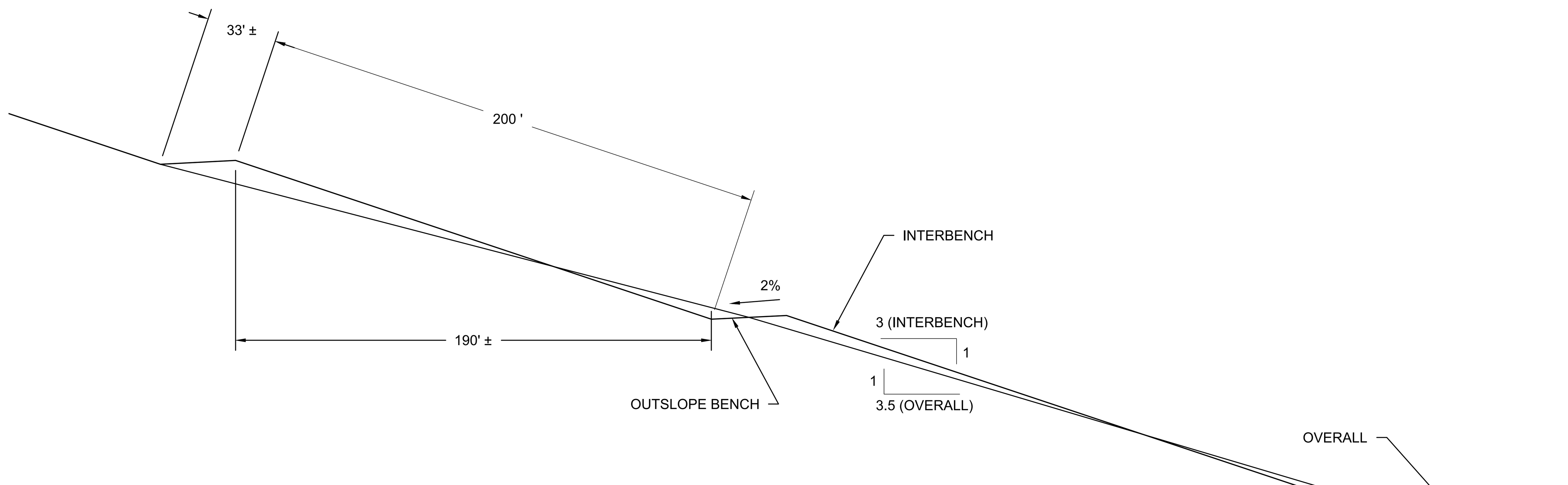
PREPARED FOR: FREEPORT-McMoRAN



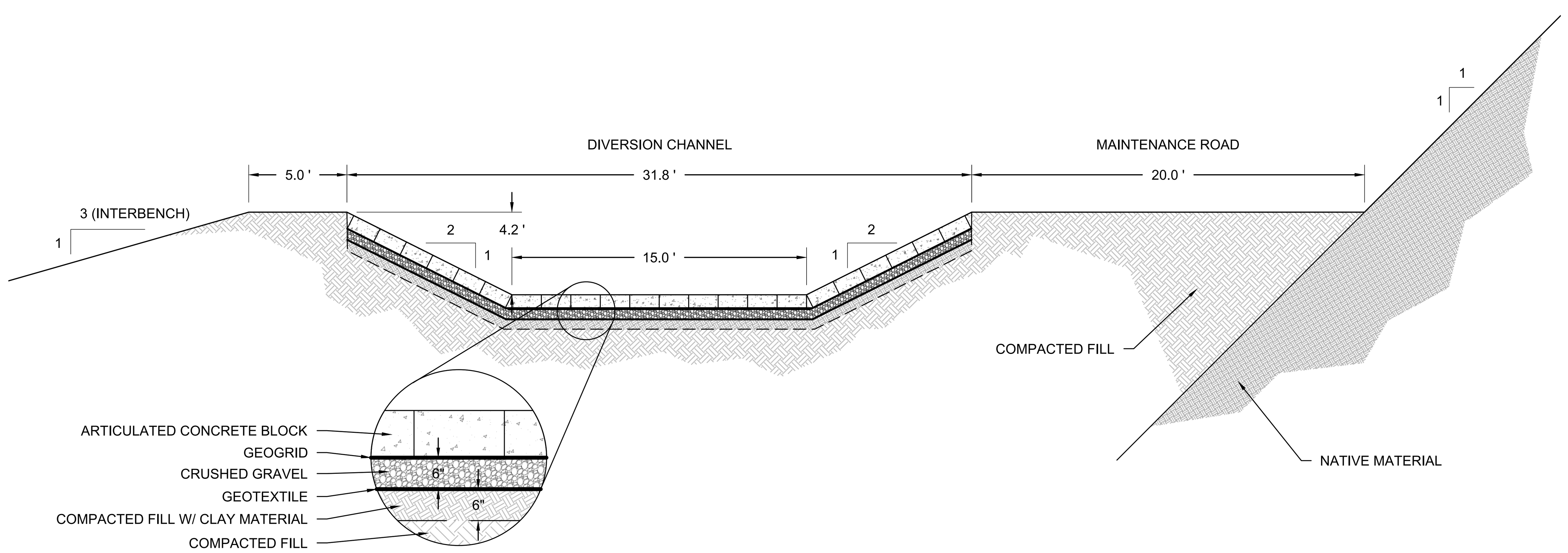
TYPICAL BENCH CHANNEL CROSS SECTION
SECTION VIEW



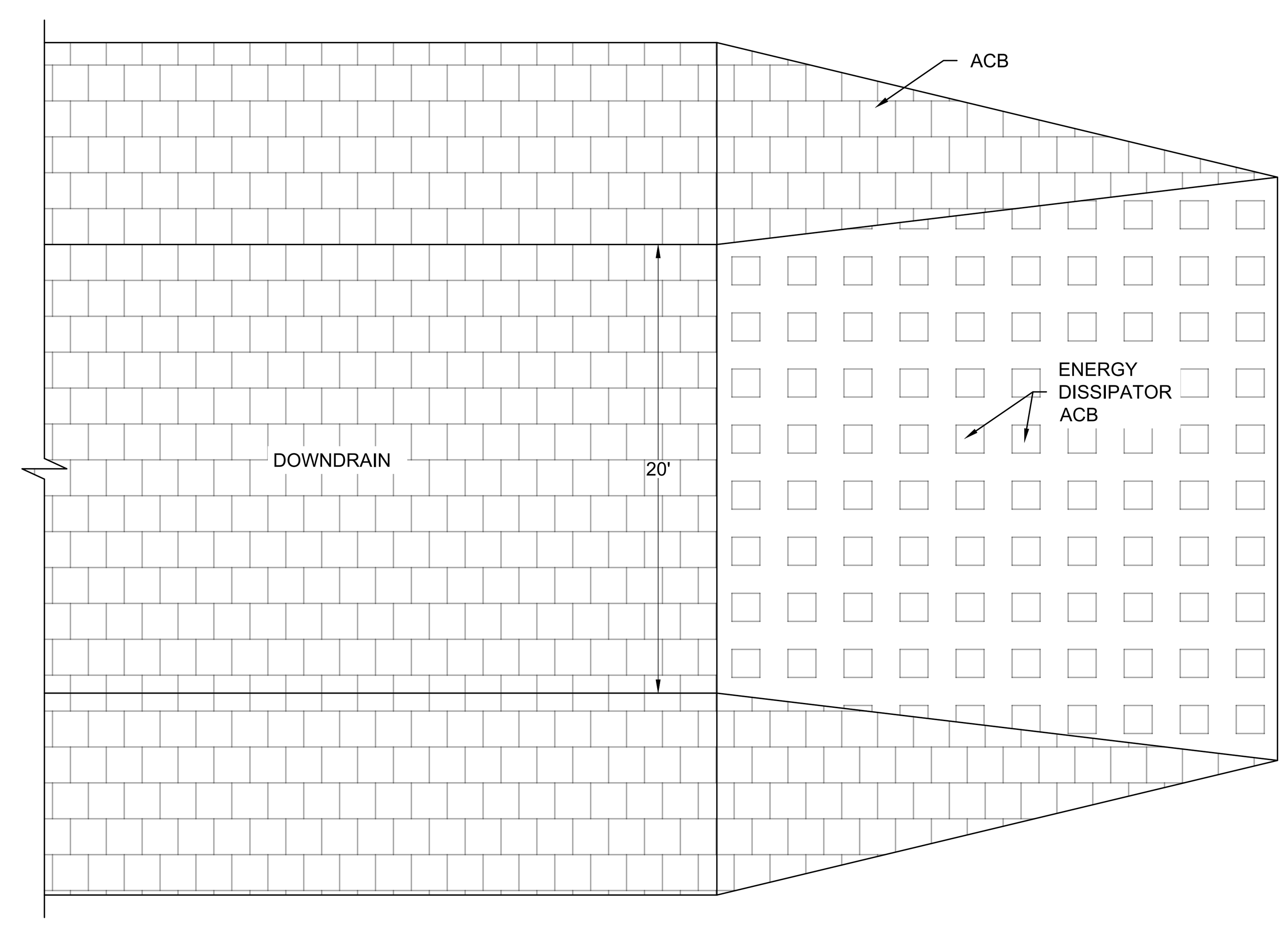
TYPICAL DOWNDRAIN
SECTION VIEW



TYPICAL OUTSLOPE BENCH ON A 3:1 SLOPE
PROFILE VIEW



DEADMAN DIVERSION
SECTION VIEW



TYPICAL ENERGY DISSIPATOR
PLAN VIEW

LEGEND / NOTES

REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
0	DRAFT FOR COMMENT	5/21/20	JC	TT
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TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

STORMWATER MANAGEMENT DETAILS

SHEET NUMBER: 14
REVISION NUMBER: 1

PREPARED BY:
TELESTO SOLUTIONS INCORPORATED

PREPARED FOR:
FREEPORT-McMoRAN

APPENDIX B

FACILITY CHARACTERISTICS FORMS

Little Rock Mine Closure/Closeout
Facility Characteristics Form

West In-Pit Waste stockpile

Function	Waste rock stockpile (non-discharging) with potential reclamation cover material (material to be tested and approved prior to use as reclamation cover)
Location Characteristics	No upstream issues No downstream issues Constructed entirely within the Little Rock Mine Open Pit
Construction Method	End dumped at initial angle of repose slope
Physical Characteristics	Non-acid generating material Coarse to very coarse grained Medium to high saturated hydraulic conductivity
Leach Status	Non-leach
Existing Engineering Measures	Stormwater controls

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	49.2
Item	Quantity
Cover Material	2,648 cubic yards
Top Surface Regrading	NA
Top Surface Ripping	0.6 acres
Outslope Regrading	1,683,940 cubic yards
Revegetation	49.2 acres
Channels and Benches	10,627 feet
Other	1,487 feet Downdrains

[1.] Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

North In-Pit Waste stockpile

Function	Waste rock stockpile (non-discharging) with potential reclamation cover material (material to be tested and approved prior to use as reclamation cover)
Location Characteristics	No upstream issues No downstream issues Constructed entirely within the Little Rock Mine Open Pit The entire stockpile is projected to be completely covered by the pit lake surface after closure
Construction Method	End dumped at initial angle of repose slope
Physical Characteristics	Non-acid generating material Coarse to very coarse grained Medium to high saturated hydraulic conductivity
Leach Status	Non-leach
Existing Engineering Measures	Stormwater controls

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	NA
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	NA
Outslope Regrading	NA
Revegetation	NA
Channels and Benches	NA
Other	NA

[1.] Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

East In-Pit Waste stockpile

Function	Waste rock stockpile (non-discharging) with potential reclamation cover material (material to be tested and approved prior to use as reclamation cover)
Location Characteristics	No upstream issues No downstream issues Constructed entirely within the Little Rock Mine Open Pit A portion of the Deadman Canyon Diversion structure will be constructed on top of the stockpile in 2024
Construction Method	End dumped at initial angle of repose slope
Physical Characteristics	Non-acid generating material Coarse to very coarse grained Medium to high saturated hydraulic conductivity
Leach Status	Non-leach
Existing Engineering Measures	Stormwater controls

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	9.9
Item	Quantity
Cover Material	534 cubic yards
Top Surface Regrading	NA
Top Surface Ripping	7.9 acres
Outslope Regrading	NA
Revegetation	9.9 acres
Channels and Benches	NA
Other	NA

[1.] Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Tyrone Mine Closure/Closeout
Facility Characteristics Form

NRW Waste stockpile

Function	Waste rock stockpile (non-discharging) with potential reclamation cover material (material to be tested and approved prior to use as reclamation cover)
Location Characteristics	Whitewater Canyon runs along the northwest perimeter of the stockpile No downstream issues Regional depth to groundwater is approximately 50 to 200 feet, direction of flow is toward the east
Construction Method	End dumped at initial angle of repose slope
Physical Characteristics	Non-acid generating material Very coarse grained Medium to high saturated hydraulic conductivity
Leach Status	Non-leach
Existing Engineering Measures	Stormwater controls

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	51.4
Item	Quantity
Cover Material	2,766 cubic yards
Top Surface Regrading	NA
Top Surface Ripping	17.4 acres
Outslope Regrading	700,085 cubic yards
Revegetation	51.4 acres
Channels and Benches	6,602 linear feet
Other	1,215 feet Downdrains; 5,385 feet Livestock Fencing

[1.] Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

CLW Waste stockpile

Function	Waste rock stockpile (non-discharging) with potential reclamation cover material (material to be tested and approved prior to use as reclamation cover)
Location Characteristics	California Gulch channel runs along the southern and eastern perimeter of the stockpile The Little Rock Mine Open Pit is located downstream Regional depth to groundwater is approximately 100 to 200 feet, direction of flow is toward the northeast
Construction Method	End dumped at initial angle of repose slope
Physical Characteristics	Non-acid generating material Very coarse grained Medium to high saturated hydraulic conductivity
Leach Status	Non-leach
Existing Engineering Measures	Stormwater controls, CLDS and CLDS-1 seepage collection systems

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	38.6
Item	Quantity
Cover Material	2,073 cubic yards
Top Surface Regrading	NA
Top Surface Ripping	2.8 acres
Outslope Regrading	382,165 cubic yards
Revegetation	38.6 acres
Channels and Benches	8,569 feet
Other	868 feet Downdrains; 4,208 Livestock Fencing

[1.] Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Little Rock Mine Open Pit

Function	Mined pit
Location Characteristics	Intersects California Gulch and later stages will intersect Deadman Canyon. No downstream issues Pit dewatering capture zone controls regional groundwater level and flow direction
Construction Method	Blasting, shoveling, and hauling rock in 50-foot benches
Physical Characteristics	Precambrian host rocks, oxide, with low primary permeability and medium fracture permeability
Leach Status	NA
Existing Engineering Measures	Pit dewatering contains regional groundwater Temporary lined pond for the collection of seepage water from the CLDS and CLDS-1 collection systems Pit perimeter fencing and berms

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	4.9
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	4.9 acres
Outslope Regrading	NA
Revegetation	4.9 acres
Channels and Benches	NA
Other	NA

[1.] Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Exploration Holes, Monitoring Wells

Function	Exploration and Monitoring
Location Characteristics	Mine Permit Area
Construction Method	N/A
Physical Characteristics	N/A
Leach Status	NA
Existing Engineering Measures	N/A

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	NA
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Outslope Regrading	NA
Revegetation	NA
Channels and Benches	NA
Other	Replace 750 feet; Plug & Abandon 2,850 feet at closure

1. Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Fencing, Berms, Signs, and Vehicle Gates Around the Little Rock Mine Open Pit

Function	N/A
Location Characteristics	Little Rock Mine Open Pit perimeter
Construction Method	N/A
Physical Characteristics	N/A
Leach Status	N/A
Existing Engineering Measures	Pit perimeter fencing and berms

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	45.0
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	45.0
Outslope Regrading	NA
Revegetation	NA
Channels and Benches	NA
Other	6,661 feet Chain Link Fence, 17,917 feet Berms; 5 Vehicle Gates; 50 Signs

[1.] Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Pipelines and Infrastructure Closures

Function	Pipeline closures; demolition of electrical infrastructure, buildings, and fire hydrants
Location Characteristics	Mine Area
Construction Method	N/A
Physical Characteristics	Pipelines (LR sump-1x1 dewatering pipeline and other miscellaneous pipelines); above-ground electrical lines and substations, concrete slabs and associated structures/facilities
Leach Status	N/A
Existing Engineering Measures	Power poles will be left in place to serve as raptor perches after reclamation

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	40.1
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	40.1
Outslope Regrading	NA
Revegetation	40.1
Channels and Benches	NA
Other	NA

[1.]Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Little Rock Haul Road and Open Pit Access Ramps

Function	Haul roads and access ramps
Location Characteristics	Mine Permit Area
Construction Method	N/A
Physical Characteristics	N/A
Leach Status	N/A
Existing Engineering Measures	Storm water control structures located along haul roads and access roads

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	26.2
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	16.5 acres
Outslope Regrading	NA
Revegetation	26.2 acres
Channels and Benches	NA
Other	NA

[1.]Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Allowance for Other Disturbed Areas

Function	Unforeseen changes to the mine plan including but not limited to small staging areas, utility corridors, haul roads, pull-offs, stockpile expansions, or other miscellaneous facilities
Location Characteristics	Mine Permit Area
Construction Method	N/A
Physical Characteristics	N/A
Leach Status	N/A
Existing Engineering Measures	N/A

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	10
Item	Quantity
Cover Material	538 cubic yards
Top Surface Regrading	NA
Top Surface Ripping	10 acres
Outslope Regrading	NA
Revegetation	10 acres
Channels and Benches	NA
Other	NA

1. Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.

N/A – Not analyzed

NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Flat Revegetation Areas In-Between Facility Closures

Function	Miscellaneous areas not accounted for in stockpile or other facility closures
Location Characteristics	Mine Permit Area
Construction Method	N/A
Physical Characteristics	N/A
Leach Status	N/A
Existing Engineering Measures	N/A

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	13.2
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	13.2 acres
Outslope Regrading	NA
Revegetation	13.2 acres
Channels and Benches	NA
Other	NA

1. Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Deadman Diversion

Function	New diversion for Deadman Canyon
Location Characteristics	Mine Permit Area
Construction Method	Construct diversion by moving fill material from the Northern Haul Road area, grading, compacting, and installing ACBs
Physical Characteristics	N/A
Leach Status	N/A
Existing Engineering Measures	N/A

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	9.9
Item	Quantity
Cover Material	534 cubic yards
Top Surface Regrading	NA
Outslope Regrading	47,432 cubic yards
Revegetation	9.9 acres
Channels and Benches	2,232 feet
Other	798 feet Downdrains

[1.]Quantites based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated June 2020.
N/A – Not analyzed
NA - Not applicable

APPENDIX C

RECLAMATION COST BASIS SUMMARY REPORT

Earthwork Cost Estimate
Process Summary Report

Little Rock Mine
Closure/Closeout Plan

Prepared for

Freeport-McMoRan Tyrone Inc.
P.O. Box 571
Tyrone, New Mexico 88065

Prepared by

Telesto Solutions, Inc.
750 14th Street SW
Loveland, CO 80537

June 2020

TELESTO
SOLUTIONS • INCORPORATED

Signature Page

Earthwork Cost Estimate
Process Summary Report

Little Rock Mine
Closure/Closeout Plan

June 2020

Report Authors and Contributors

Telesto Solutions, Inc.

Taryn Tigges, P.E. – Primary Author

Jonathan Cullor, P.E. – Report Review

Contributors:

Jessica Menconi

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1.0 INTRODUCTION

The New Mexico Environmental Department, Groundwater Bureau (NMED) and the New Mexico Energy, Minerals and Natural Resources Department, Mining and Minerals Division (MMD) regulations require that financial assurance (FA) be posted for facilities that have to be reclaimed at closure (New Mexico Administrative Code NMAC 20.6.7.29 and NMAC 19.10.12, respectively). This report details the scope of earthwork associated with closure/closeout activities and includes appendices that describe the base assumptions and approach that will be used to determine the FA and associated earthwork reclamation cost estimate (RCE) for the Little Rock Mine (Little Rock).

Telesto Solutions Inc. (Telesto) presents the earthwork RCE for Freeport McMoRan Tyrone Inc. (Tyrone) as an update and an expansion of the Little Rock Mine. The reclamation drawings that will provide the basis for the cost estimate can be found in Appendix A of the CCP. The cost estimate for the CCP will be provided under separate cover after State Agencies approve the scope of work for the site.

1.1 Reclamation Overview

The earthwork RCE update is to be based on the configuration of facilities as described in the end-of-year (EOY) 2024 mine plan, and assumes design for reclamation would take place during the first year with reclamation starting the following year. A recent evaluation of the five year mining sequence (for this report it is assumed 2020 to 2024) determined that 2024 is the highest reclamation cost year based on total acreages and proportions (and relative reclamation cost) of sloped, flat, and regraded sloped areas to be reclaimed. The 2014 mine plan evaluation included the Western Haul Road and Reclaimed Copper Leach Stockpile. These facilities will not be included in the earthwork RCE update because it is assumed that they do not exist in Year 2024. It was shown that Year 2024 used as the basis of this estimate will yield a higher cost than other years when all or portions of these facilities exist.

A summary of the mine facilities, including reclamation status, is provided in Table 1. The earthwork RCE includes facilities not reclaimed as of EOY 2024 and Operations and Maintenance (O&M) costs for previously reclaimed areas. A description of completed reclamation projects and projects where reclamation was projected to be complete by EOY 2024 can be found in CCP Section 2.1.5.

1.2 Report Layout

This report consists of the following sections:

- **Section 1.0** provides an introduction and overview of the RCE that will be prepared for Tyrone.
- **Section 2.0** presents the data and assumptions that will be used for estimating earthwork processes and equipment costs, indirect and O&M costs, and quotes and unit costs.
- **Section 3.0** summarizes the information that will be used to complete the earthwork RCE.
- **Section 4.0** lists the references cited in this report.

The following appendices provide supporting information and calculations:

- **Appendix A** presents the engineering take-offs that will be used in the calculations.
- **Appendix B** presents the key equations and documentation of the calculations that will be used in the reclamation cost spreadsheet.
- **Appendix C** provides the letter and table documenting the FA Work Group agreement for indirect costs that will be used in the RCE.

Table 1 Reclamation Overview

Feature	Notes
Stockpiles	
West In-Pit Waste	Reclaim by grading outslopes, hauling 4 inches of cover to 10% of stockpile, constructing stormwater channels, and revegetating
East In-Pit Waste	Stockpile partially located under the pit lake; Hauling stockpile material to Deadman Diversion for fill; Reclaim by grading outslopes, hauling 4 inches of cover to 10% of stockpile, and revegetating
CLW Waste	Reclaim by grading outslopes, hauling 4 inches of cover to 10% of stockpile, constructing stormwater channels, and revegetating
NRW Waste	Reclaim by grading outslopes, hauling 4 inches of cover to 10% of stockpile, constructing stormwater channels, and revegetating
North In-Pit Waste	Stockpile located under the pit lake and no additional reclamation requirements.
Pits	
Little Rock Open Pit	Reclaim accessible flat areas by ripping, and revegetating; Fence and berm installation around perimeter
Other	
Southern Haul Road and Little Rock Haul Road	Reduce to 30' width to allow one-lane use for maintenance activities. The remaining haul road areas will be reclaimed by ripping and revegetating.
Infrastructure and Miscellaneous Facilities	Plug and abandon monitoring wells and exploration drill holes; demolition, ripping, and revegetation of substation, concrete slabs, and powerlines; ripping and revegetation of other roads and pipeline corridors
Northern Haul Road	Fill from this area is removed at closure and utilized to construct the Deadman Diversion. The remaining haul road area will be reclaimed by seeding by manual application.
[1]P-Plant	Regrading, hauling 4 inches of cover to 10% of area, rip, and revegetate
Allowance for Other Disturbed Areas	Regrading, hauling 4 inches of cover to 10% of area, rip and revegetate
Deadman Diversion	Construct diversion by moving fill material from the Northern Haul Road area, East In-Pit Waste, and Spanning Arch Culvert (Southern Haul Road), grading, compacting, installing ACBs, and constructing stormwater channels. Reclaim outslope (area outside ACBs and above pit lake) by hauling 4 inches of cover to 10% of area and revegetating.

[1]The P-Plant area will not be removed during operations and for FA purposes, it is assumed the P-Plant area will be disturbed during operations.

2.0 DATA AND ASSUMPTIONS

The reclamation design that will be used as the basis for the earthwork RCE is presented in CCP Appendix A. The cost estimate will be included in a standalone calculation sheet that will be submitted when the Scope of Work is approved.

Key assumptions to be used in the cost estimate, calculations for earthwork processes and equipment, and indirect and O&M costs are listed in this section.

2.1 Earthwork Processes and Equipment

Data and assumptions used in the RCE for earthwork processes and equipment include the following:

- **Dozer Push Distances:** Dozer push distances represent the distance from the centroid of the cut block to the centroid of the fill block.
- **Cover Placement**: Trucks and loaders or hydraulic shovels with dozer assist, water truck, and motor grader perform cover loading and distribution. The economic optimum number of trucks per loader or hydraulic shovel is used for each haul route.
- **Haul Distances**: Haul distances are calculated along a preferred route and assumed to originate at the approximate centroid of the source and terminate at the approximate centroid of the reclamation area. Each haul route uses a maximum of three segments.
- **Borrow Areas:** For the purposes of calculation of the FA cost estimate, reclamation cover material will be sourced from CLW Waste.
- **Scraper Operations**: Construction of the Deadman Diversion will be completed using a Caterpillar 657G scraper and Caterpillar D9T dozer, or similar models.
- **Dust Suppression and Road Maintenance:** A water truck and a motor grader are included as part of the fleet during reclamation (Table 2). The water truck and grader task time is equal to loader or hydraulic shovel task time.

- **Labor Rates:** All labor rates will be developed based on the NMDOL Type H (Heavy Engineering) rates. These rates will include the base, fringe benefit, and apprenticeship contribution rates.
- **Equipment Rates:** The equipment unit operating costs will be taken from EquipmentWatch Custom Cost Evaluator.
- **Hourly Adjustment:** The RCE is based on 50 minutes of work per hour. Cost information presented in EquipmentWatch is based on 50 minutes of work per hour. Because the hourly adjustment is made in the RCE calculations, an hourly adjustment to a 60-minute work hour is applied to the EquipmentWatch data.
- **Revegetation and Scarification:** Scarifying the final surface takes place at the same time as revegetation.
- **Equipment Production Factors:** Table 2 summarizes equipment production factors from the Caterpillar Handbook (CPH), and EquipmentWatch. Productivity curves are also developed from the Caterpillar references.
- **Miscellaneous Unit Costs:** Other miscellaneous unit costs will be taken from several sources.

2.2 Indirect and O&M Costs

The RCE handles indirect and O&M costs as follows:

- **Capital Indirect Costs**: Total indirect costs of 30% are applied to the capital direct costs based on discussions involving the FA Work Group completed in December 2018. The indirect costs include but are not limited to Mobilization and Demobilization, Contingencies, Engineering Redesign Fee, Contractor Profit and Overhead, Project Management Fee, and State Procurement Cost. Appendix C presents the letter and table documenting the FA Work Group agreement for FNMO's RCEs to use 30% to calculate indirect costs.
- **Operations and Maintenance Indirect Costs**: Total indirect costs of 17.5% are applied for long-term O&M, also as agreed by the FA Work Group for FNMO's RCEs. The indirect costs include but are not limited to Mobilization and Demobilization, Contingencies, Engineering Redesign Fee, Contractor Profit and Overhead, Project Management Fee, and State Procurement Cost (see Appendix C).
- **Reclamation Timeframe**: This earthwork cost estimate assumes that earthwork occurs relatively evenly (in terms of dollars spent) over a 5-year period (in addition to 1 year of pre-construction work and 1 year of

post-construction work). Revegetation monitoring, O&M are assumed to be completed at the end of 12 years in each area after the initial revegetation. Other earthwork reclamation and facility monitoring, O&M are assumed to be fully completed at the end of 30 years (i.e., year 29 or 2053).

2.3 Direct Quotes

Direct quotes will be used in the RCE as a source of information to prepare unit costs which will be presented in the RCE cost spreadsheet. Direct quotes include the following:

- **Articulated Concrete Blocks (ACBs):** ACB material and installation unit costs
- **Revegetation Materials:** Costs for seed and hay mulch used for reclamation
- **Well Abandonment:** Well abandonment unit costs
- **Well Replacement:** Well replacement unit costs

2.4 Changes from Previously Submitted CCP Update

The specific sources for input data and assumptions used to prepare the RCE are identified below, some of which have been updated from the previously submitted CCP. These changes include the following:

- Bench channel sizes are revised to match bench channels designed for other Freeport New Mexico operations. The bench channel design is also used where flow is conveyed in low-gradient channels between downdrains and downgradient areas. Bench channels are conservatively designed for erosion protection with riprap over filter.
- ACBs are used for downdrains instead of riprap, based on specifications for use at other Freeport New Mexico operations.
- Updated quantities for channels, downdrains, and dissipators are used (Appendix A).
- The revegetation unit cost will be updated based on R.S. Means and EquipmentWatch.
- The labor rates will be updated to reflect recent values.
- The EquipmentWatch equipment costs will be updated to reflect recent values.

- The fuel cost will be updated based on discussions with the FA Work Group in the fall of 2018 as agreed in January 2019; historical local quotes are correlated with public data to estimate the fuel cost.
- Equipment production factors are revised to be consistent with the CPH and EquipmentWatch.
- Indirect costs are 30% of capital costs and 17.5% of O&M costs per the 2019 agreement between NMED, MMD, and GRIP on indirect costs (see Appendix C).

Table 2 Earthwork Equipment Production Factors

Parameter	Value	Comment/Reference
Swell Factor(1)	0% for native rock and compacted fill 8% for cover load & haul sites	Regraded material and compacted fill has no swell factor. Cover material volumes are calculated based on the reclaimed area and the cover depth. A swell factor is included in the cost estimate while calculating the bank cover volume.
Coarse Regrading Tops and Outslopes (D11T CD)		
Operator Factor (1)	1.0	Due to large job size assume operator with excellent skills (CPH 48: 19-55, excellent)
Material Factor	1.2 1.0	(CPH 48: 19-55) 1.2 for fine grading cover, other surfaces, and channel, 1.0 for coarse regrading stockpiles and tailing
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Grade Factor – Tops	1.0	(CPH 48: 19-55) 1 to 5% Slope
Grade Factor - Outslopes(1)	1.6	(CPH 48: 19-55) 3H:1V Slopes
Material Weight (lb/cy)	3,600	Stockpiles & Cover Materials
Production Method/Blade Factor	1.2	(CPH 48: 19-55) Slot dozing
Visibility Factor	1.0	(CPH 48: 19-55) Clear, dust controlled by water trucks
Elevation Factor	1.0	(CPH 48: 30-7) Horsepower reduction table
Direct Drive Transmission	1.0	-
Fine Grading Cover, Other Surfaces, and Channels (D11T CD, D9T, D6T, 16M, 14M)		
Material Factor	1.2	(CPH 48: 19-55) fine grading cover
Grade Factor – Tops	1.0	(CPH 48: 19-55) 1-5% slopes
Grade Factor – Outslopes(1)	1.6	(CPH 48: 19-55) 3H:1V Slopes
Material Weight (lb/cy)	3,600	Fine grading cover material
Production Method/Blade	1.2 1.0	(CPH 48: 19-55, slot dozing) No correction applied channels, downdrains, and benches
Effective Blade Width (feet [ft])	22.0 ft D11T CD 14.08 ft D9T Semi Universal Blade 16 ft 16M, 14 ft 14M 10.67' D6T SU	(CPH 48: 19-17, 19-49) (CPH 48: 19-47) (CPH 48: 11-17) (CPH 48: 19-10, 19-43)
Speed (miles/hr)	2.5 mph D11T CD, 16M, and 14M 1.0 mph D9T and D6T	(CPH 48: 11-19, 19-24, 19-25) maximum equipment speeds based on information provided in the Cat Handbook and Safe mining practices
Operator Factor(1)	0.75	(CPH 48: 19-55) Average operator skill
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Visibility Factor	1.0	(CPH 48: 19-55) Clear, dust controlled by water trucks
Elevation	1.0	(CPH 48: 30-7)

Parameter	Value	Comment/Reference
Direct Drive Transmission	1.0	-
Ripper (D11T CD Multi-shank [w/MSR-359H])		
Ripping Length (ft)	1,000	-
Penetration (in)	18	-
Pocket Spacing (in)	59	(CPH 48: 19-72)
Number of Pockets	3	(CPH 48: 19-72)
Turn Time (min/pass)	0.25	(CPH 48: 19-72 to 19-75)
Speed (mph)	1	(CPH 48: 19-72 to 19-75)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Distance between passes (in)	59	Maintain pocket spacing value between passes
Loader (992K)		
Heaped Capacity (cy)	16.0	(CPH 48: 23-223, 23-365)
Loader Cycle Time (load, dump, and maneuver; min)	0.65	(CPH 48: 23-287)
Bucket Fill Factor	0.875	(CPH 48: 23-287) ≥ 1" Loose Material
Speed (mph)	7.6 12.8	(CPH 48: 23-18) 7.6 mph loaded, forward 2nd gear; 12.8 mph empty, forward 3rd gear
Work Hour (min/hr)	50	(CPH 48: 19-55)
Loaders (988H, 980H)		
Heaped Capacity (cy)	8.3 (988H) 7.5 (980H)	(CPH 41: 19-75) (CPH 48: 23-213, 23-214)
Loader Cycle Time (load, dump, and maneuver; min)	0.575 (988H) 0.525 (980H)	(CPH 44: 23-223) (CPH 48: 23-287)
Bucket Fill Factor	0.875	(CPH 48: 23-287) ≥ 1" Loose Material
Speed (mph)	7.3 12.9	(CPH 41: 12-7 [988H], 48:23-17 [980H]) 7.3 mph loaded, forward 2nd gear; 12.9 mph empty, forward 3rd gear
Work Hour (min/hr)	50	(CPH 48: 19-55)
Loader (966H)		
Heaped Capacity (cy)	5.5	(CPH 48: 23-209, 23-210)
Loader Cycle Time (load, dump, and maneuver; min)	0.525	(CPH 48: 23-287)
Bucket Fill Factor	0.875	(CPH 48: 23-287) ≥ 1" Loose Material
Speed (mph)	7.8 13.7	(CPH 48: 23-16) 7.8 mph loaded, forward 2nd gear; 13.7 mph empty, forward 3rd gear
Work Hour (min/hr)	50	(CPH 48: 19-55)
Shovel (Hitachi EX3600-5/CAT 5230B FS) (2)		
Heaped Bucket Capacity (cy)	27.4	EquipmentWatch Spec for Hitachi EX3600-5
Loader Cycle Time (min)	0.45	(CPH 35: 4-236)
Bucket Fill Factor	1.025	(CPH 48: 30-2) assuming rock dirt mixture factor range from 1.00 to 1.05
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Trucks (CAT 789D/Komatsu 730E) (3)		
Struck Capacity (cy)	101	EquipmentWatch Spec for Komatsu 730E
Heaped Capacity (cy)	145	EquipmentWatch Spec for Komatsu 730E
Rolling Resistance	2.5%	(CPH 48: 30-2) Radial tires, dirt road maintained fairly regularly, watered, flexing

Parameter	Value	Comment/Reference
		slightly
Truck Exchange Time (min)	0.7	(CPH 48: 10-20) Avg. 0.6-0.8
Dump/Maneuver Time (min)	1.1	(CPH 48: 10-20) Avg. 1.0-1.2
Speed (mph)	35.5	(CPH 48: 10-14) top speed (loaded)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Trucks (CAT 769D)		
Struck Capacity (cy)	22.2	(CPH 29: 9-2) Capacity assumed for bench channel materials
Heaped Capacity (cy)	31.7	(CPH 29: 9-2) Capacity assumed for bench channel materials
Rolling Resistance	2.5%	(CPH 48: 30-2) Radial tires, dirt road maintained fairly regularly, watered, flexing slightly
Truck Exchange Time (min)	0.7	(CPH 48: 10-20) Avg. 0.6-0.8
Dump/Maneuver Time (min)	1.1	(CPH 48: 10-20) Avg. 1.0-1.2
Speed (mph)	47	(CPH 29: 9-2) top speed (loaded)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Trucks (CAT 725)		
Struck Capacity (cy)	14.5	EquipmentWatch spec
Heaped Capacity (cy)	19.0	EquipmentWatch spec
Rolling Resistance	2.5%	(CPH 48: 30-2) Radial tires, dirt road maintained fairly regularly, watered, flexing slightly
Truck Exchange Time (min)	0.7	(CPH 48: 10-20) Avg. 0.6-0.8
Dump/Maneuver Time (min)	1.1	(CPH 48: 10-20) Avg. 1.0-1.2
Speed (mph)	34	(CPH 48: 1-2) top speed (loaded)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Scraper (657G) Push-Pull		
Heaped Capacity (cy)	44	(CPH 48: 24-4)
Struck Capacity (cy)	32	(CPH 48: 24-4)
Rated Load (lb)	104,000	(CPH 48: 24-4)
Rolling Resistance	2.5%	(CPH 48: 30-2) Radial tires, dirt road maintained fairly regularly, watered, flexing slightly
Load Time (min)	0.85	(CPH 48: 24-17) 0.6 to 1.1
Maneuver & Spread Time (min)	0.65	(CPH 48: 24-17) 0.6 to 0.7
Push Cycle Time (min)	0.10 Boost Time 1.19 return time (140% of scraper load time) 0.15 maneuver time	(CPH 48: 28-10)
Speed (mph)	33	(CPH 48: 24-4)
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency

Parameter	Value	Comment/Reference
Excavator (319D L)		
Work Hour (min/hr)	50	(CPH 48: 19-55) Job efficiency
Heaped Capacity (cy)	1	EquipmentWatch spec
Sheepsfoot Roller Length (ft)	3	Estimated
Maximum Reach at Ground Level (in)	380	EquipmentWatch spec
Swing Time (Loaded) (min)	0.09	(CPH 48: 7-247)
Swing Time (Empty) (min)	0.07	(CPH 48: 7-247)
Deere 7430 (and Finn B260 Mulcher, MSR-189H Ripper)		
Operating Width (ft)	12	Assigned based on typical width of revegetation equipment/implements
Speed (mph)	3	Assigned as average speed of tractor pulling revegetation equipment/implements
Work Hour (min/hr)	50	Assigned for consistency with other earthwork operations

CPH = Caterpillar Performance Handbook (Multiple Editions)
(1) The swell and operator factors used are consistent with factors presented to MMD and NMED in meetings with Tyrone on June 11, 2012, November 2, 2012, and a letter to MMD and NMED from Tyrone dated September 5, 2012 (Freeport-McMoRan Copper & Gold, 2012). Furthermore, these were agreed to in discussions on Chino expansion projects.
(2) Performance information for the CAT 5230B FS is used for parameters unavailable for the Hitachi EX3600-5.
(3) Performance information for the CAT 789D is used for parameters unavailable for the Komatsu 730E.

3.0 CALCULATIONS

This section describes the elements included in estimating the earthwork reclamation costs for the Little Rock Mine, utilizing the data and assumptions discussed in Section 2.0. Key equations and calculations that will be used for the cost estimate calculations are presented in Appendix B. Design parameters, assumptions, and other information are also provided within the spreadsheet to support the cost estimation. The steps to complete the earthwork RCE are as follows:

1. Project the effort required to perform each of the various reclamation activities (i.e., material quantities, distances, slopes, equipment choices, work type).
2. Based on construction industry information and labor and fuel costs, estimate the unit cost of each reclamation activity.
3. Multiply the corresponding quantities by the unit costs to calculate the sub-total cost for each reclamation activity and sum for a total.
4. Multiply the indirect percentage rate to the total to complete the cost estimate.

Overall, the cost estimating process follows the typical, standard approach used in the engineering and construction industries. The earthwork cost estimate is an iterative process based on the required loading and hauling operations and haul distance. Telesto utilizes the unit costs associated with equipment in the fleet to calculate the total reclamation cost utilizing the spreadsheets. Figure 1 summarizes the costing steps used for one piece of equipment in developing the fleet.

The main reclamation activities for the earthwork RCE are discussed in this section for stockpiles, open pits, and other miscellaneous costs. Key reclamation activities for each facility are shown in Table 3.

The cost estimates for the following sections will be included in standalone calculation sheets that will be submitted when the Scope of Work is approved.

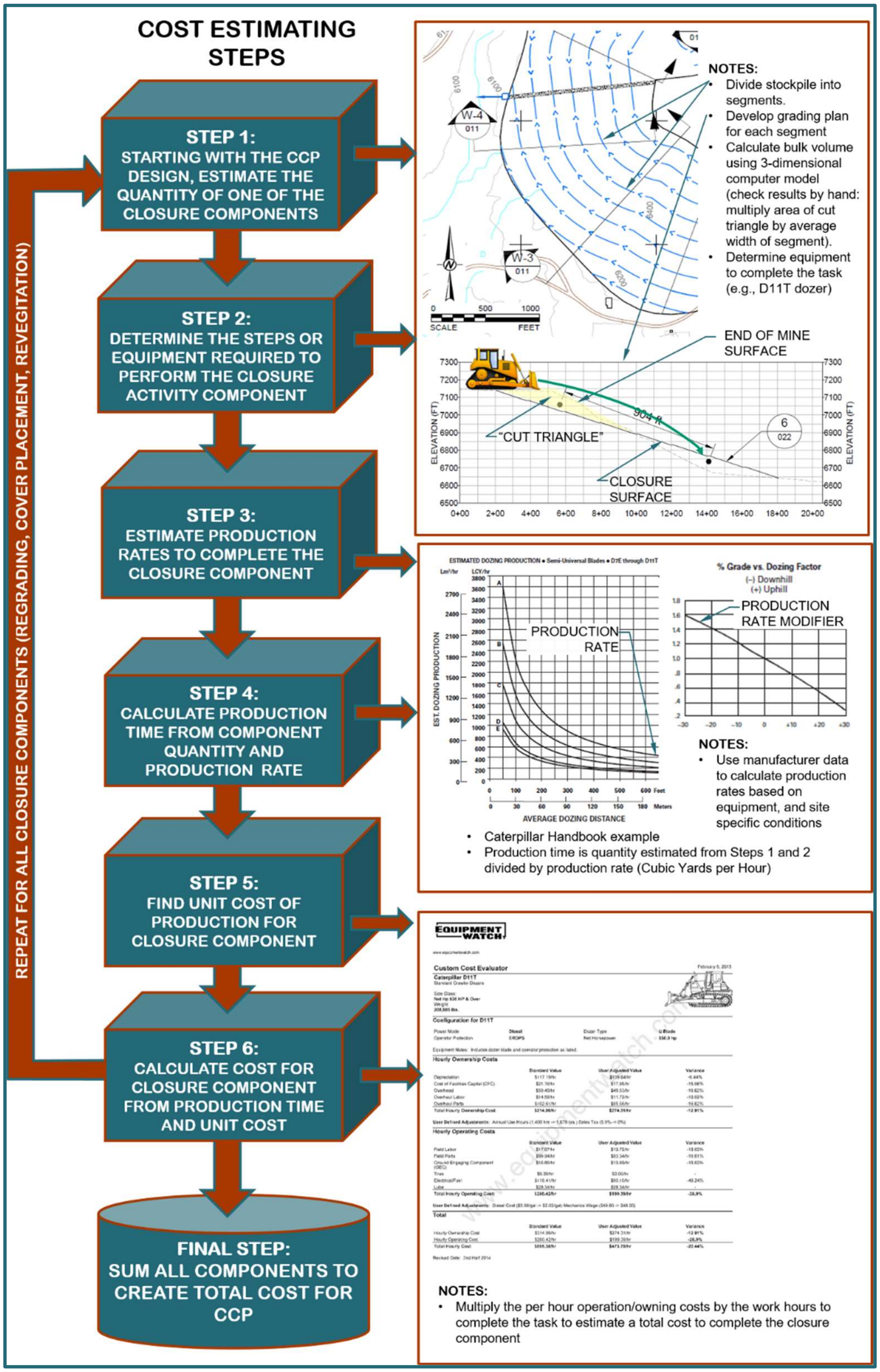

Figure 1 Earthwork Cost Estimating Process

Table 3 Reclamation Activity by Facility

Facility	Scraper Operations	Rip	Regrade 3.5:1	Cover Placement [1]	Channels	Downdrains	Revegetation	Well Replacement [2]	Fencing/Berms [3]	O&M	Demolition
West In-Pit Waste											
Top		X		X			X			X	
Outslope			X	X	X	X	X			X	
East In-Pit Waste											
Top		X		X			X			X	
Outslope				X			X			X	
CLW Waste									X		
Top		X		X			X			X	
Outslope			X	X	X	X	X			X	
NRW Waste									X		
Top		X		X			X			X	
NW Outslope			X	X	X	X	X			X	
SE Outslope			X	X	X	X	X			X	
Little Rock Open Pit[4]		X					X		X	X	
Southern Haul Road and Little Rock Haul Road		X					X		X	X	
Monitoring wells and exploration drill holes								X			X
Substation, concrete slabs, and powerlines		X		X			X			X	X
Other roads and pipeline corridors		X					X			X	
Northern Haul Road							X		X	X	
West Canyon Stockpile and North Stockpile										X	
P-Plant		X		X			X			X	
Allowance for Other Disturbed Areas		X		X			X			X	
Deadman Diversion[5]	X										
East In-Pit Fill Material	X										
Northern Haul Road Fill material[6]	X						X				
Deadman Diversion Outslope			X	X	X	X	X			X	

[1] Cover placement at 4-inch thickness on 10% of area to be revegetated
[2] Also includes Plug and Abandon Well activity
[3] Livestock fencing will be constructed around CLW Waste and NRW Waste
[4] Accessible open pit flat areas are defined as open pit haul road driving surfaces and flat areas at least 50-feet from a highwall
[5] Deadman Diversion will be constructed at approximately 4% grade.
[6] Includes partial removal of the Northern Haul Road.

The primary design elements for the cost estimate for areas to be closed include the following:

- **Regrading/Grading**: Slopes are regraded to an overall outslope gradient of 3.5H:1V with inter-bench slope lengths of 200 ft and 3H:1V interbench slopes. Grading is done in a manner to ensure positive drainage.
- **Channel Construction:** Bench and other channels are constructed with 5-foot base width and 3:1 (inner) and 2.5:1 (outer) side slopes, 2.0% maximum cross-bench slope, and 2.0% longitudinal bench slope; cover material is placed at 3-ft thickness; and filter material and riprap are placed for erosion control.
- **Downdrain Construction:** Downdrains utilize ACBs and dissipators, when needed, for erosion protection.
- **Cover**: A cover thickness of 4 inches is used on 10% of stockpile areas to be revegetated, originating from the CLW Waste. A cover thickness of 36 inches is used if materials from the demolition of the facilities are buried in place.
- **Cover Placement:** Trucks and loaders or hydraulic shovels with dozer assist perform all cover loading and distribution. The economic optimum number of trucks per loader or hydraulic shovel is used for each haul route.
- **Scraper Operations**: Scrapers with dozer assist will be used to move fill material from Northern Haul Road, Spanning Arch Culvert (Southern Haul Road material), and the East In-Pit Waste for construction of the Deadman Diversion.
- **Revegetation and Scarification:** Scarifying of the final surface is performed at the same time as the revegetation and is included in the revegetation cost.
- **Exploration Hole and Monitoring Well Abandonment:** For FA purposes it is assumed five monitoring wells will need to be replaced during reclamation. Nine monitoring wells will be abandoned after 30 years of post-reclamation sampling. Plugging exploration holes are also included in the estimate and described in Section 3.3.1.
- **Haul Road Reclamation:** Rip and revegetate haul road areas to be reclaimed. It is not anticipated that any haul roads will be located on acid-generating material.
- **Fencing Installation:** Livestock fencing will be constructed around the revegetated haul roads outside the open pit, CLW Waste, and NRW Waste

to exclude livestock while vegetation is becoming established. Livestock fencing consists of a 4-strand wire fence for protection of revegetation areas after seeding. A combination of 6-foot chain link fence and berms will be located along the Little Rock open pit boundary. Revegetation is included for an approximate 25-foot wide disturbance area to construct chain link fencing and 100-ft wide disturbance area for berm construction.

3.1 Stockpiles

Stockpile surfaces targeted for reclamation under this plan include all outslopes and top surfaces of waste stockpiles. The conceptual designs presented in the CCP for the stockpiles are based on an overall outslope gradient of 3.5H:1V, 5-foot base width bench channels with 3:1 side slopes, and 200-foot inter-bench slope lengths to allow for flexibility in the final design of the terrace benches and associated surface water conveyance channels. With these designs, the inter-bench slope is 3H:1V.

The waste stockpiles consist of Pre-Cambrian Granite. These overburden materials are non-acid generating and have few apparent limitations as a plant growth media when compared to the native soils. Tyrone is currently monitoring Pre-Cambrian test plots and believes the results of the studies will provide additional information on the adequacy of this material.

Currently, Tyrone and State agencies have agreed that these facilities do not require three feet of cover. Instead, based on Tyrone's experience on a reclamation test project, it is anticipated that less than 10% of the surface will likely not yield an adequate seed bed and may require some additional fine material be placed and spread on the surface. By agency request, the cost estimate will include the cost for hauling and placing additional fine-grained cover, from a local source (for FA purposes, it is assumed CLW Waste), on the waste stockpiles to enhance the seed bed in potential rocky areas. This includes 4-inches of additional cover thickness over 10% of operational in-pit stockpile. Trucks and loaders or hydraulic shovels with dozer assist perform all cover loading and distribution. The economic optimum number of trucks per loader or hydraulic shovel is used for each haul route.

See Table 3, for a list of activities that will occur in closing the waste stockpiles. Note that the East In-Pit Waste includes regrading of the SW outslope area above the final pit lake elevation to a 3.5:1 slope. The area below the final pit lake elevation will not be reclaimed, except at the Deadman Diversion.

3.2 Haul Roads

Existing haul roads will be reduced to 30' width to allow one-lane use for maintenance activities. Reclamation activities will include ripping and revegetating. It is not anticipated that any haul roads will be located on acid-generating material

Fill from the Northern Haul Road area is removed at closure and utilized to construct the Deadman Diversion. The remaining haul road area will be inaccessible by heavy equipment and will be reclaimed by seeding by manual application.

3.3 Infrastructure and Other Miscellaneous Facilities

This category includes miscellaneous estimated closure costs such as abandonment of exploration holes and wells, demolition, and unplanned disturbed areas. A brief discussion also summarizes an evaluation of potential overlap between the Tyrone Mine earthwork CCP/RCE and this Little Rock Mine earthwork CCP/RCE.

3.3.1 Exploration Holes and Monitoring Wells

All historic exploration holes were abandoned or mined out in first quarter 2010 (Tyrone, 2011). All exploration holes drilled since the first quarter of 2010 were closed immediately. However, for greater flexibility in meeting the mine planning schedule and reduce the number of FA amendments, Tyrone has included costs for plugging and abandoning ten exploration drill holes outside the open pit boundary.

Nine monitoring wells will be abandoned after 30 years of post-reclamation sampling and five wells located within regraded stockpile footprints will be replaced during closure.

Exploration hole plugging and well abandonment unit costs estimates will be based on MMD guidance for abandoning wet drill holes.

3.3.2 Demolition

Utilities serving structures to be demolished and remaining concrete slabs are included in the estimate for demolition and include:

- 46 kilovolt powerline
- Substation
- Pipelines
- Concrete slabs

Power transmission lines and substation will be removed once they are not needed for post-closure purposes. Power poles will be left in place to serve as raptor perches after reclamation. Powerline corridors will be revegetated as needed.

Pipeline demolition includes removal of residual sediments from pipelines and disposal of materials at an approved location, removal or burial of pipelines, covering impacted areas with 36 inches of cover material, and revegetation of disturbed areas.

Concrete slab demolition includes breaking up and burying the concrete in-place, covering areas with 36 inches of cover material, and revegetation of disturbed areas.

3.3.3 Other Roads and Pipeline Corridors

The existing Deadman Spanning Arch Culvert will exist EOY 2024. Reclamation costs assume the spanning arch culvert will be demolished during the construction of the Deadman Canyon Diversion at closure. Reclamation quantities were estimated from the existing spanning arch culvert as-builts, completed September 15, 2011. Earth fill associated with the Spanning Arch Culvert will be excavated and used to construct the Deadman Diversion. Concrete and metal debris will be hauled to the operational in-pit stockpile and buried.

Other access roads not listed under Section 3.2, will be reclaimed by ripping, constructing berms where required for safety reasons, and revegetating. Costs will also be included for O&M activities. See Table 3.

As of June 2020, there are 2 seepage collection systems located at CLS Leach and they will be left in place.

After 30 years of O&M, pipeline corridors will be ripped and revegetated.

3.3.4 Little Rock Open Pit

Accessible open pit flat areas, above the anticipated EOY 2024 open pit lake elevation of 5,669 ft. will be ripped to a depth of 18 to 24 inches and revegetated. For the purposes of this cost estimate, accessible open pit flat areas are defined as flat areas located 50-feet or greater from a highwall.

A combination of 6-foot chain link fence and earthen berms will be located along the Little Rock open pit boundary, approximately 40 feet from the open pit highwalls to limit public access. Signs will be posted on fencing at 500-foot intervals. Revegetation is included for an approximate 25-foot wide disturbance area to construct chain link fencing and 100-ft wide disturbance area for berm construction.

See Table 3, for a list of activities that will occur in closing the Little Rock Open Pit.

3.3.5 West Canyon Stockpile, North Stockpile, and Precipitation Plant (P-Plant)

The West Canyon Stockpile and North Stockpile are naturally revegetated and additional reclamation activities will not disturb the established vegetation (EOY 2024). Reclamation costs for West Canyon Stockpile and North Stockpile will be included for 2 years of vegetation maintenance.

The P-Plant was reclaimed in 2010 and revegetated in August, 2010. On June 20, 2011 partial financial assurance was released. In a letter from Tyrone dated January 15, 2013, release of the remaining financial assurance was requested with the exception of the vegetation and erosion control monitoring. MMD assigned modification number 13-1 to Permit No. GR007RE for this request. For FA purposes, it is assumed that the P-Plant will be disturbed in the 5-year mine plan. See Table 3, for a list of activities that will occur in closing the P-Plant.

3.3.6 Allowance for Other Disturbed Areas

Tyrone will include costs in the CCP earthwork cost estimate to account for the dynamic nature of mining. This approach is intended to allow for greater flexibility in meeting the mine planning schedule and reduce the number of FA amendments. Unplanned disturbed areas may include but limited to small staging areas, utility corridors, haul roads, pull-offs, stockpile expansions, or other miscellaneous unforeseen changes in the mine plan. See Table 3, for a list of activities that will occur in closing the unplanned disturbed areas for an additional 10 acres.

3.4 Deadman Canyon

At closure, Tyrone will use scrapers to remove the material from Northern Haul Road and place it in the Deadman Diversion to re-establish Deadman Canyon. The fill material beneath the diversion (approximately 1/3 of total fill volume) will be placed in lifts and compacted to 90% proctor using a water truck. The remaining fill will be end dumped. For FA purposes, it is assumed that the fill to build Deadman Diversion, will come from the Northern Haul Road, Spanning Arch Culvert (Southern Haul Road material), and the East In-Pit Waste.

The diversion will be constructed as follows (see Table 3):

- 6” compacted fine grade subgrade (90% proctor) mixed with clay material
- Non-woven geotextile filter fabric
- 6” crushed gravel base course
- Geogrid
- ACBs

3.5 Little Rock Permit Boundary Overlap Area

Reclamation coverage in the RCE will be evaluated relative to the reclamation covered in the proposed Little Rock Design Limit and MMD Permit Boundary. If reclamation activities are included in the overlap area of the two permit boundaries, the activities will be included in the Little Rock RCE.

3.6 Operations and Maintenance

O&M costs related to periodic erosion control, road maintenance, and vegetation maintenance will be included in a standalone calculation sheet that will be submitted when the Scope of Work is approved.

Little Rock Mine reclamation costs assume O&M begin Year 1 and include 12 years of vegetation maintenance, 12 years of erosion control, 30 years of water quality monitoring and reporting, and 30 years of road maintenance.

Erosion Control and Monitoring: Little Rock Mine annual erosion control and monitoring cost estimates are based on an erosion control crew engaged for 10 days per year for the first year and then 4 days per year for an additional 11 years for a total of 12 years of monitoring.

Water Quality Monitoring and Reporting: Sampling will be conducted quarterly the first 2 years after reclamation, semi-annual for the next 8 years, and yearly for the remaining 20 years, for a total of 44 sampling events over 30 post-closure years.

- Nine post-closure monitoring wells remain by EOY 2024 (monitoring wells are plugged after 30 years of post-reclamation sampling as described in Section 3.3).
- It is assumed that open pit water will be present and sampled at one location.
- It is assumed that monitoring wells, 1x1 Lined Pond, and Little Rock pit bottom are dry two quarters a year
- Four surface water samplers will be checked quarterly and are assumed to be dry two quarters a year

In summary, water quality monitoring and reporting for a 30-year period includes nine groundwater monitoring wells, two seepage collection systems, four surface water samplers, Little Rock Open Pit, Sugar Loaf Spring, and McCain Spring. Pit water elevation and precipitation data will also be collected at the same time as water quality sampling.

Road Maintenance: Road maintenance costs for post-reclamation years 13 through 30 is included for the nine monitoring wells and the powerline access road. Road maintenance consists of a motor grader engaged for 12 hours prior to each sampling event annually. Road maintenance for post-reclamation years 1 through 12 is covered by erosion control and monitoring costs.

Vegetation Maintenance: Vegetation maintenance of reclaimed areas assumes a 2% failure every year for a total of 12 years, starting the year reclamation is completed. Vegetation maintenance accounts for the number of years that have already passed since reclamation was completed for items that have already been reclaimed.

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APPENDICES

Appendix A

Engineering Take-Offs/ Quantities

Stockpiles - Dozer Regrade

Stockpile	Volume (CY)	Average Push Distance (ft)
CLW Waste	382165	116.6
NRW - NW	673989	514.7
NRW - SE	26096	106.8
West In-Pit	1683940	538.9
Northern Haul Road	1032816	414.0
Deadman Diversion	47432	20.0

Stockpiles - Cut and Relocate

Stockpile	Volume (CY)	Haul to	Segment 1 Distance (ft)	Segment 1 Average Grade (%)	Segment 2 Distance (ft)	Segment 2 Average Grade (%)	Segment 3 Distance (ft)	Segment 3 Average Grade (%)
Northern Haul Road	1032816	Deadman Diversion	390	10.15%	346	-11.51%	-	-
Deadman Diversion	16900	Deadman Diversion	329	-20.04%	-	-	-	-
East In-Pit	413536	Deadman Diversion	325	15.12%	329	0.00%	110	15.81%

Cover Material

Stockpile	Volume (CY)	Haul to
CLW Waste	8554	CLW, NRW, West In-Pit, East In-Pit

Stockpiles - Cover

Stockpile	2D Area (sf)	Volume (CY)	Haul From	Segment 1 Distance (ft)	Segment 1 Average Grade (%)	Segment 2 Distance (ft)	Segment 2 Average Grade (%)	Segment 3 Distance (ft)	Segment 3 Average Grade (%)
CLW Waste	1679186	2073	CLW	406	20.31%	-	-	-	-
NRW	2240486	2766	CLW	3498	-7.49%	1443	2.10%	-	-
West In-Pit	2144516	2648	CLW	1396	-9.19%	-	-	-	-
East In-Pit	432669	534	CLW	4939	-8.94%	3259	1.87%	791	-20.37%
Deadman Diversion	432286	534	CLW	4939	-8.92%	3259	1.84%	791	-20.37%

Stockpiles - Top Areas

Stockpile	2D Area (sf)
CLW Waste	123484
NRW	757189
West In-Pit	27358
East In-Pit	344445

Stockpiles - Stormwater Management

Stockpile	Bench Channels (ft)	Downdrains (ft)	Energy Dissipator (ea)
CLW Waste	8569	868	2
NRW	6602	1215	1
West In-Pit	10627	1487	0
East In-Pit	0	0	0
Deadman Diversion	2232	798	0

Flat Revegetation Areas In-Between Facilty Closures

Facility	2D Area (sf)
All Areas	1929798
P-Plant	51462

Appendix B

Equations used in Cost Spreadsheet

EQUATIONS USED IN CAPITAL COST SPREADSHEET

Sheet #4 Earthwork:

Bank Volume (bcy)= Loose Volume(cy)/(1+Swell Factor)

*Loose Volume (lcy)= Area (ac)*Cover Depth (in)*43560 (ft^2/ac)/(12 (in/ft)*27 (cy/ft^3))*

*** Swell Factor only applies to the cover material volume calculations*

Sheet #5 Dozer (Grading):

Productivity Example for D11T CD:

*Normal productivity (cy/hr) = 162,758.76 * Centroid to Centroid Push Distance$(ft)^{-0.866691}$*

(Caterpillar Performance Handbook Edition 47 page 19-51)

$$Productivity\ (cy/hr) = Normal\ Production\ (cy/hr) * Operator * Material * \frac{Work\ Hour\ (min/hr)}{60\ (min/hr)} * Grade\ Factor * \frac{2300\ (lbs/cy)}{Material\ Weight\ (lbs/cy)} * Prod.\ Method * Visibility * Elev. * Drive\ Trans.$$

$$Productivity\ (ac/hr) = Effective\ Blade\ Width\ (ft) * Speed\ \left(\frac{miles}{hr}\right) * 5{,}280\,\frac{ft}{mile} * \frac{ac}{43{,}560\ sq\ ft} * Operator * Material * \frac{Work\ Hour\ (min/hr)}{60\ (min/hr)} * Grade\ Factor * \frac{2300\ (lbs/cy)}{Material\ Weight\ (lbs/cy)} * Prod.\ Method * Visibility * Elev. * Drive\ Trans.$$

$$Total\ Task\ Time\ (hr) = \frac{Loose\ or\ Stockpile\ Volume\ (cy)}{\text{Productivity}\ (cy/hr)}$$

$$Grade\ (Dozing\ Factor) = -0.02 * Grade\ (\%) + 1$$

$$(Caterpillar\ Performance\ Handbook\ Edition\ 48\ page\ 19-55)$$

Sheet #7 Ripper:

$$\text{Productivity } (acres/hr) = \frac{Work\ Hour\ (min/hr)}{\left[\left(\frac{Ripping\ Length\ (ft)}{5280(ft/mi) * \frac{Speed\ (mi/hr)}{60\ (min/hr)}}\right) + Turn\ Time\ (min/pass)\right] * Passes/Acre^{*}}$$

$$Task\ Time\ (hr) = \frac{Area\ (acres)}{\text{Productivity } (acres/hr)}$$

$$Passes/Acre^{*} = \frac{43560\ (ft^2/acre)}{Ripping\ Length\ (ft) * Ripped\ Width\ Plus\ Distance\ b/n\ Passes\ (ft)}$$

**Passes are 1000 ft for large surface areas and 100 ft for reservoirs*

$$Ripped\ Width\ Plus\ Distance\ b/n\ Passes\ (ft) = ((Pocket\ Spacing\ (in) + Distance\ Between\ Passes\ (in)) * No.Shank\ Pockets)/(12(in/ft))$$

Sheet #8 Excavator:

$$Task\ Time\ (hr) = (Cycle\ Time\ (min))/(60(min/hr)) * (Area\ (ac) * 0.5 * 43560(ft^2/ac))/(Sheepsfoot\ Roller\ Width\ (ft) * Maximum\ Reach\ (ft))$$

Sheet #9 Trucks:

$$Truck\ Cycle\ Time\ (min) = Haul\ Time\ (min) + \text{Return } Time\ (min) + Loading\ Time\ (min) + Truck\ Exchange\ Time\ (min) + Dump/Maneuver\ Time\ (min)$$

$$\text{Productivity } (cy/hr) = Work\ Hour\ (min/hr) * Loader/Shovel\ Cycles\ Per\ Truck * Loader/Shovel\ Net\ Bucket\ Cap\ (cy) * \frac{Optimum\ Number\ of\ Trucks}{Truck\ Cycle\ Time\ (min)}$$

$$Task\ Time\ (hr) = Maximum\ \left[\frac{Volume\ (cy)}{\text{Productivity } (cy/hr)}, Loader\ Task\ Time\ (hr)\right]$$

$$Loader/\ Shovel\ Cycles\ Per\ Truck$$

$$= Maximum\ \left[\frac{Truck\ Struck\ Capacity\ (cy)}{Loader/Shovel\ Net\ Bucket\ Capacity\ (cy)}, \frac{Truck\ Heaped\ Capacity\ (cy)}{Loader/Shovel\ Net\ Bucket\ Capacity\ (cy)}\right]$$

$$Total\ Haul\ \text{Distance}\ (ft) = \sum Segment\ Haul\ \text{Distance}\ (ft)$$

$$Haul\ \text{Distance}\ Segment\ (m) = Haul\ \text{Distance}\ (ft) * 0.3048\ \left(\frac{m}{ft}\right)$$

$$Haul\ Effective\ Grade\ (\%) = If(Haul\ Grade\ (\%) \geq$$

$$Rolling\ Resistance\ (\%), \big(Haul\ Grade\ (\%) +$$

$$Rolling Resistance\ (\%)\big), Absolute\ Value(Haul\ Grade\ (\%) + Rolling Resistance\ (\%))$$

$$\text{Return}\ Effective\ Grade\ (\%) = If(-Haul\ Grade\ (\%) \geq$$

$$Rolling\ Resistance\ (\%), \big(-Haul\ Grade\ (\%) +$$

$$Rolling Resistance\ (\%)\big), Absolute\ Value(-Haul\ Grade\ (\%) + Rolling Resistance\ (\%))$$

Travel Time Loaded and Empty (Uphill) Example for 777F:

$$777F\ Segment\ Travel\ Time\ Loaded\ Uphill\ (min/\ m) =$$

$$6.43 * Haul\ Effective\ Grade\ Segment\ (\%)\ ^4$$

$$-\ 3.2933 * Haul\ Effective\ Grade\ Segment\ (\%)\ ^3$$

$$+\ 0.6548 * Haul\ Effective\ Grade\ Segement\ (\%)\ ^2$$

$$-\ 0.005 * Haul\ Effective\ Grade\ Segment\ (\%) + 0.0009$$

$$777F\ Segment\ Travel\ Time\ Empty\ Uphill\ (min/\ m) =$$

$$-\ 0.0197 * \text{Return}\ Effective\ Grade\ Segment\ (\%)\ ^4$$

$$+\ 0.0276 * \text{Return}\ Effective\ Grade\ Segment\ (\%)\ ^3$$

$$+\ 0.011 * \text{Return}\ Effective\ Grade\ Segement\ (\%)^2$$

$$+\ 0.0008 * \text{Return}\ Effective\ Grade\ Segement\ (\%) + 2.147$$

$$(Caterpillar\ Performance\ Handbook\ Edition\ 41\ page\ 9 - 39)$$

$$This\ is\ repeated\ for\ loaded\ and\ empty\ downhill\ travel\ times$$

$$Haul\ Time\ (min)$$

$$= \sum (Segment\ Travel\ Time\ Loaded\ (min/\ m)$$

$$*\ Segment\ Haul\ Dist\ (m))$$

Return $Time\ (min)$

$$= \sum (Segment\ Travel\ Time\ Empty\ (min/m) * Segment\ Haul\ Dist\ (m))$$

$$Loading\ Time\ (min) = Loader/Shovel\ Cycle\ Time\ (min)$$

Sheet #10 Loader or Shovel:

$$Net\ Bucket\ Capacity\ (cy) = Struck\ (Rated)\ Bucket\ Capacity\ (cy) * Bucket\ Fill\ Factor$$

$$\text{Productivity}\ (cy/hr) = \frac{Net\ Bucket\ Capcity\ (cy) * Work\ Hour\ (min/hr)}{Loader/Shovel\ Cycle\ Time\ (min)}$$

$$Task\ Time\ (hr) = \frac{Volume\ (cy)}{\text{Productivity}\ (cy/hr)}$$

Sheet #12 M'grader

$$\boldsymbol{Grader\ Shaping\ Productivity\ (acre/hr) = WorkHour(min/hr)/(60\ (min/hr)) * MaterialFactor * ((2300\ (lb/cy))/MaterialWeight(lb/cy)) * ProductionMethod, Blade * OperatorFactor * GradeFactor * Speed\ (mph) * (Eff. Blade\ Width(ft) - Pass\ Overlap(ft)) * 5280(ft/mi)/43560(ft\hat{}2/ac)}$$

(Motor Grader Productivity, Caterpillar Performance Handbook Edition 48)

$$Task\ Time(hr) = Area(acre)/(GradingShapingProductivity(acre/hr))$$

$$Grade\ Factor = -0.02 * \%\ Final\ Grade + 1$$

Sheet #13 Earth Sum:

$$Direct\ Equipment\ Cost\ (\$) = [Lube, Tires, GEC, \&\ Field\ Parts\ Adjusted\ Rental\ Cost \left(\frac{\$}{hr}\right) + Labor\ Cost\ \left(\frac{\$}{hr}\right) + Field\ Cost\ \left(\frac{\$}{hr}\right)] * TimeRequired\ (hr) * Number\ of\ Units\ of\ Equipment$$

Sheet #14 Revegetation:

$$Direct\ Fuel\ Cost\ (\$) = Fuel\ Unit\ Cost(\$/acre) * Area(acre)$$

$$Direct\ Reveg.Cost\ (\$) = Reveg.Unit\ Cost(\$/acre) * Area(acre)$$

Sheet #15 Other:

$$Fuel\ Direct\ Cost\ (\$/units) = Quantity\ (units) * Fuel\ Unit\ Cost(\$/unit)$$

$$Direct\ Cost(\$) = Quantity\ (units) *\ Unit\ Cost(\$/unit)$$

Sheet #16 Sum:

$$\begin{aligned}\boldsymbol{Subtotal\ Direct\ Costs}\ (\$) \\ &= \boldsymbol{Facility\ and\ Structure\ Removal\ Total\ Direct\ Cost}\ (\$) \\ &+ \boldsymbol{Earthmoving\ Total\ Direct\ Cost}\ (\$) \\ &+ \boldsymbol{Reveg.Total\ Direct\ Cost}\ (\$) + \boldsymbol{Other\ Total\ Direct\ Cost}\ (\$)\end{aligned}$$

$$\boldsymbol{Subtotal\ Indirect\ Costs}(\$) = \boldsymbol{SubTotal\ Direct\ Cost}\ (\$) * \frac{\boldsymbol{Indirect\ Costs}\ (\%)}{\boldsymbol{100}}$$

$$\boldsymbol{Total\ Cost}\ (\$) = \boldsymbol{Subtotal\ Direct\ Cost}\ (\$) + \boldsymbol{Subtotal\ Indirect\ Cost}\ (\$)$$

Sheet #18 Truck Optimization:

$$Loader/Shovel\ Time\ Per\ Truck = (Loader/Shovel\ Cycles\ per\ Truck) * (Loader/Shovel\ Cycle\ Time)$$

$$Maximum\ Number\ of\ Trucks\ Per\ Loader/Shovel = (Truck\ Cycle\ Time\ Per\ Truck)/(Loader/Shovel\ Time\ per\ Truck)$$

$$\text{Productivity}\ (cy/hr) = Work\ Hour\ (min/hr) * Loader/Shovel\ Cycles\ Per\ Truck * Loader/Shovel\ Net\ Bucket\ Capacity\ (cy) * \frac{Number\ of\ Trucks[n]}{Truck\ Cycle\ Time\ (min)}$$

$$Task\ Time\ (hr) = (Haul\ Volume(cy))/Productivity(cy/hr)$$

$$Cost\ of\ [n]\ Trucks\ per\ Loader\ (\$) = MAX(Truck\ Task\ Time, Loader\ Task\ Time) * (Loader\ Cost\ (\$/hr) + [n] * Truck\ Cost\ (\$/hr))$$

Appendix C

Indirect Costs

State of New Mexico
ENERGY, MINERALS and NATURAL RESOURCES DEPARTMENT
and the
ENVIRONMENT DEPARTMENT

Michelle Lujan Grisham
Governor

Howie Morales
Lieutenant Governor

Sarah Cottrell Propst
Cabinet Secretary Designate, EMNRD

James Kenney
Cabinet Secretary Designate, NMED

7008 0500 0001 4875 1648

Certified Mail

January 16, 2019

Sherry Burt-Kested, Manager
Environmental Services
Freport-McMoRan Chion Mines Company
P.O. Box 10
Bayard, NM 88023

Re: Approval of Cost Estimate Resolutions (Agreement) and Request for Schedule

Dear Ms. Burt-Kested,

The New Mexico Mining and Minerals Division of the Energy, Minerals and Natural Resources Department (MMD-EMNRD), and the Mining Environmental Compliance Section (MECS) of the New Mexico Environment Department (MECS-NMED) (collectively, the Agencies) received a letter with tabulated cost estimate resolutions (Agreement) dated January 11, 2019, from Freeport McMoRan New Mexico Operations (FMNO). As noted in your letter, the Financial Assurance (FA) work group included representatives of the Agencies, FMNO, and the Gila Resources Information Project (GRIP). Over the course of multiple meetings and teleconferences, the FA work group developed the Agreement in 2018. The Agencies hereby approve the Agreement for the formulation of cost estimates for closure/closeout plans at the Continental, Little Rock, Tyrone and Chino Mines.

Since the FA work group reached agreement, the Agencies concur this precludes the need for a third party review of cost estimates that had been conditionally required by condition 8.N.7 of MMD Permit No. GR002RE Revision 15-2, and C113.E of NMED Draft DP-1403. FMNO must submit an updated cost estimate by April 3, 2019, in order to fulfill Continental permit condition 8.N.6 of MMD Permit No. GR002RE Revision 15-2, which is similar to condition C113.D of NMED Draft DP-1403.

In your letter, FMNO proposed a timeline for the Continental, Chino, and Tyrone mines for the submittal of updated cost estimates. To ensure efficient use of limited resources, the Agencies request FMNO submit a more detailed schedule that provides greater specificity of when the cost estimates and any other major milestones will be completed. The schedule should provide managers and permit leads a best estimate of key FMNO submittals. With FMNO cooperation, the Agencies anticipate completion of reviews and approvals of cost estimates and associated changes to FA instruments before the end of 2019.

The Agencies acknowledge the successful resolution of multiple cost estimate issues. We appreciate that the FA work group reached agreement through extra effort by FMNO, GRIP, and the Agencies. This Agreement reduces much of the uncertainty associated with FMNO cost estimation and the Agencies' review process. Going forward, the Agencies believe the Agreement ensures timely updates of closure/closeout cost estimates that maintain adequate FA to the mutual benefit of all parties.

If you have any questions, please do not hesitate to contact us or the respective permit leads at MMD and NMED for Continental, Tyrone, Little Rock, and Chino Mines.

Sincerely,

Holland Shepherd
Program Manager
Mining Act Reclamation Program
Mining and Minerals Division-EMNRD
505-476-3437

Kurt Vollbrecht
Program Manager
Mining Environmental Compliance Section
New Mexico Environment Department
505-827-0195

cc: Allyson Siwik, Executive Director, GRIP
MMD mine permit files GR002RE, GR007RE, GR009RE and GR010RE.
NMED discharge permit files DP-1236, 1340, DP-1341 and DP-1403.

Table 1 Summary of Cost Estimate Resolutions

Issue Item	Resolution
Equipment Unit Cost Source and Removal of Indirect Cost Items from EquipmentWatch Ownership Values	Equipment costs determined in the following order sourced from EquipmentWatch: • Unmodified EquipmentWatch Average Rental Rate for Southern New Mexico • Unmodified EquipmentWatch Average Rental Rate for New Mexico • Unmodified Blue Book Rental Rate • If equipment is not listed in EquipmentWatch, then another piece of equipment must be used • Minimum listed rates will not be used • EquipmentWatch Average Rental Rates will be used without adjustment for duplicative indirect cost components
Revegetation	Revegetation steps costed in similar manner to other earthworks
Demolition Costs	Freeport will add 20% for buildings with large equipment (e.g., mills, SX, crusher)
Direct "Commodity" Costs / Quotes	It is fine to use quotes, but the quotes must be for the specifications and scope/scale of Freeport's default scenario (e.g., fuel to complete all Freeport New Mexico mine closures over a series of years). The following are specific examples discussed. • FNMO will compile a database of vendor quotes as they are developed for submittal to the agencies • Quotes will be used directly with no consideration to vendor's profit/overhead or other indirect costing items • Quotes will be used directly with no adjustment for duplicated indirect components
Fuel	Use historical quotes and correlate to public data for future cost estimates
Seed	Freeport quotes, specs and scope
Lime	Freeport quotes, specs and scope
Mulch	Freeport quotes, specs and scope
Articulated Concrete Blocks	Freeport quotes, specs and scope
Well Plugging/replacement	Freeport quotes, specs and scope
Geomembranes (e.g., stormwater pond replacement)	Use RS Means published data
Power	Published rates for area, scope considered
State Labor Rates	Use prevailing wage as published by NMDOLA, which includes fringe benefits
Indirect Rates	Negotiated total values (includes: mobilization and demobilization, contingencies, engineering redesign fees, contractor profit and overhead, project management, administrative expenses, bonding, state procurement costs, construction management, insurance, QA/QC, etc.)
All capital cost items	30%
All Operations and Maintenance cost items	17.5%

Items in black are reformatted from workgroup spreadsheet sent 11/19/2019 and subsequent negotiations

Items in red are from subsequent communications and added for clarity

APPENDIX D

LITTLE ROCK STOCKPILE STABILITY ANALYSIS FOR THE 2020 CLOSURE CLOSE-OUT PLAN UPDATE

Stockpile Stability Analysis for Little Rock 2020 Closure Close-Out Plan Update

Tyrone, New Mexico

Submitted to:

Mandy Lilla

Freeport McMoRan Tyrone Inc.
PO Drawer 571
Tyrone, New Mexico 88065

Submitted by:

Golder Associates Inc.

595 Double Eagle Court, Suite 1000
Reno, Nevada, USA 89521

+1 775 828-9604

20136957.R.002.Rev0

June 10, 2020

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1.0 INTRODUCTION

This report provides an assessment of the stability of the reclaimed configurations of waste rock stockpiles at Freeport McMoRan Tyrone Inc's (Tyrone's) Little Rock Mine in support of the 2020 Closure/Closeout Plan (CCP) Update. The site is located in Grant County, New Mexico, as shown in the attached Figure 1. The purpose of this report is to assess the stockpile stability in support of the Closure/Closeout Planning for the Little Rock Site.:

This report addresses only the new planned stockpile facilities at the Little Rock Mine that were not evaluated as part of the 2013 Tyrone CCP Update (Golder, 2020). The new stockpiles include the NRW Waste, CLW Waste, and the East In-Pit Waste. This report also addresses the Deadman Canyon Diversion. Stockpiles that were previously addressed in the 2013 Tyrone CCP Update were the West In-Pit Waste and the North In-Pit Waste.

The 2020 CCP Update is based on a recent evaluation of the five-year mining sequence (for this report it is assumed 2020 to 2024) determined that 2024 is the highest reclamation cost year. Use of the EOY 2024 mine plan is consistent with the snapshot in time philosophy that was adopted by Tyrone and the Agencies early in the closure planning process and represents the year with the greatest volume of regrading and cover placement required between 2020 and 2024. If mining activities were to cease during the 5-year mine plan, the highest reclamation cost scenario would be associated with the EOY 2024 conditions. Accordingly, the stability of the stockpiles was evaluated for their reclaimed configuration if mining ceased at the EOY 2024. The EOY 2024 stockpiles are shown on Figure 2 in their reclaimed configurations. The CLW Waste stockpile will be placed on the footprint of the pre-existing, reclaimed Copper Leach Stockpile that will be removed by the EOY 2020 prior to the CLW Waste stockpile placement.

2.0 APPROACH

The stability analyses apply methods consistent with the methods applied during previous assessments of the stability of the Tyrone and Little Rock stockpiles that was recently summarized in Appendix F of the 2013 Tyrone Mine CCP Update (Golder, 2020). The final reclaimed geometries of the stockpiles were provided by Tyrone. The geologic conditions were taken from the available mapping information which is based on the geologic map of the Wind Mountain quadrangle (Hedlund, 1978) and mapping by Tyrone geologists. Information on the groundwater levels is available from DP-1236 semiannual groundwater monitoring reports that are prepared by Daniel B. Stephens & Associates Inc. (DBS&A). The geotechnical engineering parameters for the geologic units are generally consistent with parameters that have been developed previously and summarized in the stockpile stability report contained within the 2013 Tyrone Mine CCP Update (Golder 2020) where similar geologic units are present. Additional characterizations were completed for units not previously encountered.

Previous assessments of the stability of the Tyrone stockpiles that addressed Condition 78 of DP-1341, included an evaluation of the changes in the stockpile strength parameters and long-term stability resulting from the natural weathering processes. Assessment of the long-term impacts of chemical weathering were addressed by the Supplemental Materials Characterization study prepared by EnviroGroup Limited (2005). Golder evaluated the impacts of weathering on the physical parameters of the stockpile materials by evaluating the trends in the grain size, Atterberg limits, and shear strength as functions of age, roughly translated as depth, in the stockpiles. This assessment of the effects weathering on the long-term strengths of the stockpiles is discussed in detail in the stockpile stability report contained within the 2013 Tyrone Mine CCP Update (Golder 2020). Golder has concluded that the soil matrix fraction of material weathered for long periods of time remains similar in character to the matrix fraction of the less weathered material but may become higher in proportion due to the physical breakdown of the rock fragments. Therefore, the laboratory derived shear strengths of samples that are scalped of the larger size rock fragments are considered to reflect the fully weathered long-term strengths of the stockpiles.

3.0 SITE CONDITIONS

3.1 Stockpile Descriptions

The stockpile crest elevations of the Little Rock Mine area stockpiles are generally between 5,700 and 6,315 feet (ft) and the stockpiles range in height between 140 to 380 feet from crest to toe. Stockpiles will be placed at angle-of-repose during operational phases with occasional setbacks resulting in overall slopes typically between 30° and 35°. The stockpiles are generally constructed by end dumping the materials in 30 to 50-foot lifts from the bottom up. The stockpiles will to be regraded upon closure to achieve overall 3.5 horizontal to 1 vertical (3.5H:1V) slopes to promote revegetation and provide long-term erosional stability.

The following stockpiles which are designated on Figure 2 comprise the Little Rock stockpile system addressed in this report. For naming consistency, only the current stockpile names are listed below.

- CLW Waste
- NRW Waste
- East In-Pit Waste (includes the Deadman Canyon Diversion)

Figure 1 illustrates the existing topography with the EOY 2024 reclamation plan designs overlain on the bedrock geology map.

3.2 Climate

The Little Rock area is in a semi-arid region with elevations ranging from about 5,800 to 6,300 feet above mean sea level (amsl). The climate is warm and dry with mean annual precipitation of about 16 inches and a mean annual temperature near 50° F (Golder, 2007). Precipitation falls mainly as rain, but snow may occur from November to March. Most precipitation falls during monsoon period from July through October in the form of short intense thunderstorms. About 60% of the precipitation falls during the monsoon. Annual evaporation greatly exceeds annual precipitation.

3.3 Geology

The geologic base map shown on Figure 2 prepared by Golder (2007) from the geologic map of the Wind Mountain quadrangle (Hedlund, 1978) supplemented with mapping by Tyrone geologists. The geologic setting of the Little Rock area is similar to that at the Tyrone Mine. The mineralization is in and around the Quartz Monzonite of Tyrone (Tqm) stock, a 53 to 57 million-year-old Paleocene quartz monzonite porphyry (DuHamel et al., 1995) emplaced into the Precambrian Burro Mountain Granite (p₵g). Tyrone geologists have subdivided a Tertiary Granodiorite unit (Tgd) that post-dates the Tqm and was not mapped by Hedlund (1978). Paleozoic strata that are present north and east of Silver City and Cretaceous units present elsewhere in the Burro Mountains are not present in the Little Rock Mine area. Miocene-Pliocene-Pleistocene fan, sheet flood deposits, and older fan deposits (Qfo/Qtg), which includes the Gila Conglomerate (also referred to locally as the Mangas Conglomerate) are in direct contact with the crystalline basement rocks.

Large scale structural features in the Little Rock Mine area is dominated by high angle to moderate dipping east-west to northwest striking faults and northwest striking dikes.

3.3.1 Lithology

The distribution of the lithologic units is shown on Figure 2. The bedrock units that are present below the Little Rock Mine stockpiles include the Precambrian-age Burro Mountain Granite (p~~C~~g), containing dikes and stocks of Tertiary Quartz Monzonite (Tqm) and Tertiary Granodiorite (Tgd). Local occurrences of Quaternary Fan deposits (Qfo/Qtg) and Quaternary Talus (Qt) occur north of the Little Rock Mine open pit area and will underly the NRW Waste stockpile. Holocene alluvium (Qa) is present along alluvial valleys in Deadman Canyon, Whitewater Canyon, and their larger tributaries.

The p~~C~~g is described by Paige (1922) as a light-gray, medium grained hypidiomorphic granular granite containing 20-40% perthitic microcline, 30-50% sodic oligoclase, 30-38% quartz and 2% biotite.

The p~~C~~g is intruded by the Tqm. The Tqm is a very light gray to pinkish-gray, medium-grained, hypidiomorphic-granular rock containing 15% orthoclase, 60% oligoclase 20% quartz 4% biotite. The Tqm is locally porphyritic.

The Tgd unit, subdivided as a separate lithology at Little Rock by Tyrone geologists, is reportedly texturally similar to the quartz monzonite; however, it lacks the silicification that is present in the Tqm and is considered to be mechanically similar to the Burro Mountain Granite (Tyrone geologists, verbal communication).

The Miocene-Pliocene-Pleistocene Gila Conglomerate (Qfo/QTg) is present north of the Little Rock Mine area. The Gila Conglomerate is a well-consolidated basin fill and fan deposit ranging from sand to conglomerate. It is often cemented by caliche. Where exposed in the east wall of the Tyrone Main Pit it forms steep bench slopes and maintains stable 50° slopes angles.

The Mangas Conglomerate and Gila Conglomerate have been used interchangeably by various workers. Over most of the Little Rock Mine area where these units occur, Tyrone identifies the Upper and Lower Mangas units and assigns them a late Tertiary to Quaternary age. Hedlund (1978) identified Gila Conglomerate only in localized exposures northeast of the Little Rock Mine area, while he mapped the majority of the cemented alluvium and conglomerate in and adjacent to the mine area as older fanglomerate deposits (Qfo), Hedlund reports the Qfo as being derived from the underlying Gila Conglomerate. Where Hedlund mapped Qfo, others have mapped the Upper and Lower Mangas Conglomerate.

Griffin (2001) described the Lower Mangas as sediments eroded from the Big Burro Mountains and Silver City Range that were deposited in a graben system during the late Neogene. The Upper Mangas fan deposits were formed upon reactivation of basin and range faults which bisected the older graben forming the Mangas half-graben as described by Griffin (2001).

A Quaternary talus (Qt) geologic unit mapped by Hedlund (1978) is shown north of the Little Rock Mine area and will underly the lower portion of the NRW Waste stockpile. The Qt unit is described by Hedlund (1978) as poorly sorted, unconsolidated, locally derived rock fragments largely deposited by gravity on or at the foot of a slope. Thickness typically exceeds 15 m. However, more recent mapping by Tyrone geologists assign these areas to part of the Gila Conglomerate. Inspection of the materials show they are fine to medium sands with gravel. They are moderately consolidated, non-cemented and are relatively more erodible compared to areas of Gila Conglomerate exposed in the Tyrone Main Pit and exposures along Mangas Wash.

Younger alluvium (Qa) is present along alluvial valleys in Deadman Canyon, Whitewater Canyon, and California Gulch and their tributaries. The alluvium is typically a relatively loose to compact sand to clayey sand.

3.3.2 Structure

The main fault systems in the Little Rock Mine area strike predominantly east-west to northwest and are shown on Figure 2. The main northwest trending faults include the Austin-Amazon, the Southern Star, the Mangas faults, and various unnamed smaller faults in the vicinity of the Tqm dikes. The northwest trending Mangas Fault northeast of the Little Rock Mine area on the north side of the Mangas Valley is southwest dipping normal fault that has preserved a wedge of the Gila Conglomerate in the down-dropped block, being thickest at the fault and thinning to the southwest. The Southern Star fault passes east-west north of the Little Rock Mine open pit and NRW Waste stockpile. The Austin-Amazon passes east-west in a forked branch under the West In-pit Waste stockpile. The faults have localized supergene enrichment and localize weathering to greater depths than non-faulted areas.

3.3.3 Alteration

Porphyry copper mineralization is related to the intrusion of the quartz monzonite with phyllic, propyllitic, and argillic primary alteration zoned around the intrusion. The primary alteration is overprinted by supergene alteration and secondary copper enrichment.

Sericite is the most abundant hydrothermal alteration product. Propyllitic alteration has been observed at the periphery of the deposit. Silicification is prevalent in the granite-quartz monzonite contact zone. A zone of clay may be present at the base of the enrichment zone (Kolessar, 1982). The crystalline bedrock units are generally competent, brittle rock units and significant strength-reducing alteration such as pervasive argillic alteration is not significant.

3.4 Hydrogeologic Conditions

Groundwater levels applied in the stability models are based on groundwater monitoring data reported in the DP-1236 semiannual monitoring reports provided by DBS&A. Groundwater contours were provided based on water levels measured during the second quarter (Q2) 2019 monitoring cycle and are provided on Figure 3. Water table surfaces are developed for the perched water table present in the alluvium and the deeper regional bedrock aquifer. However, the DBS&A perched water level contour maps do not extend to where the Little Rock stockpiles will overlie the alluvium.

4.0 DEVELOPMENT OF MODEL PARAMETERS

4.1 Summary of Material Parameters Applied in the Stability Analyses

Table 1 summarizes the unit weights and the Mohr-Coulomb (M-C) strength parameters (i.e. friction angle [ϕ] and cohesion [c]) applied in the stability analyses. The values are consistent with the values applied in the Golder stockpile stability report for the Tyrone 2013 CCP update (Golder, 2020) and the basis for the selection of the parameters are provided in that report.

Two lithologic units are present at Little Rock that have not previously had material parameters applied. These units are the Quaternary Talus (Qt) and the Tertiary Granodiorite (Tgd).

The geologic map by Hedlund (1978) includes the Qt unit; however, more recent mapping by Tyrone includes this unit as part of the Gila Conglomerate. Based on inspection of exposures of areas mapped as Qt that will underlie the NRW Waste stockpile as part of this stability assessment, the Qt was characterized as moderately consolidated, non-cemented, fine to medium sands with gravel. Given the lack of site-specific testing of these materials, a conservative strength parameters, comparable to that assigned to the Quaternary Alluvium (Qa), have been applied as a screening evaluation to determine whether this unit might lead to low factors of safety. Higher strength parameters could be justified for this unit if unacceptable factors of safety were indicated.

The Tertiary Granodiorite unit (Tgd) was included with the Quartz is assigned a strength comparable to the Burro Mountain Granite (p€g) based on the similarity in the intact rock strength and the fracture characteristics.

Table 1: Summary of Material Parameters

Material	Strength Model	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	ϕ (°)	c (psi)
Waste Rock	M-C	125	138	30.9	11.5
Alluvium (Qa)	M-C	125	138	29.0	0
Liquified Alluvium	M-C	125	138	8.0	0
Talus (Qt)	M-C	125	138	29.0	0
Gila Conglomerate (QTg/Qfo)	M-C	125	138	35	6.94
Granodiorite (Tgd)	M-C	160	160	35	340
Quartz Monzonite (Tqm)	M-C	160	160	43	669
Burro Mountain Granite (p€g)	M-C	160	160	35	340

4.2 Hydrogeologic Conditions

4.2.1 Stockpile Moisture Conditions

Information regarding moisture conditions in the stockpiles at Tyrone is available in the Golder (2020) report. These data and conclusions indicate that the stockpiles are drained, that moisture content correlates with the grain size of the materials, with sands and gravels having low moisture content and zones with higher clay content having higher retained moisture. Overall, the stockpiles are assumed to be unsaturated. Drained conditions are also assumed for the Little Rock stockpiles except where the stockpiles are below the pit lake level.

4.2.2 Perched Alluvial and Regional Bedrock Groundwater Conditions

Groundwater levels applied in the stability models are based on the groundwater levels provided in the DP-1236 semiannual monitoring reports provided by DBS&A (2019). The regional water table is in the basement below the stockpiles, generally 200 to 500 feet below the native ground surface and is intercepted by the Little Rock Mine open pit. Contoured perched water level data is not available for the alluvium in the Deadman and Whitewater Canyon areas as they pass through the Little Rock Mine area, thus the perched groundwater levels in the alluvium were averaged from the typical depth in the rest of the Deadman Canyon alluvium. Perched groundwater levels in the alluvium upstream of the Little Rock Mine were obtained from individual well measurements which ranged between 8 to 12 feet below ground surface (bgs) in the second quarter of 2019. A groundwater depth of 10 ft bgs was assumed for the alluvium under the northern toe of the NRW Waste stockpile. This alluvium is within a tributary to Whitewater Canyon. The surface water flows to this tributary or cut off by the Little Rock Mine open pit and the tributary canyon will be buried by the NRW Waste stockpile. The 10 ft groundwater depth assumption is therefore considered to be conservative. However, this value should be verified before reclamation construction commences and stability analyses updated, and reclamation grading modified if necessary.

4.2.3 Closure Pit Lake

Upon closure of the Little Rock Mine, dewatering of the pit is planned to cease. The floor of the EOY 2024 Little Rock Mine open pit is approximately 5550 ft amsl and recent studies by DBS&A predict the lake level will eventually reach an elevation of 5669 ft amsl. The rate of pit lake rise is predicted to be approximately 10 ft per year during the early years, reducing over time and reaching an approximate elevation of 5630 ft amsl in ten years and reaching the maximum predicted lake level of 5669 ft amsl in approximately 80 years.

The pit lake is expected to affect the stability of the East In-Pit Waste stockpile. The submerged portion of the stockpile will have a reduced frictional strength due to the buoyant weight of the stockpile material below the water level. This destabilizing effect will be countered by the buttressing effect of the water pressure against the slope. The stability analyses modelled both the fully dewatered condition and the maximum predicted pit lake level.

4.3 Seismic Coefficient

A pseudo-static analysis requires selection of the pseudo-static coefficient, which is estimated as a fraction of the peak ground acceleration (PGA) that the structure is expected to experience for a specified annual exceedance probability (AEP) or its inverse, return period. The PGA AEP value is developed through probabilistic seismic hazard analysis (PSHA). Based on the previous criteria applied for the stockpile stability assessments at Tyrone, an earthquake ground motion with a 2% probability of exceedance in 50 years (i.e., a 2,475-year return period) is applied for the stockpile stability assessment for closure conditions.

The seismic parameters applied for the Little Rock stockpiles are the same that were applied to the Tyrone and Little Rock stockpiles as described in the 2013 Tyrone CCP Update report (Golder, 2020). The PGA at a site is influenced by the type of soils overlying the bedrock. An amplification factor of 1.3, reflecting a soil Site Class C (appropriate for Gila Conglomerate type soils), was applied to the bedrock PGA of 0.1088 resulting in a site PGA of 0.141.

A pseudo-static coefficient equal to two-thirds of the amplified peak ground acceleration (i.e., 0.094) was applied for the pseudo-static analyses of these facilities. We have conservatively retained the same pseudo-static coefficient for stockpiles underlain by bedrock units. Golder believes this approach to be conservative and consistent with standard industry practice.

5.0 STABILITY ANALYSIS METHOD

Golder analyzed the stability through two-dimensional, limit-equilibrium, method of slices analysis using the software program, Slide version 2018 (RocScience, 2018). This program provides for various failure surface types, including circular and non-circular (block), and various failure surface search methods. Golder applied Morgenstern-Price's Method of Slices which satisfies conditions of static horizontal and vertical equilibrium, as well as moment equilibrium.

Analyses considered both circular and block type failure surfaces. Circular failure surface searches were generally used to identify the most critical failure surface (i.e. lowest factor of safety) for failures through the stockpile materials. The circular surfaces also evaluate failures through the stockpile foundation. Block type failures are typically used to identify critical failure surfaces that develop along preferential zones of weakness, such as thin layers of weak alluvium or through liner systems.

The stability of the reclaimed configurations of the stockpiles are analyzed for static and pseudo-static loading conditions. The stability analyses cross section output for each analyzed failure mode is included in Appendix A. The geotechnical units are indicated by colors with the color legend at the front on Figure A1 in Appendix A. The cross sections show the limits of the circular failure searches and the 10 lowest failure surfaces with the factor of safety for the lowest surface reported. Block failure surface search windows shown as red polygons. The perched and regional water table is shown on the stability cross sections as blue lines.

Two-dimensional cross-sectional models were prepared based on pre-mining topography (digitized from early topographic maps), recent aerial surveys, and the EOY 2024 reclamation plan designs prepared by Tyrone. The geologic units present below the stockpiles is interpreted from the geological site map (Figure 2).

5.1 Selection of Critical Cross Sections

One or two sections were selected for the evaluation of the stability of each stockpile in its EOY 2024 closure configuration. Selection of the most-critical sections was based on the planned closure facility design slope gradient, slope height, subsurface geology, and hydrogeologic conditions. The critical cross section models for each stockpile is described in more detail in Section 6.0. The planned closure geometry, surficial geology and locations of the critical cross sections are shown in Figure 2. The cross-section models are shown on Figure 4.

5.2 Loading Conditions

The stability of the reclaimed stockpile configurations was evaluated considering static and pseudo-static loading conditions targeting factors of safety as defined by the Copper Rule. For the seismic case, Golder evaluated pseudo-static earthquake loading applying a pseudo-static coefficient of 0.094 as discussed in Section 4.3. A factor-of-safety of 1.5 for critical structures and 1.3 for non-critical structures is considered suitable under the Copper Rule for static loading and minimum target factors of safety for pseudo-static loading are 1.1 or greater.

5.3 Evaluation of Liquefaction Potential

The potential for liquefaction of zones of saturated alluvium that locally underlie the toe of the NRW Waste stockpile was assessed using the methods described in the Golder (2020) report. Where standard penetration test (SPT) or other data to assess the liquefaction potential is not available, the alluvium is conservatively assumed to be potentially liquefiable. Post-liquefaction stability was conservatively analyzed assuming the alluvium below the water table has a liquefied shear strength. Where local well data is not available the water table is assumed to be at a depth of 10 ft bgs based on a review of well data and average depths of perched groundwater elsewhere (Section 4.2.2).

The liquefied shear strength is based on work by Vaid and Thomas (1994) who found that the residual undrained strength of loose clean sand samples subjected to extension tests ranged from 0.1 to 0.18 times the effective overburden stress ($\sigma_{vo'}$). This is approximately equivalent to an internal friction angle of 5° to 11°. For the analysis of the stability with liquefied alluvium, the zones of alluvium below the modelled groundwater table were assigned an internal friction angle (ϕ) of 8° representative of an undrained, post-liquefaction shear strength. The modeled groundwater elevation is considered to be conservatively high because the rainwater tributary to this area is intercepted by the pit and will be covered by waste rock.

6.0 STABILITY ANALYSIS RESULTS

The results of the stability analyses provided in this section were based on the parameters and methods described in the preceding sections. All the calculated factors of safety were found to be above the minimum required factor of safety criterion, and the stockpiles are predicted to maintain long-term stability for the planned closure geometries.

Table 2 summarizes the minimum factors of safety obtained for each stockpile for static and pseudo-static loading conditions. Where alluvium is present underlying the toe area of the reclaimed stockpiles, and SPT blow count data is lacking or indicates some potential for liquefaction exists, the factor of safety assuming liquefied strengths for alluvium below the water table is reported.

The following sections describe the individual stability models prepared for each stockpile, the analyses completed and resulting factors of safety. The stability cross section models are shown in the Appendix A. The minimum factors of safety are provided for each of the failure surface search methods analyzed (e.g. block, circular). Output from all stability analysis models are provided in Appendix A.

Unless otherwise noted the reclaimed slope geometry consists of overall 3.5H:1V overall slopes consisting of 3H:1V interbench slopes and benches spaced every 200 feet of slope length.

Table 2: Stability Analysis Results Summary

Stockpile	Critical Failure Mode	Minimum Static FOS	Minimum Pseudo-static FOS	Liquefied FOS
CLW Waste	Global failure, circular type	3.92	2.88	No liquefiable soils present
NRW Waste	Local toe, circular type	2.29	1.68	1.32
East In-Pit Waste	Closure with pit lake El. 5670 ft	2.21	1.64	No liquefiable soils present
	Closure without pit lake	1.82	1.54	
	Raised WT to Deadman Canyon Diversion	2.16	1.52	

6.1 CLW Waste

The CLW Waste stockpile is located to the south of the Little Rock Mine open pit in the footprint area of a reclaimed Copper Leach Stockpile facility that will be removed prior to placement of the CLW Waste stockpile. The eastern and northern slope have a crest elevation of 6330 feet and a maximum stockpile height of 185 feet. At closure, the slopes will be regraded to overall 3.5H:1V and the stockpile will be pushed to the south and east to extend the slope height to 220 feet. The stockpile is underlain by Tertiary Granodiorite.

Two critical stability sections were selected to run-north south (Section LR-C1) and east-west (LR-C2) perpendicular to slope contours at the maximum slope height. The locations of the critical cross-sections are shown on Figure 2. The most critical failure surface is an overall circular failure from crest to toe of the slope Along Section LR-C1 with a minimum static factor of safety of 3.92 (Figure A2 in Appendix A) and the minimum pseudo-static factor of safety is 2.88 (Figure A3). No potentially liquefiable soils are present below the stockpile.

Table 3: CLW Waste Stability Results

Factor of Safety

CLW Waste Stockpile Configuration	Section Name	Failure Type	Crest El.	Toe El.	Slope Height (ft)	Critical Failure Type	Static	Seismic (k = 0.94g)
Closure	LR-C1	Circular	6330	6190	140	Global	3.92	2.88
	LR-C2	Circular	6330	6110	220	Global	3.94	2.90

6.2 NRW Waste Stockpile

The NRW Waste stockpile is located to the north of the Little Rock Mine open pit. The western and southern slope are buttressed against native hillside of Burro Mountain Granite. The stockpile has a crest elevation of 6010 feet and a maximum stockpile height of 300 feet. The upper slope is underlain by the Burro Mountain Granite and the lower slopes are underlain by the Quaternary Talus unit. At closure, the slopes will be regraded to overall 3.5H:1V and stockpile will be pushed to the north and will have an overall slope height 320 feet. The NRW Waste stockpile toe will be advanced a short distance over an area with mapped Quaternary alluvium. Site specific subsurface geotechnical information is not available in this area to assess whether the alluvium is liquefiable under the design earthquake loading. The alluvium is therefore conservatively assumed to be liquefiable below the groundwater table. Perched water level measurements are not available in this area. Perched water levels in other similar areas with mapped alluvium average approximately 10 ft bgs. It should be noted that this deposit of alluvium occurs in a tributary to Whitewater Canyon and is intercepted by the Little Rock Mine open pit and will be buried by the NRW Waste stockpile so runoff contributing to the alluvium will be cutoff.

One critical stability section was selected to run perpendicular to the slope of the stockpile at its greatest height. The location of the critical cross-section (LR-N1) is shown on Figure 2. The most critical failure surface would be a global circular failure along the northern slope. The minimum static factor of safety is 2.29 (Figure A6) and the minimum pseudo-static factor of safety is 1.68 (Figure A9). Post-liquefaction conditions were considered assuming that the alluvium below the assumed water table liquefies, applying liquefied strength to the alluvium below the modeled water table. In this case, the critical failure mode is a circular failure through the liquefied alluvium at the toe stockpile with a factor of safety of 1.32 (Figure A7).

Table 4: NRW Waste Stability Results

							Factor of Safety	
NRW Waste Stockpile Configuration	Section Name	Failure Type	Crest El.	Toe El.	Slope Height (ft)	Critical Failure Type	Static	Seismic (k = 0.94g)
Closure	LR-N1	Circular	6010	5690	320	Global	2.29	1.68
		Block – Liquefied Qa				Toe	1.41	NA
		Circular – Liquefied Qa				Toe	1.32	NA

6.3 East In-Pit Waste Stockpile

The East In-Pit Waste stockpile is contained to the east by the pit wall. The stockpile has a crest elevation of 5815 feet amsl and an overall height of 265 feet. The north portion of the stockpile (Section LR-E1) is composed of an upper slope approximately 115 ft high that will be reclaimed to an overall 3.5H:1V slope angle. There is a flat stockpile top surface at 5700 ft amsl. The west end of the East In-Pit Waste stockpile slopes down to the pit floor at an elevation of 5550 ft amsl at an overall slope angle of 3.5H:1V above the planned maximum pit lake level and an overall slope angle of 1.5H:1V below the maximum pit lake level. The south portion of the stockpile (Section LR-E2) will have a continuous reclaimed 3.5H:1V slope from the east crest of the stockpile to the pit floor.

The Deadman Canyon Diversion Channel will be constructed along the east crest of the stockpile and is being designed by Telesto. Golder's understanding is that the diversion will be constructed on compacted waste rock fill and will be armored using articulated concrete mats. The analysis has considered infiltration of stormwater from the diversion channel will cause mounding of the water table in the stockpile. This is a conservative assumption due to the ephemeral nature of flows in Deadman Canyon and anticipated high permeability of the waste rock.

Two critical stability sections were selected to evaluate the stability of the northern (Section LR-E1) and the southern (Section LR-E2) portions of the stockpile. The locations of the critical cross-sections are shown on Figure 2 and the cross-sectional geometry is shown on Figure 4. The toe of the stockpile is expected to be submerged by the pit lake that will be allowed to develop upon closure. The water table is predicted to eventually rise to a level of 5669 ft amsl. The stability was analyzed for the fully dewatered pit, the highest predicted elevation of pit lake condition, and the condition of a raised water table in the waste rock due to infiltration from the Deadman Canyon Diversion. The waste rock is assumed to be sufficiently permeable that the water levels in the pit will rise at approximately the same rate that the water levels rise in the waste rock.

The most critical failure surface for the would be a global failure from crest to toe of the slope. The minimum static FS for the condition with the toe submerged in the pit lake is 2.21 (Figure A10) and the minimum pseudo-static FS is 1.64 (Figure A11). In dry pit conditions, the static FS is 1.82 (Figure A12) and the pseudo-static conditions are 1.54 (Figure A13). For the condition of the raised water table due to infiltration from the Deadman Canyon Diversion Channel flows, the minimum static and pseudo-static FS is 2.16 (Figure A20) and 1.52 (Figure A21) for Section LR-E2), respectively. Waste rock is not considered to be liquefiable due to the high permeability and ability to rapidly dissipate any excess pore pressured that may develop due to earthquake shaking induced settlement.

Table 5: East In-Pit Waste Stability Results

							Factor of Safety	
East In-pit Waste Stockpile Configuration	Section Name	Failure Type	Crest El.	Toe El.	Slope Height (ft)	Critical Failure Type	Static	Seismic (k = 0.94g)
Closure with pit lake at El. 5669 ft	LR-E1	Circular	5815	5550	265	Global	2.21	1.64
Closure with no pit lake		Circular				Global	1.82	1.54
Raised WT to Deadman Canyon		Circular				Global	2.18	1.61
Closure with pit lake at El. 5669 ft	LR-E2	Circular	5815	5510	305	Global	2.69	1.85
Closure with no pit lake		Circular				Global	2.98	2.19
Raised WT to Deadman Canyon		Circular				Global	2.16	1.52

7.0 CONCLUSIONS

Stability evaluations incorporating the design parameters outlined in this report indicate long-term factors of safety for the reclaimed stockpile configurations of at least 1.82 under static conditions and 1.52 under seismic loading. The stockpiles are not predicted to undergo long-term reductions in shear strength and reductions in the factor of safety due to weathering. Stability analyses included an evaluation of the effects of liquefaction on the stockpile stability. These safety factors meet the minimum factor of safety criteria and indicate the stockpiles will be stable post-closure to support the Closure/Closeout Plan designs and meet both state and federal stability criteria.

The potential for earthquake induced instability was evaluated using pseudo-static analyses. The pseudo-static coefficient applied considered the peak ground acceleration associated with a design basis earthquake with a 2500- year return period and applied an amplification factor appropriate for the sites underlain by the Gila Formation. The factors of safety applying the pseudo-static loads met the typical minimum factors of safety. All were above 1.5.

The stability analyses also considered the potential for liquefaction. The potential for liquefaction of Quaternary alluvium deposits below the water table in the toe areas of stockpiles was assessed using available subsurface geotechnical information where available. Where site specific geotechnical information is not available, the alluvium below the perched water table was assumed to be susceptible to liquefaction. If liquefaction potential was indicated, an additional stability analysis was performed applying a liquefied strength to the saturated alluvium. The resulting factors of safety indicate that liquefaction is not predicted to lead to the instability of the reclaimed stockpiles.

The stockpiles are currently indicated to be generally unsaturated. Golder expects moisture contents in the stockpile and in the alluvium in the toe areas of the stockpiles will decrease further after closure as a result of revegetation of the reclaimed stockpiles and implementation of surface water management controls. The development of elevated groundwater levels in the stockpiles that could impact the stockpile’s long-term stability is not expected.

Golder Associates Inc.

Kathrine Price, EIT
Staff Engineer

Thomas Wythes, PE
Associate and Senior Engineer

KDP/TJW/kg

8.0 REFERENCES

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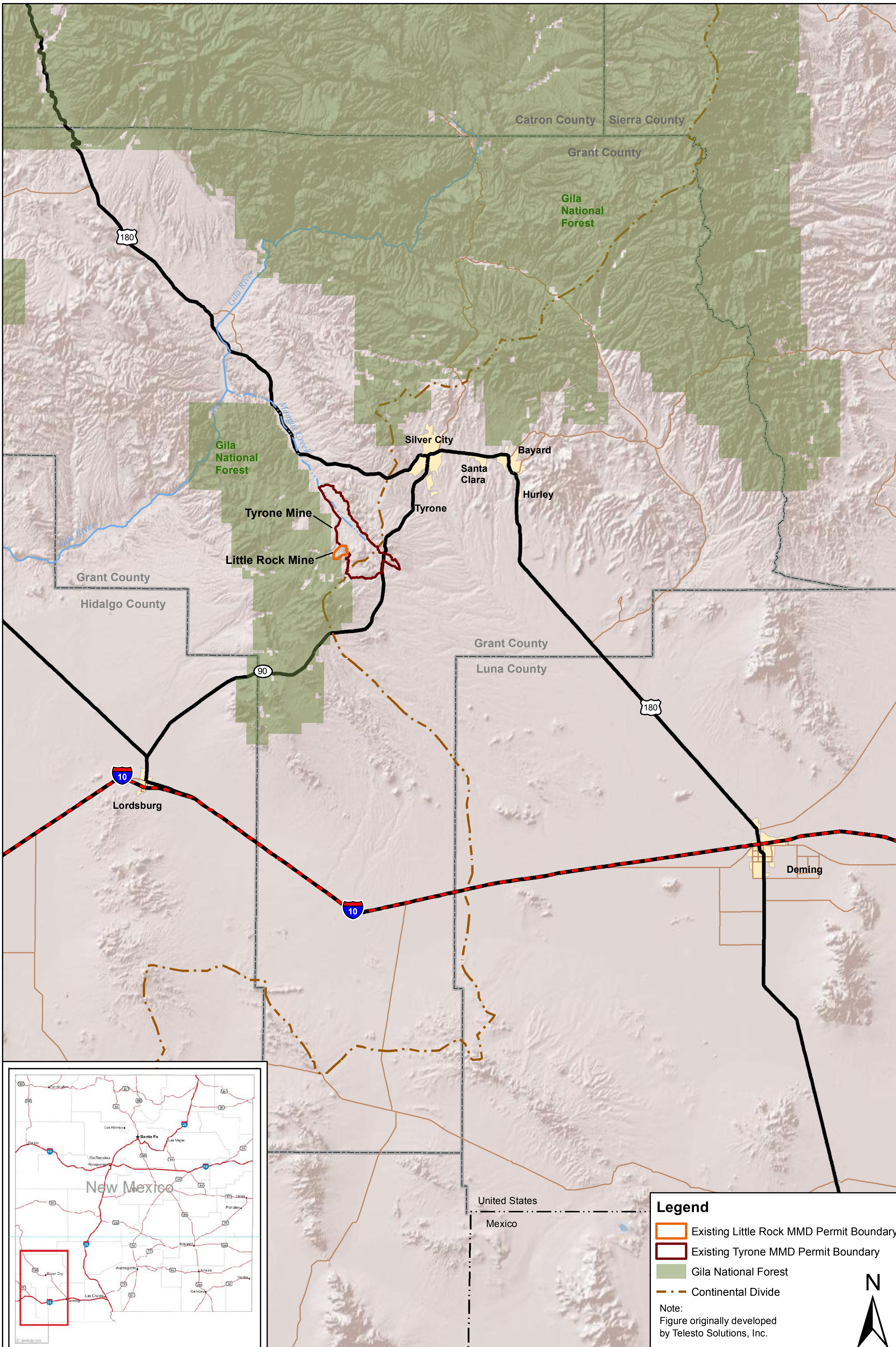
https://golderassociates.sharepoint.com/sites/121812/project files/6 deliverables/002-little rock stockpile stability/little rock stockpile client comments incorporated.docx

FIGURES



80,000 40,000 0 Feet

FREEPORT-McMoRAN COPPER & GOLD

PROJECT No.	113-01155	PROJECT/REPORT	FREEPORT MCMORAN TYRONE, INC. LITTLEROCK CLOSURE/CLOSEOUT PLAN GRANT COUNTY, NEW MEXICO
FIGURE	1	TITLE	MINE LOCATION MAP

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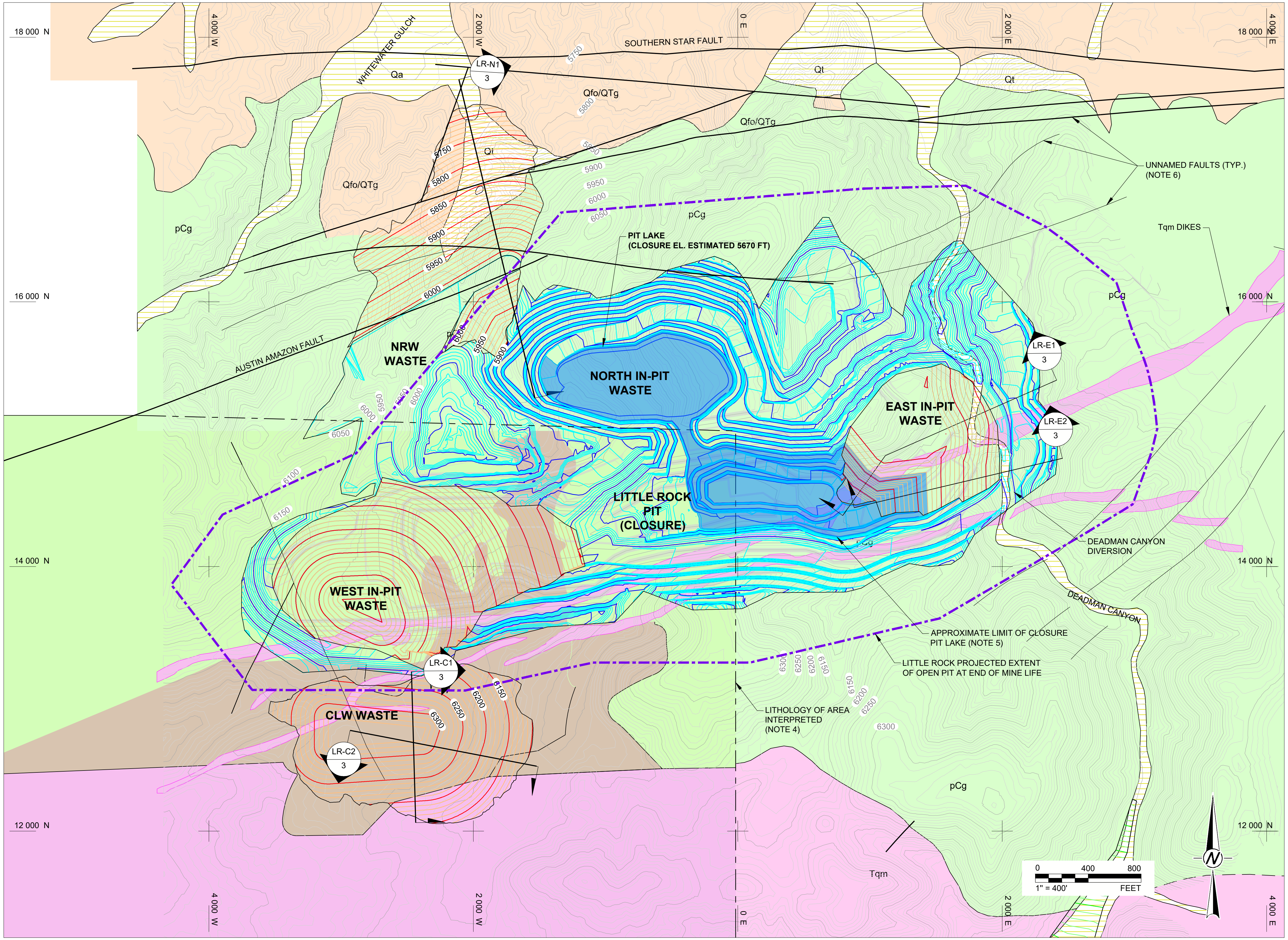


LEGEND

- EXISTING NATIVE TOPOGRAPHY (NOTE 2, 10 FT CONTOUR INTERVAL)
- EOY 2024 LITTLE ROCK PIT (NOTE 5, 10 FT CONTOUR INTERVALS)
- CLOSURE SLOPES FOR LITTLE ROCK STOCKPILES (NOTE 3, 10 FT CONTOUR INTERVALS)
- Qa — ALLUVIUM (HOLOCENE): UNCONSOLIDATED POORLY SORTED GRAVEL, SAND, AND SILT (NOTE 1)
- Qt — QUATERNARY TALUS (NOTE 1, NOTE 7)
- Qfo/QTg — UNDIFFERENTIATED OLDER FAN DEPOSITS, UNDIFFERENTIATED SHEET FLOOD DEPOSITS (PLESTIOCENE) AND GILA CONGLOMERATE (PLESTIOCENE, PLIOCENE, AND MIOCENE): UPPER ERODED SURFACE LOCALLY CEMENTED BY CALICHE (NOTE 1)
- Tgd — TERTIARY GRANODIORITE (NOTE 4)
- Tqm — QUARTZ MONZONITE OF TYRONE (PALEOCENE): UNDIFFERENTIATED QUARTZMONZONTIRE, QUARTZ MONZONITE PORPHYRY, AND RELATED INTRUSIVE ROCKS (NOTE 1)
- pCg — BURRO MOUNTAIN GRANITE (PRECAMBRIAN): CONTAINS DIKES OF QUARTZ MONZONITE AND OTHER LITHOLOGIES (NOTE 1)
- APPROXIMATE LIMIT OF CLOSURE PIT LAKE (NOTE 5)

SOURCE

1. EXISTING REGIONAL GEOLOGY FROM TYRONE CLOSURE/CLOSEOUT PLAN FIGURE 2-15 (GOLDER, 2014). MAP WAS DEVELOPED FROM RECENT UNPLUBLISHED DATA FROM TYRONE, HEDLUND, 1978, GEOLOGIC MAP OF THE WIND MOUNTAIN QUADRANGLE, GRANT CO., NM, USGS MISC. FIELD STUDIES, MF-1031, 7.5' MAP. HEDLUND, 1978, GEOLOGIC MAP OF THE TYRONE QUADRANGLE, GRANT CO., NM, USGS MISC. FIELD STUDIES, MF-1037, 7.5' MAP. HEDLUND, 1978, GEOLOGIC MAP OF THE BURRO PEAK QUAD-RANGLE, GRANT CO., NM, USGS MISC. FIELD STUDIES, MF-1040, 7.5' MAP. HEDLUND, 1978, AND DBS&A, 2012.
2. EXISTING TOPOGRAPHY CONTOURS PROVIDED BY FREEPORT MCMORAN IN 2014 IN AN ELECTRONIC FILE TITLED '140103_Final_Overall Reclaim Areas rev 2.dwg'.
3. RECLAMATION TOPOGRAPHY BASED ON END OF YEAR 2024 MINE CONFIGURATION. NRW AND CLW WASTE STOCKPILE CONTOURS PROVIDED BY FREEPORT MCMORAN ON APRIL 3, 2020 IN AN ELECTRONIC FILE TITLED '20200330_Yr5 Surfaces.dwg'.
4. EXTENTS OF Tgd UNIT TAKEN FROM TELESTO FIGURE PROVIDED BY FREEPORT MCMORAN ON APRIL 23, 2020 IN A FILE TITLED 'FIGURE 8 PROJECT AREA SOILS LITTLE ROCK MINE'.
5. LITTLE ROCK PIT, IN-PIT LAKE, AND IN-PIT WASTE CONTOURS PROVIDED BY FMI TYRONE ON MAY 7, 2020 IN AN ELECTRONIC FILE TITLED '20200507_Site Closure Plan Yr5.dwg'.
6. EXISTING FAULT TRACES PROVIDED BY FMI TYRONE IN APRIL 2020 IN A ELECTRONIC FILE TITLED 'FAULTS.dwg'.
7. THE GEOLOGIC MAP BY HEDLUND (1978) INCLUDES THE Qt UNIT; HOWEVER MORE RECENT MAPPING BY TYRONE INCLUDES THIS UNIT AS PART OF THE GILA CONGLOMERATE (Qfo).

CLIENT
FREEPORT-MCMORAN TYRONE INC.
GRANT COUNTY, NEW MEXICO

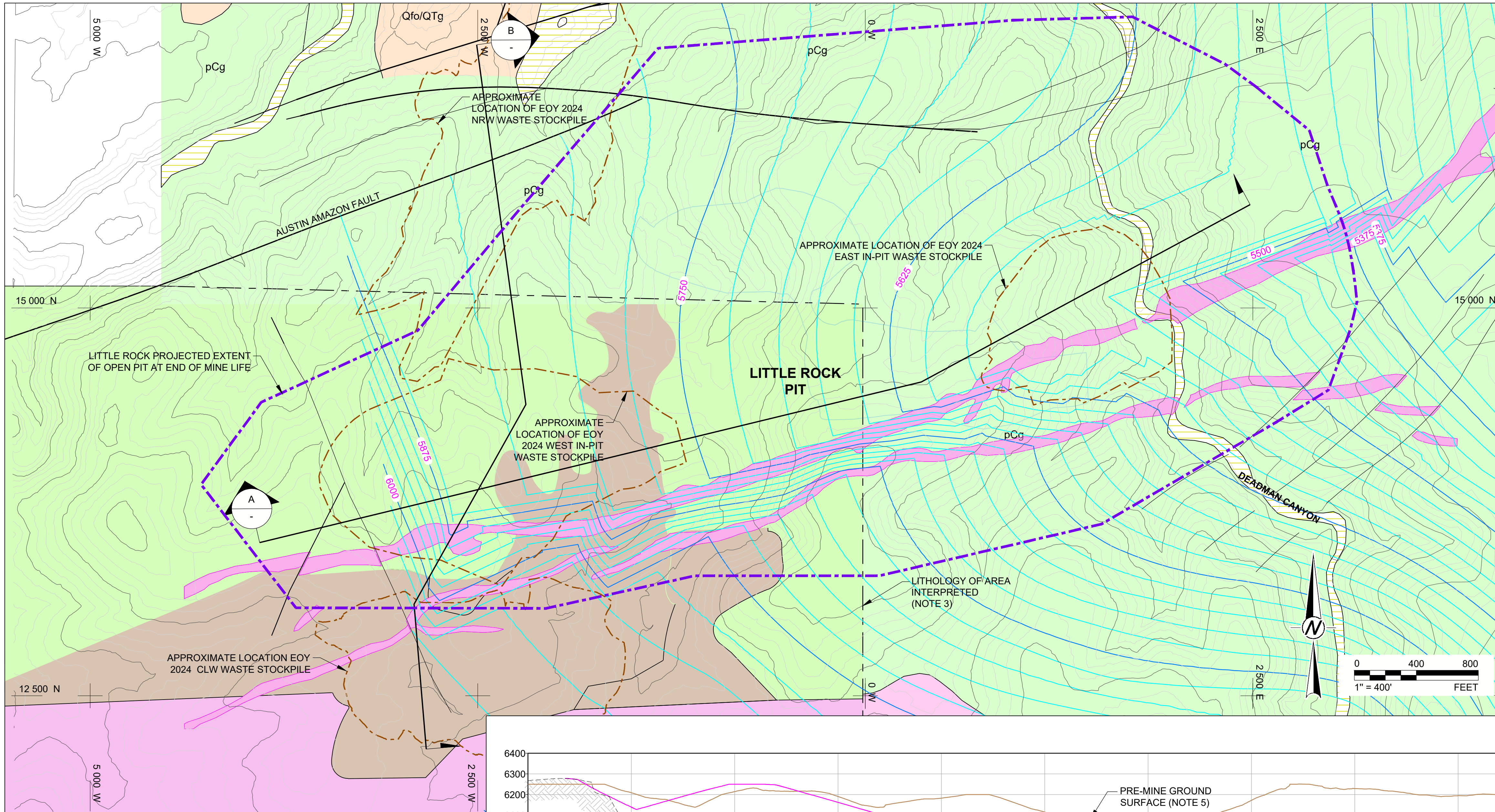
PROJECT
LITTLE ROCK 2020 CCP UPDATE
STOCKPILE STABILITY

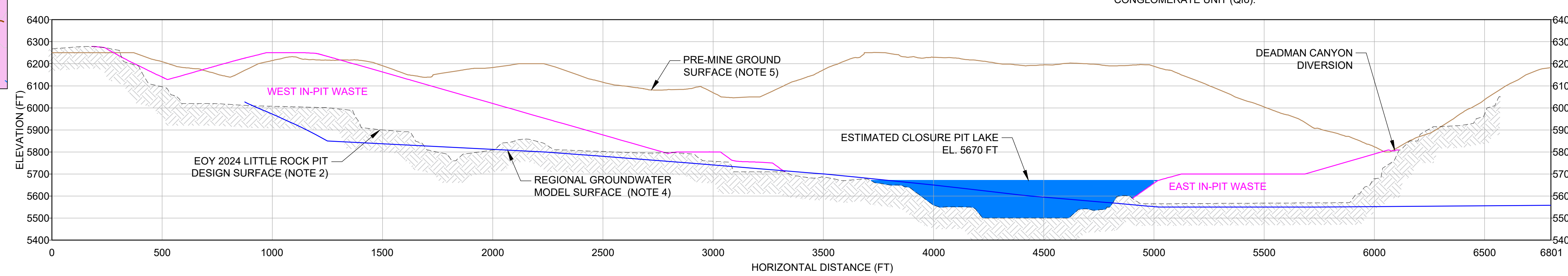
CONSULTANT
GOLDER

YYYY-MM-DD	2020-06-10
DESIGNED	KDP
PREPARED	KDP
REVIEWED	TW
APPROVED	TW

TITLE
LITTLE ROCK END-OF-YEAR 2024 PIT AND CLOSURE STOCKPILE PLAN

PROJECT NO. 20136957 | REV. 1 | FIGURE 2





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VERT. SCALE 1" = 300'
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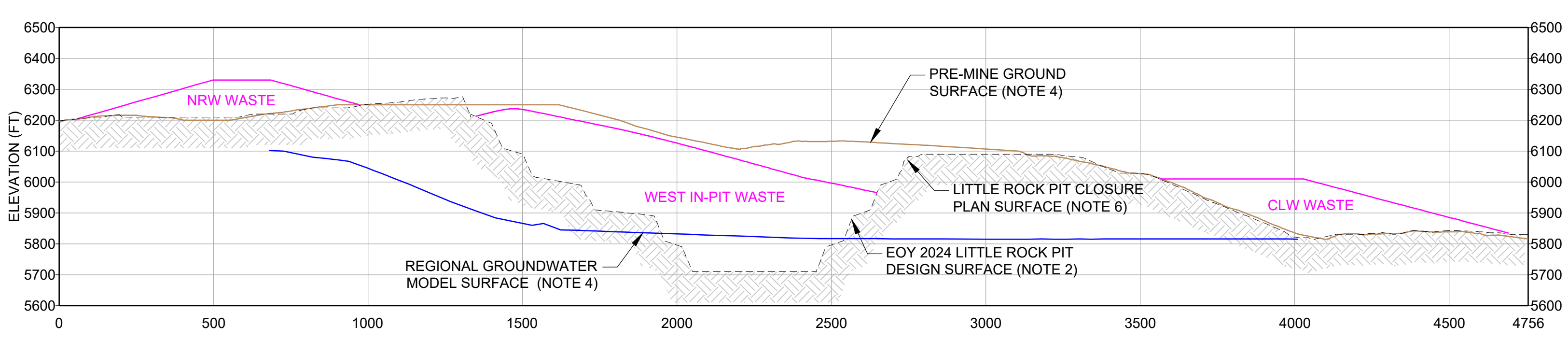

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VERT. SCALE 1" = 300'
B - NORTH TO SOUTH CROSS SECTION

0 300 600
1" = 300' FEET

LEGEND

- PREMINE SURFACE CONTOURS (NOTE 5, 25 FT CONTOUR INTERVAL)
- REGIONAL GROUNDWATER MODEL CONTOURS WITH DEWATERING EFFORTS (NOTE 4, 25 FT CONTOUR INTERVALS)
- APPROXIMATE EXISTING PIT AND DUMP LIMITS
- Qa — ALLUVIUM (HOLOCENE): UNCONSOLIDATED POORLY SORTED GRAVEL, SAND, AND SILT (NOTE 1)
- Qt — QUATERNARY TALUS (NOTE 1, NOTE 7)
- Qfo/QTg — UNDIFFERENTIATED OLDER FAN DEPOSITS, UNDIFFERENTIATED SHEET FLOOD DEPOSITS (PLESTIOCENE) AND GILA CONGLOMERATE (PLESTIOCENE, PLIOCENE, AND MIOCENE): UPPER ERODED SURFACE LOCALLY CEMENTED BY CALICHE (NOTE 1)
- Tgd — TERTIARY GRANODIORITE (NOTE 3)
- Tqm — QUARTZ MONZONITE OF TYRONE (PALEOCENE): UNDIFFERENTIATED QUARTZMONZONTIRE, QUARTZ MONZONITE PORPHYRY, AND RELATED INTRUSIVE ROCKS (NOTE 1)
- pCg — BURRO MOUNTAIN GRANITE (PRECAMBRIAN): CONTAINS DIKES OF QUARTZ MONZONITE AND OTHER LITHOLOGIES (NOTE 1)

SOURCE

1. EXISTING REGIONAL GEOLOGY FROM TYRONE CLOSURE/CLOSEOUT PLAN FIGURE 2-15 (GOLDER, 2014). MAP WAS DEVELOPED FROM RECENT UNPUBLISHED DATA FROM TYRONE, HEDLUND, 1978, GEOLOGIC MAP OF THE WIND MOUNTAIN QUADRANGLE, GRANT CO., NM, USGS MISC. FIELD STUDIES, MF-1031, 7.5' MAP. HEDLUND, 1978, GEOLOGIC MAP OF THE TYRONE QUADRANGLE, GRANT CO., NM, USGS MISC. FIELD STUDIES, MF-1037, 7.5' MAP. HEDLUND, 1978, GEOLOGIC MAP OF THE BURRO PEAK QUAD-RANGLE, GRANT CO., NM, USGS MISC. FIELD STUDIES, MF-1040, 7.5' MAP. HEDLUND, 1978, AND DBS&A, 2012.
2. 2019 CCP LITTLE ROCK PIT DESIGN SURFACE CONTOURS PROVIDED BY FREEPORT MCMORAN IN 2014 IN AN ELECTRONIC FILE TITLED '140103_Final_Overall Reclaim Areas rev 2.dwg'.
3. EXTENTS OF Tgd UNIT TAKEN FROM TELESTO FIGURE PROVIDED BY FREEPORT MCMORAN ON APRIL 23, 2020 IN A FILE TITLED 'FIGURE 8 PROJECT AREA SOILS LITTLE ROCK MINE'.
4. REGIONAL GROUNDWATER MODEL CONTOURS PROVIDED BY FMI TYRONE ON APRIL 3, 2020 IN AN ELECTRONIC FILE TITLED 'wle_regional_2019_2Q.DWG'.
5. PRE-MINE BEDROCK SURFACE INTERPRETED FROM CONTOURS PROVIDED BY FMI TYRONE IN AN ELECTRONIC FILE TITLED 'Underdump.dwg'.
6. LITTLE ROCK PIT CLOSURE PLAN SURFACE PROVIDED BY FMI TYRONE ON MAY 7, 2020 IN AN ELECTRONIC FILE TITLED '20200507_Site Closure Plan Yr5.dwg'.
7. THE GEOLOGIC MAP BY HEDLUND (1978) INCLUDES THE Qt UNIT; HOWEVER MORE RECENT MAPPING BY TYRONE INCLUDES THIS UNIT AS PART OF THE GILA CONGLOMERATE UNIT (Qfo).

CLIENT
FREEPORT-MCMORAN TYRONE INC.
GRANT COUNTY, NEW MEXICO

PROJECT
TYRONE CLOSURE/CLOSEOUT PLAN
TYRONE MINE STOCKPILE STABILITY

CONSULTANT
GOLDER

YYYY-MM-DD	2020-06-10
DESIGNED	KDP
PREPARED	KDP
REVIEWED	TW
APPROVED	TW

TITLE
LITTLE ROCK AREA BEDROCK AND GROUNDWATER

PROJECT NO.	REV.	FIGURE
20136957	1	3

LEGEND

- 2019 Q2 REGIONAL GROUND WATER LEVEL (NOTE 7)
- Qa — ALLUVIUM (HOLOCENE): UNCONSOLIDATED POORLY SORTED GRAVEL, SAND, AND SILT (NOTE 1)
- Qt — QUATERNARY TALUS (NOTE 1, NOTE 8)
- Qfo/QTg — UNDIFFERENTIATED OLDER FAN DEPOSITS, UNDIFFERENTIATED SHEET FLOOD DEPOSITS (PLESTIOCENE) AND GILA CONGLOMERATE (PLESTIOCENE, PLIOCENE, AND MIOCENE): UPPER ERODED SURFACE LOCALLY CEMENTED BY CALICHE (NOTE 1)
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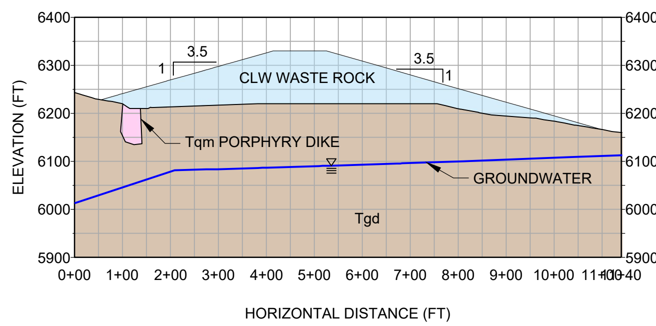
- APPROXIMATE LIMIT OF CLOSURE PIT LAKE (NOTE 5)



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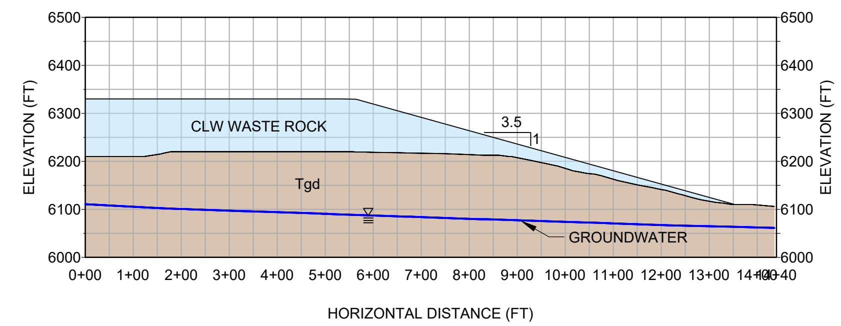

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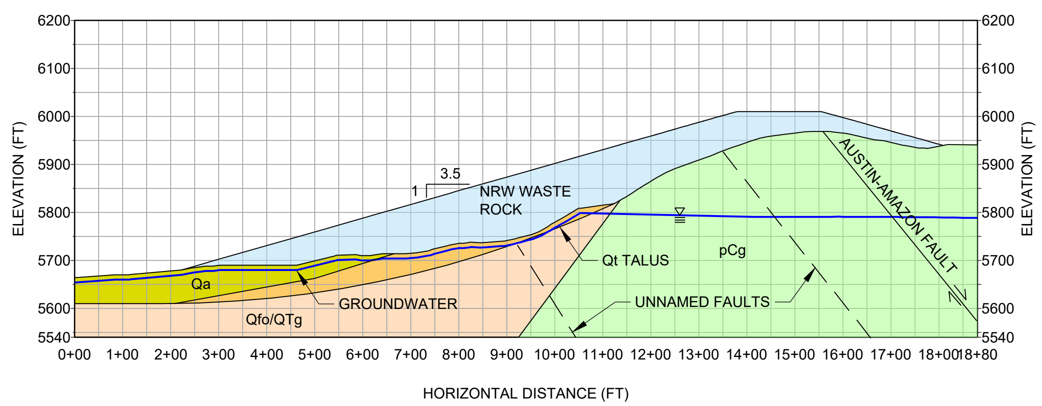

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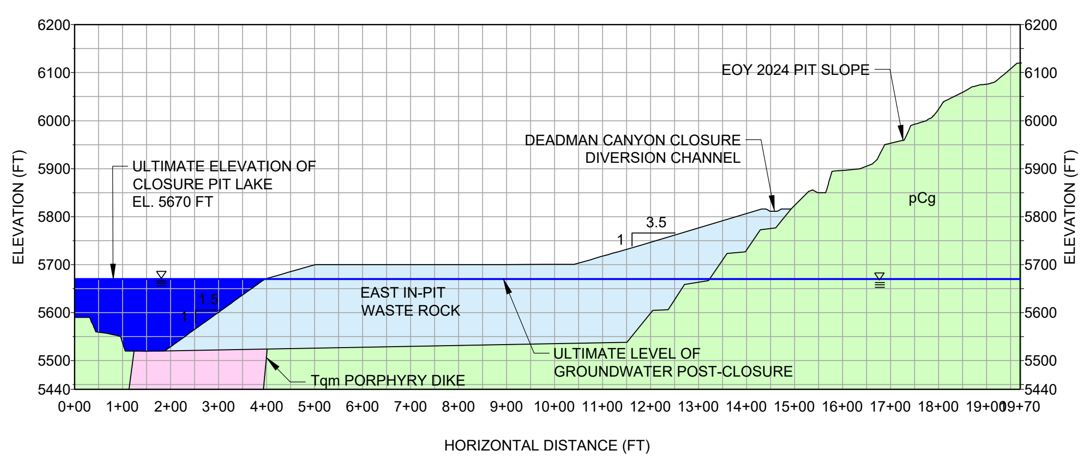

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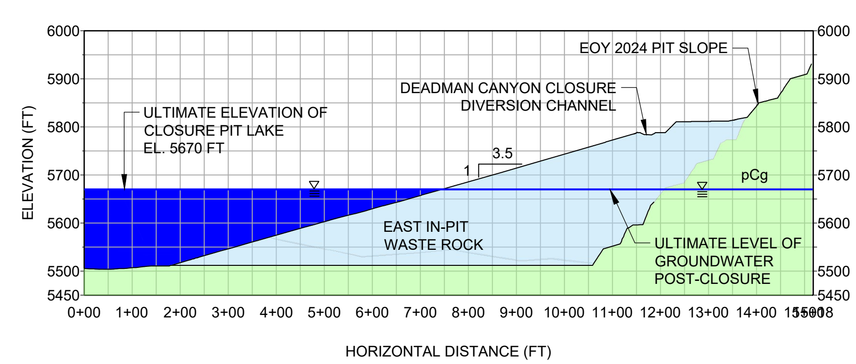

SCALE 1" = 200' LR-E2 1 EAST IN-PIT WASTE SECTION

SOURCE

1. SUBSURFACE GEOLOGY INTERPRETED FROM 'FIGURE 8 SURFACE GEOLOGY LITTLE ROCK MINE (DANIEL B STEPHENS AND ASSOCIATES, INC. 06/12/2014'.
2. EXISTING TOPOGRAPHY CONTOURS PROVIDED BY FREEPORT MCMORAN IN 2014 IN AN ELECTRONIC FILE TITLED '140103_Final_Overall Reclaim Areas rev 2.dwg'.
3. NRW AND CLW WASTE STOCKPILE CONTOURS PROVIDED BY FREEPORT MCMORAN ON APRIL 3, 2020 IN AN ELECTRONIC FILE TITLED '20200330_Yr5 Surfaces.dwg'.
4. EXTENTS OF THE Tgd UNIT TAKEN FROM TELESTO FIGURE PROVIDED BY FREEPORT MCMORAN ON APRIL 23, 2020 IN A FILE TITLED 'FIGURE 8 PROJECT AREA SOILS LITTLE ROCK MINE'.
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0 200 400
1" = 200' FEET

CLIENT
FREEPORT-MCMORAN TYRONE INC.
GRANT COUNTY, NEW MEXICO

PROJECT
LITTLE ROCK 2020 CCP UPDATE
STOCKPILE STABILITY

CONSULTANT
GOLDER

YYYY-MM-DD	2020-06-10
DESIGNED	KDP
PREPARED	KDP
REVIEWED	TW
APPROVED	TW

TITLE
LITTLE ROCK END-OF-YEAR 5 PIT AND CLOSURE STOCKPILE PROFILES

PROJECT NO.	REV.	FIGURE
20136957	1	4

APPENDIX A

Stability Output

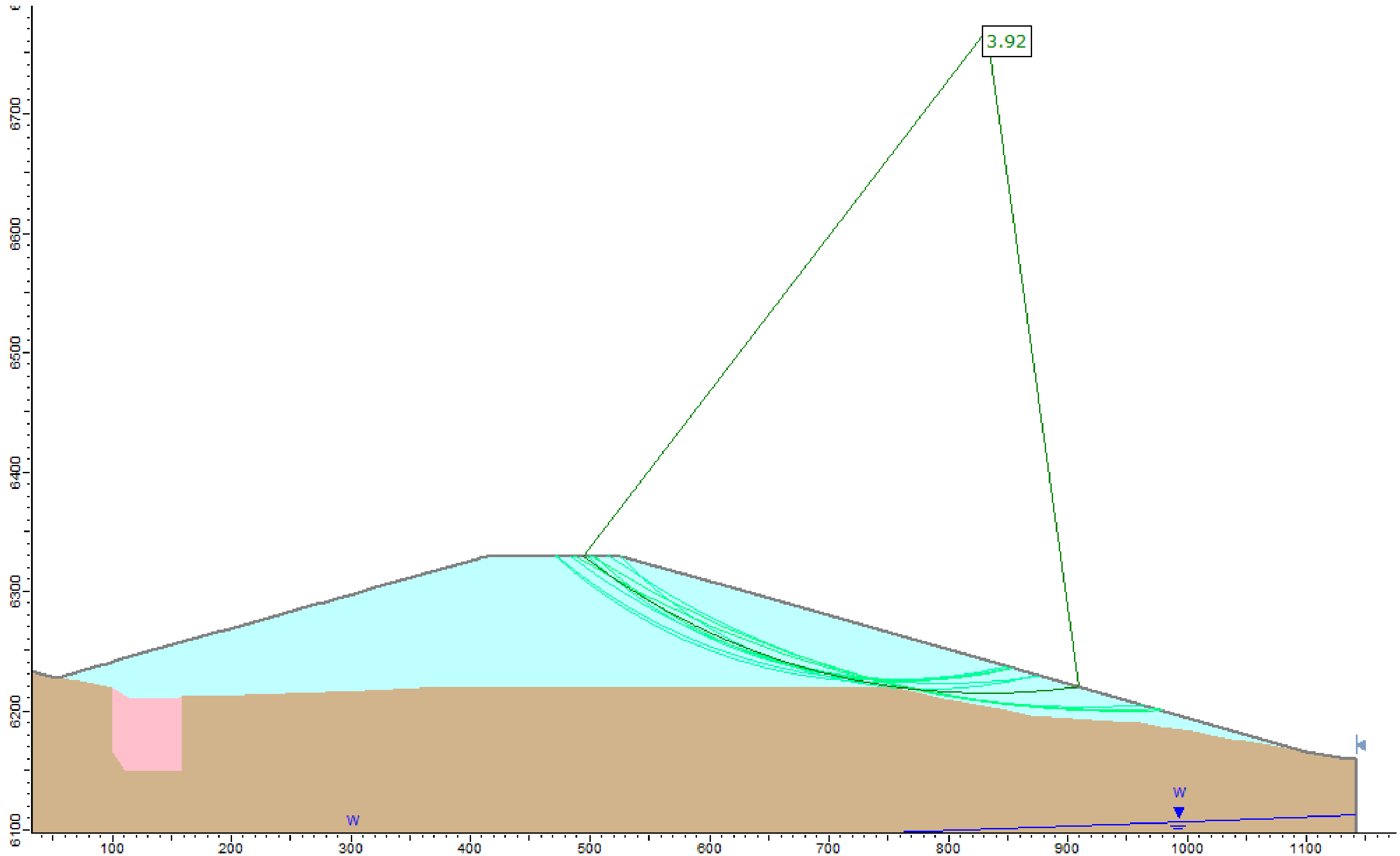
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
pCg - Burro Mountain Granite		160	160	Mohr-Coulomb	48960	35	Water Surface	Custom	1	
Tqm - Quartz Monzonite + Intrusive Rocks		160	160	Mohr-Coulomb	96336	43	Water Surface	Custom	1	
Tgd - Granodiorite		160	160	Mohr-Coulomb	48960	35	Water Surface	Custom	1	
QTg - Gila Congolomerate		125	138	Mohr-Coulomb	1000	35	Water Surface	Custom	1	
Qt - Talus		125	138	Mohr-Coulomb	0	37.5	Water Surface	Custom	1	
Qa - Alluvium		125	138	Mohr-Coulomb	0	29	Water Surface	Custom	1	
Qa - Alluvium (liquefied)		125	138	Mohr-Coulomb	0	8	None	Custom	1	
Waste Rock		125		Mohr-Coulomb	1656	30.9	Water Surface	Custom	1	
Water		62.4		No strength			None			0

MODELLED MATERIAL PROPERTIES

GOLDER

SLIDEINTERPRET 8.014

Project	FMI – Tyrone: Little Rock Closure Close-out Plan Update
Analysis Description	SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
Figure	A1
Company	FMI - Tyrone
Date	6-10-2020
File Name	

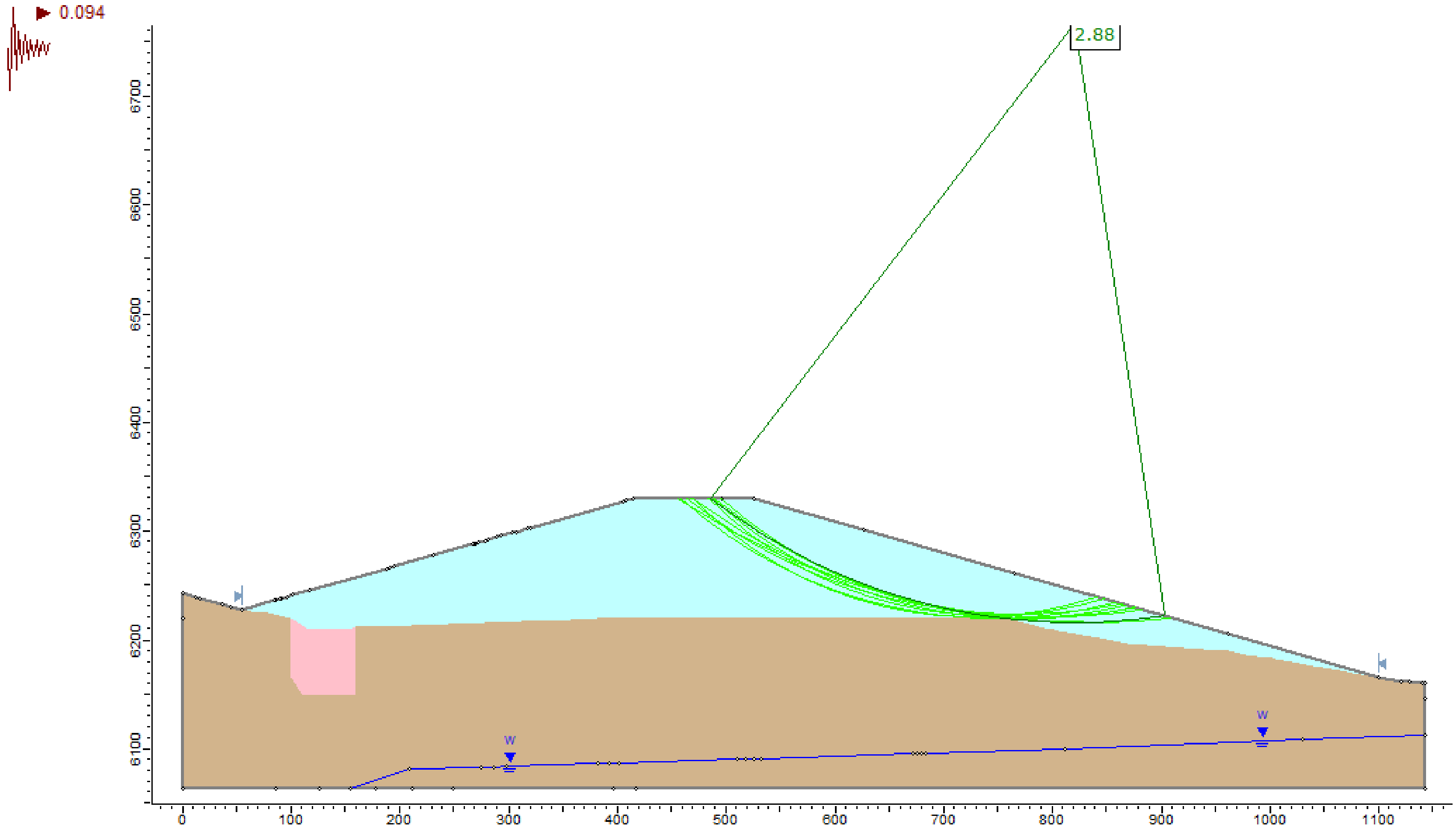


SECTION: *CLW WASTE: LR-C1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER

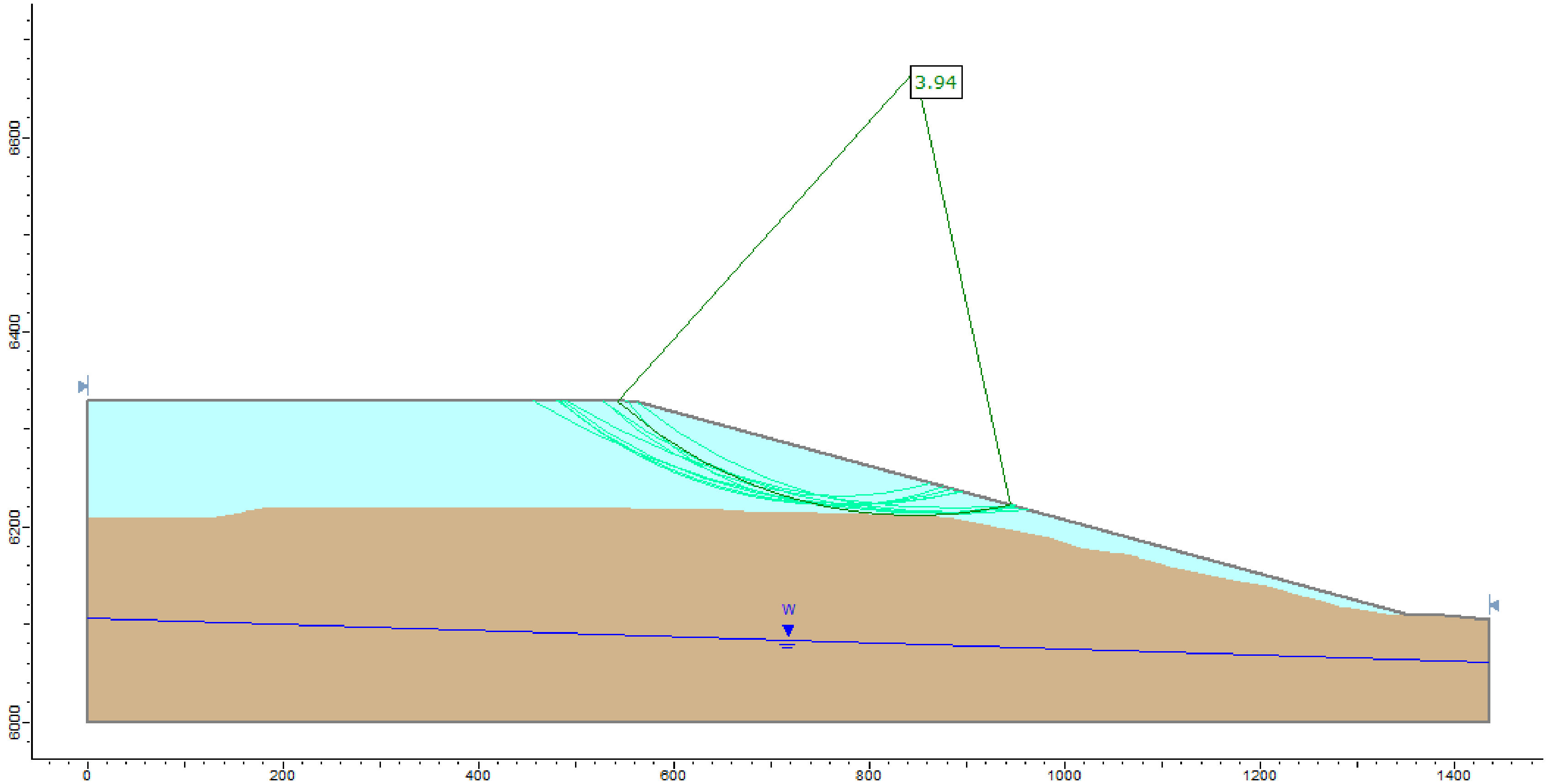
SLIDEINTERPRET 8.014

Project FMI – Tyrone: Little Rock Closure Close-out Plan Update			
Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)			
Figure A2		*Company* FMI - Tyrone	
Date 6-10-2020		*File Name*	



SECTION: *CLW WASTE: LR-C1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
	Figure A3	*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020	*File Name*

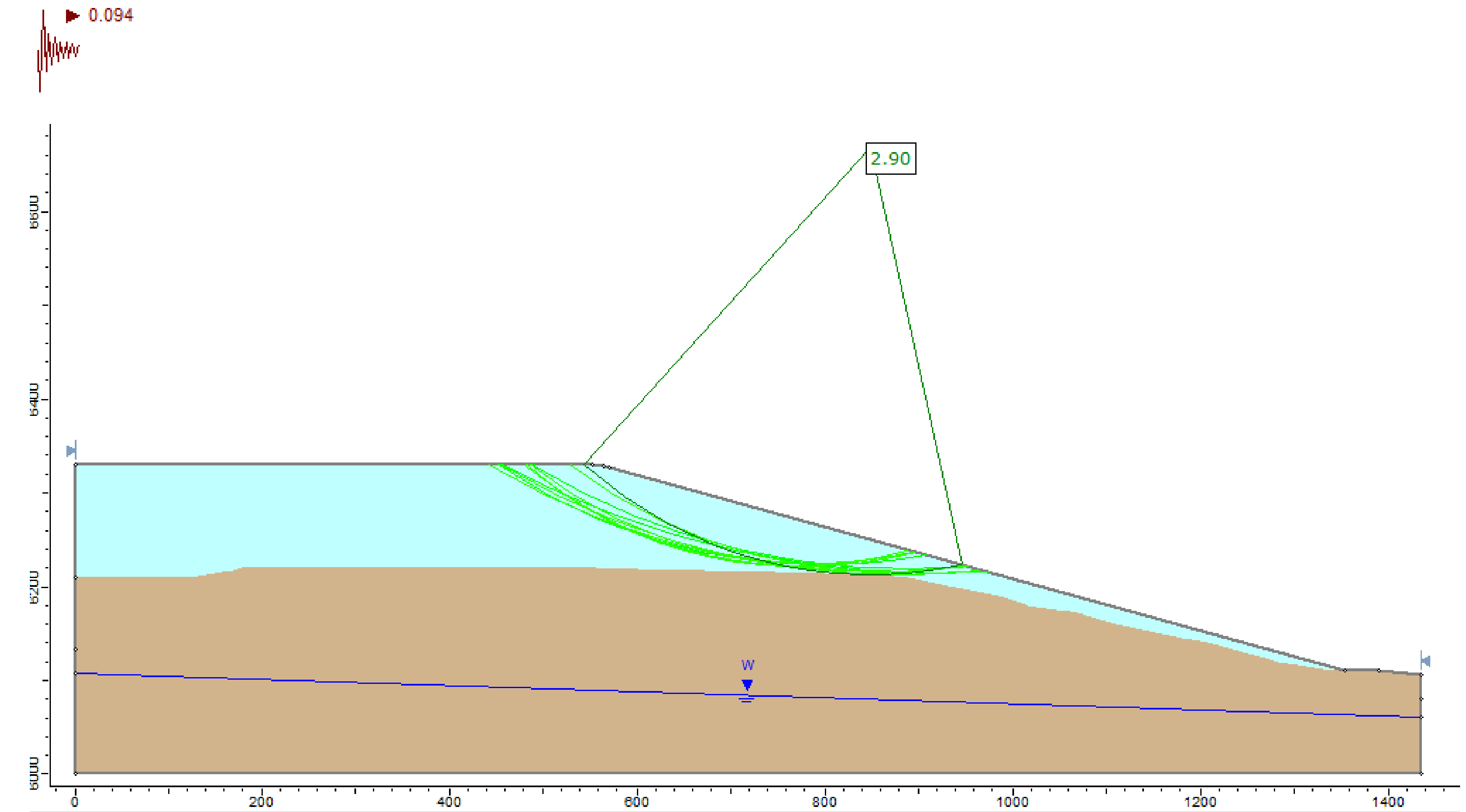


SECTION: *CLW WASTE: LR-C2*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER

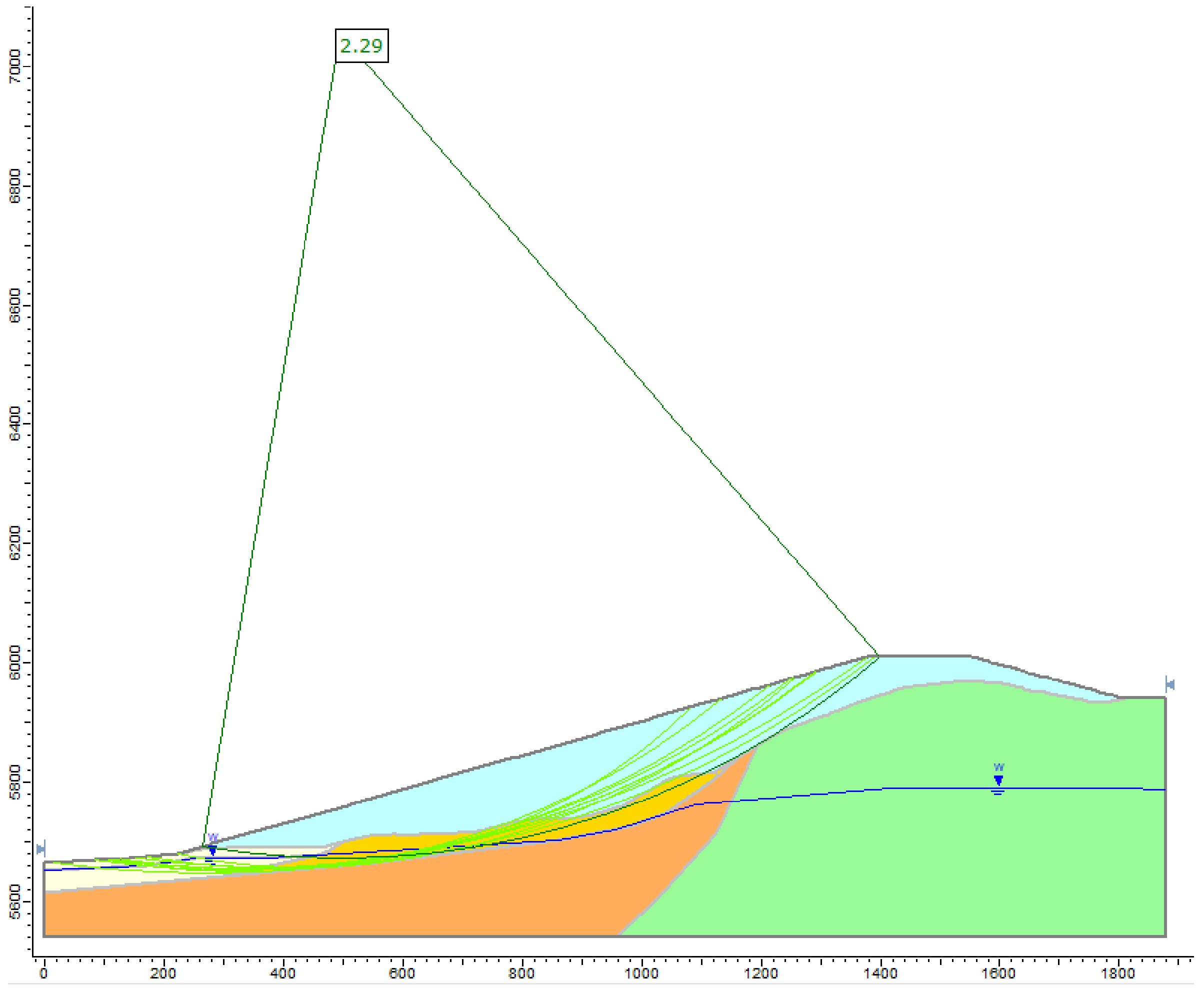
Project	FMI – Tyrone: Little Rock Closure Close-out Plan Update
Analysis Description	SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
Figure	A4
Company	FMI - Tyrone
Date	6-10-2020
File Name	

SLIDEINTERPRET 8.014



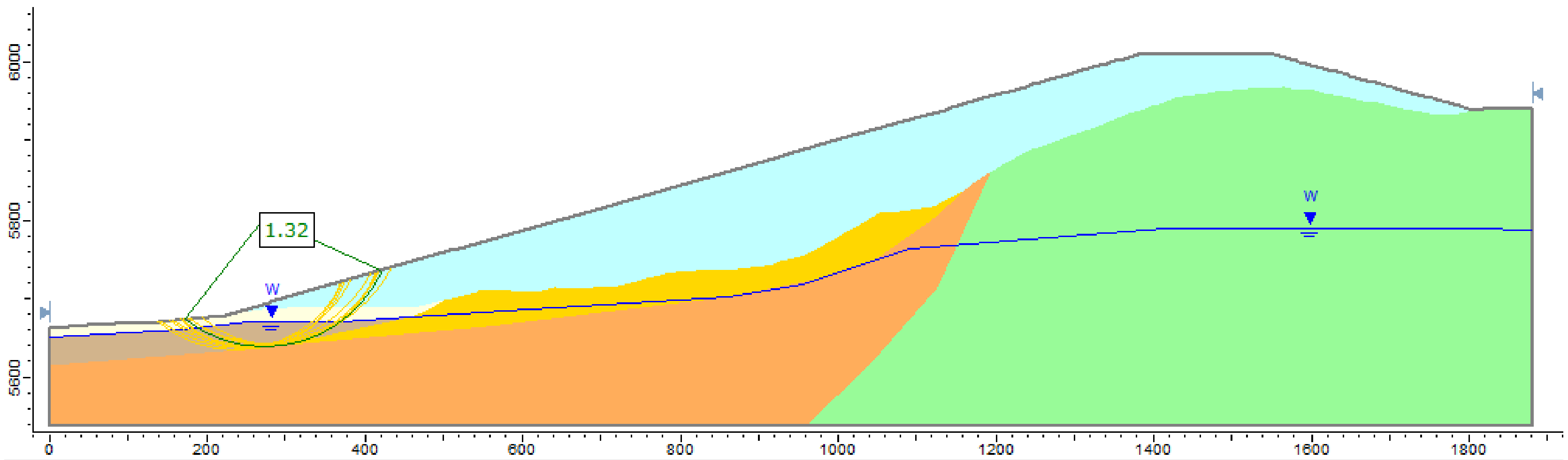
SECTION: *CLW WASTE: LR-C2*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
	Figure A5	*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020	*File Name*



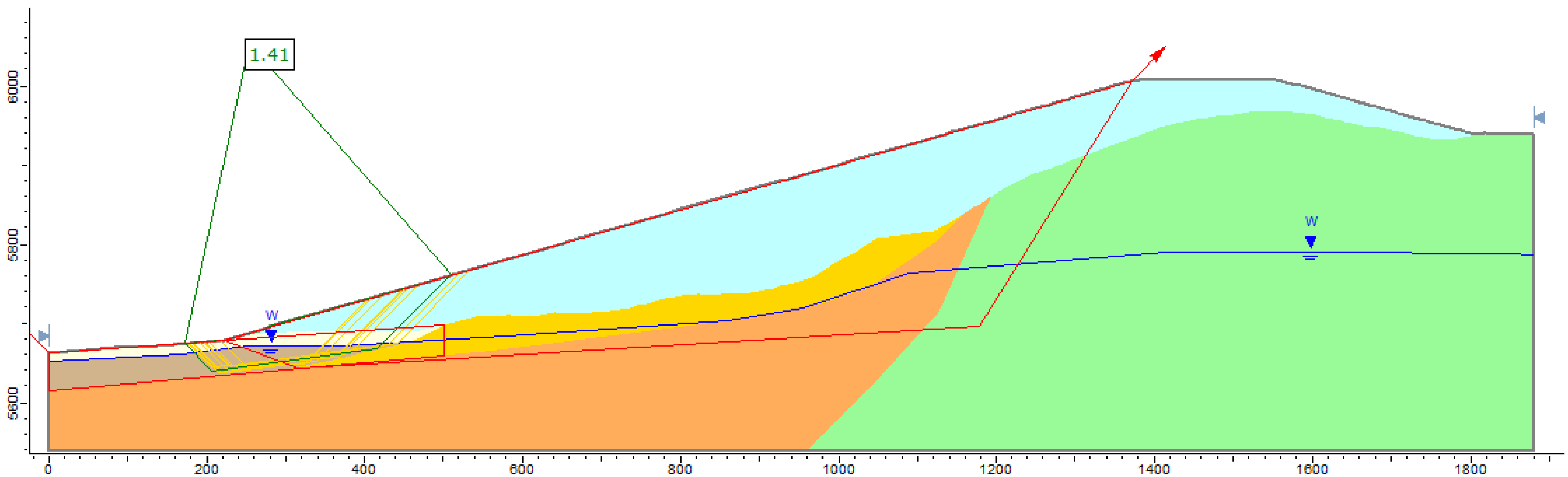
SECTION: *NRW WASTE: LR-N1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A6		*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020		*File Name*



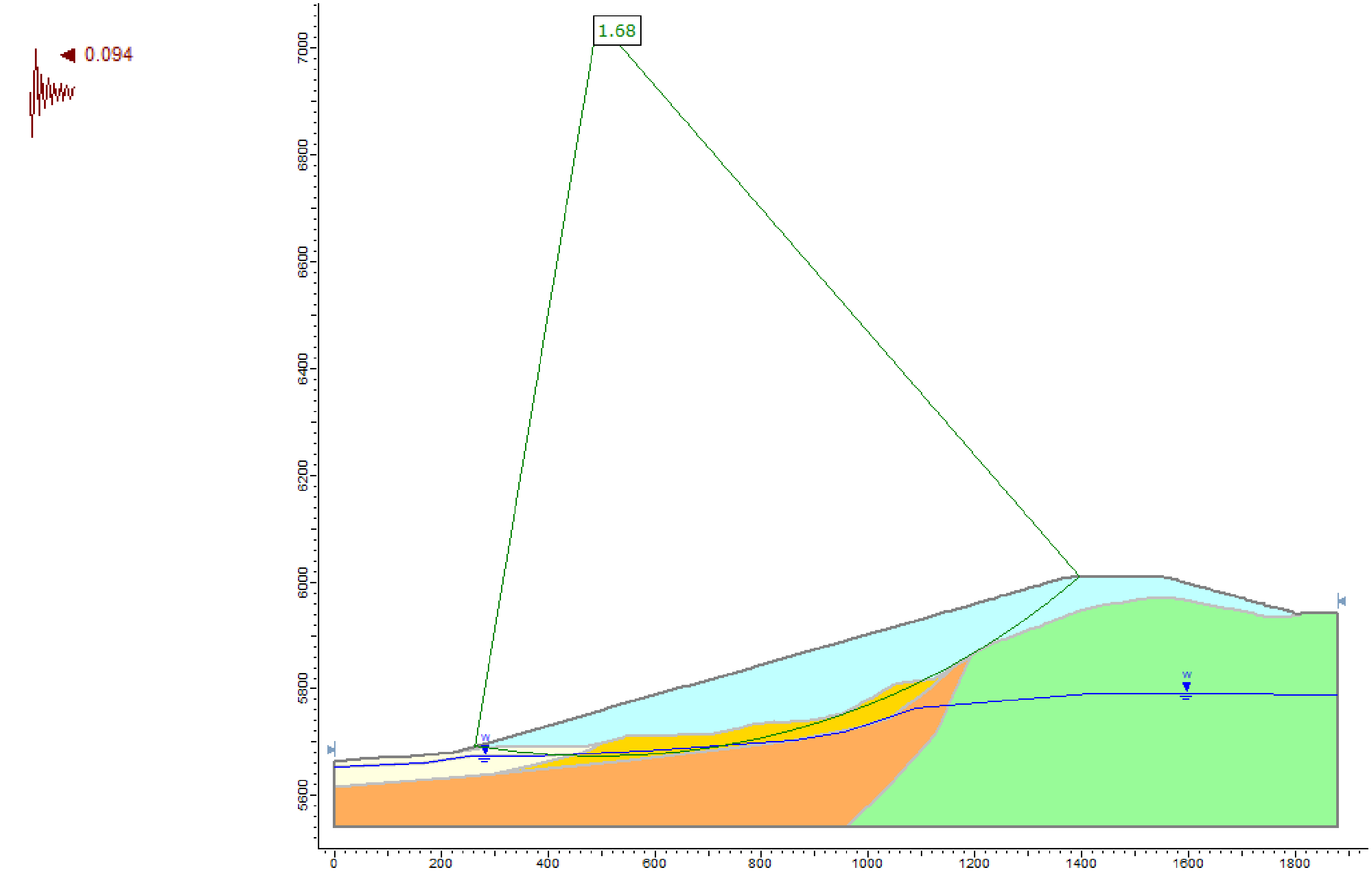
SECTION: *NRW WASTE: LR-N1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *CIRCULAR, STATIC, Post-Liquefied Qa*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
	Figure A7 — *Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020 — *File Name*



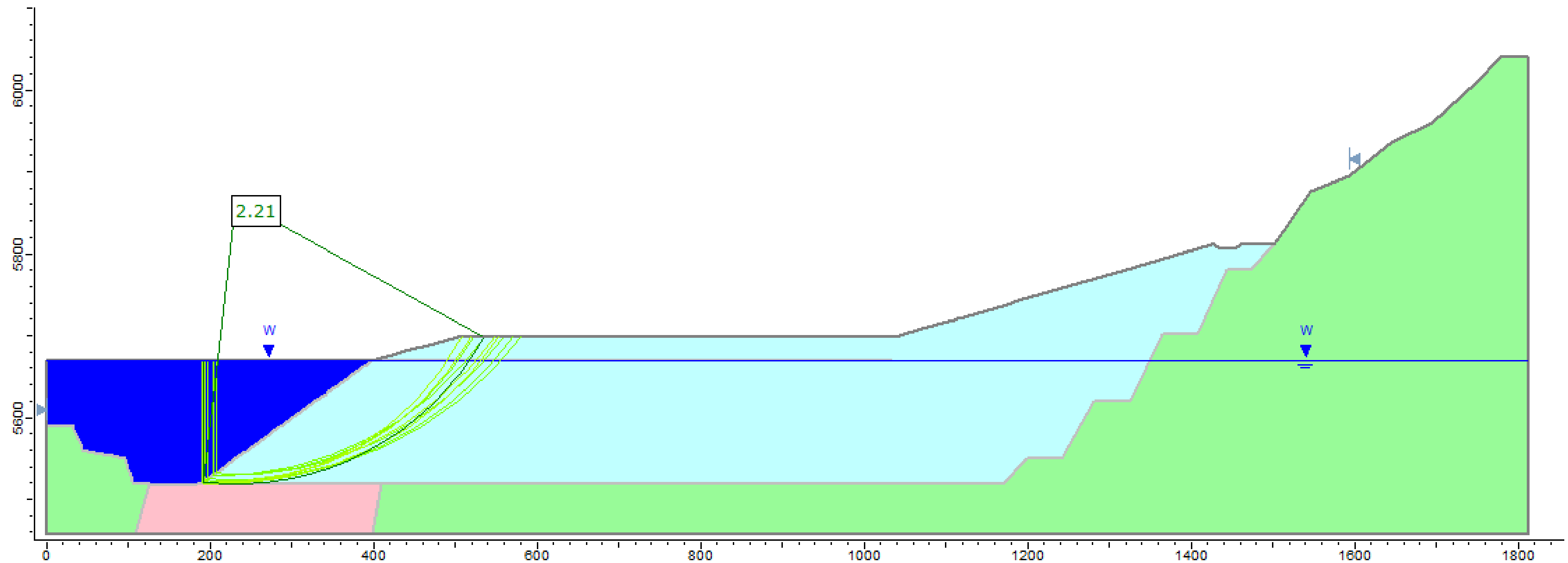
SECTION: *NRW WASTE: LR-N1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *BLOCK, STATIC, Post-Liquefied Qa*

GOLDER	*Project*	FMI – Tyrone: Little Rock Closure Close-out Plan Update
	Analysis Description	SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
	Figure A8	*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020	*File Name*



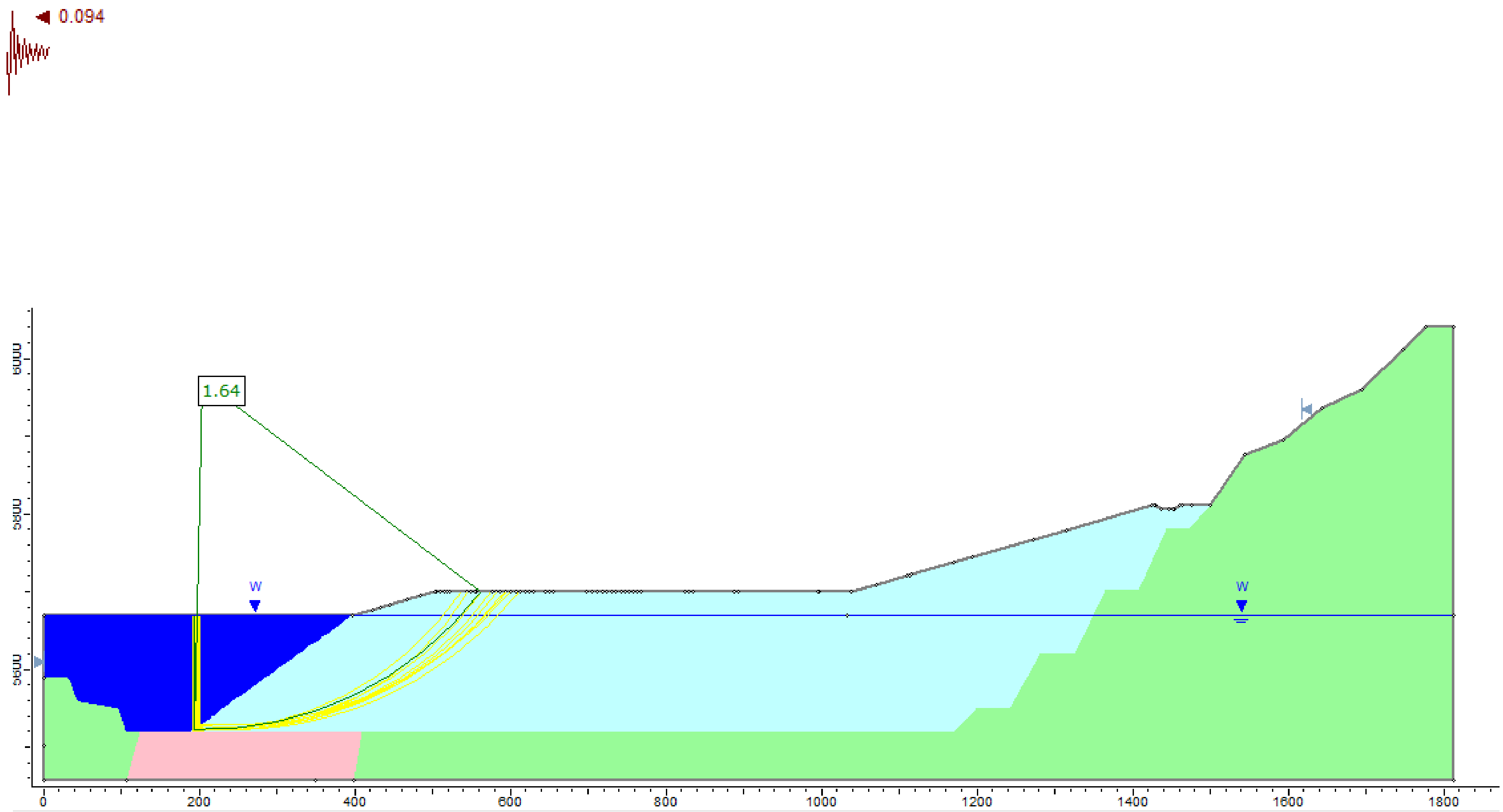
SECTION: *NRW WASTE: LR-N1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A9	*Company*	FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020	*File Name*	



SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
	Figure A10	*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020	*File Name*

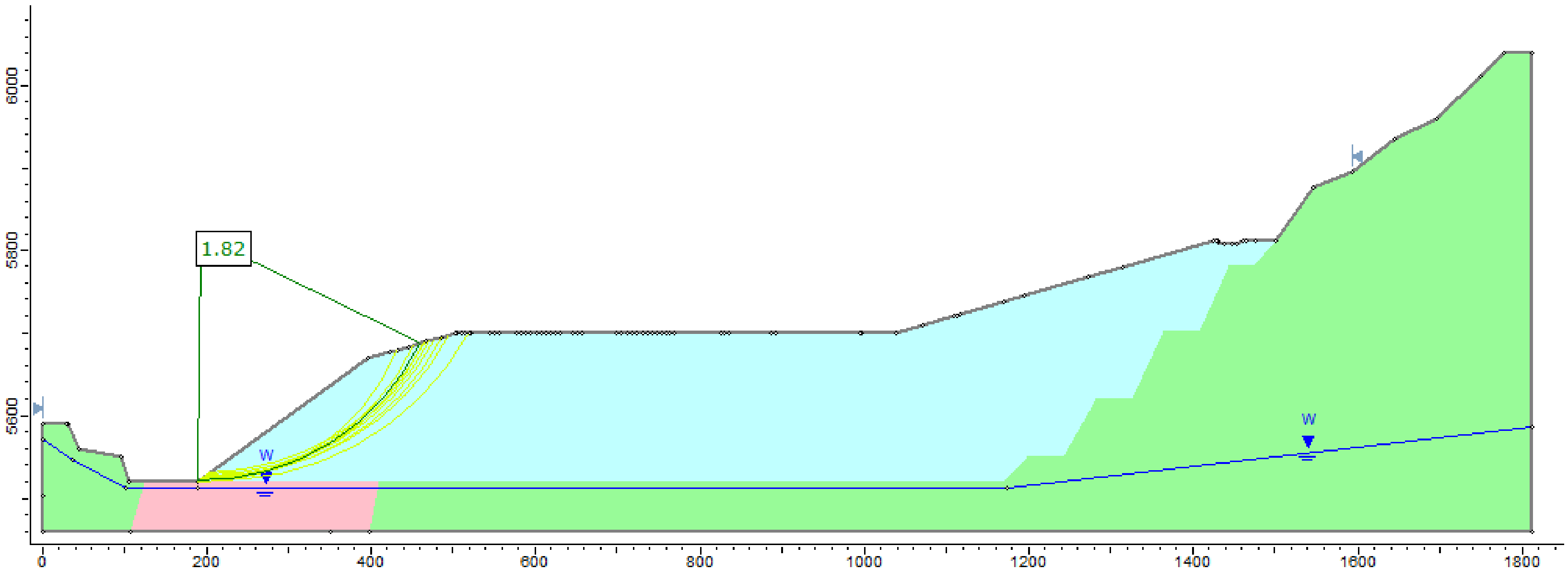


SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER

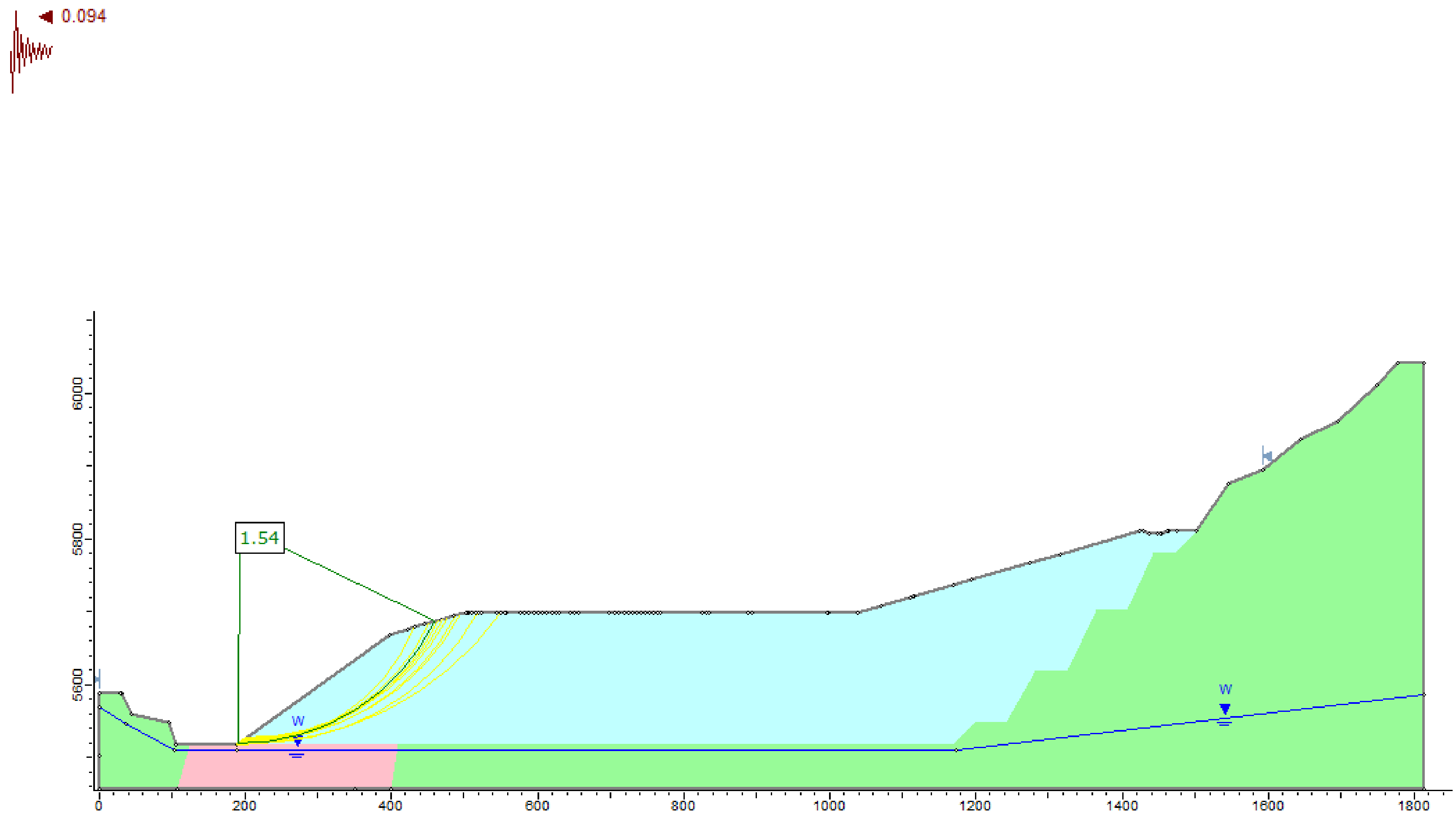
Project FMI – Tyrone: Little Rock Closure Close-out Plan Update			
Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)			
Figure A11		*Company* FMI - Tyrone	
Date 6-10-2020		*File Name*	

SLIDEINTERPRET 8.014



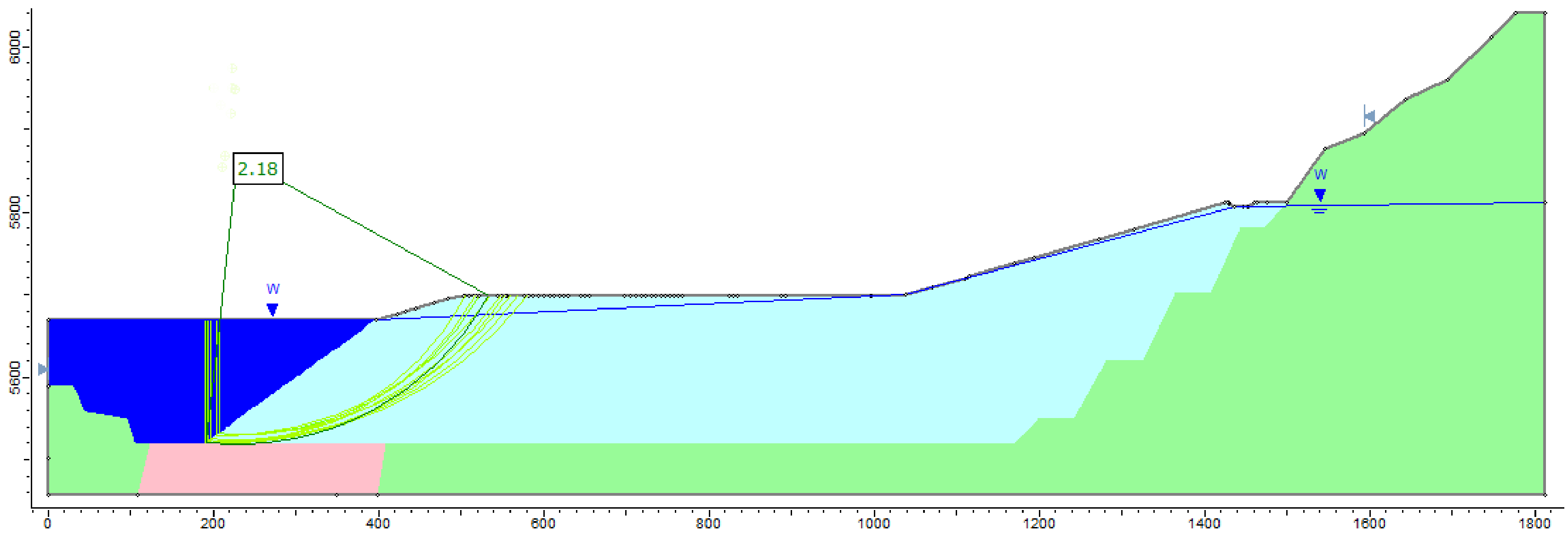
SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *NO PIT LAKE – DEWATERED PIT*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A12		*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020		*File Name*



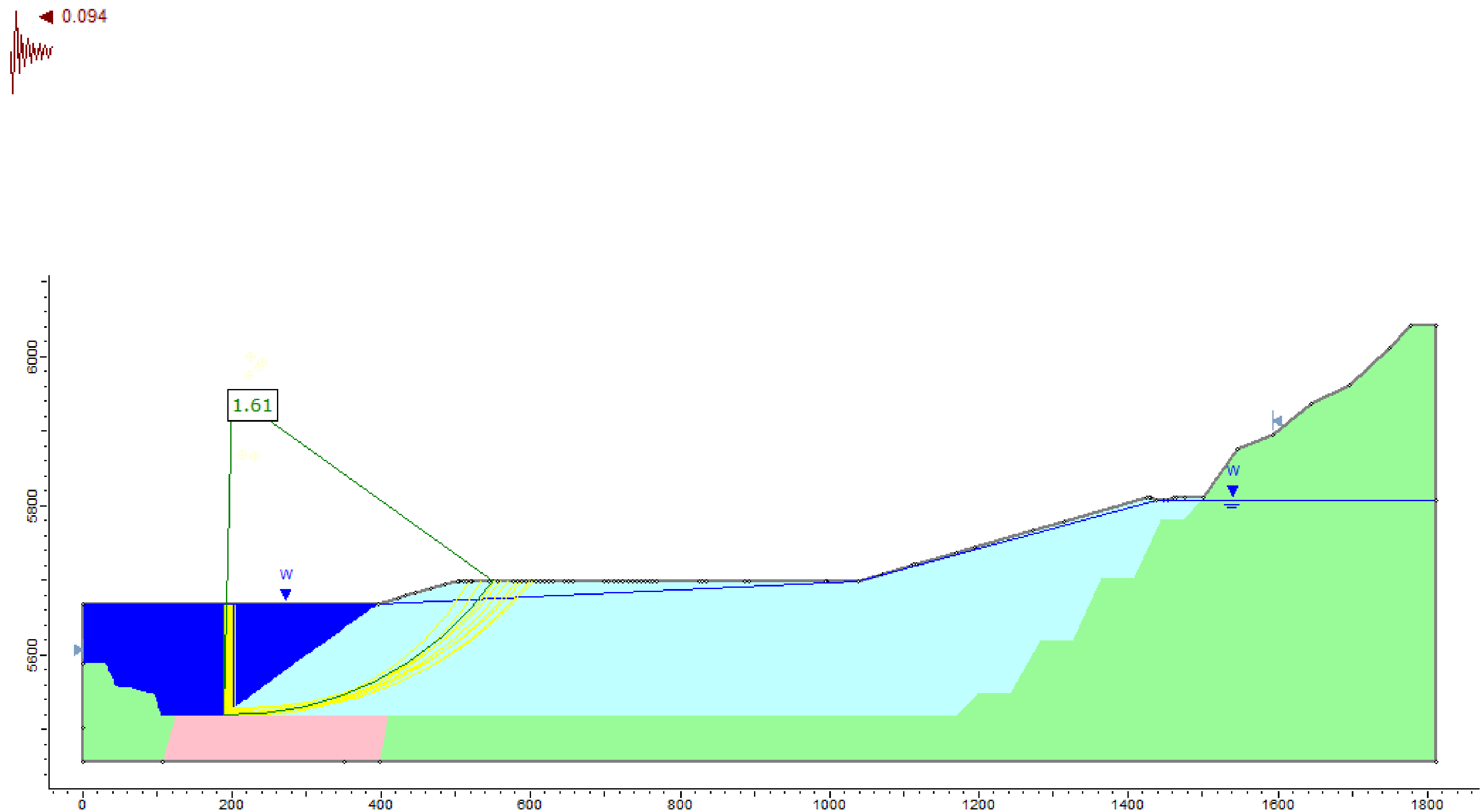
SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *NO PIT LAKE – DEWATERED PIT*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A13		*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020		*File Name*



SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT AND RAISED WATER TABLE FROM DEADMAN CANYON IN-PIT DIVERSION*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update	
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)	
	Figure A14	*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020	*File Name*

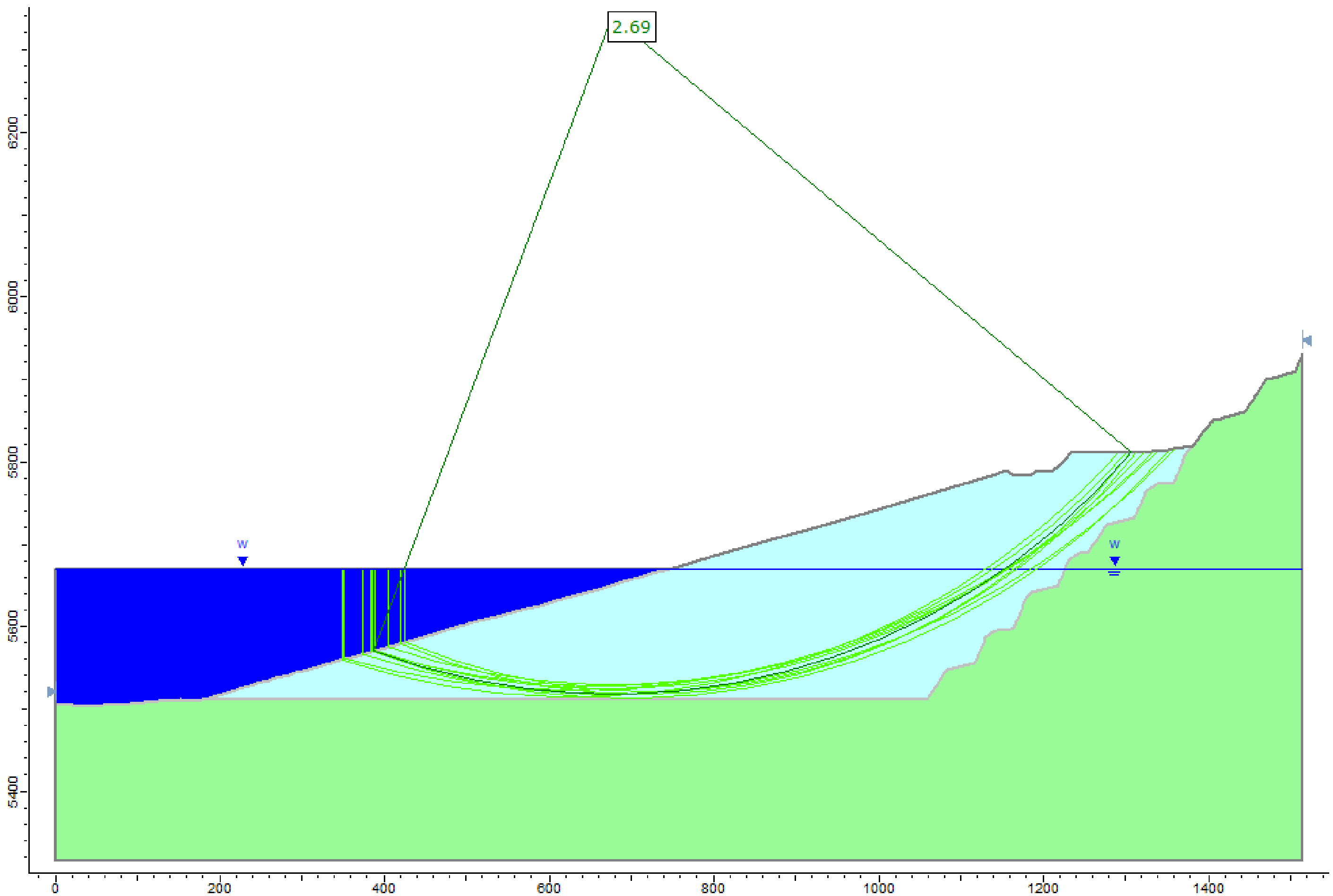


SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT AND RAISED WATER TABLE FROM DEADMAN CANYON IN-PIT DIVERSION*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER

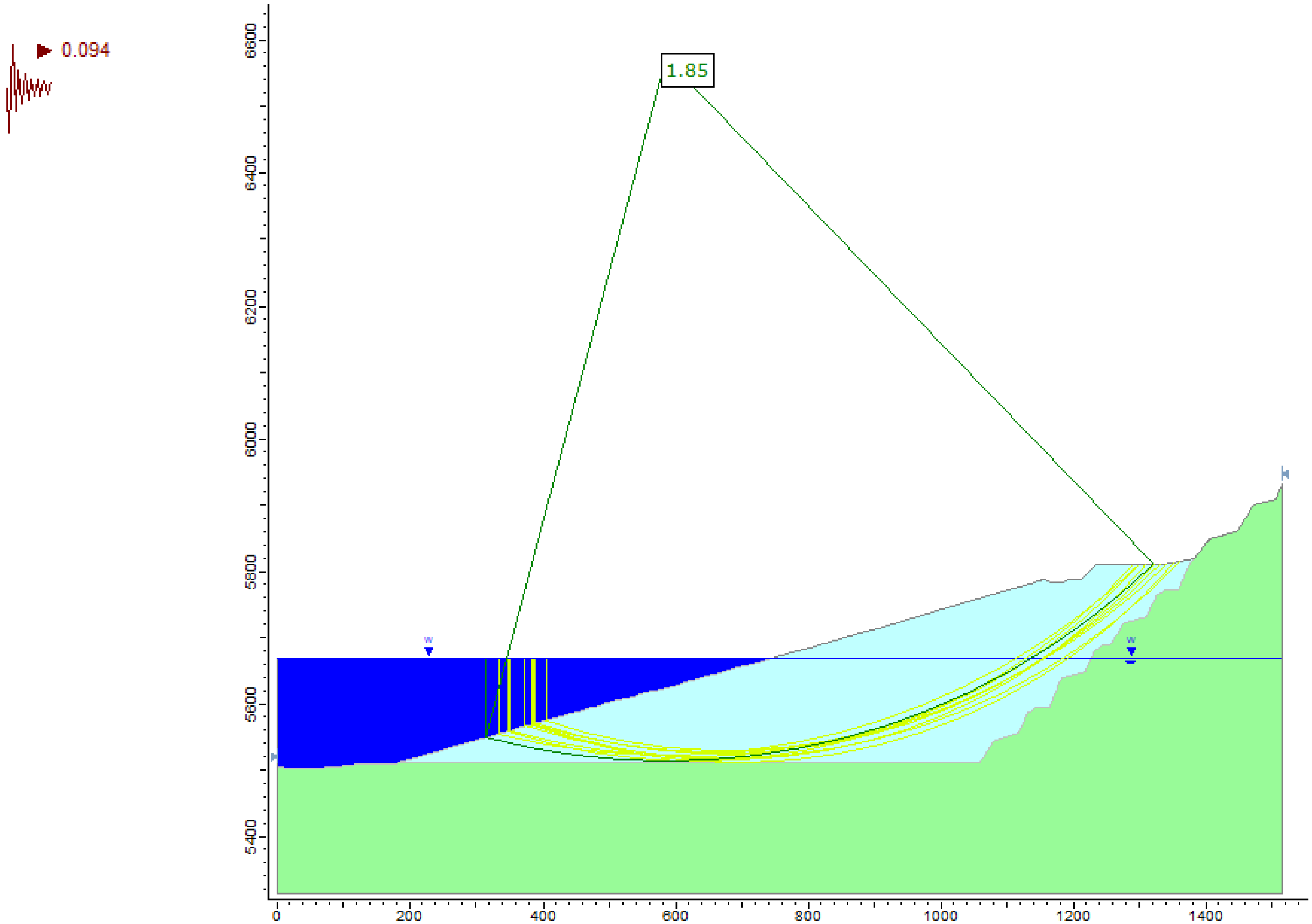
Project FMI – Tyrone: Little Rock Closure Close-out Plan Update			
Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)			
Figure A15		*Company* FMI - Tyrone	
Date 6-10-2020		*File Name*	

SLIDEINTERPRET 8.014



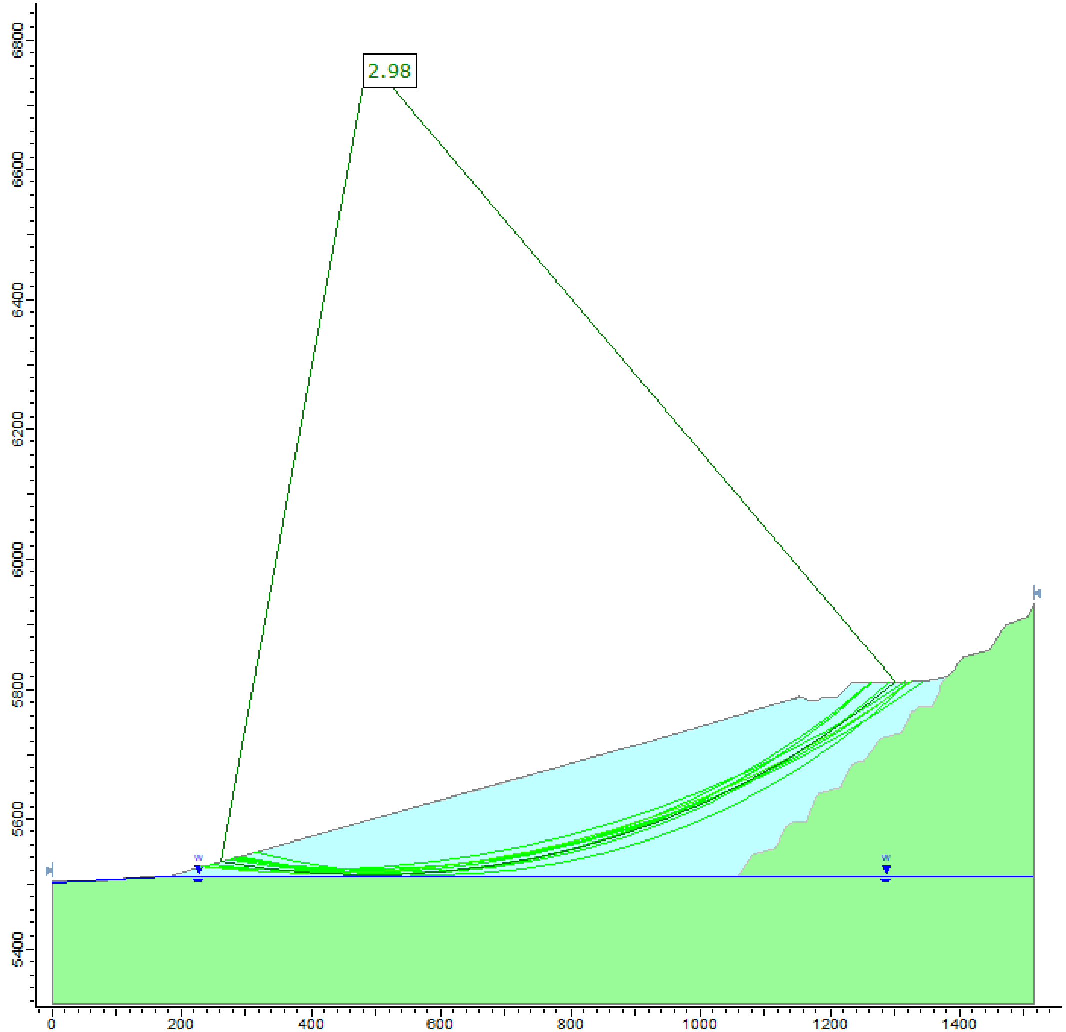
SECTION: *EAST IN-PIT WASTE: LR-E2*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A16		*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020		*File Name*



SECTION: *EAST IN-PIT WASTE: LR-E2*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A17		*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020		*File Name*

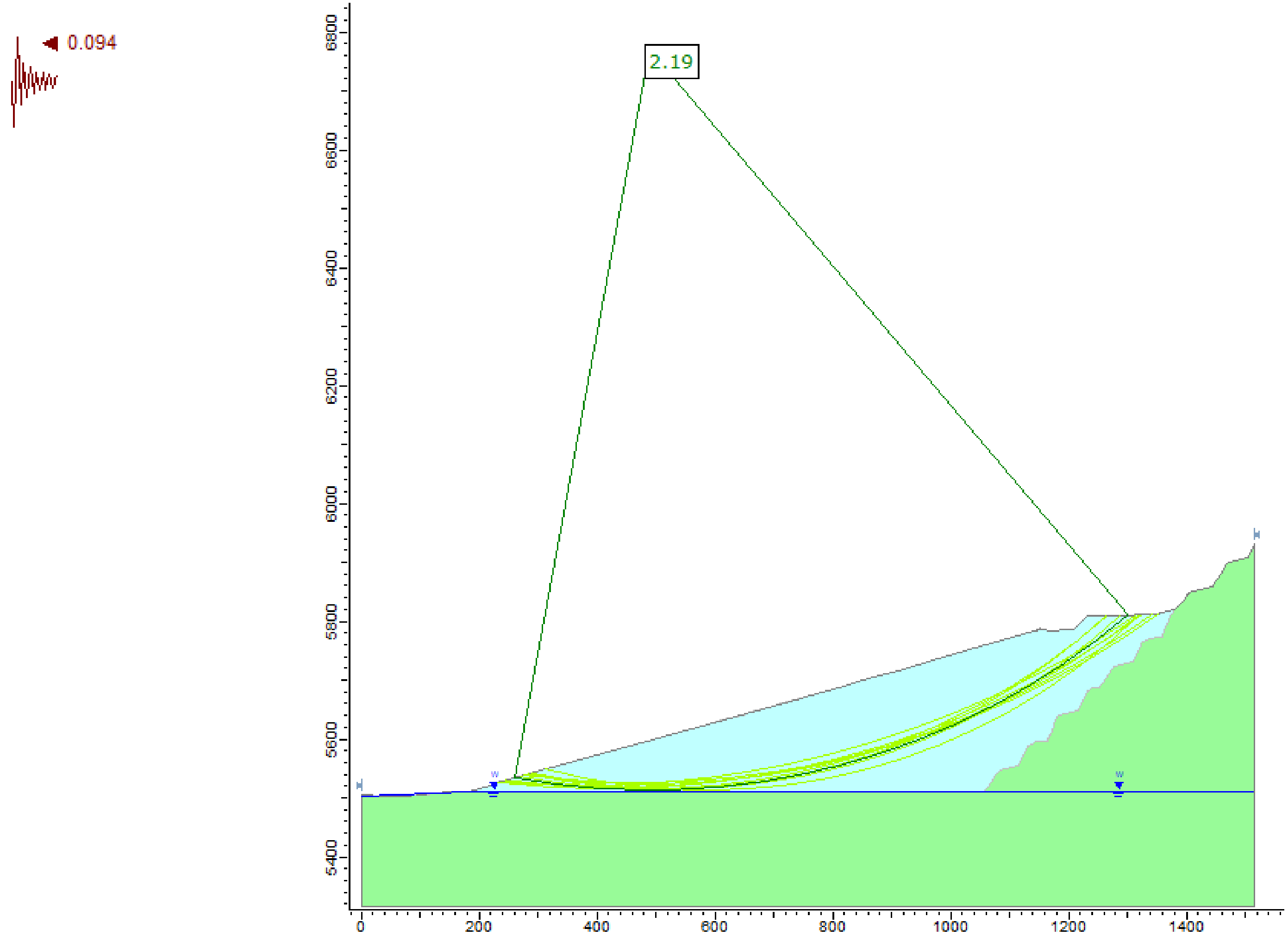


SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *NO PIT LAKE – DEWATERED PIT*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER

Project	FMI – Tyrone: Little Rock Closure Close-out Plan Update		
Analysis Description	SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
Figure	A18	*Company*	FMI - Tyrone
Date	6-10-2020	*File Name*	

SLIDEINTERPRET 8.014



SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *NO PIT LAKE – DEWATERED PIT*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

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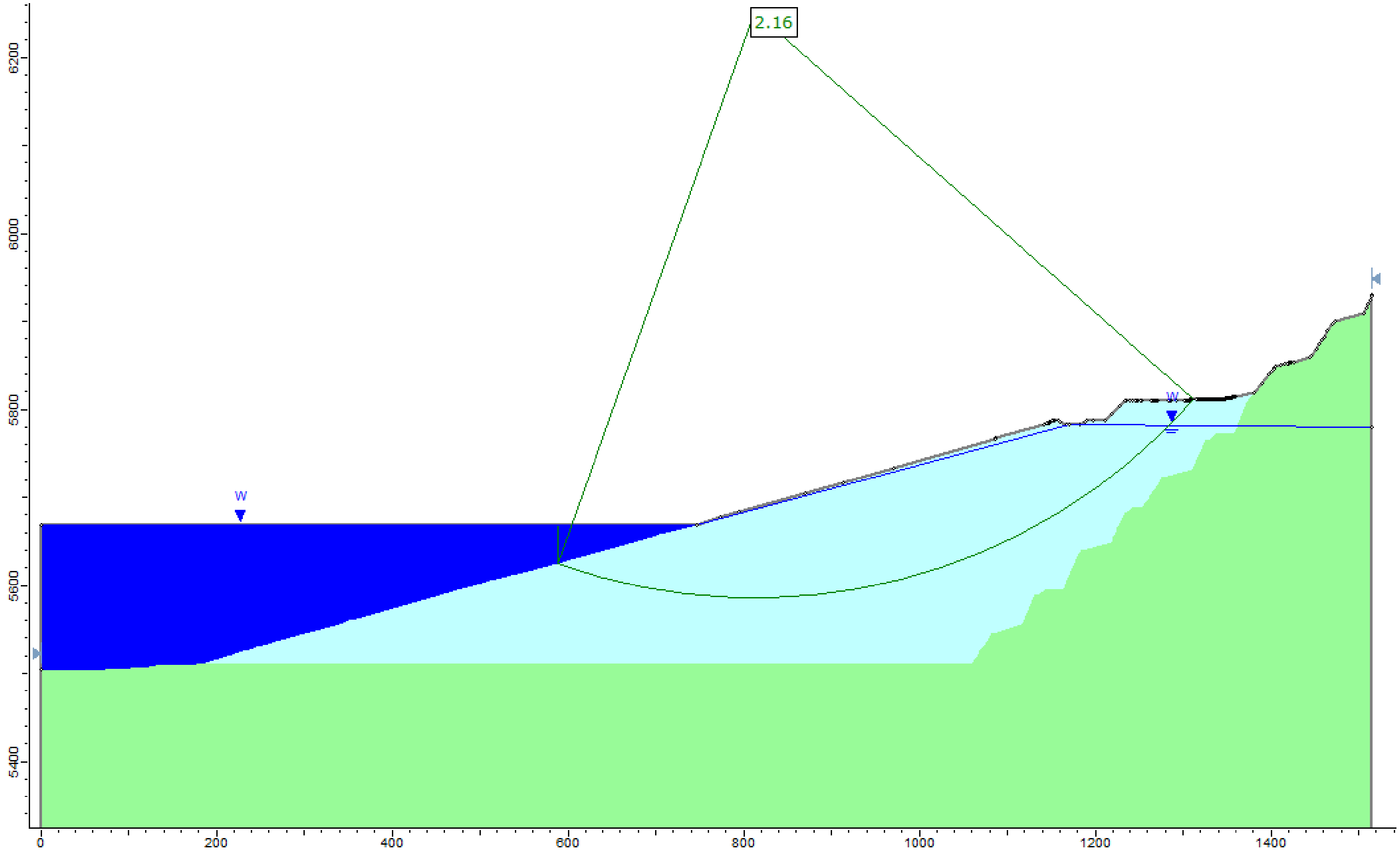
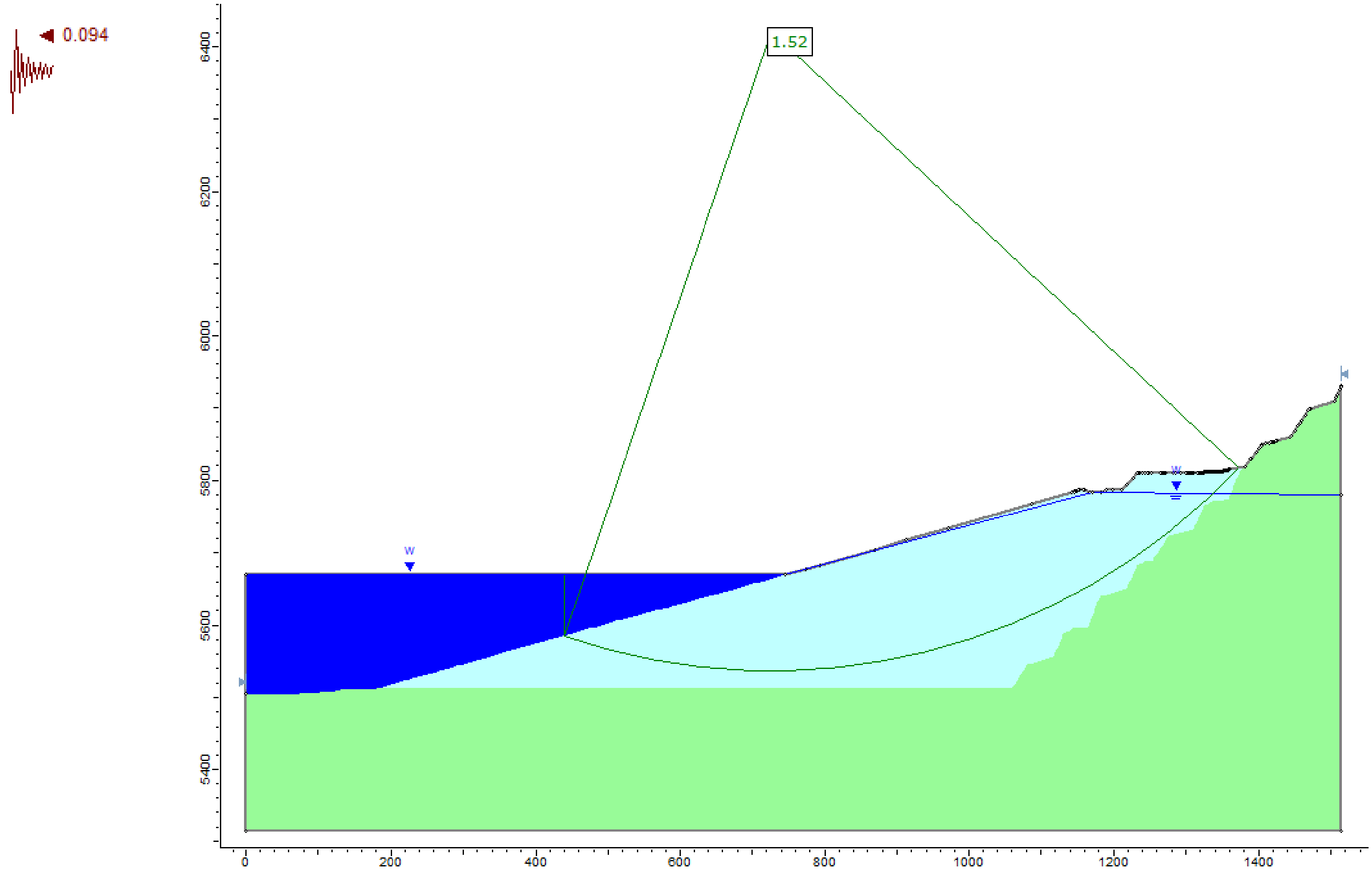
SLIDEINTERPRET 8.014

Project FMI – Tyrone: Little Rock Closure Close-out Plan Update			
Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)			
Figure A19		*Company* FMI - Tyrone	
Date 6-10-2020		*File Name*	



SECTION: *EAST IN-PIT WASTE: LR-E2*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT AND RAISED WATER TABLE FROM DEADMAN CANYON IN-PIT DIVERSION*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A20		*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020		*File Name*



SECTION: *EAST IN-PIT WASTE: LR-E2*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT AND RAISED WATER TABLE FROM DEADMAN CANYON IN-PIT DIVERSION*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A21		*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 6-10-2020		*File Name*

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