REPORT

UPDATED CLOSURE/CLOSEOUT PLAN FOR THE LITTLE ROCK MINE

Submitted to:

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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 updated 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 302 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 220 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 configuration of the planned East In-Pit Waste, and NRW Waste stockpiles unless otherwise noted.

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 are 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 prior to reclamation. 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 prior to reclamation. The North In-Pit Waste stockpile is projected to be completely covered by the stabilized pit lake surface at approximately 80 years after closure.

Two additional new waste rock stockpiles are included in the EOY 2024 mine plan (**Figure 2-1**). 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 109.1 acres prior to reclamation. 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 prior to reclamation. The East In-Pit stockpile facility is projected to cover an area of approximately 10 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 Little Rock Mining Area Design Limit or the 9A Waste and 9AX Waste stockpiles 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 removed and/or demolished and remaining concrete slabs include:

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

Power transmission lines, power poles, and substation will be removed once they are not needed for post-closure purposes.

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 NMED approved 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). A generalized geologic map showing the exposed geology associated with the projected EOY 2024 open pit configuration is presented on **Figure 2-4**, and associated geologic cross sections through the projected EOY 2024 open pit are presented on **Figures 2-5 and 2-6**. 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 southwest 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. Several 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 several unnamed faults that run west of the Southern Star Fault (**Figure 2-4**). Additional unnamed northeast trending faults are also located within the eastern portion of the permit area.

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 50ºF (10ºC). 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 proposed Little Rock open pit boundary. 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 is also currently evaluating the suitability of Precambrian Granite from the Little Rock Mine as reclamation cover material for the Tyrone Mine. As detailed in the USNR test plot as-built report (Golder 2017), the two-acre test plot includes four treatments, which are approximately a half-acre each, including: 1) a control plot (conventional seed mix and mulching); 2) mulch prior to seeding with conventional seed mix plot; 3) conventional mulch with alternative seed mix plot; and 4) mulch prior to seeding with alternative seed mix plot. 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 and reclaimed acreages 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 176.3 acres of stockpile surfaces are targeted for reclamation under this (EOY 2024) plan. By agency request, the reclamation cost estimate includes the cost for hauling and placing additional fine-grained cover, from a local source (for financial assurance purposes, it is assumed the North Stockpile), on the waste stockpiles to enhance the seed bed in potential rocky areas. No additional earthwork reclamation measures are proposed for the West Canyon waste rock stockpile and operations and maintenance costs is included in the CCP until financial assurance (FA) 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**).

Two new waste stockpiles (East In-Pit Waste and NRW 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 (Proposed Little Rock Open Pit Boundary), 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 13.7 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 was completed by DBS&A and the results was 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 31.1 acres of haul road surfaces are targeted for reclamation under this (EOY 2024) plan. The Northern Haul RoadSouthern 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 (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 128.3 acres. Also, an additional 10 acres of area is included in the reclamation cost estimate for allowance for additional disturbed areas within the Mine Permit area. The additional disturbed areas may include exploration drilling and well pads, small staging areas, utility corridors, haul roads, pull-offs, 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, power poles, and temporary buildings and providing erosion and drainage control and revegetation. 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, NRW Waste, Reclaimed Copper Leach Stockpile, and historical North and West Canyon waste rock stockpiles. All of the waste 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 historical North stockpile is constructed above the surrounding terrain therefore run on controls are not required for this facility. 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 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 Reclaimed Copper Leach Stockpile and P-Plant 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;
- The remaining Northern Haul Road and its accessible disturbance area will be reclaimed by seeding by manual application;
- Reduce the Southern Haul Road and Little Rock Haul Road to a 30-foot width to allow one-lane use for maintenance activities;
- Ripping of haul road areas to be reclaimed 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, power poles, 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

- There are no ancillary facilities and/or infrastructure that will be used for post-closure purposes.

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, transmission lines, and power poles; 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 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.

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, erosion control, and establishment of vegetation that is supportive of wildlife habitat 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.

Based on the results of numerous vegetation monitoring and test plot studies at both Chino and Tyrone, cool-season grasses are generally not found within the reference area and in reclaimed areas despite seeding efforts to introduce these species. As shown on **Table 6-3**, Tyrone proposes to change the numerical standard of perennial cool season grasses from 2 to 0 (eliminating the cool-season grass standard). The elimination of the cool-season grass component is consistent with the surrounding ecosystem and will not negatively affect the PMLU.

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		
Total Reclamation Area • Stockpile Reclamation Area • Open Pit Perimeter Reclamation Area • Accessible Flat Areas • Haul Road Reclamation Area • Deadman Diversion • Substation, Powerline, and Pipeline Corridors • Allowance for Other Disturbed Areas[1]	315 176 30 14 31 13 41 10	acres acres acres acres acres acres acres acres
Stockpile Grading	2.3	million cubic yards
Stockpile Bench Grading	31,382	feet
Cover Material	10,272	cubic yards
Stockpile Surface Water Conveyance Channels and Downdrains	36,304	feet
Open Pit Grading	NA	million cubic yards
Open Pit Cover Material	NA	cubic yards

Earthwork Material Take-Off Summary		
Building Demolition	1,614	square feet

Notes:

[1] – Includes additional 10 acres of area that is included in the reclamation cost estimate for allowance for additional disturbed areas within the Mine Permit area.

NA – Not applicable

Reclamation areas presented to the nearest acre

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 is allocated as follows:

Erosion Control and Monitoring:

Annual cost estimates after closure is 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 19 years for a total of 20 years of monitoring.

Road Maintenance:

Access road and haul road maintenance for post-reclamation years 1 through 12 is included in the erosion control and monitoring costs. The road maintenance cost for post-reclamation years 13 through 30 is 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,

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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
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, and NRW 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 (for FA purposes).
■ 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) - Reduce the Southern Haul Road and Little Rock Haul Road to a 30-foot width to allow one-lane use for maintenance activities - Haul road areas to be reclaimed 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, power poles, 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, power poles, booster pump stations, and substation will be removed once they are not needed for post-closure purposes. - 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[1,2]

Stockpile	Critical Failure Mode	Minimum Static FOS	Minimum Pseudo-Static FOS	Liquefied FOS
West In-Pit Waste[3]	Global failure, circular type	2.55	1.88	No liquefiable soils present
North In-Pit Waste[3]	Global failure, circular type	2.56	1.95	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. 2022. Stockpile Stability Analysis for Little Rock 2020 Closure Close-Out Plan Update. Freeport McMoRan Tyrone Inc. March 28.

[3] - 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
Heteropogon 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
Erigeron speciosus	Aspen fleabane	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 aristata	Blanket flower	Forb	Per	NA	ND	ND
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
Isocoma tenuisecta	Burroweed	Forb	Per	NA	ND	ND
Ipomopsis aggregata	Scarlet gilia	Forb	Per	NA	ND	ND
Lesquerella gordonii	Gordon bladderpod	Forb	Per	NA	ND	ND
Lotus rigidius	Deervetch	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
Melilotus officinalis	Sweetclover	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
Oenothera pallida	Pale 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

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

Species[a] Scientific Name	Common Name	Life-Form	Duration[b]	Seasonality	Rate[a,c]	PLS/ sq ft[d]
Alternate Seed Mix (cont.)						
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
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 flaccidus	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
Encelia virginensis	Virgin River brittlebush	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.)						
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
Robinia neomexicana	NM locust	Shrub	Per	NA	ND	ND
Senegalia greggii	Catclaw acacia	Shrub	Per	NA	ND	ND
Vachellia constricta	Whitethorn acacia	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	1
Forbs	NA	2	0.1

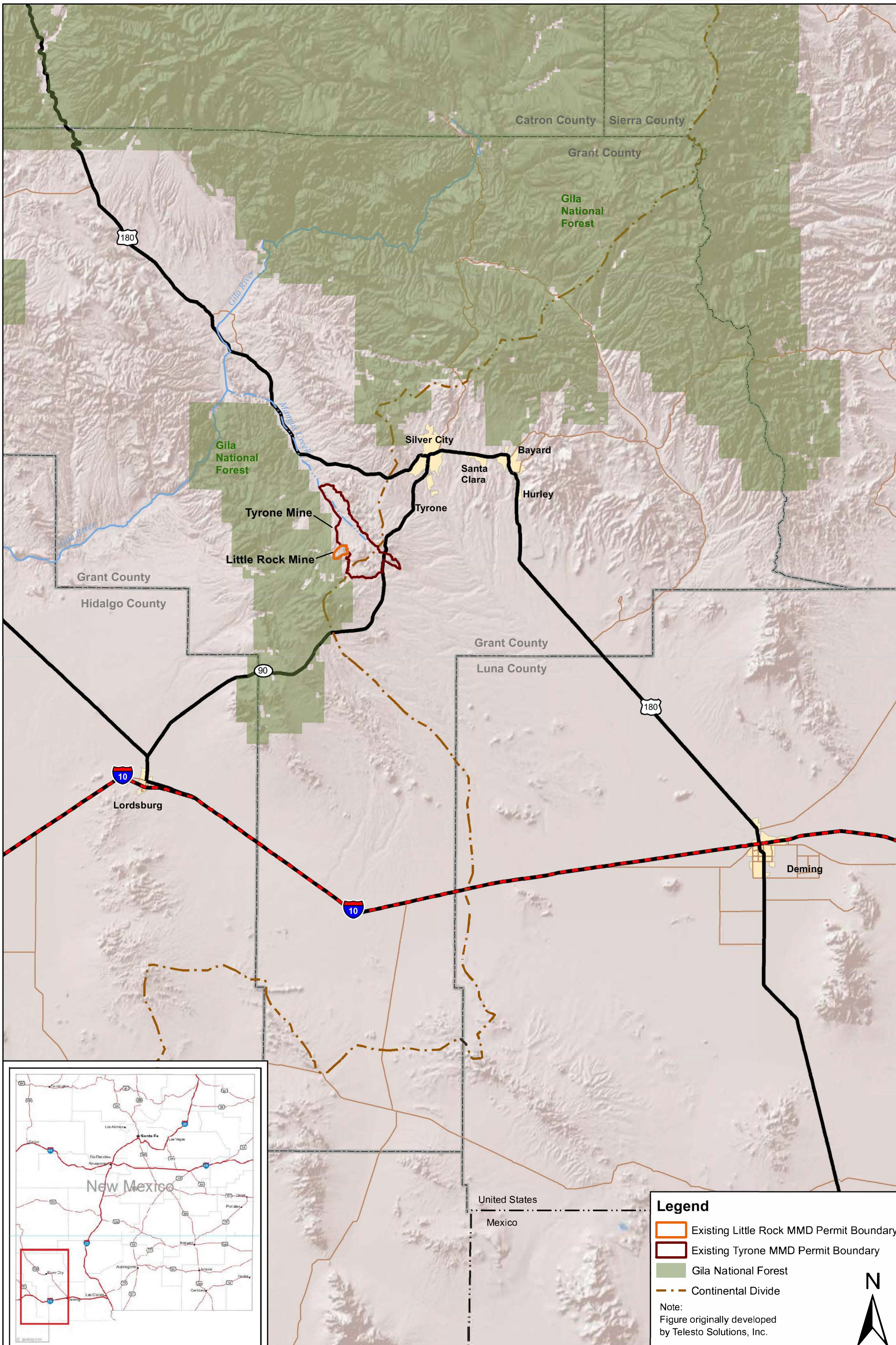
Notes:
NA = Not applicable

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
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 after the pipelines are no longer needed	1
Deadman Canyon Diversion	180 days following Cessation of Operation	2
North Stockpile	After all other areas are reclaimed	1
Ancillary Facilities and Infrastructure	180 days after the facilities and infrastructure are no longer needed	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



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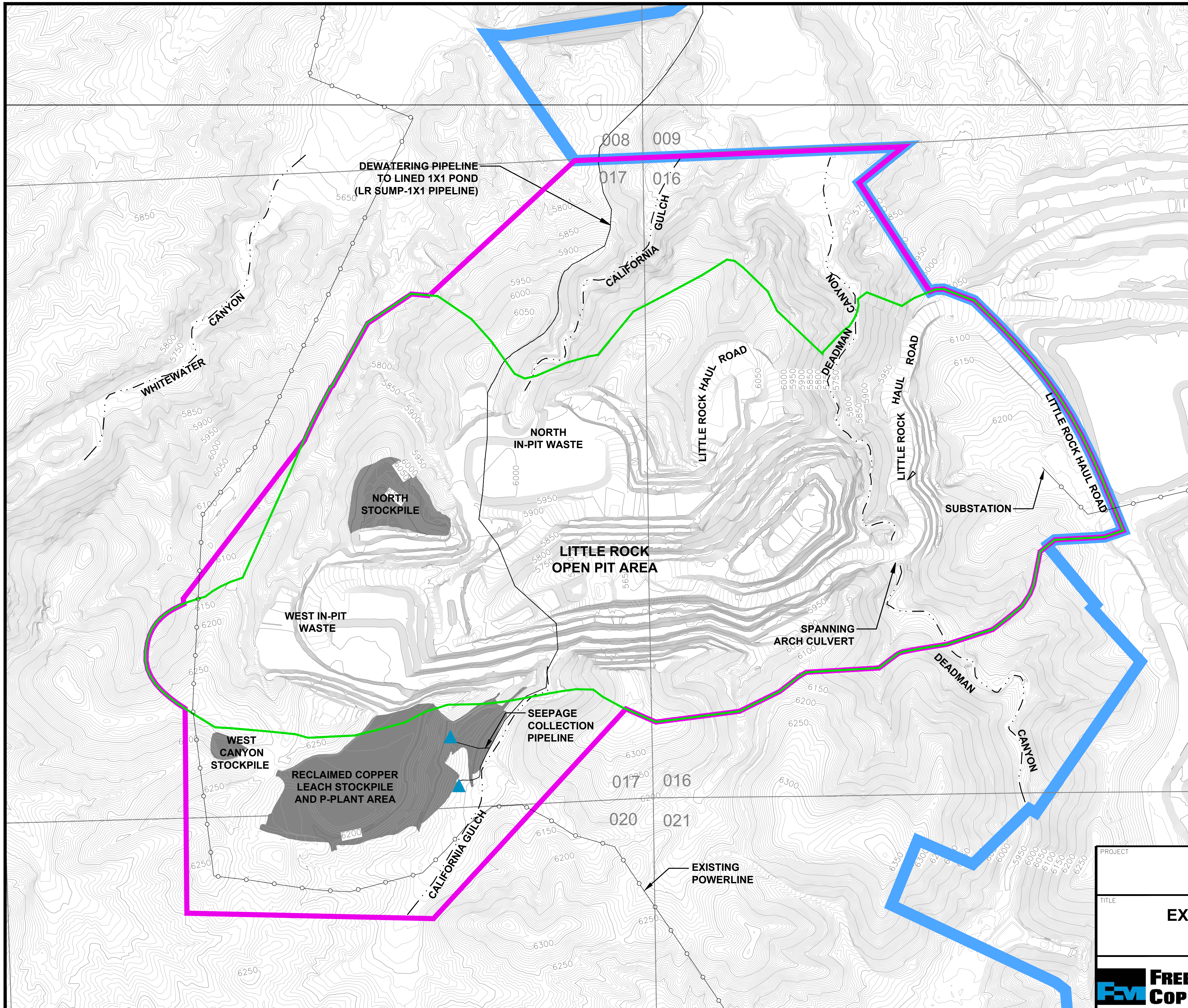
FREEPORT-MCMORAN COPPER & GOLD

PROJECT No. 20136957

FIGURE 1-1

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

TITLE
MINE LOCATION MAP



LEGEND

- EXISTING LITTLE ROCK MINE PERMIT BOUNDARY
- EXISTING TYRONE MINE PERMIT BOUNDARY
- SEEPAGE COLLECTION FACILITY
- APPROVED MINING AREA DESIGN LIMIT (PERMIT REVISION 14-1 TO MMD PERMIT GR007RE)
- RECLAIMED AREA

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. WITH THE EXCEPTION OF THE RECLAIMED COPPER LEACH STOCKPILE, 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.
6. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR.

800 0 800
SCALE FEET

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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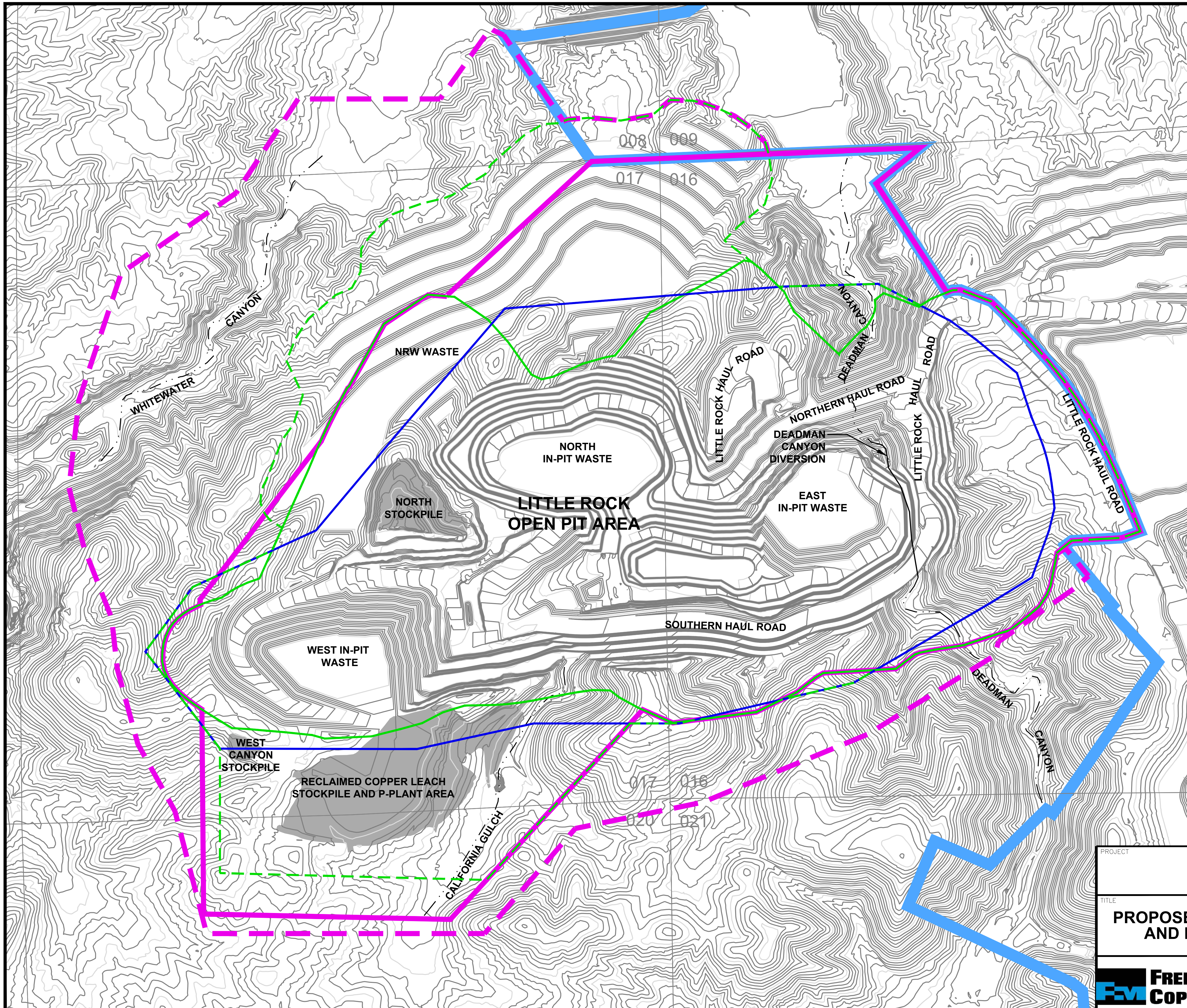
CADD	SIB	03/25/22		
CHECK				
REVIEW				

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
- PROPOSED LITTLE ROCK OPEN PIT BOUNDARY
- EXISTING LITTLE ROCK MINE PERMIT BOUNDARY
- PROPOSED CHANGE TO LITTLE ROCK MINE PERMIT BOUNDARY
- EXISTING TYRONE MINE PERMIT BOUNDARY
- RECLAIMED AREA

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. WITH THE EXCEPTION OF THE RECLAIMED COPPER LEACH STOCKPILE, 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.
6. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR.
7. DEADMAN CANYON DIVERSION TO BE CONSTRUCTED DURING RECLAMATION.
8. NRW WASTE AS SHOWN IS FACILITY FULL BUILD-OUT.

N

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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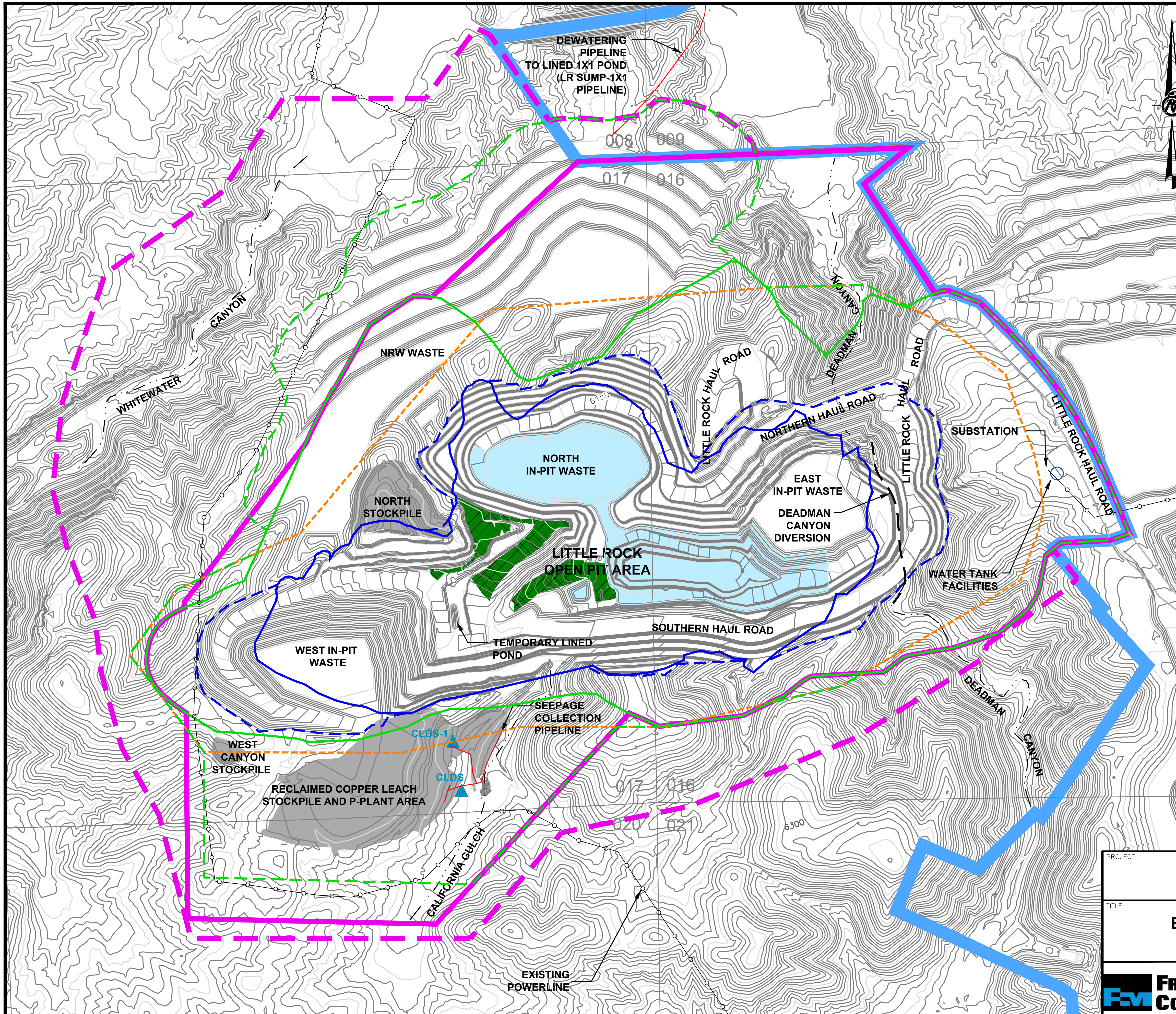
CADD	SIB	05/18/20	
CHECK			
REVIEW			

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
- CLDS-1 SEEPAGE COLLECTION FACILITY
- POST CLOSURE PIT LAKE AREA
- ACCESSIBLE FLAT AREAS
- PROPOSED LITTLE ROCK OPEN PIT BOUNDARY
- RECLAIMED AREA

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. WITH THE EXCEPTION OF THE RECLAIMED COPPER LEACH STOCKPILE, 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.
6. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR.
7. DEADMAN CANYON DIVERSION TO BE CONSTRUCTED DURING RECLAMATION.
8. NRW WASTE AS SHOWN IS FACILITY FULL BUILD-OUT.

800 0 800
SCALE FEET

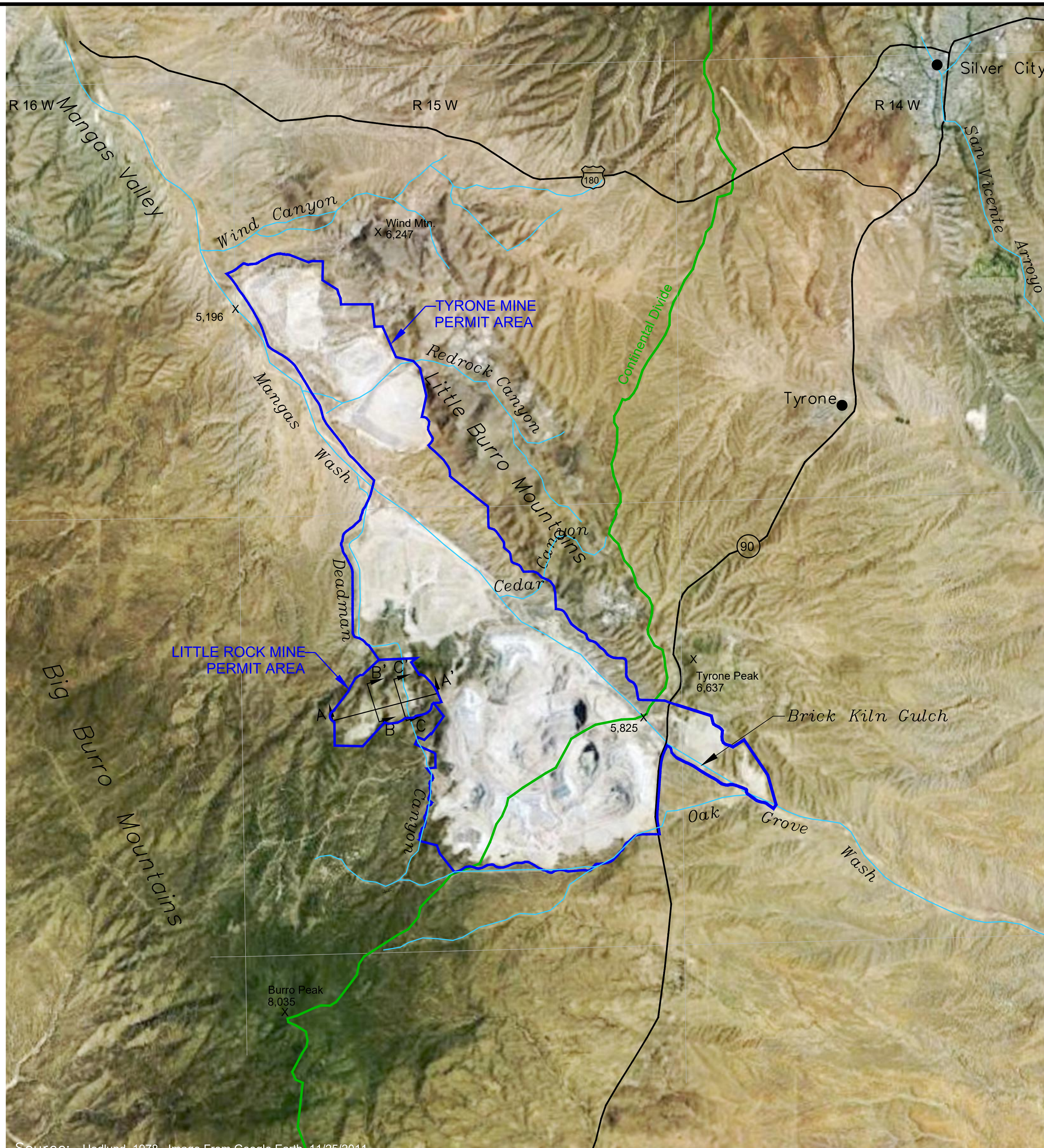
PROJECT
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

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		
CHECK				
REVIEW				

FIGURE 2-1



LEGEND

- CROSS SECTION LOCATIONS
- MINE PERMIT AREA
- NATURAL DRAINAGE
- CONTINENTAL DIVIDE
- X5,825 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

N

8000 0 8000
SCALE FEET

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

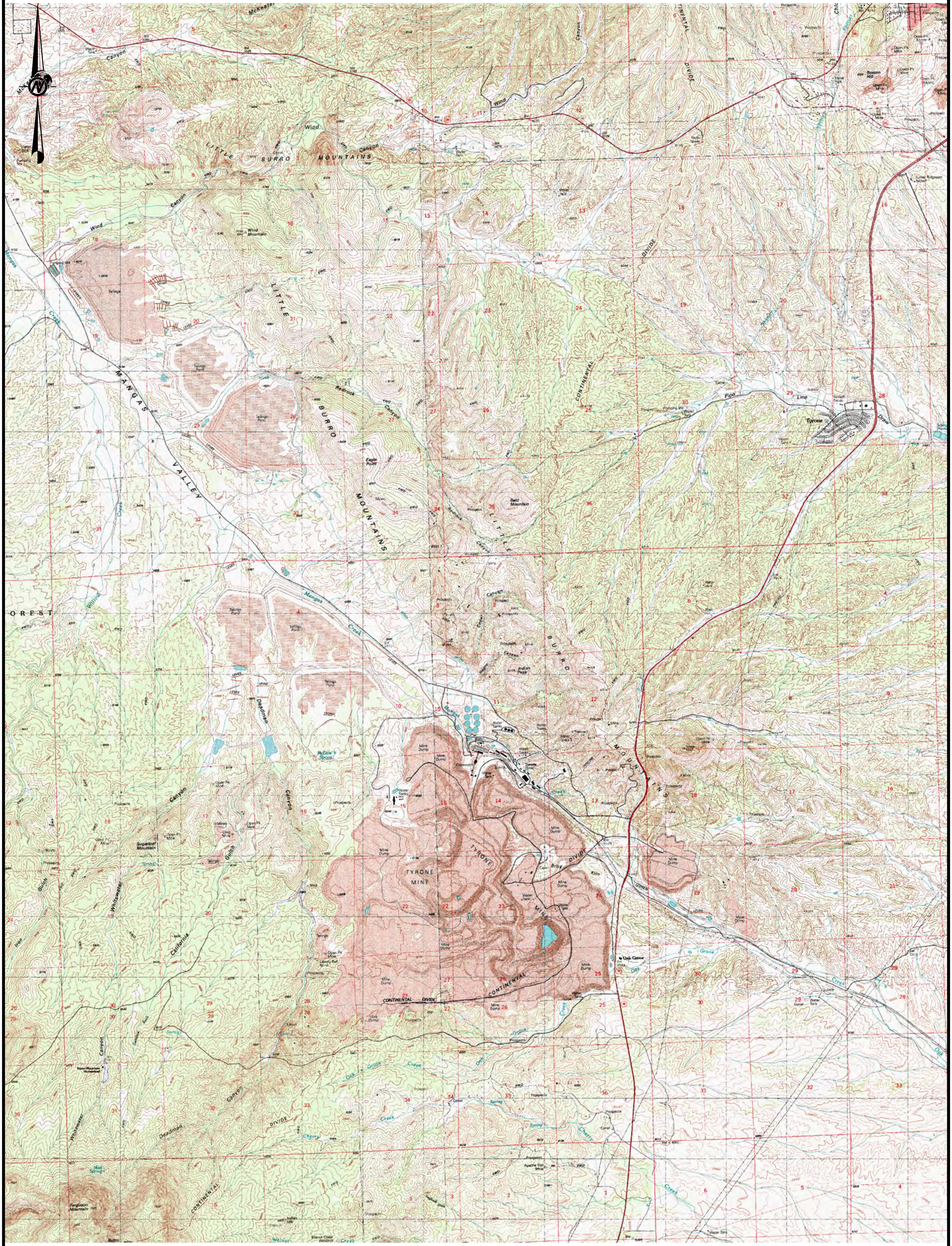
TITLE
REGIONAL PHYSIOGRAPHIC FEATURES AND CROSS SECTION LOCATIONS

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			**FIGURE 2-2**
REVIEW			

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

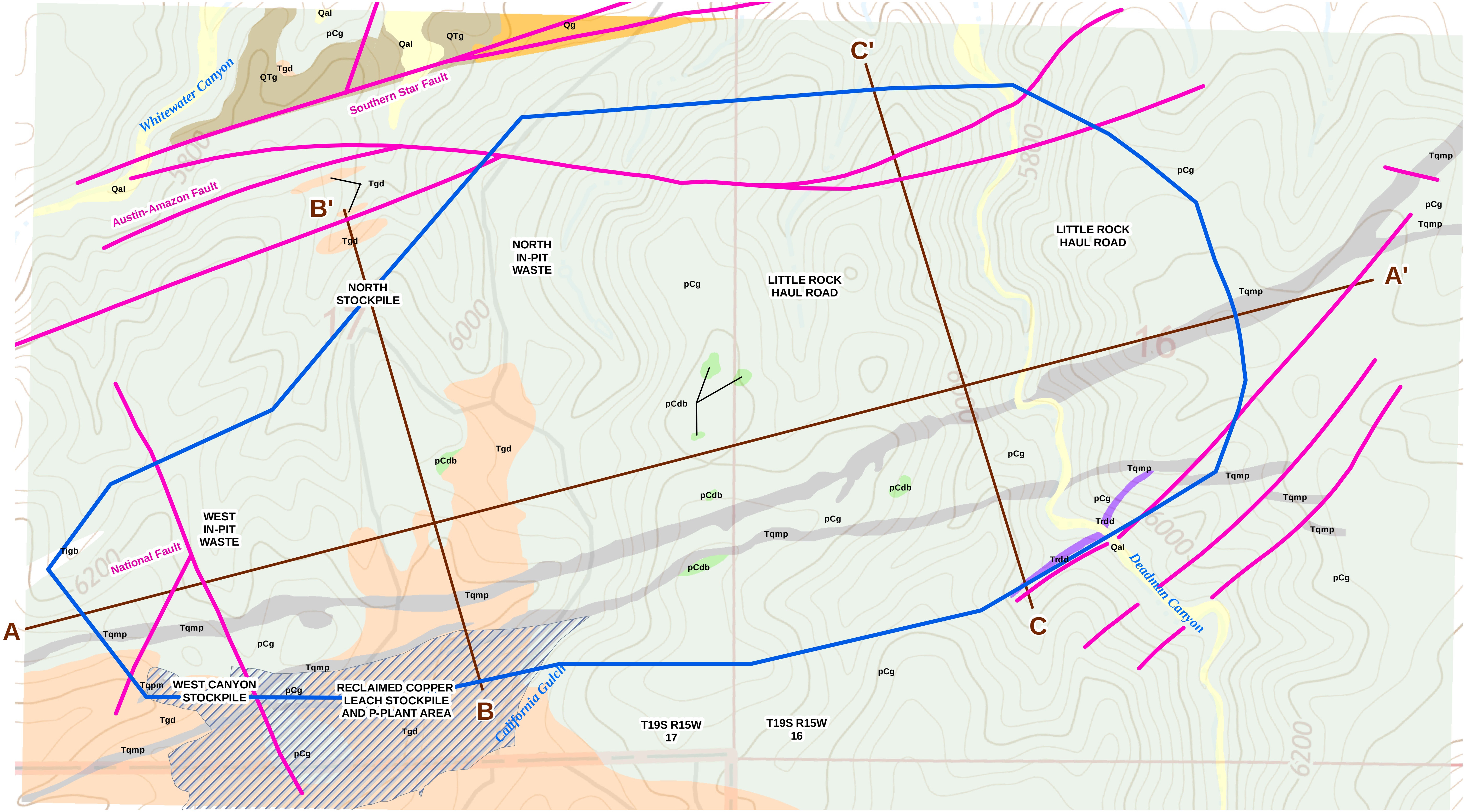
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

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				



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).

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

0 1,000
SCALE IN FEET

PREPARED FOR:
FREEPORT-MCMORAN COPPER & GOLD

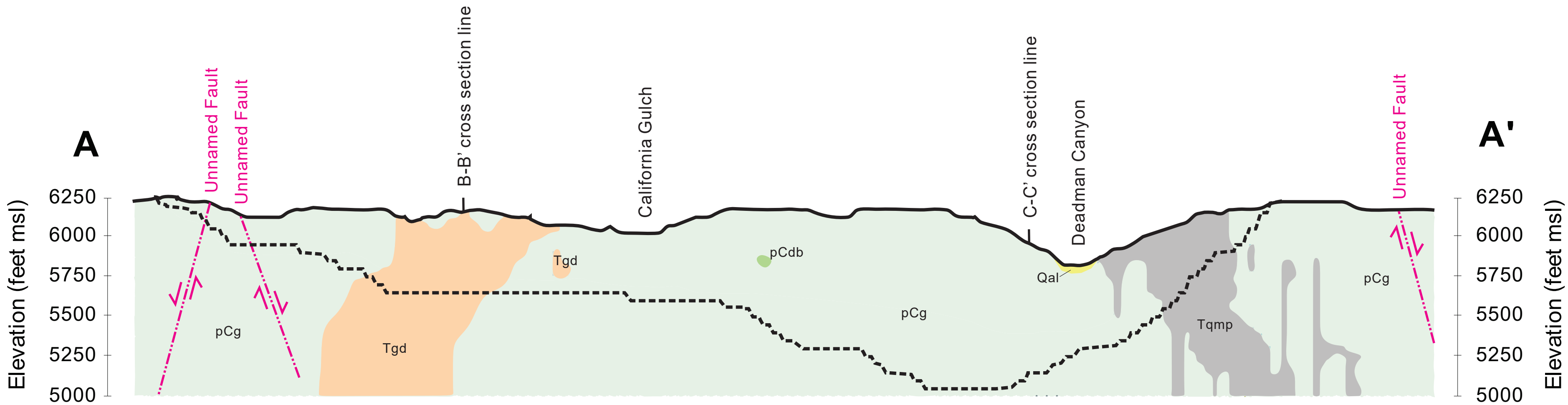
PROJECT No. 113-01155

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

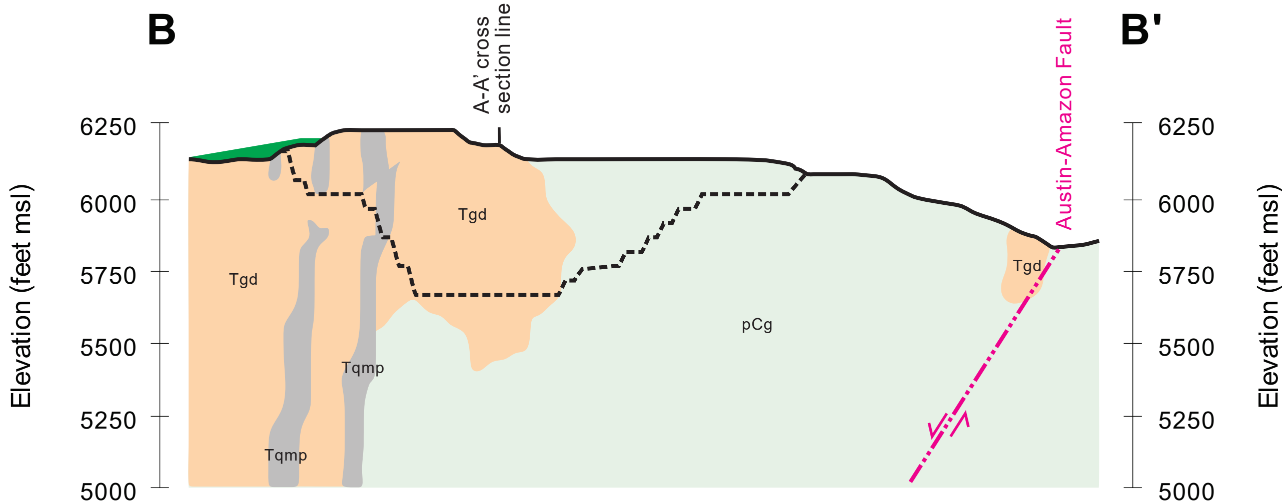
LITTLE ROCK MINE

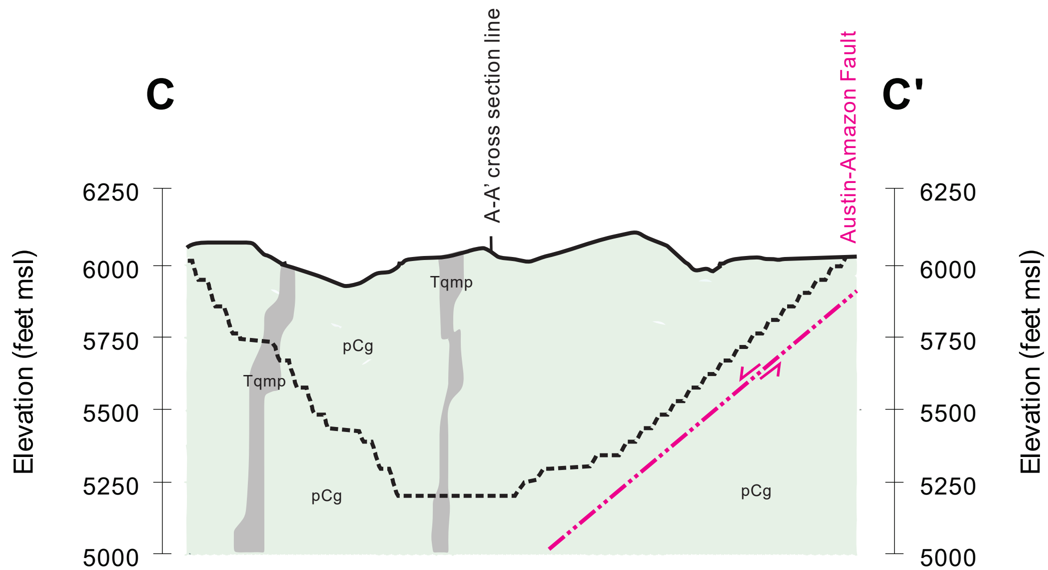
West to East Geologic Cross Section A-A'

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

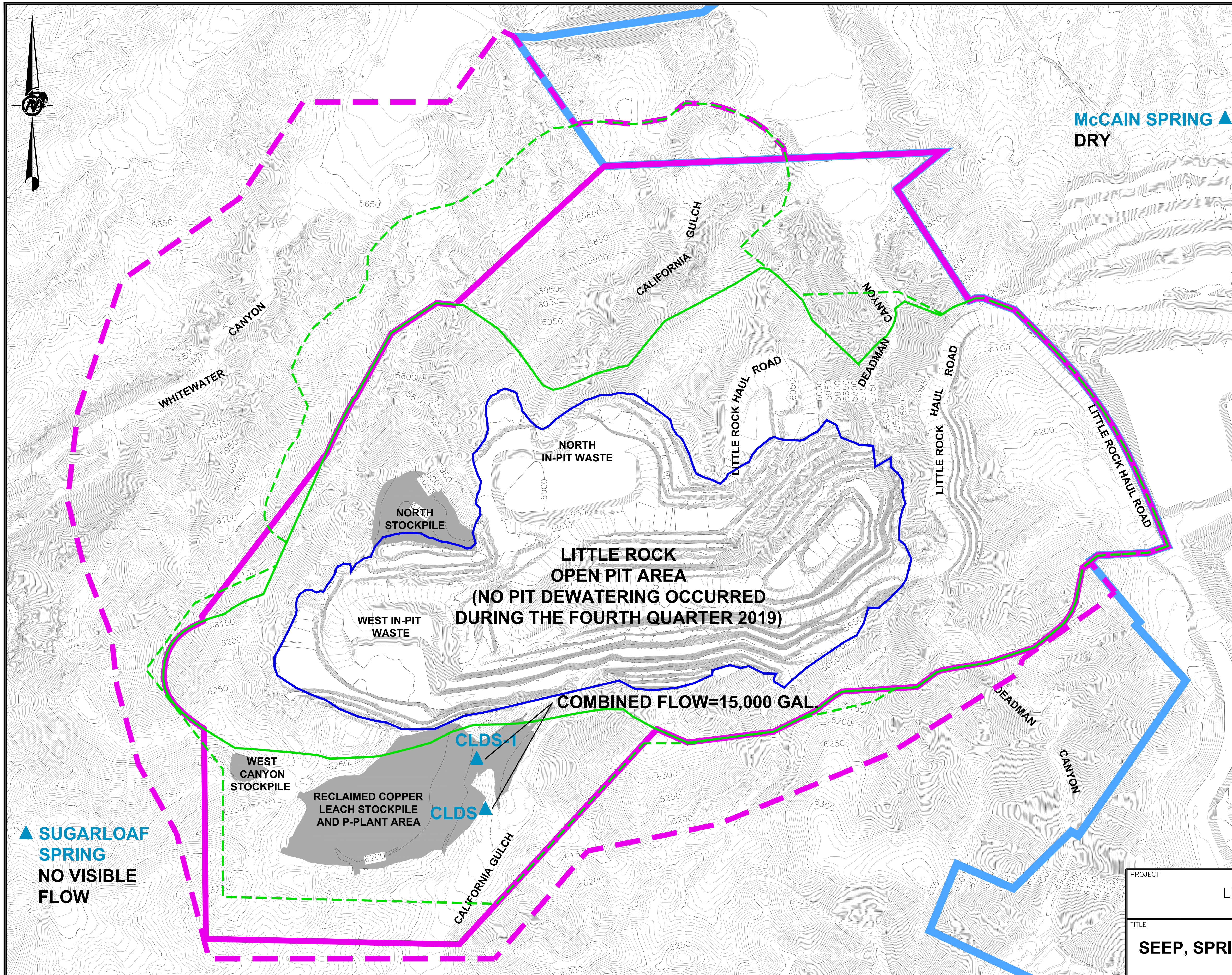
FREEPORT-MCMORAN COPPER & GOLD

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
- 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
- RECLAIMED AREA

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. WITH THE EXCEPTION OF THE RECLAIMED COPPER LEACH STOCKPILE. 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.
6. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR.

800 0 800
SCALE FEET

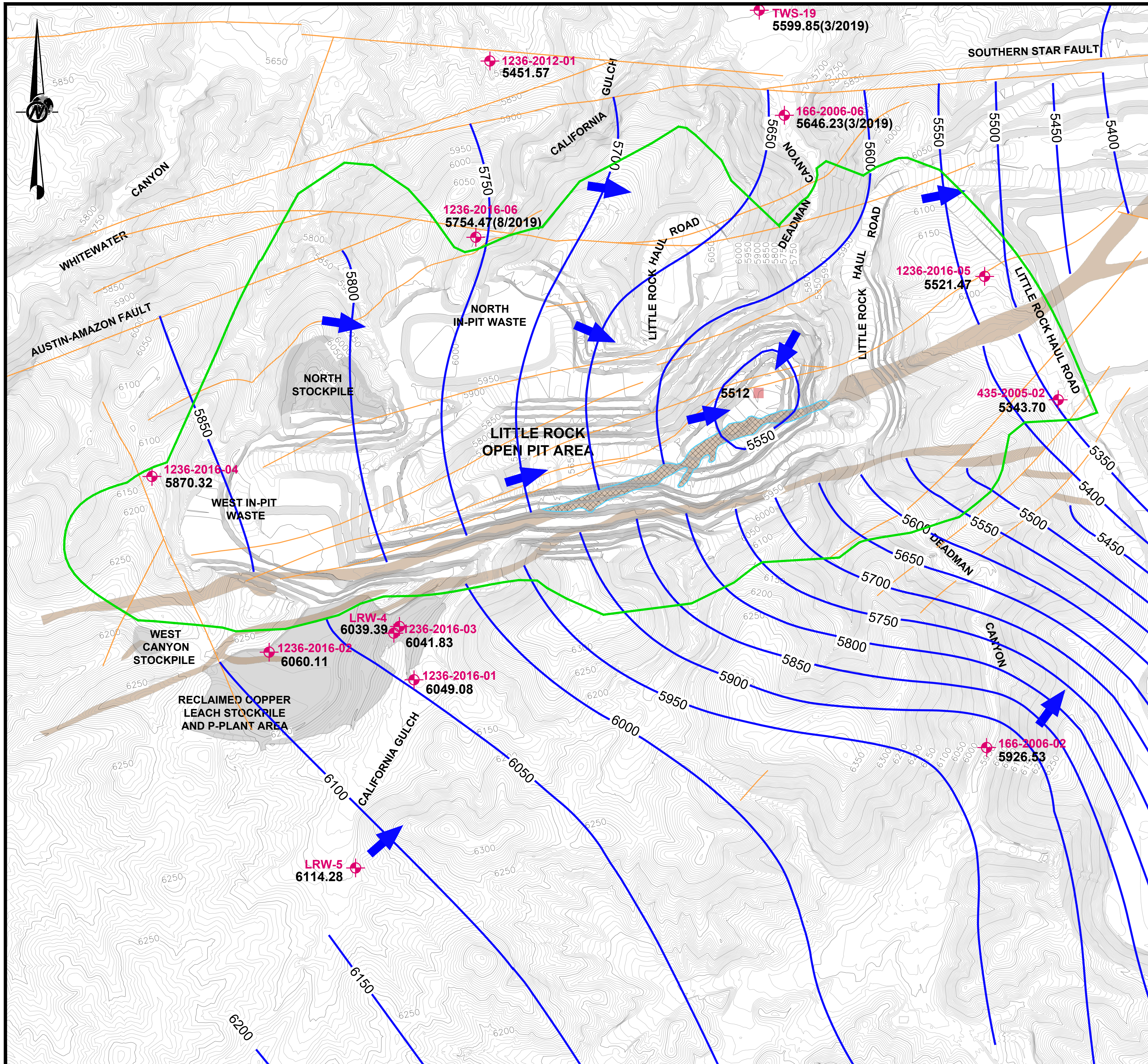
PROJECT
FREEPORT MCMORAN TYRONE, INC.
LITTLE ROCK CLOSURE/CLOSEOUT PLAN
GRANT COUNTY, NEW MEXICO

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				
REVIEW				

FIGURE 2-7



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
- RECLAIMED AREA

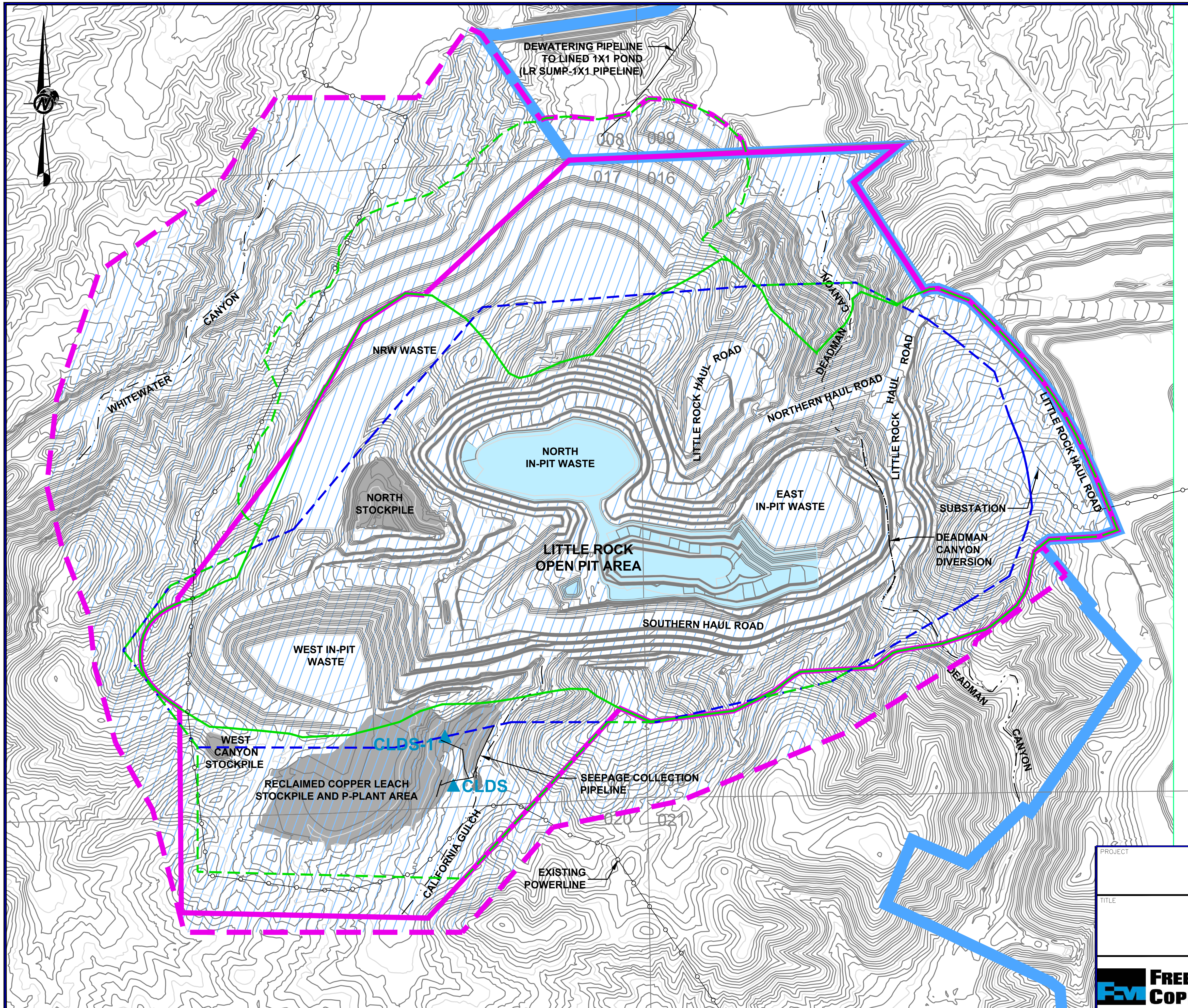
NOTES:
1. SOURCE: TOPOGRAPHIC SURFACE FROM JUNE 2019 SURVEY PROVIDED BY FREEPORT MCMORAN TYRONE, INC.
2. SOURCE: FAULTS, DIKES AND GROUNDWATER CONTOURS PROVIDED BY DBS&A IN MAY 2020.
3. CONTOUR INTERVAL AT 10 FEET.
4. COORDINATE SYSTEM IN TYRONE LOCAL MINE.
5. VALUES FROM DP-1236 MONITORING REPORT (02/25/2020).
6. WITH THE EXCEPTION OF THE RECLAIMED COPPER LEACH STOCKPILE. 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.
6. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR.

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.	11301155B002-8
DESIGN	TS	05/07/20	SCALE AS SHOWN	REV. 0
CADD	SIB	05/07/20	**FIGURE 2-8**	
CHECK				
REVIEW				



LEGEND

- APPROVED MINING AREA DESIGN LIMIT (PERMIT REVISION 14-1 TO MMD PERMIT GR007RE)
- PROPOSED CHANGE TO MINING AREA DESIGN LIMIT BOUNDARY
- PROPOSED LITTLE ROCK OPEN PIT BOUNDARY
- EXISTING LITTLE ROCK MINE PERMIT BOUNDARY
- PROPOSED CHANGE TO LITTLE ROCK MINE PERMIT BOUNDARY
- EXISTING TYRONE MINE PERMIT BOUNDARY
- PROPOSED WILDLIFE HABITAT POST MINING LAND USE AREA
- CLDS-1 SEEPAGE COLLECTION FACILITY
- POST CLOSURE PIT LAKE AREA
- RECLAIMED AREA

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. WITH THE EXCEPTION OF THE RECLAIMED COPPER LEACH STOCKPILEALL 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.
6. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR.
7. DEADMAN CANYON DIVERSION TO BE CONSTRUCTED DURING RECLAMATION.
8. NRW WASTE AS SHOWN IS FACILITY FULL BUILD-OUT.

800 0 800

SCALE FEET

PROJECT

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

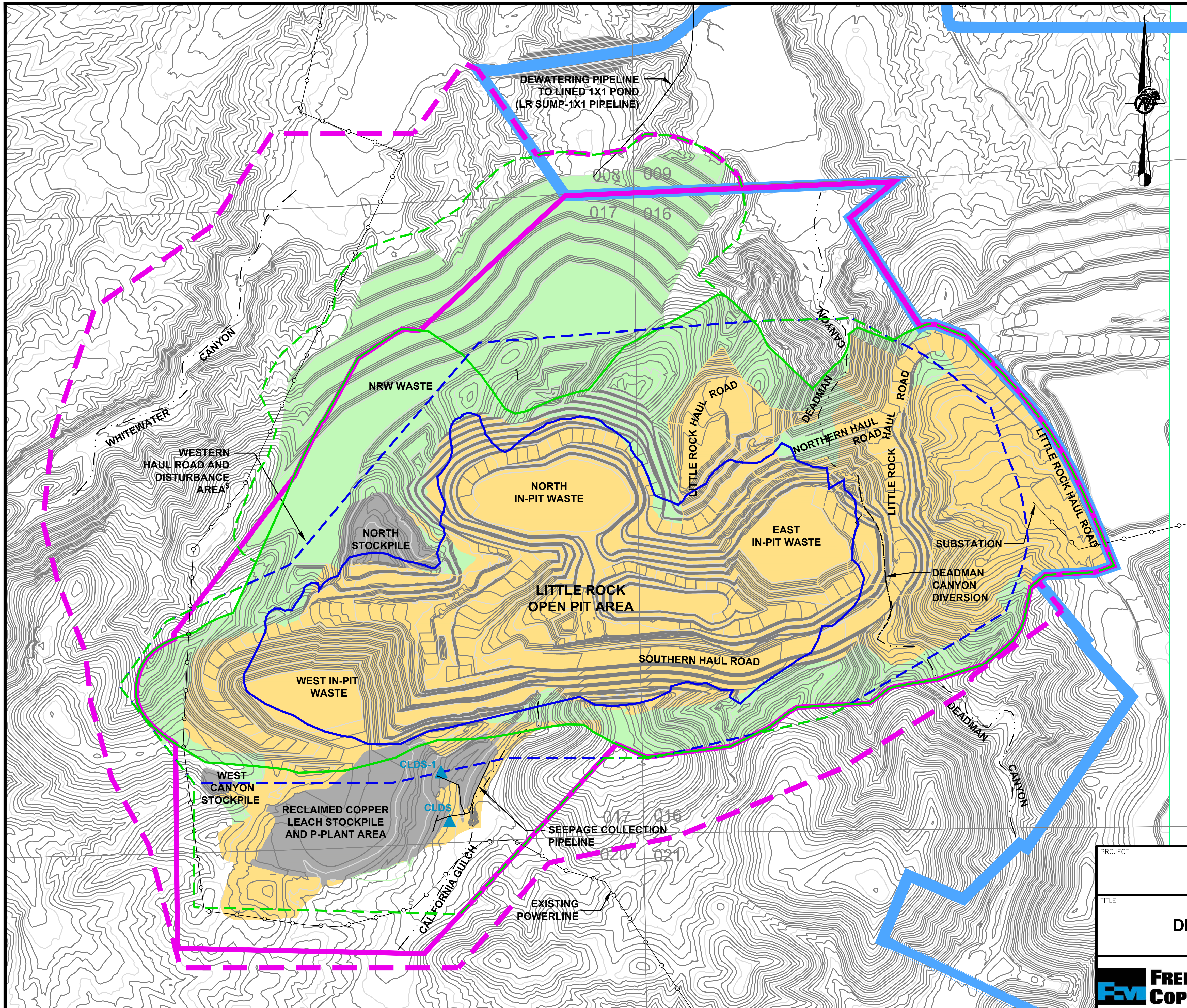
TITLE

PROPOSED WILDLIFE HABITAT POST MINE LAND USE AREA

FREEPORT-MCMORAN COPPER & GOLD

PROJECT No.		20136957	FILE No.	11301155B007-1
DESIGN	TS	03/27/22	SCALE AS SHOWN	REV. 0
CADD	SIB	03/27/22		
CHECK				
REVIEW				

FIGURE 6-1



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
- PROPOSED LITTLE ROCK OPEN PIT BOUNDARY
- EXISTING LITTLE ROCK MINE PERMIT BOUNDARY
- PROPOSED CHANGE TO LITTLE ROCK MINE PERMIT BOUNDARY
- EXISTING TYRONE MINE PERMIT BOUNDARY
- 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
- RECLAIMED AREA

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. WITH THE EXCEPTION OF THE RECLAIMED COPPER LEACH STOCKPILE. 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.
6. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR.
7. DEADMAN CANYON DIVERSION TO BE CONSTRUCTED DURING RECLAMATION.
8. NRW WASTE AS SHOWN IS FACILITY FULL BUILD-OUT.

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

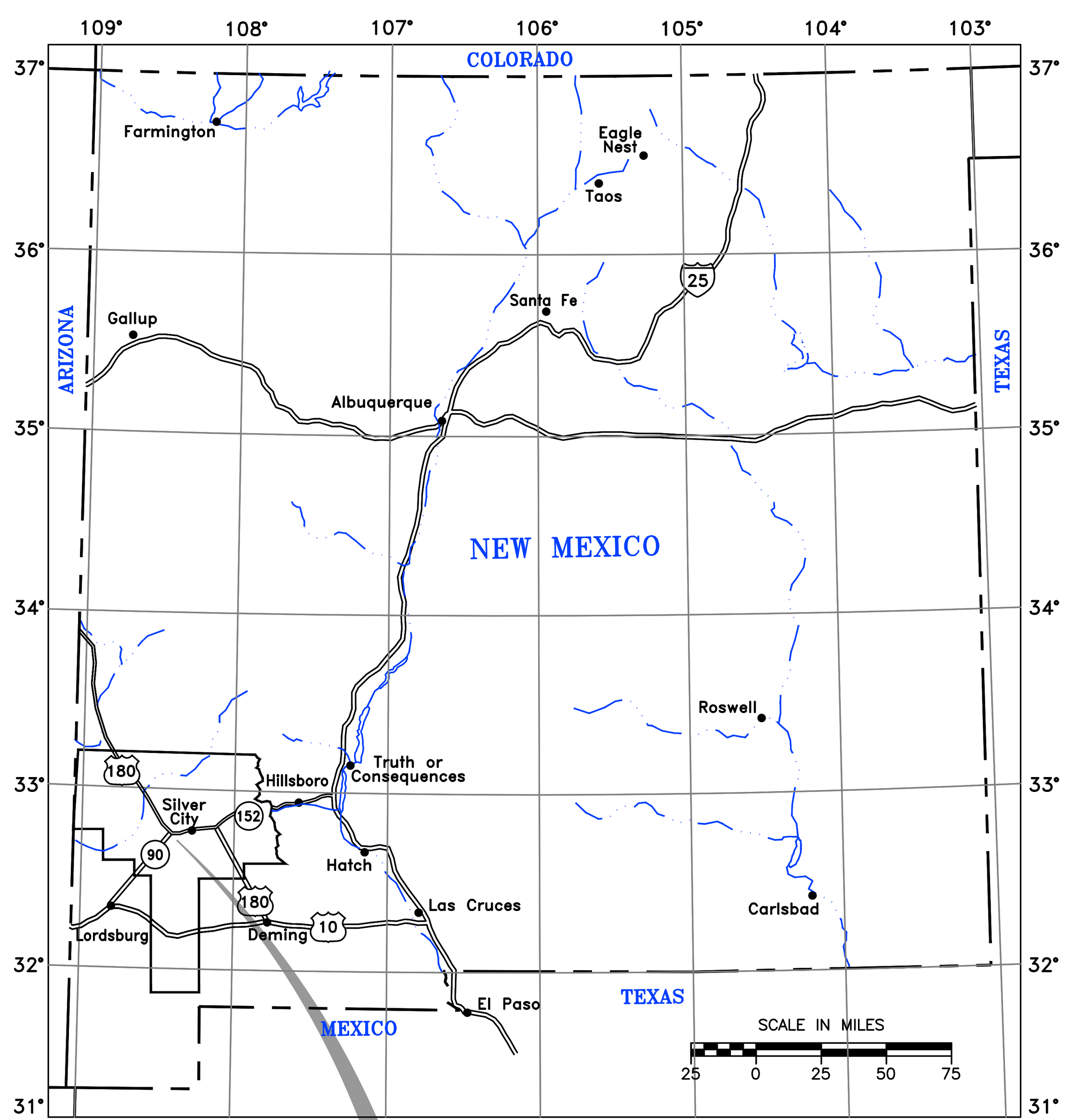
PROJECT No.		20136957	FILE No.	11301155B007-2	
DESIGN	TS	03/27/22	SCALE	AS SHOWN	REV. 0
CADD	SIB	03/27/22			
CHECK					
REVIEW					

FIGURE 6-2

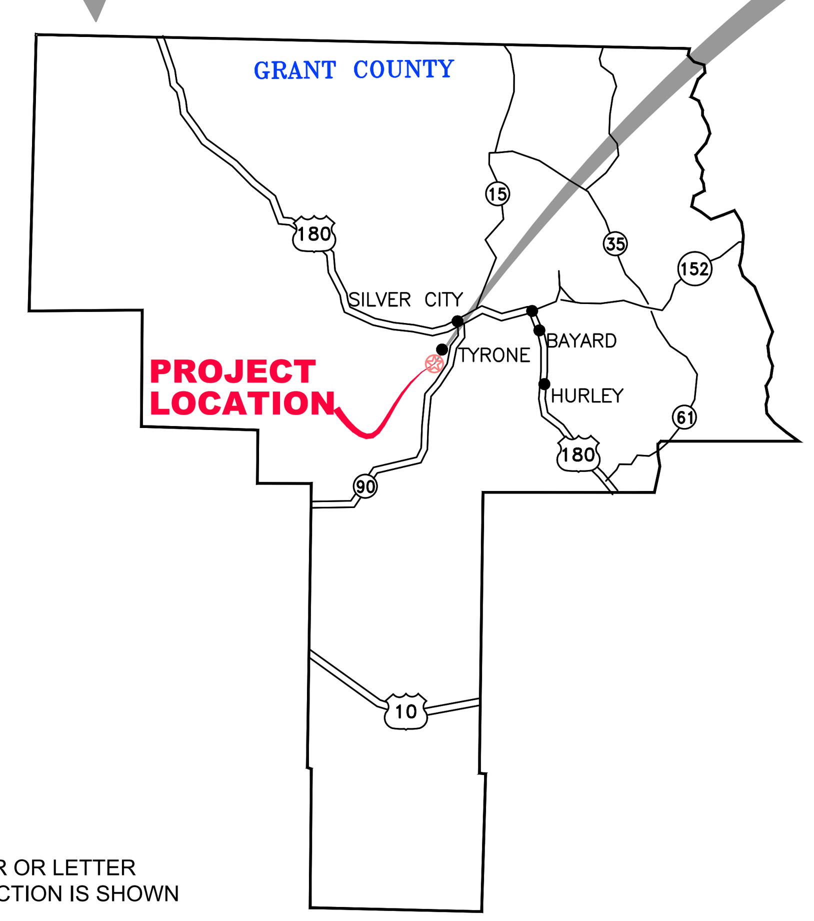
APPENDIX A

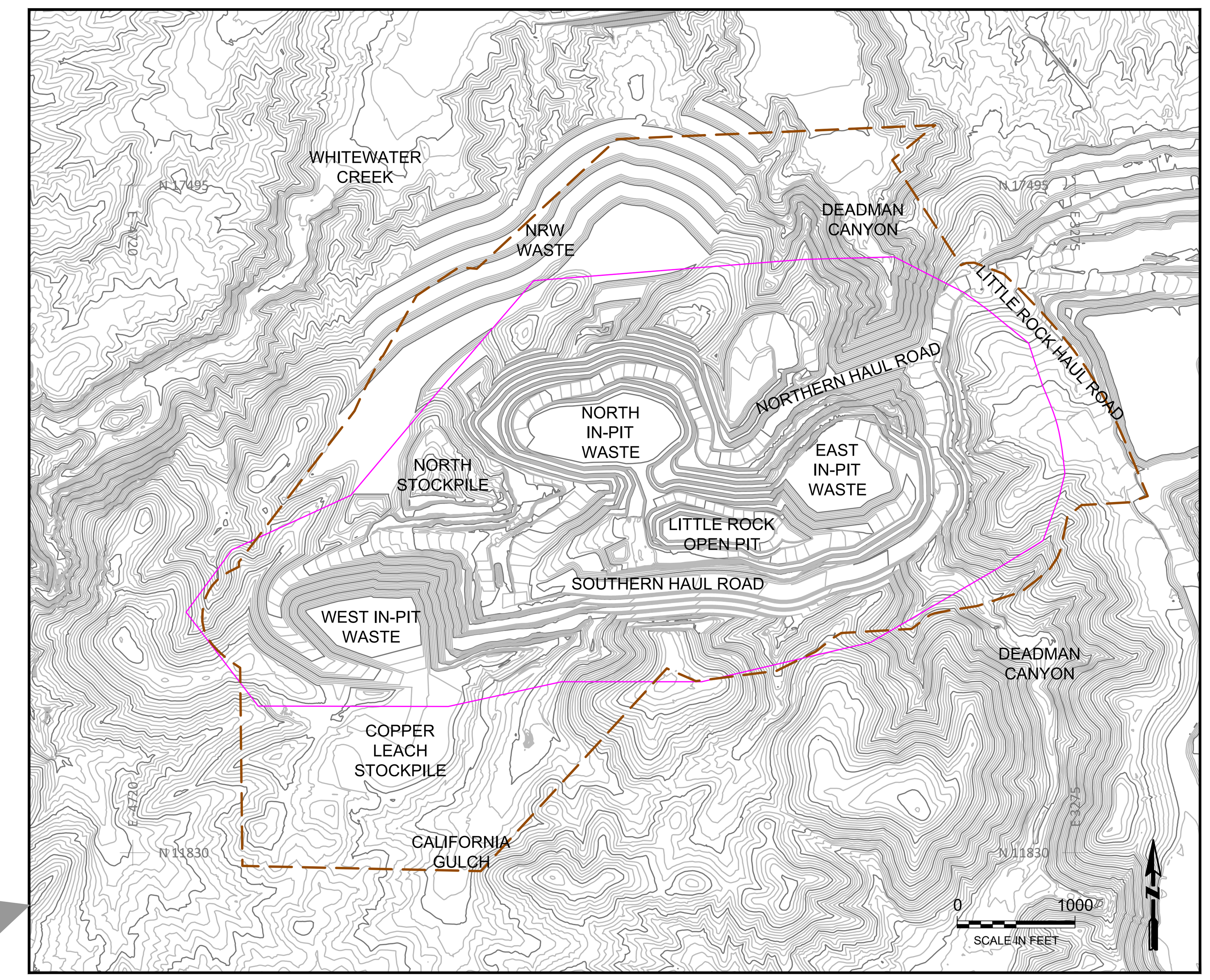
RECLAMATION DESIGN DRAWINGS

APPENDIX A UPDATED CLOSURE/CLOSEOUT PLAN FOR THE LITTLE ROCK MINE MARCH 2022
ISSUED FOR FINANCIAL ASSURANCE RECLAMATION COST ESTIMATE



NORTH





LITTLE ROCK MINE - END-OF-YEAR 2024

SHEET LIST TABLE

SHEET NUMBER	SHEET TITLE
1	COVER SHEET
2	MINE LAYOUT - PRE-RECLAMATION (END OF 2024)
3	MINE LAYOUT - POST-RECLAMATION
4	CLOSURE PLAN - EAST IN-PIT & DEADMAN DIVERSION - PLAN
5	CLOSURE PLAN - EAST IN-PIT & DEADMAN DIVERSION - SECTIONS
6	CLOSURE PLAN - NRW WASTE - PLAN - PRE-RECLAMATION
7	CLOSURE PLAN - NRW WASTE - PLAN - POST-RECLAMATION
8	CLOSURE PLAN - NRW WASTE & DEADMAN DIVERSION - SECTIONS
9	CLOSURE PLAN - NRW WASTE - SECTIONS
10	CLOSURE PLAN - WEST IN-PIT WASTE - PLAN
11	CLOSURE PLAN - WEST IN-PIT WASTE - SECTIONS
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 LITTLE ROCK OPEN PIT BOUNDARY
- PRE-REC. MAJ. CONTOUR (50 FT)
- PRE-REC. MIN. CONTOUR (10 FT)

NOTES:

1. EXISTING TOPOGRAPHY FREEPOR- MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN
2. NRW WASTE AS SHOW IS FACILITY FULL BUILD-OUT

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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

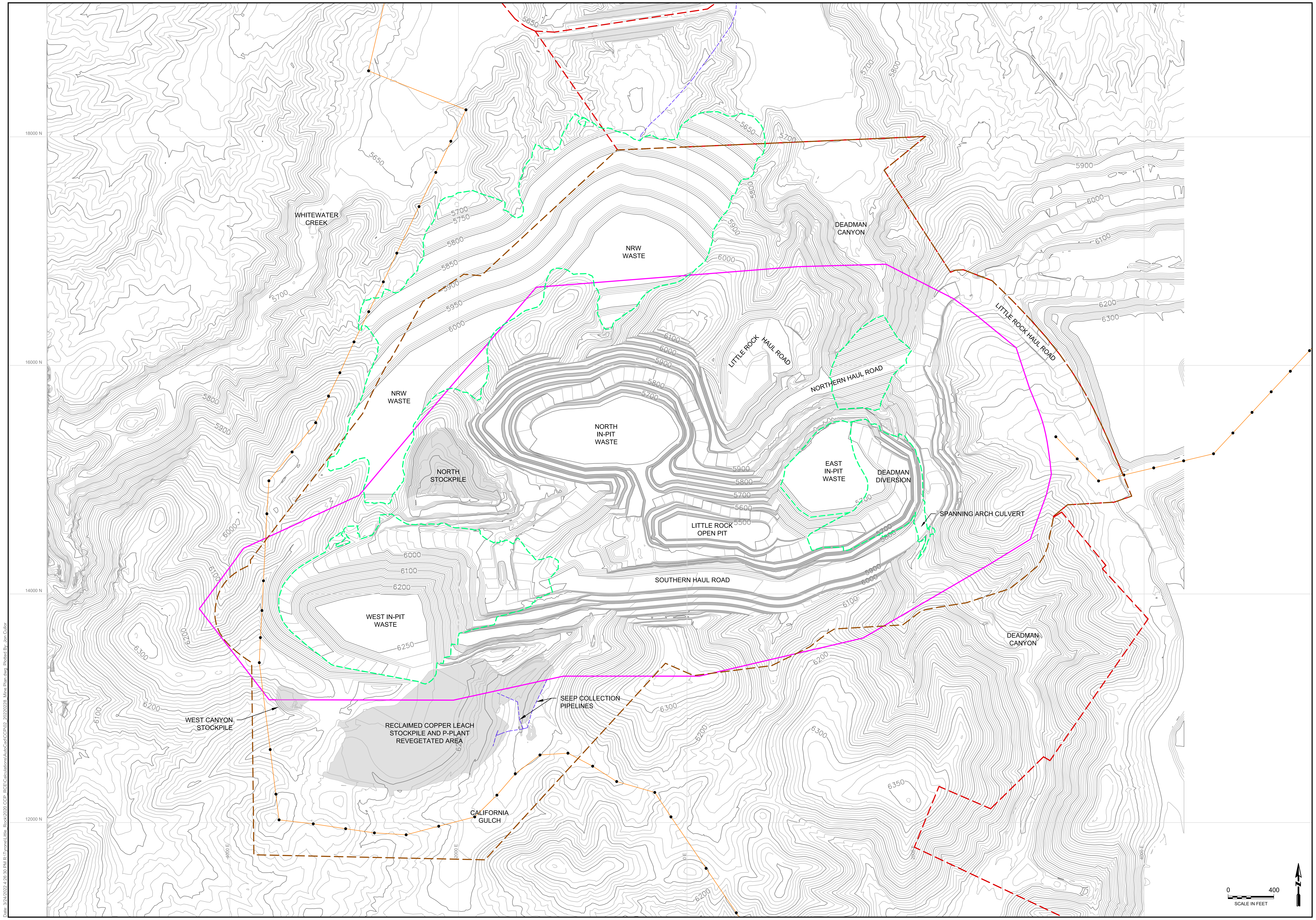
2020 LITTLE ROCK CCP

COVER SHEET

SHEET NUMBER: 1
REVISION NUMBER: 5

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN



LEGEND / NOTES

- EXISTING LITTLE ROCK PERMIT BOUNDARY
- TYRONE PERMIT BOUNDARY
- PROPOSED LITTLE ROCK OPEN PIT BOUNDARY
- FACILITY RECLAMATION BOUNDARY
- MAJOR CONTOUR (50 FT)
- MINOR CONTOUR (10 FT)
- 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
5. NRW WASTE AS SHOWN IS FACILITY FULL BUILD-OUT

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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

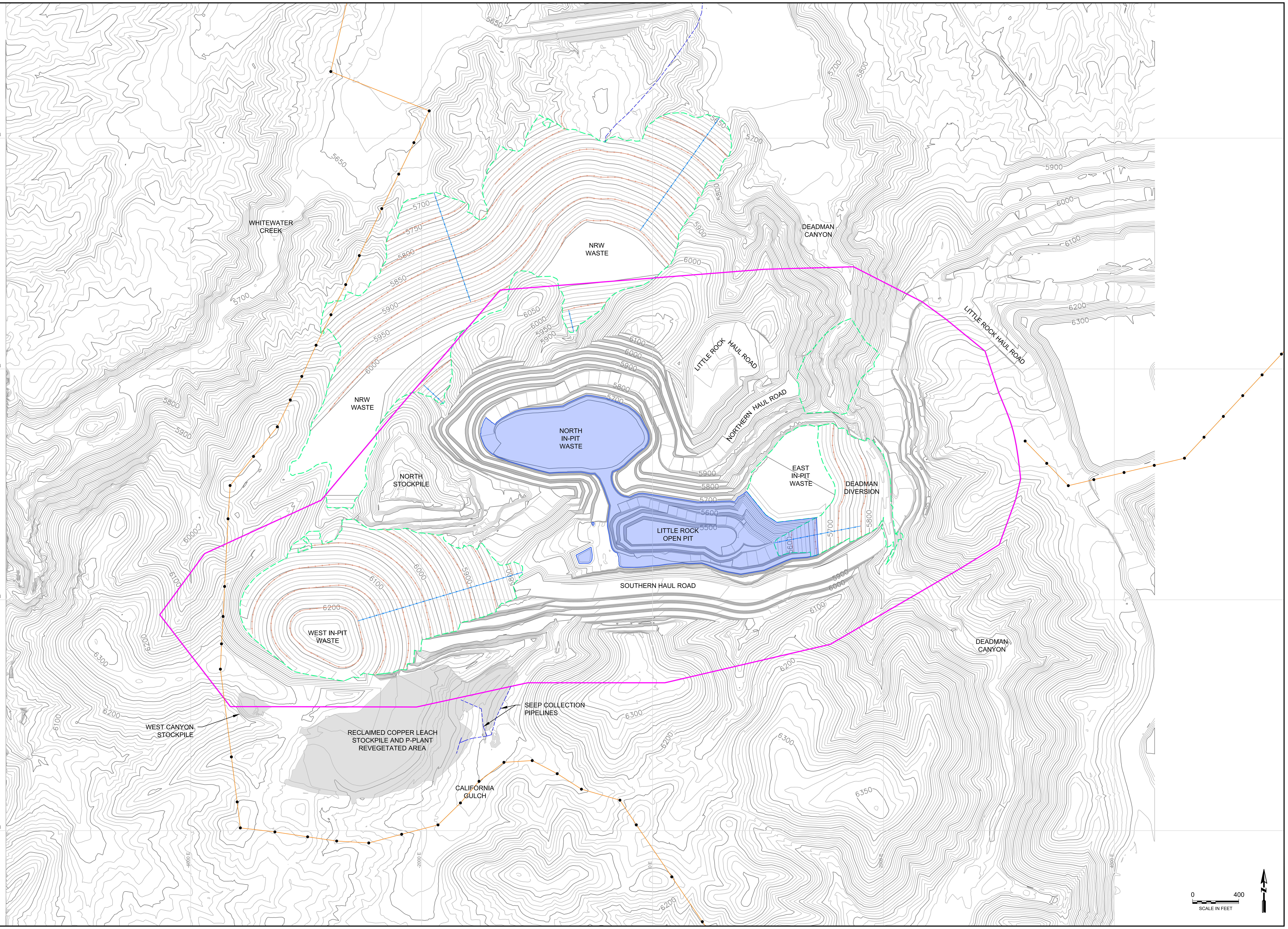
2020 LITTLE ROCK CCP

MINE LAYOUT - PRE-RECLAMATION (END OF 2024)

SHEET NUMBER: 2
REVISION NUMBER: 5

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN



LEGEND / NOTES

- PROPOSED LITTLE ROCK OPEN PIT BOUNDARY
- FACILITY RECLAMATION BOUNDARY
- MAJOR CONTOUR (50 FT)
- MINOR CONTOUR (10 FT)
- BENCH CHANNEL
- DOWNDRAIN
- LR SUMP - 1x1 PIPELINE
- EXISTING POWER LINE
- RECLAIMED AREA
- POST-CLOSURE PIT LAKE AREA

NOTES:

1. POST-RECLAMATION TOPOGRAPHY FOR END-OF-YEAR 2024 MINE PLAN
2. HISTORICAL RECLAIMED STOCKPILES BUILT BY PREVIOUS OPERATOR
3. NRW WASTE AS SHOWN IS FACILITY FULL BUILD-OUT

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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

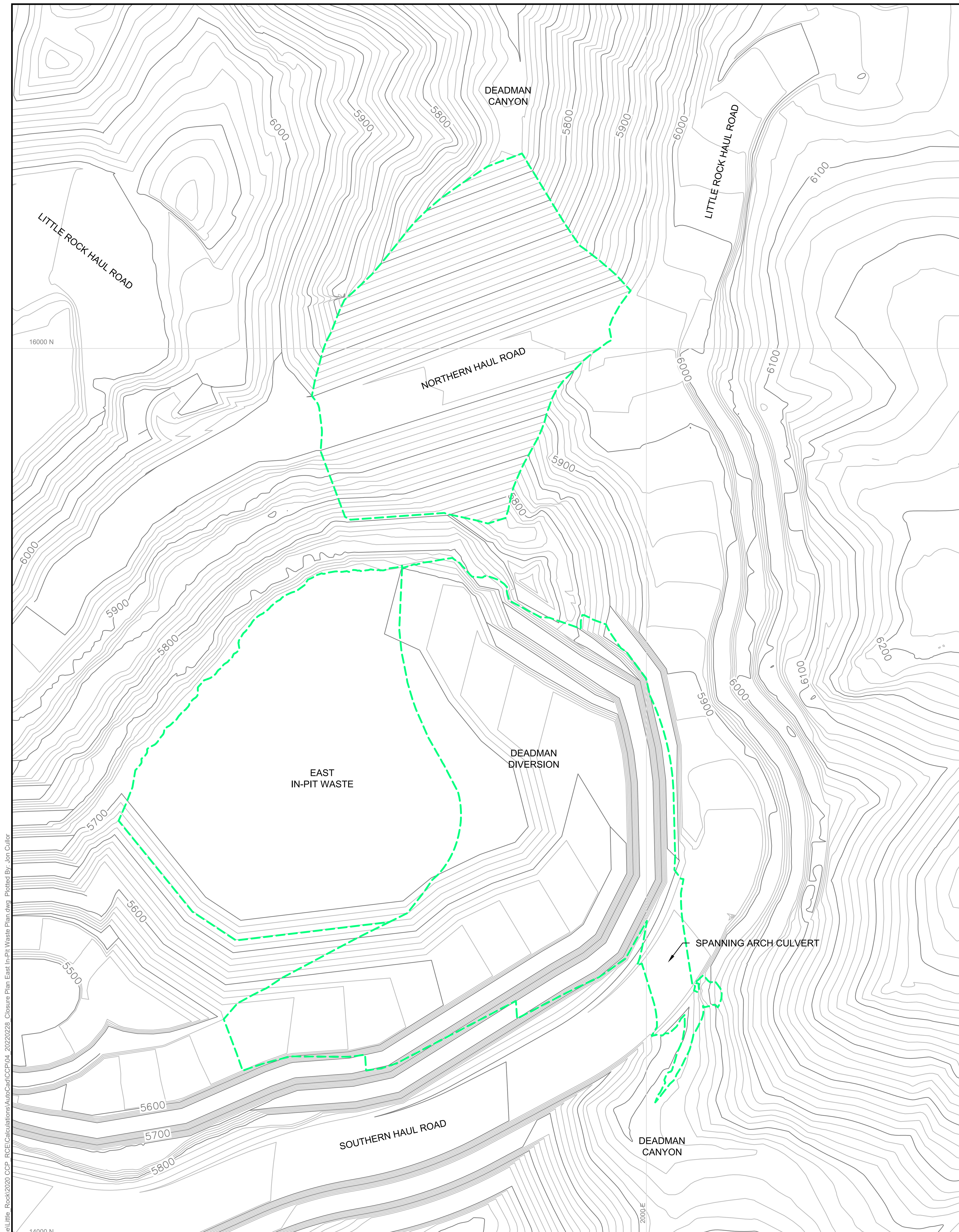
2020 LITTLE ROCK CCP

MINE LAYOUT - POST-RECLAMATION

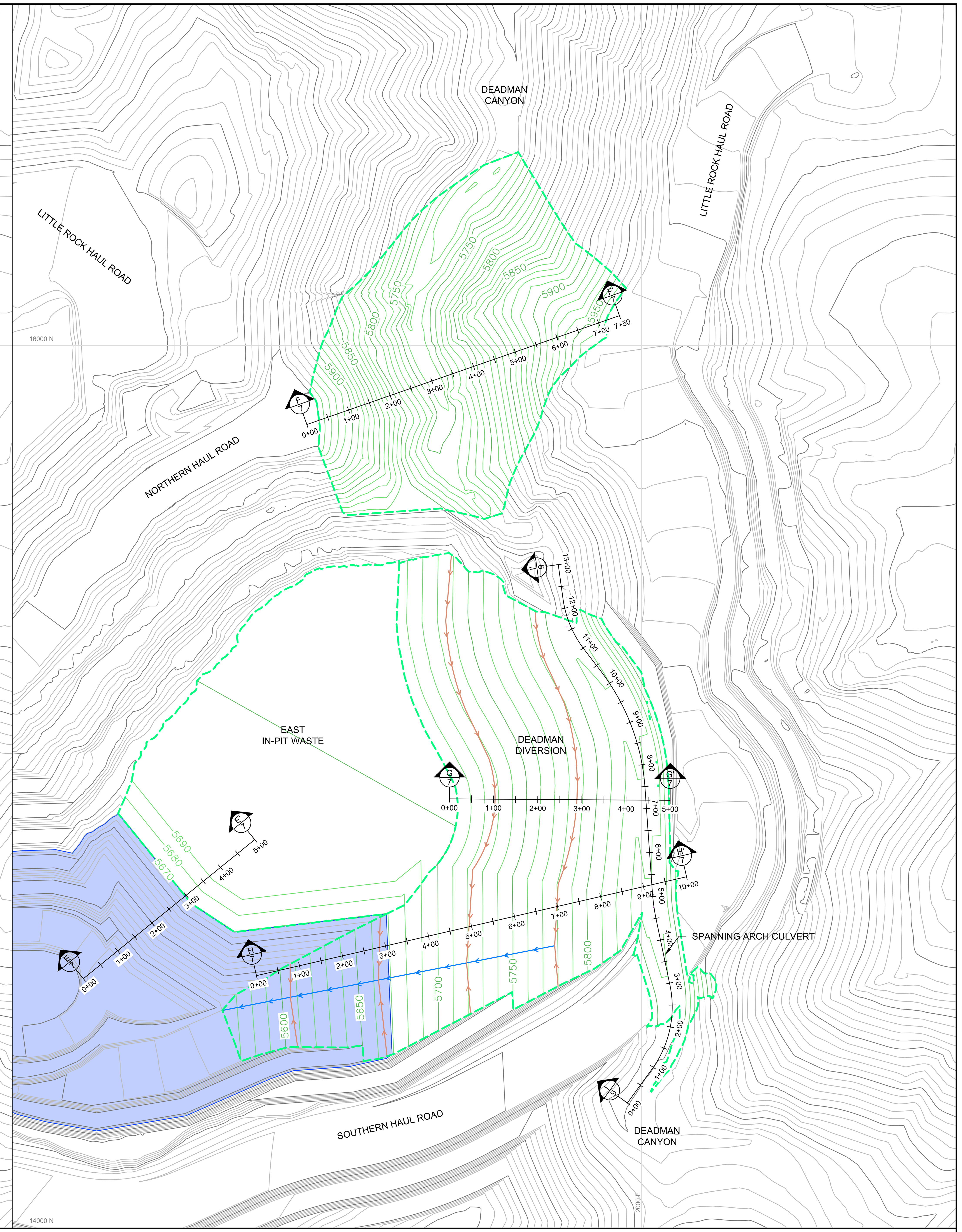
SHEET NUMBER: 3
REVISION NUMBER: 5

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN



PLAN VIEW - PRE-RECLAMATION



PLAN VIEW - POST-RECLAMATION

LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- PRE-REC. MAJ. CONTOUR (50 FT)
- PRE-REC. MIN. CONTOUR (10 FT)
- POST-REC. MAJ. CONTOUR (50 FT)
- POST-REC. MIN. CONTOUR (10 FT)
- BENCH CHANNEL
- DOWNDRAIN
- POST-CLOSURE PIT LAKE AREA

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
1	PER CLIENT COMMENT	6/8/20	JC	TT
2	FOR AGENCY	6/11/20	JC	TT
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

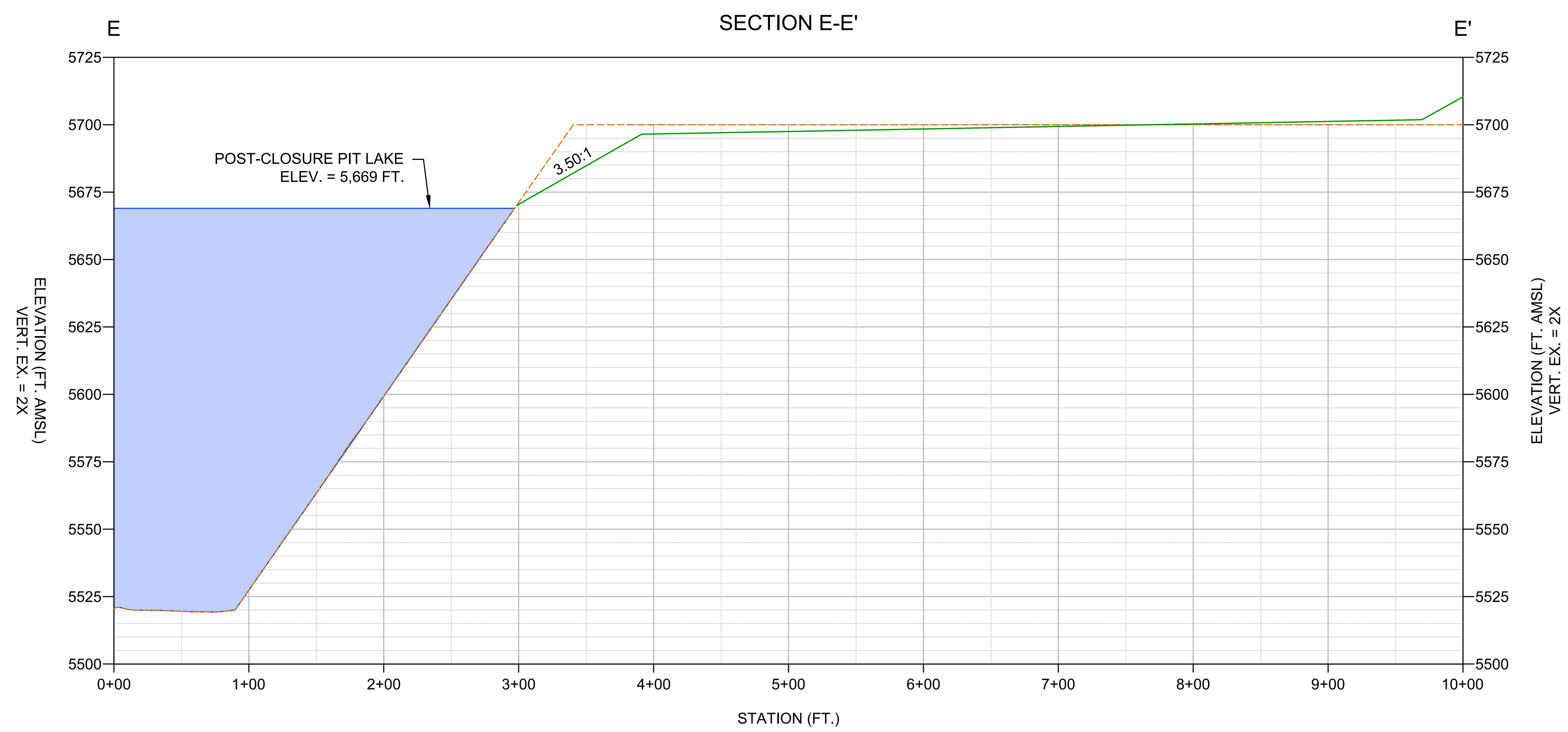
CLOSURE PLAN - EAST IN-PIT & DEADMAN DIVERSION - PLAN

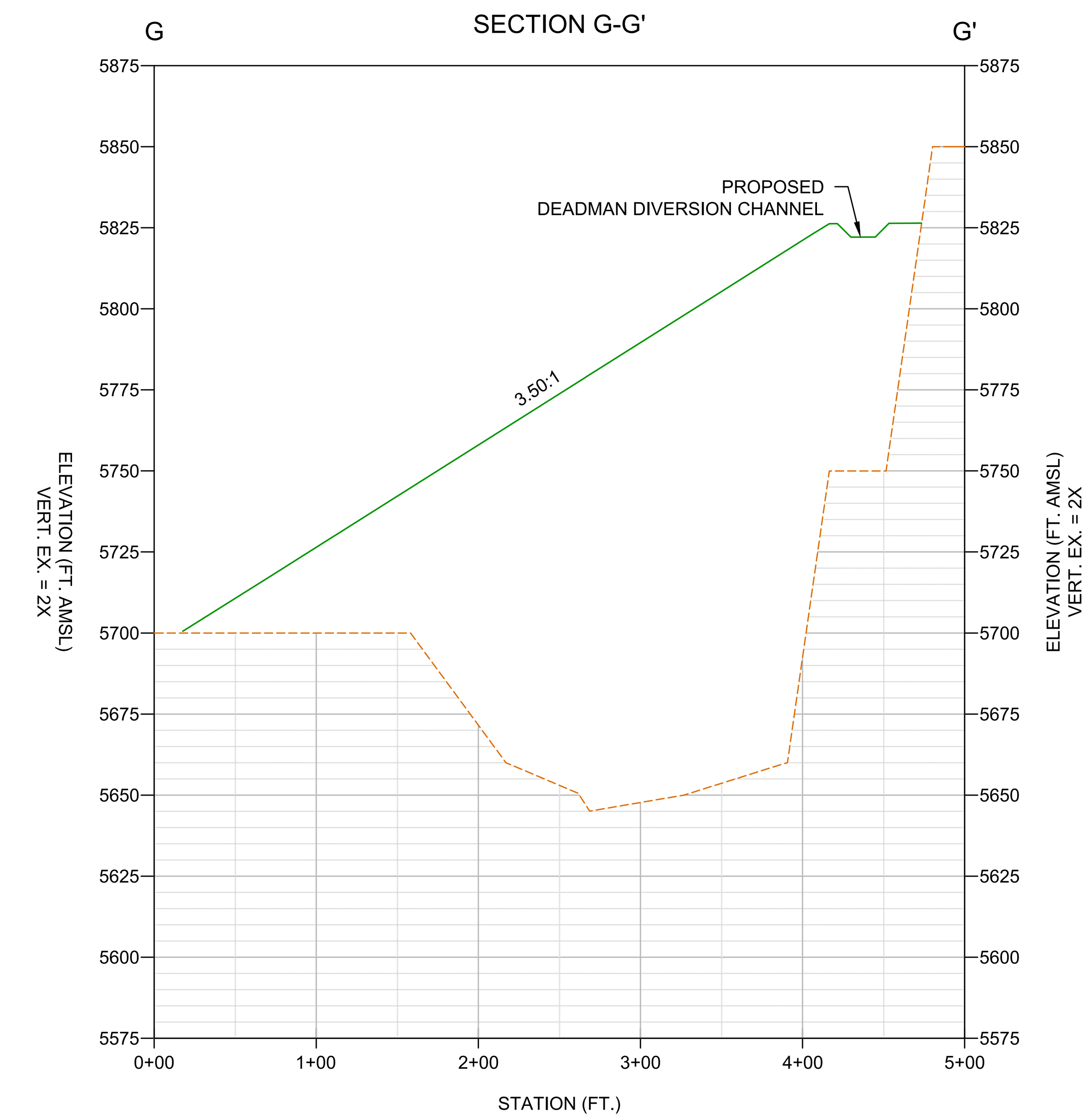
SHEET NUMBER: 4

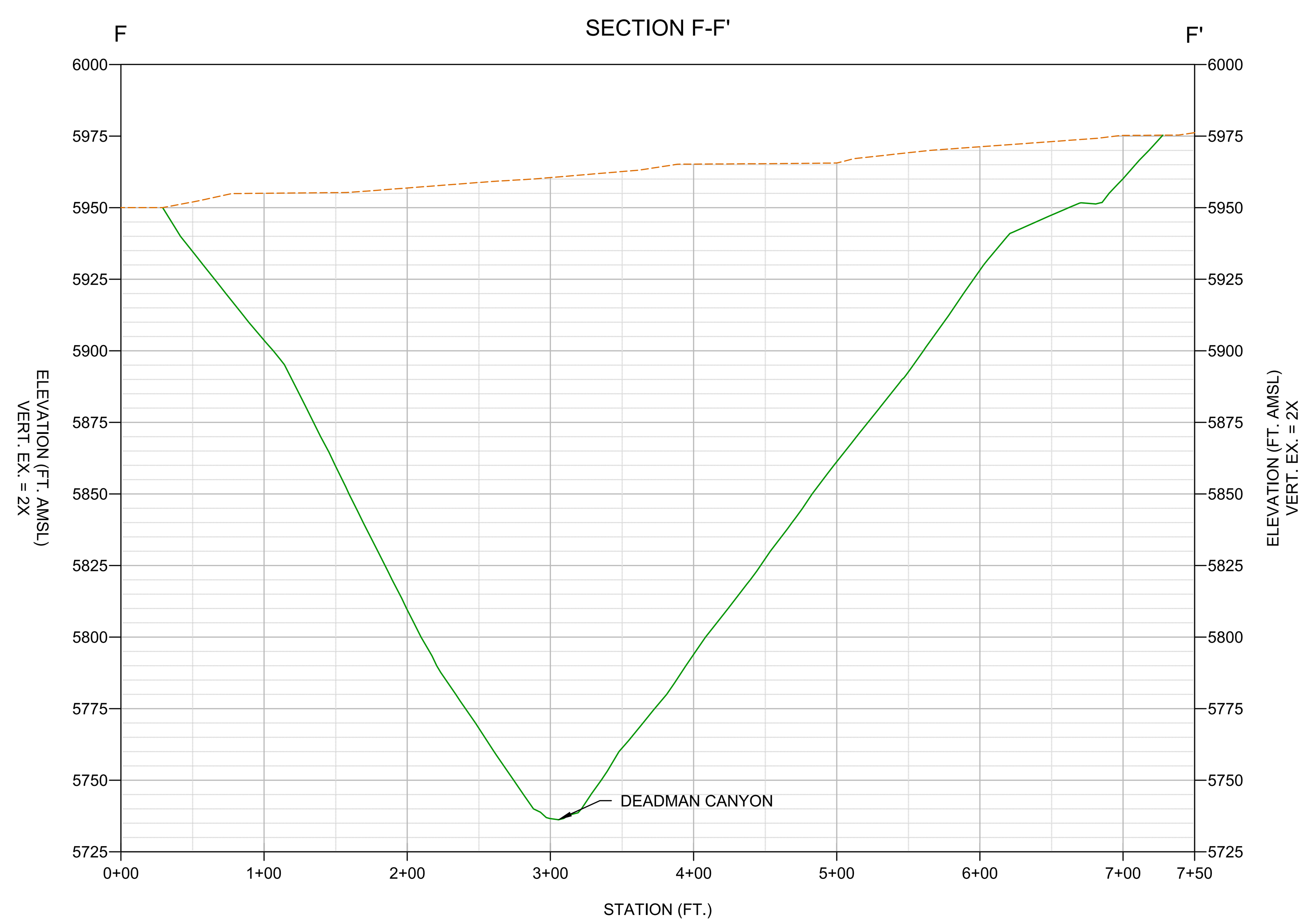
REVISION NUMBER: 5

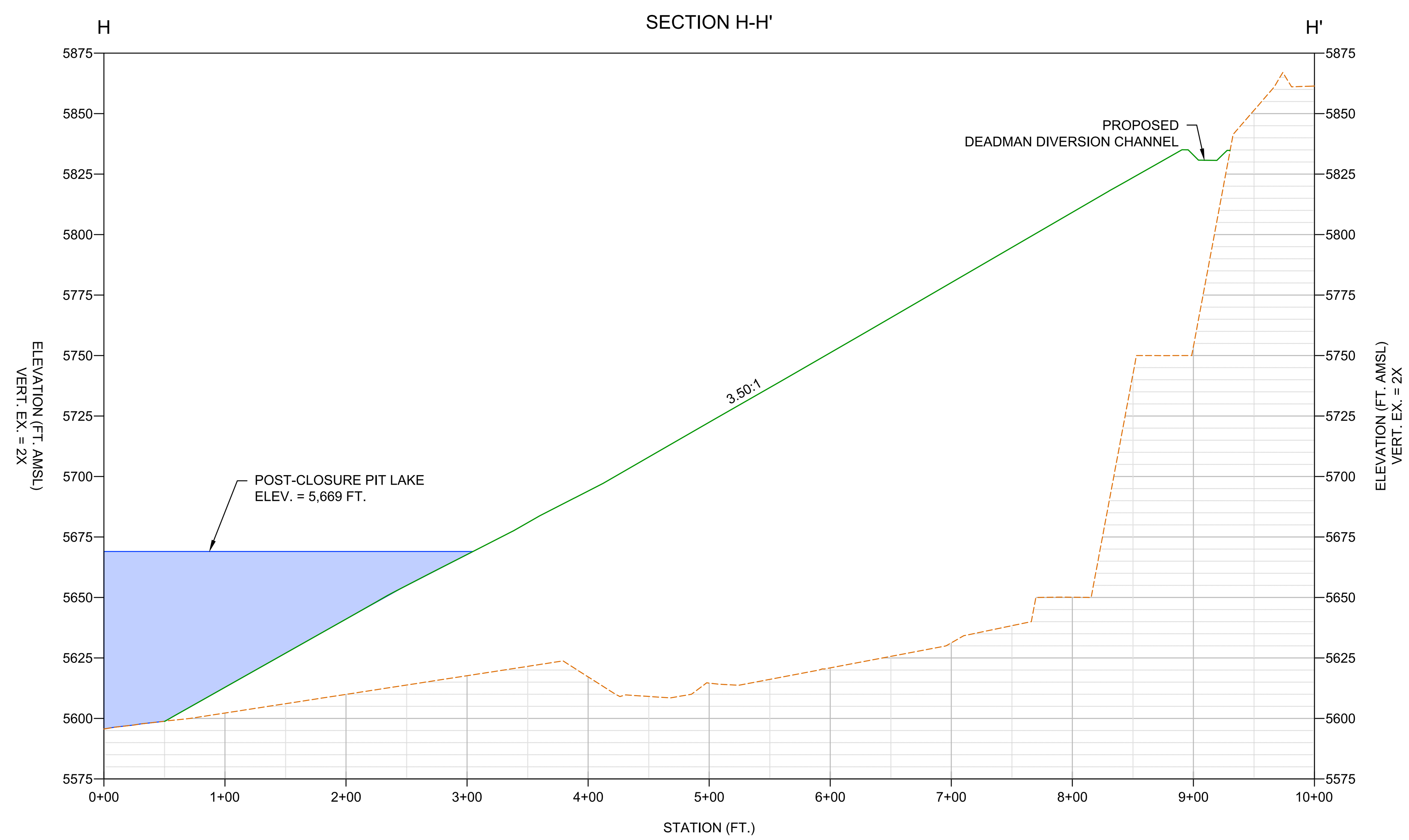
PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN









LEGEND / NOTES

PRE-RECLAMATION SURFACE

POST-RECLAMATION SURFACE

POST-CLOSURE 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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

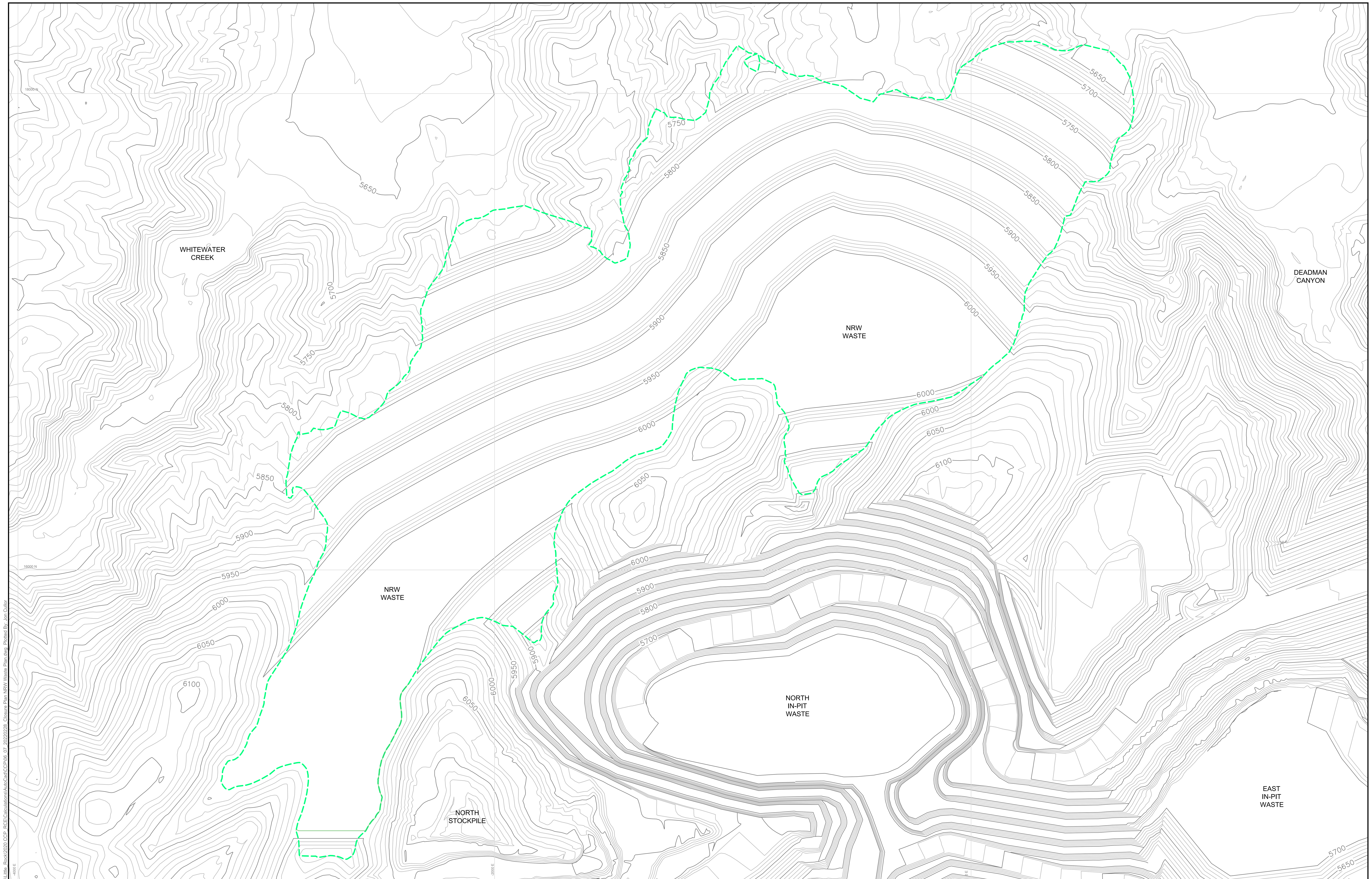
CLOSURE PLAN - EAST IN-PIT & DEADMAN DIVERSION - SECTIONS

SHEET NUMBER: 5

REVISION NUMBER: 5

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-MCMORAN



PLAN VIEW - PRE-RECLAMATION

LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- PRE-REC. MAJ. CONTOUR (50 FT)
- PRE-REC. MIN. CONTOUR (10 FT)

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN
2. NRW WASTE AS SHOWN IS FACILITY FULL BUILD-OUT

0 200
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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

CLOSURE PLAN - NRW WASTE - PLAN - PRE-RECLAMATION

SHEET NUMBER: 6

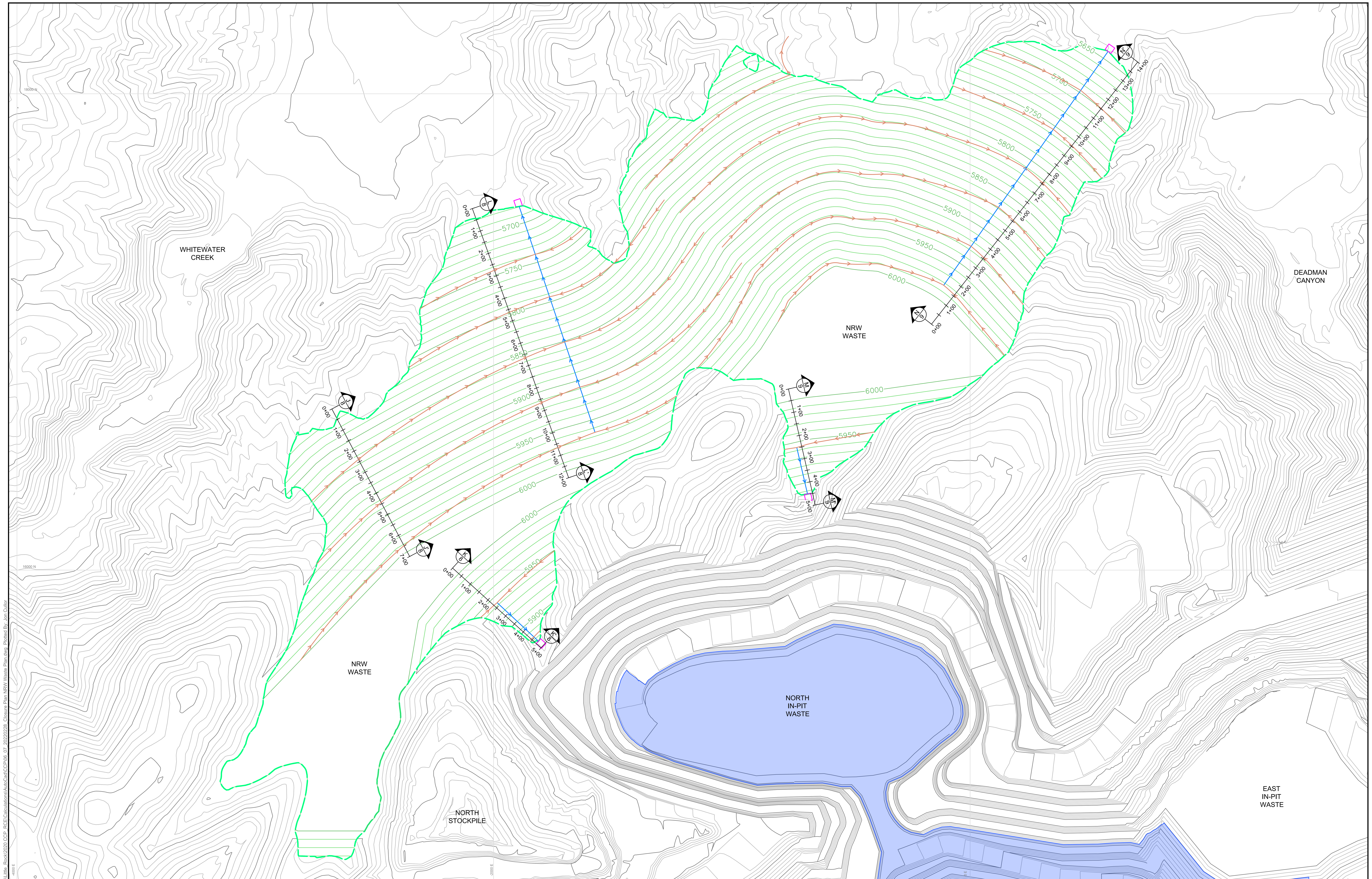
REVISION NUMBER: 5

PREPARED BY:

TELESTO SOLUTIONS INCORPORATED

PREPARED FOR:

FREEPORT-MCMORAN



PLAN VIEW - POST RECLAMATION

LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- PRE-REC. MAJ. CONTOUR (50 FT)
- PRE-REC. MIN. CONTOUR (10 FT)
- POST-REC. MAJ. CONTOUR (50 FT)
- POST-REC. MIN. CONTOUR (10 FT)
- BENCH CHANNEL
- DOWNDRAIN
- ENERGY DISSIPATOR
- POST-CLOSURE PIT LAKE AREA

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN
2. NRW WASTE AS SHOWN IS FACILITY FULL BUILD-OUT

0 200
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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

CLOSURE PLAN - NRW WASTE - PLAN - POST-RECLAMATION

SHEET NUMBER: 7
REVISION NUMBER: 5

PREPARED BY:
TELESTO SOLUTIONS INCORPORATED

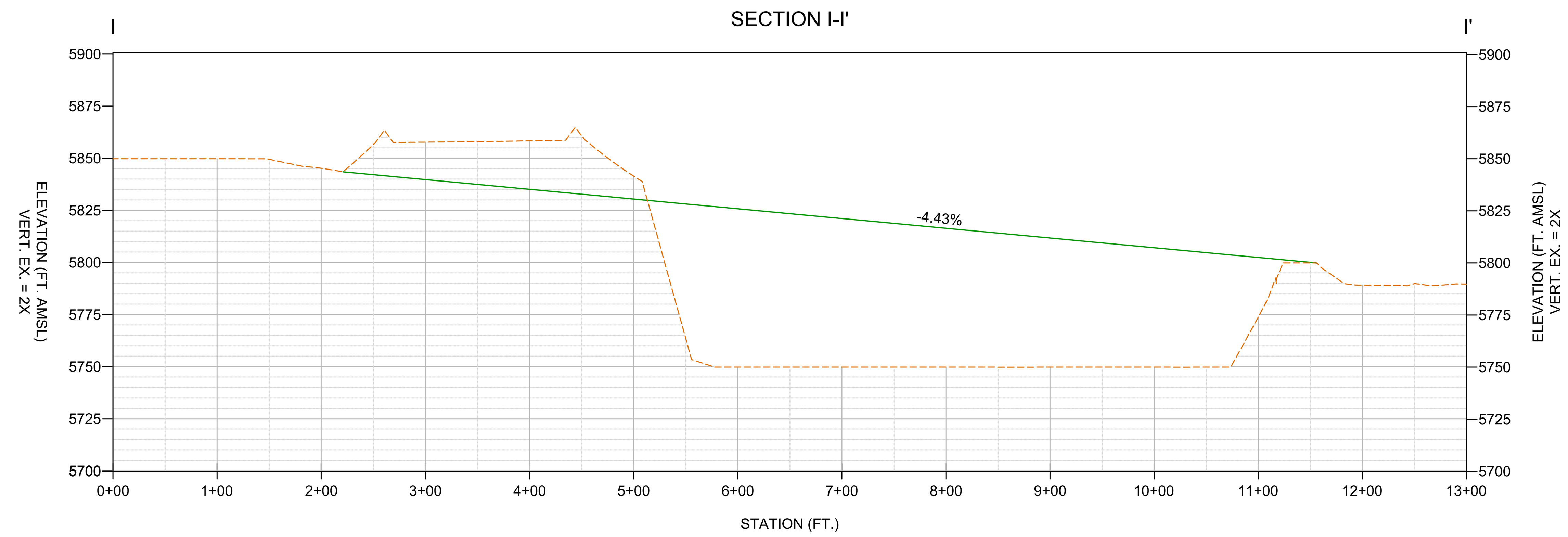
PREPARED FOR:
FREEPORT-MCMORAN

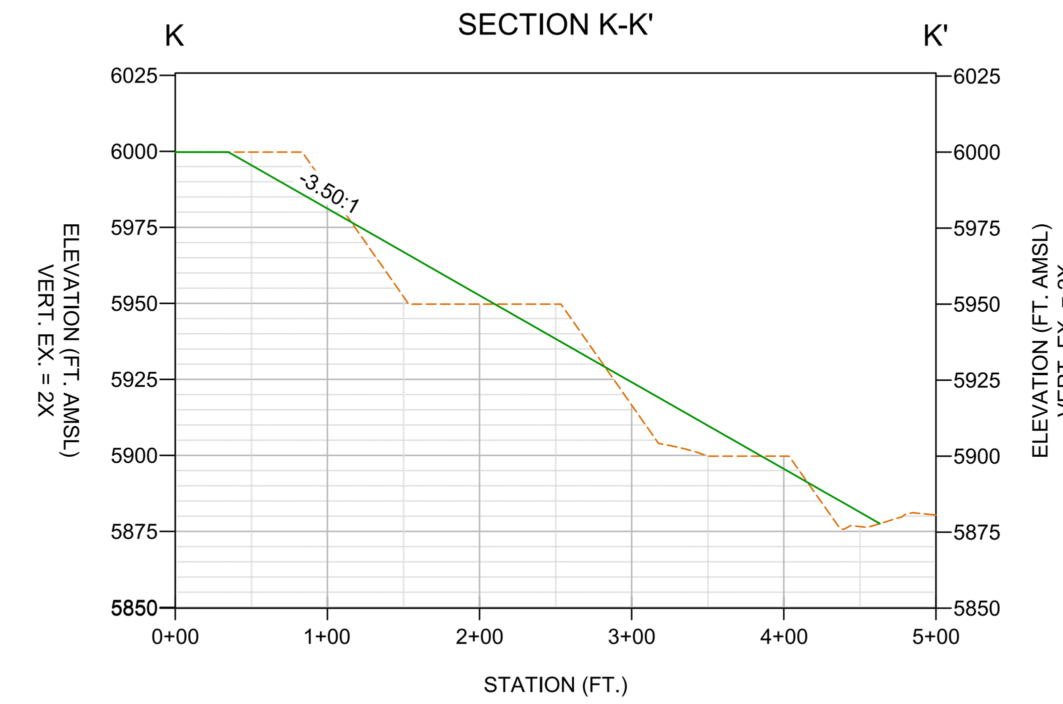
LEGEND / NOTES

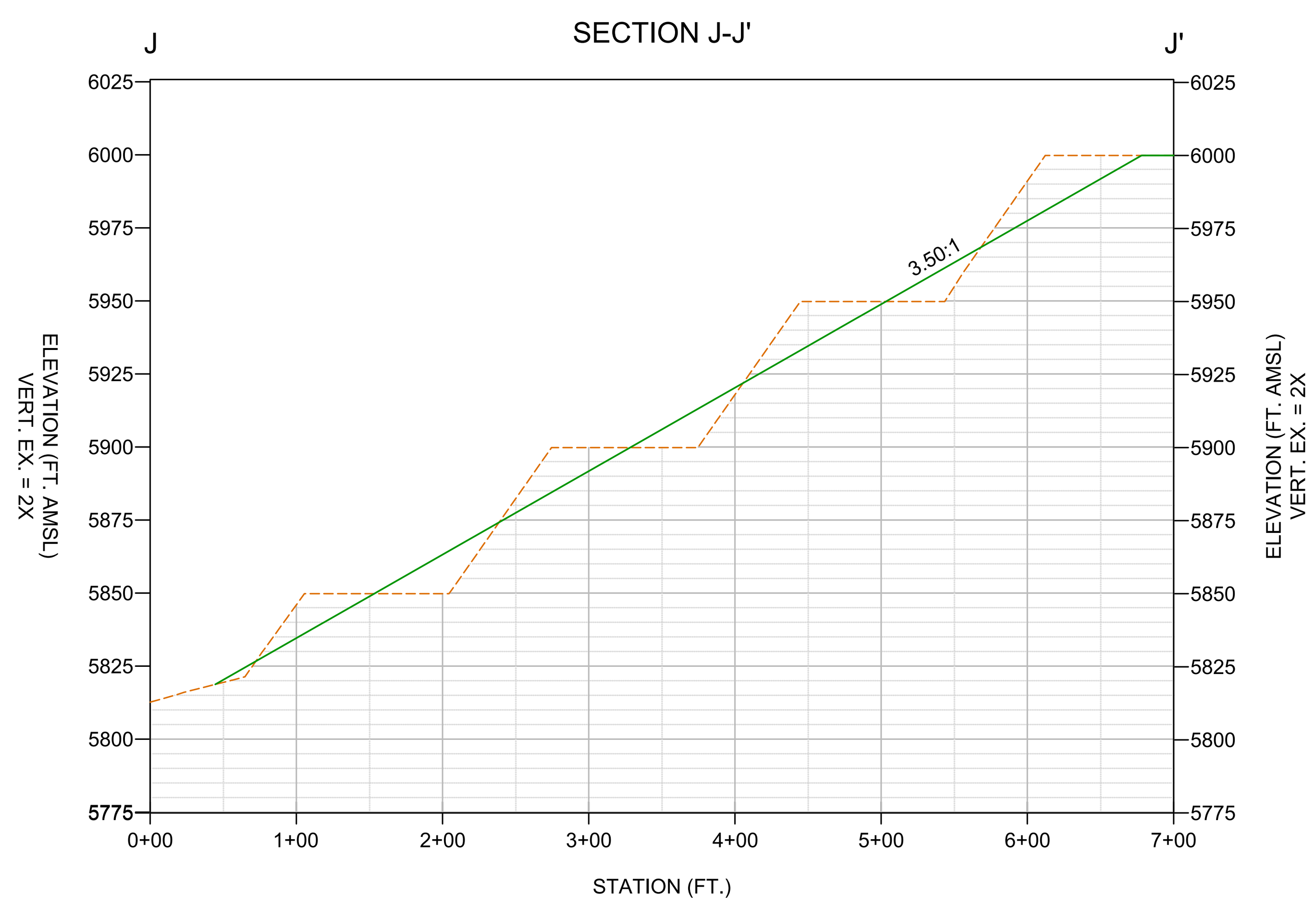
PRE-RECLAMATION SURFACE

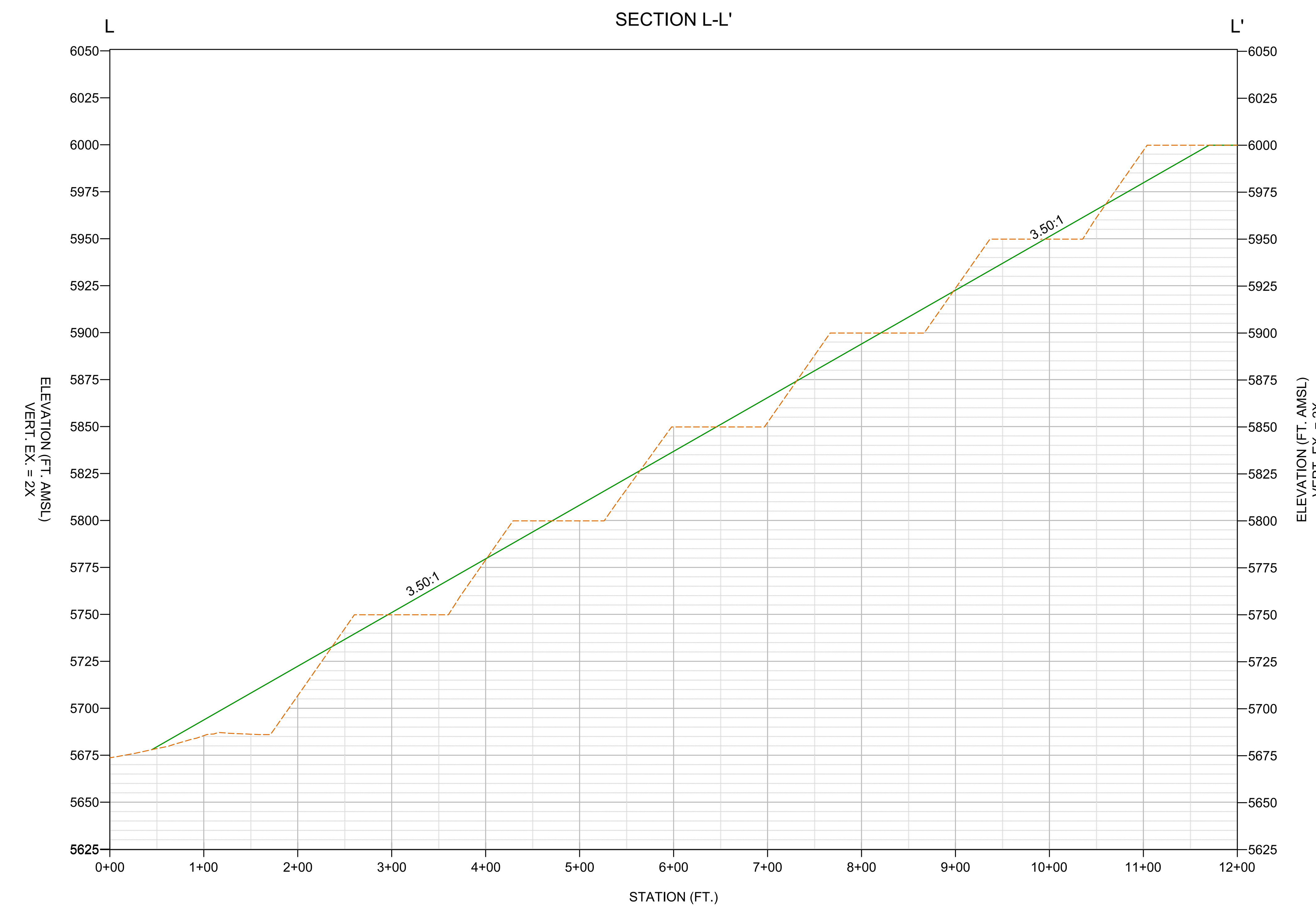
POST-RECLAMATION SURFACE

COORDINATE SYSTEM
TYRONE LOCAL









REVISIONS

#	DESCRIPTION	DATE	BY	APPROVAL
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2	FOR AGENCY	6/11/20	JC	TT
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

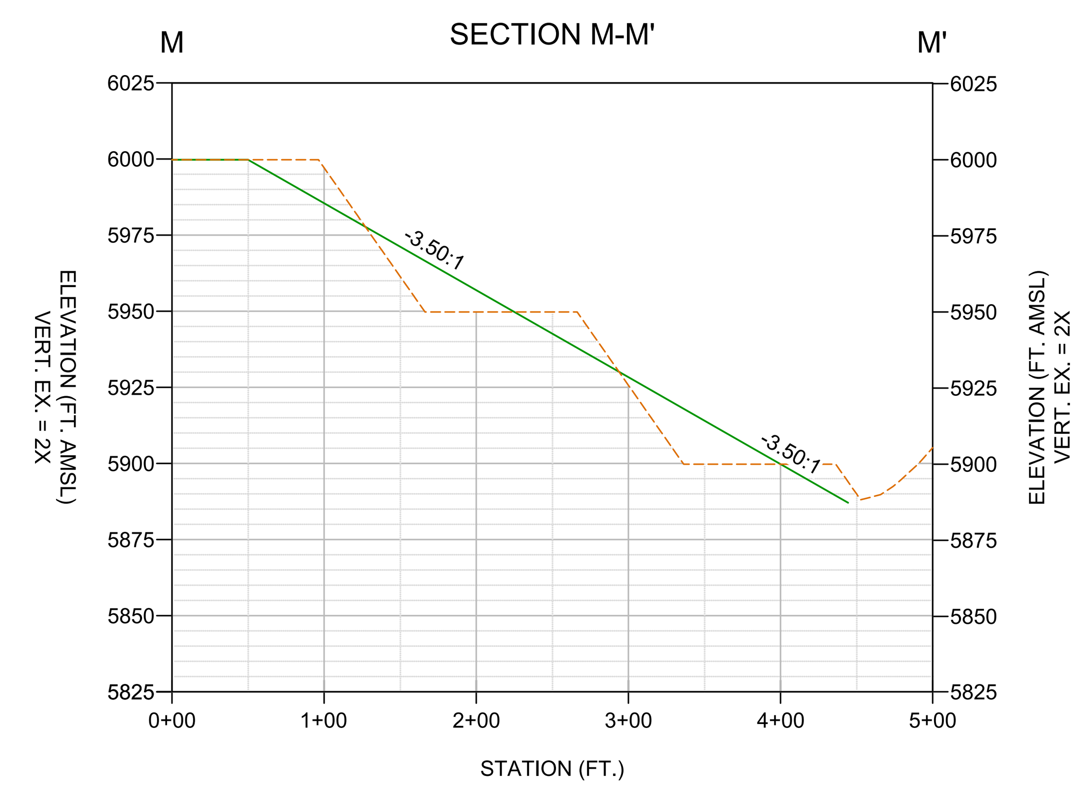
CLOSURE PLAN - NRW WASTE & DEADMAN DIVERSION - SECTIONS

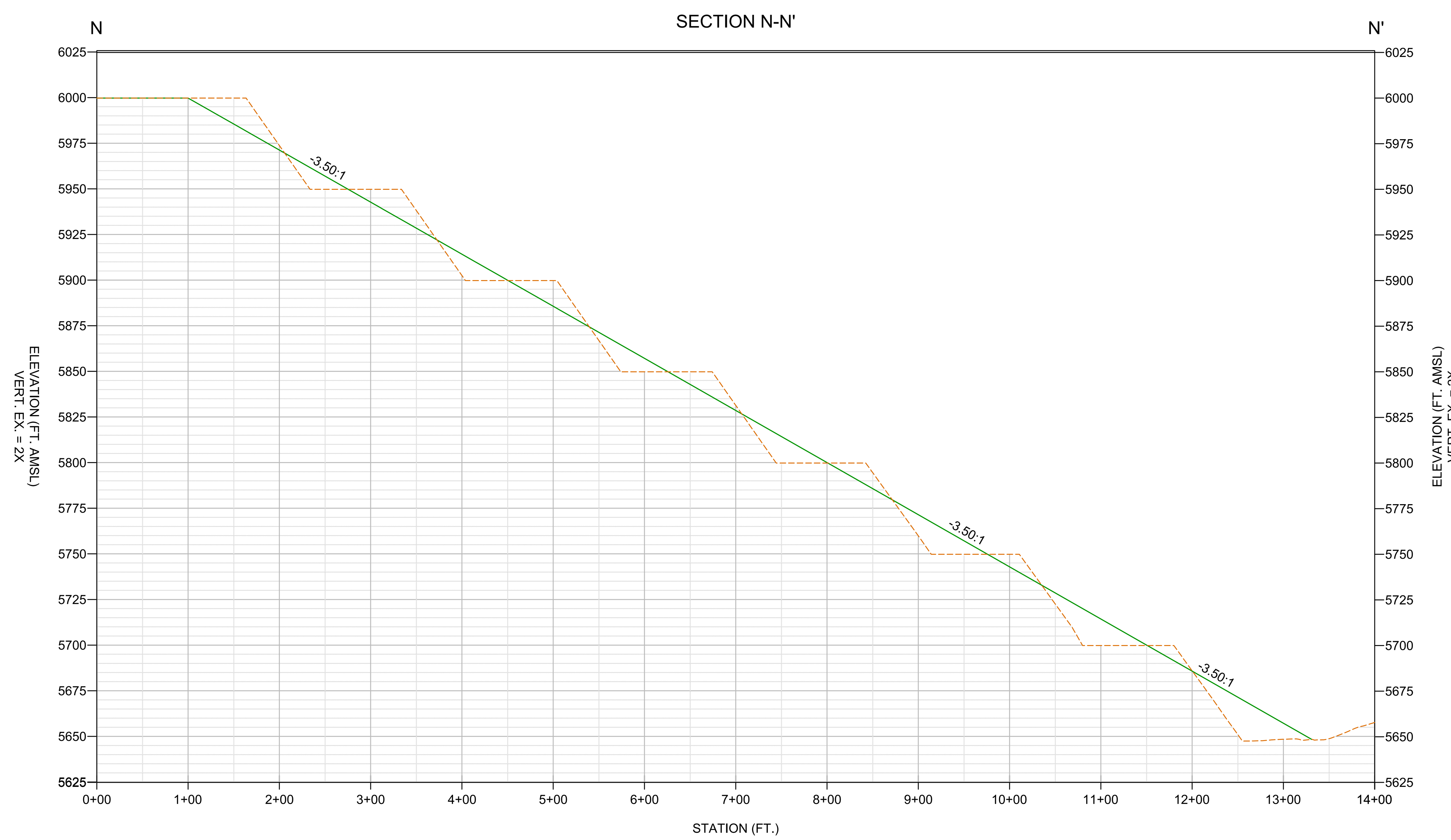
SHEET NUMBER: 8

REVISION NUMBER: 5

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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

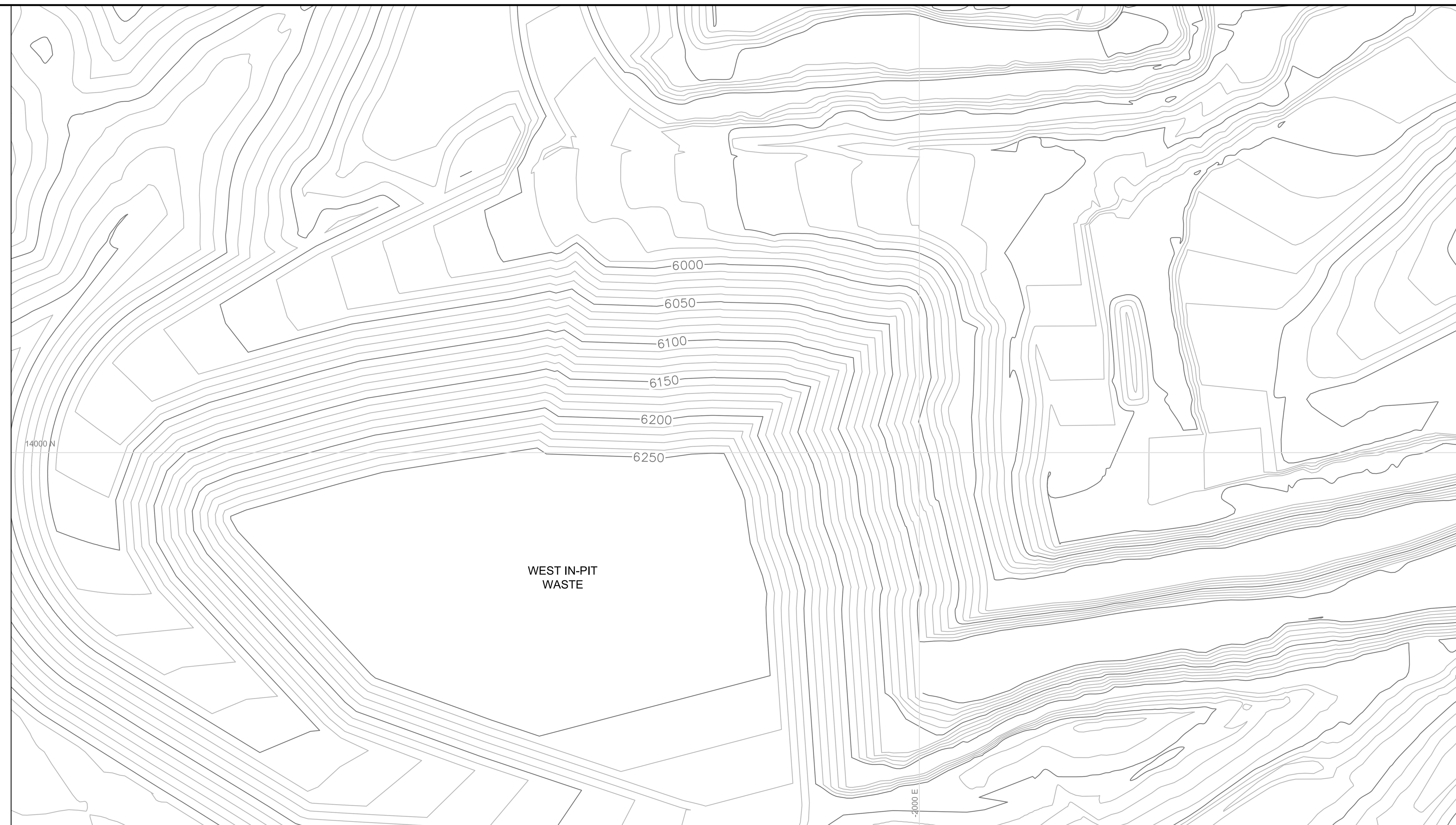
CLOSURE PLAN - NRW WASTE - SECTIONS

SHEET NUMBER: 9

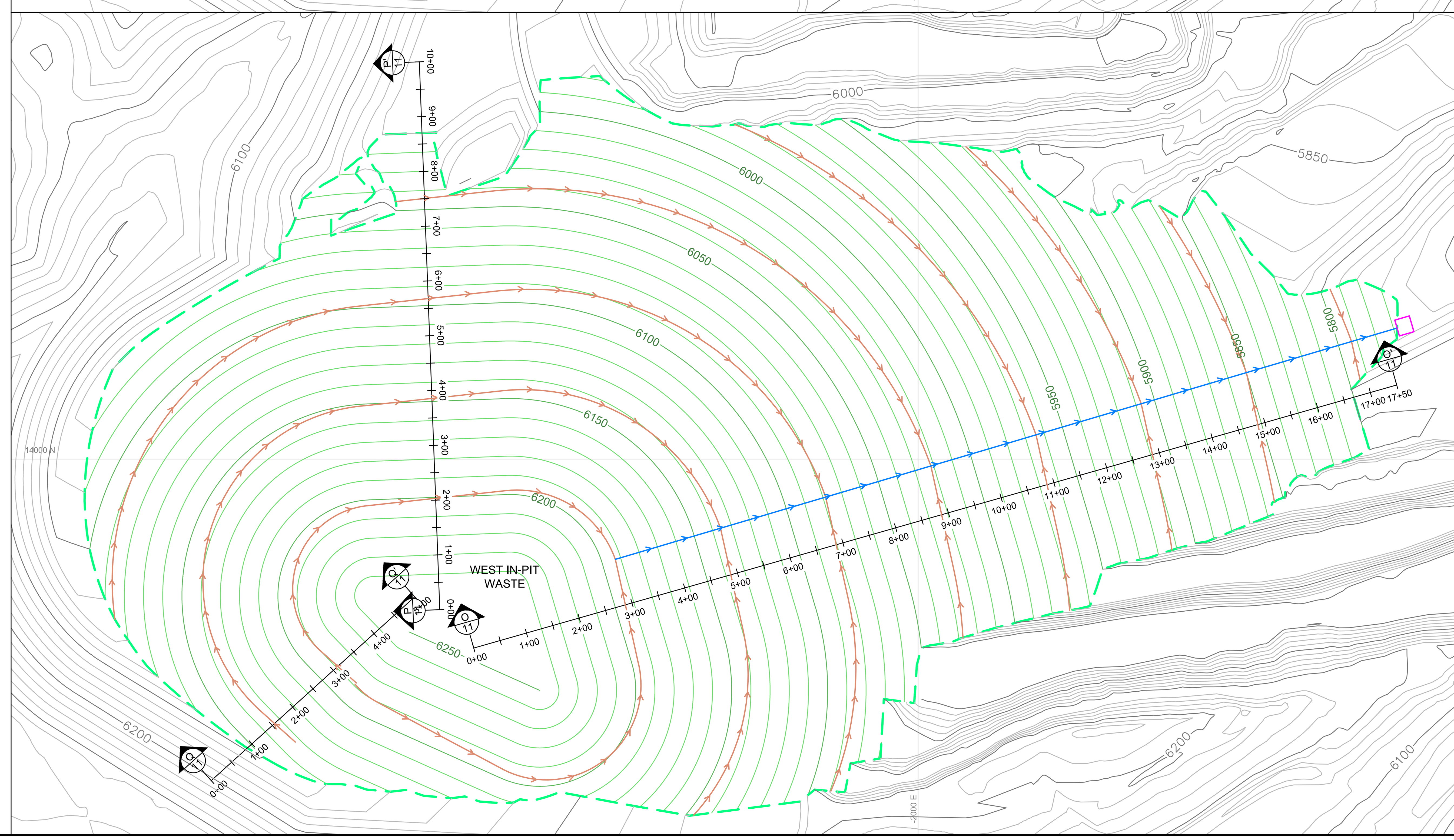
REVISION NUMBER: 5

PREPARED BY:
TELESTO SOLUTIONS INCORPORATED

PREPARED FOR:
FREEPORT-McMoRAN



PLAN VIEW - PRE-RECLAMATION



PLAN VIEW - POST-RECLAMATION

LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- PRE-REC. MAJ. CONTOUR (50 FT)
- PRE-REC. MIN. CONTOUR (10 FT)
- POST-REC. MAJ. CONTOUR (50 FT)
- POST-REC. MIN. CONTOUR (50 FT)
- 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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

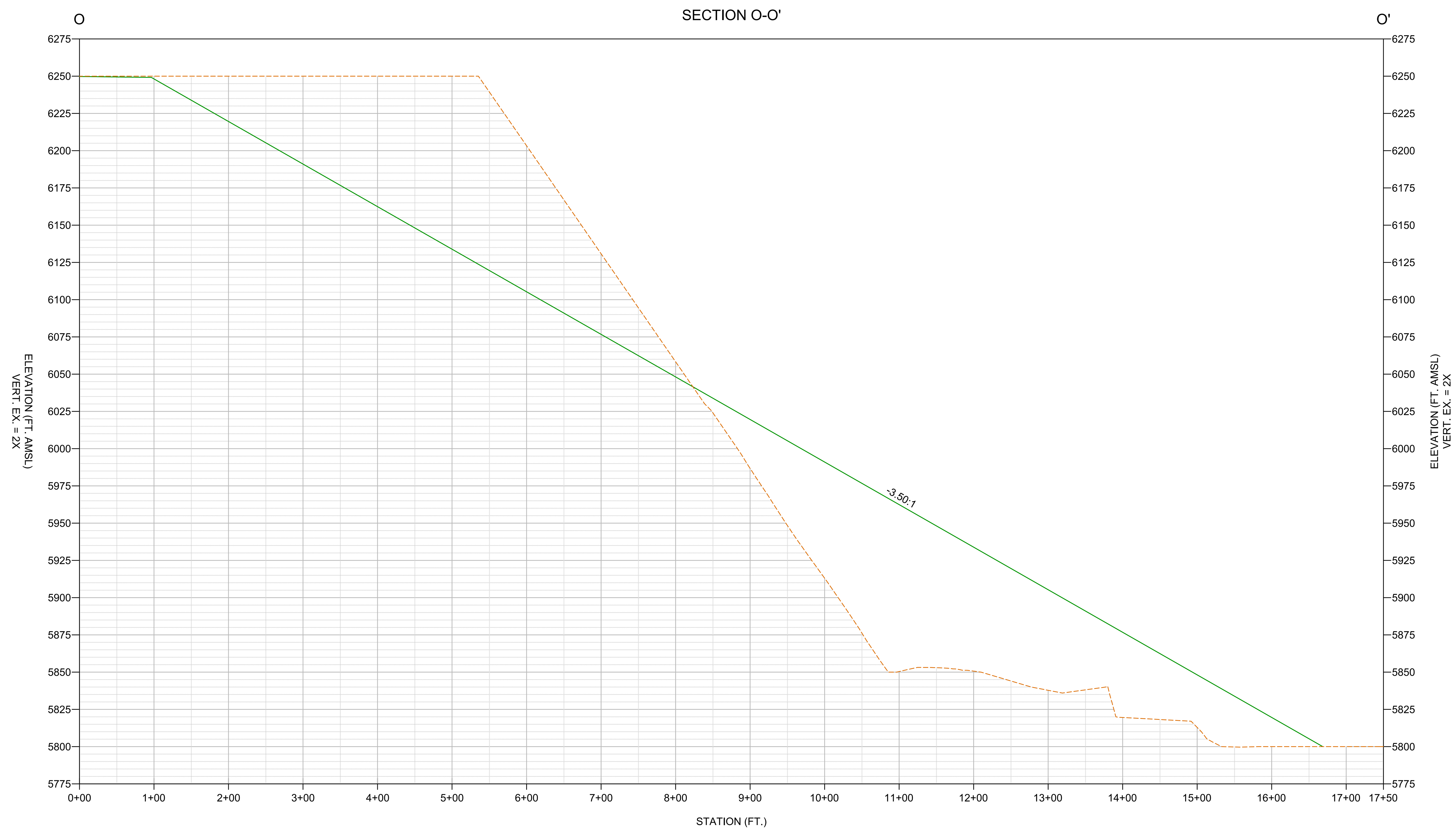
2020 LITTLE ROCK CCP

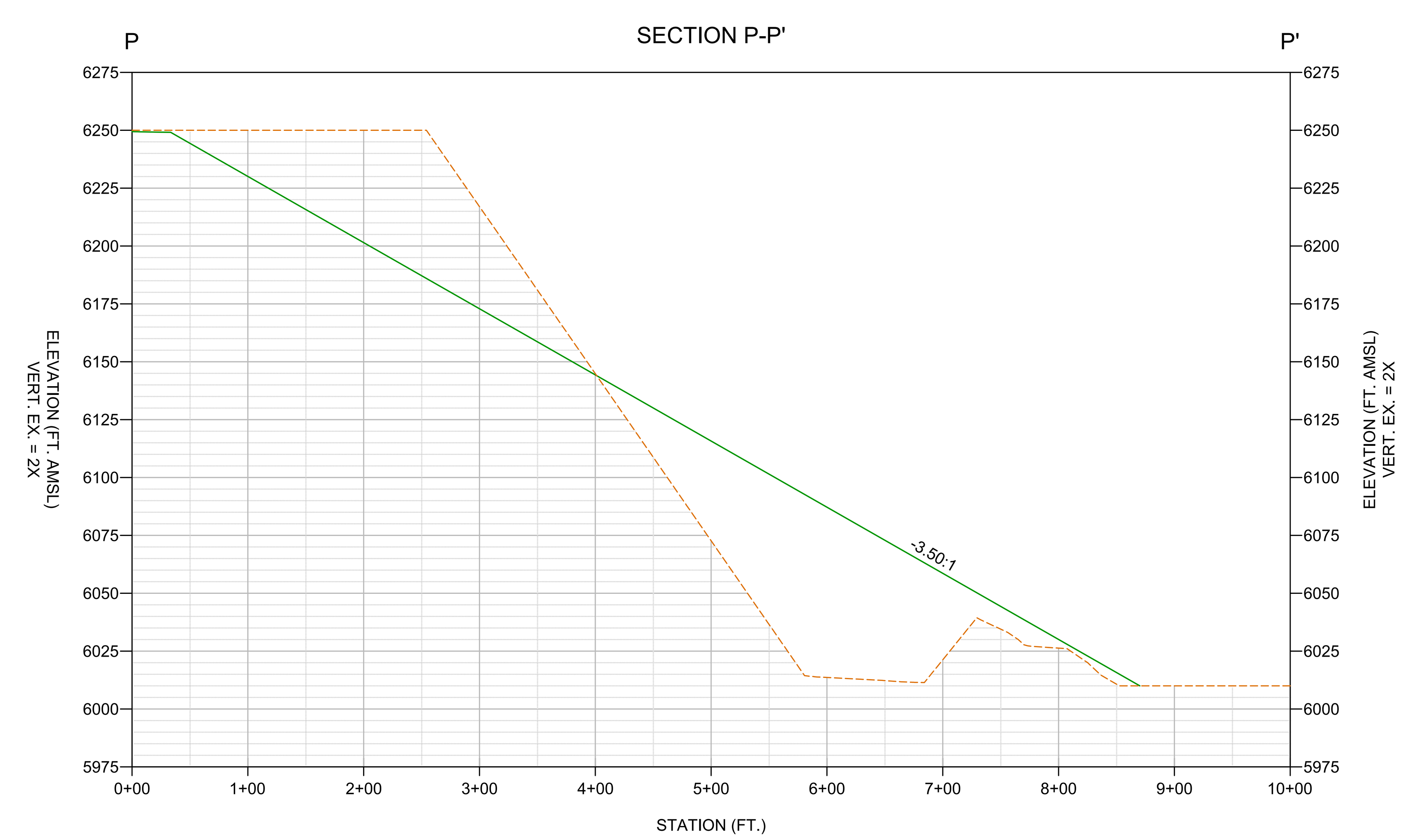
CLOSURE PLAN - WEST IN-PIT WASTE - PLAN

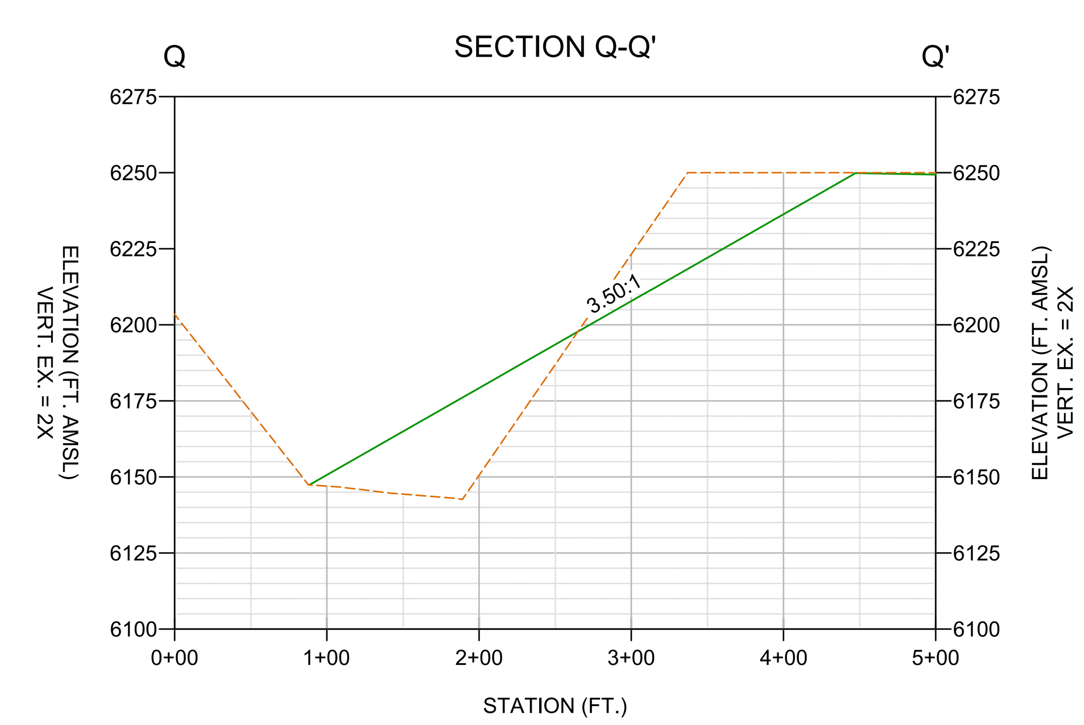
SHEET NUMBER: 10
REVISION NUMBER: 5

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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

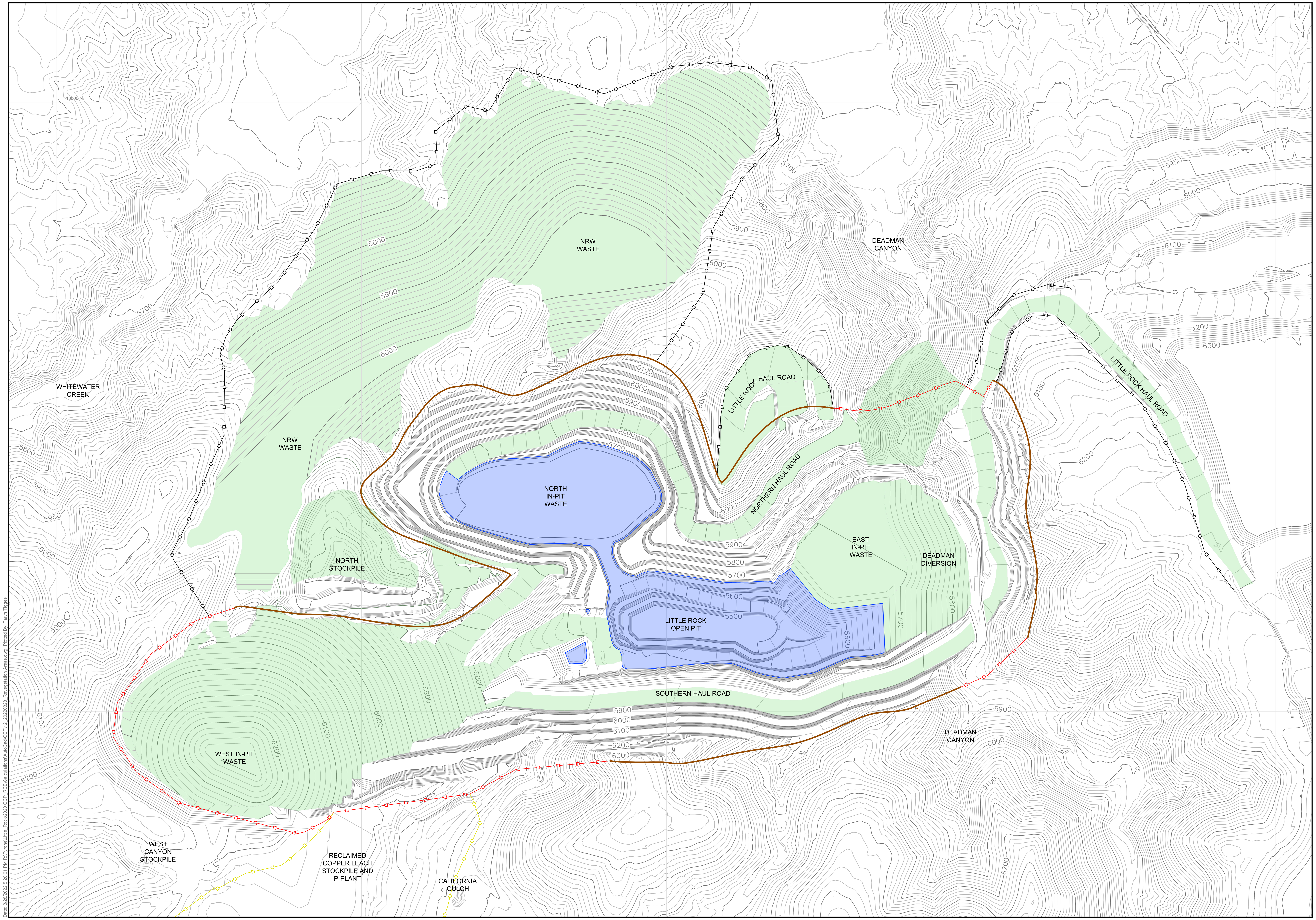
CLOSURE PLAN - WEST IN-PIT WASTE - SECTIONS

SHEET NUMBER: 11

REVISION NUMBER: 5

PREPARED BY:
TELESTO SOLUTIONS INCORPORATED

PREPARED FOR:
FREEPORT-McMoRAN



LEGEND / NOTES

- MAJOR CONTOUR (50 FT)
- MINOR CONTOUR (10 FT)
- PROPOSED BERM
- PROPOSED PERMANENT FENCE
- PROPOSED LIVESTOCK FENCE
- EXISTING LIVESTOCK FENCE
- REVEGETATED AREA
- POST-CLOSURE PIT LAKE AREA

NOTES:

1. EXISTING TOPOGRAPHY FREEPORT MCMORAN TYRONE INC. END-OF-YEAR 2024 MINE PLAN
2. TYRONE BOUNDARY PENDING APPROVAL
3. NRW WASTE AS SHOWN IS FACILITY FULL BUILD-OUT

0 300
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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

2020 LITTLE ROCK CCP

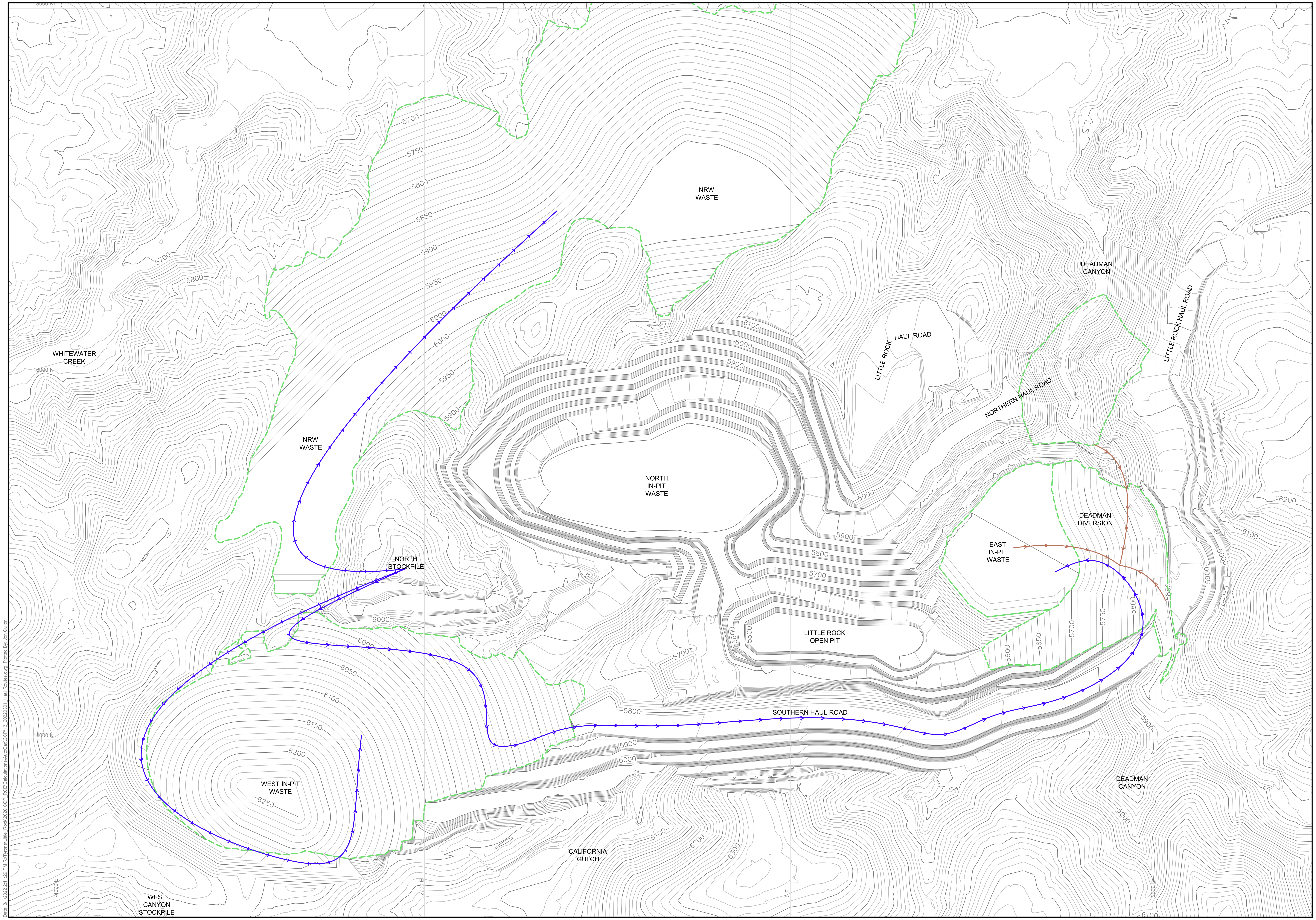
REVEGETATION AREAS

SHEET NUMBER: 12

REVISION NUMBER: 5

PREPARED BY: TELESTO SOLUTIONS INCORPORATED

PREPARED FOR: FREEPORT-McMoRAN



LEGEND / NOTES

- FACILITY RECLAMATION BOUNDARY
- MAJOR CONTOUR (50 FT)
- MINOR CONTOUR (10 FT)
- 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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	3/24/2022
PROJECT	200540a
TASK NUMBER	001-01
DRAWN BY	JC
PROJECT ENGINEER	JC
CHECKED BY	TT

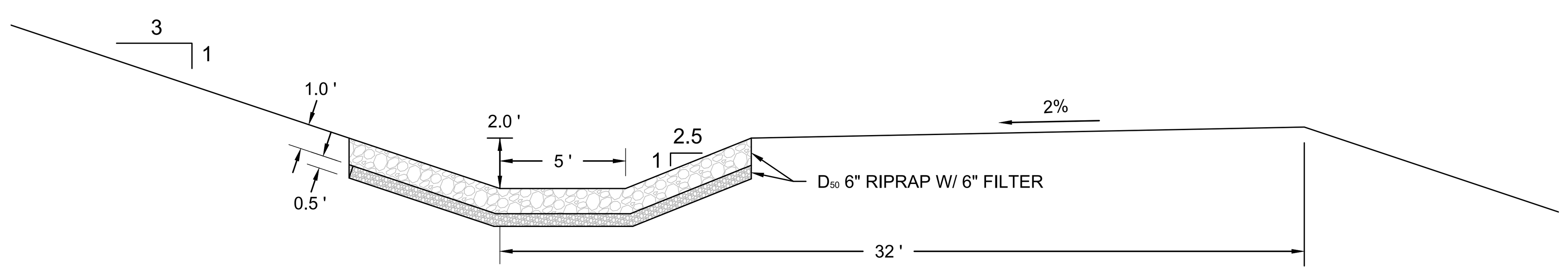
2020 LITTLE ROCK CCP

RECLAMATION HAUL ROUTES

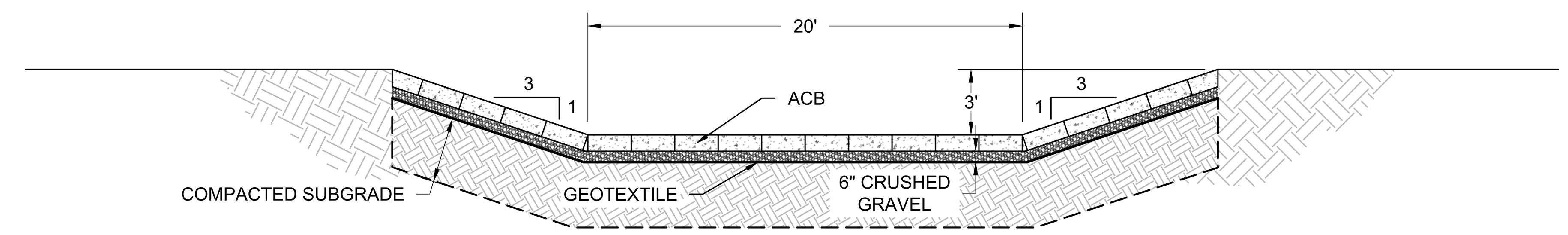
SHEET NUMBER: 13
REVISION NUMBER: 5

PREPARED BY:
TELESTO SOLUTIONS INCORPORATED

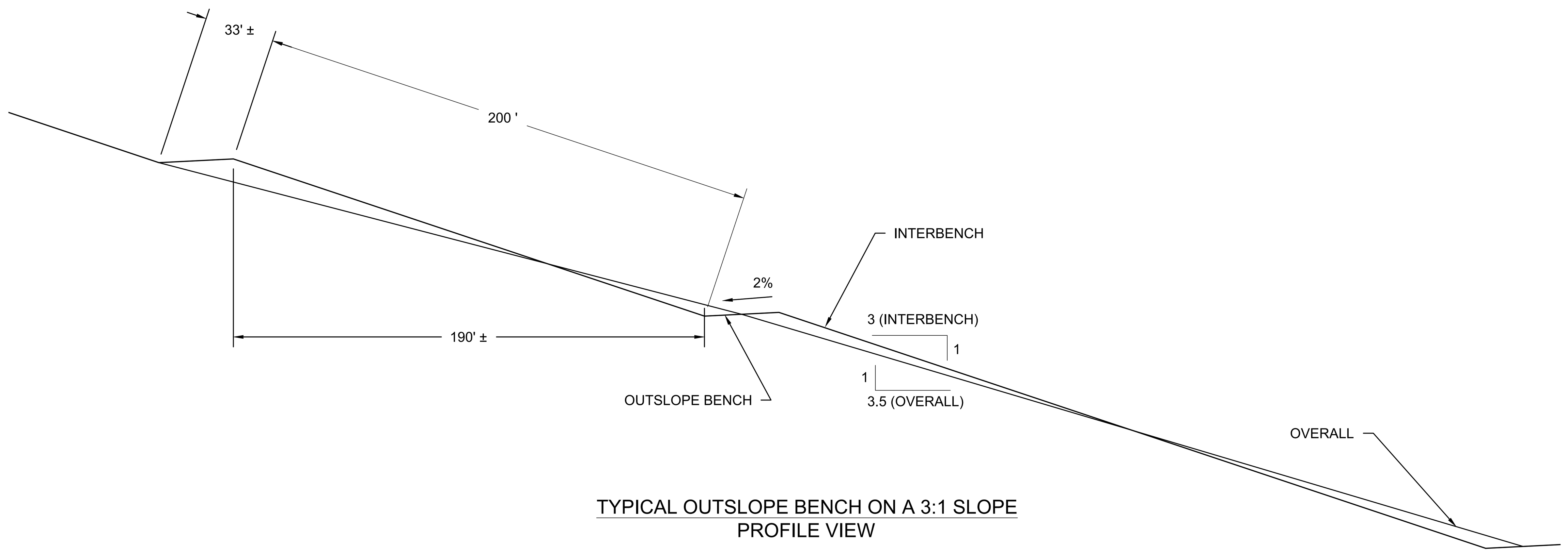
PREPARED FOR:
FREEPORT-McMoRAN



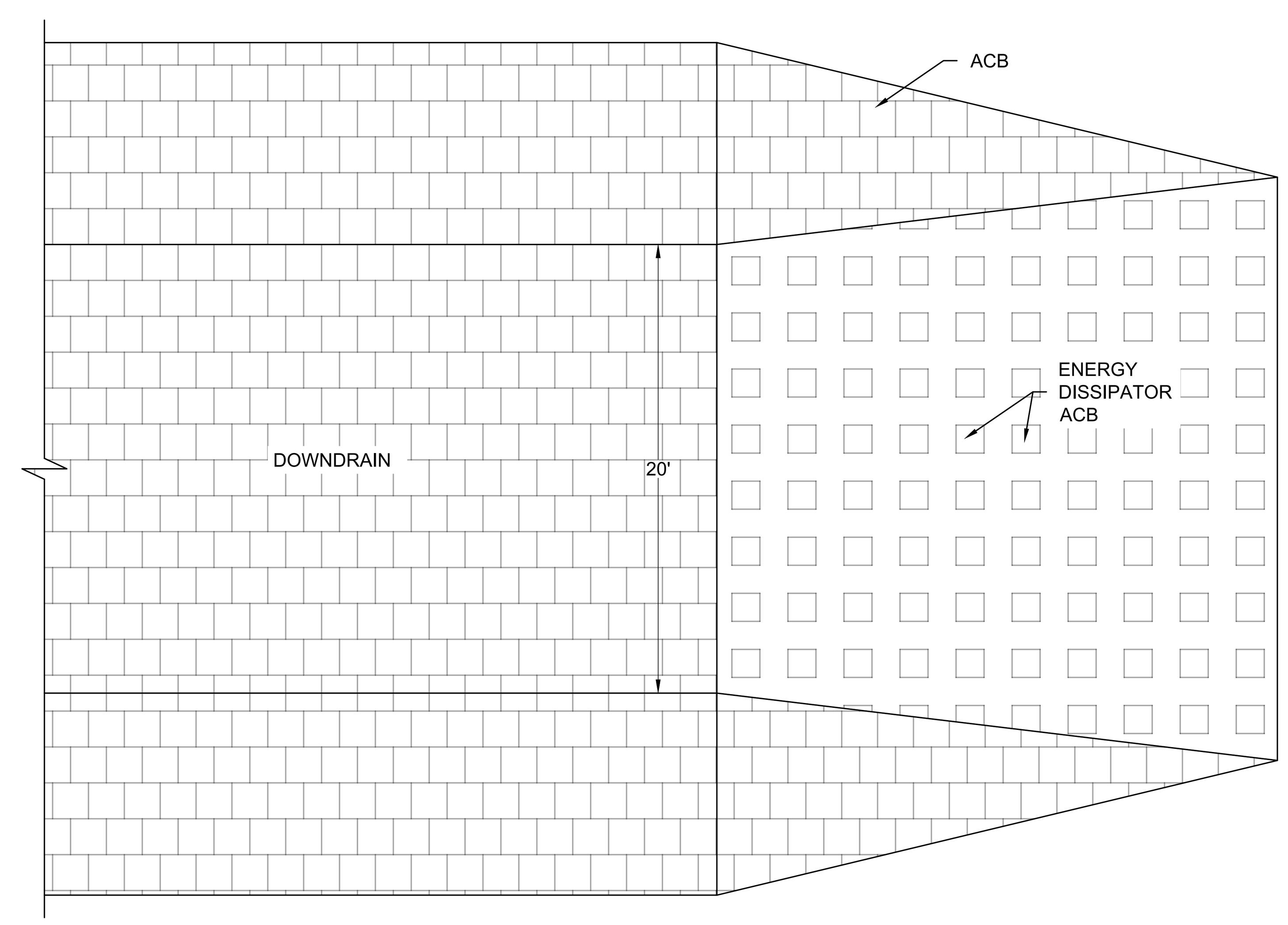
TYPICAL BENCH CHANNEL CROSS SECTION
SECTION VIEW



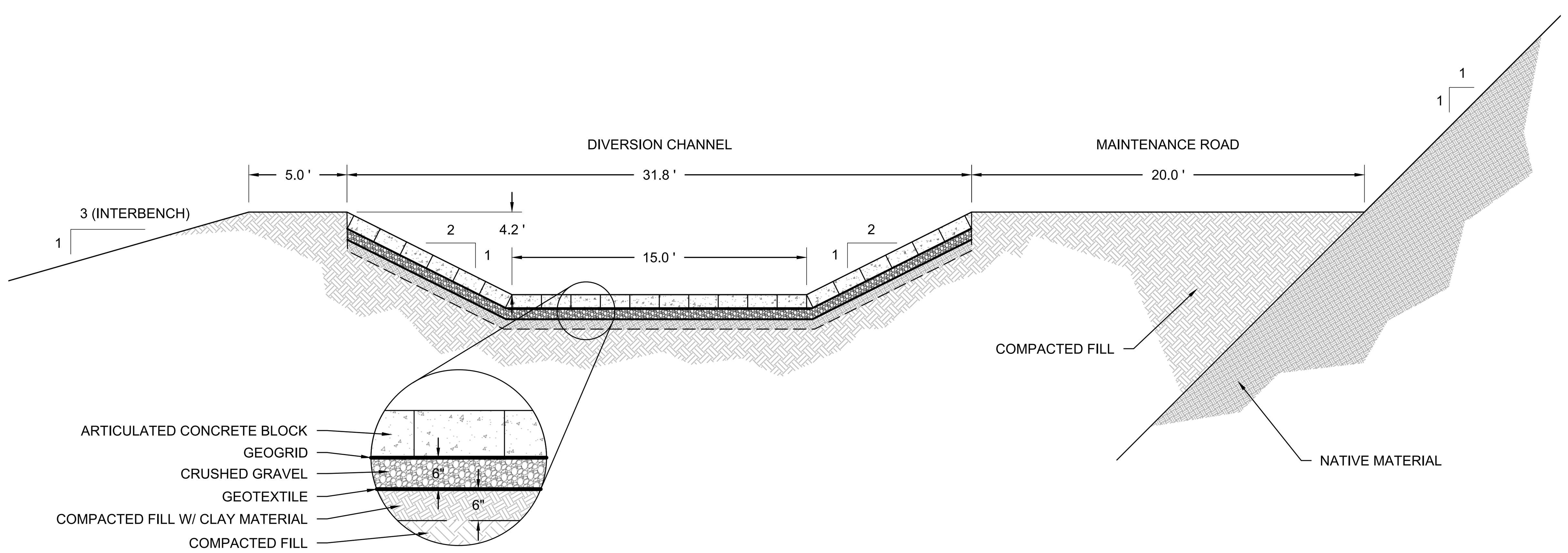
TYPICAL DOWNDRAIN
SECTION VIEW



TYPICAL OUTSLOPE BENCH ON A 3:1 SLOPE
PROFILE VIEW



TYPICAL ENERGY DISSIPATOR
PLAN VIEW



DEADMAN DIVERSION
SECTION VIEW

LEGEND / NOTES

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
3	PER AGENCY COM.	1/25/21	JC	TT
4	NRW/CLW MODS	3/3/22	JC	TT
5	ADD COPPER LEACH	3/24/22	JC	TT

DATE	*3/24/2022*
PROJECT	*200540a*
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: 5

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
<u>Item</u>	Quantity
Cover Material	2,648 cubic yards
Top Surface Regrading	NA
Top Surface Ripping	0.6 acres
Outslope Regrading	1,681,546 cubic yards
Revegetation	49.2 acres
Channels and Benches	10,627 feet
Other	1,487 feet downdrains

[1.]Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
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.] Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
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)	10
Item	Quantity
Cover Material	535 cubic yards
Top Surface Regrading	NA
Top Surface Ripping	8.7 acres
Outslope Regrading	NA
Revegetation	10 acres
Channels and Benches	NA
Other	NA

[1.] Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
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)	109.1
Item	Quantity
Cover Material	5,865 cubic yards
Top Surface Regrading	NA
Top Surface Ripping	23.1 acres
Outslope Regrading	529,193 cubic yards
Revegetation	109.1 acres
Channels and Benches	18,523 linear feet
Other	2,637 feet of downdrains; 8,734 feet of livestock fencing

1. Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.

N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Reclaimed Copper Leach Stockpile and P-Plant Area

Function	Reclaimed P-Plant and the Copper Leach Stockpile
Location Characteristics	California Gulch channel runs along the southern and eastern perimeter of the reclaimed area 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	Acid generating material covered with reclamation cover material Very coarse grained Medium to high saturated hydraulic conductivity
Leach Status	Former leach facility now fully reclaimed
Existing Engineering Measures	Vegetated reclamation cover, stormwater controls, CLDS and CLDS-1 seepage collection systems

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	30.7
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	NA
Outslope Regrading	NA
Revegetation	NA
Channels and Benches	NA
Other	30.7 acres vegetation maintenance

[1.] Reclamation of the P-Plant and the Copper Leach Stockpile commenced in February 2010 and all work was completed in 2011. For FA purposes, reclamation costs for the Copper Leach Stockpile and P-Plant are included for 2 years of vegetation maintenance. Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.

N/A – Not analyzed

NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Accessible Flat Areas (Inside of 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)	13.7
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	13.7 acres
Outslope Regrading	NA
Revegetation	13.7 acres
Channels and Benches	NA
Other	1,633 feet of livestock fencing

[1.] Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
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 of wells and exploration holes at closure

1. Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022. 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.

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)	30.1
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	30.1
Outslope Regrading	NA
Revegetation	NA
Channels and Benches	NA
Other	6,544 feet chain link fence, 11,494 feet berms; 4 vehicle gates; 37 signs

[1.] Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
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	

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	40.7
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	40.7
Outslope Regrading	NA
Revegetation	40.7
Channels and Benches	NA
Other	NA

[1.]Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Little Rock Haul Road, Northern Haul Road, and Southern Haul Road

Function	Haul roads
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)	31.1
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	31.1 acres
Outslope Regrading	NA
Revegetation	31.1 acres
Channels and Benches	NA
Other	8.4 acres/ 1,032,816 cubic yards of Northern Haul Road used for Deadman Canyon fill, 3,968 feet of livestock fencing

[1.]Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
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, 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. Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Accessible Flat Areas (Outside of Pit)

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)	13.7
Item	Quantity
Cover Material	NA
Top Surface Regrading	NA
Top Surface Ripping	13.7 acres
Outslope Regrading	NA
Revegetation	13.7 acres
Channels and Benches	NA
Other	NA

1. Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
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)	12.8
Item	Quantity
Cover Material	686 cubic yards
Top Surface Regrading	NA
Outslope Regrading	47,432 cubic yards
Cut/Fill Material	1,098,055 cubic yards
Revegetation	12.8 acres
Channels and Benches	2,232 feet
Other	798 feet of downdrains

1. Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.
N/A – Not analyzed
NA - Not applicable

Little Rock Mine Closure/Closeout
Facility Characteristics Form

Pit Lake

Function	A pit lake is expected to begin to form within the Little Rock Mine open pit due to the cessation of dewatering activities
Location Characteristics	Mine Permit Area
Construction Method	NA
Physical Characteristics	N/A
Leach Status	N/A
Existing Engineering Measures	N/A

Reclamation Quantities/Facility[1]

Reclaimed Area (Acres)	NA
Item	Quantity
Post Closure Pit Lake Surface Area	39.5 acres
Post Closure Pit Lake Terminal Elevation	5,669 ft
Other	NA

1. Quantities based on Telesto Solutions Inc. Earthwork Cost Basis Document and associated EOY 2024 reclamation plans dated March 2022.

N/A – Not analyzed
NA - Not applicable

APPENDIX C

RECLAMATION COST BASIS SUMMARY REPORT

Earthwork Cost Estimate Process Summary Report Version 2

Little Rock Mine Closure/Closeout Plan

Prepared for

Freeport-McMoRan Tyrone Inc.
P.O. Box 571
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Prepared by

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March 2022

Signature Page

Earthwork Cost Estimate Process Summary Report Version 2

Little Rock Mine Closure/Closeout Plan

March 2022

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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 is provided in Appendix E of this report.

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, the NRW Waste configuration at full build-out, 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. This facility will not be included in the earthwork RCE update because it is assumed that it does 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 this facility 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 used to complete the earthwork RCE.
- **Section 4.0** presents the results including a listing by location for direct and indirect capital costs and site-wide direct and indirect O&M costs.
- **Section 5.0** lists the references cited in this report

The following appendices provide supporting information and calculations:

- **Appendix A** presents the engineering take-offs used in the calculations.
- **Appendix B** presents the key equations and documentation of the calculations used in the reclamation cost spreadsheet.
- **Appendix C** provides the letter and table documenting the FA Work Group agreement for indirect costs used in the RCE.
- **Appendix D** presents supporting data for the cost estimate, including labor rates, equipment data, direct quotes, and information for fuel costs.
- **Appendix E** presents the RCE spreadsheet.

Table 1 Reclamation Overview

Feature	Notes
Stockpiles	
West In-Pit Waste	Reclaim by grading outslopes, ripping flat areas, hauling 4 inches of finer cover[1] to 10% of stockpile (for FA purposes, consistent with GR007RE Rev. 14-1), 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, ripping flat areas, hauling 4 inches of finer cover[1] to 10% of stockpile, and revegetating
North Stockpile	Reclaim disturbance caused by borrowing material for cover by ripping and revegetating (for FA purposes)
NRW Waste	Reclaim by grading outslopes, ripping flat areas, hauling 4 inches of finer cover[1] to 10% of stockpile (for FA purposes), 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 Deadman Canyon area is removed at closure and utilized to construct the Deadman Diversion. The remaining haul road area and accessible disturbance areas will be reclaimed by seeding by manual application.
Allowance for Other Disturbed Areas	Regrading, hauling 4 inches of finer cover[1] to 10% of area (for FA purposes), 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 finer cover[1] to 10% of area (for FA purposes) and revegetating

[1]The entire stockpile is made from cover material. 4 inches of finer cover is only applied on areas that are too coarse to seed.

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 for the CCP is provided in Appendix E of this report.

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.

Data and key assumptions used throughout the cost estimate calculations for earthwork processes and equipment, indirect and O&M costs, and direct quotes are listed in this section and provided in more detail in Appendix D. The sub-appendices in Appendix D are organized as follows:

- **Appendix D.1** tabulates the 2021 labor rates from the New Mexico Department of Labor (NMDOL).
- **Appendix D.2** contains copies of the EquipmentWatch (Penton Media, 2021) sheets from which equipment unit rates were obtained.
- **Appendix D.3** provides the curve fits used in the production sheets for dozers and haul trucks.
- **Appendix D.4** provides copies of the pertinent information from RSMeans (R.S. Means, 2021) and pages from several editions of the Caterpillar Performance Handbook (CPH).
- **Appendix D.5** provides direct quotes used in the cost estimates.
- **Appendix D.6** provides data and calculations used to prepare the fuel cost.

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 North Stockpile.
- **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.
- **Fuel Costs:** The fuel cost is 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.
- **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.

- Articulating Concrete Blocks (ACBs) are used for downdrain armoring 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 - 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	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)
Direct Drive Transmission	1.0	-

Parameter	Value	Comment/Reference
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 slightly

Parameter	Value	Comment/Reference
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
Excavator (319D L)		

Parameter	Value	Comment/Reference
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.

Table 3 Labor and Equipment Unit Costs

Equipment Description	Type	Fuel Cost ($/hr)	Total Rental Cost (w/o fuel) ($/hr)	NMDOL Operator Group	NMDOL Labor Rates	Total Cost ($/hr)
Cat D11T CD	Dozer	$80.62	$236.53	Equipment Operator IV	$28.65	$345.80
Cat D9T, SU Blade	Dozer	$38.89	$207.08	Equipment Operator IV	$28.65	$274.62
Cat D6T, SU Blade	Dozer	$19.57	$65.97	Equipment Operator IV	$28.65	$114.19
Cat D6T XL, SU Blade	Dozer	$21.14	$90.38	Equipment Operator IV	$28.65	$140.17
Cat 319D L	Excavator	$14.23	$51.57	Equipment Operator VI	$28.95	$94.75
Cat 992K	Loader	$69.46	$239.31	Equipment Operator VII	$28.97	$337.74
Cat 988H	Loader	$41.19	$127.50	Equipment Operator VII	$28.97	$197.66
Cat 980H	Loader	$29.27	$96.40	Equipment Operator VII	$28.97	$154.64
Cat 966H	Loader	$22.71	$73.25	Equipment Operator VII	$28.97	$124.93
Cat 16M – Fine Grading	Motor Grader	$25.75	$86.71	Equipment Operator VIII	$30.93	$143.39
Cat 16M – Rough Grading	Motor Grader	$25.75	$86.71	Equipment Operator VI	$28.95	$141.41
Cat 14M – Fine Grading	Motor Grader	$22.47	$90.77	Equipment Operator VIII	$30.93	$144.17
Cat 14M – Rough Grading	Motor Grader	$22.47	$90.77	Equipment Operator VI	$28.95	$142.19
Finn B260	Mulcher	$11.19	$15.88	Truck Driver III	$24.57	$51.64
Cat D11T CD Multi-shank (w/MSR-359H)	Dozer w/Ripper	$80.62	$254.38	Equipment Operator IV	$28.65	$363.65
Ripper (MSR-189H)	Ripper	--	$8.26	--	--	$8.26
Hitachi EX3600-5	Shovel	$224.17	$513.29	Equipment Operator VII	$28.97	$766.43
Deere 7430	Tractor	$16.21	$27.99	Truck Driver III	$24.57	$68.77
Cat 769D	Truck	$26.40	$106.35	Truck Driver VII	$24.96	$157.71
Cat 725	Truck	$16.31	$76.63	Truck Driver VI	$24.82	$117.76
Komatsu 730E	Truck	$90.73	$215.93	Truck Driver VIII	$25.16	$331.82
Off-Hwy Water Truck,6,000-gal.	Water Truck	$30.49	$76.25	Truck Driver V	$24.57	$131.31
1 Deck Screening Plant (5X16, 48X60)	Screening Plant	$13.14	$75.59	Laborer I	$23.88	$112.61
3 Deck Screening Plant (5X16, 42X60)	Screening Plant	$13.14	$111.31	Laborer I	$23.88	$148.33

Table 4 Miscellaneous Unit Costs

Activity	Base Per Unit Cost	Fuel Per Unit Cost	Units	Source	Reference
Fuel	$2.71	$-	gal	-	Diesel fuel cost is estimated by correlating historical local quotes with public data, as agreed upon in November 2018 discussions with the agencies. Fuel cost includes direct and indirect costs at $2.71/gal, as agreed upon in a letter to MMD dated January, 18 2022.
Revegetation	$854.50	$4.46	ac	Revegetation Unit Cost Sheet	See unit rates calculations - Cost is based on a calculated unit rate that includes tractor rental and maintenance, fuel, scarifying, discing, drill seeding, mulching, crimping, seed, and mulch.
Seed	$222.85	$-	ac	Quote	Rocky Mountain Reclamation, 4/2018, est. cost for seed at 8.9 PLS/ac, $210/ac. Escalated 2% 2018-2021= $222.85/ac
Mulch	$260.00	$-	ton	Quote	Rocky Mountain Reclamation, 4/2018, est. cost for hay mulch (nox. weed free, native), $245/ton). Escalated 2% 2018-2021= $260.00/ton
Manual Seeding	$248.64	$-	day	Means Line Item 329343.10 0560	Planting, trees, shrubs, and ground cover, medium soil, bare root seedlings, 3" to 5", includes planting only
Bench Grading Stockpile	$1.62	$0.47	ft	Bench Grading Unit Cost Sheet	See unit rates calculations
Bench Grading Tailings Pond	$1.62	$0.47	ft	Bench Grading Unit Cost Sheet	See unit rates calculations
Deadman Diversion Channel Construction	$490.71	$-	ft	Quote	See unit rates calculations
Downdrain Construction	$389.66	$-	ft	Downdrain Unit Cost Sheet	See unit rates calculations
Downdrain Dissipater	$15,106.89	$-	ea	Downdrain Unit Cost Sheet	See unit rates calculations
Channel Construction w/ Riprap	$7.22	$1.57	ft	Channel Unit Cost Sheet	See unit rates calculations
Channel Construction w/o Riprap	$0.48	$0.15	ft	Channel Unit Cost Sheet	See unit rates calculations
Erosion Control	$3,014.46	$442.71	day	Modified Crew B-13A	Erosion control for O&M - includes 1 foreman, 2 laborers, 1 equipment operator, 2 truck drivers, 1 loader (4 cy), 2 dump trucks (8 cy)
Structure Demolition	$0.23	$-	cf	Means Line Item 024116.13 0100	Building demolition, large urban projects, mixture of types, excludes foundation demolition, dump fees
Concrete Slab Demolition	$0.62	$-	sf	Means Line Item 024116.17 0400	Building footings and foundations demolition, floors, concrete slab on grade, plain concrete, 6" thick, excludes disposal costs and dump fees
Storage Tank Demolition	$1,059.54	$-	ea	Means Line Item 130505.75 0530	Selective Demolition - Storage Tanks, steel tank, single wall, above ground, not including foundations, pumps or piping, 5,000 thru 10,000 gallon
Storage Tank Demolition	$2,098.05	$-	ea	Means Line Item 130505.75 0540	Steel tank, single wall, above ground, 15,000 thru 30,000 gallon, selective demolition, excluding foundation, pumps or piping
Power Line Demolition	$0.63	$-	ft	Means Line Item 260505.10 0370	Electrical Demolition - Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead powerlines.
Power Pole Demolition	$220.56	$-	ea	Means Line Item 024113.80 0200	Selective Demolition - wood utility poles 35-45 ft high
Pipeline (small HDPE pipe)	$2.93	$-	ft	Pipeline Demo Sheet	Selective demolition water, process water HDPE piping; (6 to 8-inch diameter); excludes excavation
Pipeline (large HDPE pipe)	$6.98	$-	ft	Pipeline Demo Sheet	Selective demolition water, process water HDPE piping (20 to 36-inch diameter); excludes excavation
Well Plug & Abandon	$18.90	$-	ft	Quote	Unit cost of $18.17/ft is based on a July 2019 direct quote from Layne, A Granite Company (formerly Layne Christensen Company) for a total of 172,631 ft of well and exploration borehole abandonment over 300 days (575 ft/day); the unit cost includes 1 mobilization ($15,000) and 1 demobilization ($15,000) spread over 300 days at 575 ft/day. Escalated 2% 2019-2021 = $18.90
Well Replacement	$70.50	$-	ft	Quote	Wilcox Professional Services, 8/2011, est. cost for 5 ½ in bore, $173,500 for 3000 ft total ($57.83/ft). Escalated 2% 2011-2021= $70.50/ft
Seepage Collection Replacement	$133,355.94	$-	ea		Est. cost from 2019 Tyrone RCE
Reinforced Concrete Wall Demolition	$190.58	$-	hr	Means Crew B-12C	Standard Union Crew: 1 equipment operator (crane), 1 laborer, 1 hydraulic excavator, 2 cy, approximately 40 hrs to demo 200 ft reinforced concrete dam.
Disc harrow attachment, for tractor	$670.65	$-	month	Means Line Item 015433.20 1500	Equipment rental costs
Cast-In-Place Concrete	$262.58	$-	cy	Means Line Item 033053.40 6200	Structural concrete, in place, gravity retaining wall (3000 psi), includes forms and reinforcement
Cleanup & Disposal of Wastes Requiring Special Handling	$334.41	$-	ton	Means Line Item 028120.10 1120/1130	Solid pickup; average of minimum and maximum
Transportation of Wastes Requiring Special Handling	$4.78	$-	mile	Means Line Item 028120.10 1260/1270	Transportation to disposal site (Truckload = 80 drums or 25 cy or 18 tons); average of minimum and maximum
Road Maintenance	$5,354.66	$1,346.16	month		Road maintenance for O&M - includes one 14M motor grader and one 6,000-gal water truck
Berming	$0.37	$-	ft	See Berm Unit Cost Sheet	See unit rates calculations
Livestock Fencing	$0.15	$-	ft	Means Line Item 323126.20 0020	Wire fencing & gates, wire fencing general, barbed wire, galvanized, domestic steel, standard, 12-3/4 ga.
Chain Link Fencing	$24.65	$-	ft	Means Line Item 323113.20 0800	Fence, chain link industrial, galvanized steel, 6 ga. wire, 2" posts @ 10' OC, 6' high, includes excavation, & concrete, excludes barbed wire
Vehicle Gates, Pit Perimeters	$957.01	$-	ea	Means Line Item 323113.20 5070	Fence, chain link industrial, double swing gates, 6' high, 20' opening, includes excavation, posts & hardware in

					concrete
Signs every 500 ft., pit perimeters	$73.63	$-	ea	Means Line Item 101453.20 0600	Signs, guide and directional signs, reflectorized, 12" x 18", excludes posts
Fire Hydrant Demolition	$398.83	$-	ea	Means Line Item 024113.23 0900	Utility removal, hydrants, fire, remove only, excludes hauling
Culvert Removal	$12.46	$-	ft	Means Line Item 024113.40 0190	Selective demolition, metal drainage piping, CMP, steel, 48"-60", diameter, excludes excavation
Grade Control Wall	$170.79	$-	cy	Means Line Item 033053.40 3945	Structural concrete, in place, continuous strip footing (3000 psi), 36" wide x 12" deep, unreinforced, includes forms(4 uses), concrete (Portland cement Type I), placing and finishing, excludes reinforcing
Sludge Removal	$305.54	$-	ea	Means Line Item 026510.30 0320	Removal of underground storage tanks, petroleum storage tanks, non-leaking, remove sludge, water and remaining product from tank bottom of tank with vacuum truck, 9,000 - 12,000 gallon tank
Earth Fill Removal (dozer excavate, haul, spread)	$5.20	$-	cy	Means Line Item 312316.46 6070	Excavating, bulk, dozer, open site, bank measure, common earth, 700 HP dozer, 300' haul
Concrete Foundation and Metal Arch (excavate and load)	$1.55	$-	cy	Means Line Item 312316.46 6010	Excavating, bulk, dozer, open site, bank measure, common earth, 700 HP dozer, 50' haul
Concrete Foundation and Metal Arch (haul and dump)	$2.87	$-	cy	Means Line Item 312323.20 5040	Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 15 min load/wait/unload, 22 C.Y. truck, cycle 1 mile, 5 MPH, excludes loading equipment
Substation Demo	$12,266.20	$-	ea	Substation Unit Cost Sheet	See unit rates calculations
Clay Fill	$12.61	$-	cy	Means Line Item 312323.14 5440	Backfill, structural, clay, 300 HP dozer, 300' haul, from existing stockpile, excludes compaction
Transformer	$1,069.16		Ea.	Means Line Item 260505.10 1570	Transformer, dry type, primary, 3 phase, to 600 V, 750 kVA, electrical demolition, remove, including removal of supports, wire & conduit terminations
Steam Cleaner	$313.04	$-	week	Means Line Item 015433.40 6300	Rent steam cleaner 100 gph, Incl. Hourly Oper. Cost.

Means data are obtained from RS Means online (2021) with location adjustment for Las Cruces

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 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 estimate. 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.

The cost estimating process follows the typical, standard approach used in the engineering and construction industries as summarized in Figure 1. 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. Additionally, the RCE spreadsheet incorporates optimization routines that calculate the most efficient truck/loader/scraper combinations.

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 5.

The cost estimates for the following sections are included in standalone calculation sheets in Appendix E of this report.

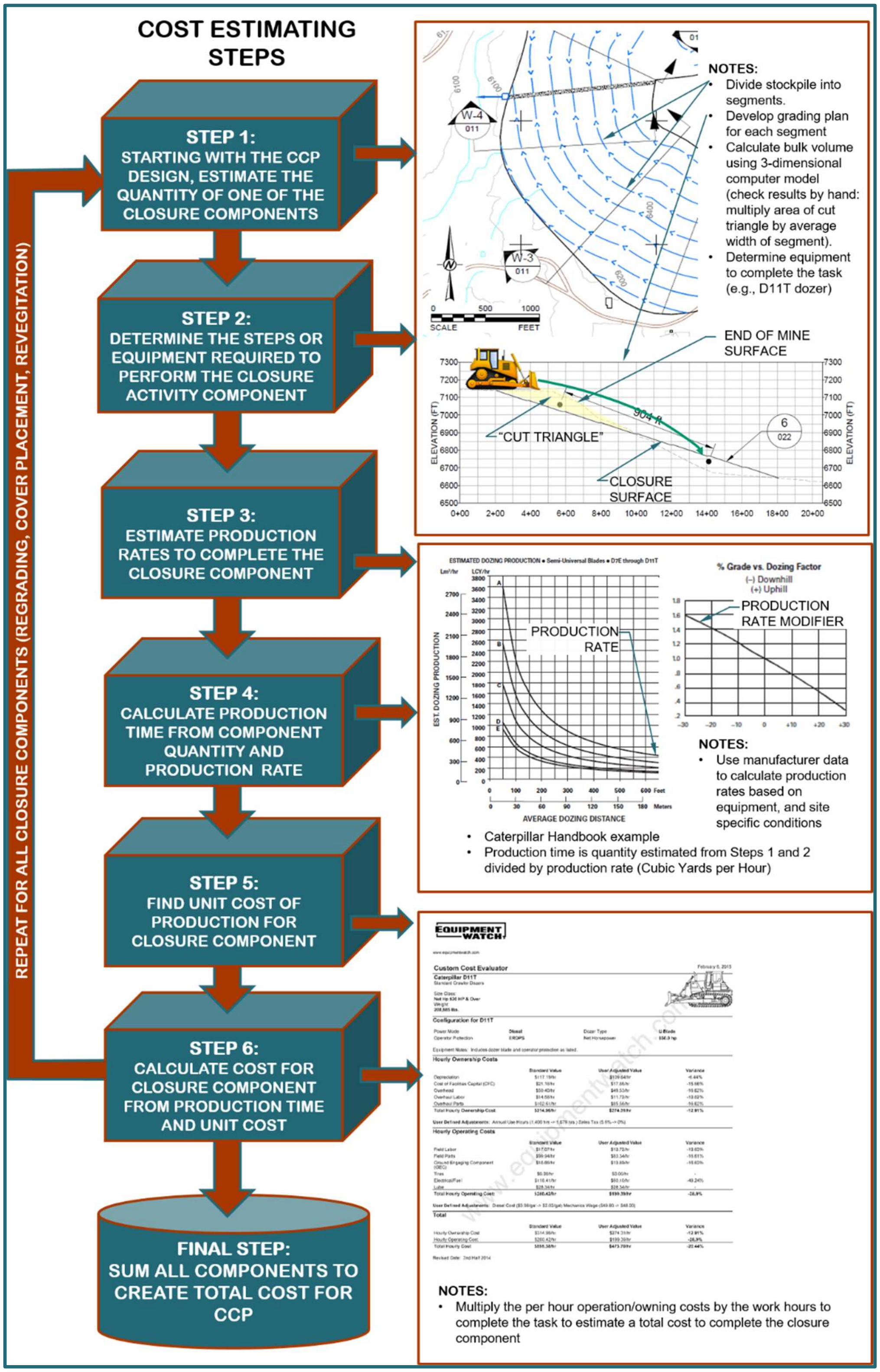

Figure 1 Earthwork Cost Estimating Process

Table 5 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			X	
North Stockpile		X					X			X	
NRW Waste									X		
Top		X		X			X			X	
North Outslopes			X	X	X	X	X			X	
South Outslopes			X	X	X	X	X			X	
Little Rock Open Pit[4]		X					X		X	X	
Southern Haul Road and Little Rock Haul Road[7]		X					X		X	X	
Monitoring wells and exploration drill holes								X			X
Substation, concrete slabs, and powerlines		X					X			X	X
Other roads and pipeline corridors		X					X			X	
Northern Haul Road							X		X	X	
West Canyon Stockpile and Copper Leach										X	
P-Plant		X		X			X			X	
Allowance for Other Disturbed Areas		X		X			X			X	
Deadman Diversion[5]	X			X							
East In-Pit Fill Material	X										
Northern Haul Road Fill material[6]	X						X				
Spanning Arch Culvert Area	X										X
Deadman Diversion Outslope			X	X	X	X	X			X	

[1] Cover placement at 4-inch thickness on 10% of area (for FA purposes) to be revegetated
[2] Also includes Plug and Abandon Well activity
[3] Livestock fencing will be constructed around NRW Waste and Little Rock Haul Road
[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
[7] Haul roads will be reduced to 30' width to allow one-lane use for maintenance activities

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 (for FA purposes) to be revegetated, originating from the North Stockpile. 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 & Berm Installation:** Livestock fencing will be constructed around the revegetated haul roads outside the open pit 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 includes the cost for hauling and placing additional fine-grained cover, from a local source (for FA purposes, it is assumed North Stockpile), on the waste stockpiles to enhance the seed bed in potential rocky areas. This includes 4-inches of additional cover thickness over 10% of reclaimed stockpiles. 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 5, 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 when moving fill to Deadman Canyon during scraper operations.

The area below the final pit lake elevation will not be reclaimed, except at the Deadman Diversion.

3.2 Haul Roads

Southern Haul Road and Little Rock Haul Road 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 reducing 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. 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.

Unit costs for powerlines and power poles are developed based on recent cost information (R.S. Means, 2021). The total footage of each is multiplied by the respective unit cost. Light poles and telephone wires/pole unit costs are assumed to be equivalent to unit costs to demolish powerlines and power poles.

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 5.

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

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

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

The P-Plant and Copper Leach Stockpile were reclaimed in 2010 and 2011, respectively. Additional reclamation activities will not disturb the established vegetation. Reclamation costs for the Copper Leach Stockpile and P-Plant are included for 2 years of vegetation maintenance (for FA purposes).

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, or other miscellaneous unforeseen changes in the mine plan. See Table 5, 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 5):

- 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 per facility (20 years total), 12 years of erosion control per facility (20 years total), 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 19 years for a total of 20 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.

Vegetation Maintenance: Vegetation maintenance of reclaimed areas assumes a 2% failure every year for a total of 12 years per facility, 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.

4.0 RESULTS

The total current dollar cost for earthwork reclamation is estimated to be $7,104,750 plus $1,036,136 O&M for a total of $8,139,885. A summary of the cost estimate is provided in Table 3. The costs presented in this RCE are 2021 dollar costs.

Table 6 Earthwork Cost Estimate Summary

Item	Direct Cost	Indirect Cost	Total Estimated Cost
Facility		**30% of Direct**	
West In-Pit Waste	$1,765,574	$529,672	$2,295,246
East In-Pit Waste	$10,741	$3,222	$13,964
North Stockpile	$6,916	$2,075	$8,991
NRW Waste	$1,445,134	$433,540	$1,878,674
Stockpile Subtotal	***$3,228,365***	***$968,509***	***$4,196,874***
Demolition	$152,418	$45,725	$198,143
Demolition Subtotal	***$152,418***	***$45,725***	***$198,143***
Unplanned Disturbance Area	$11,624	$3,487	$15,111
Other Disturbed Areas Subtotal	***$11,624***	***$3,487***	***$15,111***
Haul Roads	$24,639	$7,392	$32,031
Accessible Flat Areas	$13,721	$4,116	$17,837
Little Rock Open Pit	$201,806	$60,542	$262,348
Deadman Diversion	$1,685,863	$505,759	$2,191,622
Previously Reclaimed	$0	$0	$0
Seepage Collection Systems	$0	$0	$0
Monitoring & Exploration Wells	$106,750	$32,025	$138,776
Substation, Powerline Corridors, Pipeline Corridors	$40,004	$12,001	$52,006
Miscellaneous Subtotal	***$2,072,785***	***$621,836***	***$2,694,621***
Closure Costs Total	**$5,465,192**	**$1,639,558**	**$7,104,750**
O&M		**17.5% of Direct**	
Full Site O&M Costs Total	**$880,966**	**$154,169**	**$1,035,136**
Total Cost (Closure + O&M)	**$6,346,158**	**$1,793,727**	**$8,139,885**

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APPENDICES

Appendix A

Engineering Take-Offs/ Quantities

Stockpiles - Regrade

Stockpile	Volume (CY)	Average Push Distance (ft)
NRW - North Outslopes	481922	90.0
NRW - South Outslopes	47271	90.0
West In-Pit Outslopes	1681546	795.5
Deadman Diversion Outslope	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 and Spanning Arch Culvert Area	16900	Deadman Diversion	329	-20.04%	-	-	-	-
East In-Pit	48339	Deadman Diversion	325	15.12%	329	0.00%	110	15.81%

Cover Material

Stockpile	Volume (CY)	Haul to
North Stockpile	10272	NRW, West In-Pit, East In-Pit, Deadman, Allowance for Other Disturbed Areas

Stockpiles - Cover

				Haul Distance (ft)			Haul Slope (%)		
Stockpile	2D Area (sf)	Volume (CY)	Haul From	Segment 1	Segment 2	Segment 3	Segment 1	Segment 2	Segment 3
NRW	4750990	5865	North Stockpile	550	2000	475	-10.0%	0.0%	-10.0%
West In-Pit	2144516	2648	North Stockpile	750	3125	-	-10.0%	10.0%	-
East In-Pit	433640	535	North Stockpile	2250	3650	800	-10.0%	-1.7%	-10.0%
Deadman Diversion	555575	686	North Stockpile	2250	3650	400	-10.0%	-1.7%	-10.0%

Stockpiles - Top Areas

Stockpile	2D Area (sf)
NRW	1004450
West In-Pit	27358
East In-Pit	378251

Stockpiles - Stormwater Management

Stockpile	Bench Channels (ft)	Downdrains (ft)	Energy Dissipator (ea)
NRW	18523	2637	4
West In-Pit	10627	1487	1
Deadman Diversion	2232	798	0

Haul Road Revegetation Areas

Facility	2D Area (sf)
Northern Haul Road	387087
Northern Haul Road Fill Material	367421
Little Rock Haul Road	658774
Southern Haul Road	307255

Other Areas

Facility	2D Area (sf)
North Stockpile	350727
Accessible Flat Areas	596401
Little Rock Open Pit Fence/Berm Perimeter	1313000
Substation, Powerline Corridors, Pipeline Corridors	1771500
Allowance for Other Disturbed Areas	435600
P-Plant & Copper Leach Stockpile	1337002

Fencing/Berming

Facility	Temporary Fence (ft)	Berm (ft)	Chain Link Fence (ft)
NRW	8734	0	0
Little Rock Haul Road	3968	0	0
Accessible Flat Areas	1633	0	0
Open Pit	0	11494	6544

Appendix B

Key Equations and Calculations

Earthwork RCE Calculation Summary

TELESTO SOLUTIONS • INCORPORATED	Job No: 200540a	Client: Freeport NM Operations	Page 1 of 23
	Task: Earthwork RCE	Computed By: Taryn Tigges	Date: 4/30/19
		Checked By: Fred Charles	Date: 4/30/19

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes a spreadsheet developed by the New Mexico Mining and Minerals Division (MMD) to estimate the earthwork's closure costs associated with the Little Rock Mine Closure/Closeout Plan (CCP). The spreadsheet calculations are intricate and complex and require careful study to master their structure. Each worksheet groups similar activities, and each line on each worksheet documents one construction step required to complete reclamation. All lines totaled equal the entire earthworks for the CCP. The sheer amount of information in the spreadsheet makes review of the cost estimate difficult for a site as complex as the Little Rock Mine.

Objective:

1. Provide a guide to the earthwork spreadsheets.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine. The example screenshots shown are from the Tyrone Mine CCP.

Approach:

1. Identify worksheets within the spreadsheet.
2. Provide a general equation or explanation of the calculation performed in each worksheet.
3. Use a graphic of each worksheet to illustrate the equations and augment the explanations pertaining to the specific worksheet.

Results:

The following worksheets are included within the earthwork RCE spreadsheet and covered in this calculation documentation:

Databases:
1. Quantities
2. Activity-Material Codes
3. Unit Rates
4. Equipment

Earthwork Calculations:
1. General
2. Demo
3. Material
4. Earthwork
5. Dozer
6. Road Maint
7. Ripper
8. Excavator
9. Trucks
10. Loader Shovel
11. Scrapers
12. M'grader
13. Earth Sum
14. Revegetation
15. Other
16. Summary
17. Facility Characteristics

Results:

The following worksheets are included within the earthwork RCE spreadsheet and covered in separate calculation documentations or are self-explanatory:

Equipment Optimization:

1. Truck Optimization

O&M:

1. Full Site Vegetation Maintenance
2. Full Site O&M
3. Full Site O&M Summary

Building Demolition:

1. Building Demo
2. Building Cover
3. Building Vegetation
4. Building Waste
5. Building Summary

Unit Costs:

1. Bench Grading
2. Bench Channel (and Riprap/Gravel)
3. Downdrain
4. Pipeline (6”-8” and 20”-36”)
5. Revegetation
6. Seepage Collection
7. Trestle Demo
8. Berm
9. Substation Demo

Results Cont'd

Sheet 1 – General: A summary of the overall costs (before escalation and discounting for the time-value of money) are included on this sheet along with the applicant's information.

	A	B	C
1			Tyrone Mine
2			Stockpile Spreadsheet Worksheet #1
3	***General Information***		4/29/2019
4			
5	Applicant	Tyrone Mine Company	
6		Tyrone, New Mexico 88065	
7			
8			
9			
10			
11	Disturbed Surface Area (acres)	3,031	
12	*(does not include previously reclaimed areas)*		
13			
14	Type of Operation	Existing/Surface/Copper	
15			
16			
17			
18	*Current value of earthwork and O&M before escalation and discounting*	**$101,470,627**	
19			
20			
21			
22			
23			**Stockpiles, Tailing,**
24			**Reservoirs, Haul Roads**
25			**and Disturbed Areas**

Quantities Sheet: This sheet assigns an item code to a facility and corresponding sub-area code with a description of the facility and sub-area. This sheet provides raw data and factors (such as area, volume, distances, grades, etc.) to be used in calculations within all the other worksheets. Each facility is broken down into sub-areas to account for differing reclamation quantities to more accurately determine the amount of work required for each facility. The Quantities sheet includes 36 columns of hard-wired (hand entered) data associated with each facility. Columns A through H for 1A and 1B Leach, 1C, 2A Leach and 2B Waste, and 3A/3B Stockpiles are shown as an example:

	A	B	C	D	E	F	G	H
1								
2	1	2	3	4	5	6	7	8
3	**Item**	**Facility**	**Sub Area or Destination for Cover Material**	**Description**	**Area (sf)**	**Volume (cy)**	**Push Distance (ft) Berm Length (ft) or Fence Length(ft)**	**Coarse Regrading and Fine Grading (%)**
4	1000	1A and 1B Leach	1A1B-0	Entire Stockpile	11,891,880	1,548,670	-	-
5	1001	1A and 1B Leach	1A1B-1	Top	740,520	79,000	430	1.0%
6	1002	1A and 1B Leach	1A1B-2	Outslopes - Regrade benches from pullback	-	1,329,670	90	-29.0%
7	1003	1A and 1B Leach	1A1B-3	Outslopes - Area outside of pullback	11,151,360	140,000	250	-29.0%
8	1100	1C	1C-0	Top (Haul Road)	740,700	-	-	
9	1200	2A Leach and 2B Waste	2A2B-0	Entire Stockpile	21,213,358	8,203,000	-	-
10	1201	2A Leach and 2B Waste	2A2B-1	Top	1,568,160	143,000	370	1.0%
11	1202	2A Leach and 2B Waste	2A2B-2	Outslopes	19,645,198	8,060,000	470	-29.0%
12	1300	3A / 3B	3A3B-0	Entire Stockpile	19,819,800	5,289,064	-	-
13	1301	3A / 3B	3A3B-1	Top	1,437,480	199,000	560	1.0%
14	1302	3A / 3B	3A3B-2	Outslopes Pullback	-	17,500,000	-	-29.0%
15	1303	3A / 3B	3A3B-3	Outslopes - Regrade benches from pullback	-	1,590,064	90	-29.0%
16	1304	3A / 3B	3A3B-4	Outslopes (total area, volume outside of pullback)	18,382,320	3,500,000	560	-29.0%

For example use only. Values may not match the current spreadsheet.

Results Cont'd

Activity-Material Codes Sheet: This sheet assigns an activity code (column A) to each activity (column B)

	A	B	C
1	**Item**	**Activity**	**Description**
2	-	-	Place holder for item
3	A	Grade	Rough grading original material or fine grading cover material
4	B	Dozer Assist	Dozer is used to assist loader or shovel at cover stockpile or assist scrapers during rough grading
5	C	Load	Cover material is loaded at borrow areas onto haul trucks
6	D	Haul	Haul trucks transport cover material from borrow areas to destination stockpiles
7	E	Rip	Tops of stockpiles are ripped before placing cover to compensate for compaction of soil during rough grading. Stockpiles are also ripped before rough grading with a scraper. Borrow stockpile ripped
8	F	Grade Benches	Benches are graded at stockpiles and tailings after fine grading
9	G	Construct Downdrains	Downdrains are constructed after fine grading and consist of articulated concrete blocks (ACB's)
10	Gb	Construct Downdrain Dissipators	Energy dissipators are specified as part of the downdrains
11	H	Construct Bench Channels w/ Riprap	Bench channels are constructed along benches after bench grading. Construction includes excavation and wasting, riprap production, riprap and filter placement, and final grading.
12	Hb	Construct Bench Channels w/o Riprap	Bench channels are constructed along benches after bench grading. Construction includes excavation and wasting and final grading.
13	I	Construct Top/Outslope Channels	Top and outslope channels are not part of this RCE
14	J	Revegetate	Occurs after final grading and channel construction and includes tractor rental and maintenance, fuel, scarifying, discing, drill seeding, mulching, crimping, seed, and mulch
15	K	Perforate Liner	Reservoir liners are perforated prior to reclamation
16	L	Replace Infrastructure	Replacing infrastructure is not part of this RCE
17	M	Post-Closure O&M	Includes vegetation maintenance for 12 years after reclamation and erosion control, road maintenance, and groundwater monitoring for 100 years after reclamation
18	N	Plug and Abandon Well	Well borehole is backfilled with cement grout
19	O	Replace Well	Includes borehole drilling, casing, and cementing
20	P	Road Maintenance	Dust suppression and road maintenance with water truck and motor grader
21	Q	Construct Haul Road	For shorter hauls etc.
22	R	Construct Berms	Berming for stormwater runoff control
23	S	Fencing	Fencing for pits
24	T	Build Grade Control Walls	Grade control in each drainage of Tailing Launder Line removal
25	U	Vehicle Gates	Limited access at 1-mile intervals around open pits
26	V	Signs Every 500 ft	Warning signs posted every 500 feet around open pits

The same is done by assigning a material code (column A) to differentiate the materials used in the spreadsheet.

	A	B	C
28			
29	**Item**	**Material**	**Description**
30	-	-	Placeholder
31	a	Existing Ground	Existing ground before rough grading
32	b	Cover	Cover material from cover stockpiles, before being placed at destination location
33	c	Rough Graded Material	Exisiting ground after rough grading
34	d	Placed Cover	Cover material after being placed at destination location
35	e	Final Grade	Facility material and cover material after rough grading and fine grading
36	f	Backfill/Stockpile Material	Material used to backfill pit/ponds or stockpile material used in pullback
37			

These codes are used to assign an ID to each task, on the Materials sheet. The codes dictate which earthwork calculation is used for each row of work.

For example use only. Values may not match the current spreadsheet.

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Job No: 200540a | Client: Freeport NM Operations |

Task: Earthwork RCE | Computed By: Taryn Tigges | Date: 4/30/19

Checked By: Fred Charles | Date: 4/30/19

Results Cont'd

Unit Rates Sheet: This sheet applies the same concept as the Quantities and Activity-Material Codes sheets whereby unit rates for particular activities utilized in the development of costs within the spreadsheet are identified and assigned a unit rate code. The unit rates are used throughout the RCE spreadsheet and are referenced from this sheet.

	A	B	C	D	E	F	G
10	Code	Activity	Base Per Unit Cost	Fuel Per Unit Cost	Units	Source	Reference
11	U1	Fuel	$ 2.34	$ -	gal	-	Diesel fuel cost is estimated by correlating historical local quotes with public data, as agreed upon in November 2018 discussions with the agencies. Fuel cost
12	U2	Revegetation	$ 820.12	$ 3.85	ac	Revegetation Unit Cost Sheet	See unit rates calculations - Cost is based on a calculated unit rate that includes tractor rental and maintenance, fuel, scarifying, discing, drill seeding, mulching,
13	U3	Bench Grading Stockpile	$ 1.35	$ 0.33	ft	Bench Grading Unit Cost Sheet	See unit rates calculations
14	U4	Bench Grading Tailings Pond	$ 1.35	$ 0.33	ft	Bench Grading Unit Cost Sheet	See unit rates calculations
15	U5	Downdrain Construction	$ 374.38	$ -	ft	Downdrain Unit Cost Sheet	See unit rates calculations
16	U6	Downdrain Dissipater	$ 14,556.48	$ -	ea	Downdrain Unit Cost Sheet	See unit rates calculations
17	U7a	Bench Channel Construction w/	$ 6.60	$ 1.39	ft	N/A	See unit rates calculations
18	U7b	Bench Channel Construction w/o	$ 0.41	$ 0.10	ft	N/A	See unit rates calculations
19	U8	Erosion Control	$ 2,923.36	$ 382.26	day	Modified Crew B-13A	Erosion control for O&M - includes 1 foreman, 2 laborers, 1 equipment operator, 2 truck drivers, 1 loader (4 cy), 2 dump trucks (8 cy)
20	U9	Structure Demolition	$ 0.25	$ -	cf	Means Line Item 024116.13 0100	Building demolition, large urban projects, mixture of types, excludes foundation demolition, dump fees
21	U10	Concrete Slab Demolition	$ 0.62	$ -	sf	Means Line Item 024116.17 0400	Building footings and foundations demolition, floors, concrete slab on grade, plain concrete, 6" thick, excludes disposal costs and dump fees
22	U11	Storage Tank Demolition	$ 1,005.97	$ -	ea	Means Line Item 130505.75 0530	Selective Demolition - Storage Tanks, steel tank, single wall, above ground, not including foundations, pumps or piping, 5,000 thru 10,000 gallon
23	U12	Storage Tank Demolition	$ 2,168.93	$ -	ea	Means Line Item 130505.75-0540	Steel tank, single wall, above ground, 15,000 thru 30,000 gallon, selective demolition, excluding foundation, pumps or piping
24	U13	Storage Tank Demolition	$ 3,934.80	$ -	ea	Scaled Means Items	Storage Tanks, steel tank, single wall, above ground, not incl fdn, pumps or piping; scaled for a 45,500 gal tank
25	U14	Power Line Demolition	$ 0.63	$ -	ft	Means Line Item 260505.10 0370	in cost to overhead powerlines.
26	U15	Power Pole Demolition	$ 216.24	$ -	ea	Means Line Item 024113.80 0200	Selective Demolition - wood utility poles 35-45 ft high
27	U16	Pipeline (small HDPE pipe)	$ 2.29	$ -	ft	Means Line Item 024113.38 1700	excludes excavation
28	U17	Pipeline (medium HDPE pipe)	$ 3.82	$ -	ft	Means Line Item 024113.38 1800	excludes excavation
29	U18	Pipeline (large HDPE pipe)	$ 5.72	$ -	ft	Means Line Item 024113.38 1900	excludes excavation
30	U19	Well Plug & Abandon	$ 10.55	$ -	ft	N/A	Layne Christensen Company, 7/31/18 Tyrone estimate is $10,000 mobilization and demobilization plus $5,704.94 (escalated at 2% to $5819.04) for one 1500 ft well
31	U20	Well Replacement	$ 67.76	$ -	ft	N/A	Wilcox Professional Services, 8/2011, est. cost for 5 ¼ in bore, $173,500 for 3000 ft total ($57.83/ft). Escalated 2% 2011-2019= $67.76/ft
32	U21	Reinforced Concrete Wall Demolition	$ 199.20	$ -	hr	Means Crew B-12C	Standard Union Crew: 1 equipment operator (crane), 1 laborer, 1 hydraulic excavator, 2 cy, approximately 40 hrs to demo 200 ft reinforced concrete dam.
33	U22	Disc harrow attachment, for tractor	$ 616.33	$ -	month	Means Line Item 015433.20 1500	Equipment rental costs
34	U23	Cast-In-Place Concrete	$ 254.97	$ -	cy	Means Line Item 033053.40 6200	reinforcement
35	U24	Cleanup & Disposal of Wastes Requiring Special Handling	$ 335.20	$ -	ton	Means Line Item 028120.10 1120/1130	Solid pickup; average of minimum and maximum
36	U25	Tranportation of Wastes Requiring Special Handling	$ 4.78	$ -	mile	Means Line Item 028120.10 1260/1270	Transporation to disposal site (Truckload = 80 drums or 25 cy or 18 tons); average of minimum and maximum
37	U26	Road Maintenance	$ 4,945.96	$ 1,240.32	month		water truck
38	U27	Tailing Cover Maintenance	$ 2,144.29	$ 269.57	day	Modified Crew B-13A	1 dump truck (12 ton)
39	U28	Berming	$ 0.06	$ -	ft		per ft. to 0.13 cy/ft; Finish grade volume is 1/3 X 'Excavation Volume' or 0.04 ft/lf; The berm will be made from cover material; only applicable to the types of berms at the reclaimed borrow areas - These berms are only used to move water along an
40	U29	Fencing	$ 23.05	$ -	ft	Means Line Item 323113.20 0800	
41	U30	Vehicle Gates, Pit Perimeters	$ 1,002.88	$ -	ea	Means Line Item 323113.20 5070	Fence, chain link industrial, double swing gates, 6' high, 20' opening, includes excavation, posts & hardware in concrete
42	U31	Signs every 500 ft., pit perimeters	$ 65.19	$ -	ea	Means Line Item 101453.20 0600	Signs, guide and directional signs, reflectorized, 12" x 18", excludes posts
43	U32	Fire Hydrant Demolition	$ 396.73	$ -	ea	Means Line Item 024113.33 0900	Utility removal, hydrants, fire, remove only, excludes hauling
44	U33	Seepage Collection Replacement	$ 133,355.94	$ -	ea	Seepage Collection Unit Cost Sheet	See unit rates calculations
45	U34	Culvert Removal	$ 12.69	$ -	ft	Means Line Item 024113.40 0190	excludes excavation
46	U35	Grade Control Wall	$ 165.59	$ -	cy	Means Line Item 033053.40 3945	deep, unreinforced, includes forms(4 uses), concrete (Portland cement Type I), placing and finishing, excludes reinforcing
47	U36	Steel Trestle Demolition	$ 30,689.10	$ -	ea	Means Line Item 024116.33 0200	Bridge demolition, pedestrian, steel, 50' to 160' long, 8' to 10' wide
48	U37	Sludge Removal	$ 306.69	-	ea	Means Line Item 026510.30 0320	remove sludge, water and remaining product from tank bottom of tank with vacuum truck, 9,000 - 12,000 gallon tank
49	U38	Substation Demo	$ 12,470.55	$ -	ea	Substation Demo Unit Cost	See unit rates calculations

Unit rates are either derived from separate calculations, RSMeans pages, or direct quotes. The unit costs are broken into base per unit cost (column C) and fuel per unit cost (column D) when applicable. If a unit cost is obtained from RSMeans, the Las Cruces, New Mexico, area cost is utilized.

For example use only. Values may not match the current spreadsheet.

Results Cont'd

Equipment Sheet: This sheet assigns a code to the various types of heavy equipment (bulldozers, wheeled loaders, excavators, etc.) used for mine closure activities. It also delineates a multitude of equipment costs and factors as well as labor costs based on the 2019 New Mexico Department of Labor hourly labor rates associated with each piece of equipment.

Equipment Code

Rental & Operating Equipment Costs

See Dozer sheet (Sheet 5) for development of the Productivity Equation

$$Productivity_{normal} = C * (Distance_{Pus}{}^{b})$$

C = Multiplier Constant and b = Exponent Constant

EARTHWORK AND O&M EQUIPMENT

Code	Equipment Description	Equipment Type	Fuel Consumption (gal/hr)	Fuel Cost ($/hr)	Lube Cost ($/hr)	Field Parts ($/hr)	Tire Cost ($/hr)	Ground Engaging Component Cost ($/hr)	Monthly Rental Rate ($/month)	Field Labor Time Cost ($/hr)	Rental Cost (w/o fuel, lube, tires, or field parts) ($/hr)[6]	Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) ($/hr)	Dozing Production (lcy/hr)[1] Production = C(Avg. dozing distance in ft)^b: C	b
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Comb1	Cat 14M, Off-Hwy Water Tanker Truck,6,000-gal.	Combo 1	19.54	$ 45.72	$ 12.72	$ 3.75	$ 13.46	$ 1.16	$ 20,078.37	$ 9.23	$ 114.08	$ 154.40	-	-
Dz1	Cat D11T, U Blade	Dozer	29.75	$ 69.62	$ 26.23	$ 13.89	$ -	$ 12.22	$ 34,408.41	$ 6.60	$ 195.50	$ 254.44	155,881.59	-0.889952
Dz2	Cat D11T CD, U Blade	Dozer[7]	29.75	$ 69.62	$ 26.23	$ 13.89	$ -	$ 12.22	$ 34,408.41	$ 6.60	$ 195.50	$ 254.44	162,758.76	-0.866691
Dz3	Cat D9T, SU Blade	Dozer	14.35	$ 33.58	$ 11.22	$ 5.49	$ -	$ 3.98	$ 30,109.48	$ 6.60	$ 171.08	$ 198.37	52,161.03	-0.845532
Dz4	Cat D6T, SU Blade	Dozer	7.22	$ 16.89	$ 4.83	$ 2.10	$ -	$ 2.10	$ 8,939.42	$ 3.83	$ 50.79	$ 63.65	13,582.45	-0.74851
Dz5	Cat D6T XL, SU Blade	Dozer	7.80	$ 18.25	$ 5.28	$ 2.32	$ -	$ 2.36	$ 9,104.55	$ 3.83	$ 51.73	$ 65.52	13,582.45	-0.74851
Ex1	Cat 319D L	Excavator	5.25	$ 12.29	$ 3.47	$ 1.19	$ -	$ 0.84	$ 7,450.15	$ 4.55	$ 42.33	$ 52.38	-	-
Ld1	Cat 992K	Loader	25.63	$ 59.97	$ 22.35	$ 4.43	$ 35.39	$ 4.99	$ 25,527.98	$ 4.02	$ 145.05	$ 216.23	-	-
Ld2	Cat 988H	Loader	15.20	$ 35.57	$ 11.40	$ 2.11	$ 16.85	$ 1.93	$ 16,272.06	$ 4.02	$ 92.45	$ 128.76	-	-
Ld3	Cat 980H	Loader	10.80	$ 25.27	$ 6.70	$ 1.13	$ 7.69	$ 1.03	$ 10,030.76	$ 4.02	$ 56.99	$ 77.56	-	-
Ld4	Cat 966H	Loader	8.38	$ 19.61	$ 5.33	$ 0.84	$ 5.71	$ 0.75	$ 9,937.50	$ 4.02	$ 56.46	$ 73.11	-	-
Ld5	Cat 993K	Loader	30.40	$ 71.14	$ 26.70	$ 5.32	$ 42.47	$ 4.73	$ 25,527.98	$ 4.02	$ 145.05	$ 228.29	-	-
Mg1	Cat 16M	Motor Grader	9.50	$ 22.23	$ 8.69	$ 3.26	$ 10.13	$ 1.76	$ 11,906.70	$ 2.02	$ 67.65	$ 93.51	-	-
Mg2	Cat 14M	Motor Grader	8.29	$ 19.40	$ 6.57	$ 2.27	$ 7.04	$ 1.16	$ 11,906.70	$ 2.02	$ 67.65	$ 86.71	-	-
Rp1	Cat D11T CD Multi-shank (w/ MSR-359H)	Ripper	29.75	$ 69.62	$ 26.60	$ 14.20	$ -	$ 1.56	$ 36,753.56	$ 8.16	$ 208.83	$ 259.35	-	-
Sc1	Cat 637G	Scraper	38.00	$ 88.92	$ 17.07	$ 6.27	$ 7.57	$ 1.28	$ 25,070.00	$ 12.80	$ 142.44	$ 187.43	-	-
Sc2	Cat 657G	Scraper	42.86	$ 100.29	$ 20.41	$ 7.73	$ 9.34	$ 2.31	$ 25,070.00	$ 12.80	$ 142.44	$ 195.03	-	-
Sh1	Hitachi EX3600-5	Shovel[2]	82.72	$ 193.56	$ 59.15	$ 24.25	$ -	$ 16.56	$ 69,269.00	$ 14.45	$ 393.57	$ 507.98	-	-
Tc1	Deere 7430	Tractor	5.98	$ 13.99	$ 2.84	$ 0.61	$ 2.42	$ -	$ 5,210.05	$ 2.53	$ 29.60	$ 38.00	-	-
Tk1	Komatsu HD-1500 5	Truck[3]	28.12	$ 65.80	$ 19.90	$ 1.79	$ 25.19	$ -	$ 25,211.93	$ 7.47	$ 143.25	$ 197.60	-	-
Tk2	Cat 769D	Truck	9.74	$ 22.79	$ 8.77	$ 1.48	$ 13.72	$ -	$ 14,042.50	$ 4.25	$ 79.79	$ 108.01	-	-
Tk3	Cat 725	Truck	6.02	$ 14.09	$ 5.74	$ 0.94	$ 7.11	$ -	$ 9,849.60	$ 3.36	$ 55.96	$ 73.11	-	-
Tk4	Komatsu 730E	Truck[4]	33.48	$ 78.34	$ 20.49	$ 1.80	$ 21.21	$ -	$ 29,356.98	$ 11.49	$ 166.80	$ 221.79	-	-
Tk5	Cat 777F	Truck	18.76	$ 43.90	$ 19.31	$ 3.03	$ 26.81	$ -	$ 56,160.00	$ 6.38	$ 319.09	$ 374.62	-	-
Tw1	Off-Hwy Water Tanker Truck,6,000-gal.	WaterTruck	11.25	$ 26.33	$ 6.15	$ 1.48	$ 6.42	$ -	$ 8,171.67	$ 7.21	$ 46.43	$ 67.69	-	-
Tw2	Off-Hwy Water Tanker Truck,10,000-gal.	WaterTruck	15.43	$ 36.11	$ 9.04	$ 2.43	$ 10.47	$ -	$ 12,949.87	$ 10.30	$ 73.58	$ 105.82	-	-
X1	2 Deck Screening Plant (5X16, 48X60)	ScreenPlant	4.85	$ 11.35	$ 2.39	$ 1.15	$ 0.40	$ -	$ 5,738.88	$ 4.46	$ 32.61	$ 41.01	-	-
X2	3 Deck Screening Plant (5X16, 48X60)	ScreenPlant	4.85	$ 11.35	$ 2.43	$ 1.24	$ 0.39	$ -	$ 5,994.24	$ 4.62	$ 34.06	$ 42.74	-	-
X3	1 Deck Screening Plant (5X16, 48X60)	ScreenPlant	4.85	$ 11.35	$ 2.37	$ 1.14	$ 0.39	$ -	$ 5,671.66	$ 4.46	$ 32.23	$ 40.59	-	-
X4	3 Deck Screening Plant (5X16, 42X60)	ScreenPlant	4.85	$ 11.35	$ 2.38	$ 1.16	$ 0.37	$ -	$ 5,743.36	$ 4.62	$ 32.63	$ 41.16	-	-

The equipment sheet also contains the production equation coefficients for dozing (columns N-O) and scraper haul travel time coefficients (columns P-AI)

Haul Travel Time (min/m)=*A(Eff. Grade %)*^{4} *+ B(Eff. Grade %)*^{3} *+ C(Eff. Grade %)*^{2} *+ D(Eff. Grade %) + E*

where effective grade is the sum of the measured grade and rolling resistance

See Trucks sheet (Sheet 9) for development of the Haul Travel Time Equation

EARTHWORK AND O&M EQUIPMENT

Haul Travel Time (min/m) = A(Eff. Grade %)^4 + B(Eff. Grade %)^3 + C(Eff. Grade %)^2 + D(Eff. Grade %) + E

			Loaded Uphill					Empty Uphill					Loaded Downhill					Empty Downhill				
Code	Equipment Description	Equipment Type	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E	A	B	C	D	E
1	2	3	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
Comb1	Cat 14M, Off-Hwy Water Tanker Truck,6,000-gal.	Combo 1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dz1	Cat D11T, U Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dz2	Cat D11T CD, U Blade	Dozer[7]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dz3	Cat D9T, SU Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dz4	Cat D6T, SU Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dz5	Cat D6T XL, SU Blade	Dozer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ex1	Cat 319D L	Excavator	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ld1	Cat 992K	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ld2	Cat 988H	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ld3	Cat 980H	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ld4	Cat 966H	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ld5	Cat 993K	Loader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mg1	Cat 16M	Motor Grader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mg2	Cat 14M	Motor Grader	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rp1	Cat D11T CD Multi-shank (w/ MSR-359H)	Ripper	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sc1	Cat 637G	Scraper	3.2483	-1.9562	0.4337	-0.0026	0.001	0	-0.3247	0.1601	-0.0038	0.0011	0.6464	-0.6147	0.1749	-0.0004	0.0011	0	0	0.0367	0.0018	0.0009
Sc2	Cat 657G	Scraper	0.3036	-0.4512	0.2181	-0.0034	0.0013	0	-0.1016	0.0774	-0.0013	0.0012	0	-0.1612	0.1031	-0.0081	0.0016	0	0.1668	-0.094	0.0207	0.0004
Sh1	Hitachi EX3600-5	Shovel[2]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tc1	Deere 7430	Tractor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tk1	Komatsu HD-1500 5	Truck[3]	4.494	-2.4571	0.6319	-0.0051	0.0011	0	-0.2561	0.1351	-0.0004	0.001	0	0	0.0856	0.0135	0.0009	0	0	0	0.0143	0.0005
Tk2	Cat 769D	Truck	0.5429	-0.487	0.1823	0.0151	0.0007	0	0.0224	-0.0076	0.0141	0.0007	0	0	-0.0808	0.426	-0.0008	5.6146	-3.6353	0.7823	-0.0535	0.002
Tk3	Cat 725	Truck	0.1363	0.1636	-0.04	0.0342	0.0009	0	-0.024	0.0309	0.0099	0.001	0	2.5262	-0.7562	0.095	-0.002	0	0	0	0.0103	0.0009
Tk4	Komatsu 730E	Truck[4]	7.5599	-2.711	0.4209	0.005	0.0011	0	-0.0689	0.0501	0.0052	0.001	-	-1.1878	0.325	0.0042	0.001	-3.4907	2.4171	-0.55	0.0643	-0.0011
Tk5	Cat 777F	Truck	6.43	-3.2933	0.6548	-0.005	0.0009	0	-0.0197	0.0276	0.011	0.0008	2.147	-1.9812	0.5102	-0.0158	0.0009	0.7651	-0.3831	0.0898	-0.001	0.0008
Tw1	Off-Hwy Water Tanker Truck,6,000-gal.	WaterTruck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tw2	Off-Hwy Water Tanker Truck,10,000-gal.	WaterTruck	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X1	2 Deck Screening Plant (5X16, 48X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X2	3 Deck Screening Plant (5X16, 48X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X3	1 Deck Screening Plant (5X16, 48X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
X4	3 Deck Screening Plant (5X16, 42X60)	ScreenPlant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

For example use only. Values may not match the current spreadsheet.

Results Cont'd

Equipment Sheet cont'd:

Other equipment specifications listed in the equipment sheet can also be found in the RCE report. It is important to note that each piece of equipment is assigned an operator group by which labor rates are assigned according to the most up to date labor rates from NMDOL.

50	**EARTHWORK AND O&M LABOR**	
51	NMDOL Type A	Rate
52	Operator Group	($/hr)
53	Equipment Operator IV	$ 27.41
54	Equipment Operator V	$ 27.52
55	Equipment Operator VI	$ 27.70
56	Laborer I	$ 23.09
57	Laborer II	$ 23.84
58	Truck Driver III	$ 24.27

Sheet 2 – Demolition: Costs are based on square footage (ex: buildings), linear footage (ex: pipeline or power line length), or lump sum per item (ex: power pole, well casing). The costs are derived from the 2019 R.S. Means Online Heavy Construction cost data or actual on-site experience and bids.

Example calculation: (10,300 feet of powerline) x ($0.63 per linear foot)=$6,489

	A	B	C	D	E	F	G	H	I
1									Tyrone Mine
2									Stockpile Spreadsheet Worksheet #2
3	***Demolition***								4/29/2019
4									
5	Building Demolition costs are calculated in "1 BuildingDemo", "2 BuildingCover", "3 BuildingVeg", and "4BuildingWaste" and summarized on the last line of this table.								
6									
7									
8									
9									
10	**Item**	**Activity**	**Quantity**	**Unit**	**Unit Cost ($/unit)**	**Direct Item Cost ($)**	**Reference**	**Means Line Item**	**Description**
11	Power line Demolition (3 PLS to 1x1 Pond installed 2012)	-	10,300	ft	$0.63	$6,489	Means	Means Line Item 260505.10 0370	Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead power lines.
12	Power pole Demolition (3 PLS to 1x1 Pond installed 2012)	-	36	ea	$216.24	$7,785	Means	Means Line Item 024113.80 0200	wood utility poles 35-45 feet high
13	Power line Demolition (San Salvador Pit)	-	5,222	ft	$0.63	$3,290	Means	Means Line Item 260505.10 0370	Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead power lines.
14	Power pole Demolition (San Salvador Pit)	-	17	ea	$216.24	$3,676	Means	Means Line Item 024113.80 0200	wood utility poles 35-45 feet high
15	Power lines to substations or spurs for buildings to be demolished	-	66,200	ft	$0.63	$41,706	Means	Means Line Item 260505.10 0370	Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead power lines.
16	Power Poles to substations or spurs for buildings to be demolished	-	135	ea	$216.24	$29,192	Means	Means Line Item 024113.80 0200	wood utility poles 35-45 feet high
17	Telephone Lines around buildings to be demolished	-	1,400	ft	$0.63	$882	Means	Means Line Item 260505.10 0370	Nonmetallic sheathed cable 3 wire; assume similar enough in cost to overhead power lines.
18	Light Poles around to be demolished buildings	-	13	ea	$216.24	$2,811	Means	Means Line Item 024113.80 0200	wood utility poles 35-45 feet high
19	Fire Hydrants Mainly by SXEW	-	14	ea	$396.73	$5,554	Means	Means Line Item 024113.33 0900	Minor Site Demolition; remove fire hydrants
20	Little Rock Dewatering Pipeline Alignment #1 and #2 (Year 34 of Closure)	6"-8" Diameter Plastic	4,940	ft	$1.88	$9,266	-	-	See Pipeline UC
21	Water Treatment Pipelines (Year 99 of Closure)	assume 20-36-inch diameter	74,500	ft	$4.57	$340,282	-	-	See Pipeline UC
22	Sewer Pipelines (Year 6 of Closure)	assume 20-36-inch diameter	1,414	ft	$4.57	$6,459	-	-	See Pipeline UC
23	PLS Pipelines (Year 6 of Closure)	assume 20-36-inch diameter	18,893	ft	$4.57	$86,295	-	-	See Pipeline UC
24	2A East PLS Tank and 2A West PLS Tank (Year 6 of Closure)	Tank Demolition	2	ea	$3,934.80	$7,870	Means	Scaled Means Items	Storage Tanks, steel tank, single wall, above ground, not incl fdn, pumps or piping, 15,000 thru 30,000; scaled for a 45,500 gal tank - assuming 22 ft diameter and 16 ft high
25	1A and 1B PLS Tanks (Year 99 of Closure)	Tank Demolition	2	ea	$3,934.80	$7,870	Means	Scaled Means Items	Storage Tanks, steel tank, single wall, above ground, not incl fdn, pumps or piping, 15,000 thru 30,000 gal; scaled for a 45,500 gal tank - assuming 22 ft diameter and 16 ft high
26	Culverts at Tailing Launder Line	Culvert Removal	22	ea	$12.69	$279	Means	Means Line Item 024113.40 0190	Selective demolition, metal drainage piping, CMP, steel, 48"-60", diameter, excludes
27	Steel Trestle at Tailing Launder Line	Steel Trestle Demo	1	ea	$30,689.10	$30,689	-	-	Bridge demolition, pedestrian, steel, 50' to 160' long, 8' to 10' wide
28	Substation Removal at Mangus Pumphouse	Substation Demo	1	ea	$12,470.55	$0	-	-	See Substation Demo UC
29	Buildings and Associated Facilities	Demolition	See Demo Sheets	-	-	$4,499,228	-	-	-
30									
31					**Total Direct Cost:**	$5,089,622			

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 3 – Material: No calculations are included on this sheet. Four codes, which can be referenced from the Quantities, Activity-Material Codes, and Equipment or Unit Rates sheets, are entered by hand for each row in Columns A – D. The column labeled ID concatenates the codes. The ID contains the codes for facility location (with sub-area if applicable), work activity, material and equipment used for that particular row of work. This combination determines which equipment production and cost equations are used in the rest of the spreadsheet. The other columns on this sheet then reference the ID to lookup the description from the Activity Material Codes sheet, the source and destination locations from the Quantities sheet, the total haul or push distance and grade from the Quantities sheet, and the equipment (when applicable) from the Equipment sheet.

All activities for the Tyrone RCE are listed on this sheet and carried through the succeeding worksheets of the RCE. The description (F123) lists the activity, top or outslope (if applicable), and the material. The source location (G123) lists the stockpile name (or sub-area) for the location of the activity. If borrow material is involved, it is transported from a borrow stockpile to a destination stockpile (H123). Push or haul distance (I123) is used as part of calculating equipment production on Sheets 5, 9, and 11. Grade (J123 – haul grade or facility slope) is used as part of calculating equipment production on Sheets 5, 9, 11, and 12. Equipment (K123) lists the name of the equipment referenced in the ID. Blank cells indicate that that column is not relevant to a particular activity.

The ID for the example below is 1300-D-b-Tk4. This indicates that a Komatsu 730E truck (Tk4) will be used to haul (D) cover material (b) from the Gila Borrow Area to the 3A/3B (1300). The total haul distance from STS2 to the Raffinate Pond is 11,221 feet, with an average haul grade of 1.3%.

2300-Facility and 23-Sub-area

D-Activity and b-Material

Tk4-Equipment to be used

Tyrone Mine
Stockpile Spreadsheet Worksheet #3
4/29/2019

Material Handling Plan Summary Sheet

All activities for the Tyrone RCE are listed on this sheet and carried through the succeeding worksheets of the RCE. The column labeled ID contains the codes for the facility location, activity, material and equipment used for that particular row of work. The description lists the activity, top or outslope (if applicable), and the material. The source location lists the stockpile name (or sub-area) for the location of the activity. If borrow material is involved, it is transported from a borrow stockpile to a destination stockpile. Blank cells indicate that that column is not relevant to a particular activity.

Notes and Assumptions:

1 - Haul/Push Distance based on 2015 Tyrone RCE Submittal or measured/assumed as shown in documentation
2 - Weighted Average Haul Grades based on 2015 Tyrone RCE Submittal
3 - Grade Factors from 2015 Tyrone RCE Submittal
4 - Cover haul distance for 2A/3B stsockpile is volume weighted average of Gila Borrow Area (1/3) & 9AX Stockpile (2/3)

Row	Item	Activity	Material	Eq	ID	Description	Source Location 1	Destination Location 2	Total Haul/Push Distance (ft)[1]	Grade (%)[2,3]	Equipment
123	1300	D	b	Tk4	1300-D-b-Tk4	Haul-Cover	Gila Borrow Area	3A / 3B	11,221	1.3%	Komatsu 730E
124	1500	D	b	Tk4	1500-D-b-Tk4	Haul-Cover	Gila Borrow Area	5A Overburden	4,750	1.9%	Komatsu 730E
125	2200	D	b	Tk4	2200-D-b-Tk4	Haul-Cover	Leach Stockpile	San Salvador Pit	12,570	1.8%	Komatsu 730E
126	2300	D	b	Tk4	2300-D-b-Tk4	Haul-Cover	Gila Borrow Area	Savanna In-Pit Leach Stockpile	5,730	1.6%	Komatsu 730E
127	1400	D	b	Tk4	1400-D-b-Tk4	Haul-Cover	Gila Borrow Area	4C Leach	17,830	5.0%	Komatsu 730E
128	1800	D	b	Tk4	1800-D-b-Tk4	Haul-Cover	Gila Borrow Area	2C, 4A, 4B, 7B Leach	13,990	3.9%	Komatsu 730E
129	1900	D	b	Tk4	1900-D-b-Tk4	Haul-Cover	Gila Borrow Area	8C	5,730	1.6%	Komatsu 730E
130	1600	D	b	Tk4	1600-D-b-Tk4	Haul-Cover	Gila Borrow Area	6B	10,050	2.0%	Komatsu 730E
131	1700	D	b	Tk4	1700-D-b-Tk4	Haul-Cover	Gila Borrow Area	6C	11,833	2.5%	Komatsu 730E
132	2701	D	b	Tk4	2701-D-b-Tk4	Haul-Cover	Gila Borrow Area	Cntmnt-1	10,811	2.9%	Komatsu 730E
133	3300	D	b	Tk4	3300-D-b-Tk4	Haul-Cover	Gila Borrow Area	Unplanned Disturbance Area	10,811	2.9%	Komatsu 730E
134	2100	D	b	Tk4	2100-D-b-Tk4	Haul-Cover	9AX Stockpile Toe	9AX	6,343	7.7%	Komatsu 730E
135	2600	D	b	Tk2	2600-D-b-Tk2	Haul-Cover	9AX Stockpile	Tailing Launder Line	17,721	-1.8%	Cat 769D
136	2900	D	b	Tk2	2900-D-b-Tk2	Haul-Cover	Tailing Launder Line	Mangus Pumphouse	14,100	-1.8%	Cat 769D

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 4 – Earthwork: Repeats the ID, Description, Source Location, and Destination Location for each row from the Materials sheet. The acreage (I123), cover depth (J123), swell factor (L123), and loose/stockpile volume (M123) are referenced from the Quantities sheet. The in-place (i.e., bank) volume (K123) is calculated from the loose/stockpile volume by dividing by the swell factor. Swell is assumed to occur when cover material is moved from the borrow stockpile to the haul truck. Material left in place is assumed to have no swell, meaning the bank and loose volumes are equal.

$$Volume_{loose\_cover} = area * depth_{cover}$$

I325*J325/12*43560/27

	E	F	G	H	I	J	K	L	M
1									Tyrone Mine
2									Stockpile Spreadsheet Worksheet #4
3	*Earthwork Quantity Worksheet*								04/29/19
4									
5	**Notes and Assumptions:**								
6	1 - Acres and volumes based on 2015 Tyrone RCE Submittal								
7	2 - Cover Material Swell: The 'Loose Volume' is calculated based on the acreage to be covered, cover depth, and accounts for appropriate swell factor.								
8	3 - No swell factor for Tyrone								
9	4 - Has been agreed upon with State agencies that swell occurs when cover material is moved from source to haul truck but not from the truck to placement on stockpile								
10									
11									
12									
13									
14	ID	Description	Source Location 1	Destination Location 2	Area (ac)[1]	Cover Depth (in)	Bank/Stockpile Volume (bcy)[1,4]	Swell Factor (%)[3]	Loose/Stockpile Volume (lcy)[2]
123	1300-D-b-Tk4	Haul-Cover	Gila Borrow Area	3A / 3B	455.0	36	2,039,074	8%	2,202,200

M325/(1+L325)

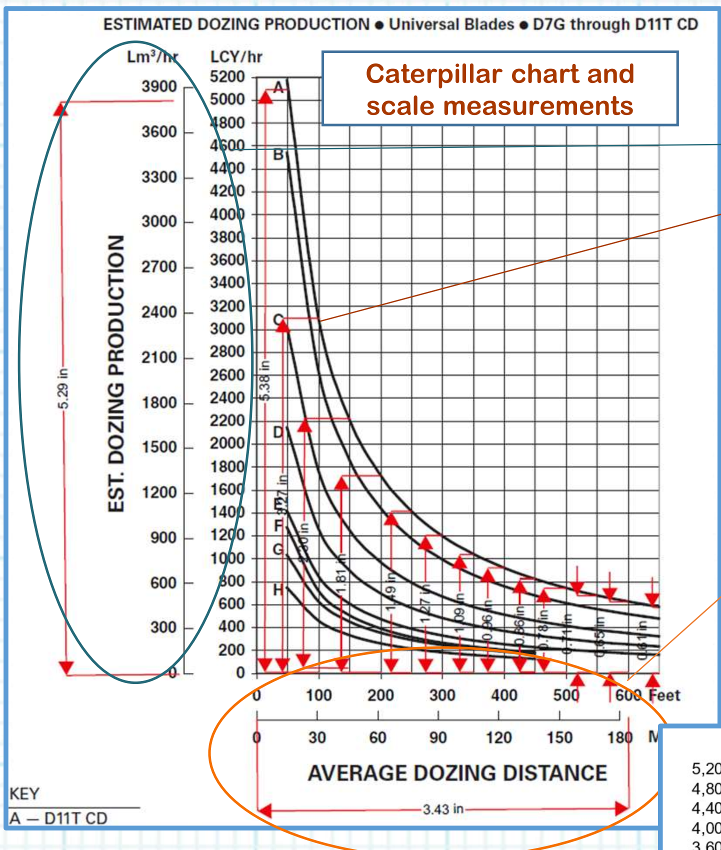
$$Volume_{bank} = \frac{Volume_{loose}}{(1 + F_{swell})_{bank}}$$

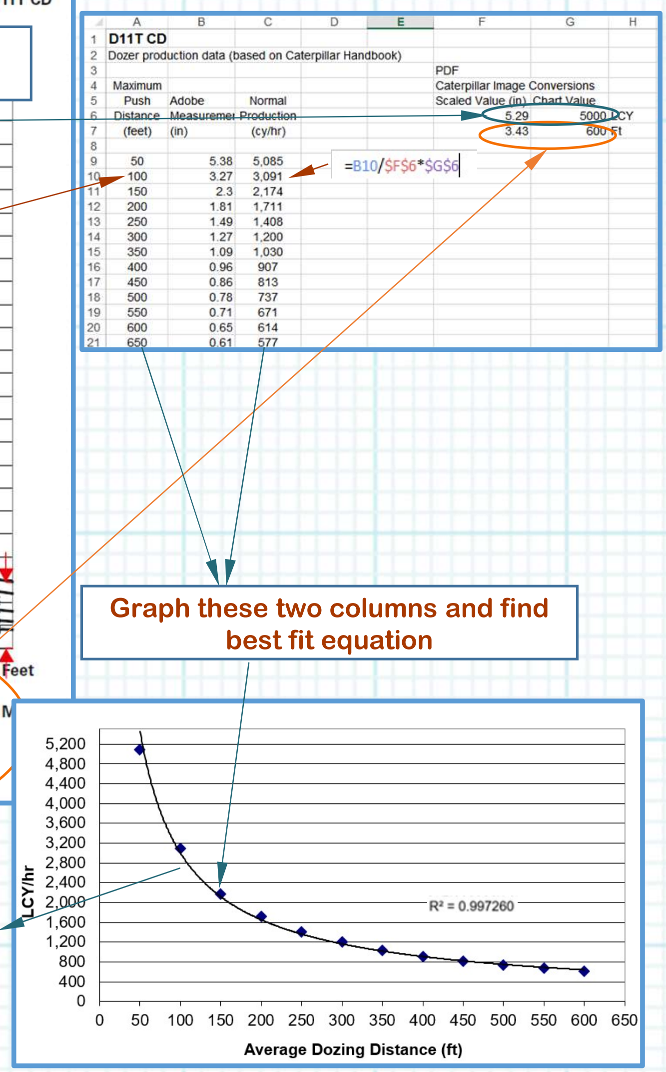
Sheet 5 – Dozer: Dozers are used for rough grading facilities, assisting loaders or shovels at borrow stockpiles, or pushing scrapers for grading facilities. See page 11 of this calculation documentation for a screenshot of the Dozer sheet. Columns E through K repeats ID, activity, locations, equipment from Sheet 3 (Material) and volumes from Sheet 4 (Earthwork). Columns O, P, and Z are the results of the dozer productivity calculations for grading (the multiplier and exponent coefficients C and b, respectively, for the normal productivity equation can be found in columns N and O of the Equipment sheet). Column T is the calculated task time. If the task is for dozer assist of scrapers or loaders/shovels, the dozer task time is equal to the task time of the scraper or loader/shovel, respectively. Columns Q, R, and S are calculated on the scraper and loader sheets and repeated on the dozer sheet. The remaining columns are the input factors that produce the calculation result of bulldozer material handling productivity in cubic yards per hour or acres per hour based on material weight, grade, dozing type, push distance, and operating conditions such as visibility, operator experience, and elevation.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 5 – Dozer cont'd: Input values, power curves and capacities are taken from the 2017 and 2018 Caterpillar (Cat) Performance Handbook (CPH) (Editions 47 and 48) for the specific model dozer. Determining actual productivity starts by calculating the *normal* production factor using a formula derived by curve fit to productivity graphs provided in the CPH for the specific dozer. This is accomplished by scaling values from the figures and using the curve fitting tools within Microsoft Excel:





Maximum Push Distance (feet)	Adobe Measurement (in)	Normal Production (cy/hr)
50	5.38	5,085
100	3.27	3,091
150	2.3	2,174
200	1.81	1,711
250	1.49	1,408
300	1.27	1,200
350	1.09	1,030
400	0.96	907
450	0.86	813
500	0.78	737
550	0.71	671
600	0.65	614
650	0.61	577

$$Productivity_{normal} = 159{,}372.008958 * Distance_{Push}^{-0.862481}$$

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 5 – Dozer cont'd: The *normal* production curves assume a flat surface with a pushed material density of 2,300 lb/cy and a material that is not loose. To account for slope, operator experience, equipment specifications, and other site-specific factors, the CPH modifies the normal production curve by multiplying various factors to obtain the overall productivity:

Productivity and Hours Required for Dozer Use---Earthmoving

Notes and Assumptions:

Uses volumes of outslope sections and dam breaches to calculate productivity

Uses push distances of outslope sections for grading productivity

Uses scraper push cycle time for dozer assist with scraper

Uses loader cycle time for dozer assist with loader at cover stockpiles

Grade Factor = -0.02(Grade %) + 1

May filter on equipement (D14) to show pertinent rows

Number of Dozers per Assist = 1

2 dozers per assist at 3A/3B and San Salvador Pit (manually entered)

ID	Task Description	Source Location 1	Destination Location 2	Equipment	Type of Equipment to Assist (ID)	Type of Equipment to Assist (Name)	Number of Dozers per Assist	Loose /Stockpile Volume (cy)	Area (ac)	Productivity (cy/hr)	Productivity (ac/hr)
1502-A-a-Dz2	Grade-Outslopes-Existing Ground	5A Overburden	-	Cat D11T CD	--	--	--	6,300,000	308	768	-

Tyrone Mine
Stockpile Spreadsheet Worksheet #5
04/29/19

$$Production_{normal} = C * Distance_{Push}^{b}$$

PERFORMANCE FACTORS

Scraper Pusher Cycle Time (min)	Cycles per Scraper per Hr	Loader/ Shovel/ Excavator Cycle Time	Total Task Time (hrs)	Material Factor	Grade Factor	Material Weight (lb/cy)	Production Method/ Blade	Centroid to Centroid Push Distance (ft)	Normal Production (cy/hr)	Effective Blade Width (ft)	Speed (mph)	Operator Factor	Work Hour (min/hr)	Visibility Factor	Elevation Factor	Direct Drive Trans.	Cut to Fill Haul Grade (%)
-	-	-	8,204.8	1.0	1.6	3,300	1.2	540	697	22	3	1.00	50	1.0	1.0	1.0	-29%

$$Productivity\left(\frac{cy}{hr}\right) = F_{ma'l} * F_{grade} * F_{prod-metho} * F_{operator} * F_{visibility} * F_{elev} * F_{drive} * \frac{WorkHour}{60min/hr} * \frac{2{,}300\ lb/cy}{Mat'l\ Weight} * Production_{normal}$$

=U39*V39*X39*AC39*AE39*AF39*AG39*(AD39/60)*(2300/W39)*Z39

Sheet 6 – Road Maint: This sheet calculates the time required for a water truck and motor grader to be used for dust suppression and site maintenance during earthwork reclamation. Columns E through I repeats ID, activity, locations, and equipment. The Operational Maintenance Time (Column J) is assumed to be equal to the loader/shovel task time.

Productivity and Hours Required for Dust Suppression and Road Maintenance

Tyrone Mine
Stockpile Spreadsheet Worksheet #6
04/29/19

Notes and Assumptions:

6,000 gal water truck and 14M motor grader for dust suppression and site maintenance (water truck hours and 14M hours tied to loading time for cover material)

May filter on equipement (D14) to show pertinent rows

Sheet to which to tie hrs 10 Loader Shovel

Equipment for hrs Sh1

Equipment for hrs Ld2

ID	Task Description	Source Location 1	Destination Location 2	Equipment	Operational Maintenance Time
1000-P-b-Comb1	Road Maintenance	Gila Borrow Area	1A and 1B Leach	Cat 14M, Off-Hwy Water Tanker Truck,6,000-gal.	423

Equals loading time on Loader/Shovel sheet

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 7 – <u>Ripper</u>: Rippers are used after rough grading, before placing cover, at all facilities (or before revegetation at borrow stockpiles) to promote revegetation. Rippers are also used to loosen the existing ground before rough grading with scrapers. Columns E through J repeat the ID, title of the activity, locations, equipment and areas from Sheets 3 & 4. Columns K and L are the results of the dozer ripper productivity calculations. The remaining columns are the inputs that allow the calculation of bulldozer ripper productivity in acres per hour based on ripper performance factors:

Tyrone Mine
Stockpile Spreadsheet Worksheet #7
04/29/19

Productivity and Hours Required for Ripper---Equipped Dozer Use

Notes and Assumptions:
Uses area to calculate task time
88 ft/min = 1mph
May filter on equipement (D14) to show pertinent rows
Task time is less than 1hour for areas smaller than productivity rate (ac/hr)

	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U	V
13								PERFORMANCE FACTORS									
14	Task Description	Source Location 1	Destination Location 2	Equipment	Area (ac)	Productivity (ac/hr)	Task Time (hrs)	Ripping Length (ft)	Ripper Penetration (in)	Pocket Spacing (in)	Distance b/n Passes	Number of Shank Pockets	Turn Time (min/pass)	Work Hour (min/hr)	Speed (mph)	1000 Ft or 100 Ft Passes/Acre	Ripped Width Plus Distance b/n Passes (ft)
64	Rip-Top-Rough Graded Material	1A and 1B Leach	-	Cat D11T CD Multi-shank (w/ MSR-359H)	17	2.9	5.8	1,000	18	59	59	3	0.25	50	1.0	1.5	30

=S64/((M64/(5280*T64/60)+R64)*U64)

=43560/(M64*V64)

=J64/K64

=Q64*(P64+O64)/12

Unit conversion factors

Sheet 8 – <u>Excavator</u>: An excavator with a sheepsfoot attachment is used for perforating liners before reclamation of lined impoundments. Columns E through J repeat the ID, title of the activity, locations, equipment and areas from Sheets 3 & 4. Task time (column Q) to complete compacting the entire area is calculated using the inputs from columns J-P, which are referenced from the Equipment sheet.

Tyrone Mine
Stockpile Spreadsheet Worksheet #8
#####

Productivity and Hours Required for Hydraulic Excavator

Notes and Assumptions:
Uses area to calculate time for perforating liners
3' sheepsfoot roller
Can be used for excavating and loading, or sheepsfoot compaction using a roller
May filter on equipment (D14) to show pertinent rows

	E	F	G	H	I	J	K	L	M	N	O	P	Q
13	5	6	7	8	9	10		11		12	13		14
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Area (ac) or Volume (lcy)	Unit (ac or lcy)	Sheepsfoot Roller Width (ft) or Bucket Capacity (cy)	Unit (ft or cy)	Maximum Reach at Ground Level (ft)	Cycle Time (min)	Work Hour (min/hr)	Task Time (hr)
78	2701-K-a-Ex1	Perforate Liner-Surface Impoundments	Surface Impoundments closed at year 99; some closed year 6	-	Cat 319D L	21.2	ac	3.0	ft	31.7	0.16	50.00	31.15

=O78*(J78*43560)/(L78*N78)/P78

Unit conversion factor

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 9 – Trucks: Trucks are used to haul cover material from borrow stockpiles to destination facilities. Columns E through J repeat the ID, title of the activity, locations, equipment and volumes from Sheets 3 & 4. Column K sums the truck cycle, which includes the haul time loaded, return time empty, loading time, truck exchange time, and the dump/maneuver time. Column L reports the optimum number of trucks as limited by the number and size of loaders (calculated on the Truck Optimization sheet, as shown in the Equipment Optimization calculation summary). Column M lists the loader or shovel net bucket capacity, referenced from the Shovel sheet. Column O lists the loader or shovel task time, referenced from the Shovel sheet. Columns N and P calculate the overall productivity and time required of the load-haul-dump operations, respectively. Column P calculates the time for the truck to complete that task and compares that time to the loader task time, because the truck will have to idle while the loader/shovel finishes loading if the loader/shovel task time is longer than the truck task time (or vice versa). If the loader task time is longer, the loader task time is listed. If the truck task time is longer, the truck task time is listed.

Productivity and Hours Required for Truck Use

Notes and Assumptions:

Uses haul distance to calculate haul and return time (total task time includes loading, manuevering, dumping, hauling and return time) - moves from cover stockpile to destination stockpile

Volume of cover material based on area of destination

Cycles per truck = the greater of Heaped capacity or Struck capacity divided by Loader's per bucket capacity

1mph = 88 ft/min

1m/min = 0.03728227153424 mph

See Truck Optimization optimum number of trucks per loader

Haul Grade (%) assumes postive is uphill while the Effective Haul Grade (%) and Effective Return Grade (%) are postive for downhill and uphill

May filter on equipement (D14) to show pertinent rows

	E	F	G	H	I	J	K	L	M	N	O	P	Q
13	5	6	7	8	9	10	11	12	13	14	15	16	17
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Loading Equipment ID	Loose/ Stockpile Volume (cy)	Truck Cycle Time (min)	Optimum Number of Trucks	Loader/Shovel/ Excavator Net Bucket Capacity (cy)	Productivity (cy/hr)	Loader/ Shovel/ Excavator Task Time(hrs)	Truck Task Time (hrs)
123	1300-D-b-Tk4	Haul-Cover	Gila Borrow Area	3A / 3B	Komatsu 730E	Sh1	2,202,200	18.4	8	28.1	3,052.2	705.7	721.5

=SUM(AL123:AP123)

=AQ123*T123*N123*M123/L123

=IF(OR(K123=0,O123=0),0,IF(K123/O123<P123,P123,K123/O123))

Columns R and S are equipment specifications from the CPH. Column T calculates the loader or shovel cycles per truck, based on loader/shovel bucket capacity and truck capacity. The total haul distance (column U) can be divided into three segments (columns V-X) if the route varies greatly in slope. The average grade for each segment is calculated and entered in Columns Y-AA. Columns U through AA are obtained from the Quantities sheet. Column AB is the rolling resistance for the assumed underfooting and tires per the CPH. Columns AC-AE convert segment distances from feet to meters for application of the performance equations from the CPH.

Tyrone Mine
Stockpile Spreadsheet Worksheet #9
04/29/19

PERFORMANCE FACTORS

	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD	AE
13	18	19	20	21	22	23	24	25	26	27	28	29	30	31
14	Struck Capacity (cy)	Heaped Capacity (cy)	Loader/ Shovel Cycles per Truck	Total Haul Distance (ft)	Haul Distance Segment 1 (ft)	Haul Distance Segment 2 (ft)	Haul Distance Segment 3 (ft)	Haul Grade Segment 1 (%)	Haul Grade Segment 2 (%)	Haul Grade Segment 3 (%)	Rolling Resistance (%)	Haul Distance Segment 1 (meters)	Haul Distance Segment 2 (meters)	Haul Distance Segment 3 (meters)
123	101.0	145.0	5.0	11,221	4,411	6,810	-	-7.0%	6.6%	0.0%	2.5%	1,344	2,076	-

=TRUNC(R123/ N123)

=SUM(V123:X123)

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 9 – Trucks cont'd: Columns AF through AK calculate the effective grade of the segment (physical grade plus the rolling resistance). Haul time (column AL) and return time (column AM) are calculated by multiplying travel times (per distance) by haul/return distance. Loading time (column AN) is based on loader/shovel productivity (Sheet 10). Times in columns AO, AP, and AQ are referenced from the Equipment sheet.

=AR123*AC123+AS123*AD123+AE123*AT123

	AF	AG	AH	AI	AJ	AK	AL	AM	AN	AO	AP	AQ
13	32	33	34	35	36	37	38	39	40	41	42	43
14	Effective Haul Grade Segment 1 (%)	Effective Haul Grade Segment 2 (%)	Effective Haul Grade Segment 3 (%)	Effective Return Grade Segment 1 (%)	Effective Return Grade Segment 2 (%)	Effective Return Grade Segment 3 (%)	Haul Time (min)	Return Time (min)	Loading Time (min)	Truck Exchange Time (min)	Dump/Maneuver Time (min)	Work Hour (min/hr)
123	4.5%	9.1%	2.5%	9.5%	4.1%	2.5%	9.6	4.7	2.25	0.7	1.1	50

=IF(Y123>=$AB123,
Y123+$AB123,
ABS(Y123+$AB123))

=IF(-Y123>=$AB123,
-Y123+$AB123,
ABS(-Y123+$AB123))

=AU123*AC123+AV123*AD123+AE123*AW123

Columns AR through AW calculate the travel time (per distance) from a curve fit based on CPH production factors, as explained on the following page. Travel time is dependent on effective grade. If the haul grade is positive (uphill), the loaded or empty uphill travel time is calculated, within the maximum speed of the truck. If the grade is negative (downhill), the loaded or empty downhill travel time is calculated, within the maximum speed of the truck.

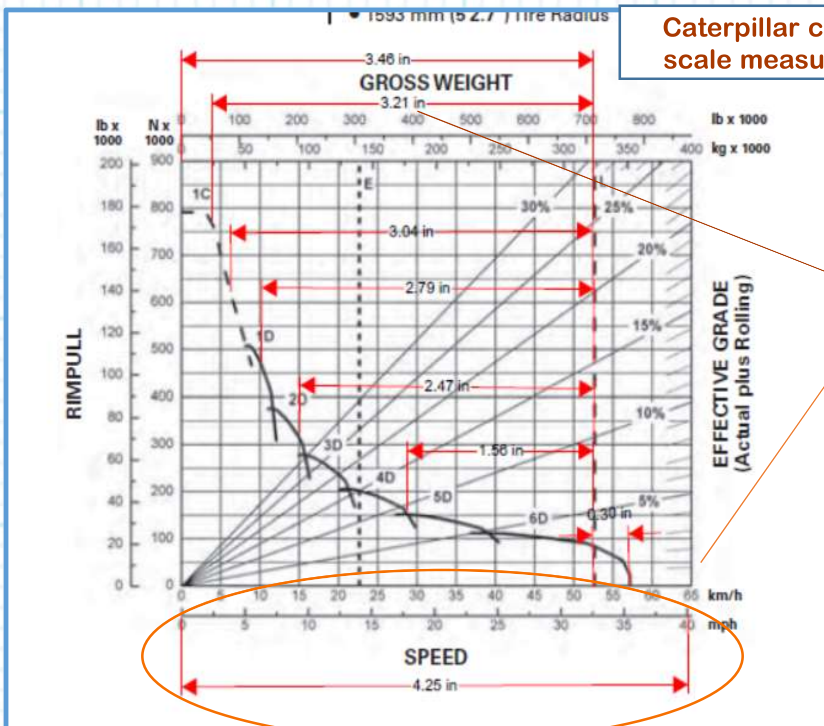
	AR	AS	AT	AU	AV	AW
1						Tyrone Mine
2						Stockpile Spreadsheet Worksheet #9
3						04/29/19
13	44	45	46	47	48	49
14	Travel Time Loaded Segment 1 (min/m)	Travel Time Loaded Segment 2 (min/m)	Travel Time Loaded Segment 3 (min/m)	Travel Time Empty Segment 1 (min/m)	Travel Time Empty Segment 2 (min/m)	Travel Time Empty Segment 3 (min/m)
123	0.00174	0.00352	0.00145	0.00189	0.00105	0.00105

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 9 – Trucks cont'd: Haul times are calculated for the trucks by using rimpull-speed-gradeability curves and retarding curves to create a relationship for travel time vs. effective resistance for travel uphill and downhill, respectively. A formula is derived by curve fit to the rimpull-speed-gradeability curves and retarding curves provided in the CPH for the specific truck. Similar to the dozer productivity curves, this is accomplished by scaling values from the figures and using the curve fitting tools within Microsoft Excel. Input values are taken from the 1998, 2011, 2017 and 2018 Caterpillar (Cat) Performance Handbook (CPH) (Editions 29, 41, 47, and 48) for the specific model truck. The example below shows how travel time is calculated for uphill routes, assuming a loaded truck:

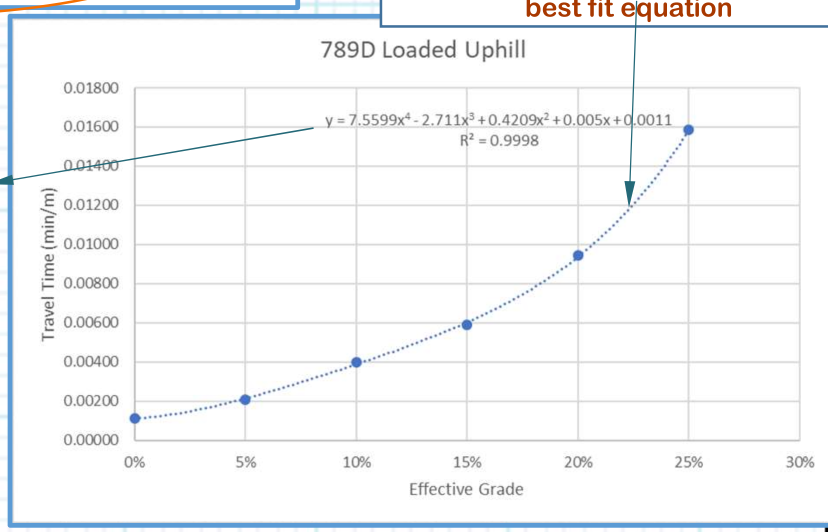
Caterpillar chart and scale measurements



	B	C	D	E	F
1	Loaded Up Hill				
2	Measurement	Speed (mph)			
3	4.25	40			
4	3.46	32.6			
5					
6	Measurement	Speed (mph)	Travel Time (min/m)	Effective Grade	
7	3.21	2.35	0.01585	25%	
8	3.04	3.95	0.00943	20%	
9	2.79	6.31	0.00591	15%	
10	2.47	9.32	0.00400	10%	
11	1.56	17.88	0.00209	5%	
12	0	32.56	0.00114	0%	

Graph these two columns and find best fit equation

Haul Travel Time (min/m)=7.5599(Eff. Grade %)⁴ + -2.711(Eff. Grade %)³ + 0.4209(Eff. Grade %)² + 0.005(Eff. Grade %) + 0.0011



These coefficients are listed for each type of truck in columns P-AI of the Equipment sheet.

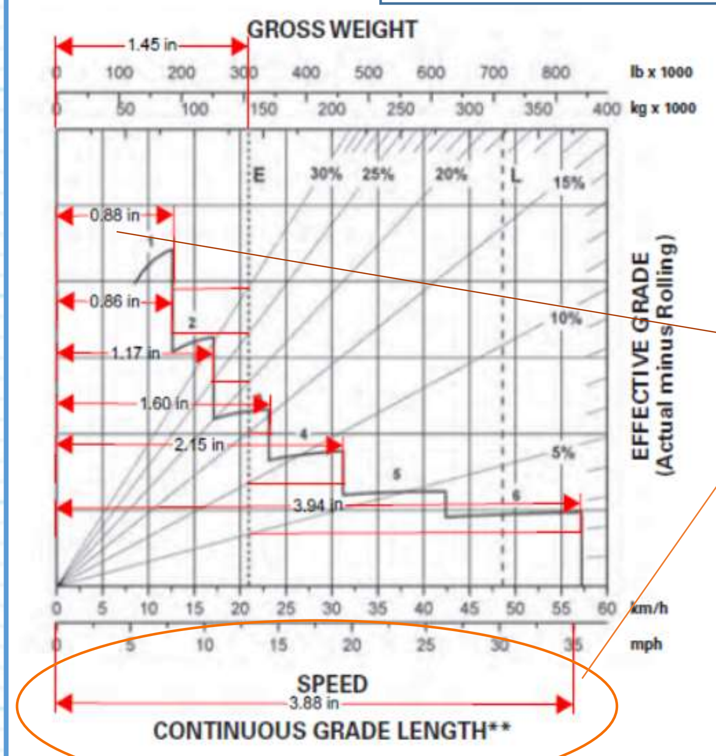
For example use only. Values may not match the current spreadsheet.

TELESTO SOLUTIONS • INCORPORATED	Job No: 200540a	Client: Freeport NM Operations	Page 16 of 23
	Task: Earthwork RCE	Computed By: Taryn Tigges	Date: 4/30/19
		Checked By: Fred Charles	Date: 4/30/19

Results cont'd

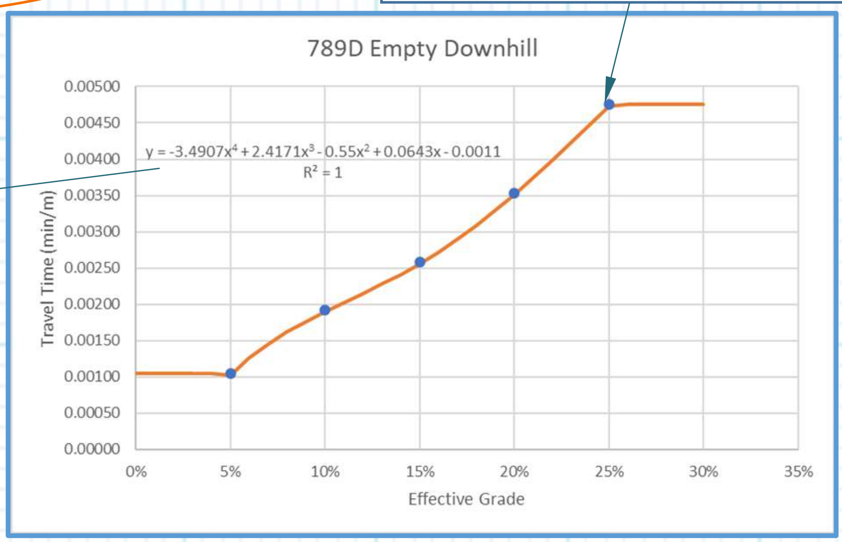
Sheet 9 – Trucks cont'd: The example below shows how travel time is calculated for downhill routes, assuming an empty truck:

Caterpillar chart and scale measurements



	B	C	D	E	F
1					
2	Measurement	Speed (mph)			
3	3.88	35			
4					
5	Measurement	Speed (mph)	Travel Time (min/m)	Effective Grade	
6	0.87	7.85	0.00475	30%	
7	0.87	7.85	0.00475	25%	
8	1.17	10.55	0.00353	20%	
9	1.6	14.43	0.00258	15%	
10	2.15	19.39	0.00192	10%	
11	3.95	35.63	0.00105	5%	
12	3.95	35.63	0.00105	0%	
13					

Graph these two columns and find best fit equation



Haul Travel Time (min/m)= -3.4907(Eff. Grade %)^4 + 2.4171(Eff. Grade %)^3 + 0.0643(Eff. Grade %)^2 + 0.0643(Eff. Grade %) + 0.0011

Fit has been adjusted to only include travel times for effective grades 5%-25%. If statements have been included in truck sheet to make travel time constant if effective grade is above 25% or below 5% for this truck type.

These coefficients are listed for each type of truck in columns P-AI of the Equipment sheet.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 10 – Loader Shovel: Loaders or shovels are used to load cover material onto haul trucks at borrow stockpiles. Columns E through I repeat the ID, title of the activity, locations, and equipment from Sheet 3. Column J is the hauling equipment that is loaded by the loader or shovel. Column K is from Sheet 4 and contains the total amount of material to be loaded/moved. Loader/shovel cycle time (column L), net bucket capacity (column P), and work hour (column Q) are from the Equipment sheet. Per Loader/Shovel Productivity (cy/hr) (column M) and Loader/Shovel Task Time (hrs) (column N) are calculated directly. Similar to the truck task time calculation, the maximum of either the loader/shovel task time or the truck task time is used (column O).

Tyrone Mine

Productivity and Hours Required for Front End Loader Use or Hydraulic Shovel Use

Stockpile Spreadsheet Worksheet #10

4/29/2019

Assumptions:

Uses cover volume to calculate loading time of cover material

May filter on equipement (D14) to show pertinent rows

PERFORMANCE FACTORS

E	F	G	H	I	J	K	L	M	N	O	P	Q
5	6	7	8	9	10	11	12	13	14	15	16	17
ID	Task Description	Source Location 1	Destination Location 2	Equipment	Hauling Equipment ID	Loose/Stockpile Volume (cy)	Loader/ Shovel Cycle Time (min)	Per Loader/Shovel Productivity (cy/hr)	Loader/ Shovel Task Time (hrs)	Max of Loader/Shovel or Truck Task Time (hrs)	Net Bucket Capacity (cy)	Work Hour (min/hr)
1000-C-b-Sh1	Load-Cover	Gila Borrow Area	1A and 1B Leach	Hitachi EX3600-5	Tk4	1,321,320	0.45	3,120.6	423.4	423.4	28.1	50

=P99/L99*Q99

=K99/M98

Sheet 11 – Scrapers: No scrapers are used in Tyrone RCE.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheet 12 – M'Grader: Motor graders are used for rough grading tops of stockpiles or for fine grading cover material. Columns E through I repeat the ID, title of the activity, locations, and equipment from Sheet 3. Column J is from Sheet 4 and contains the area of material to be graded. The grade factor (Column M) is calculated based on percent grade. Column K, shaping productivity, is calculated from the speed and effective blade width. Column L is calculated directly. Column N is an assumed material handling factor and Column U is a factor based on operator experience. Columns O-T are based on material properties and equipment information.

Tyrone Mine

Productivity and Hours Required for Motorgrader Use---Grading

Stockpile Spreadsheet Worksheet #12

4/29/2019

Notes and Assumptions:

Productivity (based on area of overall stockpile) = Sq.ft per hour = Speed x (Eff. Blade L -Blade Overlap) x Efficiency (*Cat. Handbook Edition 47* pg 11-27)

Max. safe slope for motor graders is 2:1 (50%), proposed final grade for Tyrone cover grading on stockpiles is 33%, therefore use of graders an option (Cat. Handbook Edition 46 pg 11-30)

Grade Factor = -0.02(Grade %) + 1

May filter on equipement (D14) to show pertinent rows

ID	Task Description	Source Location 1	Destination Location 2	Grading Equipment	Area (ac)	Grading Shaping Productivity (ac/hr)	Task Time (hrs)	Grade Factor	Material Factor	Material Weight (lb/cy)	Production Method/ Blade	Effective Blade Width (ft)	Pass Overlap (ft)	Speed (mph)	Work Hour (min/hr)	Operator Factor
1001-A-a-Mg1	Grade-Top-Existing Ground	1A and 1B Leach	-	Cat 16M	17	3	5.9	1.0	1.0	3,300	1.20	16.00	2.00	2.50	50	1.00

=(T46/60)*N46*(2300/O46)*P46*U46*M46*S46*(Q46-R46)*5280/43560

=IF(K115>0,J115/K115,0)

Unit conversion factors

Soil weight (lb/cy) assumed in CPH

Sheet 13 – EarthSum: This sheet summarizes all of the quantities and production rates on the individual sheets (5, and 7 through 12) and applies costs from Equipment Watch, the New Mexico labor rates table, fuel quotes, etc. Columns E through I repeat the ID, title of the activity, locations, equipment from Sheet 3. Columns J through L list the fuel, rental and maintenance, and labor unit costs from the Equipment sheet for the associated piece of equipment. The number of units of equipment is assumed to be one except for trucks and scrapers, which use an optimum number of units, calculated on the truck and scraper optimization sheets. The time required is taken from each of the equipment sheets (Sheets 5-12). The fuel, rental and maintenance, and labor costs are calculated by multiplying the unit costs by the time required for each task. The total equipment cost (column R) is the sum of the fuel, rental and maintenance, and labor costs. The total production volumes and areas are repeated from Sheet 4.

Summarizes costs for line items involving earthworks

Summary Calculation of Earthmoving Costs

Notes and Assumptions:

Summarizes all earthmoving quantities and co

Productivity (based on area of overall stockpile) = Sq.ft per hour = Speed x (Eff. Blade L -Blade Overlap) x Effici

Max. safe slope for motor graders is 2:1(50%), proposed final grade for Tyrone cover grading on stockpiles is 33

Grade Factor = -0.02(Grade %) + 1

May filter on equipement (D14) to show pertinent rows

ID	Description	Source Location 1	Destination Location 2	Equipment	Fuel Cost ($/hr)	Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) ($/hr)	Labor Cost ($/hr)
1202-A-a-Dz2	Grade-Outslopes-Existing Ground	2A Leach and 2B Waste	-	Cat D11T CD	$69.62	$254.44	$27.41

For example use only. Values may not match the current spreadsheet.

Results cont'd

Sheet 13 – EarthSum cont'd:

	M	N	O	P	Q	R	S	T
1								Tyrone Mine
2								Stockpile Spreadsheet Worksheet #13
3								04/29/19
4								
5	iency (*Cat. Handbook Edition 47* pg 11-27)							
6	3%, therefore use of graders an option (Cat. Handbook Edition 46 pg 11-30)							
7								
8								
9								
10								
11								
12								
13								
14	Number of Units (Equipment)	Time Req'd (hrs)	Direct Fuel Cost ($)	Direct Lube, Tires, GEC, & Field Parts Adjusted Rental Cost (w/o fuel) (	Direct Labor Cost ($)	Total Equipment Cost ($)	Total Production Volume (CY)	Total Production Area (AC)
36	1	9,386.9	$647,897	$2,368,057	$255,101	$3,271,055	8,060,000	-

=SUM(O15:Q15)

=J15*N15*M15

Sheet 14 – Revegetation: Columns E through I repeat the ID, title of the activity, locations, and areas from Sheets 3 & 4. The calculated unit rates for revegetation (reveg fuel cost and reveg cost without fuel) are multiplied by the corresponding areas to calculate the associated direct revegetation costs for each location. The total revegetation direct cost is then the sum of all direct costs related to each location.

	E	F	G	H	I	J	K	L	M
1									Tyrone Mine
2	*Revegetation Costs*								Stockpile Spreadsheet Worksheet #14
3									04/29/19
4	**Description:**								
5	Includes scarifying (ripping), discing, rangeland drill seeding, mulching, crimping, and daily per diem								
6	May filter on equipement (D14) to show pertinent rows								
7									
8									
9									
10									
11									
12									
13									
14	ID	Description	Source Location 1	Destination Location 2	Area (ac)	Fuel Unit Cost ($/ac)	Reveg w/o Fuel Unit Cost ($/ac)	Fuel Direct Cost ($)	Reveg w/o Fuel Direct Cost ($)
154	1000-J-e-U2	Revegetate-Entire Stockpile-Final Grade	1A and 1B Leach	-	273.0	$ 3.85	$ 820.12	$ 1,051	$ 223,893
155	1100-J-e-U2	Revegetate-Top (Haul Road)-Final Grade	1C	-	17.0	$ 3.85	$ 820.12	$ 65	$ 13,945
156	1200-J-e-U2	Revegetate-Entire Stockpile-Final Grade	2A Leach and 2B Waste	-	487.0	$ 3.85	$ 820.12	$ 1,874	$ 399,392
157	1300-J-e-U2	Revegetate-Entire Stockpile-Final Grade	3A / 3B	-	455.0	$ 3.85	$ 820.12	$ 1,751	$ 373,155
158	1500-J-e-U2	Revegetate-Entire Stockpile-Final Grade	5A Overburden	-	371.0	$ 3.85	$ 820.12	$ 1,428	$ 304,265
159	2200-J-e-U2	Revegetate-Entire Pit-Final Grade	San Salvador Pit	-	115.0	$ 3.85	$ 820.12	$ 443	$ 94,314
160	2300-J-e-U2	Revegetate-Entire Stockpile-Final Grade	Savanna In-Pit Leach Stockpile	-	65.0	$ 3.85	$ 820.12	$ 250	$ 53,308
161	1400-J-e-U2	Revegetate-Entire Stockpile-Final Grade	4C Leach	-	183.0	$ 3.85	$ 820.12	$ 704	$ 150,082
162	1800-J-e-U2	Revegetate-Entire Stockpile-Final Grade	2C, 4A, 4B, 7B Leach	-	375.0	$ 3.85	$ 820.12	$ 1,443	$ 307,545
163	1900-J-e-U2	Revegetate-Sludge Disposal Area-Final Grade	8C	-	47.4	$ 3.85	$ 820.12	$ 182	$ 38,841
164	1600-J-e-U2	Revegetate-Entire Stockpile-Final Grade	6B	-	54.0	$ 3.85	$ 820.12	$ 208	$ 44,286
165	1700-J-e-U2	Revegetate-Entire Stockpile-Final Grade	6C	-	66.0	$ 3.85	$ 820.12	$ 254	$ 54,128
166	2000-J-e-U2	Revegetate-Entire Stockpile-Final Grade	9A Overburden	-	129.0	$ 3.85	$ 820.12	$ 496	$ 105,796
167	2600-J-e-U2	Revegetate-Tailing Launder Line-Final Grade	Tailing Launder Line	-	7.4	$ 3.85	$ 820.12	$ 28	$ 6,072
168	2900-J-e-U2	Revegetate-Mangus Pumphouse-Final Grade	Mangus Pumphouse	-	7.0	$ 3.85	$ 820.12	$ 27	$ 5,741
169	2701-J-e-U2	Revegetate-Surface Impoundments closed at year 99; some closed year 6-	Surface Impoundments closed at year 99; some closed year 6	-	21.2	$ 3.85	$ 820.12	$ 82	$ 17,411
170	2702-J-e-U2	Revegetate-Surface Impoundments graded over at closure-Final Grade	Surface Impoundments graded over at closure	-	0.5	$ 3.85	$ 820.12	$ 2	$ 394
171	3300-J-e-U2	Revegetate-Unplanned Disturbance Area-Final Grade	Unplanned Disturbance Area	-	125.0	$ 3.85	$ 820.12	$ 481	$ 102,515
172	2100-J-e-U2	Revegetate-Entire Stockpile-Final Grade	9AX	-	63.7	$ 3.85	$ 820.12	$ 245	$ 52,242
173	2803-J-e-U2	Revegetate-Revegetation Area-Final Grade	Tailing Repositories Borrow Areas	-	74.7	$ 3.85	$ 820.12	$ 287	$ 61,263
290									
291				TOTAL	####			$ 11,301	$ 2,408,586

=I173*J173

=SUM(M15:M290)

For example use only. Values may not match the current spreadsheet.

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	Checked By: Fred Charles	Date: 4/30/19

Sheet 15 – Other: This sheet contains the direct costs associated with miscellaneous (other) earthwork tasks. These tasks include grading benches, constructing downdrains, constructing downdrain dissipators, constructing bench channels (including filter and riprap production and placement), replacing infrastructure, plugging and abandoning wells, replacing wells, constructing berms, fencing (including vehicle gates and signs), and building grade control walls. Columns E through H repeat the ID, description, and locations from Sheet 3. Columns I and J document the quantity and unit associated with each quantity for each task (referenced from the Quantities sheet). The unit costs (columns K and L) are referenced from the Unit Cost sheet. The quantity multiplied by the unit costs give the direct costs for each activity. The direct costs are totaled at the bottom of the sheet.

Other Reclamation Activity Costs

Tyrone Mine
Stockpile Spreadsheet Worksheet #15
04/29/19

Assumptions:
1 - Cost to construct drain or channel on re-graded stockpile
2 - The downdrain, ACB, well plug & abandon, and well replacement costs include fuel
May filter on equipement (D14) to show pertinent rows

	ID	Description	Source Location 1	Destination Location 2	Quantity	Unit	Fuel Unit Cost ($/unit)	Unit Cost w/o Fuel ($/unit)[1]	Fuel Direct Cost ($)	Direct w/o Fuel Cost ($)
238	1700-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	6C	-	550	ft	$ -	$ 374.38	$ -	$ 205,909
239	2000-G-e-U5	Construct Downdrains-Entire Stockpile-Final Grade	9A Overburden	-	2,500	ft	$ -	$ 374.38	$ -	$ 935,951
240	1000-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	1A and 1B Leach	-	4	ea	$ -	$ 14,556.48	$ -	$ 58,226
241	1200-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	2A Leach and 2B Waste	-	5	ea	$ -	$ 14,556.48	$ -	$ 72,782
242	1300-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	3A / 3B	-	4	ea	$ -	$ 14,556.48	$ -	$ 58,226
243	1500-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	5A Overburden	-	2	ea	$ -	$ 14,556.48	$ -	$ 29,113
244	2200-Gb-e-U6	Construct Downdrain Dissipators-Entire Pit-Final Grade	San Salvador Pit	-	1	ea	$ -	$ 14,556.48	$ -	$ 14,556
245	1400-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	4C Leach	-	3	ea	$ -	$ 14,556.48	$ -	$ 43,669
246	1800-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	2C, 4A, 4B, 7B Leach	-	3	ea	$ -	$ 14,556.48	$ -	$ 43,669
247	1600-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	6B	-	1	ea	$ -	$ 14,556.48	$ -	$ 14,556
248	1700-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	6C	-	1	ea	$ -	$ 14,556.48	$ -	$ 14,556
249	2000-Gb-e-U6	Construct Downdrain Dissipators-Entire Stockpile-Final Grade	9A Overburden	-	1	ea	$ -	$ 14,556.48	$ -	$ 14,556
250	1000-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	1A and 1B Leach	-	50,013	ft	$ 1.39	$ 6.60	$ 69,277.99	$ 330,108
251	1200-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	2A Leach and 2B Waste	-	68,062	ft	$ 1.39	$ 6.60	$ 94,279.45	$ 449,240
252	1300-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	3A / 3B	-	65,980	ft	$ 1.39	$ 6.60	$ 91,395.47	$ 435,497
253	1500-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	5A Overburden	-	50,330	ft	$ 1.39	$ 6.60	$ 69,717.09	$ 332,200
254	2200-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Pit-Final Grade	San Salvador Pit	-	9,940	ft	$ 1.39	$ 6.60	$ 13,768.88	$ 65,608
255	1400-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	4C Leach	-	23,501	ft	$ 1.39	$ 6.60	$ 32,553.57	$ 155,117
256	1800-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	2C, 4A, 4B, 7B Leach	-	26,700	ft	$ 1.39	$ 6.60	$ 36,984.83	$ 176,232
257	1700-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	6C	-	4,100	ft	$ 1.39	$ 6.60	$ 5,679.32	$ 27,062
258	2000-H-e-U7a	Construct Bench Channels w/ Riprap-Entire Stockpile-Final Grade	9A Overburden	-	25,148	ft	$ 1.39	$ 6.60	$ 34,835.00	$ 165,988
259	2800-Hb-e-U7b	Construct Bench Channels w/o Riprap-Borrow Areas-Final Grade	Tailing Repositories Borrow Areas	-	13,501	ft	$ 0.10	$ 0.41	$ 1,381.33	$ 5,593
260	2800-R-e-U28	Construct Berms-Borrow Areas-Final Grade	Tailing Repositories Borrow Areas	-	3,142	ft	$ -	$ 0.06	$	$ 195
261	2600-T-e-U35	Build Grade Control Walls-Tailing Launder Line-Final Grade	Tailing Launder Line	-	1,002	ft	$ -	$ 165.59	$ -	$ 165,992
291								TOTAL	$ 547,382	$ 19,979,626

=I259*K259

=SUM(M15:M261)

For example use only. Values may not match the current spreadsheet.

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	Checked By: Fred Charles	Date: 4/30/19	

Results cont'd

Sheet 16 – Sum: This sheet summarizes the direct costs from Sheets 2, 13, 14 and 15. The indirect costs are added as a percentage of the direct costs.

	A	B	C	D	E	
1					Tyrone Mine	
2					Stockpile Spreadsheet Worksheet #16	
3					4/29/2019	
4						
5	***Tyrone Mine***					
6	Reclamation Summary Stockpiles, Haul Roads, Reservoirs, and Disturbed Areas					
7						
8				**Current Value**		
9	**DIRECT COSTS**	Facility and Structure Removal		$5,089,622		='2 Demo'!F31
10		Earthmoving		$43,140,197		='13 EarthSum'!R295
11		Revegetation		$2,419,888		='14 Revegetation'!M291+'14 Revegetation'!L291
12		Other		$20,527,008		='15 Other'!N291+'15 Other'!M291
13		**Subtotal, Direct Costs**		**$71,176,714**		=SUM(D9:D12)
14						
15	**INDIRECT COSTS**	**Subtotal, Indirect Costs**	**30.0%**	**$21,353,014**		=C15*D13
16						
17						
18	**TOTAL COST**			**$92,529,729**		=(D13+D15)
19		Twelve Year Annual Expenditure		**$7,710,811**		=D18/12
20						
21						
22	Notes:					
23	Indirect costs are based on 2019 agreement between FMI and agencies					
24	Indirect costs include but are not limited to mobilization and demobilization, engineering redesign fee,					
25	contingencies, contractor profit and overhead, project management fee, and state procurement cost					

Total indirect costs of 30% are applied to the capital direct costs based on discussions involving the FA Work Group completed in December 2018 and as agreed in January 2019. The FA Work Group involved representatives of Freeport-McMoRan New Mexico Operations (FNMO), MMD, NMED, and Gila Resources Information Project (GRIP). The indirect costs incorporate Mobilization and Demobilization, Contingencies, Engineering Redesign Fee, Contractor Profit and Overhead, Project Management Fee, and other administrative costs. The RCE report provides further information on the FA Work Group agreement.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Sheets 17-Facility Characteristics- This sheet summarizes direct and indirect cost for each facility in the Tyrone RCE spreadsheet. The first four facilities listed on this sheet are shown below:

	A	B	C	D	E	F
1						
2						
3	**Facility Characteristics**					
4	Facilities are categorized in this listing to meet the MMD reporting					
5	requirement					
6			1000	1100	1200	1300
7		**Facility**	**1A and 1B Leach**	**1C**	**2A Leach and 2B Waste**	**3A / 3B**
8						
9		**Reclaimed Acres[6]**	273.00	17.00	486.99	455.00
10						
11		**Item**	**Capital Cost**	**Capital Cost**	**Capital Cost**	**Capital Cost**
12	Direct Costs	Cover Material Excav, Haul, Grade[1]	$1,262,102	$95,723	$3,231,529	$3,105,876
13		Pullback or Backfill	$0	$0	$0	$13,577,409
14		Top/Outslope Adjustment Grading[2]	$164,600	$0	$3,277,233	$1,659,024
15		Scarify, Seed & Mulch, Reveg[3]	$224,943	$14,011	$401,266	$374,906
16		Channels & Benches[4]	$1,928,349	$0	$3,709,623	$2,966,998
17		Demolition	$0	$0	$0	$0
18		Other[5]	$0	$0	$0	$0
19		**Capital Cost Totals**	**$3,579,994**	**$109,734**	**$10,619,651**	**$21,684,211**
20		**Capital Cost/Acre**	**$13,114**	**$6,453**	**$21,807**	**$47,658**
21						
22	Indirect Costs	Cover Material Excav, Haul, Grade1	$378,631	$28,717	$969,459	$931,763
23		Pullback or Backfill	$0	$0	$0	$4,073,223
24		Top/Outslope Adjustment Grading[2]	$49,380	$0	$983,170	$497,707
25		Scarify, Seed & Mulch, Reveg[3]	$67,483	$4,203	$120,380	$112,472
26		Channels & Benches[4]	$578,505	$0	$1,112,887	$890,099
27		Demolition	$0	$0	$0	$0
28		Other[5]	$0	$0	$0	$0
29		**Indirect Cost Totals**	**$1,073,998**	**$32,920**	**$3,185,895**	**$6,505,263**
30		**Indirect Cost/Acre**	**$3,934**	**$1,936**	**$6,542**	**$14,297**
31						
32						
33						
34		**Total Cost**	**$4,653,992**	**$142,654**	**$13,805,546**	**$28,189,475**
35		Total Cost Cover	$1,640,733	$124,440	$4,200,988	$4,037,638
36		Pullback or Backfill	$0	$0	$0	$17,650,631
37		Total Cost Top/Outslope Adjustment	$213,980	$0	$4,260,403	$2,156,731
38		Total Cost Earthwork	$1,854,712	$124,440	$8,461,391	$23,845,001
39		Capital Cost Re-Veg	$292,426	$18,214	$521,645	$487,377
40		Capital Cost Other[5]	$0	$0	$0	$0
41						
42		**Total Cost/Acre**	**$17,048**	**$8,389**	**$28,349**	**$61,955**
43		Total Cost/Acre Cover	**$6,010**	**$7,318**	**$8,626**	**$8,874**
44		Pullback or Backfill	**$0**	**$0**	**$0**	**$38,793**
45		Total Cost/Acre Top/Outslope Adjustment	**$784**	**$0**	**$8,748**	**$4,740**
46		Total Cost/Acre Earthwork	**$6,794**	**$7,318**	**$17,375**	**$52,407**
47		Capital Cost/Acre Re-Veg	**$1,071**	**$1,071**	**$1,071**	**$1,071**
48		Capital Cost/Acre Other[5]	**$0**	**$0**	**$0**	**$0**
49						

The Direct and Indirect Costs are each broken down into the following sections: Cover Material, Pullback or Backfill, Top/Outslope Adjustment Grading, Revegetation, Channels & Benches, Demolition, and Other. Demolition is not divided by location but is given as a total.

For example use only. Values may not match the current spreadsheet.

Results cont'd:

Remaining Sheets: The remaining sheets and data supporting the earthwork calculations described in this calculation documentation are described in the following calculation summaries:

- Equipment Optimization
- O&M
- Building Demo
- Bench Grading Unit Cost
- Bench Channel Unit Cost (and Riprap/Gravel Unit Cost)
- Downdrain Unit Cost
- Pipeline Unit Cost
- Revegetation Unit Cost
- Fuel Unit Cost

Fuel Cost

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	Task: Fuel Cost	Computed By: Fred Charles	Date: 2/19/2019
		Checked By: Taryn Tigges	Date: 2/19/2019

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes fuel price information as part of earthwork closure cost estimation associated with the Little Rock Mine Closure/Closeout Plan (CCP). A reliable estimate of the local 2021 fuel price is needed, based on local and national data for past years.

Objective:

1. Develop an equation to predict the estimated 2021 local fuel price for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.

Approach:

1. Identify existing data used for the calculation.
2. Correlate local and national data for fuel price, paired by year.
3. Estimate 2021 fuel price for use in the earthwork closure costs.

Data and Assumptions:

1. Data used for the calculations are shown below (1995-2018 as example) and include (a) U.S. No. 2 Diesel Retail Prices (annual national) and (b) FMI quotes (for specific dates within a year) for the local Silver City area. All prices are in $/gallon.

Fuel Price Data

Data 1: U.S. No 2 Diesel Retail Prices (Dollars per Gallon)

Date	U.S. No 2 Diesel Retail Prices[1]
1995	1.109
1996	1.235
1997	1.198
1998	1.044
1999	1.121
2000	1.491
2001	1.401
2002	1.319
2003	1.509
2004	1.81
2005	2.402
2006	2.705
2007	2.885
2008	3.803
2009	2.467
2010	2.992
2011	3.84
2012	3.968
2013	3.922
2014	3.825
2015	2.707
2016	2.304
2017	2.65
2018	3.178

Date	U.S. No 2 Diesel Retail Prices[1]
Jan 2019	2.98

FMI Fuel Quotes[2]

Site	Date	Dyed, low-sulfur diesel	Notes
Continental	1/21/2005	$1.40	Tom Shelley - quote from fuel broker
Chino & Tyrone	5/9/2007	$2.41	Porter Oil Quote (7500 gal capacity)
Continental	1/23/2009	$1.80	Porter Oil Quote (7500 gal capacity)
Tyrone (Little Rock)	1/14/2010	$2.49	Porter Oil Quote (7500 gal capacity)
Tyrone	7/7/2012	$3.13	Western Refining Oil
Continental	6/18/2014	$3.22	Western Refining Oil
Chino (North Lampbright)	11/5/2015	$1.74	Western Refining Oil
Chino	5/20/2016	$1.66	Western Refining Oil
Tyrone (Little Rock)	4/24/2017	$1.90	Western Refining Oil
Continental	3/12/2018	$2.75	Griffin Propane
Chino	10/10/2018	$2.75	Griffin Propane

1. U.S. Energy Information Administration http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

For example use only. Values may not match the current spreadsheet.

Data and Assumptions (continued):

2. The local FMI fuel quotes and annual national retail fuel (U.S. No. 2) prices are assumed to trend similarly – if the national prices increase the local prices also increase.
3. A correlation between national and local fuel prices is assumed to be a reasonable predictor of local fuel prices for any time period (e.g., annual, monthly, etc).

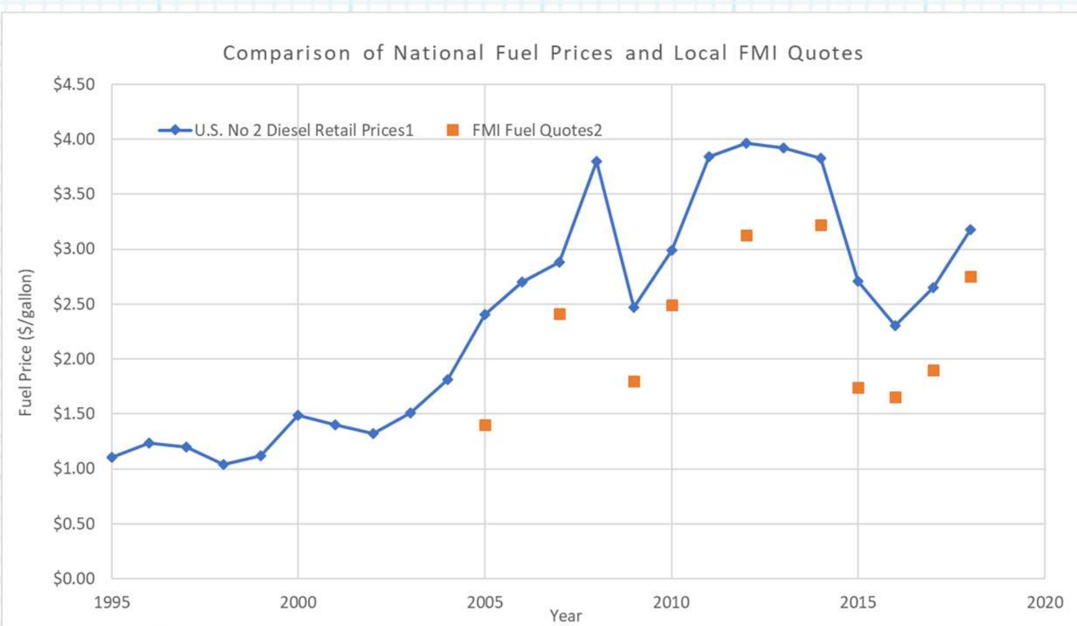
Calculations and Results:

1. The annual national retail fuel prices (U.S. Energy Information Administration) dataset is tabulated and plotted for comparison with the available annual local FMI fuel quotes (note that quotes are not available for blank years).

Year	U.S. No 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]
1995	1.109	
1996	1.235	
1997	1.198	
1998	1.044	
1999	1.121	
2000	1.491	
2001	1.401	
2002	1.319	
2003	1.509	
2004	1.81	
2005	2.402	$1.40
2006	2.705	

Year	U.S. No 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]
2007	2.885	$2.41
2008	3.803	
2009	2.467	$1.80
2010	2.992	$2.49
2011	3.84	
2012	3.968	$3.13
2013	3.922	
2014	3.825	$3.22
2015	2.707	$1.74
2016	2.304	$1.66
2017	2.65	$1.90
2018	3.178	$2.75

1. U.S. Energy Information Administration
http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)



For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

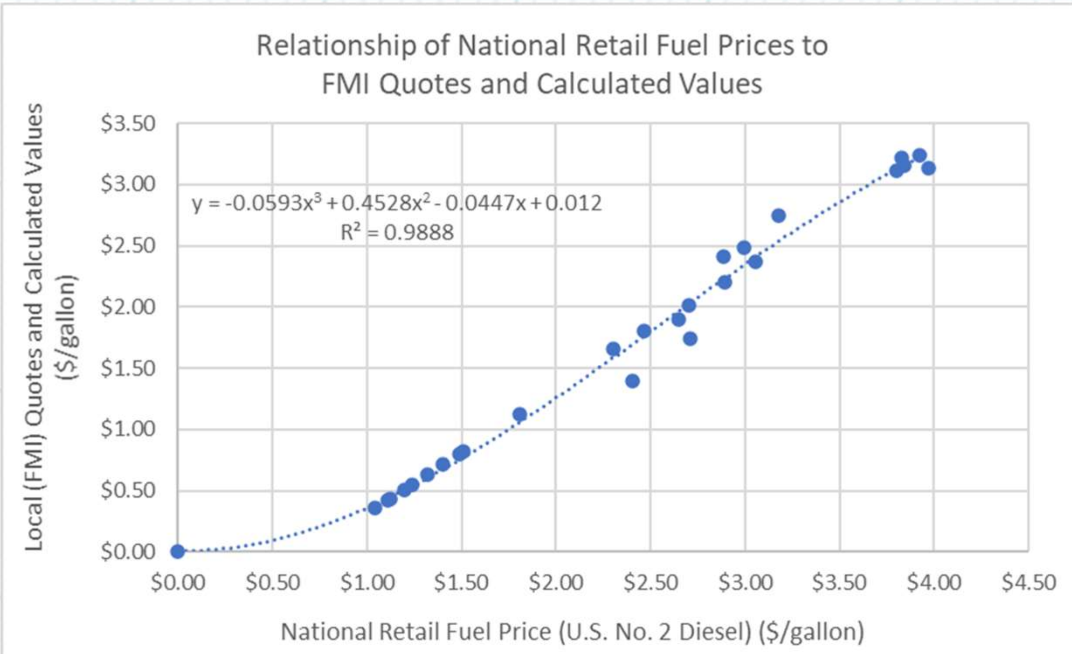
2. The annual national fuel retail prices are ranked from lowest to highest, and corresponding local FMI fuel quotes are listed for matching years in which they are available. (see Col. A and B, below)
3. The difference between the national fuel retail prices and FMI fuel quotes is calculated for each pairing. Note that FMI fuel quotes are all lower than the corresponding national fuel retail prices. The differences for all pairs are averaged. (Col. C)
4. For each year without an FMI quote, the average difference ($0.69) is subtracted from the national fuel retail prices. This results in a calculated FMI value for each unpaired data year. (Col. D)
5. The available FMI fuel quotes and calculated FMI values are combined into one column for a full listing of calculated FMI values and FMI quotes. (Col. E)
6. The annual national fuel retail prices (Col. A) are plotted vs FMI calculated values and quotes (Col. E), and a correlation is developed with national fuel prices as the independent variable and FMI values and quotes as the dependent (i.e., estimated) variable. (see Col. F and graph below)

A	B	C	D	E	F
U.S. No. 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]	Difference Between Retail Prices and FMI Quotes	Calculated FMI Values Based on Average Difference	Calculated FMI Values and Quotes	y = -0.0617x3 + 0.4659x2 - 0.0611x + 0.0148
$0.00				$0.00	$0.01
$1.11			$0.42	$0.42	$0.44
$1.24			$0.55	$0.55	$0.53
$1.20			$0.51	$0.51	$0.50
$1.04			$0.36	$0.36	$0.39
$1.12			$0.43	$0.43	$0.44
$1.49			$0.80	$0.80	$0.75
$1.40			$0.71	$0.71	$0.67
$1.32			$0.63	$0.63	$0.60
$1.51			$0.82	$0.82	$0.77
$1.81			$1.12	$1.12	$1.06
$2.40	$1.40	$1.00		$1.40	$1.70
$2.71			$2.02	$2.02	$2.04
$2.89	$2.41	$0.47		$2.41	$2.23
$3.80			$3.11	$3.11	$3.13
$2.47	$1.80	$0.67		$1.80	$1.77
$2.99	$2.49	$0.50		$2.49	$2.35
$3.84			$3.15	$3.15	$3.16
$3.97	$3.13	$0.84		$3.13	$3.25
$3.92			$3.23	$3.23	$3.22
$3.83	$3.22	$0.61		$3.22	$3.14
$2.71	$1.74	$0.97		$1.74	$2.04
$2.30	$1.66	$0.65		$1.66	$1.59
$2.65	$1.90	$0.75		$1.90	$1.98
$3.18	$2.75	$0.43		$2.75	$2.89
	Average	$0.69			

1. U.S. Energy Information Administration
http://tonto.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):



7. The prediction equation (and coefficient of determination, R^2) is shown in the above graph where x = national retail fuel price ($/gallon) and y = predicted local fuel price ($/gallon).
8. Based on this equation, and a national retail fuel price in December of 2020 of $2.59, the predicted local FMI fuel price for U.S. No. 2 diesel (December) is

$$Local\ fuel\ price = (-0.0593)(2.59)^3 + (0.4528)(2.59)^2 - (0.0447)(2.59) + 0.012 = \$1.90/gallon$$

Summary and Conclusions:

1. National and local (FMI) fuel price data were used to develop a strongly-correlated (R^2 = 0.9888) prediction equation by which local FMI fuel prices can be predicted from national fuel price data. Note that the relationship developed in this analysis applies only to FMI operations in the Silver City (Grant County), NM area.
2. The following prediction equation developed in these calculations can be used to predict the estimated December 2020 local fuel price for use in earthwork closure costs:

$$Local\ fuel\ price = -0.0593x^3 + 0.4528x^2 - 0.0447x + 0.012$$

where x = national retail fuel price ($/gallon) and y = predicted local fuel price ($/gallon)

For example use only. Values may not match the current spreadsheet.

Bench Grading Unit Cost

Calculation Documentation

Problem Statement:
Freeport-McMoRan (FMI) utilizes unit cost information for bench grading on side slopes of stockpiles and tailing ponds as part of earthwork closure cost estimation associated with the Little Rock Mine Closure/Closeout Plan (CCP). The unit costs need to account for the earthwork process and site-specific conditions, equipment productivity, equipment rental rates, and associated equipment maintenance, fuel costs, and labor rates.

This calculation set presents a summary of the approach and results for estimating the unit cost for bench grading. Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop a bench grading unit cost ($/ft) for stockpile side slopes and tailing pond side slopes for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Account for equipment and fuel costs in the estimate.

Approach:

1. The data, assumptions, calculations, and results for the bench grading unit cost estimate are presented within the Tyrone earthwork RCE spreadsheet file in a sheet (tab) named "Bench Grading_UC".
2. The approach for estimating bench grading unit costs is as follows:
   - Compile data and assumptions used in the calculations. Data obtained from the CCP or Scope of Work include:
     - Material factors
     - Grade factors
     - Soil weight
     - Production method/blade factors
     - Centroid to centroid push distance
     - Operator factor
     - Work hour
     - Visibility factor
     - Elevation factor
     - Transmission factor
     - Number of passes to finish grade
     - Speed
     - Volume

For example use only. Values may not match the current spreadsheet.

Approach:

- Equipment costs are referenced from the Equipment Sheet
- Estimate the unit cost for bench grading on sides slopes of the stockpiles and tailing ponds. The unit cost for bench grading operations is calculated based on two construction steps: excavate and final grade.
    - Productivity in cy/hr is calculated for excavation using the following equation:

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

    - Productivity in hrs/ft is calculated for finish grade by using the following equation:

$$Productivity\ (hrs/ft) = \left(Operator * Material * Grade\ Factor * \frac{Work\ Hour\ (min/hr)}{60\ (min/hr)} * \frac{2300\ \left(\frac{lbs}{cy}\right)}{Material\ Weight\ \left(\frac{lbs}{cy}\right)} * Prod.\ Method * Visibility * Elev. * Drive\ Trans. * Speed\ (mi/hr) * 5280\ (ft/mi) * \frac{1}{\#\ Passes} \right)^{-1}$$

Results:

1. The results of the bench grading unit cost calculations are shown below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.

Bench Grading Unit Cost

Bench Grading - Stockpiles

Task Description	Equipment	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)		
Excavate	Cat D11T CD	$1.43	$0.35		
Finish Grade	Cat D6T XL, SU Blade	$0.09	$0.02		
		$1.52	$0.37	**$1.89**	**Total**

Bench Grading -Tailings

Task Description	Equipment	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)		
Excavate	Cat D11T CD	$1.43	$0.35		
Finish Grade	Cat D6T XL, SU Blade	$0.09	$0.02		
		$1.52	$0.37	**$1.89**	**Total**

For example use only. Values may not match the current spreadsheet.

Bench Channel Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes bench channel unit cost information as part of earthwork closure cost estimation associated with the Little Rock Mine Closure/Closeout Plan (CCP). The unit cost for bench channel construction (including production and placement of riprap and filter material) needs to account for the earthwork process and site-specific conditions, equipment productivity, equipment rental rates, and associated equipment maintenance, fuel costs, and labor rates.

Objectives:

1. Develop a bench channel unit cost ($/ft) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the bench channel unit cost estimate are presented within the Tyrone earthwork RCE spreadsheet file in sheets (tabs) named "Bench Channel_UC" and "Riprap_Gravel_UC".
2. The approach for the calculations is as follows:
   - Estimate the unit cost for each of the five following bench channel construction steps:
     - Earthwork excavate and waste
     - Load and transfer riprap and filter
     - Haul riprap and filter
     - Place riprap and filter
     - Finish grade channel and riprap
   - Estimate the cost to produce riprap and filter where these materials are obtained.
   - Combine equipment and fuel costs for the bench channel operations and riprap and filter production for a total bench channel unit cost.

For example use only. Values may not match the current spreadsheet.

Data and Assumptions:

1. Bench channel cross-section data and earthwork quantities are defined in the reclamation design, with additional calculations presented below in Calculations and Results. Basic channel dimensions are shown in Table 1.

Table 1

BENCH CHANNELS		
Dimensions:		
Left Side Slope:	3.00	H:1V
Left Side Slope:	2.50	H:1V
Depth:	2.00	ft
Left Side Slope Length:	3.61	
Right Side Slope Length:	3.20	
Bottom Width:	5.00	ft
Left Anchor	0.00	ft
Right Anchor	0.00	ft
Perimeter:	11.81	ft
Excavation Area:	21.00	sf
Filter Area[1] (cross-sectional)	5.90	sf or cf/ft [2]
Riprap Area (cross-sectional)	11.81	sf or cf/ft

1. Bench cross width* 6" filter thickness
2. Volume (cy) =Area(sf)*Length(ft)/27

2. Equipment and fuel cost information used for bench channel unit cost calculations is developed in the Equipment sheet of the separate Earthwork RCE spreadsheet (summary) calculation set.
3. Equipment rates from Equipment Watch include overhaul labor, parts, and time, and are corrected for a 50-minute work hour.
4. Other equipment parameters used in the calculations are assigned based on previous use at other FMI New Mexico operations.
5. The work day is set at 8 hours/day, 50 minutes/hour.
6. The following assumptions/data inputs apply to riprap and filter production:
    - For riprap and filter production, the primary plant is fed directly by two 769D haul trucks, 300 to 400 yd haul.
    - 400 tons input/hr (per Rusty McCauley, equipment peak production is 900 tons/hr).
    - 30% - 60% waste depending on smallest rip rap size used. (per Rusty McCauley, consistent w/ McCain Springs waste rate of 43% - 1" minus).
    - 3650 lb/cy (Caterpillar Performance Handbook p. 27-4, consistent with 1.8 tons/cy riprap unit weight).

Data and Assumptions (continued):

7. Key assumptions/data inputs for riprap and filter production equipment and labor are shown in Table 2.

Table 2

Equipment & Labor	Rate ($/hr)	Comment
One 988H Loader with Operator (bucket = 8.3 cy)	$ 156.46	Used to load stockpiled material to 769D trucks and 777 haul trucks
Three 769D haul trucks with drivers (22 cy, 36 ton payload each)	$ 396.83	Option: Two used to directly feed primary screening plant, one used to move material from end of conveyor
One 1 Deck Portable Screening Plant w/ 5x16 screen & 48"x60' conveyor + 1 Operator	$ 63.68	Primary screening plant, grizzly used to split oversized, 6" - 12" and 6" minus (2 conveyers) One operator required in tower to run screening plant
		One operator required in tower to run screening plant
One 3 Deck Portable Screening Plant w/ 5x16 screen & 42"x60' conveyor + 1 Operator	$ 64.25	Fed with 6" minus, Produce 6" - 6", 1.5" - 3", 3/8" - 1.5", 3/8 minus One operator required in tower to run screening plant
Two Cat 980H Loaders with Operator (bucket = 7.5 cy)	$ 210.53	Used move material to conveyors or load trucks
Zero Cat 992K Loaders with Operator (bucket = 16 cy)	$ -	Unused loader option
One Cat 966H Loader with Operator (bucket = 5.5 cy)	$ 100.81	Used to move material from end of conveyors & load trucks
One Water Truck with Driver (10,000 gal)	$ 91.96	Dust suppression
One Foreman	$ 23.84	

For example use only. Values may not match the current spreadsheet.

Calculations and Results:

The unit costs for each of the five following bench channel construction steps are developed:

- Earthwork excavate and waste
- Load and transfer riprap and filter
- Haul riprap and filter
- Place riprap and filter
- Finish grade channel and riprap

1. Excavate and waste (earthwork) operations comprise the first construction step (shown in "Bench Channel_UC" sheet). The unit cost is calculated based on both operations using a Cat D11T CD, U Blade dozer. Table 3 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations. This table is followed by the calculations (or assigned parameters) for the "Excavate" row.

Table 3

	B	C	D	E	F	G	H	I	J
5		Task Description	Equipment	Volume (cy/ft)	Productivity (cy/hr)	Material Factor[2]	Grade Factor[2]	Material Weight[2] (lb/cy)	Production Method/ Blade Factor[2]
6	Bench Channels	Excavate	Cat D11T CD, U Blade	0.78	1123	1.20	1.0	2900	1.00
7	Bench Channels	Waste	Cat D11T CD, U Blade	0.78	1001	1.20	1.0	2900	1.00

	B	C	K	L	M	N	O	P	Q
5		Task Description	Centroid to Centroid Push Distance[2] (feet)	Normal Production (cy/hr)	Operator Factor[2]	Work Hour[2] (min/hr)	Visibility Factor[2]	Elevation Factor[2]	Transmission Factor[2]
6	Bench Channels	Excavate	175	1851	0.75	50	1.00	1.00	1.00
7	Bench Channels	Waste	200	1649	0.75	50	1.00	1.00	1.00

	B	C	R	S	T	U	V	W	X	Y
5		Task Description	Productivity (hrs/ft)	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost (IV) ($/hr)	Dozer Cost ($/hr)	Bench Equipment Cost ($/ft)	Bench Fuel Cost ($/ft)	Total $/ft
6	Bench Channels	Excavate	0.0007	69.62	254.44	27.41	281.85	0.20	0.05	
7	Bench Channels	Waste	0.0008	69.62	254.44	27.41	281.85	0.22	0.05	
8								0.41	0.10	$ 0.52

The following parameters used in the calculations are based on previous use at other FMI New Mexico operations – also see Equipment sheet in the separate Earthwork RCE (summary) spreadsheet calculation set: Material Factor (Col. G), Grade Factor (Col. H), Material Weight (Col. I), Production Method/Blade Factor (Col. J), Centroid to Centroid Push Distance (Col. K), Operator Factor (Col. M), Work Hour (Col. N), Visibility Factor (Col. O), Elevation Factor (Col. P), and Transmission Factor (Col. Q).

Calculations and Results (continued):

1. Excavate and waste (earthwork) calculations (continued)

$$Volume(Col.E) = \frac{(Excav\ Area, sf\ [Bench\ channel, Table\ 1])}{(27\ cf/cy)} = \frac{21.00\ sf}{27\ cf/cy} = 0.78\ cy/ft$$

$$Productivity(Col.F) = \text{Col.}\,L\ x\ M\ x\ G\ x\left(\frac{N}{60}\right)x\ H\ x\left(\frac{2300}{I}\right)x\ J\ x\ O\ x\ P\ x\ Q =$$

$$1851\frac{cy}{hr}\ x\ 0.75\ x\ 1.20\ x\ \left(\frac{50\ min/hr}{60\ min}\right)x\ 1.0\ x\frac{2300\ lb/cy}{2900\ lb/cy}\ x\ 1.00\ x\ 1.00\ x\ 1.00\ x\ 1.00 =$$

1123 cy/hr

$Normal\ Production\ (Col.L){:}\ If\ Centroid\ to\ Centroid\ Push\ Distance\ is\ not\ 0,$
$then, for\ the\ equipment\ used, look\ up\ the\ production\ curve\ fit\ parameters\ C\ and\ b$
$for\ equation{:}\ C\ x\ (Average\ dozing\ distance\ [ft])^b = 162{,}758.76\ x\ (175\ ft)^{-0.86691} =$
1851 cy/hr

$$Productivity(Col.R) = \frac{\left(Volume, \frac{cy}{ft}[Col.E]\right)}{\left(Productivity, \frac{cy}{hr}[Col.F]\right)}$$ = (0.78 cy/ft)/(1123 cy/hr) =

0.00069 hr/ft (or 0.0007 hr/ft)

$Fuel\ Cost\ (Col.S), Equipment\ Cost(Col.T), and\ Operator\ (IV)\ Cost\ (Col.U)\ are\ from$
$Equipment\ cost\ calcs\ (presented\ in\ the\ Earthwork\ RCE\ spreadsheet\ calculation\ set).$

$$Dozer\ Cost\ (Col.\ V) = \frac{\$254.44}{hr}(equipment) + \frac{\$27.41}{hr}(operator) = \frac{\$281.85}{hr}$$

$Bench\ equipment\ cost\ (Col.W) =$
$\left(Dozer\ cost, \frac{\$}{hr}[Col.V]\right)x\left(Productivity, \frac{hr}{ft}[Col.R]\right)$ = ($281.85/hr) x (0.00069 hr/ft) =
$0.20/ft

$Bench\ Fuel\ Cost\ (Col.\ X) =$
$\left(Fuel\ cost, \frac{\$}{hr}[Col.S]\right)x\left(Productivity, \frac{hr}{ft}[Col.R]\right)$ = ($69.62/hr) x (0.00069 hr/ft) =
$0.05/ft

The total unit cost for the earthwork (excavate and waste) = $0.52/ft

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

2. Load riprap and filter, and transfer for placing, unit cost is calculated based on the following separate operations (see “Riprap_Gravel_UC” sheet): load riprap, load filter, transfer riprap for placing, and transfer filter for placing. A Cat 992K is used for these operations. Table 4 (split into 2 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations. This table is followed by the calculations (or assigned parameters) for the “Load Riprap” row.

Table 4

	B	C	D	E	F	G	H	I	J
4	Earthwork								
5	Loading per cy								
6	Task Description	Equipment		Load, Dump, Maneuver Time (min)	Work Time (min)	Loads/ hr	Net Bucket (cy/load)	Production Rate (cy/hr)	Fuel Use Gal per Hour
7	Load riprap	Cat 992K		0.65	50	76.92	14.00	1076.92	25.63
8	Load filter	Cat 992K		0.65	50	76.92	14.00	1076.92	25.63
9	Transfer riprap for placing	Cat 992K		0.65	50	76.92	14.00	1076.92	25.63
10	Transfer filter for placing	Cat 992K		0.65	50	76.92	14.00	1076.92	25.63

	B	K	L	M	N	O	P	Q
4	Earthwork							
5	Loading per cy							
6	Task Description	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost ($/hr)	Loader+Oper Cost ($/hr)	Load+Op Cost ($/cy)	Fuel Cost ($/cy)	Total Cost ($/cy)
7	Load riprap	59.97	216.23	27.70	243.93	0.23	0.06	0.28
8	Load filter	59.97	216.23	27.70	243.93	0.23	0.06	0.28
9	Transfer riprap for placing	59.97	216.23	27.70	243.93	0.23	0.06	0.28
10	Transfer filter for placing	59.97	216.23	27.70	243.93	0.23	0.06	0.28

The following parameters used in the calculations are developed in the Equipment sheet as described for the separate Earthwork RCE (summary) spreadsheet calculation set: Load, Dump, Maneuver Time (min) (Col. E); Net Bucket (cy/load) (Col. H); Fuel Use Gal per Hour (Col. J); Fuel Cost ($/hr) (Col. K); Equipment Cost ($/hr) (Col. L); and Operator Cost ($/hr) (Col. M).

Calculations and Results (continued):

2. Load/transfer riprap and filter (continued)

Work Time (Col. F) = 50 min per hour

Loads/hr (Col. G) = (Col. F)/(Col. E) = 50/0.65 = 76.92 loads/hr

Production Rate (cy/hr) (Col. I) = (Col. H) x (Col. G) = 14.00 x 76.92 = 1076.92 cy/hr

Loader + Operator Cost/hr (Col. N) = Equipment Cost (Col. L) + Operator Cost (Col. M) = $216.23/hr + $27.70/hr = $243.93/hr

Loader + Operator Cost/cy (Col. O) = [Loader Cost, $/hr (Col. N)]/[Production Rate, cy/hr (Col. I)] = ($243.93/hr)/(1076.92 cy/hr) = $0.23/cy

Fuel Cost/cy (Col. P) = [Fuel Cost/hr (Col. K)]/[Production Rate, cy/hr (Col. I)] = ($59.97/hr)/(1076.92 cy/hr) = $0.06/cy

The total unit cost for the loading and transferring (for placing) riprap and filter = total for equipment + total for fuel = $0.23/ft + $0.06/ft = $0.28/ft (difference due to rounding)

Calculations and Results (continued):

3. Haul riprap and filter unit cost is calculated based on the following separate operations (see "Riprap_Gravel_UC" sheet): haul riprap and haul filter. A Komatsu 730E is used for these operations. Table 5 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations. This table is followed by the calculations (or assigned parameters) for the "Haul Riprap" row.

Table 5

	B	C	D	E	F	G	H	I	J
12									
13	Hauling								
14	Task Description	Equipment		Exchange Time (min)	Delivery Travel Time[1] (min)	Unload and Maneuver Time (min)	Return Travel Time[1] (min)	Load Time (min)	Total Time (min)
15	Haul riprap from source to site	Komatsu 730E		0.70	8.62	1.10	3.47	6.73	20.62
16	Haul filter from source to site	Komatsu 730E		0.70	8.62	1.10	3.47	6.73	20.62

	B	K	L	M	N	O	P
12							
13	Hauling						
14	Task Description	Work Time (min)	Loads/ hr	Heaped Capacity (cy/load)	Production Rate (cy/hr)	Fuel Use Gal per Hour	Fuel Cost ($/hr)
15	Haul riprap from source to site	50	2.42	145	352	33.48	78.34
16	Haul filter from source to site	50	2.42	145	352	33.48	78.34

	B	Q	R	S	T	U	V
12							
13	Hauling						
14	Task Description	Equipment Cost ($/hr)	Operator Cost ($/hr)	Truck+Op Cost ($/hr)	Truck + Op Cost ($/cy)	Fuel Cost ($/cy)	Total Cost ($/cy)
15	Haul riprap from source to site	221.79	24.27	246.06	0.70	0.22	0.92
16	Haul filter from source to site	221.79	24.27	246.06	0.70	0.22	0.92

The following parameters used in the calculations are developed in the Equipment sheet as described for the separate Earthwork RCE (summary) spreadsheet calculation set: Exchange Time (min) (Col. E); Unload and Maneuver Time (min) (Col. G); Heaped Capacity (cy/load) (Col. M); Fuel Use Gal per Hour (Col. O); Fuel Cost ($/hr) (Col. P); Equipment Cost ($/hr) (Col. Q); and Operator Cost ($/hr) (Col. R).

Delivery Travel Time (Col. F) and Return Travel Time (Col. H) are based on site-wide average borrow haul time.

Calculations and Results (continued):

3. Haul riprap and filter (continued)

Load Time (Col. I)
= Dump, Maneuver Time (Col. E in load/transfer riprap)
x [Heaped Capacity, cy/load (Col. M)]/[Net Bucket, cy/load (Col. H in load/transfer riprap)]
= 0.65 min x (145 cy/load)/(14.00 cy/load) = 6.73 min

Total Time (Col. J) = Exchange Time (Col. E) + Delivery Travel Time (Col. F) + Unload and Maneuver Time (Col. G) + Return Travel Time (Col. H) + Load Time (Col. I)
= 0.70 + 8.62 + 1.10 + 3.47 + 6.73 = 20.62 min

Work Time (Col. K) = 50 min per hour

Loads/hr (Col. L) = [Work Time (Col. K)]/[Total Time (Col. J)] = 50/20.62 = 2.42 loads/hr

Production Rate, cy/hr (Col. N) = [Heaped Capacity, cy/load (Col. M)] x [Loads/hr (Col. L)]
= (145 cy/load) x (2.42 loads/hr) = 352 cy/hr

Truck + Operator Cost/hr (Col. S) = Equipment Cost (Col. Q) + Operator Cost (Col. R)
= $221.79/hr + $24.27/hr = $246.06/hr

Truck + Operator Cost/cy (Col. T) = [Truck + Operator Cost, $/hr (Col. S)]/[Production Rate, cy/hr (Col. N)] = ($246.06/hr)/(352 cy/hr) = $0.70/cy

Fuel Cost/cy (Col. U) = [Fuel Cost/hr (Col. P)]/[Production Rate, cy/hr (Col. N)]
= ($78.34/hr)/(352 cy/hr) = $0.22/cy

The total unit cost for the hauling riprap and filter = total for equipment + total for fuel = $0.70/ft + $0.22/ft = $0.92/ft

Calculations and Results (continued):

4. Place riprap and filter unit cost is calculated based on the following separate operations (see “Riprap_Gravel_UC” sheet): place riprap and place filter. A Cat 725 is used for these operations. The sequence of calculations for the place riprap and filter unit cost is the same as for haul riprap and filter (from source to site) calculations, above. Inputs to the calculations for placing riprap and filter are generally the same except that Cat 725 operating parameters and costs are used. Delivery and return travel times are calculated based on the haul distance and the Haul Travel Time polynomial equation (see Equipment sheet) that calculates minutes/meter based on effective grade.

   Table 6 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations.

   Table 6

	B	C	D	E	F	G	H	I
19	Placing							
20	Task Description	Equipment	Distance	Grade	Exchange Time (min)	Delivery Travel Time (min)	Unload and Maneuver Time (min)	Return Travel Time (min)
21	Place riprap	Cat 725	400.00	-30%	0.70	3.25	1.10	0.74
22	Place filter	Cat 725	400.00	-30%	0.70	3.25	1.10	0.74

	B	J	K	L	M	N	O	P
19	Placing							
20	Task Description	Load Time (min)	Total Time (min)	Work Time (min)	Loads/ hr	Heaped Capacity (cy/load)	Production Rate (cy/hr)	Fuel Use Gal per Hour
21	Place riprap	0.87	6.67	50	7.50	19	141.01	6.02
22	Place filter	0.87	6.67	50	7.50	19	141.01	6.02

	B	Q	R	S	T	U	V	W
19	Placing							
20	Task Description	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost ($/hr)	Truck + Op Cost ($/hr)	Truck+Op Cost ($/cy)	Fuel Cost ($/cy)	Total Cost ($/cy)
21	Place riprap	14.09	73.11	24.27	97.38	0.69	0.10	0.79
22	Place filter	14.09	73.11	24.27	97.38	0.69	0.10	0.79
23								

Calculations and Results (continued):

5. Finish grade unit cost is calculated based on the following separate operations (see “Riprap_Gravel_UC” sheet): finish grade channel and finish grade riprap. A Cat D6T, SU Blade is used for these operations. The sequence of calculations for the finish grade unit cost is the same as for the first operation for bench channel construction – earthwork (excavate and waste) (see those calculations, above, for details). Inputs to the finish grade channel and finish grade riprap calculations are generally the same with the following exceptions:
   - Cat D6T, SU Blade operating parameters and costs are used.
   - Material Factor (Col. E) and Material Weight (Col. G) for riprap are used, which are different than for the excavate and waste, and channel grading, materials.

   Table 7 (split into 3 segments due to many columns) shows the progression of the calculations to estimate the cost for these operations.

   Table 7

	B	C	D	E	F	G	H	I
24								
25	Grading							
26	Task Description	Equipment	Productivity (cy/hr)	Material Factor	Grade Factor	Soil Weight (lb/cy)	Production Method/Blade Factor	Centroid to Centroid Push Distance (ft)
27	Finish grade -filter	Cat D6T, SU Blade	304.38	1.0	1.02	3500	1.0	50
28	Finish grade - Riprap	Cat D6T, SU Blade	230.34	0.8	1.02	3700	1.0	50

	B	J	K	L	M	N	O
24							
25	Grading						
26	Task Description	Normal Production (cy/hr)	Operator Factor	Work Time (min)	Visibility Factor[2]	Elevation Factor	Transmission Factor
27	Finish grade -filter	727	1	50	1	1.00	1.00
28	Finish grade - Riprap	727	1	50	1	1.00	1.00

	B	P	Q	R	S	T	U	V
24								
25	Grading							
26	Task Description	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost (IV) ($/hr)	Dozer +Op Cost ($/hr)	Dozer + Op Cost ($/cy)	Fuel Cost ($/cy)	Total Cost ($/cy)
27	Finish grade -filter	16.8948	63.65	27.41	91.06	0.30	0.06	0.35
28	Finish grade - Riprap	16.8948	63.65	27.41	91.06	0.40	0.07	0.47

Calculations and Results (continued):

6. Riprap and filter production costs (where the material source is located) are estimated according to Table 8, with a summary of the calculations provided after Table 8.

Table 8

	B	C	D	E	F	G	H	I
36	Equipment	Equipment Cost	Fuel Cost	# Equipment	Operator	# Operator	Total Equipment Cost	Total Fuel Cost
37		($/hr)	($/hr)		($/hr)		($/hr)	($/hr)
38	Cat 988H	$ 128.76	$ 35.57	1	$ 27.70	1	$ 156.46	$ 35.57
39	Cat 769D	$ 108.01	$ 22.79	3	$ 24.27	3	$ 396.83	$ 68.37
40	1 Deck Screening Plant (5X16, 48X60)	$ 40.59	$ 11.35	1	$ 23.09	1	$ 63.68	$ 11.35
41	3 Deck Screening Plant (5X16, 42X60)	$ 41.16	$ 11.35	1	$ 23.09	1	$ 64.25	$ 11.35
42	Cat 980H	$ 77.56	$ 25.27	2	$ 27.70	2	$ 210.53	$ 50.54
43	Cat 992K	$ 216.23	$ 59.97	0	$ 27.70	0	$ -	$ -
44	Cat 966H	$ 73.11	$ 19.61	1	$ 27.70	1	$ 100.81	$ 19.61
45	Off-Hwy Water Tanker Truck,6,000-gal.	$ 67.69	$ 26.33	1	$ 24.27	1	$ 91.96	$ 26.33
46	Supervisor	$ -	-	0	$ 23.84	1	$ 23.84	$ -
47								
48					Direct Cost	Equipment	Fuel	
49						$ 1,108	$ 223	$/hr
50						8	8	hr/work day
51						$ 8,867	$ 1,785	$/day
52								
53					Production			
54						400	tons input/hr (total)	
55						0.30	% waste	
56						0.70	% rip rap and gravel/filter	
57						280	tons produced/hr (net)	
58						560,000	lb/hr	
59						3,650	lb/cy	
60						153	cy/hr	
61						8	hr/day (net (60 min/hr))	
62						1,227	cy/day net production	
63								
64					Production	$ 7.22	$ 1.45	$/cy
65					Filter Delivery and placement	$ 2.14	$ 0.49	$/cy
66					Rip Rap Delivery and placement	$ 2.24	$ 0.51	$/cy
67								

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

6. Riprap and filter production calculations (continued):

For each type of equipment used, the costs calculated (see Earthwork RCE spreadsheet calculation set) are tabulated in Table 8, including Equipment Cost (Col. C), Fuel Cost (Col. D), and Operator Cost (Col. F).

The number of pieces of equipment (Col. E) and number of operators (Col. G) are assigned based on the logistical requirements for production. Pieces of equipment match the number of operators, except for addition of a Supervisor.

Total equipment cost (Col. H) is calculated as follows, with an example calculation shown for the Cat 988H:

$$Total\ Equipment\ Cost, \$/hr =$$
$$\{(Equip\ Cost\ [Col. C])\ x\ (\#\ Equipment\ [Col. E])\} +$$
$$\{(Operator\ Cost\ [Col. F])\ x\ (\#\ Operator\ [Col. G])\} =$$
$$\{(\$128.76)x(1)\} + \{(\$27.70)x(1)\} = \$156.46/hr$$

Total fuel cost (Col. I) is calculated as follows, with an example calculation shown for the Cat 988H:

$$Total\ Fuel\ Cost, \$/hr = \{(Fuel\ Cost\ [Col. D])\ x\ (\#\ Equipment\ [Col. E])\} =$$
$$\{(\$35.57)x(1)\} = \$35.57/hr$$

The daily cost is calculated for all equipment by summing the total equipment cost (Cell G56) and total fuel cost (Cell H56), as follows:

$$Daily\ Total\ Equipment\ Cost, \frac{\$}{day} = \left(Sum\ for\ all\ equipment, \frac{\$}{hr}\right) x \left(8\frac{hr}{day}\right) =$$
$$\left(\frac{\$1{,}108}{hr}\right) x \left(8\frac{hr}{day}\right) = \frac{\$8{,}867}{day}$$

$$Daily\ Total\ Fuel\ Cost, \frac{\$}{day} = \left(Sum\ for\ all\ fuel, \frac{\$}{hr}\right) x \left(8\frac{hr}{day}\right) =$$
$$\left(\frac{\$223}{hr}\right) x \left(8\frac{hr}{day}\right) = \frac{\$1{,}785}{day}$$

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

6. Riprap and filter production calculations (continued):

Next, the production calculations are summarized (see Rows 54-62 in Table 8). Daily net production is calculated via the following sequence:

- 400 tons input/hr (total) – see production assumptions
- 30% waste – see production assumptions
- 70 % riprap and gravel/filter = 100 minus % waste
- 280 tons produced/hr (net) = (400 tons input/hr) x (70%)
- 560,000 lb/hr = (280 tons) x (2,000 lb/ton)
- 3,650 lb/cy – see production assumptions
- 153 cy/hr = (560,000 lb/hr)/(3,650 lb/cy)
- 8 hr/day (net [60 min/hr]) – see production assumptions
- 1,227 cy/day net production = (153 cy/hr) x (8 hr/day)

The total cost for production (see Row 64 in Table 8) is calculated separately for equipment and fuel as follows:

- Equipment portion of the cost = ($8,867/day)/(1,227 cy/day) = $7.22/cy
- Fuel portion of the cost = ($1,785/day)/(1,227 cy/day) = $1.45/cy
- This yields a total cost of $8.67/cy

Summary and Conclusions:

These calculations achieve the objective to develop an estimated bench channel unit cost for the earthwork RCE, as summarized below for production of filter and riprap, and delivery and placement of filter and riprap.

The cost for production of filter and riprap $7.22/cy (equipment + operator) + $1.45/cy (fuel) = $8.68/cy (difference due to rounding).

The cost for filter delivery and placement is the sum of the calculations presented above, for loading, hauling, placing, and final grading, for a total of $2.14/cy (equipment + operator) + $0.49/cy (fuel) = $2.63/cy

Similarly, the cost for riprap delivery and placement is the sum of the calculations above, for a total of $2.24/cy (equipment + operator) + $0.51/cy (fuel) = $2.75/cy

The total cost ($/ft) for bench channel construction, including the initial earthwork (excavate and waste) along with riprap placed at 0.44 cy/ft and filter placed at 0.22 cy/ft, for combined equipment/operator and fuel costs, is:

$0.52/ft (excavate and waste) + $2.47/ft (filter) + $5.00/ft (riprap) = $7.99/ft

Downdrain/ Dissipater Unit Cost

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes downdrain/dissipater unit cost information as part of earthwork closure cost estimation associated with the Little Rock Mine Closure/Closeout Plan (CCP). Downdrains are constructed on regraded side slopes of rock stockpiles to convey runoff. Dissipaters are constructed as needed at the bottom end (downslope) of specific downdrains to dissipate the energy of the downdrain runoff flow. The unit cost needs to account for excavation/preparation of the subgrade, material and placement costs to install articulated concrete blocks (ACBs) in the downdrains and dissipaters, and installation of a concrete cutoff wall at the downslope end of each dissipater.

Objective:

1. Develop unit costs for downdrains ($/ft) and dissipaters ($/each) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the downdrain/dissipater unit cost estimate are presented within the Tyrone earthwork RCE spreadsheet file.
2. The approach for the calculations is as follows:
   - Identify locations and lengths required for downdrains. Use reclamation design drawings and quantities.
   - Identify excavation equipment and estimate cost to complete the rough grade where the downdrains and dissipaters will be constructed. Use equipment cost information and calculations as also developed for other earthwork operations in the overall earthwork cost estimate.
   - Estimate cost to finish grade and place ACBs in downdrains and dissipaters. Use available unit costs from Contech Engineered Solutions (Contech ES), the manufacturer and installer of ACBs in the area.
   - Estimate cost to install cast-in-place concrete cutoff wall at downslope end of dissipaters. Use online RS Means data.

For example use only. Values may not match the current spreadsheet.

Data and Assumptions (continued):

1. Attachment A presents the following key quantity data used to develop unit costs (note that Attachment A also includes the calculations and results presented in this calculation set):
   - Downdrain base excavation area = 52 square feet/foot of length (sf/ft)
   - Downdrain ACB area coverage = 31 sf/ft
   - Dissipater area (middle [Area 2]) = 320 sf
   - Dissipater area (each side [Area 1 = Area 3]) = 253 sf
   - Cutoff wall concrete volume (each dissipater) = 14 cubic yards
2. Unit cost data from Contech ES (February 2019, see Attachment A) include the following:
   - Material costs for ACBs (includes non-woven geotextile and microgrid/geogrid) are as follows:
     - $7.42/sf (Block Class 40T, for the channel of each downdrain and both side areas of each dissipater)
     - $10.65/sf (Block Class 70T, for the center area of each dissipater)
   - Installation cost is $4.63/sf, which covers the following installation process for both sizes of ACBs: off-load the truck and place delivered ACBs in temporary storage area, fine grade base/subgrade soils, compact soils to 90% Standard Proctor (D698), place and secure filter fabric (non-woven geotextile), place 4- to 6-inch drainage layer overlaid by geogrid, place ACBs in final configuration, grout seams, and backfill ACBs with crushed stone. The installation cost includes crushed stone.
3. Cost data from RS Means for installation of a concrete cutoff wall at the downslope end of each dissipater are presented in Attachment A. The online RS Means cost is $254.97/cubic yard.

Calculations and Results:

1. The estimated cost to excavate the rough grade (where the downdrains will be constructed) is developed in the same manner as excavation costs prepared for bench channel unit costs. Therefore, see the bench channel unit cost calculation set for details. The downdrain rough grade cost = $0.83/ft.
2. The estimated cost to install ACBs in downdrains includes the finish grade and subsequent placement of ACBs. This estimated cost is developed from the Contech ES quotes (as listed above in Data and Assumptions), as follows:
   - Downdrain material cost for 40T ACBs is $7.42/sf
   - Downdrain installation cost for 40T ACBs is $4.63/sf
   - The cost per ft of downdrain ($/ft) = ($7.42/sf + $4.63/sf) x (31 sf/ft) = $12.05/sf x 31 sf/ft = $373.55/ft

$$\boldsymbol{Total\ downdrain\ installation\ cost\ (after\ rough\ grading) = \$373.55/ft}$$

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

3. Similarly, the estimated cost to install ACBs in dissipaters includes the finish grade and subsequent placement of ACBs. This estimated cost is developed from the Contech ES quotes (as listed above in Data and Assumptions), as follows:

    - Dissipater material cost for 40T ACBs is $7.42/sf
    - Dissipater material cost for 70T ACBs is $10.65/sf
    - Dissipater installation cost for 40T and 70T ACBs is $4.63/sf
    - For each dissipater, 40T ACBs cover 506 sf and 70T ACBs cover 320 sf
    - The cost for the 40T part of each downdrain ($/each) =
      ($7.42/sf + $4.63/sf) x (506 sf) = $12.05/sf x 506 sf = $6,097.30/each
    - The cost for the 70T part of each downdrain ($/each) =
      ($10.65/sf + $4.63/sf) x (320 sf) = $15.28/sf x 320 sf = $4,889.60/each
    - The total cost for ACBs in each dissipater = $6,097.30 + $4,889.60 = $10,986.90

4. The estimated cost for installing a cast-in-place concrete cutoff wall at the downslope end of each dissipater is based on on-line cost data from RS Means and the required concrete volume:

    - Cast-in-place concrete cutoff wall (RS Means) cost = $254.97/cubic yard
    - Each dissipater requires cutoff wall concrete volume of 14 cubic yard
    - The total cost for cutoff wall installation at each dissipater =
      ($254.97/cubic yard) x (14 cubic yard) = $3,569.58

$$\boldsymbol{Total\ dissipater\ installation\ cost\ (after\ rough\ grading) =}$$

$10,986.90 + $3,569.58 = $14,556.48

Summary and Conclusions:

1. Unit costs for installing downdrains ($/ft) and dissipaters ($/each) were developed for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Note that the estimated unit cost developed in this analysis applies only to FMI operations in the Silver City (Grant County), NM area.
2. Downdrain cost = $0.83/ft (rough grading) + $373.55/ft (after rough grading) = **$374.38/ft**
3. Dissipater cost **=** $10,986.90/each (rough grading is included in downdrain cost) + $3,569.58/each (cutoff wall) = **$14,556.48/each**

Downdrain Unit Cost

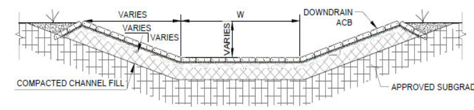
Rough Grade

Task Description	Equipment	Productivity (cy/hr)	Material Factor	Grade Factor	Soil Weight (lb/cy)	Production Method/Blade Factor	Centroid to Centroid Push Distance (ft)	Normal Production (cy/hr)	Operator Factor	Work Hour (min/hr)	Visibility Factor	Elevation Factor	Transmission Factor	Volume (cy/ft)	Productivity (hrs/ft)	Fuel Cost ($/hr)	Equipment Cost ($/hr)	Operator Cost (IV) ($/hr)	Dozer Cost ($/hr)	Equipment w/o Fuel Cost ($/ft)	Fuel Cost ($/ft)	Total Excavation Cost ($/ft)
Excavate	Cat D11T CD	1731	1.2	1.6	2900	1.0	175	1851	0.75	50	1.0	1.0	1.0	1.9	0.0011	$69.62	$254.44	$27.41	$281.85	$0.31	$0.08	$0.39
Waste	Cat D11T CD	1542	1.2	1.6	2900	1.0	200	1649	0.75	50	1.0	1.0	1.0	1.9	0.0012	$69.62	$254.44	$27.41	$281.85	$0.35	$0.09	$0.44
								.												$0.67	$0.16	$0.83

Finish Grade & Place ACB

	Area (sf/ft)	Unit Cost ($/sf)	$/ft
Downdrain ACBs			
40T[1]	31	$7.42	$230.02
Installation[1]	31	$4.63	$143.53
		ACB Cost/ft	**$373.55**

Total Downdrain Cost ($/ft)	**$374.38**



N.T.S. AU 022A TYPICAL DOWNDRAIN SECTION

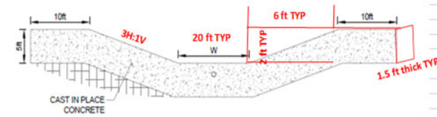
Place ACB

Dissipater ACBs	Area (sf)	Unit Cost ($/sf)	$/sf
70T[1]	320	$10.65	$3,408.00
Installation[1]	320	$4.63	$1,481.60
40T[1]	506	$7.42	$3,754.52
Installation[1]	506	$4.63	$2,342.78
		ACB Cost per Dissipater	**$10,986.90**

Install Cutoff Wall

Cutoff Wall (cast in place concrete)	cubic yard	$/cubic yard	$/dissipater[2]
RSMeans (2019)	14	$ 254.97	**$3,569.58**

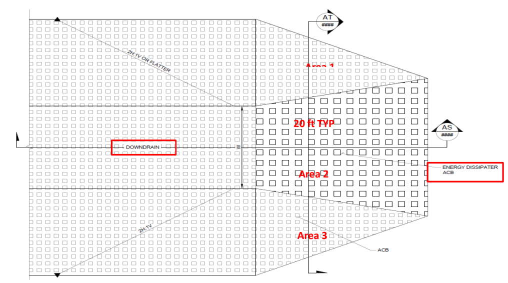
Total Dissipator Cost ($/each)	**$14,556.48**



N.T.S. AX 022A TYPICAL CUTTOFF WALL SECTION

DOWNDRAIN Dimensions:		
Left Side Slope:	3	H:1V
Left Side Slope:	3	H:1V
Depth:	2	ft
Perimeter:	31	ft
Excavation Area:	52	sf
ACB Area:	31	sf

DISSIPATERS	ACB				Cutoff Wall[3]		
	Surface Area 1	Surface Area 2	Surface Area 3	Total	Cross-Sectional Area	Thickness	Volume
	(sf)	(sf)	(sf)	(sf)	(sf)	(ft)	(cy)
	253	320	253	825	260	1.5	14



N.T.S. 8 022A TYPICAL TOE ENERGY DISSIPATOR PLAN DETAIL

1. Quote from Contech ES 2018; Downdrain ACB installation includes fine grade base/subgrade soils (assuming subgrade at + 0.5 ft); equipment is D6 LGP dozer with Power Angle Tilt Blade (PAT) and GPS Blade Control
2. One cutoff wall per dissipator
3. Typical flow depth is 2'; concrete depth is 5' (diagram is not drawn to scale); concrete thickness is 1.5'

Fred Charles

From: Fawcett, Clayton <CFawcett@conteches.com>
Sent: Tuesday, February 5, 2019 9:25 AM
To: Fred Charles
Subject: RE: confirm or update costs for ACBs (reply requested by end of day Monday Feb 4, if possible)

Fred,

Hello and good morning. I hope this message finds you doing well. I made it back in to the office this morning and saw your e-mails.

Material and installation costs we discussed in September are still good. Please feel free to use those to complete your estimate.

Regarding your questions:

1. Yes, installation costs are the same for both downchutes and dissipator basins.
2. Yes, installation cost does include crushed stone infill (purchase and install)

Regarding your follow up e-mail with questions pertaining to cut-off walls.

1. Cut-off walls are not always required, however they are a good idea. The use of cut-off walls has increased in the last five years and as such, they are now recommended for inclusion at dissipator basins.
2. Material and installation costs for the installation of a cut-off wall are not included in the costs previously discussed and should be added.

I hope this information helps. Feel free to contact me directly with any additional questions.

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager - West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Fred Charles [mailto:fcharles@telesto-inc.com]
Sent: Sunday, February 3, 2019 3:28 PM
To: Fawcett, Clayton <CFawcett@conteches.com>
Subject: confirm or update costs for ACBs (reply requested by end of day Monday Feb 4, if possible)

Hi Clayton. This email is a follow up to our email correspondence in September 2018 regarding material and installation costs for articulated concrete blocks (ACBs) used for downdrains at Chino. We've been using the cost info you passed along to me at that time. Now, I need you to confirm those costs or update them. We will use this information in a reclamation cost estimate (financial assurance for closure bonding) which we are currently finalizing for Chino and other mines in that area.

Costs
As we had discussed, the material costs for ACBs (includes non-woven geotextile and microgrid/geogrid) are as follows:

- $7.42/square foot (Block Class 40T, for the channel of each downdrain)

- $10.65/square foot (Block Class 70T, for the dissipation basin at bottom of each downdrain)

Also, you quoted $4.63/square foot for installation costs, which covers the following installation process: off-load the truck and place delivered ACBs in temporary storage area, fine grade base/subgrade soils, compact soils to 90% Standard Proctor (D698), place and secure filter fabric (non-woven geotextile), place 4-6" drainage layer overlaid by geogrid, place ACBs in final configuration, grout seams, and backfill ACBs with crushed stone.

2 questions

In addition to you confirming or updating the material and installation costs, I have two questions: (1) Is the installation cost ($4.63/square foot) the same for both channel downdrains and dissipation basins? (2) Does the installation or material cost include the crushed stone used to backfill the ACBs?

Please create a new email to me with updated unit costs or reply to this email to confirm what I show is still correct. I will present what you provide for documentation in the cost estimate we submit to the state agencies.

Thanks,

Fred Charles, Ph.D., P.E. Senior Engineer
Office: 970-484-7704, Ext 120 Cell: 720-318-5021
3801 Automation Way, Suite 201, Fort Collins, CO 80525
fcharles@telesto-inc.com

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Truck and Scraper Optimization

Calculation Documentation

Problem Statement:
Freeport-McMoRan's (FMI's) Chino Mines Company utilizes truck optimization information to develop the most efficient proportions of equipment as part of earthwork closure cost estimation associated with the Little Rock Mine Closure/Closeout Plan (CCP). Optimization needs to account for the time required and associated costs for truck loading and hauling operations.

Objectives:

1. Develop optimization calculations to determine the most efficient number of trucks (2 to 9 and a calculated maximum) per loader or shovel for loading cover material at borrow stockpiles.
2. Note that this calculation set presents the approach and calculations and results for optimizing equipment for earthwork. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, calculations, and results for the optimization calculations are presented within the Tyrone earthwork RCE spreadsheet file in sheet (tab) named "18 Truck Optimization".
2. Truck optimization is calculated for each cover material source and destination based on
   - The truck cycle time for 1 roundtrip between a cover material source and destination and the maximum number of trucks per loader/shovel.
   - For X number of trucks (2 to 9 and a calculated maximum), the productivity, task time, cost of using X trucks per loader, the optimum number of trucks per loader/shovel, and the maximum number of trucks per loader/shovel.

TELESTO SOLUTIONS • INCORPORATED

Job No: 200540a
Client: Freeport NM Operations

Task: Truck Optimization
Computed By: Fred Charles
Date: 2/28/2019

Checked By: Taryn Tigges
Date: 3/14/2019

Calculations and Results:

1. The truck optimization calculations are set up as shown in Table 1, which is a snapshot of a row of data/calculations in the "18 Truck Optimization" sheet. Table 1 is shown in 6 parts due to the many columns in the spreadsheet. Key calculation steps are listed after Table 1, with referencing to the Column identifier in Table 1 (and the spreadsheet).

Table 1

	E	F	G	H	I	J	K	L
13								
14	ID	Task Description	Source Location 1	Destination Location 2	Equipment	Work Hour (min/hr)	Loader/Shovel Cycles per Truck	Loader/Shovel Cycle Time (min)
299	1200-D-b-Tk4	Haul-Cover	Upper South	West Stockpile	Komatsu 730E	50	5	0.45

	M	N	O	P	Q	R	S	T	U
13									
14	Loader/Shovel Time Per Truck (min)	Truck Cycle Time Per Truck (min)	Trucks Per Loader/ Shovel	Loader/ Shovel Type	Loader/ Shovel Cost ($/hr)	Loader Net Bucket Capacity (cy)	Haul Volume (cy)	Max Trucks Round Up	Max Trucks Round Down
299	2.25	22.7	10.1	Sh1	$ 535.68	27.4	3,031,924	3,317	3,016

	V	W	X	Y	Z	AA	AB	AC
13	Productivity for X Trucks (cy/hr)							
14	9	8	7	6	5	4	3	2
299	2,714	2,412	2,111	1,809	1,508	1,206	905	603

	AD	AE	AF	AG	AH	AI	AJ	AK	AL	AM
13	Task Time for X Trucks (hr)									
14	Max Trucks Round Up	Max Trucks Round Down	9	8	7	6	5	4	3	2
299	914.0	1,005.4	1,117.2	1,256.8	1,436.4	1,675.7	2,010.9	2,513.6	3,351.5	5,027.2

	AN	AO	AP	AQ	AR	AS	AT	AU
13			Cost of Using X Trucks per Loader ($					
14	Loader/ Shovel Task Time (hr)	Truck Cost ($/hr)	Max Trucks Round Up	Max Trucks Round Down	9	8	7	6
299	995.9	$ 246.06	$ 3,229,021	$ 3,012,613	$ 3,072,458	$ 3,147,264	$ 3,243,442	$ 3,371,681

	AV	AW	AX	AY	AZ	BA	BB
13	$)						
14	5	4	3	2	Lowest Cost ($)	Optimum Number of Trucks Per Loader/ Shovel	Optimum Number of Trucks Per Loader/ Shovel Within Max
299	$ 3,551,215	$ 3,820,515	$ 4,269,350	$ 5,167,019	$ 3,012,613	10	10

For example use only. Values may not match the current spreadsheet.

Calculations and Results:

1. Truck optimization (continued)

- Calculate the number of loader/shovel (or referred to as loader) cycles to load a truck and the loading time required per truck (Columns K, L, and M) – this calculation uses data from the "9 Trucks" and "10 Shovel" sheets.

Loader Time Per Truck (Col. M) =
[Loader Cycles per Truck (Col. K)] x [Loader Cycle Time, min (Col. L)]
= (5 cycles/truck) x (0.45 min/cycle) = 2.25 min/truck

- Using the truck cycle time for 1 roundtrip between a cover material source and destination (data from the "9 Trucks" sheet), calculate the maximum number of trucks per loader/shovel.

Max Number Trucks Per Loader (Col. O) = [Truck Cycle Time, min (Col. N)]/[Loader Time, min/truck (Col. M)]
= (22.7 min)/(2.25 loader min/truck) = 10.1 trucks/loader

- Calculate the productivity (cy/hr) for X number of trucks (2 to 9 and a calculated maximum).

For X=6 trucks, Productivity, cy/hr (Col. Y) =
(X) x Work Hour, min/hr (Col. J) x Loader Cycles/Truck (Col. K) x [Loader Net Bucket Capacity, cy (Col. R)]/[Truck Cycle Time Per Truck, min (Col. N)]
= [6 x (50 min/hr) x (5 loader cycles/truck) x (27.4 cy/loader cycle)]/(22.7 min/truck cycle) = 1,809 cy/hr

- Using the productivity and total volume of cover material to be hauled, calculate the task time for X trucks (2 to 9).

For X=6 trucks, Task Time, hr (Col. AI) =
[Haul Volume, cy (Col. S)]/[Productivity, cy/hr (Col. Y)]
= (3,031,924 cy)/(1,809 cy/hr) = 1,676 hr

Calculations and Results (continued):

1. Truck optimization (continued):

- Calculate the cost of using X trucks per loader (2 to 9 and a calculated maximum) using data for loader/shovel task time in "9 Trucks" (for each cover material source and destination), loader/shovel cost ($/hr), truck cost ($/hr), and task time for the number of trucks.

For X=6 trucks, Cost of Using X Trucks per Loader, $ (Col. AU) =
[Max of Task Time for Trucks (Col AI) or Loader/Shovel Task Time (Col. AN)] x
{(Loader Cost, $/hr (Col. Q) + [(X) x (Truck Cost, $/hr (Col. AO)]}
= (1,675.7 hr) x {($535.68/hr + [6 x $246.06/hr]} = $3,371,681

- The optimum number of trucks per loader is the lowest cost number of trucks per loader/shovel. This optimum number is compared with the maximum number of trucks per loader/shovel, to ensure the optimum number is within the maximum.

For this row of data, the optimum number of trucks per loader = 10, which is the same within the max.

For example use only. Values may not match the current spreadsheet.

Building Demolition Cost

Calculation Documentation

Problem Statement:
Freeport-McMoRan (FMI) utilizes cost information for demolition of buildings (including storage tanks) as part of earthwork closure cost estimation associated with the Little Rock Mine Closure/Closeout Plan (CCP). The demolition costs need to account for site-specific conditions including building dimensions and footprint areas which are used with available construction/earthwork unit rates to estimate the demolition cost.

This calculation set presents a summary of the approach and results for estimating the building demolition cost. Detailed information is presented in the Tyrone earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop a cost estimate for demolition of buildings (including storage tanks) for use in estimating earthwork closure costs at FMI’s mining operations in Grant County, NM.

Approach:

1. The data, assumptions, calculations, and results for the building demolition cost estimate are presented within the Tyrone earthwork RCE spreadsheet file in a series of sheets (tabs) that address building demolition, cover placement, revegetation, and removal/disposal of building waste materials requiring special handling. An additional tab presents a summary of the costs.
2. The approach for estimating building demolition costs is as follows:
   - Compile building and storage tank dimension/footprint area data and assumptions used in the calculations.
   - Estimate the cost for demolition to account for volume of structural materials, volume of cover material placement, area of revegetation, and tonnage of waste requiring special handling.

For example use only. Values may not match the current spreadsheet.

TELESTO SOLUTIONS INCORPORATED			
Job No: 200540A	Client: Freeport NM Operations	Page 2 of 2	
Task: Building Demolition Cost	Computed By: Fred Charles	Date: 2/27/2019	
	Checked By: Taryn Tigges	Date: 3/14/2019	

Results:

1. The results of the building demolition cost calculations are summarized below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.
2. The indirect costs are set at 30% of direct costs, based on an agreement between FMI and the agencies in January 2019. Indirect costs include but are not limited to mobilization and demobilization, contingencies, engineering redesign fees, contractor profit and overhead, project management, administrative expenses, etc.

DRAFT Facility Demolition Summary

			Current Value
DIRECT COSTS	Facility and Structure Removal		$666,916
	Cover		$24,132
	Ripping & Revegetation		$2,061
	Hazardouse Waste Removal		$2,534,217
	Subtotal, Direct Costs		**$3,227,325**
INDIRECT COSTS[1]	**Subtotal, Indirect Costs**	**30.0%**	**$968,198**
TOTAL COST			**$4,195,523**

For example use only. Values may not match the current spreadsheet.

Pipeline Demolition Unit Cost

TELESTO SOLUTIONS • INCORPORATED	Job No: 200540a	Client: Freeport NM Operations	Page 1 of 2
	Task: Pipeline Demolition Unit Cost	Computed By: Fred Charles	Date: 3/14/2019
		Checked By: Taryn Tigges	Date: 3/14/2019

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes unit cost information for pipeline demolition as part of earthwork closure cost estimation associated with the Little Rock Mine Closure/Closeout Plan (CCP). The unit costs need to account for site-specific conditions and pipeline information which are used with available construction/earthwork unit rates to estimate the pipeline demolition cost.

This calculation set presents a summary of the approach and results for estimating the unit cost for pipeline demolition (remove sludge/water, place cover). Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop a pipeline demolition unit cost ($/ft) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.

Approach:

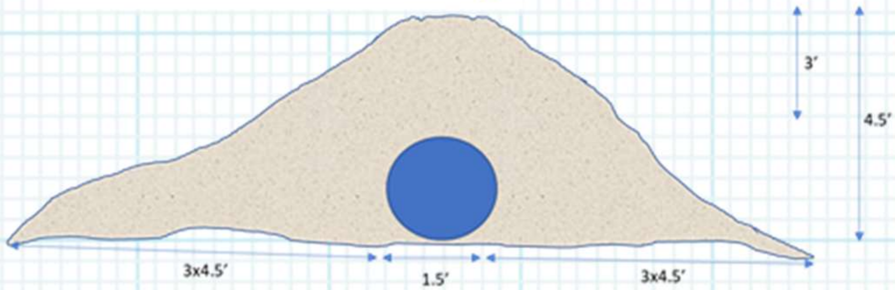
1. The data, assumptions, calculations, and results for the pipeline demolition unit cost estimate are presented within the Tyrone earthwork RCE spreadsheet fil in sheets (tabs) named "6"-8" Pipeline_UC", "18" Pipeline_UC", and 20"-36" Pipeline UC".
2. The approach for estimating the pipeline demolition unit cost is as follows:
    - Compile pipeline data and assumptions used in the calculations.
    - Identify a unit rate for pipeline sludge/water removal from available construction/earthwork data. For the required sludge/water removal, use a similar operation for storage tank sludge/water removal from R.S. Means Online to develop a pipeline cost ($/ft).
    - Estimate the volume of cover (cubic yard [cy]) required and cost to excavate, haul, and grade the cover material over the pipeline areas. Calculate a site-wide average unit cost ($/cy) to excavate, haul, and grade cover material.
    - Based on an assumed cover volume per foot of pipeline, calculate a weighted cost ($/ft) for all pipeline areas.

For example use only. Values may not match the current spreadsheet.

Approach:

- For the calculation shown below for an 18” pipe, 65 sf of cover per foot of pipeline is assumed based on 3 ft of cover over the pipeline with 3:1 side slopes:

$$3 \cdot 4.5\ ft \cdot 4.5\ ft + 3\ ft \cdot 1.5\ ft = 2.417\ \frac{yd^3}{ft}$$



- Calculate the total unit cost by adding the unit rate for sludge/water removal and the site-wide average cost to excavate, haul, and grade cover.

Results:

1. The results of the pipeline demolition unit cost calculations are shown below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.
   - The total unit cost for 18” pipeline demolition is $3.12/ft. Results for the other sizes are shown in the earthwork RCE spreadsheet..
   - The total unit cost for 18” pipeline demotion is the sum of the unit rate for removing sludge/water ($0.13/ft) and the calculated unit cost to cover the pipeline areas ($2.99/ft).

Revegetation Unit Cost

Calculation Documentation

Problem Statement:
Freeport-McMoRan (FMI) utilizes revegetation unit cost information as part of earthwork closure cost estimation associated with the Little Rock Mine Closure/Closeout Plan (CCP). The unit cost for revegetation needs to account for equipment rental rates and associated maintenance, fuel costs, and labor rates.

Objectives:

1. Develop a revegetation unit cost ($/acre) for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM.
2. Note that this calculation set presents the approach, data and assumptions, and calculations and results for developing the unit cost. It is intended to serve as a guide/example even if the actual quantities and/or cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Approach:

1. The data, assumptions, calculations, and results for the revegetation unit cost estimate are presented within the Tyrone earthwork RCE spreadsheet file.
2. The approach for the calculations is as follows:
   - Identify equipment types for scarifying, discing, drill seeding, mulching, crimping.
   - Obtain equipment information from EquipmentWatch (EQW) and RS Means, labor rates from NMDOL; revegetation material costs (seed, mulch) from FMI and/or their supplier; and the current fuel price from fuel cost calculations.
   - Determine the equipment traveling distance and time to cover 1 acre.
   - For each of the key operations, estimate the operating cost ($/hour).
   - Combine all operations and material costs, calculate the total unit cost.

Data and Assumptions:

1. Rental and operating cost information is accessed online from EQW for tractor (Deere 7340), ripper, and mulcher, and from RS Means for disc harrow (see Attachment A). Monthly rental rates are converted to hourly rates assuming 176 hours/month.
2. Equipment information is not available in EQW nor RS Means for drill seeding and crimping. Therefore, the drill seeder cost is assumed to be an average of the mulcher and disc (complexity is between the two, thus an average is assumed), and the crimper rental cost is assumed to be equal to the disc harrow (similar type of equipment).
3. Costs are included in the ripper and disc harrow (and drill seeder and crimper) to account for the ground engaging component (GEC) of these implements. The GEC cost for the ripper is applied to each of these other implements.
4. Local fuel price is developed from fuel cost calculations also prepared for earthwork closure cost estimates – the estimated 2019 fuel price is $2.34/gallon.
5. Revegetation material costs are from a quote by Rocky Mountain Reclamation, based on typical sources for seed and mulch (see Attachment A). The cost for seed is $210/acre and for mulch is $245/ton which, at 2 tons/acre, is $490/acre.

For example use only. Values may not match the current spreadsheet.

Data and Assumptions (continued):

6. Labor rates are from NMDOL (see Attachment A).
7. Equipment typical net coverage (width) is set at 12 feet, and equipment travel speed is set at 3 miles/hour (mph) for a 60-minute hour.

Calculations and Results:

1. The Deere 7340 tractor data, along with labor and fuel costs, are tabulated in the following table:

	B	C		D	E
5	**Tractor used for each operation is Deere 7430**	**Cost**		**Unit**	**Information or Calculation**
6	EQW base rate for tractor rental	$	5,210.05	$ per month	EQW for Deere 7430
7	EQW base rate for tractor rental	$	29.60	$ per hour	= ($/month)/176
8	EQW field labor rate per hour of operation	$	2.53	$ per hour	EQW for Deere 7430, which includes mechanic's wage of $23.09 (NMDOL, 2019)
9	EQW lube material cost	$	2.84	$ per hour	EQW for Deere 7430
10	EQW field parts cost	$	0.61	$ per hour	EQW for Deere 7430
11	EQW tire material cost	$	2.42	$ per hour	EQW for Deere 7430
12	EQW fuel burn rate		5.98	gallons per hour	EQW for Deere 7430
13	Local fuel cost	$	2.34	$ per gallon	Local quote
14	Fuel cost	$	13.99	$ per hour	= (EQW fuel burn rate) x (local fuel cost)
15	NM Department of labor equipment operator rate	$	24.27	$ per hour	NM Department of Labor (NMDOL)
16	**Total tractor cost**	**$**	**76.27**	**$ per hour**	**Sum of $ per hour costs shown in boxes**

Data in Rows 6 and 8-12 are from EQW, data in Row 8 also incorporates an NMDOL labor rate in the EQW cost, Row 13 is the estimated local fuel cost of $2.34/gallon, and Row 15 shows an NMDOL labor rate. Costs in other rows (7, 14, and 16) are calculated as follows:

$$EQW\ base\ rate\ for\ tractor\ rental = (\$5{,}210.05/\text{month})/(176\ \text{hours/month}) = \$29.60/\text{hour}$$

$$Fuel\ cost = (\text{EQW burn rate})\ \text{x}\ (\text{local fuel cost}) = (5.98\ \text{gallons/hour})\ \text{x}\ (\$2.34/\text{gallon}) = \$13.99/\text{hour}$$

$$Total\ tractor\ cost = \text{sum of rows } 7, 8, 9, 10, 11, 14, 15 =$$
$$29.60 + 2.53 + 2.84 + 0.61 + 2.42 + 13.99 + 24.27 = \$76.27/\text{hour}$$

2. Based on an equipment typical net width of 12 feet, and equipment net travel speed of 2.5 mph (3 mph x 50/60 to adjust for a 50-minute hour), each operation will travel a distance of 3,630 feet to cover 1 acre, and will require 0.275 hour to travel this distance (see calc steps in the table below). The resulting fuel cost is $3.85/acre.

	B	C	D	E
18	**Tractor coverage/rate of operation, fuel cost per acre**			
19	Tractor/equipment net width	12	feet	Assigned as a typical net width of coverage for each pass
20	Tractor/equipment travel speed	2.5	miles per hour	Assigned as approximate average speed of equipment (3 mph for 50 min/hr)
21	For 1 acre, total traveling distance	3630	feet per acre	= (43560 sf/ac)/(net width)
22	Time of travel over 1 acre	0.275	hour per acre	= [(traveling distance feet/acre)/(5280 ft/mile)]/(travel speed)
23	**Fuel cost per acre**	**$ 3.85**	**$ per acre**	**Already included in total tractor cost... Fuel cost/acre = (fuel cost/hour) x (travel time hour/acre)**

TELESTO SOLUTIONS • INCORPORATED			
Job No: 200540A	Client: Freeport NM Operations	Page 3 of 4	
Task: Revegetation Unit Cost	Computed By: Fred Charles	Date: 2/21/2019	
	Checked By: Taryn Tigges	Date: 3/14/2019	

Calculations and Results (continued):

3. Operating costs for each of the 5 revegetation operations are calculated as shown in the following table. Calculation equations are also noted in the table. Note the total cost for each operation includes fuel.

	B	C	D	E
25	**Operation**			
26	*Scarifying*			
27	Base rate for ripper rental	$ 898.90	per month	EQW Ripper, Miscellaneous MSR-189H, to 260 HP
28	Base rate for ripper rental	$ 5.11	$ per hour	= ($/month)/176
29	Lube labor rate per hour of operation	$ 0.57	$ per hour	EQW for ripper, incl mechanic's wage $23.09 (NMDOL, 2019)
30	Lube material cost	$ 0.15	$ per hour	EQW for ripper
31	Field parts cost	$ 0.16	$ per hour	EQW for ripper
32	Ground Engaging Component cost	$ 0.78	$ per hour	EQW for ripper
33	**Total cost with tractor+operator included**	**$ 83.03**	**per hour**	
35	*Discing*			
36	Disc harrow attachment, for tractor	$ 616.33	per month	RS Means 01 54 33 20 1500
37	Disc harrow attachment, for tractor	$ 3.50	per hour	= ($/month)/176
38	Ground Engaging Component (GEC) cost	$ 0.78	$ per hour	Assume similar to GEC cost for ripper (EQW)
39	**Total cost with tractor+operator included**	**$ 80.55**	**per hour**	
41	*Drill seeding (assume similar to discing)*			
42	Disc harrow attachment, for tractor	$ 616.33	per month	RS Means 01 54 33 20 1500
43	Disc harrow attachment, for tractor	$ 3.50	per hour	= ($/month)/176
44	Ground Engaging Component cost	$ 0.78	$ per hour	Assume similar to GEC cost for ripper (EQW)
45	**Total cost with tractor+operator included**	**$ 80.55**	**per hour**	
47	*Mulching*			
48	Mulcher, diesel powered, trailer mounted	$ 2,167.95	per month	EQW for trailer mounted mulcher (Finn B260)
49	Mulcher, diesel powered, trailer mounted	$ 12.32	per hour	= ($/month)/176
50	Lube labor rate per hour of operation	$ 1.25	$ per hour	EQW for trailer mounted mulcher (Finn B260), incl mechanic's wage $23.09 (NMDOL, 2019)
51	Lube material cost	$ 1.60	$ per hour	EQW for trailer mounted mulcher (Finn B260)
52	Field parts cost	$ 0.15	$ per hour	EQW for trailer mounted mulcher (Finn B260)
53	Tire material cost	$ 0.60	$ per hour	EQW for trailer mounted mulcher (Finn B260)
54	Fuel burn rate	4.13	gallons per hour	EQW for trailer mounted mulcher (Finn B260)
55	Local fuel cost	$ 2.34	$ per gallon	Local quote
56	Fuel cost	$ 9.66	$ per hour	= (EQW fuel burn rate) x (local fuel cost)
57	NM Department of labor equipment operator rate	$ 24.27	$ per hour	NM Department of Labor (NMDOL)
58	**Total cost with tractor+operator included**	**$ 126.12**	**per hour**	
60	*Crimping (assume similar to discing)*			
61	Disc harrow attachment, for tractor	$ 616.33	per month	RS Means 01 54 33 20 1500
62	Disc harrow attachment, for tractor	$ 3.50	per hour	= ($/month)/176
63	Ground Engaging Component cost	$ 0.78	$ per hour	Assume similar to GEC cost for ripper (EQW)
64	**Total cost with tractor+operator included**	**$ 80.55**	**per hour**	
65	*Summary for operations*			

For example use only. Values may not match the current spreadsheet.

Calculations and Results (continued):

5. The hourly operating cost for each operation (includes fuel) is summed for a total cost of \$450.79/hour. The cost for each operations is as follows:
    - Scarifying = \$83.03/hour
    - Discing = \$80.55/hour
    - Drill seeding = \$80.55/hour
    - Mulching = \$126.12/hour
    - Crimping = \$80.55/hour

6. The total combined equipment operating cost with fuel (\$/acre) is then calculated based on the operating cost per hour and the time of travel over 1 acre, as follows:

$$Total\ combined\ operating\ cost = \left(\frac{\$450.79}{hour}\right) x \left(0.275\frac{hour}{acre}\right) = \$123.97/acre$$

7. Seed and mulch costs are added to the total combined operating cost (\$/acre) to calculate the total revegetation unit cost as follows:
    - Total combined operating cost = \$123.97/acre
    - Seed = \$210/acre
    - Mulch = \$490/acre

Total revegetation unit cost = Total combined operating cost + Seed + Mulch = \$123.97/acre + \$210/acre + \$490/acre = \$823.97/acre (\$824/acre)

Summary and Conclusions:

1. A revegetation unit cost was developed for use in estimating earthwork closure costs at FMI's mining operations in Grant County, NM. Note that the estimated unit cost developed in this analysis applies only to FMI operations in the Silver City (Grant County), NM area.
2. The total revegetation unit cost is \$824/acre.

For example use only. Values may not match the current spreadsheet.

EquipmentWatch

www.equipmentwatch.com

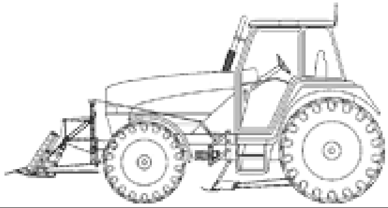
All prices shown in US$

Adjustments for MANDYLILLA27 in All Saved Models

January 17, 2019

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A



Configuration for 7430 (disc. 2011)

Power Mode **Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	$12.48/hr	$11.70/hr	-6.3%
Cost of Facilities Capital (CFC)	$3.12/hr	$2.43/hr	-22.1%
Overhead	$4.42/hr	$3.35/hr	-24.2%
Overhaul Labor	$6.46/hr	$1.92/hr	-70.3%
Overhaul Parts	$5.55/hr	$4.20/hr	-24.3%
Total Hourly Ownership Cost:	**$32.03/hr**	**$23.60/hr**	**-26.3%**

User Defined Adjustments: Annual Use Hours (1,030hrs -> 1,359hrs) Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	$8.51/hr	$2.53/hr	-70.3%
Field Parts	$4.86/hr	$0.61/hr	-87.4%
Ground Engaging Component (GEC)	$0.00/hr	-	-
Tire	$2.42/hr	-	-
Electrical/Fuel	$19.54/hr	$5.98/hr	-69.4%
Lube	$2.84/hr	-	-
Total Operating Ownership Cost:	**$38.17/hr**	**$14.38/hr**	**-62.3%**

User Defined Adjustments: Annual Field Repair Parts Cost ($4,174.20 -> $0.20) Diesel Cost (3.27 -> 1) Mechanics Wage ($58.84 -> $23.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	$32.03/hr	$23.60/hr	-26.3%
Hourly Operating Costs	$38.17/hr	$14.38/hr	-62.3%
Total Hourly Cost	**$70.20**	**$37.98/hr**	**-45.9%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	$20.02/hr	$17.48/hr	-12.7%
Idle	$51.57/hr	$29.58/hr	-42.6%

Revised Date: 1st Half 2019

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

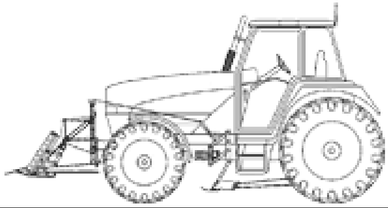
All prices shown in US$

Adjustments for MANDYLILLA27 in All Saved Models

January 17, 2019

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A



Configuration for 7430 (disc. 2011)

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	$3,891.00	$1,303.00	$463.00
Adjustments			
Region (New Mexico: 134%)	$1,319.05	$441.72	$156.96
User Defined			
Rental Rates (100%)	-	-	-
Total:	**$5,210.05**	**$1,744.72**	**$619.96**

Date Last Updated: Oct 01, 2018

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

EquipmentWatch™

www.equipmentwatch.com

All prices shown in US$

Custom Cost Evaluator

February 21, 2019

Miscellaneous MSR-189H
Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3,557 lbs.

Model Image

Configuration for MSR-189H

Engine Horsepower	**130 - 189**	Number of Shanks	**3**
Ripper Type	**Parallelogram**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	$2.64/hr	$2.50/hr	-5.3%
Cost of Facilities Capital (CFC)	$0.38/hr	$0.31/hr	-18.4%
Overhead	$0.66/hr	$0.52/hr	-21.2%
Overhaul Labor	$1.10/hr	$0.34/hr	-69.1%
Overhaul Parts	$0.95/hr	$0.75/hr	-21.1%
Total Hourly Ownership Cost:	**$5.73/hr**	**$4.42/hr**	**-22.9%**

User Defined Adjustments: Annual Use Hours (1,285hrs -> 1,629hrs) Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	$1.83/hr	$0.57/hr	-68.9%
Field Parts	$1.18/hr	$0.16/hr	-86.4%
Ground Engaging Component (GEC)	$0.99/hr	$0.78/hr	-21.2%
Tire	$0.00/hr	-	-
Electrical/Fuel	$0.00/hr	-	-
Lube	$0.15/hr	-	-
Total Operating Ownership Cost:	**$4.15/hr**	**$1.66/hr**	**-60%**

User Defined Adjustments: Annual Field Repair Parts Cost ($1,268.18 -> $0.18) Mechanics Wage ($58.84 -> $23.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	$5.73/hr	$4.42/hr	-22.9%
Hourly Operating Costs	$4.15/hr	$1.66/hr	-60%
Total Hourly Cost	**$9.88**	**$6.08/hr**	**-38.5%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	$3.68/hr	$3.33/hr	-9.5%
Idle	$5.73/hr	$4.42/hr	-22.9%

Revised Date: 1st Half 2019

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

EquipmentWatch

www.equipmentwatch.com

All prices shown in US$

Rental Rate Blue Book®

February 21, 2019

Miscellaneous MSR-189H
Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3,557 lbs.

Configuration for MSR-189H

Engine Horsepower	**130 - 189**	Number of Shanks	**3**
Ripper Type	**Parallelogram**		

Blue Book Rates

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	$1,010.00	$285.00	$71.00	$11.00	$4.15	$9.89
Adjustments						
Region (Las Cruces, New Mexico: 89%)	($111.10)	($31.35)	($7.81)	($1.21)		
Model Year (2019: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**$898.90**	**$253.65**	**$63.19**	**$9.79**	**$4.15**	**$9.26**

Non-Active Use Rates	**Hourly**
Standby Rate	$3.52
Idling Rate	$5.11

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	50%	$505.00/mo
Overhaul (ownership)	31%	$313.10/mo
CFC (ownership)	7%	$70.70/mo
Indirect (ownership)	12%	$121.20/mo

Fuel cost data is not available for these rates.

Revised Date: 1st Half 2019

These are the most accurate rates for the selected Revision Date(s). However, due to more frequent online updates, these rates may not match Rental Rate Blue Book Print. Visit the Cost Recovery Product Guide on our Help page for more information.

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EquipmentWatch

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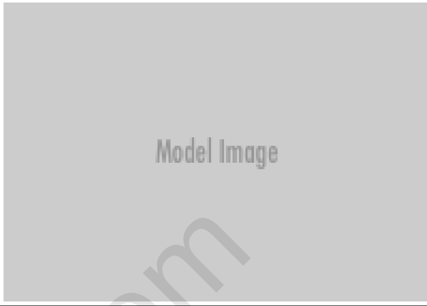
All prices shown in US$

Custom Cost Evaluator

February 21, 2019

Finn B260
Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4,880 lbs.



Configuration for B260

Power Mode	**Diesel**	Horsepower	**115**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	$5.80/hr	$5.45/hr	-6%
Cost of Facilities Capital (CFC)	$0.88/hr	$0.69/hr	-21.6%
Overhead	$1.18/hr	$0.90/hr	-23.7%
Overhaul Labor	$3.36/hr	$1.00/hr	-70.2%
Overhaul Parts	$2.54/hr	$1.92/hr	-24.4%
Total Hourly Ownership Cost:	**$13.76/hr**	**$9.96/hr**	**-27.6%**

User Defined Adjustments: Annual Use Hours (1,050hrs -> 1,388hrs) Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	$4.20/hr	$1.25/hr	-70.2%
Field Parts	$1.47/hr	$0.15/hr	-89.8%
Ground Engaging Component (GEC)	$0.00/hr	-	-
Tire	$0.60/hr	-	-
Electrical/Fuel	$13.50/hr	$4.13/hr	-69.4%
Lube	$1.60/hr	-	-
Total Operating Ownership Cost:	**$21.37/hr**	**$7.73/hr**	**-63.8%**

User Defined Adjustments: Annual Field Repair Parts Cost ($1,342.66 -> $0.66) Diesel Cost (3.27 -> 1) Mechanics Wage ($58.84 -> $23.09)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	$13.76/hr	$9.96/hr	-27.6%
Hourly Operating Costs	$21.37/hr	$7.73/hr	-63.8%
Total Hourly Cost	**$35.13**	**$17.69/hr**	**-49.6%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	$7.86/hr	$7.04/hr	-10.4%
Idle	$27.26/hr	$14.09/hr	-48.3%

Revised Date: 1st Half 2019

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Rental Rate Blue Book®

February 21, 2019

Finn B260
Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4,880 lbs.

Model Image

Configuration for B260

Power Mode	**Diesel**	Horsepower	**115**

Blue Book Rates

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	$2,425.00	$680.00	$170.00	$26.00	$21.35	$35.13
Adjustments						
Region (Las Cruces, New Mexico: 89.4%)	($257.05)	($72.08)	($18.02)	($2.76)		
Model Year (2019: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**$2,167.95**	**$607.92**	**$151.98**	**$23.24**	**$21.35**	**$33.67**

Non-Active Use Rates	**Hourly**
Standby Rate	$6.16
Idling Rate	$25.82

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	37%	$897.25/mo
Overhaul (ownership)	50%	$1,212.50/mo
CFC (ownership)	6%	$145.50/mo
Indirect (ownership)	7%	$169.75/mo
Fuel (operating) @ 3.27	63%	$13.50/hr

Revised Date: 1st Half 2019

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RS Means Online Data
Accessed February 13, 2019

Revegetation

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
015433201500	Rent disc harrow attchment for tractor, Excl. Hourly Oper. Cost.	Month	$ -	$ -	$ 616.33	$ 616.33	Year 2019	NEW MEXICO / LAS CRUCES (880)

Labor Rates

NMDOL Type A Operator Group	Base rate	Fringe rate	Apprenticeship		Total 2019 Rate ($/hr)
Equipment Operator IV	20.87	5.94	0.6	$	27.41
Equipment Operator V	20.98	5.94	0.6	$	27.52
Equipment Operator VI	21.16	5.94	0.6	$	27.70
Laborer I	16.86	5.63	0.6	$	23.09
Laborer II	17.61	5.63	0.6	$	23.84
Truck Driver III	16.15	7.52	0.60	$	24.27

Labor rates based on NM Department of Labor Type H (Heavy Engineering) 2019 labor rates. Rates include base hourly wage, fringe benefit, and apprenticeship contribution rates.

https://www.dws.state.nm.us/Portals/0/DM/LaborRelations/Prevailing_Wage_Poster_H_2019_final.pdf

Revegetation/Reclamation
Rangeland Rehabilitation
Landscaping / Fencing
Hydroseeding
Environmental Consulting

ROCKY MOUNTAIN RECLAMATION

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(307) 745-5230

ron@reveg.us
www.reveg.us

P.O. Box 1695
Laramie, WY 82073

FREEPORT MCMORAN – NEW MEXICO MINING OPERATIONS

PRICE ESTIMATES FOR REVEGETATION SERVICES FOR BUDGETING ESTIMATES

Table 1 –Freeport McMoRan, New Mexico Mining Operations – Price Estimates for Revegetation Services for Budgeting Estimates, prepared April, 2018.

	REVEGETATION OPERATION	ESTIMATED QUANTITY	UNITS	COST/UNIT ($)	TOTAL COST
I.	**OPERATIONS:**				
1	**SCARIFYING**	500	Acres	$30.00	$15,000.00
2	**DISCING**	500	Acres	$20.00	$10,000.00
3	**DRILL SEEDING (special Rangeland Drill)**	500	Acres	$80.00	$40,000.00
4	**MULCHING**	500	Acres	$148.00	$74,000.00
5	**CRIMPING**	500	Acres	$55.00	$27,500.00
6	**DAILY PER DIEM, ETC.**	50	Days	$385.00	$19,250.00
7	**MOBILIZATION**	1	Each	$13,500.00	$13,500.00
	Subtotal				**$199,250.00**
II.	**MATERIALS:**				
1	**SEED** at 8.9 PLS/acre	500	Acres	$210.00	$105,000.00
2	**HAY MULCH** - nox. weed free, native	1000	Tons	$245.00	$245,000.00
	Subtotal				**$350,000.00**
	TOTAL ESTIMATED REVEGETATION COST BEFORE TAX				**$549,250.00**
	Add New Mexico Gross Receipts Tax	5.9375	%		**$32,611.72**
	ESTIMATED REVEGETATION COST PER ACRE:			**$1,163.72**	
	TOTAL ESTIMATED REVEGETATION COST				**$581,861.72**

Estimate prepared by Ron Schreibeis, Rocky Mountain Reclamation, for use for Budgeting Estimates.

O&M Costs

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes cost information for operations and maintenance (O&M) as part of earthwork closure cost estimation associated with the Little Rock Mine Closure/Closeout Plan (CCP). The O&M costs need to account for vegetation maintenance costs for a 12-year period after completion of initial revegetation activities in each area, along with ongoing erosion control, road maintenance, and groundwater monitoring for a 100-year period. Tailing cover maintenance for areas reclaimed in the past will take place for the first 7 years of closure reclamation.

This calculation set presents a summary of the approach and results for estimating O&M costs. Detailed information is presented in the earthwork reclamation cost estimate (RCE) spreadsheet file.

This calculation set is intended to serve as a guide/example even if the actual cost data used in these calculations change due to updates or application to a different Freeport NM Operations mine.

Objective:

1. Develop the estimated O&M costs for vegetation maintenance for a 12-year period after completion of initial revegetation activities in each area, along with ongoing erosion control, road maintenance, and groundwater monitoring activities for a 100-year period. Also, develop tailing cover maintenance costs for previously reclaimed areas for the first 7 years of closure reclamation. The O&M costs are used as part of the earthwork RCE for FMI's mining operations in Grant County, NM.

Approach:

1. The data, assumptions, calculations, and results for the O&M cost estimate are presented within the Tyrone earthwork RCE spreadsheet file. Also, a summary of results is presented in the spreadsheet file.
2. The approach for estimating vegetation maintenance O&M costs is as follows:
   - For each facility (stockpile, tailing pond, reservoirs, etc), the total area is listed, along with approximate year of reclamation start, vegetation maintenance start, and vegetation maintenance complete. A 2% loss per year (i.e., 2% of vegetation fails each year) for 12 years is assumed to estimate the acreage requiring vegetation maintenance for each year.
   - Revegetation unit costs (equipment and fuel) are applied to the loss of acreage for each year to calculate the vegetation maintenance cost for each facility.

For example use only. Values may not match the current spreadsheet.

Approach (continued):

3. The approach for estimating erosion control, road maintenance, tailings cover maintenance, and groundwater monitoring ("Other") O&M costs is as follows:
   - For erosion control and road maintenance
     - Determine base costs ($/day) for equipment and fuel base. Also, estimate the number of days/yr for erosion control and road maintenance for three periods: Years 0-19, 20-39, and 40-99.
     - Calculate the annual equipment and fuel costs, based on days/yr, for the same three periods.
   - For tailing cover maintenance
     - Use erosion control equipment with reduced truck requirement and, therefore, reduced base cost. Assume 10 days/yr for Years 0-6, after which tailing cover maintenance is not required.
   - For groundwater monitoring
     - Determine base costs ($/day) for equipment and aqueous chemistry (lab analytical), and days/yr for groundwater monitoring for three periods: Years 0-19, 20-39, and 40-99.
     - Calculate the annual equipment and annual aqueous chemistry costs, based on days/yr, for the same three periods.
   - For these "Other" O&M activities
     - While reclamation is ongoing, adjust the O&M costs accordingly based on the proportion of reclamation completed as of each year. The full annual cost applies when reclamation is complete.
     - For years after reclamation is complete, assign the O&M costs for each year based on the annual costs calculated for Years 0-19, 20-39, and 40-99.

Results:

1. The vegetation maintenance and "Other" O&M costs are summed for all years, as shown in the summary table below (some of the final results may vary from what is shown). These results are used in the overall earthwork RCE.
2. The indirect costs are set at 17.5% of direct costs, based on an agreement between FMI and the agencies in January 2019. Indirect costs include but are not limited to mobilization and demobilization, contingencies, engineering redesign fees, contractor profit and overhead, project management, administrative expenses, etc.

DRAFT Operations and Maintenance Summary			
			Current Value
DIRECT COSTS	Facility and Structure Removal		$0
	Earthmoving		$0
	Vegetation		$1,328,888
	Other		$6,202,825
	Subtotal, Direct Costs		**$7,531,713**
INDIRECT COSTS[1]	**Subtotal, Indirect Costs**	**17.5%**	**$1,318,050**
TOTAL COST			**$8,849,763**

For example use only. Values may not match the current spreadsheet.

Stormwater Conveyance Channels

TELESTO SOLUTIONS INCORPORATED

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes a spreadsheet developed by the New Mexico Mining and Minerals Division (MMD) to estimate the earthwork's closure costs associated with the Closure/Closeout Plans (CCPs) for various New Mexico operations. Part of the CCP involves design and unit cost of channels to direct stormwater from stockpiles. Channel sizes are unknown and needed for estimating closure costs and complying with regulations.

Objectives:

1. Estimate the runoff potential for each contributing watershed to the reclamation channels under the 100-year, 24-hour storm event (i.e., design storm)
2. Verify that the channels created by typical cross sections can convey the design storm
3. Recommend areas of channel protection (riprap) and size based on a conceptual design

Approach:

1. Utilize NOAA Frequency precipitation website to determine the most current 100-yr, 24-hr storm event
2. Use the SCS TR-55 method to estimate total runoff from each basin and the peak flow to each conveyance channel or runoff scenario (stockpile top with no channel, top channels, bench channels, and downdrains)
3. Determine the "worst case" scenario/channels with the highest peak flows to determine the standard channel size needed for the entire site
4. Estimate the peak velocity and if > 5 fps, then size riprap using the US Army Corps (USACE) technique

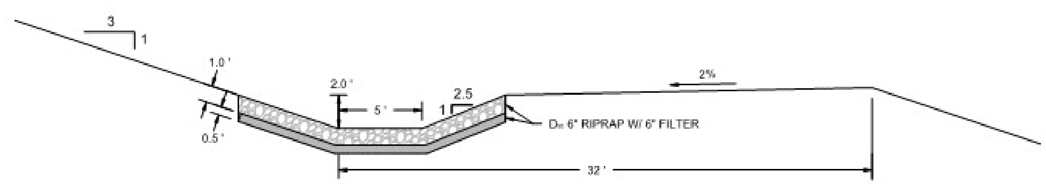
Data and Assumptions:

1. SCS Curve number of 80 and Manning's n=0.13 for disturbed mine areas (utilized throughout Freeport's mines as agreed to in various agency documents)
2. Assume peak flows from each drainage basin occur simultaneously
3. Manning's n for Articulate Concrete Block (ACB) is 0.025 (Contech)
4. Manning's n for riprap is 0.033 (Chow)
5. Analyze the basins that will produce the largest peak flow for riprap and ACB requirement.
6. NOAA Frequency precipitation 100-yr, 24-hr storm event depth is 3.74 inches.

Calculation Documentation

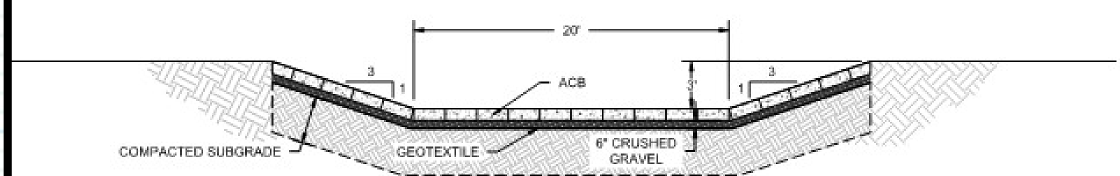
Data and Assumptions:

7. Bench channels are dimensioned as follows:

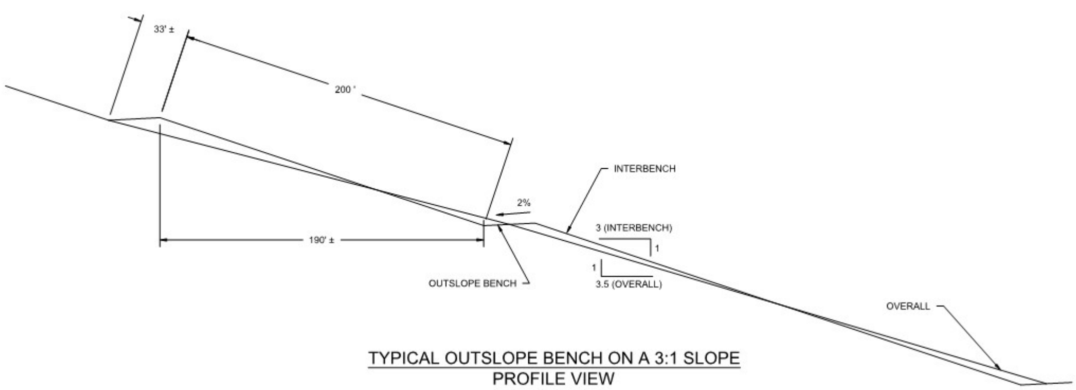


TYPICAL BENCH CHANNEL CROSS SECTION
SECTION VIEW

8. Downdrains are dimensioned as follows:



TYPICAL DOWNDRAIN
SECTION VIEW



TYPICAL OUTSLOPE BENCH ON A 3:1 SLOPE
PROFILE VIEW

9. When used, top channels have historically had a base width between 5-10 ft and varying side slopes.
10. Typical channel dimensions should be verified for each project site.

Calculation Documentation

Data and Assumptions:

11. Calculate total and peak runoff using SCS TR-55. Add together the travel times for sheet flow and shallow concentrated flow, where applicable. Use a minimum Tc of 0.1 hr.

Equations for sheet flow:

SCS runoff curve number method

The SCS Runoff Curve Number (CN) method is described in detail in NEH-4 (SCS 1985). The SCS runoff equation is

$$Q = \frac{(P - I_a)^2}{(P - I_a) + S} \quad \text{[eq. 2-1]}$$

where

Q = runoff (in)
P = rainfall (in)
S = potential maximum retention after runoff begins (in) and
I_a = initial abstraction (in)

Initial abstraction (I_a) is all losses before runoff begins. It includes water retained in surface depressions, water intercepted by vegetation, evaporation, and infiltration. I_a is highly variable but generally is correlated with soil and cover parameters. Through studies of many small agricultural watersheds, I_a was found to be approximated by the following empirical equation:

$$I_a = 0.2S \quad \text{[eq. 2-2]}$$

By removing I_a as an independent parameter, this approximation allows use of a combination of S and P to produce a unique runoff amount. Substituting equation 2-2 into equation 2-1 gives:

$$Q = \frac{(P - 0.2S)^2}{(P + 0.8S)} \quad \text{[eq. 2-3]}$$

S is related to the soil and cover conditions of the watershed through the CN. CN has a range of 0 to 100, and S is related to CN by:

$$S = \frac{1000}{CN} - 10 \quad \text{[eq. 2-4]}$$

Figure 2-1 and table 2-1 solve equations 2-3 and 2-4 for a range of CN's and rainfall.

For sheet flow of less than 300 feet, use Manning's kinematic solution (Overtop and Meadows 1976) to compute T_t:

$$T_t = \frac{0.007(nL)^{0.8}}{(P_2)^{0.5} s^{0.4}} \quad \text{[eq. 3-3]}$$

where:

T_t = travel time (hr),
n = Manning's roughness coefficient (table 3-1)
L = flow length (ft)
P_2 = 2-year, 24-hour rainfall (in)
s = slope of hydraulic grade line (land slope, ft/ft)

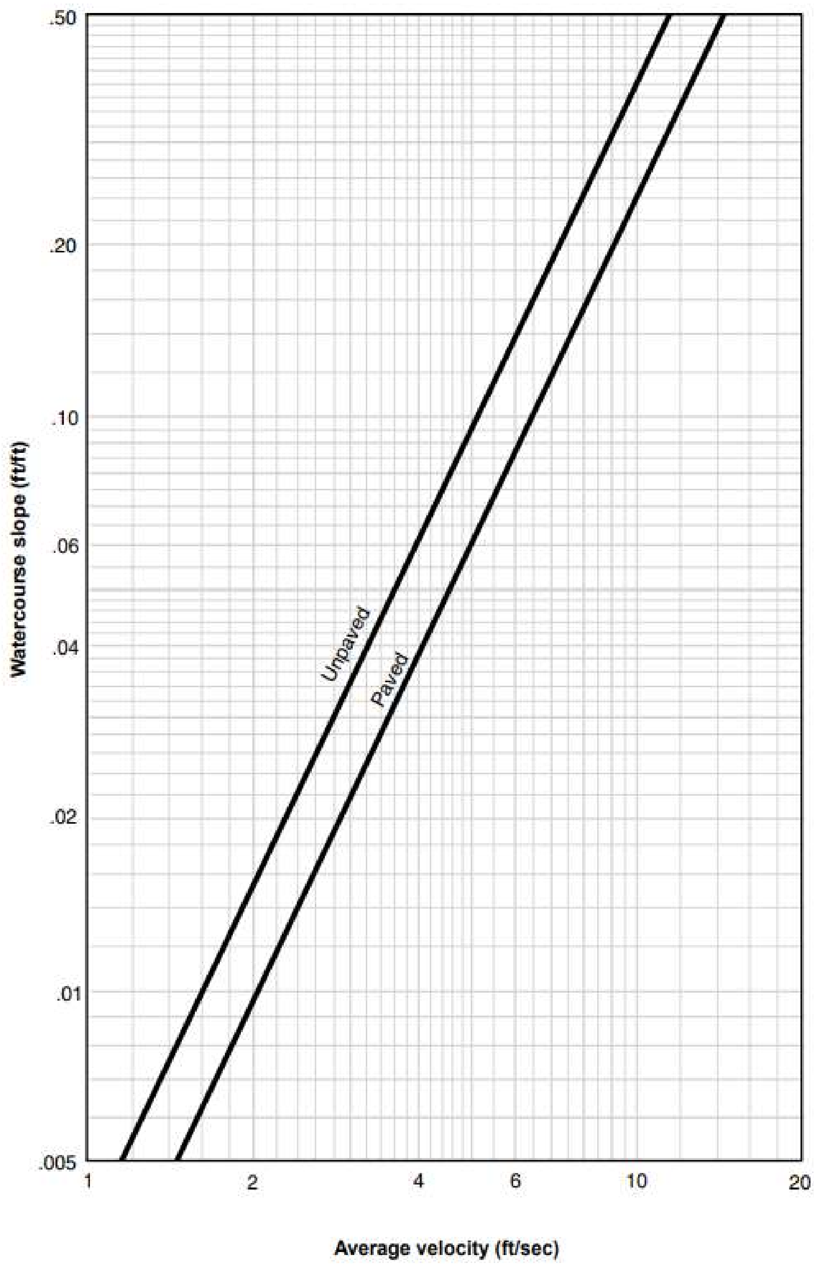
Calculation Documentation

Data and Assumptions:

Shallow concentrated flow =10^(0.5*LOG10(slope)+1.2)

(or use Figure 3-1):

Figure 3-1 Average velocities for estimating travel time for shallow concentrated flow



3–2 (210-VI-TR-55, Second Ed., June 1986)

Calculation Documentation

Data and Assumptions:

To calculate channel velocity and depth, use manning's equation:

Manning's equation is:

$$V = \frac{1.49 r^{\frac{2}{3}} s^{\frac{1}{2}}}{n} \qquad \text{[eq. 3-4]}$$

where:

- V = average velocity (ft/s)
- r = hydraulic radius (ft) and is equal to a/p_w
  - a = cross sectional flow area (ft^2)
  - p_w = wetted perimeter (ft)
- s = slope of the hydraulic grade line (channel slope, ft/ft)
- n = Manning's roughness coefficient for open channel flow.

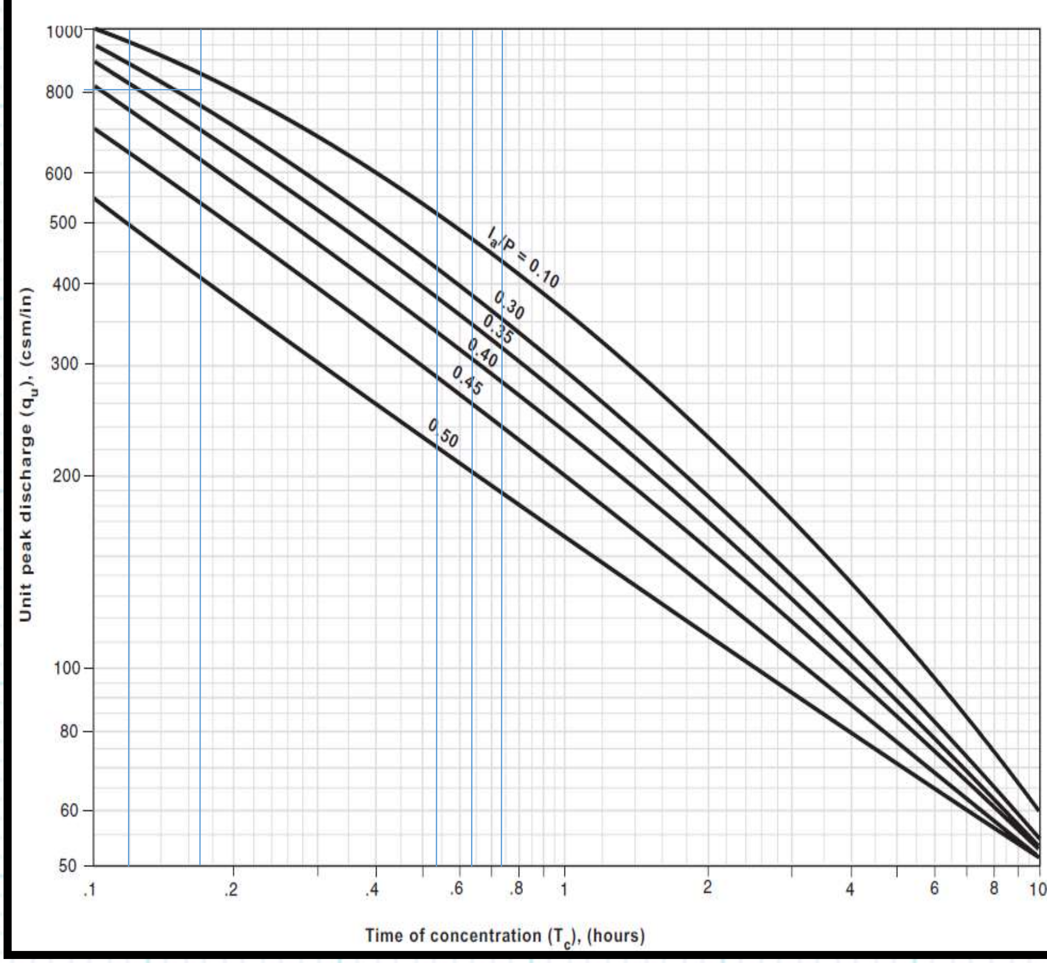
TELESTO SOLUTIONS INCORPORATED	Job No: 200540A	Client: FMI	Page 6 of 13
	Task: NM Operations Stormwater Management	Computed By: T. Tigges	Date: 1/21/21
		Checked By: W. Niccoli	Date: 1/12/21

Calculation Documentation

Data and Assumptions:

12. Use the total calculated Tc with graphical peak flow method to determine unit and peak flow rates:

Exhibit 4-II Unit peal discharge (q_u) for NRCS (SCS) type II rainfall distribution



$$q_p = q_u A_m Q F_p$$ [eq

where:

q_p = peak discharge (cfs)
q_u = unit peak discharge (csm/in)
A_m = drainage area (mi²)
Q = runoff (in)
F_p = pond and swamp adjustment factor

Table 4-2 Adjustment factor (F_p) for pond and swamp areas that are spread throughout the watershed

Percentage of pond and swamp areas	F_p
0	1.00
0.2	0.97
1.0	0.87
3.0	0.75
5.0	0.72

Calculation Documentation

Calculations and Results:

1. The TR-55 method is shown as an example to determine peak discharge from the top of a stockpile to a 1% top channel (see: YYYYMMDD_TR-55_Channel_Sizing.xlsx):

	A	B	
1			
2		1% Top Channel	
3			
4	L =	1,000 ft	From CAD, the longest (straight line) flow path to the channel
5			
6	A =	0.0230 ac	=B4/43560 (based on one unit length of channel)
7		3.59E-05 mi^2	=B6/640
8			**TIME OF TRAVEL (MANNING'S FORMULA) FOR SHEET FLOW, TR55:**
9	n =	0.13	See assumptions
10	L(<300) =	300 ft	Based on topography and <300 ft
11	P2 =	1.83 in	=B41
12	S =	0.01	From CAD
13			
14	Tt =	36.73 min	=0.007*((B9*B10))^0.8/(B11^0.5*B12^0.4)*60 (from TR-55)
15			
16			**TIME OF TRAVEL FOR SHALLOW CONCENTRATED FLOW, TR55:**
17	L =	700 ft	=B4-B10
18	v =	1.58 ft/s	=10^(0.5*LOG10(B12)+1.2) (from TR-55)
19			
20	Tt =	7.36 min	=B17/B18/60
21			
22	Tc =	44.09 min	=B20+B14
23		0.73484 hr	
35			**SCS CURVE NUMBER METHO:D**
36	P =	3.74 in	=From NOAA
37	Ia =	0.50 in	=0.2*B40
38	CN =	80	Assumed
39			
40	S =	2.50 in	=1000/Q38-10
41	Q =	1.83 in	=(B36-B37)^2/(B36-B37+B40)
42		0.003499 ac-ft	=B41/12*B6
43		ac-ft	**GRAPHICAL PEAK DISCHARGE METHOD:**
44			
45	Ia/P =	0.13	=B37/B36
46			
47	Qu =	417 csm/in	From TR-55 Chart
48	Am =	3.59E-05 mi^2	=B7
49	Q =	1.83 in	=B41
50	Fp =	1.00	
51			
52	Qp =	2.73E-02 cfs	=B47*B48*B49*B50

Calculation Documentation

Calculations and Results (con'd)

1. (con'd) Multiply Qp (cell B52) by the channel length to compute total peak flow from the top channel. Multiple channel lengths are shown in column A (starting in row 57):

	A	B	C
1			
2		1% Top Channel	
3			
4	L =	1,000	ft
5			
6	A =	0.0230	ac
7		3.59E-05	mi^2
8			
9	n =	0.13	
10	L(<300) =	300	ft
11	P2 =	1.83	in
12	S =	0.01	
13			
14	Tt =	36.73	min
15			
16			
17	L =	700	ft
18	v =	1.58	ft/s
19			
20	Tt =	7.36	min
21			
22	Tc =	44.09	min
23		0.73484	hr
35			
36	P =	3.74	in
37	Ia =	0.50	in
38	CN =	80	
39			
40	S =	2.50	in
41	Q =	1.83	in
42		0.003499	ac-ft
43		ac-ft	
44			
45	Ia/P =	0.13	
46			
47	Qu =	417	csm/in
48	Am =	3.59E-05	mi^2
49	Q =	1.83	in
50	Fp =	1.00	
51			
52	Qp =	2.73E-02	cfs

	A	B
57	Ditch Length	
58	100	6.55
59	200	13.10
60	400	26.20
61	800	52.40
62	1000	65.51
63	1500	98.26
64	1600	104.81
65	3200	209.62

Calculation Documentation

Calculations and Results (con'd)

2. The TR-55 method is shown as an example to determine peak discharge from the top of a stockpile to a bench channel (see: YYYYMMDD_TR-55_Channel_Sizing.xlsx):

	A	B	C
1			
2	3:1 Outslope Bench Channel		
3	TOTAL WATERSHED LENGTH		
4	L =	200	ft
5	TOTAL WATERSHED AREA		
6	A =	0.0046	ac
7		7.17401E-06	mi^2
8	**TIME OF TRAVEL (MANNING'S FORMULA) FC**		
9	n =	0.13	
10	L(<300) =	200	ft
11	P2 =	1.83	in
12	S =	0.333333333	
13			
14	Tt =	6.53	min
15			
16	**TIME OF TRAVEL FOR SHALLOW CONCENTI**		
17	L =	0	ft
18	v =	9.15	ft/s
19			
20	Tt =	0.00	min
21			
22	Tc =	6.53	min
23		0.108851936	hr
35	**SCS CURVE NUMBER METHOD**		
36	P =	3.74	in
37	Ia =	0.50	in
38	CN =	80	
39			
40	S =	2.50	in
41	Q =	1.83	in
42		0.000699744	ac-ft
43	**GRAPHICAL PEAK DISCHARGE METHOD**		
44			
45	Ia/P =	0.13	
46			
47	Qu =	973	csm/in
48	Am =	7.17E-06	mi^2
49	Q =	1.83	in
50	Fp =	1.00	
51			
52	Qp =	0.01	cfs

Use the same equations shown on page 7 for a top channel.

Multiply Qp (cell B52) by bench channel length to compute total peak flow to each bench channel. Multiple channel lengths are shown in column A:

	A	B
69	Ditch Length	Flow (cfs)
70	1260	**16.08**
71	1010	12.89
72	1140	14.55
73	340	4.34
74	215	2.74
75	280	3.57
76	405	5.17
77	405	5.17
78	470	6.00
79	400	5.11

The longest bench channel has the contributing area and largest peak flow, which can be used for capacity and erosion calculations.

TELESTO SOLUTIONS • INCORPORATED

Job No: 200540A Client: FMI

Task: NM Operations Stormwater Management Computed By: T. Tigges Date: 1/21/21

Checked By: W. Niccoli Date: 1/12/21

Calculation Documentation

Calculations and Results (Con'd)

3. Downdrains- where conveying to a downdrain, combine flow from top of stockpile with bench channel flows

Ditch Length	Flow (cfs)	CUMULATIVE TOTAL TO DOWNDRAIN (CFS)
1260	16.08	36.77
1010	12.89	49.66
1140	14.55	64.21
340	4.34	68.55
215	2.74	71.30
280	3.57	74.87
405	5.17	80.04
405	5.17	85.21
470	6.00	91.21
400	5.11	96.31

Combined with top flow of 20.69 cfs

=36.77+12.89 etc.

Total flow to downdrain

4. For each channel type (downdrain shown as an example), calculate channel depths and velocities based upon Manning's Formula and verify that typical channel dimensions are adequate for calculated flow:

	A	B	C	D	E	F	G	H	I	J	K	L
1												
2		TRAPEZOIDAL DITCH										
3	NAME	SLOPE	LS	RS	DEPTH	BOTTOM	MANNING	AREA	WETTED	HYD RAD	MANNING	VELOCITY
4			SLOPE	SLOPE	FT	WIDTH	COEFF	FT^2	PER	FT	FLOW	F/S
5			L:H	L:H		FT			FT		CFS	
6						ACB Down Drain						
7	A	0.28571	3	3	0.10	20	0.025	2.03	20.63	0.10	13.78	6.79
8	A	0.28571	3	3	0.20	20	0.025	4.12	21.26	0.19	43.95	10.67
9	A	0.28571	3	3	0.30	20	0.025	6.27	21.90	0.29	86.78	13.84

Slope along ditch

Outslope

Cross-slope

Depth of flow, iterate this value

20 ft for downdrain (see page 2)

See assumptions

=(F9+F9+E9*C9+E9*D9)*E9/2

=F9+SQRT(E9^2+(E9*C9)^2)+SQRT(E9^2+(E9*D9)^2)

=H9/I9

=1.49/G9*H9*(J9)^(2/3)*B9^0.5

=K9/H9

Calculation Documentation

Calculations and Results (Con'd)

5. For the bench channels (or a channel where riprap is used), check riprap requirement on section with highest velocity and slope (see: YYYYMMDD_Riprap Sizing Spreadsheet.xlsx for use of the USACE method):

Color Key:
Entered by user
Calculated by spreadsheet
Iteratively adjusted by user to calculate riprap size
Calculated results
Flow regieme (supercritical or sub-critical flow)

$d_0 = 0.25 d_{50}$ $d_{15} \cong 0.42 d_{50}$ $d_{100} = 2.00 d_{50}$

Steps to Calculate Riprap Size:
1. User selects and copies the appropriate riprap sizing tab dependant on channel bedslope (s), sideslope (z) and design D50
2. User enters all values in green in "trapezoidal channel hyrdaulics" and the appropriate riprap sizing tab
3. User adjusts design D50 until design D50 is greater than D50 minimum
4. User adjusts h (ft) with solver ad-in until column s = 0 (Design Q - Calculated Q)
5. User repeats steps 3. and 4. until both column R = 0 and design D50 > minimum D50
6. Check that channel freeboard and flow regieme (Froude Number) is adequate

Channel Name	Bedslope (S) (ft/ft)	Design Discharge (Q) (cfs)	Side Slope (z)	Bw (ft)	Channel Depth (ft)	Minimum Riprap Depth (in)	Design Min. Riprap Size (d_0) (in)	Design Min. Riprap Size (d_{15})	Design Max. Riprap Size (d_{100}) (in)	Design d_{50} (in)	Calculated Min d_{50} (in)	Flow Depth (h) (ft)	Channel Freeboard (ft)	Cross Sect. Area (A) (ft^2)	Wetted Perimeter (Pw) (ft)	Hydraulic Radius (R) (ft)	Calculated Discharge (Q) (cfs)	Design Q - Calculated Q	Design Vel. (ft/s)	Flow Top Width (Tw) (ft)	Channel Top Width (Tw) (ft)	Froude Number
Example 1 (S < 2%, z >= 1.5)	0.020	17.0	2.5	5.0	2.0	2.0	0.3	0.4	2.0	1.0	0.3	1.00	1.0	7.5	10.4	0.72	48.6	998.160	2.3	10.00	15.0	0.40
Example 2 (S > 2%, D50 > 6")	0.020	17.0	2.5	5.0	2.0	2.0	0.3	0.4	2.0	1.0	1.9	1.00	1.0	7.5	10.4	0.72	51.8	1212.326	2.3	10.00	15.0	0.40
Example 3 (S > 2%, D50 < 6")	0.020	17.0	2.5	5.0	2.0	2.0	0.3	0.4	2.0	1.0	1.7	1.00	1.0	7.5	10.4	0.72	51.8	1212.326	2.3	10.00	15.0	0.40

5. For the given downdrain geometry, the Contech 40T ACB system has been verified to be used with a flow rate of 200 cfs and higher. The minimum Factor of Safety with the ACB systems that Freeport has previously established is 1.8. A flow rate of 200 cfs (18.9 ft/s velocity) results in a factor of safety of 2.73. This calculation was obtained from Contech on 1/21/21 and is included as Attachment A. Re-evaluate this calculation with larger flow rates (over 200 cfs) or a different channel geometry.

Discussion and Conclusions:

1. This calculation set is conservative in that it assumes the peak flows occur simultaneously, which is not the case. Larger drainage areas will lag behind the smaller areas.
2. The calculation set met its objectives by estimating, runoff flow rates, verifying that the channels can carry the flow safely, and showing that typical erosion protection is adequate.

Factor of Safety
Hydraulic Analysis

These calculations are an application of the Moment Stability Analysis technique presented in Julien (2010) ai as illustrated in the NCMA Manual (2010), listed in the References.

The factor of safety method is used in the selection of block sizes for ACB's for revetments or bed armor.

The following assumes that hydraulic testing has been performed for the block system to quantify a critical shear stress; the use of Manning's equation conservatively assumes normal depth and critical velocity.

References

1. Julien, Pierre Y. (2010) "Erosion and Sedimentation", 2nd Edition, Cambridge University Press

2. National Concrete Masonry Association (2010), "Design Manual for Articulating Concrete Block (ACB) Revetment Systems", NCMA Publication TR220A.

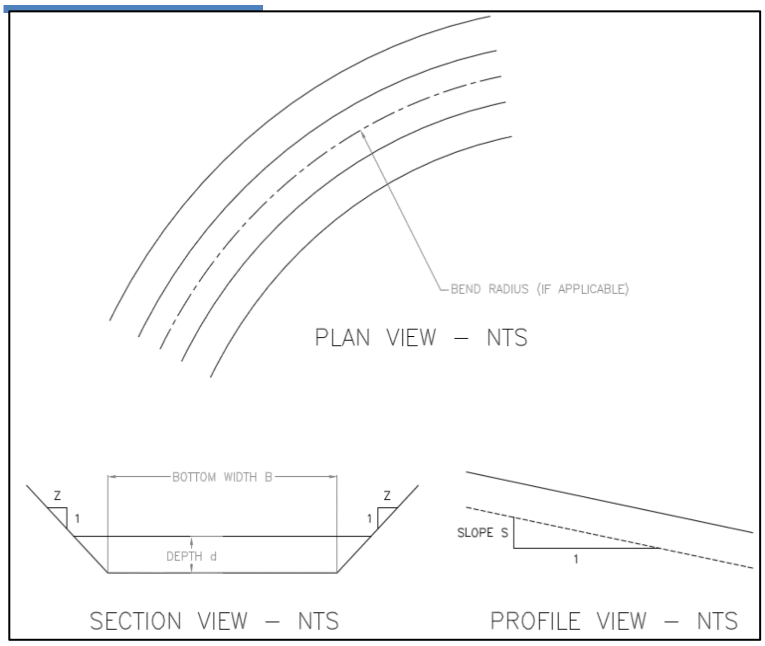
3. USDOT Federal Highway Administration Hydraulic Engineering Circular No. 15, Third Edition (2005) "Design of Roadside Channels with Flexible Linings", National Highway Institute.

4. Cox, A.L. (2010), "Moment Stability Analysis Method for Determining Safety Factors for Articulated Concrete Blocks", Ph.D. Dissertation, Colorado State University

5. ASTM D 7276 & D7277 Testing and Analysis Compliant

Factor of Safety
Hydraulic Analysis

Project Data



Channel Bottom Width, B	20	ft
Bed Slope, S_o	0.285	ft/ft
Friction Slope, S	0.285	ft/ft
Left Side Slope, Z_L	3	(_H:1V)
Right Side Slope, Z_R	3	(_H:1V)
Bend Radius, r	0	ft
Depth of Flow d	0.49	ft

The Depth of Flow is varied iteratively to obtain a given volumetric flow rate.

Top Surface Width ,T	22.96	ft

Other Constants

Unit Weight of Water, γ	62.4	pcf
Unit Wt. of Concrete, Dry-Cast	130	pcf
Sp. Gr. Of Concrete, S_c	2.083	--
Gravitational Constant, g	32.2	ft/s²

Calculated Channel Geometry Factors

Flow Area, A	10.60	ft²
Wetted Perimeter, P	23.12	ft
Hydraulic Radius = R_H = A/P =	0.46	ft
Bend Coefficient, K_b	1	--
Froude Number, Fr	4.73	--
Flow Type	Supercritical	

Volumetric Flow Rate, Q	200.00	cfs

The Volumetric Flow Rate is determined using Manning's equation:

$Q = 1.486 / (n * A * R^{2/3} * S^{1/2})$

Velocity, V	18.87	ft/sec

			sin	cos	tan
Largest Side Slope Angle, θ_1	18.435	°	0.316	0.949	0.333
Bed Slope Angle, θ_0	15.908	°	0.274	0.962	0.285

ArmorFlex Block parameters

Class	**40-T**
SF	**2.60**

ϑ_1	0.198	ft	A_B	1.1	
ϑ_2	0.725	ft	C_L	0.00834	
ϑ_3	0.396	ft	Weight	58.1	lbs
ϑ_4	0.725	ft	Width	1.292	ft
ϑ_5	0.646		τ_c	25.0	psf
ϑ_6	0.646		ΔZ	0.0	in
ϑ_7	0.971		n	0.025	--
ϑ_8	0.971				

ARMORTEC
Erosion Control Solutions

Factor of Safety
Hydraulic Analysis

Detailed Calculations REFERENCE

Flow Area, A = $A_L + A_B + A_R$

$A_L = ½ * d^2 * Z_L =$	0.37	ft^2	
$A_B = B * d =$	9.87	ft^2	
$A_R = ½ * d^2 * Z_R =$	0.37	ft^2	
$A =$	10.60	ft^2	

Wetted Perimeter, P = $P_L + P_B + P_R$

$P_L = d * (Z_L^2 + 1)^{0.5} =$	1.56	ft	
$P_B = B =$	20	ft	
$P_R = d * (Z_R^2 + 1)^{0.5} =$	1.56	ft	
$P =$	23.12	ft	

Volumetric Flow Rate, Q

$Q = 1.486 / n * A * R_H^{2/3} * S^{1/2} =$	200.00	cfs	(Ref. 3 Eqn. 2.1)

Compute Factor of Safety Parameters

Submerged Weight, W_s	$W_s = W * ((S_c - 1) / S_c) =$	30.22	lb	(Ref. 2 Eqn 4.13a)
Applied Shear Stress, τ_o	$\tau_o = \gamma * d * S_o =$	8.78	psf	(Ref. 3 Eqn. 2.4)

Bend Coefficient Calculation

X = r/B = (Constrained to between 1.984 and 10)	1.984	--	
Calculated $K_b = 2.38 - 0.206(X) + 0.0073(X)^2 =$	2.00	--	(Ref. 3 Eqn. 3.7)
Constrained K_b: $1.05 \le K_b \le 2 \rightarrow$	1.00		

(If no bend radius is present, K_b = 1)

(Design Shear Stress)	$\tau_o = K_b \gamma y \sin(\tan^{-1} S_o) =$	8.44	lbs/ft^2	(Ref. 3 Eqn 3.1 & 3.6)

Calculate Cox Parameters

	$\beta = \cos^{-1}((b/2)/\vartheta_8) =$	48.31	°	
$\sin\beta =$ 0.747	$\cos\beta =$	0.665		
	$W_{SX} = W_S*\sin\theta_0$	8.28	lb	(Ref. 4. Eqn. 7.1)
	$\theta_2 = \tan^{-1}(\tan\theta_1*\cos\theta_0)$	17.774	°	(Ref. 4. Eqn. 7.3)
	$W_{SY} = W_S*\cos\theta_0*\cos\theta_2$	27.68	lb	(Ref. 4. Eqn. 7.2)
	$W_{SZ} = W_S*\cos\theta_0*\sin\theta_2$	8.87	lb	(Ref. 4. Eqn. 7.4)
	Applied $F_D = \tau_0*A_B =$	9.46	lbs	(Ref. 4. Eqn. 7.10)
	Applied $F_L = 0.5*C_{BL}*\rho*A_B*V^2 =$	3.22	lbs	(Ref. 4. Eqn. 7.11)
	$F_L' = F_D' = 0.5\Delta Zb\rho V_{des}^2 =$	0.00	lbs	(Ref. 4. Eqn. 7.12)

$SF_M = (\vartheta_7*W_{SY})/[(\vartheta_1*(W_{SX}*\sin\beta + W_{SZ} * \cos\beta)) + (\vartheta_3*(F_D + F_D')*\sin\beta) + (\vartheta_8 * (F_L + F_L'))] =$

3.23 (Ref. 4. Eqn. 7.18)

$SF_P = (\vartheta_2*W_{SY})/[(\vartheta_1*W_{SX}) + (\vartheta_3*(F_D + F_D')) + (\vartheta_4 * (F_L + F_L'))] =$

2.60 (Ref. 4. Eqn. 7.20)

$SF_O = (\vartheta_5*W_{SY})/[(\vartheta_1*W_{SZ}) + (\vartheta_6 * (F_L + F_L'))] =$

4.66 (Ref. 4. Eqn. 7.22)

$SF_{BED} = (\vartheta_2*W_S*\cos\theta_0)/[(\vartheta_1*(W_S*\sin\theta_0)) + (\vartheta_3*(F_D + F_D')) + (\vartheta_4 * (F_L + F_L'))] =$

2.73 (Ref. 4. Eqn. 7.28)

Factor of Safety
Hydraulic Analysis

Parameters for Factor of Safety Calculations

Block Class	Block Area	ϑ_1	ϑ_2	ϑ_3	ϑ_4	ϑ_5	ϑ_6	ϑ_7	ϑ_8	τ_c 0°	Width	Weight	Lift Coeff. C_L
	(SF)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(psf)	(ft)	(lbs)	
30-S	0.68	0.198	0.542	0.396	0.542	0.483	0.483	0.726	0.726	5.180	0.967	32.89	0.11045
40	1.23	0.198	0.725	0.396	0.725	0.646	0.646	0.971	0.971	11.200	1.292	59.02	0.04563
40-L	1.93	0.198	0.725	0.396	0.725	0.983	0.983	1.222	1.222	19.460	1.967	97.18	0.02455
40-T	1.12	0.198	0.725	0.396	0.725	0.646	0.646	0.971	0.971	25.022	1.292	58.12	0.00834
45	1.49	0.198	0.725	0.396	0.725	0.646	0.646	0.971	0.971	13.530	1.292	71.25	0.04563
45-L	2.31	0.198	0.725	0.396	0.725	0.983	0.983	1.222	1.222	21.860	1.967	109.15	0.02455
45-S	0.83	0.198	0.542	0.396	0.542	0.483	0.483	0.726	0.726	6.170	0.967	39.20	0.11045
50	1.23	0.250	0.725	0.500	0.725	0.646	0.646	0.971	0.971	13.610	1.292	76.29	0.04563
50-L	1.93	0.250	0.725	0.500	0.725	0.983	0.983	1.222	1.222	22.050	1.967	116.02	0.02455
50-S	0.68	0.250	0.542	0.500	0.542	0.483	0.483	0.726	0.726	6.130	0.967	42.03	0.11045
50-T	1.12	0.250	0.725	0.500	0.725	0.646	0.646	0.971	0.971	30.500	1.292	75.39	0.00834
55	1.49	0.250	0.725	0.500	0.725	0.646	0.646	0.971	0.971	16.290	1.292	91.37	0.04563
55-L	2.31	0.250	0.725	0.500	0.725	0.983	0.983	1.222	1.222	26.280	1.967	138.29	0.02455
55-S	0.83	0.250	0.542	0.500	0.542	0.483	0.483	0.726	0.726	7.330	0.967	50.25	0.11045
60	1.23	0.313	0.725	0.625	0.725	0.646	0.646	0.971	0.971	15.490	1.292	93.17	0.04563
60-T	1.12	0.313	0.725	0.625	0.725	0.646	0.646	0.971	0.971	35.200	1.292	93.42	0.00834
70	1.23	0.354	0.725	0.708	0.725	0.646	0.646	0.971	0.971	17.730	1.292	113.90	0.04563
70-L	1.93	0.354	0.725	0.708	0.725	0.983	0.983	1.222	1.222	29.520	1.967	174.46	0.02455
70-T	1.12	0.354	0.725	0.708	0.725	0.646	0.646	0.971	0.971	38.500	1.292	108.96	0.00834
75	1.49	0.313	0.725	0.625	0.725	0.646	0.646	0.971	0.971	18.620	1.292	112.02	0.04563
85	1.49	0.354	0.725	0.708	0.725	0.646	0.646	0.971	0.971	21.100	1.292	135.60	0.04563
85-L	2.31	0.354	0.725	0.708	0.725	0.983	0.983	1.222	1.222	35.060	1.967	207.23	0.02455

	A_B	ϑ_1	ϑ_2	ϑ_3	ϑ_4	ϑ_5	ϑ_6	ϑ_7	ϑ_8	τ_c 0°	Width	Weight	Lift Coeff. C_L
40-T	1.121	0.198	0.725	0.396	0.725	0.646	0.646	0.971	0.971	25.022	1.292	58.120	0.00834

Modified from Julien (2010)

Calculation Documentation

Problem Statement:

Freeport-McMoRan (FMI) utilizes a spreadsheet developed by the New Mexico Mining and Minerals Division (MMD) to estimate the earthwork's closure costs associated with the Closure/Closeout Plans (CCPs) for the Little Rock Mine. Part of the CCP involves design and unit cost of channels to direct stormwater from stockpiles. Channel sizes are unknown and needed for estimating closure costs and complying with regulations.

See the Channel Size Verification calculation documentation for New Mexico operations for detailed calculation steps. This documentation summarizes the results from the calculations specific to the Little Rock Mine.

Objectives:

1. Estimate the runoff potential for each contributing watershed to the reclamation channels under the 100-year, 24-hour storm event (i.e., design storm)
2. Verify that the channels created by typical cross sections can convey the design storm
3. Recommend areas of channel protection (riprap) and size based on a conceptual design

Approach:

1. Use the SCS TR-55 method to estimate total runoff from each basin and the peak flow to each conveyance channel or runoff scenario (stockpile top with no channel, top channels, bench channels, and downdrains)
2. Determine the "worst case" scenario/channels with the highest peak flows to determine the standard channel size needed for the entire site
3. Estimate the peak velocity and if > 5 fps, then size riprap using the US Army Corps technique

Data and Assumptions:

1. See the Channel Size Verification calculation documentation for New Mexico operations

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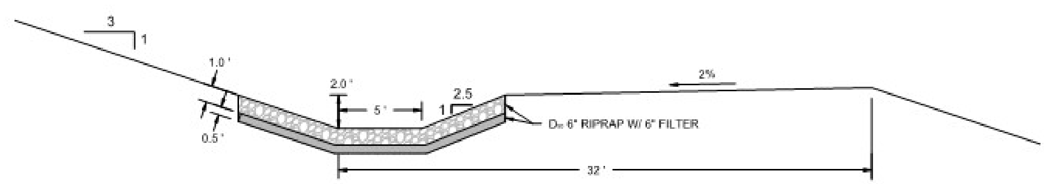
Job No: 200540A | Client: FMI | Page 2 of 13

Task: NM Operations Stormwater Management | Computed By: T. Tigges | Date: 1/13/21

Checked By: W. Niccoli | Date: 1/12/21

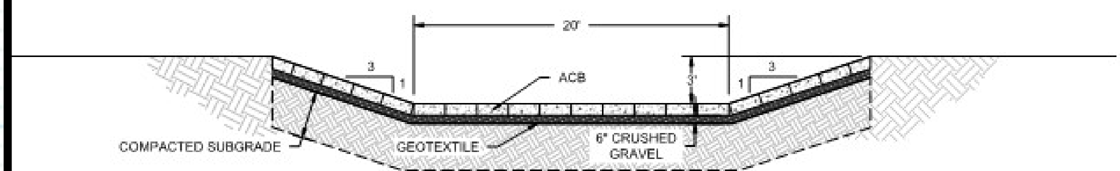
Data and Assumptions: ***Calculation Documentation***

2. Bench channels are dimensioned as follows:

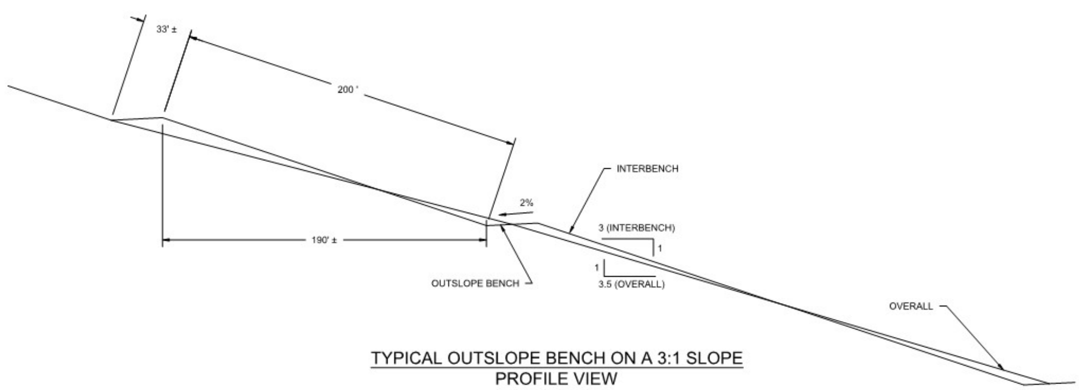


TYPICAL BENCH CHANNEL CROSS SECTION
SECTION VIEW

3. Downdrains are dimensioned as follows:



TYPICAL DOWNDRAIN
SECTION VIEW



TYPICAL OUTSLOPE BENCH ON A 3:1 SLOPE
PROFILE VIEW

4. No top channels are proposed in the Little Rock Mine CCP.

TELESTO SOLUTIONS INCORPORATED

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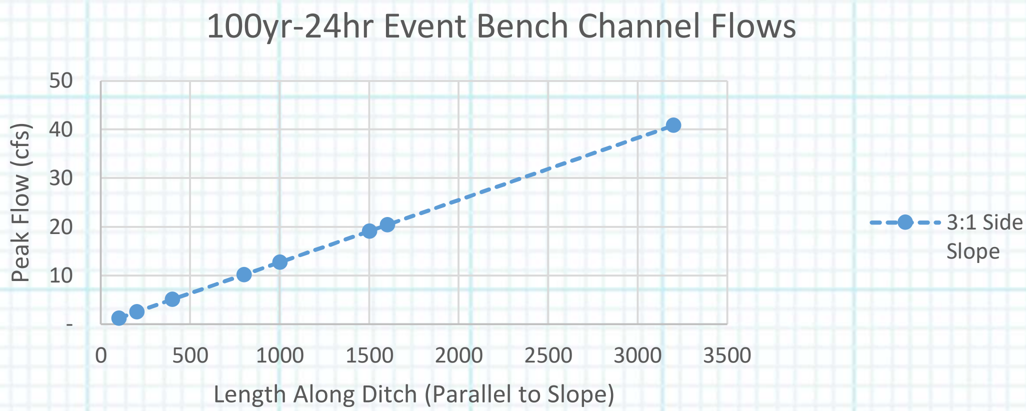
Task: NM Operations Stormwater Management | Computed By: T. Tigges | Date: 1/13/21

Checked By: W. Niccoli | Date: 1/12/21

Calculation Documentation

Calculations and Results:

Calculate total and peak runoff using SCS TR-55 (see: YYYYMMDD_TR-55_Channel_Sizing.xlsx). Use the spreadsheet to calculate required channel sizes (bench and downdrain) for the Little Rock Mine CCP. The West In-Pit waste was found to have the largest peak flows for both bench channels and downdrain.



West In-Pit Waste: *("worst case" scenario for Little Rock reclamation channels)*

Longest bench channel = 1824 ft

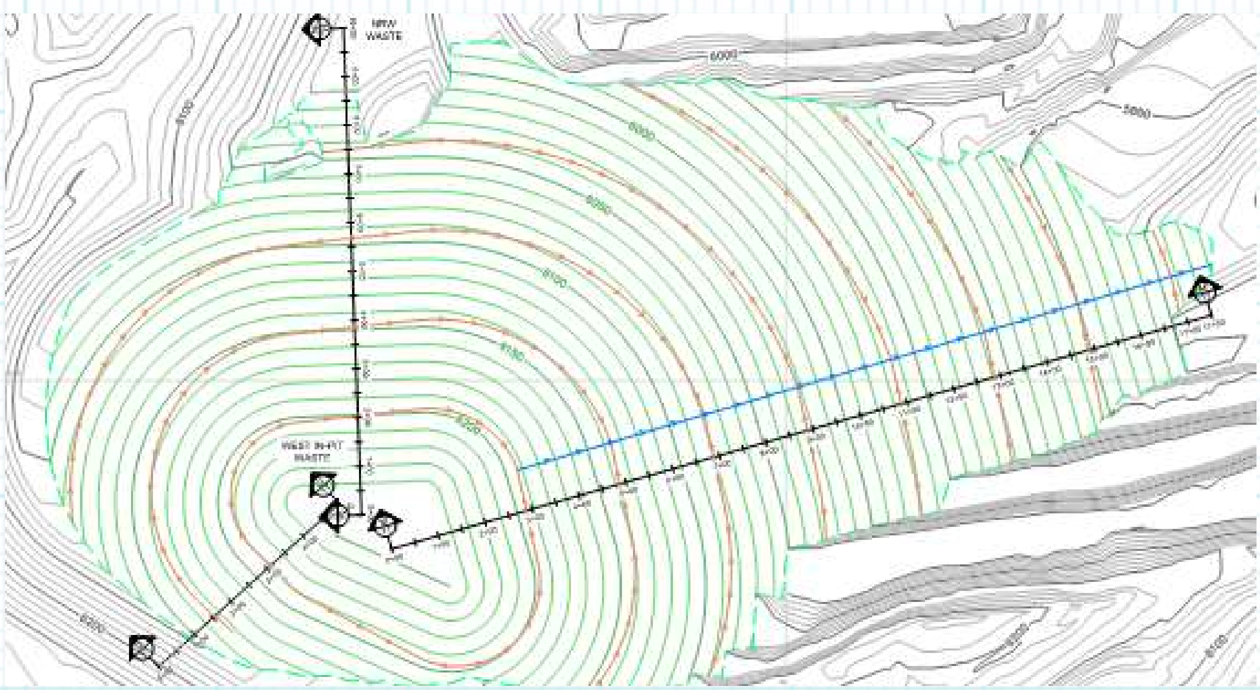
Maximum bench channel flow = 24 cfs

Bench channel depth = 0.77 ft, velocity = 4.3 fps

Total downdrain flow = 134 cfs

Downdrain depth = 0.39 ft, velocity = 16.9 fps

Because the requirements have been met for the West In-Pit Waste, the other stockpile conveyance channels are also adequate, with smaller ditch lengths and total flow.



Discussion and Conclusions:

1. The bench channels at West In-Pit Waste were found to have velocities less than 5 fps and the typical bench channel capacity was adequate, as well. For future projects, verify riprap size for velocities above 5 ft/s (silt erosive velocity).
2. The downdrain at West In-Pit Waste also met the requirements needed for use of 40T ACB system and typical channel capacity.
3. This calculation set is conservative in that it assumes the peak flows occur simultaneously, which is not the case. Larger drainage areas will lag behind the smaller areas.
4. The calculation set met its objectives by estimating, runoff flow rates, verifying that the channels can carry the flow safely, and showing that typical erosion protection is adequate.

Appendix C

Indirect Costs

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

Supporting Data for Cost Estimate

Appendix D.1

2021 Labor Rates (NMDOL)

Labor Rates

NMDOL Type A Operator Group	Base rate	Fringe rate	Apprenticeship	Total 2021 Rate ($/hr)
Equipment Operator IV	21.51	6.54	0.6	$ 28.65
Equipment Operator V	21.63	6.54	0.6	$ 28.77
Equipment Operator VI	21.81	6.54	0.6	$ 28.95
Equipment Operator VII	21.83	6.54	0.6	$ 28.97
Equipment Operator VIII	23.79	6.54	0.6	$ 30.93
Laborer I	17.06	6.22	0.6	$ 23.88
Laborer II	17.81	6.22	0.6	$ 24.63
Truck Driver III	17.72	6.25	0.60	$ 24.57
Truck Driver V	17.80	6.25	0.60	$ 24.65
Truck Driver VI	17.97	6.25	0.60	$ 24.82
Truck Driver VII	18.11	6.25	0.60	$ 24.96
Truck Driver VIII	18.31	6.25	0.60	$ 25.16

Labor rates based on NM Department of Labor Type H (Heavy Engineering) 2021 labor rates. Rates include
https://www.dws.state.nm.us/Portals/0/DM/LaborRelations/Prevailing_Wage_Poster_H_2021.pdf

Appendix D.2

Equipment Watch Data

www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 14M (disc. 2015)
Articulated Frame Graders

Size Class:
250 HP & Over
Weight:
46796 lbs

Configuration for 14M (disc. 2015)

Moldboard Size	**14.0 ft**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $15,082.00	USD $5,050.00	USD $1,701.00
Adjustments			
Region (New Mexico: 81%)	(USD $2,831.26)	(USD $948.01)	(USD $319.32)
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $12,250.74**	**USD $4,101.99**	**USD $1,381.68**

Date Last Updated: Sep 01, 2020

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 14M (disc. 2015)
Articulated Frame Graders

Size Class:
250 HP & Over
Weight:
46796 lbs

Configuration for 14M (disc. 2015)

Moldboard Size	**14.0 ft**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $35.39/hr	USD $33.12/hr	-6.4%
Cost of Facilities Capital (CFC)	USD $3.44/hr	USD $3.43/hr	-0.2%
Overhead	USD $11.91/hr	USD $11.88/hr	-0.2%
Overhaul Labor	USD $8.13/hr	USD $3.07/hr	-62.2%
Overhaul Parts	USD $18.12/hr	USD $18.08/hr	-0.2%
Total Hourly Ownership Cost:	**USD $76.99/hr**	**USD $69.58/hr**	**-9.6%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,397hrs -> 1,400hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $6.78/hr	USD $2.56/hr	-62.2%
Field Parts	USD $17.57/hr	USD $4.38/hr	-75.1%
Ground Engaging Component (GEC)	USD $1.46/hr	USD $0.44/hr	-70.1%
Tire	USD $7.98/hr	-	-
Electrical/Fuel	USD $20.94/hr	USD $8.29/hr	-60.4%
Lube	USD $5.80/hr	-	-
Total Operating Ownership Cost:	**USD $60.53/hr**	**USD $29.46/hr**	**-51.3%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $4,091.30 -> USD $0.00) Annual Field Repair Parts Cost (USD $20,456.52 -> USD $6,136.95)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $76.99/hr	USD $69.58/hr	-9.6%
Hourly Operating Costs	USD $60.53/hr	USD $29.46/hr	-51.3%
Total Hourly Cost	**USD $137.52**	**USD $99.04/hr**	**-28%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $50.74/hr	USD $48.43/hr	-4.5%
Idle	USD $97.92/hr	USD $77.87/hr	-20.5%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 16M (disc. 2015)
Articulated Frame Graders

Size Class:
250 HP & Over
Weight:
59435 lbs

Configuration for 16M (disc. 2015)

Moldboard Size	**16.0 ft**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $15,082.00	USD $5,050.00	USD $1,701.00
Adjustments			
Region (New Mexico: 81%)	(USD $2,831.26)	(USD $948.01)	(USD $319.32)
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $12,250.74**	**USD $4,101.99**	**USD $1,381.68**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 16M (disc. 2015)
Articulated Frame Graders

Size Class:
250 HP & Over
Weight:
59435 lbs

Configuration for 16M (disc. 2015)

Moldboard Size	**16.0 ft**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $26.74/hr	USD $25.02/hr	-6.4%
Cost of Facilities Capital (CFC)	USD $2.60/hr	USD $2.59/hr	-0.2%
Overhead	USD $12.38/hr	USD $12.36/hr	-0.2%
Overhaul Labor	USD $8.13/hr	USD $3.07/hr	-62.2%
Overhaul Parts	USD $13.69/hr	USD $13.66/hr	-0.2%
Total Hourly Ownership Cost:	**USD $63.54/hr**	**USD $56.70/hr**	**-10.8%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,397hrs -> 1,400hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $6.78/hr	USD $2.56/hr	-62.2%
Field Parts	USD $13.28/hr	USD $3.31/hr	-75.1%
Ground Engaging Component (GEC)	USD $1.11/hr	USD $0.00/hr	-100%
Tire	USD $6.03/hr	-	-
Electrical/Fuel	USD $24.01/hr	USD $9.50/hr	-60.4%
Lube	USD $5.20/hr	-	-
Total Operating Ownership Cost:	**USD $56.40/hr**	**USD $26.61/hr**	**-52.8%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $1,545.51 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $3,091.03 -> USD $0.00) Annual Field Repair Parts Cost (USD $15,455.14 -> USD $4,636.53)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $63.54/hr	USD $56.70/hr	-10.8%
Hourly Operating Costs	USD $56.40/hr	USD $26.61/hr	-52.8%
Total Hourly Cost	**USD $119.94**	**USD $83.31/hr**	**-30.5%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $41.72/hr	USD $39.97/hr	-4.2%
Idle	USD $87.55/hr	USD $66.20/hr	-24.4%

Revised Date: 1st half 2021

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 319D L (disc. 2012)
Crawler Mounted Hydraulic Excavators

Size Class:
19.1 - 21.0 MTons
Weight:
43872 lbs

Configuration for 319D L (disc. 2012)

Operating Weight	**19.9 mt**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	**Weekly**	**Daily**
Published Rates	USD $6,937.00	USD $2,749.00	USD $1,000.00
Adjustments			
Region (New Mexico: 101%)	USD $81.87	USD $32.44	USD $11.80
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $7,018.87**	**USD $2,781.44**	**USD $1,011.80**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 319D L (disc. 2012)
Crawler Mounted Hydraulic Excavators

Size Class:
19.1 - 21.0 MTons
Weight:
43872 lbs

Configuration for 319D L (disc. 2012)

Operating Weight	**19.9 mt**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $19.19/hr	USD $17.96/hr	-6.4%
Cost of Facilities Capital (CFC)	USD $1.53/hr	USD $1.39/hr	-8.9%
Overhead	USD $3.77/hr	USD $3.40/hr	-9.7%
Overhaul Labor	USD $14.04/hr	USD $4.79/hr	-65.8%
Overhaul Parts	USD $8.66/hr	USD $7.81/hr	-9.7%
Total Hourly Ownership Cost:	**USD $47.19/hr**	**USD $35.36/hr**	**-25.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,169hrs -> 1,295hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $17.01/hr	USD $5.81/hr	-65.8%
Field Parts	USD $8.84/hr	USD $2.87/hr	-67.5%
Ground Engaging Component (GEC)	USD $1.42/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $13.26/hr	USD $5.25/hr	-60.4%
Lube	USD $3.01/hr	-	-
Total Operating Ownership Cost:	**USD $43.54/hr**	**USD $16.94/hr**	**-61.1%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $1,654.20 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $2,067.75 -> USD $0.00) Annual Field Repair Parts Cost (USD $8,271.01 -> USD $3,721.95)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $47.19/hr	USD $35.36/hr	-25.1%
Hourly Operating Costs	USD $43.54/hr	USD $16.94/hr	-61.1%
Total Hourly Cost	**USD $90.72**	**USD $52.31/hr**	**-42.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $24.49/hr	USD $22.76/hr	-7.1%
Idle	USD $60.45/hr	USD $40.61/hr	-32.8%

Revised Date: 1st half 2021

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All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 637G (disc. 2010)
Dual Engine Conventional Scrapers

Size Class:
18CY & Over
Weight:
114744 lbs

Configuration for 637G (disc. 2010)

Operator Protection	**EROPS**	Power Mode	**Diesel**
Scraper Capacity	**24.0 - 34.0 cu yd**	Scraper Horsepower	**283.0**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $27,250.00	USD $6,812.00	USD $1,362.00
Adjustments			
Region (New Mexico: 102%)	USD $524.42	USD $131.09	USD $26.21
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $27,774.42**	**USD $6,943.09**	**USD $1,388.21**

Date Last Updated: Sep 01, 2020

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www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 637G (disc. 2010)
Dual Engine Conventional Scrapers

Size Class:
18CY & Over
Weight:
114744 lbs

Configuration for 637G (disc. 2010)

Operator Protection	**EROPS**	Power Mode	**Diesel**
Scraper Capacity	**24.0 - 34.0 cu yd**	Scraper Horsepower	**283.0**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $85.25/hr	USD $80.24/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $7.64/hr	USD $8.36/hr	+9.5%
Overhead	USD $15.78/hr	USD $17.40/hr	+10.3%
Overhaul Labor	USD $24.98/hr	USD $10.42/hr	-58.3%
Overhaul Parts	USD $62.76/hr	USD $69.20/hr	+10.3%
Total Hourly Ownership Cost:	**USD $196.41/hr**	**USD $185.62/hr**	**-5.5%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,516hrs -> 1,375hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $37.47/hr	USD $15.63/hr	-58.3%
Field Parts	USD $63.25/hr	USD $13.35/hr	-78.9%
Ground Engaging Component (GEC)	USD $2.69/hr	USD $0.00/hr	-100%
Tire	USD $10.63/hr	-	-
Electrical/Fuel	USD $75.16/hr	USD $29.75/hr	-60.4%
Lube	USD $19.52/hr	-	-
Total Operating Ownership Cost:	**USD $208.72/hr**	**USD $88.89/hr**	**-57.4%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $4,080.49 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $14,281.71 -> USD $0.00) Annual Field Repair Parts Cost (USD $81,609.76 -> USD $18,362.20)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $196.41/hr	USD $185.62/hr	-5.5%
Hourly Operating Costs	USD $208.72/hr	USD $88.89/hr	-57.4%
Total Hourly Cost	**USD $405.12**	**USD $274.50/hr**	**-32.2%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $108.67/hr	USD $106.00/hr	-2.5%
Idle	USD $271.57/hr	USD $215.37/hr	-20.7%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 657G
Dual Engine Conventional Scrapers

Size Class:
18CY & Over
Weight:
149417 lbs

Configuration for 657G

Operator Protection	**EROPS**	Power Mode	**Diesel**
Scraper Capacity	**32.0 - 44.0 cu yd**	Scraper Horsepower	**410.0**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $27,250.00	USD $6,812.00	USD $1,362.00
Adjustments			
Region (New Mexico: 102%)	USD $524.42	USD $131.09	USD $26.21
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $27,774.42**	**USD $6,943.09**	**USD $1,388.21**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 657G
Dual Engine Conventional Scrapers

Size Class:
18CY & Over
Weight:
149417 lbs

Configuration for 657G

Operator Protection	**EROPS**	Power Mode	**Diesel**
Scraper Capacity	**32.0 - 44.0 cu yd**	Scraper Horsepower	**410.0**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $133.27/hr	USD $125.48/hr	-5.8%
Cost of Facilities Capital (CFC)	USD $11.86/hr	USD $12.98/hr	+9.5%
Overhead	USD $35.87/hr	USD $39.55/hr	+10.3%
Overhaul Labor	USD $24.98/hr	USD $10.42/hr	-58.3%
Overhaul Parts	USD $76.69/hr	USD $84.56/hr	+10.3%
Total Hourly Ownership Cost:	**USD $282.67/hr**	**USD $273.00/hr**	**-3.4%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,516hrs -> 1,375hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $37.47/hr	USD $15.63/hr	-58.3%
Field Parts	USD $77.29/hr	USD $19.17/hr	-75.2%
Ground Engaging Component (GEC)	USD $3.29/hr	USD $0.82/hr	-75.2%
Tire	USD $12.99/hr	-	-
Electrical/Fuel	USD $93.49/hr	USD $37.01/hr	-60.4%
Lube	USD $27.99/hr	-	-
Total Operating Ownership Cost:	**USD $252.52/hr**	**USD $113.61/hr**	**-55%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Field Repair Parts Cost (USD $99,724.00 -> USD $22,437.90)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $282.67/hr	USD $273.00/hr	-3.4%
Hourly Operating Costs	USD $252.52/hr	USD $113.61/hr	-55%
Total Hourly Cost	**USD $535.19**	**USD $386.61/hr**	**-27.8%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $181.00/hr	USD $178.02/hr	-1.6%
Idle	USD $376.16/hr	USD $310.01/hr	-17.6%

Revised Date: 1st half 2021

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 725 (disc. 2014)
Articulated Rear Dumps

Size Class:
20 - 25 MTons
Weight:
49075 lbs

Configuration for 725 (disc. 2014)

Axle Configuration	**6 X 6**	Power Mode	**Diesel**
Rated Payload	**23.6 mt**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $9,023.00	USD $3,197.00	USD $1,122.00
Adjustments			
Region (New Mexico: 110%)	USD $906.51	USD $321.19	USD $112.72
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $9,929.51**	**USD $3,518.19**	**USD $1,234.72**

Date Last Updated: Sep 01, 2020

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 725 (disc. 2014)
Articulated Rear Dumps

Size Class:
20 - 25 MTons
Weight:
49075 lbs

Configuration for 725 (disc. 2014)

Axle Configuration	**6 X 6**	Power Mode	**Diesel**
Rated Payload	**23.6 mt**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $30.28/hr	USD $28.44/hr	-6.1%
Cost of Facilities Capital (CFC)	USD $2.10/hr	USD $1.92/hr	-8.7%
Overhead	USD $5.70/hr	USD $5.14/hr	-9.7%
Overhaul Labor	USD $15.12/hr	USD $5.16/hr	-65.8%
Overhaul Parts	USD $11.76/hr	USD $10.61/hr	-9.7%
Total Hourly Ownership Cost:	**USD $64.95/hr**	**USD $51.29/hr**	**-21%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,670hrs -> 1,850hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $11.72/hr	USD $4.00/hr	-65.8%
Field Parts	USD $7.37/hr	USD $1.11/hr	-85%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $10.02/hr	-	-
Electrical/Fuel	USD $15.21/hr	USD $6.02/hr	-60.4%
Lube	USD $5.08/hr	-	-
Total Operating Ownership Cost:	**USD $49.39/hr**	**USD $26.23/hr**	**-46.9%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $2,051.81 -> USD $0.00) Annual Field Repair Parts Cost (USD $10,259.07 -> USD $2,051.81)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $64.95/hr	USD $51.29/hr	-21%
Hourly Operating Costs	USD $49.39/hr	USD $26.23/hr	-46.9%
Total Hourly Cost	**USD $114.34**	**USD $77.51/hr**	**-32.2%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $38.08/hr	USD $35.51/hr	-6.8%
Idle	USD $80.16/hr	USD $57.31/hr	-28.5%

Revised Date: 1st half 2021

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 10, 2021

Caterpillar 740 (disc. 2014)
Articulated Rear Dumps

Size Class:
35 MTons & Over
Weight:
72973 lbs

Configuration for 740 (disc. 2014)

Axle Configuration	**6 X 6**	Power Mode	**Diesel**
Rated Payload	**39.5 mt**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $16,203.00	USD $5,543.00	USD $1,870.00
Adjustments			
Region (New Mexico: 110%)	USD $1,627.86	USD $556.89	USD $187.87
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $17,830.86**	**USD $6,099.89**	**USD $2,057.87**

Date Last Updated: Sep 01, 2020

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 10, 2021

Caterpillar 740 (disc. 2014)
Articulated Rear Dumps

Size Class:
35 MTons & Over
Weight:
72973 lbs

Configuration for 740 (disc. 2014)

Axle Configuration	**6 X 6**	Power Mode	**Diesel**
Rated Payload	**39.5 mt**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $34.29/hr	USD $32.24/hr	-6%
Cost of Facilities Capital (CFC)	USD $2.84/hr	USD $2.59/hr	-8.8%
Overhead	USD $7.86/hr	USD $7.09/hr	-9.7%
Overhaul Labor	USD $20.78/hr	USD $7.10/hr	-65.8%
Overhaul Parts	USD $13.49/hr	USD $12.18/hr	-9.7%
Total Hourly Ownership Cost:	**USD $79.27/hr**	**USD $61.20/hr**	**-22.8%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,670hrs -> 1,850hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $14.93/hr	USD $5.10/hr	-65.8%
Field Parts	USD $8.33/hr	USD $1.25/hr	-85%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $12.40/hr	-	-
Electrical/Fuel	USD $22.89/hr	USD $9.06/hr	-60.4%
Lube	USD $7.20/hr	-	-
Total Operating Ownership Cost:	**USD $65.74/hr**	**USD $35.01/hr**	**-46.7%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $2,317.66 -> USD $0.00) Annual Field Repair Parts Cost (USD $11,588.30 -> USD $2,317.66)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $79.27/hr	USD $61.20/hr	-22.8%
Hourly Operating Costs	USD $65.74/hr	USD $35.01/hr	-46.7%
Total Hourly Cost	**USD $145.01**	**USD $96.21/hr**	**-33.7%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $45.00/hr	USD $41.92/hr	-6.8%
Idle	USD $102.16/hr	USD $70.26/hr	-31.2%

Revised Date: 1st half 2021

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EquipmentWatch

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All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 769D (disc. 2007)
Mechanical Drive Rear Dumps

Size Class:
30 - 39 MTons
Weight:
66800 lbs

Configuration for 769D (disc. 2007)

Power Mode	**Diesel**	Rated Payload	**36.4 mt**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $13,700.00	USD $4,600.00	USD $1,150.00
Adjustments			
Region (New Mexico: 98%)	(USD $241.84)	(USD $81.20)	(USD $20.30)
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $13,458.16**	**USD $4,518.80**	**USD $1,129.70**

Date Last Updated: Sep 01, 2020

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 769D (disc. 2007)
Mechanical Drive Rear Dumps

Size Class:
30 - 39 MTons
Weight:
66800 lbs

Configuration for 769D (disc. 2007)

Power Mode	**Diesel**	Rated Payload	**36.4 mt**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $40.23/hr	USD $37.82/hr	-6%
Cost of Facilities Capital (CFC)	USD $2.71/hr	USD $2.96/hr	+9.1%
Overhead	USD $2.62/hr	USD $2.89/hr	+10.3%
Overhaul Labor	USD $15.47/hr	USD $6.45/hr	-58.3%
Overhaul Parts	USD $16.39/hr	USD $18.07/hr	+10.3%
Total Hourly Ownership Cost:	**USD $77.42/hr**	**USD $68.19/hr**	**-11.9%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (2,040hrs -> 1,850hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $12.22/hr	USD $5.10/hr	-58.3%
Field Parts	USD $9.99/hr	USD $1.84/hr	-81.6%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $14.90/hr	-	-
Electrical/Fuel	USD $24.60/hr	USD $9.74/hr	-60.4%
Lube	USD $8.04/hr	-	-
Total Operating Ownership Cost:	**USD $69.76/hr**	**USD $39.62/hr**	**-43.2%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $3,396.67 -> USD $0.00) Annual Field Repair Parts Cost (USD $16,983.34 -> USD $3,396.67)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $77.42/hr	USD $68.19/hr	-11.9%
Hourly Operating Costs	USD $69.76/hr	USD $39.62/hr	-43.2%
Total Hourly Cost	**USD $147.18**	**USD $107.81/hr**	**-26.7%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $45.57/hr	USD $43.67/hr	-4.2%
Idle	USD $102.03/hr	USD $77.93/hr	-23.6%

Revised Date: 1st half 2021

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

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All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 777F (disc. 2012)
Mechanical Drive Rear Dumps

Size Class:
90 - 104 MTons
Weight:
154753 lbs

Configuration for 777F (disc. 2012)

Power Mode	**Diesel**	Rated Payload	**90.7 mt**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $54,000.00	USD $18,000.00	USD $6,000.00
Adjustments			
Region (New Mexico: 100%)	-	-	-
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $54,000.00**	**USD $18,000.00**	**USD $6,000.00**

Date Last Updated: Mar 01, 2018

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 777F (disc. 2012)
Mechanical Drive Rear Dumps

Size Class:
90 - 104 MTons
Weight:
154753 lbs

Configuration for 777F (disc. 2012)

Power Mode	**Diesel**	Rated Payload	**90.7 mt**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $65.70/hr	USD $61.81/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $7.16/hr	USD $7.22/hr	+0.9%
Overhead	USD $16.23/hr	USD $16.37/hr	+0.9%
Overhaul Labor	USD $31.10/hr	USD $11.88/hr	-61.8%
Overhaul Parts	USD $37.63/hr	USD $37.97/hr	+0.9%
Total Hourly Ownership Cost:	**USD $157.80/hr**	**USD $135.25/hr**	**-14.3%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,867hrs -> 1,850hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $19.10/hr	USD $7.29/hr	-61.8%
Field Parts	USD $23.22/hr	USD $3.91/hr	-83.2%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $31.30/hr	-	-
Electrical/Fuel	USD $47.39/hr	USD $18.76/hr	-60.4%
Lube	USD $18.90/hr	-	-
Total Operating Ownership Cost:	**USD $139.91/hr**	**USD $80.16/hr**	**-42.7%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $7,225.79 -> USD $0.00) Annual Field Repair Parts Cost (USD $36,128.95 -> USD $7,225.80)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $157.80/hr	USD $135.25/hr	-14.3%
Hourly Operating Costs	USD $139.91/hr	USD $80.16/hr	-42.7%
Total Hourly Cost	**USD $297.71**	**USD $215.41/hr**	**-27.6%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $89.08/hr	USD $85.40/hr	-4.1%
Idle	USD $205.19/hr	USD $154.01/hr	-24.9%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 966H (disc. 2015)
4-Wd Articulated Wheel Loaders

Size Class:
250 - 274 HP
Weight:
52254 lbs

Configuration for 966H (disc. 2015)

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $9,372.00	USD $3,243.00	USD $1,100.00
Adjustments			
Region (New Mexico: 105%)	USD $449.09	USD $155.40	USD $52.71
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $9,821.09**	**USD $3,398.40**	**USD $1,152.71**

Date Last Updated: Sep 01, 2020

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 966H (disc. 2015)
4-Wd Articulated Wheel Loaders

Size Class:
250 - 274 HP
Weight:
52254 lbs

Configuration for 966H (disc. 2015)

Operator Protection	**EROPS**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $24.37/hr	USD $22.70/hr	-6.9%
Cost of Facilities Capital (CFC)	USD $2.53/hr	USD $2.30/hr	-9%
Overhead	USD $7.92/hr	USD $7.15/hr	-9.8%
Overhaul Labor	USD $12.10/hr	USD $4.13/hr	-65.9%
Overhaul Parts	USD $7.18/hr	USD $6.48/hr	-9.8%
Total Hourly Ownership Cost:	**USD $54.10/hr**	**USD $42.76/hr**	**-21%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,304hrs -> 1,445hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $14.76/hr	USD $5.04/hr	-65.9%
Field Parts	USD $7.92/hr	USD $2.04/hr	-74.3%
Ground Engaging Component (GEC)	USD $1.08/hr	USD $0.00/hr	-100%
Tire	USD $5.77/hr	-	-
Electrical/Fuel	USD $21.18/hr	USD $8.38/hr	-60.4%
Lube	USD $4.60/hr	-	-
Total Operating Ownership Cost:	**USD $55.31/hr**	**USD $25.84/hr**	**-53.3%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $1,406.65 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,538.53 -> USD $0.00) Annual Field Repair Parts Cost (USD $8,791.58 -> USD $2,945.18)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $54.10/hr	USD $42.76/hr	-21%
Hourly Operating Costs	USD $55.31/hr	USD $25.84/hr	-53.3%
Total Hourly Cost	**USD $109.42**	**USD $68.60/hr**	**-37.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $34.82/hr	USD $32.15/hr	-7.7%
Idle	USD $75.28/hr	USD $51.14/hr	-32.1%

Revised Date: 1st half 2021

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EquipmentWatch

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All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 980H (disc. 2013)
4-Wd Articulated Wheel Loaders

Size Class:
275 - 349 HP
Weight:
67294 lbs

Configuration for 980H (disc. 2013)

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $11,934.00	USD $4,255.00	USD $1,518.00
Adjustments			
Region (New Mexico: 105%)	USD $571.85	USD $203.89	USD $72.74
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $12,505.85**	**USD $4,458.89**	**USD $1,590.74**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 980H (disc. 2013)
4-Wd Articulated Wheel Loaders

Size Class:
275 - 349 HP
Weight:
67294 lbs

Configuration for 980H (disc. 2013)

Operator Protection	**EROPS**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $33.11/hr	USD $30.77/hr	-7.1%
Cost of Facilities Capital (CFC)	USD $3.15/hr	USD $3.16/hr	+0.1%
Overhead	USD $4.84/hr	USD $4.85/hr	+0.1%
Overhaul Labor	USD $10.90/hr	USD $4.13/hr	-62.1%
Overhaul Parts	USD $9.33/hr	USD $9.35/hr	+0.1%
Total Hourly Ownership Cost:	**USD $61.34/hr**	**USD $52.25/hr**	**-14.8%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,447hrs -> 1,445hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $13.30/hr	USD $5.04/hr	-62.1%
Field Parts	USD $10.30/hr	USD $2.94/hr	-71.4%
Ground Engaging Component (GEC)	USD $1.40/hr	USD $0.00/hr	-100%
Tire	USD $11.41/hr	-	-
Electrical/Fuel	USD $25.46/hr	USD $10.08/hr	-60.4%
Lube	USD $5.95/hr	-	-
Total Operating Ownership Cost:	**USD $67.83/hr**	**USD $35.43/hr**	**-47.8%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $2,029.11 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $2,219.34 -> USD $0.00) Annual Field Repair Parts Cost (USD $12,681.95 -> USD $4,248.45)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $61.34/hr	USD $52.25/hr	-14.8%
Hourly Operating Costs	USD $67.83/hr	USD $35.43/hr	-47.8%
Total Hourly Cost	**USD $129.17**	**USD $87.68/hr**	**-32.1%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $41.10/hr	USD $38.78/hr	-5.7%
Idle	USD $86.80/hr	USD $62.33/hr	-28.2%

Revised Date: 1st half 2021

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 988H (disc. 2014)
4-Wd Articulated Wheel Loaders

Size Class:
350 - 499 HP
Weight:
109230 lbs

Configuration for 988H (disc. 2014)

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $15,457.00	USD $5,361.00	USD $1,864.00
Adjustments			
Region (New Mexico: 105%)	USD $740.67	USD $256.89	USD $89.32
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $16,197.67**	**USD $5,617.89**	**USD $1,953.32**

Date Last Updated: Sep 01, 2020

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 988H (disc. 2014)
4-Wd Articulated Wheel Loaders

Size Class:
350 - 499 HP
Weight:
109230 lbs

Configuration for 988H (disc. 2014)

Operator Protection	**EROPS**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $57.12/hr	USD $53.23/hr	-6.8%
Cost of Facilities Capital (CFC)	USD $5.40/hr	USD $5.59/hr	+3.6%
Overhead	USD $8.31/hr	USD $8.63/hr	+3.9%
Overhaul Labor	USD $10.51/hr	USD $4.13/hr	-60.7%
Overhaul Parts	USD $15.36/hr	USD $15.96/hr	+3.9%
Total Hourly Ownership Cost:	**USD $96.70/hr**	**USD $87.54/hr**	**-9.5%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,501hrs -> 1,445hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $12.82/hr	USD $5.04/hr	-60.7%
Field Parts	USD $16.95/hr	USD $5.02/hr	-70.4%
Ground Engaging Component (GEC)	USD $2.31/hr	USD $0.00/hr	-100%
Tire	USD $15.51/hr	-	-
Electrical/Fuel	USD $38.40/hr	USD $15.20/hr	-60.4%
Lube	USD $9.90/hr	-	-
Total Operating Ownership Cost:	**USD $95.89/hr**	**USD $50.68/hr**	**-47.2%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $3,463.74 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $3,788.46 -> USD $0.00) Annual Field Repair Parts Cost (USD $21,648.35 -> USD $7,252.20)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $96.70/hr	USD $87.54/hr	-9.5%
Hourly Operating Costs	USD $95.89/hr	USD $50.68/hr	-47.2%
Total Hourly Cost	**USD $192.59**	**USD $138.21/hr**	**-28.2%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $70.83/hr	USD $67.45/hr	-4.8%
Idle	USD $135.10/hr	USD $102.74/hr	-24%

Revised Date: 1st half 2021

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 992K
4-Wd Articulated Wheel Loaders

Size Class:
500 - 999 HP
Weight:
214948 lbs

Configuration for 992K

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $24,283.00	USD $8,110.00	USD $2,554.00
Adjustments			
Region (New Mexico: 105%)	USD $1,163.59	USD $388.61	USD $122.38
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $25,446.59**	**USD $8,498.61**	**USD $2,676.38**

Date Last Updated: Sep 01, 2020

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar 992K
4-Wd Articulated Wheel Loaders

Size Class:
500 - 999 HP
Weight:
214948 lbs

Configuration for 992K

Operator Protection	**EROPS**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $139.97/hr	USD $130.24/hr	-7%
Cost of Facilities Capital (CFC)	USD $12.02/hr	USD $13.15/hr	+9.4%
Overhead	USD $71.53/hr	USD $78.85/hr	+10.2%
Overhaul Labor	USD $9.90/hr	USD $4.13/hr	-58.3%
Overhaul Parts	USD $30.22/hr	USD $33.31/hr	+10.2%
Total Hourly Ownership Cost:	**USD $263.64/hr**	**USD $259.69/hr**	**-1.5%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,593hrs -> 1,445hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $12.08/hr	USD $5.04/hr	-58.3%
Field Parts	USD $33.34/hr	USD $12.31/hr	-63.1%
Ground Engaging Component (GEC)	USD $4.54/hr	USD $1.68/hr	-63.1%
Tire	USD $54.99/hr	-	-
Electrical/Fuel	USD $64.75/hr	USD $25.63/hr	-60.4%
Lube	USD $20.71/hr	-	-
Total Operating Ownership Cost:	**USD $190.42/hr**	**USD $120.37/hr**	**-36.8%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Field Repair Parts Cost (USD $45,200.00 -> USD $15,142.00)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $263.64/hr	USD $259.69/hr	-1.5%
Hourly Operating Costs	USD $190.42/hr	USD $120.37/hr	-36.8%
Total Hourly Cost	**USD $454.06**	**USD $380.06/hr**	**-16.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $223.52/hr	USD $222.24/hr	-0.6%
Idle	USD $328.39/hr	USD $285.32/hr	-13.1%

Revised Date: 1st half 2021

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All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar 993K
4-Wd Articulated Wheel Loaders

Size Class:
500 - 999 HP
Weight:
294800 lbs

Configuration for 993K

Operator Protection	**EROPS**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $24,283.00	USD $8,110.00	USD $2,554.00
Adjustments			
Region (New Mexico: 105%)	USD $1,163.59	USD $388.61	USD $122.38
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $25,446.59**	**USD $8,498.61**	**USD $2,676.38**

Date Last Updated: Sep 01, 2020

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Custom Cost Evaluator

January 8, 2021

Caterpillar 993K
4-Wd Articulated Wheel Loaders

Size Class:
500 - 999 HP
Weight:
294800 lbs

Configuration for 993K

Operator Protection	**EROPS**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $167.84/hr	USD $156.18/hr	-7%
Cost of Facilities Capital (CFC)	USD $14.42/hr	USD $15.77/hr	+9.4%
Overhead	USD $35.93/hr	USD $39.61/hr	+10.2%
Overhaul Labor	USD $9.90/hr	USD $4.13/hr	-58.3%
Overhaul Parts	USD $36.24/hr	USD $39.95/hr	+10.2%
Total Hourly Ownership Cost:	**USD $264.33/hr**	**USD $255.63/hr**	**-3.3%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,593hrs -> 1,445hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $12.08/hr	USD $5.04/hr	-58.3%
Field Parts	USD $39.98/hr	USD $14.76/hr	-63.1%
Ground Engaging Component (GEC)	USD $5.44/hr	USD $2.01/hr	-63.1%
Tire	USD $65.94/hr	-	-
Electrical/Fuel	USD $76.79/hr	USD $30.40/hr	-60.4%
Lube	USD $24.75/hr	-	-
Total Operating Ownership Cost:	**USD $224.99/hr**	**USD $142.91/hr**	**-36.5%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Field Repair Parts Cost (USD $54,200.00 -> USD $18,157.00)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $264.33/hr	USD $255.63/hr	-3.3%
Hourly Operating Costs	USD $224.99/hr	USD $142.91/hr	-36.5%
Total Hourly Cost	**USD $489.32**	**USD $398.54/hr**	**-18.6%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $218.19/hr	USD $211.56/hr	-3%
Idle	USD $341.12/hr	USD $286.03/hr	-16.1%

Revised Date: 1st half 2021

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All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar D6T
Standard Crawler Dozers

Size Class:
160 - 189 HP
Weight:
40550 lbs

Configuration for D6T

Dozer Type	**Semi-U**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $7,982.00	USD $2,711.00	USD $879.00
Adjustments			
Region (New Mexico: 110%)	USD $811.77	USD $275.71	USD $89.39
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $8,793.77**	**USD $2,986.71**	**USD $968.39**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar D6T
Standard Crawler Dozers

Size Class:
160 - 189 HP
Weight:
40550 lbs

Configuration for D6T

Dozer Type	**Semi-U**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $32.73/hr	USD $30.46/hr	-6.9%
Cost of Facilities Capital (CFC)	USD $3.52/hr	USD $3.20/hr	-9.1%
Overhead	USD $16.22/hr	USD $14.64/hr	-9.7%
Overhaul Labor	USD $11.70/hr	USD $4.00/hr	-65.8%
Overhaul Parts	USD $21.59/hr	USD $19.49/hr	-9.7%
Total Hourly Ownership Cost:	**USD $85.75/hr**	**USD $71.78/hr**	**-16.3%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,160hrs -> 1,285hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $14.42/hr	USD $4.92/hr	-65.8%
Field Parts	USD $20.92/hr	USD $6.29/hr	-69.9%
Ground Engaging Component (GEC)	USD $3.49/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $18.23/hr	USD $7.22/hr	-60.4%
Lube	USD $4.80/hr	-	-
Total Operating Ownership Cost:	**USD $61.85/hr**	**USD $23.23/hr**	**-62.4%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $4,044.32 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $4,044.32 -> USD $0.00) Annual Field Repair Parts Cost (USD $20,221.59 -> USD $8,088.64)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $85.75/hr	USD $71.78/hr	-16.3%
Hourly Operating Costs	USD $61.85/hr	USD $23.23/hr	-62.4%
Total Hourly Cost	**USD $147.59**	**USD $95.02/hr**	**-35.6%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $52.46/hr	USD $48.30/hr	-7.9%
Idle	USD $103.97/hr	USD $79.00/hr	-24%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar D6T XL
Standard Crawler Dozers

Size Class:
190 - 259 HP
Weight:
44420 lbs

Configuration for D6T XL

Dozer Type	**Semi-U**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $11,423.00	USD $3,990.00	USD $1,403.00
Adjustments			
Region (New Mexico: 110%)	USD $1,161.72	USD $405.78	USD $142.69
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $12,584.72**	**USD $4,395.78**	**USD $1,545.69**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar D6T XL
Standard Crawler Dozers

Size Class:
190 - 259 HP
Weight:
44420 lbs

Configuration for D6T XL

Dozer Type	**Semi-U**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $35.74/hr	USD $33.44/hr	-6.4%
Cost of Facilities Capital (CFC)	USD $3.47/hr	USD $3.15/hr	-9.1%
Overhead	USD $16.51/hr	USD $14.90/hr	-9.7%
Overhaul Labor	USD $11.70/hr	USD $4.00/hr	-65.8%
Overhaul Parts	USD $21.96/hr	USD $19.82/hr	-9.7%
Total Hourly Ownership Cost:	**USD $89.37/hr**	**USD $75.31/hr**	**-15.7%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,160hrs -> 1,285hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $14.42/hr	USD $4.92/hr	-65.8%
Field Parts	USD $21.28/hr	USD $7.68/hr	-63.9%
Ground Engaging Component (GEC)	USD $3.55/hr	USD $1.28/hr	-63.9%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $19.70/hr	USD $7.80/hr	-60.4%
Lube	USD $5.00/hr	-	-
Total Operating Ownership Cost:	**USD $63.95/hr**	**USD $26.69/hr**	**-58.3%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Field Repair Parts Cost (USD $20,570.71 -> USD $8,228.28)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $89.37/hr	USD $75.31/hr	-15.7%
Hourly Operating Costs	USD $63.95/hr	USD $26.69/hr	-58.3%
Total Hourly Cost	**USD $153.32**	**USD $102.00/hr**	**-33.5%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $55.72/hr	USD $51.49/hr	-7.6%
Idle	USD $109.08/hr	USD $83.11/hr	-23.8%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar D9T
Standard Crawler Dozers

Size Class:
360 - 519 HP
Weight:
105600 lbs

Configuration for D9T

Dozer Type	**Semi-U**	Operator Protection	**ROPS/FOPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $26,926.00	USD $9,306.00	USD $3,273.00
Adjustments			
Region (New Mexico: 110%)	USD $2,738.37	USD $946.42	USD $332.86
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $29,664.37**	**USD $10,252.42**	**USD $3,605.86**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar D9T
Standard Crawler Dozers

Size Class:
360 - 519 HP
Weight:
105600 lbs

Configuration for D9T

Dozer Type	**Semi-U**	Operator Protection	**ROPS/FOPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $76.16/hr	USD $71.65/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $6.19/hr	USD $6.77/hr	+9.5%
Overhead	USD $31.98/hr	USD $35.27/hr	+10.3%
Overhaul Labor	USD $16.76/hr	USD $6.99/hr	-58.3%
Overhaul Parts	USD $49.91/hr	USD $55.04/hr	+10.3%
Total Hourly Ownership Cost:	**USD $180.99/hr**	**USD $175.73/hr**	**-2.9%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,544hrs -> 1,400hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $19.62/hr	USD $8.19/hr	-58.3%
Field Parts	USD $48.61/hr	USD $17.87/hr	-63.2%
Ground Engaging Component (GEC)	USD $8.10/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $36.25/hr	USD $14.35/hr	-60.4%
Lube	USD $12.47/hr	-	-
Total Operating Ownership Cost:	**USD $125.05/hr**	**USD $52.88/hr**	**-57.7%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $12,508.00 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $12,508.00 -> USD $0.00) Annual Field Repair Parts Cost (USD $62,540.00 -> USD $25,016.00)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $180.99/hr	USD $175.73/hr	-2.9%
Hourly Operating Costs	USD $125.05/hr	USD $52.88/hr	-57.7%
Total Hourly Cost	**USD $306.04**	**USD $228.61/hr**	**-25.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $114.33/hr	USD $113.69/hr	-0.6%
Idle	USD $217.24/hr	USD $190.08/hr	-12.5%

Revised Date: 1st half 2021

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EquipmentWatch

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All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Caterpillar D11T
Standard Crawler Dozers

Size Class:
520 HP & Over
Weight:
208885 lbs

Configuration for D11T

Dozer Type	**U Blade**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $30,648.00	USD $10,566.00	USD $3,597.00
Adjustments			
Region (New Mexico: 110%)	USD $3,116.90	USD $1,074.56	USD $365.81
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $33,764.90**	**USD $11,640.56**	**USD $3,962.81**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

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All prices shown in US dollars ($)

AED Green Book®

January 10, 2021

Caterpillar D11T CD
Standard Crawler Dozers

Size Class:
520 HP & Over
Weight:
N/A

Configuration for D11T CD

Dozer Type	**U Blade**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $30,648.00	USD $10,566.00	USD $3,597.00
Adjustments			
Region (New Mexico: 110%)	USD $3,116.90	USD $1,074.56	USD $365.81
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $33,764.90**	**USD $11,640.56**	**USD $3,962.81**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 10, 2021

Caterpillar D11T CD
Standard Crawler Dozers

Size Class:
520 HP & Over
Weight:
N/A

Configuration for D11T CD

Dozer Type	**U Blade**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $83.70/hr	USD $78.75/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $8.08/hr	USD $7.35/hr	-9.1%
Overhead	USD $45.28/hr	USD $40.89/hr	-9.7%
Overhaul Labor	USD $20.47/hr	USD $6.99/hr	-65.8%
Overhaul Parts	USD $66.13/hr	USD $59.70/hr	-9.7%
Total Hourly Ownership Cost:	**USD $223.66/hr**	**USD $193.68/hr**	**-13.4%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,264hrs -> 1,400hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $23.97/hr	USD $8.19/hr	-65.8%
Field Parts	USD $64.41/hr	USD $19.38/hr	-69.9%
Ground Engaging Component (GEC)	USD $10.73/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $75.15/hr	USD $29.75/hr	-60.4%
Lube	USD $17.11/hr	-	-
Total Operating Ownership Cost:	**USD $191.37/hr**	**USD $74.44/hr**	**-61.1%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $13,568.00 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $13,568.00 -> USD $0.00) Annual Field Repair Parts Cost (USD $67,840.00 -> USD $27,136.00)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $223.66/hr	USD $193.68/hr	-13.4%
Hourly Operating Costs	USD $191.37/hr	USD $74.44/hr	-61.1%
Total Hourly Cost	**USD $415.03**	**USD $268.12/hr**	**-35.4%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $137.06/hr	USD $126.98/hr	-7.4%
Idle	USD $298.81/hr	USD $223.43/hr	-25.2%

Revised Date: 1st half 2021

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EquipmentWatch

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Caterpillar D11T
Standard Crawler Dozers

Size Class:
520 HP & Over
Weight:
208885 lbs

Configuration for D11T

Dozer Type	**U Blade**	Operator Protection	**EROPS**
Power Mode	**Diesel**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $162.82/hr	USD $153.20/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $15.72/hr	USD $14.29/hr	-9.1%
Overhead	USD $45.28/hr	USD $40.89/hr	-9.7%
Overhaul Labor	USD $20.47/hr	USD $6.99/hr	-65.8%
Overhaul Parts	USD $128.64/hr	USD $116.14/hr	-9.7%
Total Hourly Ownership Cost:	**USD $372.93/hr**	**USD $331.51/hr**	**-11.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,264hrs -> 1,400hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $23.97/hr	USD $8.19/hr	-65.8%
Field Parts	USD $125.29/hr	USD $45.25/hr	-63.9%
Ground Engaging Component (GEC)	USD $20.88/hr	USD $7.54/hr	-63.9%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $75.15/hr	USD $29.75/hr	-60.4%
Lube	USD $26.19/hr	-	-
Total Operating Ownership Cost:	**USD $271.47/hr**	**USD $116.92/hr**	**-56.9%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Field Repair Parts Cost (USD $131,970.00 -> USD $52,788.00)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $372.93/hr	USD $331.51/hr	-11.1%
Hourly Operating Costs	USD $271.47/hr	USD $116.92/hr	-56.9%
Total Hourly Cost	**USD $644.40**	**USD $448.42/hr**	**-30.4%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $223.82/hr	USD $208.37/hr	-6.9%
Idle	USD $448.08/hr	USD $361.26/hr	-19.4%

Revised Date: 1st half 2021

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AED Green Book®

January 8, 2021

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A

Configuration for 7430 (disc. 2011)

Horsepower	**166.0 hp**	Power Mode	**Diesel**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $3,891.00	USD $1,303.00	USD $462.00
Adjustments			
Region (New Mexico: 92%)	(USD $292.20)	(USD $97.85)	(USD $34.69)
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $3,598.80**	**USD $1,205.15**	**USD $427.31**

Date Last Updated: Sep 01, 2020

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Deere 7430 (disc. 2011)
Wheel Tractors

Size Class:
125 to 174 hp
Weight:
N/A

Configuration for 7430 (disc. 2011)

Horsepower	**166.0 hp**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $12.78/hr	USD $11.98/hr	-6.3%
Cost of Facilities Capital (CFC)	USD $1.13/hr	USD $1.03/hr	-8.9%
Overhead	USD $3.64/hr	USD $3.28/hr	-9.7%
Overhaul Labor	USD $7.67/hr	USD $2.60/hr	-66.1%
Overhaul Parts	USD $6.08/hr	USD $5.49/hr	-9.7%
Total Hourly Ownership Cost:	**USD $31.30/hr**	**USD $24.37/hr**	**-22.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (930hrs -> 1,030hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $10.11/hr	USD $3.42/hr	-66.1%
Field Parts	USD $5.33/hr	USD $0.80/hr	-85%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $1.00/hr	-	-
Electrical/Fuel	USD $15.10/hr	USD $5.98/hr	-60.4%
Lube	USD $2.32/hr	-	-
Total Operating Ownership Cost:	**USD $33.87/hr**	**USD $13.53/hr**	**-60.1%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.66) Annual Misc Supply Parts (USD $826.36 -> USD $0.00) Annual Field Repair Parts Cost (USD $4,131.81 -> USD $826.36)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $31.30/hr	USD $24.37/hr	-22.1%
Hourly Operating Costs	USD $33.87/hr	USD $13.53/hr	-60.1%
Total Hourly Cost	**USD $65.16**	**USD $37.90/hr**	**-41.8%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $17.55/hr	USD $16.29/hr	-7.2%
Idle	USD $46.39/hr	USD $30.35/hr	-34.6%

Revised Date: 1st half 2021

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Rental Rate Blue Book®

January 10, 2021

Finn B260
Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4880 lbs

Configuration for B260

Horsepower	**115.0**	Power Mode	**Diesel**

Blue Book Rates

Non-current (i.e. archived) rates: Jul 1, 2018 - Dec 31, 2018

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $2,380.00	USD $665.00	USD $165.00	USD $25.00	USD $20.15	USD $33.67
Adjustments						
Region (Las Cruces, New Mexico: 89.4%)	(USD $252.28)	(USD $70.49)	(USD $17.49)	(USD $2.65)		
Model Year (2021: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $2,127.72**	**USD $594.51**	**USD $147.51**	**USD $22.35**	**USD $20.15**	**USD $32.24**

Non-Active Use Rates

	Hourly
Standby Rate	USD $5.92
Idling Rate	USD $24.52

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	37%	USD $880.60/mo
Overhaul (ownership)	51%	USD $1,213.80/mo
CFC (ownership)	4%	USD $95.20/mo
Indirect (ownership)	8%	USD $190.40/mo
Fuel (operating) @ USD 3.01	62%	USD $12.43/hr

Revised Date: 2nd half 2018

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Finn B260
Trailer Mounted Mulchers

Size Class:
51 HP & Over
Weight:
4880 lbs

Configuration for B260

Horsepower	**115.0**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $5.80/hr	USD $5.45/hr	-6.2%
Cost of Facilities Capital (CFC)	USD $0.31/hr	-	-
Overhead	USD $1.18/hr	-	-
Overhaul Labor	USD $3.61/hr	USD $1.36/hr	-62.2%
Overhaul Parts	USD $2.54/hr	-	-
Total Hourly Ownership Cost:	**USD $13.45/hr**	**USD $10.85/hr**	**-19.3%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $4.51/hr	USD $1.71/hr	-62.2%
Field Parts	USD $1.47/hr	USD $0.19/hr	-87%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.60/hr	-	-
Electrical/Fuel	USD $10.43/hr	USD $4.13/hr	-60.4%
Lube	USD $1.29/hr	-	-
Total Operating Ownership Cost:	**USD $18.30/hr**	**USD $7.92/hr**	**-56.7%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $201.40 -> USD $0.00) Annual Field Repair Parts Cost (USD $1,342.66 -> USD $201.40)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $13.45/hr	USD $10.85/hr	-19.3%
Hourly Operating Costs	USD $18.30/hr	USD $7.92/hr	-56.7%
Total Hourly Cost	**USD $31.75**	**USD $18.77/hr**	**-40.9%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $7.30/hr	USD $6.95/hr	-4.9%
Idle	USD $23.88/hr	USD $14.98/hr	-37.3%

Revised Date: 1st half 2021

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EquipmentWatch

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All prices shown in US dollars ($)

Rental Rate Blue Book®

January 8, 2021

Hitachi EX3600-5 (disc. 2009)
Hydraulic Shovels

Size Class:
150.1 MTons & Over
Weight:
772000 lbs

Configuration for EX3600-5 (disc. 2009)

Operating Weight	**350.0 mt**	Power Mode	**Diesel**

Blue Book Rates

Non-current (i.e. archived) rates: Jul 1, 2018 - Dec 31, 2018

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $74,405.00	USD $20,835.00	USD $5,210.00	USD $780.00	USD $505.60	USD $928.36
Adjustments						
Region (Las Cruces, New Mexico: 90.4%)	(USD $7,142.88)	(USD $2,000.16)	(USD $500.16)	(USD $74.88)		
Model Year (2009: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $67,262.12**	**USD $18,834.84**	**USD $4,709.84**	**USD $705.12**	**USD $505.60**	**USD $887.77**

Non-Active Use Rates	**Hourly**
Standby Rate	USD $187.26
Idling Rate	USD $631.16

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	33%	USD $24,553.65/mo
Overhaul (ownership)	51%	USD $37,946.55/mo
CFC (ownership)	7%	USD $5,208.35/mo
Indirect (ownership)	9%	USD $6,696.45/mo
Fuel (operating) @ USD 3.01	49%	USD $248.99/hr

Revised Date: 2nd half 2018

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Hitachi EX3600-5 (disc. 2009)
Hydraulic Shovels

Size Class:
150.1 MTons & Over
Weight:
772000 lbs

Configuration for EX3600-5 (disc. 2009)

Operating Weight	**350.0 mt**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $157.43/hr	USD $148.57/hr	-5.6%
Cost of Facilities Capital (CFC)	USD $16.64/hr	-	-
Overhead	USD $72.91/hr	-	-
Overhaul Labor	USD $32.75/hr	USD $12.39/hr	-62.2%
Overhaul Parts	USD $137.58/hr	-	-
Total Hourly Ownership Cost:	**USD $417.32/hr**	**USD $388.10/hr**	**-7%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $43.49/hr	USD $16.46/hr	-62.2%
Field Parts	USD $150.64/hr	USD $54.23/hr	-64%
Ground Engaging Component (GEC)	USD $24.10/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $208.95/hr	USD $82.72/hr	-60.4%
Lube	USD $52.98/hr	-	-
Total Operating Ownership Cost:	**USD $480.17/hr**	**USD $206.39/hr**	**-57%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Annual Ground Engaging Component (USD $44,590.87 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $55,738.59 -> USD $0.00) Annual Field Repair Parts Cost (USD $222,954.34 -> USD $100,329.46)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $417.32/hr	USD $388.10/hr	-7%
Hourly Operating Costs	USD $480.17/hr	USD $206.39/hr	-57%
Total Hourly Cost	**USD $897.49**	**USD $594.48/hr**	**-33.8%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $246.99/hr	USD $238.12/hr	-3.6%
Idle	USD $626.27/hr	USD $470.82/hr	-24.8%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

Rental Rate Blue Book®

January 10, 2021

Komatsu 730E
Electric Drive Rear Dumps

Size Class:
170 - 199 MTons
Weight:
309950 lbs

Configuration for 730E

Power Mode	**Diesel**	Rated Payload	**183.7 mt**
Wheel Motor Model	**GE788**		

Blue Book Rates

Non-current (i.e. archived) rates: Jul 1, 2018 - Dec 31, 2018

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $31,315.00	USD $8,770.00	USD $2,195.00	USD $330.00	USD $183.95	USD $361.88
Adjustments						
Region (Las Cruces, New Mexico: 91.1%)	(USD $2,787.03)	(USD $780.53)	(USD $195.35)	(USD $29.37)		
Model Year (2021: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $28,527.96**	**USD $7,989.47**	**USD $1,999.65**	**USD $300.63**	**USD $183.95**	**USD $346.04**

Non-Active Use Rates	**Hourly**
Standby Rate	USD $84.29
Idling Rate	USD $262.86

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	31%	USD $9,707.65/mo
Overhaul (ownership)	48%	USD $15,031.20/mo
CFC (ownership)	7%	USD $2,192.05/mo
Indirect (ownership)	14%	USD $4,384.10/mo
Fuel (operating) @ USD 3.01	55%	USD $100.77/hr

Revised Date: 2nd half 2018

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www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Komatsu 730E
Electric Drive Rear Dumps

Size Class:
170 - 199 MTons
Weight:
309950 lbs

Configuration for 730E

Power Mode	**Diesel**	Rated Payload	**183.7 mt**
Wheel Motor Model	**GE788**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $57.74/hr	USD $54.37/hr	-5.8%
Cost of Facilities Capital (CFC)	USD $6.47/hr	-	-
Overhead	USD $29.40/hr	-	-
Overhaul Labor	USD $57.99/hr	USD $21.94/hr	-62.2%
Overhaul Parts	USD $23.64/hr	-	-
Total Hourly Ownership Cost:	**USD $175.23/hr**	**USD $135.82/hr**	**-22.5%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $33.77/hr	USD $12.78/hr	-62.2%
Field Parts	USD $11.14/hr	USD $1.86/hr	-83.3%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $21.20/hr	-	-
Electrical/Fuel	USD $84.57/hr	USD $33.48/hr	-60.4%
Lube	USD $18.00/hr	-	-
Total Operating Ownership Cost:	**USD $168.68/hr**	**USD $87.31/hr**	**-48.2%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $3,434.40 -> USD $0.00) Annual Field Repair Parts Cost (USD $17,172.00 -> USD $3,434.40)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $175.23/hr	USD $135.82/hr	-22.5%
Hourly Operating Costs	USD $168.68/hr	USD $87.31/hr	-48.2%
Total Hourly Cost	**USD $343.91**	**USD $223.13/hr**	**-35.1%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $93.61/hr	USD $90.24/hr	-3.6%
Idle	USD $259.80/hr	USD $169.30/hr	-34.8%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

Rental Rate Blue Book®

January 10, 2021

Komatsu HD1500-5 (disc. 2008)
Mechanical Drive Rear Dumps

Size Class:
105 - 139 MTons
Weight:
221481 lbs

Configuration for HD1500-5 (disc. 2008)

Power Mode	**Diesel**	Rated Payload	**136.0 mt**

Blue Book Rates

Non-current (i.e. archived) rates: Jul 1, 2018 - Dec 31, 2018

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $26,800.00	USD $7,505.00	USD $1,875.00	USD $280.00	USD $160.20	USD $312.47
Adjustments						
Region (Las Cruces, New Mexico: 91.1%)	(USD $2,385.20)	(USD $667.95)	(USD $166.88)	(USD $24.92)		
Model Year (2008: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $24,414.80**	**USD $6,837.06**	**USD $1,708.13**	**USD $255.08**	**USD $160.20**	**USD $298.92**

Non-Active Use Rates

	Hourly
Standby Rate	USD $67.97
Idling Rate	USD $223.36

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	34%	USD $9,112.00/mo
Overhaul (ownership)	51%	USD $13,668.00/mo
CFC (ownership)	6%	USD $1,608.00/mo
Indirect (ownership)	9%	USD $2,412.00/mo
Fuel (operating) @ USD 3.01	53%	USD $84.64/hr

Revised Date: 2nd half 2018

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All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Komatsu HD1500-5 (disc. 2008)
Mechanical Drive Rear Dumps

Size Class:
105 - 139 MTons
Weight:
221481 lbs

Configuration for HD1500-5 (disc. 2008)

Power Mode	**Diesel**	Rated Payload	**136.0 mt**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $64.94/hr	USD $61.05/hr	-6%
Cost of Facilities Capital (CFC)	USD $5.54/hr	USD $5.58/hr	+0.8%
Overhead	USD $24.59/hr	USD $24.81/hr	+0.9%
Overhaul Labor	USD $38.03/hr	USD $14.39/hr	-62.2%
Overhaul Parts	USD $29.59/hr	USD $29.86/hr	+0.9%
Total Hourly Ownership Cost:	**USD $162.67/hr**	**USD $135.69/hr**	**-16.6%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,867hrs -> 1,850hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $21.97/hr	USD $8.31/hr	-62.2%
Field Parts	USD $12.55/hr	USD $2.11/hr	-83.2%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $27.39/hr	-	-
Electrical/Fuel	USD $71.03/hr	USD $28.12/hr	-60.4%
Lube	USD $17.82/hr	-	-
Total Operating Ownership Cost:	**USD $150.76/hr**	**USD $83.76/hr**	**-44.4%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.66) Annual Misc Supply Parts (USD $3,903.61 -> USD $0.00) Annual Field Repair Parts Cost (USD $19,518.04 -> USD $3,903.61)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $162.67/hr	USD $135.69/hr	-16.6%
Hourly Operating Costs	USD $150.76/hr	USD $83.76/hr	-44.4%
Total Hourly Cost	**USD $313.44**	**USD $219.45/hr**	**-30%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $95.06/hr	USD $91.45/hr	-3.8%
Idle	USD $233.70/hr	USD $163.81/hr	-29.9%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Miscellaneous 42 X 60' - 516
Single Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
23800 lbs

Configuration for 42 X 60' - 516

Conveyor Size	**42' X 60'**	Horsepower	**110.0**
Power Mode	**Diesel**	Screen Size	**5' X 16'**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $9.59/hr	USD $9.06/hr	-5.5%
Cost of Facilities Capital (CFC)	USD $0.70/hr	-	-
Overhead	USD $3.24/hr	-	-
Overhaul Labor	USD $13.38/hr	USD $5.06/hr	-62.2%
Overhaul Parts	USD $7.07/hr	-	-
Total Hourly Ownership Cost:	**USD $33.99/hr**	**USD $25.14/hr**	**-26%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $15.15/hr	USD $5.73/hr	-62.2%
Field Parts	USD $6.57/hr	USD $1.64/hr	-75%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.36/hr	-	-
Electrical/Fuel	USD $12.25/hr	USD $4.85/hr	-60.4%
Lube	USD $1.96/hr	-	-
Total Operating Ownership Cost:	**USD $36.28/hr**	**USD $14.54/hr**	**-59.9%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Field Repair Parts Cost (USD $6,567.79 -> USD $1,641.95)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $33.99/hr	USD $25.14/hr	-26%
Hourly Operating Costs	USD $36.28/hr	USD $14.54/hr	-59.9%
Total Hourly Cost	**USD $70.27**	**USD $39.68/hr**	**-43.5%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $13.54/hr	USD $13.01/hr	-3.9%
Idle	USD $46.24/hr	USD $29.99/hr	-35.1%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Miscellaneous 42 X 60' - 516
Triple Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
27900 lbs

Configuration for 42 X 60' - 516

Conveyor Size	**42' X 60'**	Horsepower	**110.0**
Power Mode	**Diesel**	Screen Size	**5' X 16'**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $10.18/hr	USD $9.62/hr	-5.5%
Cost of Facilities Capital (CFC)	USD $0.76/hr	-	-
Overhead	USD $3.52/hr	-	-
Overhaul Labor	USD $13.99/hr	USD $5.29/hr	-62.2%
Overhaul Parts	USD $7.56/hr	-	-
Total Hourly Ownership Cost:	**USD $36.00/hr**	**USD $26.75/hr**	**-25.7%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $15.65/hr	USD $5.92/hr	-62.2%
Field Parts	USD $7.23/hr	USD $1.45/hr	-80%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.37/hr	-	-
Electrical/Fuel	USD $12.25/hr	USD $4.85/hr	-60.4%
Lube	USD $2.02/hr	-	-
Total Operating Ownership Cost:	**USD $37.51/hr**	**USD $14.60/hr**	**-61.1%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,806.29 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,225.16 -> USD $1,806.29)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $36.00/hr	USD $26.75/hr	-25.7%
Hourly Operating Costs	USD $37.51/hr	USD $14.60/hr	-61.1%
Total Hourly Cost	**USD $73.52**	**USD $41.35/hr**	**-43.7%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $14.46/hr	USD $13.90/hr	-3.9%
Idle	USD $48.26/hr	USD $31.60/hr	-34.5%

Revised Date: 1st half 2021

The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Miscellaneous 42 X 60' - 516
Single Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
22200 lbs

Configuration for 42 X 60' - 516

Conveyor Size	**42' X 60'**	Horsepower	**75.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $11,400.00	USD $3,800.00	USD $1,200.00
Adjustments			
Region (New Mexico: 102%)	USD $225.00	USD $75.00	USD $23.68
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $11,625.00**	**USD $3,875.00**	**USD $1,223.68**

Date Last Updated: Sep 01, 2020

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www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Miscellaneous 42 X 60' - 516

Triple Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
26300 lbs

Configuration for 42 X 60' - 516

Conveyor Size	**42' X 60'**	Horsepower	**75.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $16,532.00	USD $5,512.00	USD $1,808.00
Adjustments			
Region (New Mexico: 108%)	USD $1,340.04	USD $446.79	USD $146.55
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $17,872.04**	**USD $5,958.79**	**USD $1,954.55**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Miscellaneous 48 X 60' - 516
Double Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
26400 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**110.0**
Power Mode	**Diesel**	Screen Size	**5' X 16'**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $10.28/hr	USD $9.72/hr	-5.5%
Cost of Facilities Capital (CFC)	USD $0.77/hr	-	-
Overhead	USD $3.56/hr	-	-
Overhaul Labor	USD $13.63/hr	USD $5.16/hr	-62.2%
Overhaul Parts	USD $7.71/hr	-	-
Total Hourly Ownership Cost:	**USD $35.95/hr**	**USD $26.91/hr**	**-25.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $15.15/hr	USD $5.73/hr	-62.2%
Field Parts	USD $7.12/hr	USD $1.42/hr	-80%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.40/hr	-	-
Electrical/Fuel	USD $12.25/hr	USD $4.85/hr	-60.4%
Lube	USD $2.03/hr	-	-
Total Operating Ownership Cost:	**USD $36.94/hr**	**USD $14.43/hr**	**-60.9%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,780.71 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,122.85 -> USD $1,780.71)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $35.95/hr	USD $26.91/hr	-25.1%
Hourly Operating Costs	USD $36.94/hr	USD $14.43/hr	-60.9%
Total Hourly Cost	**USD $72.89**	**USD $41.34/hr**	**-43.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $14.60/hr	USD $14.04/hr	-3.9%
Idle	USD $48.20/hr	USD $31.76/hr	-34.1%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Miscellaneous 48 X 60' - 516
Single Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
24900 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**110.0**
Power Mode	**Diesel**	Screen Size	**5' X 16'**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $10.30/hr	USD $9.74/hr	-5.5%
Cost of Facilities Capital (CFC)	USD $0.75/hr	-	-
Overhead	USD $3.48/hr	-	-
Overhaul Labor	USD $13.38/hr	USD $5.06/hr	-62.2%
Overhaul Parts	USD $7.59/hr	-	-
Total Hourly Ownership Cost:	**USD $35.51/hr**	**USD $26.63/hr**	**-25%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $15.15/hr	USD $5.73/hr	-62.2%
Field Parts	USD $7.05/hr	USD $1.41/hr	-80%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.39/hr	-	-
Electrical/Fuel	USD $12.25/hr	USD $4.85/hr	-60.4%
Lube	USD $2.01/hr	-	-
Total Operating Ownership Cost:	**USD $36.85/hr**	**USD $14.39/hr**	**-60.9%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,763.65 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,054.61 -> USD $1,763.65)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $35.51/hr	USD $26.63/hr	-25%
Hourly Operating Costs	USD $36.85/hr	USD $14.39/hr	-60.9%
Total Hourly Cost	**USD $72.37**	**USD $41.02/hr**	**-43.3%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $14.54/hr	USD $13.97/hr	-3.9%
Idle	USD $47.77/hr	USD $31.48/hr	-34.1%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Miscellaneous 48 X 60' - 516
Triple Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
29000 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**110.0**
Power Mode	**Diesel**	Screen Size	**5' X 16'**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $10.88/hr	USD $10.28/hr	-5.5%
Cost of Facilities Capital (CFC)	USD $0.81/hr	-	-
Overhead	USD $3.76/hr	-	-
Overhaul Labor	USD $13.99/hr	USD $5.29/hr	-62.2%
Overhaul Parts	USD $8.08/hr	-	-
Total Hourly Ownership Cost:	**USD $37.51/hr**	**USD $28.22/hr**	**-24.8%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $15.65/hr	USD $5.92/hr	-62.2%
Field Parts	USD $7.72/hr	USD $1.54/hr	-80%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $0.39/hr	-	-
Electrical/Fuel	USD $12.25/hr	USD $4.85/hr	-60.4%
Lube	USD $2.07/hr	-	-
Total Operating Ownership Cost:	**USD $38.09/hr**	**USD $14.78/hr**	**-61.2%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $1,929.86 -> USD $0.00) Annual Field Repair Parts Cost (USD $7,719.43 -> USD $1,929.86)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $37.51/hr	USD $28.22/hr	-24.8%
Hourly Operating Costs	USD $38.09/hr	USD $14.78/hr	-61.2%
Total Hourly Cost	**USD $75.60**	**USD $43.00/hr**	**-43.1%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $15.45/hr	USD $14.85/hr	-3.9%
Idle	USD $49.76/hr	USD $33.07/hr	-33.5%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Miscellaneous 48 X 60' - 516
Double Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
24800 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**100.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $11,834.00	USD $3,946.00	USD $1,279.00
Adjustments			
Region (New Mexico: 109%)	USD $1,017.82	USD $339.39	USD $110.00
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $12,851.82**	**USD $4,285.39**	**USD $1,389.00**

Date Last Updated: Sep 01, 2020

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www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Miscellaneous 48 X 60' - 516
Single Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
23300 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**100.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

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	Monthly	Weekly	Daily
Published Rates	USD $11,400.00	USD $3,800.00	USD $1,200.00
Adjustments			
Region (New Mexico: 102%)	USD $225.00	USD $75.00	USD $23.68
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $11,625.00**	**USD $3,875.00**	**USD $1,223.68**

Date Last Updated: Sep 01, 2020

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All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Miscellaneous 48 X 60' - 516
Triple Deck Portable Screening Plants

Size Class:
37 & Over
Weight:
27400 lbs

Configuration for 48 X 60' - 516

Conveyor Size	**48' X 60'**	Horsepower	**100.0**
Power Mode	**Electric**	Screen Size	**5' X 16'**

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $16,532.00	USD $5,512.00	USD $1,808.00
Adjustments			
Region (New Mexico: 108%)	USD $1,340.04	USD $446.79	USD $146.55
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $17,872.04**	**USD $5,958.79**	**USD $1,954.55**

Date Last Updated: Sep 01, 2020

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All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Miscellaneous 6000 330
Off-Highway Water Tanker Trucks

Size Class:
300 - 399 HP
Weight:
54400 lbs

Configuration for 6000 330

Horsepower	**330.0**	Power Mode	**Diesel**
Tank Capacity	**6000.0 gal**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $9,220.00	USD $3,256.00	USD $1,233.00
Adjustments			
Region (New Mexico: 102%)	USD $177.44	USD $62.66	USD $23.73
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $9,397.44**	**USD $3,318.66**	**USD $1,256.73**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Miscellaneous 6000 330
Off-Highway Water Tanker Trucks

Size Class:
300 - 399 HP
Weight:
54400 lbs

Configuration for 6000 330

Horsepower	**330.0**	Power Mode	**Diesel**
Tank Capacity	**6000.0 gal**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $22.91/hr	USD $21.43/hr	-6.5%
Cost of Facilities Capital (CFC)	USD $2.10/hr	-	-
Overhead	USD $7.31/hr	-	-
Overhaul Labor	USD $9.68/hr	USD $3.66/hr	-62.2%
Overhaul Parts	USD $5.85/hr	-	-
Total Hourly Ownership Cost:	**USD $47.85/hr**	**USD $40.35/hr**	**-15.7%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $23.77/hr	USD $8.99/hr	-62.2%
Field Parts	USD $10.69/hr	USD $2.14/hr	-80%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $6.42/hr	-	-
Electrical/Fuel	USD $28.43/hr	USD $11.25/hr	-60.4%
Lube	USD $5.31/hr	-	-
Total Operating Ownership Cost:	**USD $74.62/hr**	**USD $34.12/hr**	**-54.3%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Field Repair Parts Cost (USD $13,358.67 -> USD $2,671.74)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $47.85/hr	USD $40.35/hr	-15.7%
Hourly Operating Costs	USD $74.62/hr	USD $34.12/hr	-54.3%
Total Hourly Cost	**USD $122.47**	**USD $74.47/hr**	**-39.2%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $32.32/hr	USD $30.84/hr	-4.6%
Idle	USD $76.27/hr	USD $51.61/hr	-32.3%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

AED Green Book®

January 8, 2021

Miscellaneous 10000 450
Off-Highway Water Tanker Trucks

Size Class:
400 - 499 HP
Weight:
82200 lbs

Configuration for 10000 450

Horsepower	**450.0**	Power Mode	**Diesel**
Tank Capacity	**10000.0 gal**		

AED Rental Rates

These rental rates reflect an average for equipment of this type and size. Rates shown for specific brands or models are provided for convenience only. Rates charged by rental companies for specific brands or models will vary depending on many factors

	Monthly	Weekly	Daily
Published Rates	USD $13,290.00	USD $4,830.00	USD $1,450.00
Adjustments			
Region (New Mexico: 102%)	USD $255.76	USD $92.95	USD $27.90
User Defined			
Rental Rates (100%)	-	-	-
Total:	**USD $13,545.76**	**USD $4,922.95**	**USD $1,477.90**

Date Last Updated: Sep 01, 2020

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EquipmentWatch

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Miscellaneous 10000 450
Off-Highway Water Tanker Trucks

Size Class:
400 - 499 HP
Weight:
82200 lbs

Configuration for 10000 450

Horsepower	**450.0**	Power Mode	**Diesel**
Tank Capacity	**10000.0 gal**		

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $37.32/hr	USD $34.91/hr	-6.5%
Cost of Facilities Capital (CFC)	USD $3.42/hr	-	-
Overhead	USD $11.91/hr	-	-
Overhaul Labor	USD $13.88/hr	USD $5.25/hr	-62.2%
Overhaul Parts	USD $9.02/hr	-	-
Total Hourly Ownership Cost:	**USD $75.55/hr**	**USD $64.51/hr**	**-14.6%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $33.66/hr	USD $12.74/hr	-62.2%
Field Parts	USD $17.41/hr	USD $2.90/hr	-83.3%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $10.47/hr	-	-
Electrical/Fuel	USD $38.76/hr	USD $15.35/hr	-60.4%
Lube	USD $7.90/hr	-	-
Total Operating Ownership Cost:	**USD $108.19/hr**	**USD $49.35/hr**	**-54.4%**

User Defined Adjustments: Fuel (USD $2.53 -> USD $1.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $4,352.35 -> USD $0.00) Annual Field Repair Parts Cost (USD $21,761.77 -> USD $4,352.35)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $75.55/hr	USD $64.51/hr	-14.6%
Hourly Operating Costs	USD $108.19/hr	USD $49.35/hr	-54.4%
Total Hourly Cost	**USD $183.75**	**USD $113.86/hr**	**-38%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $52.65/hr	USD $50.24/hr	-4.6%
Idle	USD $114.32/hr	USD $79.86/hr	-30.1%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

Rental Rate Blue Book®

January 8, 2021

Miscellaneous MSR-189H

Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3557 lbs

Configuration for MSR-189H

Number Of Shanks	**3.0**	Ripper Type	**Parallelogram**

Blue Book Rates

Non-current (i.e. archived) rates: Jul 1, 2018 - Dec 31, 2018

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $990.00	USD $275.00	USD $69.00	USD $10.00	USD $4.15	USD $9.77
Adjustments						
Region (Las Cruces, New Mexico: 89%)	(USD $108.90)	(USD $30.25)	(USD $7.59)	(USD $1.10)		
Model Year (2021: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $881.10**	**USD $244.75**	**USD $61.41**	**USD $8.90**	**USD $4.15**	**USD $9.16**

Non-Active Use Rates	**Hourly**
Standby Rate	USD $3.40
Idling Rate	USD $5.01

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	51%	USD $504.90/mo
Overhaul (ownership)	32%	USD $316.80/mo
CFC (ownership)	5%	USD $49.50/mo
Indirect (ownership)	12%	USD $118.80/mo

Fuel cost data is not available for these rates.

Revised Date: 2nd half 2018

These are the most accurate rates for the selected Revision Date(s). However, due to more frequent online updates, these rates may not match Rental Rate Blue Book Print. Visit the Cost Recovery Product Guide on our Help page for more information.

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www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Miscellaneous MSR-189H
Crawler Tractor Multi-Shank Rippers

Size Class:
To 260 HP
Weight:
3557 lbs

Configuration for MSR-189H

Number Of Shanks	**3.0**	Ripper Type	**Parallelogram**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $2.64/hr	USD $2.50/hr	-5.1%
Cost of Facilities Capital (CFC)	USD $0.14/hr	-	-
Overhead	USD $0.66/hr	-	-
Overhaul Labor	USD $1.18/hr	USD $0.45/hr	-62.2%
Overhaul Parts	USD $0.95/hr	-	-
Total Hourly Ownership Cost:	**USD $5.56/hr**	**USD $4.70/hr**	**-15.6%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $1.96/hr	USD $0.74/hr	-62.2%
Field Parts	USD $1.18/hr	USD $1.18/hr	+0%
Ground Engaging Component (GEC)	USD $0.99/hr	USD $1.18/hr	+20%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $0.00/hr	-	-
Lube	USD $0.15/hr	-	-
Total Operating Ownership Cost:	**USD $4.28/hr**	**USD $3.26/hr**	**-23.9%**

User Defined Adjustments: Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $253.63 -> USD $0.00) Annual Field Repair Parts Cost (USD $1,268.16 -> USD $1,521.80)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $5.56/hr	USD $4.70/hr	-15.6%
Hourly Operating Costs	USD $4.28/hr	USD $3.26/hr	-23.9%
Total Hourly Cost	**USD $9.85**	**USD $7.96/hr**	**-19.2%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $3.44/hr	USD $3.30/hr	-3.9%
Idle	USD $5.56/hr	USD $4.70/hr	-15.6%

Revised Date: 1st half 2021

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www.equipmentwatch.com

All prices shown in US dollars ($)

Rental Rate Blue Book®

January 8, 2021

Miscellaneous MSR-359H
Crawler Tractor Multi-Shank Rippers

Size Class:
260 HP & Over
Weight:
N/A

Configuration for MSR-359H

Number Of Shanks	**3.0**	Ripper Type	**Parallelogram**

Blue Book Rates

Non-current (i.e. archived) rates: Jul 1, 2018 - Dec 31, 2018

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $2,585.00	USD $725.00	USD $180.00	USD $27.00	USD $9.70	USD $24.39
Adjustments						
Region (Las Cruces, New Mexico: 89%)	(USD $284.35)	(USD $79.75)	(USD $19.80)	(USD $2.97)		
Model Year (2021: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $2,300.65**	**USD $645.25**	**USD $160.20**	**USD $24.03**	**USD $9.70**	**USD $22.77**

Non-Active Use Rates	**Hourly**
Standby Rate	USD $8.89
Idling Rate	USD $13.07

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	51%	USD $1,318.35/mo
Overhaul (ownership)	32%	USD $827.20/mo
CFC (ownership)	5%	USD $129.25/mo
Indirect (ownership)	12%	USD $310.20/mo

Fuel cost data is not available for these rates.

Revised Date: 2nd half 2018

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The equipment represented in this report has been exclusively prepared for MANDY LILLA (mlilla@fmi.com)

www.equipmentwatch.com

All prices shown in US dollars ($)

Custom Cost Evaluator

January 8, 2021

Miscellaneous MSR-359H
Crawler Tractor Multi-Shank Rippers

Size Class:
260 HP & Over
Weight:
N/A

Configuration for MSR-359H

Number Of Shanks	**3.0**	Ripper Type	**Parallelogram**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $7.23/hr	USD $6.86/hr	-5.1%
Cost of Facilities Capital (CFC)	USD $0.35/hr	-	-
Overhead	USD $1.68/hr	-	-
Overhaul Labor	USD $2.95/hr	USD $1.12/hr	-62.2%
Overhaul Parts	USD $2.35/hr	-	-
Total Hourly Ownership Cost:	**USD $14.55/hr**	**USD $12.35/hr**	**-15.1%**

User Defined Adjustments: Sales Tax (5.1% -> 0%)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $5.40/hr	USD $2.04/hr	-62.2%
Field Parts	USD $2.37/hr	USD $2.37/hr	+0%
Ground Engaging Component (GEC)	USD $1.97/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $0.00/hr	-	-
Lube	USD $0.37/hr	-	-
Total Operating Ownership Cost:	**USD $10.12/hr**	**USD $4.78/hr**	**-52.7%**

User Defined Adjustments: Annual Ground Engaging Component (USD $2,534.87 -> USD $0.00) Mechanics Wage (USD $63.11 -> USD $23.88) Annual Misc Supply Parts (USD $506.97 -> USD $0.00) Annual Field Repair Parts Cost (USD $2,534.87 -> USD $3,041.85)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $14.55/hr	USD $12.35/hr	-15.1%
Hourly Operating Costs	USD $10.12/hr	USD $4.78/hr	-52.7%
Total Hourly Cost	**USD $24.67**	**USD $17.13/hr**	**-30.5%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $9.25/hr	USD $8.88/hr	-4%
Idle	USD $14.55/hr	USD $12.35/hr	-15.1%

Revised Date: 1st half 2021

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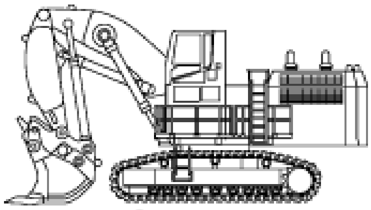
All prices shown in US dollars ($)

Rental Rate Blue Book®

May 24, 2020

Hitachi EX3600-5 (disc. 2009)
Hydraulic Shovels

Size Class:
150.1 MTons & Over
Weight:
772000 lbs



Configuration for EX3600-5 (disc. 2009)

Bucket Capacity - Heaped	**27.4 cu yd**	Net Horsepower	**1880.0 hp**
Operating Weight	**350.0 mt**	Power Mode	**Diesel**

Blue Book Rates

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $77,000.00	USD $21,560.00	USD $5,390.00	USD $810.00	USD $511.75	USD $949.25
Adjustments						
Region (Las Cruces, New Mexico: 90.4%)	(USD $7,392.00)	(USD $2,069.76)	(USD $517.44)	(USD $77.76)		
Model Year (2009: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $69,608.00**	**USD $19,490.24**	**USD $4,872.56**	**USD $732.24**	**USD $511.75**	**USD $907.25**

Non-Active Use Rates

	Hourly
Standby Rate	USD $217.52
Idling Rate	USD $648.62

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	33%	USD $25,410.00/mo
Overhaul (ownership)	45%	USD $34,650.00/mo
CFC (ownership)	10%	USD $7,700.00/mo
Indirect (ownership)	12%	USD $9,240.00/mo
Fuel (operating) @ USD 3.07	49%	USD $253.12/hr

Revised Date: 1st half 2020

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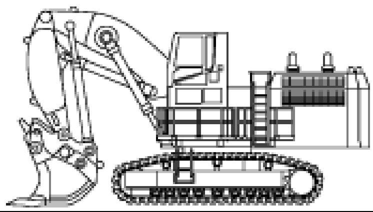
All prices shown in US dollars ($)

Adjustments for EX3600-5_2020 in All Saved Models

May 9, 2020

Hitachi EX3600-5 (disc. 2009)
Hydraulic Shovels

Size Class:
150.1 MTons & Over
Weight:
772000 lbs



Configuration for EX3600-5 (disc. 2009)

Bucket Capacity - Heaped	**27.4 cu yd**	Net Horsepower	**1880.0 hp**
Operating Weight	**350.0 mt**	Power Mode	**Diesel**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $157.54/hr	USD $148.69/hr	-5.6%
Cost of Facilities Capital (CFC)	USD $48.31/hr	USD $44.14/hr	-8.6%
Overhead	USD $72.89/hr	USD $66.17/hr	-9.2%
Overhaul Labor	USD $32.02/hr	USD $11.25/hr	-64.9%
Overhaul Parts	USD $126.74/hr	USD $115.05/hr	-9.2%
Total Hourly Ownership Cost:	**USD $437.50/hr**	**USD $385.29/hr**	**-11.9%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,850hrs -> 2,038hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $42.52/hr	USD $14.94/hr	-64.9%
Field Parts	USD $138.78/hr	USD $45.35/hr	-67.3%
Ground Engaging Component (GEC)	USD $22.20/hr	USD $0.00/hr	-100%
Tire	USD $0.00/hr	-	-
Electrical/Fuel	USD $253.95/hr	USD $82.72/hr	-67.4%
Lube	USD $57.50/hr	-	-
Total Operating Ownership Cost:	**USD $514.96/hr**	**USD $200.51/hr**	**-61.1%**

User Defined Adjustments: Fuel (USD $3.07 -> USD $1.00) Annual Ground Engaging Component (USD $41,078.32 -> USD $0.00) Mechanics Wage (USD $61.70 -> USD $23.88) Annual Misc Supply Parts (USD $51,347.90 -> USD $0.00) Annual Field Repair Parts Cost (USD $205,391.61 -> USD $92,426.22)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $437.50/hr	USD $385.29/hr	-11.9%
Hourly Operating Costs	USD $514.96/hr	USD $200.51/hr	-61.1%
Total Hourly Cost	**USD $952.46**	**USD $585.81/hr**	**-38.5%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $278.74/hr	USD $258.99/hr	-7.1%
Idle	USD $691.45/hr	USD $468.01/hr	-32.3%

Revised Date: 1st half 2020

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www.equipmentwatch.com

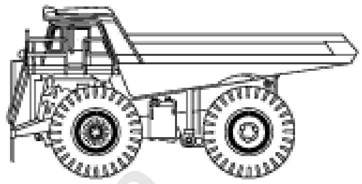
All prices shown in US dollars ($)

Rental Rate Blue Book®

May 24, 2020

Komatsu HD1500-5 (disc. 2008)
Mechanical Drive Rear Dumps

Size Class:
105 - 139 MTons
Weight:
221481 lbs



Configuration for HD1500-5 (disc. 2008)

Body Capacity (Struck--Heaped)	**71.0 - 102.0 cu yd**	Net Horsepower	**1406.0 hp**
Power Mode	**Diesel**	Rated Payload	**136.0 mt**

Blue Book Rates

** FHWA Rate is equal to the monthly ownership cost divided by 176 plus the hourly estimated operating cost.

	Ownership Costs				Estimated Operating Costs	FHWA Rate**
	Monthly	**Weekly**	**Daily**	**Hourly**	**Hourly**	**Hourly**
Published Rates	USD $28,205.00	USD $7,900.00	USD $1,975.00	USD $295.00	USD $164.82	USD $325.08
Adjustments						
Region (Las Cruces, New Mexico: 91.1%)	(USD $2,510.25)	(USD $703.10)	(USD $175.77)	(USD $26.25)		
Model Year (2008: 100%)	-	-	-	-		
Adjusted Hourly Ownership Cost (100%)	-	-	-	-		
Hourly Operating Cost (100%)					-	
Total:	**USD $25,694.76**	**USD $7,196.90**	**USD $1,799.22**	**USD $268.74**	**USD $164.82**	**USD $310.81**

Non-Active Use Rates

	Hourly
Standby Rate	USD $83.22
Idling Rate	USD $232.04

Rate Element Allocation

Element	**Percentage**	**Value**
Depreciation (ownership)	36%	USD $10,153.80/mo
Overhaul (ownership)	43%	USD $12,128.15/mo
CFC (ownership)	10%	USD $2,820.50/mo
Indirect (ownership)	11%	USD $3,102.55/mo
Fuel (operating) @ USD 3.07	52%	USD $86.05/hr

Revised Date: 1st half 2020

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EquipmentWatch

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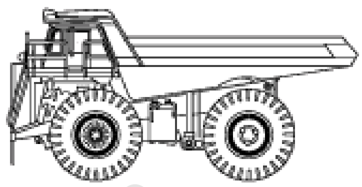
All prices shown in US dollars ($)

Adjustments for HD1500-5_2020 in All Saved Models

May 9, 2020

Komatsu HD1500-5 (disc. 2008)
Mechanical Drive Rear Dumps

Size Class:
105 - 139 MTons
Weight:
221481 lbs



Configuration for HD1500-5 (disc. 2008)

Body Capacity (Struck--Heaped)	**71.0 - 102.0 cu yd**	Net Horsepower	**1406.0 hp**
Power Mode	**Diesel**	Rated Payload	**136.0 mt**

Hourly Ownership Costs

	Standard Value	User Adjusted Value	Variance
Depreciation	USD $52.76/hr	USD $49.62/hr	-5.9%
Cost of Facilities Capital (CFC)	USD $15.90/hr	USD $14.72/hr	-7.4%
Overhead	USD $24.81/hr	USD $22.84/hr	-8%
Overhaul Labor	USD $37.52/hr	USD $13.37/hr	-64.4%
Overhaul Parts	USD $28.17/hr	USD $25.93/hr	-8%
Total Hourly Ownership Cost:	**USD $159.16/hr**	**USD $126.47/hr**	**-20.5%**

User Defined Adjustments: Sales Tax (5.1% -> 0%) Annual Use Hours (1,850hrs -> 2,010hrs)

Hourly Operating Costs

	Standard Value	User Adjusted Value	Variance
Field Labor	USD $21.68/hr	USD $7.72/hr	-64.4%
Field Parts	USD $11.94/hr	USD $1.83/hr	-84.7%
Ground Engaging Component (GEC)	USD $0.00/hr	-	-
Tire	USD $25.84/hr	-	-
Electrical/Fuel	USD $86.33/hr	USD $28.12/hr	-67.4%
Lube	USD $19.34/hr	-	-
Total Operating Ownership Cost:	**USD $165.13/hr**	**USD $82.86/hr**	**-49.8%**

User Defined Adjustments: Fuel (USD $3.07 -> USD $1.00) Mechanics Wage (USD $61.70 -> USD $23.88) Annual Misc Supply Parts (USD $3,682.86 -> USD $0.00) Annual Field Repair Parts Cost (USD $18,414.32 -> USD $3,682.86)

Total

	Standard Value	User Adjusted Value	Variance
Hourly Ownership Costs	USD $159.16/hr	USD $126.47/hr	-20.5%
Hourly Operating Costs	USD $165.13/hr	USD $82.86/hr	-49.8%
Total Hourly Cost	**USD $324.29**	**USD $209.33/hr**	**-35.4%**

Non-active use rates

	Standard Value	User Adjusted Value	Variance
Standby	USD $93.47/hr	USD $87.18/hr	-6.7%
Idle	USD $245.48/hr	USD $154.59/hr	-37%

Revised Date: 1st half 2020

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All prices shown in US dollars ($)

Spec Finder

January 8, 2021

Caterpillar 319D L (disc. 2012)
Crawler Mounted Hydraulic Excavators

Size Class:
19.1 - 21.0 MTons
Weight:
19.9 lbs

Specifications

Boom, Bucket, Loader, Platform, and Stick

Boom Length	209.0 ft
Boom Type	1-Piece
Bucket Capacity	1.0 cu yd
Bucket Capacity Range	0.59 cu yd
Bucket Digging Force-Standard	18142.0 lbf
Bucket Type	Heavy Duty
Bucket Width	36.0 in
Stick Length	126.0 in

Engine

Displacement	259.0 cid
Engine	C4.2
Engine Manufacturer	Caterpillar
Gross Horsepower	131.0 hp
Horsepower	125.0 hp
Power Mode	Diesel

Fluid Capacities

Fuel Tank Capacity	79.3 gal
Hydraulic Tank Capacity	28.0 gal

Hydraulics

Main Pump - Maximum Flow	100.1 gal/min
Standard Relief Pressure	5076.0 psi

Performance

Front Lift Capy @ 20' G.L.	13000.0 lbs
Maximum Drawbar Pull	46466.0 lbs
Maximum Swing Speed	11.1 rpm
Side Lift Capy @ 20' G.L.	6700.0 lbs
Stick Digging Force - Standard	18142.0 lbs
Travel Speed - High	3.0 mph

Undercarriage

Ground Pressure	5.1 psi
No. of Lower/Track Rollers	7.0
No. of Upper/Carrier Rollers	2.0
Track Gauge	87.0 in
Track Length	175.0 in
Track Shoe Width	28.0 in

Weights & Dimensions

Digging Depth (8' Flat Bottom)	265.0 in
Maximum Digging Depth	271.0 in
Maximum Dumping Height	269.0 in
Maximum Reach at Ground Level	380.0 in
Operating Weight	19.9 lbs
Overall Height	139.0 in
Overall Length	345.0 in
Overall Track Width--Retracted	114.0 in
Overall Width	114.0 in
Tail Swing Radius	98.0 in
Undercarriage Ground Clearance	17.0 in

Vertical Straight Wall Depth	225.0 in

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All prices shown in US dollars ($)

Spec Finder

January 8, 2021

Caterpillar 725 (disc. 2014)
Articulated Rear Dumps

Size Class:
20 - 25 MTons
Weight:
N/A

Specifications

Axles & Tires

Axle Configuration	6 X 6
Front Tire Size	23.5 R25
Rear Tire Size	23.5 R25

Dump Body

Body Capacity	14.3 cu yd
Body Floor-Plate Thickness	0.55 in
Body Front-Plate Thickness	0.31 in
Body Sidewall Thickness	0.47 in
Dump Angle	70.0 degrees
Dump Cycle (Hoist/Raise)	10.0 sec
Dump Cycle (Power Down)	8.0 sec

Engine

Displacement	680.0 cid
Emissions Tier	Tier 3
Engine	C11 ACERT
Engine Manufacturer	Caterpillar
Horsepower	301.0 hp
Number of Cylinders	6.0
Power Mode	Diesel

Fluid Capacities

Fuel Tank Capacity	94.0 gal
Hydraulic System Capacity	49.0 gal

Steering

Steering Angle	45.0 degrees

Transmission

Maximum Speed	35.0 mph
Number of Speeds	6F/1R
Transmission	Autoshift
Transmission Manufacturer	Caterpillar

Weights & Dimensions

Center Axle Weight (GVW)	34440.0 lbs
Front Axle Weight (GVW)	33135.0 lbs
Gross Weight	101085.0 lbs
Ground Clearance	18.0 in
Inside Turning Radius	146.0 in
Load Over Height	108.0 in
Net Weight	49075.0 lbs
Outside Turning Radius	286.0 in
Overall Machine Height	135.0 in
Overall Machine Length	389.0 in
Overall Machine Width	109.0 in
Rated Payload	23.6 mt
Rear Axle Weight (GVW)	33510.0 lbs
Wheelbase	215.0 in

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EquipmentWatch

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All prices shown in US dollars ($)

Spec Finder

January 8, 2021

Caterpillar 777F (disc. 2012)
Mechanical Drive Rear Dumps

Size Class:
90 - 104 MTons
Weight:
N/A

Specifications

Axles & Tires	
Front Tire Size	27.00 R49
Rear Tire Size	27.00 R49
Brakes	
Parking Brake	SAHR
Dump Body	
Body Capacity	54.8 cu yd
Dump Angle	49.4 degrees
Dump Cycle (Hoist/Raise)	15.0 sec
Dump Cycle (Power Down)	13.0 sec
Engine	
Displacement	1959.0 cid
Engine	CAT C32 ACERT
Engine Manufacturer	Caterpillar
Engine Torque @ RPM	4716Nm@-- ft-lb
Gross Horsepower	1016.0 hp
Horsepower	938.0 hp
Number of Cylinders	12.0
Power Mode	Diesel
Rated RPM	1750.0 rpm
Fluid Capacities	
Fuel Tank Capacity	300.0 gal
Hydraulic System Capacity	50.0 gal
Transmission	
Maximum Speed	40.1 mph
Number of Speeds	7F/1R
Transmission	Powershift
Transmission Manufacturer	Caterpillar
Weights & Dimensions	
Gross Weight	360000.0 lbs
Ground Clearance	35.0 in
Inside Turning Diameter	996.0 in
Load Over Height	172.0 in
Maximum Payload	90.7 mt
Overall Machine Height	204.0 in
Overall Machine Length	415.0 in
Overall Machine Width	238.0 in
Rated Payload	90.7 mt
Wheelbase	180.0 in

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All prices shown in US dollars ($)

Spec Finder

January 8, 2021

Hitachi EX3600-5 (disc. 2009)
Hydraulic Shovels

Size Class:
150.1 MTons & Over
Weight:
350.0 lbs

Specifications

Boom, Bucket, Loader, Platform, and Stick	
Boom Length	311.0 ft
Bucket Capacity	27.4 cu yd
Bucket Digging Force-Standard	254000.0 lbf
Bucket Type	Bottom Dump
Bucket Width	155.0 in
Engine	
Displacement	3990.0 cid
Engine	S16R-TAA
Engine Manufacturer	Hitachi
Gross Horsepower	1880.0 hp
Horsepower	1880.0 hp
Number of Cylinders	16.0
Power Mode	Diesel
Rated RPM	1600.0 rpm
Fluid Capacities	
Fuel Tank Capacity	1900.0 gal
Hydraulics	
Hydraulic Pumps - Type	Piston
Main Pump - Maximum Flow	1056.0 gal/min
Standard Relief Pressure	4270.0 psi
Performance	
Maximum Drawbar Pull	395700.0 lbs
Maximum Swing Speed	3.2 rpm
Stick Digging Force - Standard	269000.0 lbs
Travel Speed - High	1.4 mph
Undercarriage	
Ground Pressure	26.3 psi
Track Gauge	217.0 in
Track Shoe Width	50.0 in
Weights & Dimensions	
Component Weight-Counterweight	88600.0 lbs
Height to Top of Cab	305.0 in
Length of Track on Ground	262.0 in
Maximum Digging Depth	154.0 in
Maximum Dumping Height	433.0 in
Maximum Reach at Ground Level	599.0 in
Operating Weight	350.0 lbs
Overall Track Width--Retracted	267.0 in
Tail Swing Radius	262.0 in
Track Length	342.0 in
Undercarriage Ground Clearance	36.0 in
Upperstructure Width	355.0 in

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All prices shown in US dollars ($)

Spec Finder

January 8, 2021

Komatsu 730E
Electric Drive Rear Dumps

Size Class:
170 - 199 MTons
Weight:
N/A

Specifications

Axles & Tires

Front Tire Size	37.00R57
Rear Tire Size	37.00R57

Brakes

Elec. Dynamic Retarding (Max.)	3700.0 hp
Parking Brake	SAHR
Service Brakes - Front	Wheel Spd Disc
Service Brakes - Rear	Dual Disc

Dump Body

Body Capacity	101.0 cu yd
Body Floor-Plate Thickness	0.75 in
Body Front-Plate Thickness	0.47 in
Body Sidewall Thickness	0.35 in
Dump Angle	45.0 degrees
Dump Cycle (Hoist/Raise)	21.0 sec
Dump Cycle (Power Down)	15.0 sec

Electric Drive

Alternator/Generator Mfr	General Electric
Alternator/Generator Model	GTA-22
Maximum Travel Speed	34.6 mph
System Current	AC/DC
Wheel Motor Manufacturer	General Electric
Wheel Motor Model	GE788
Wheel Motor Planetary Ratio	26.825:1

Engine

Engine	SSA16V159
Engine Manufacturer	Komatsu
Gross Horsepower	2000.0 hp
Horsepower	1860.0 hp
Number of Cylinders	16.0
Power Mode	Diesel
Rated RPM	1900.0 rpm

Fluid Capacities

Fuel Tank Capacity	850.0 gal
Hydraulic System Capacity	193.0 gal

Weights & Dimensions

Clearance Circle	1104.0 in
Gross Weight	715000.0 lbs
Ground Clearance	45.0 in
Height of Rear Body (Empty)	221.0 in
Height to Cab Guard - Loading	246.0 in
Maximum Payload	186.0 mt
Net Weight	309950.0 lbs
Overall Machine Length	505.0 in
Overall Machine Width	297.0 in
Rated Payload	183.7 mt
Wheelbase	232.0 in

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All prices shown in US dollars ($)

Spec Finder

January 8, 2021

Komatsu HD1500-5 (disc. 2008)
Mechanical Drive Rear Dumps

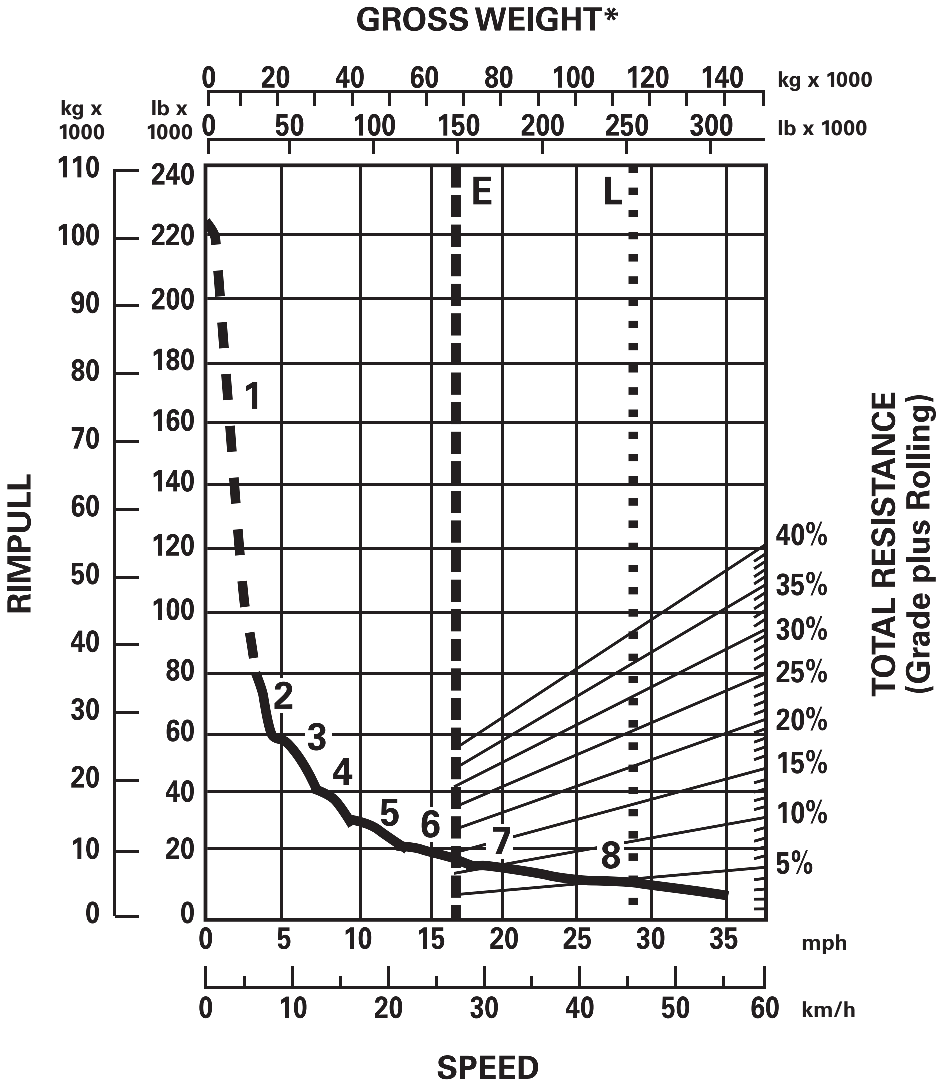
Size Class:
105 - 139 MTons
Weight:
N/A

Specifications

Axles & Tires	
Front Tire Size	33.00 R51
Rear Tire Size	33.00 R51 Dual
Dump Body	
Body Capacity	71.0 cu yd
Dump Cycle (Hoist/Raise)	15.0 sec
Dump Cycle (Power Down)	15.0 sec
Engine	
Displacement	2746.0 cid
Engine	SDA12V160
Engine Manufacturer	Komatsu
Engine Torque @ RPM	4285.0 ft-lb
Gross Horsepower	1486.0 hp
Horsepower	1406.0 hp
Number of Cylinders	12.0
Power Mode	Diesel
Rated RPM	1900.0 rpm
Fluid Capacities	
Fuel Tank Capacity	560.0 gal
Hydraulic System Capacity	238.0 gal
Transmission	
Maximum Speed	36.0 mph
Number of Speeds	7F/1R
Transmission	Powershift
Transmission Manufacturer	Komatsu
Weights & Dimensions	
Clearance Circle	960.0 in
Gross Weight	550000.0 lbs
Ground Clearance	35.0 in
Load Over Height	195.0 in
Maximum Payload	149.0 mt
Net Weight	221481.0 lbs
Overall Machine Height	230.0 in
Overall Machine Length	448.0 in
Overall Machine Width	261.0 in
Rated Payload	136.0 mt
Wheelbase	213.0 in

Appendix D.3

Equipment Productivity Curve Fits



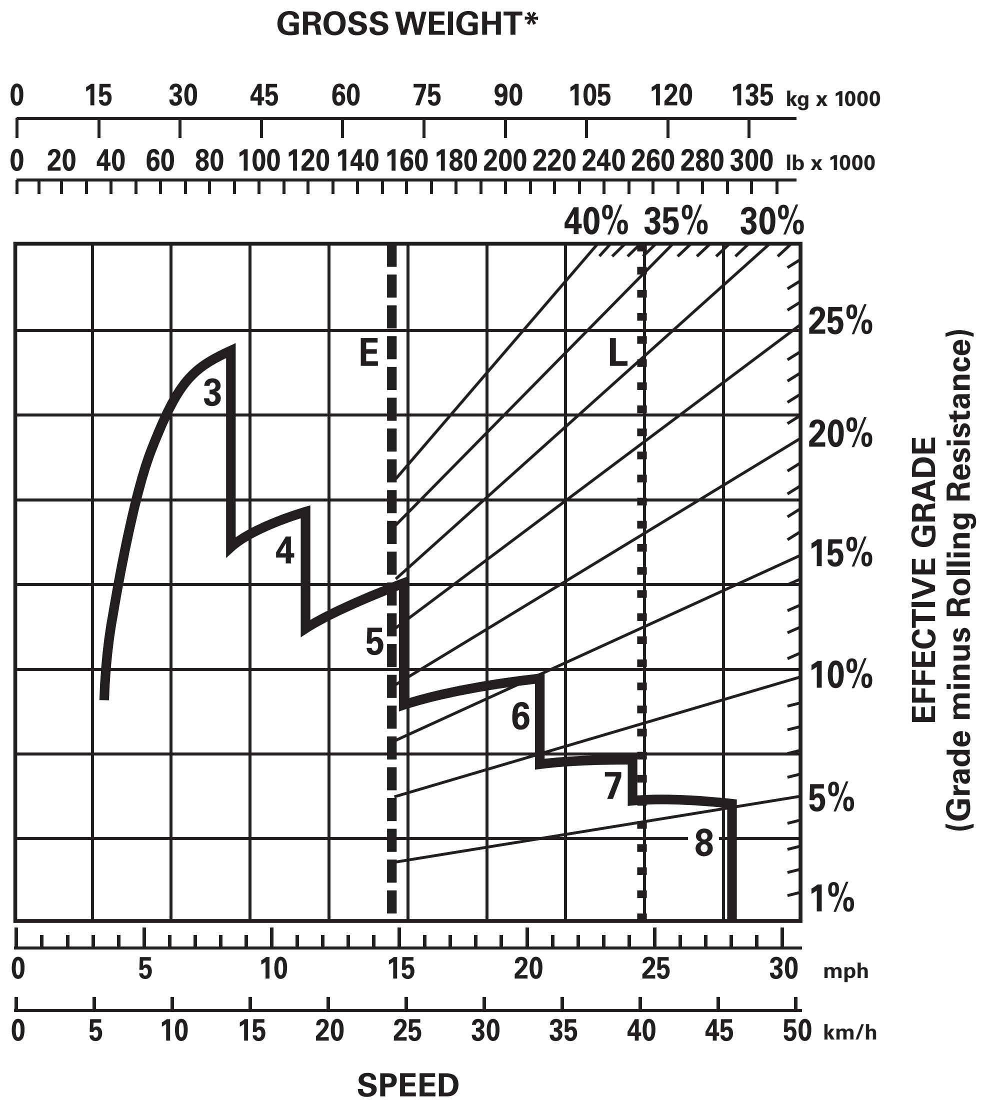
*at sea level

KEY

1 — 1st Gear Torque Converter Drive
2 — 2nd Gear Torque Converter Drive
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY

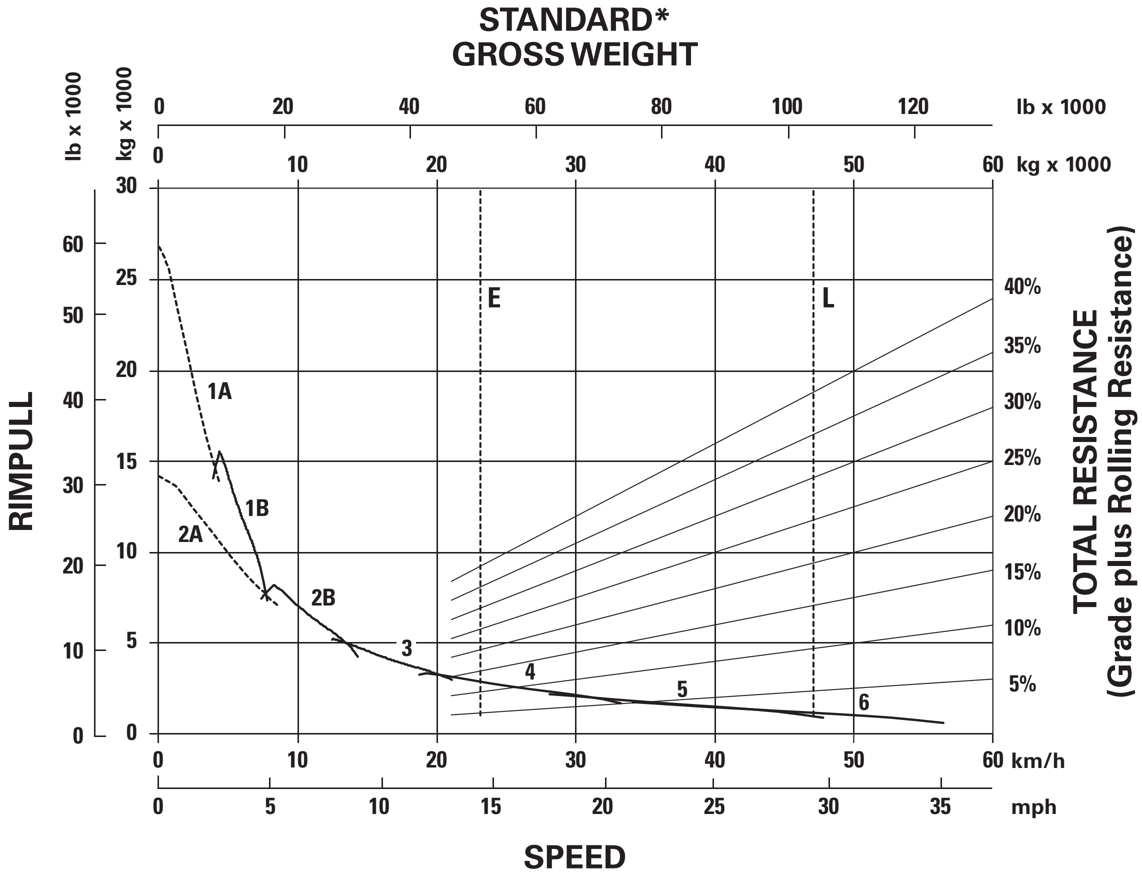
E — Empty 72 804 kg (160,505 lb)
L — Loaded 119 978 kg (264,505 lb)



*at sea level

KEY
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY
E — Empty 72 804 kg (160,505 lb)
L — Loaded 119 978 kg (264,505 lb)



KEY

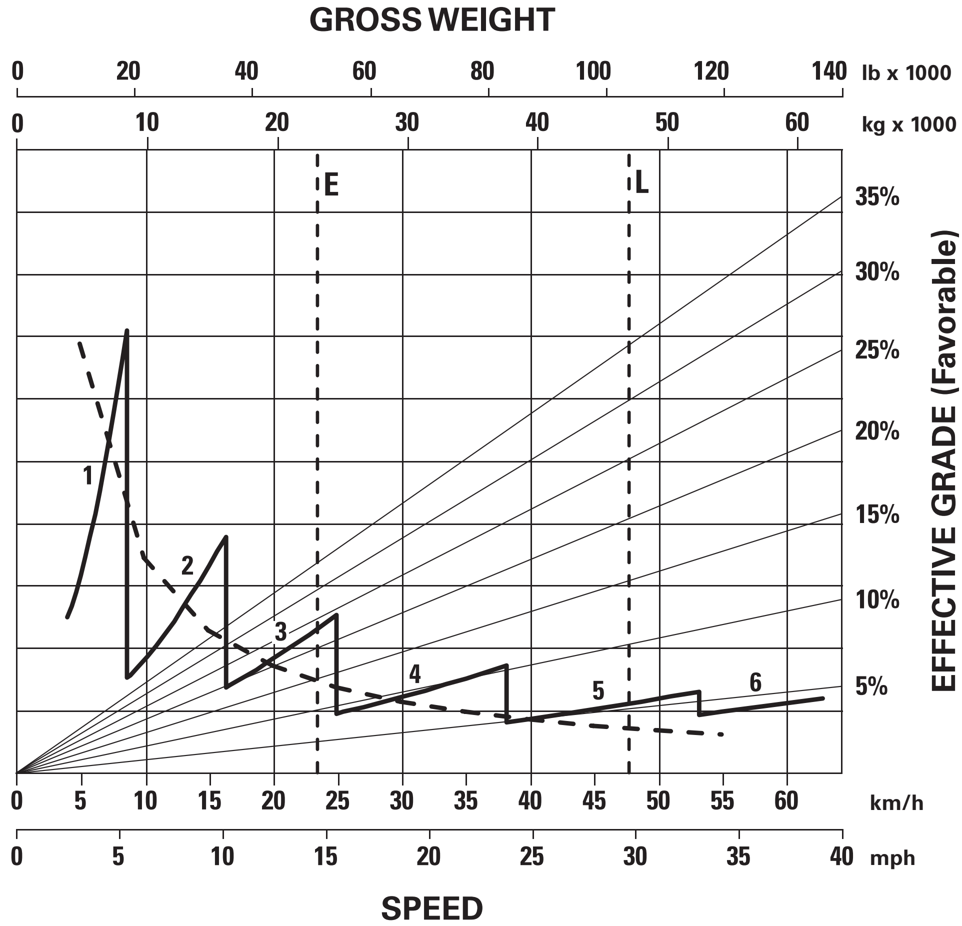
1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2A — 2nd Gear (Converter Drive
2B — 2nd Gear (Direct Drive)
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

E — Empty 23 040 kg (50,795 lb)
L — Loaded 47 040 kg (103,707 lb)

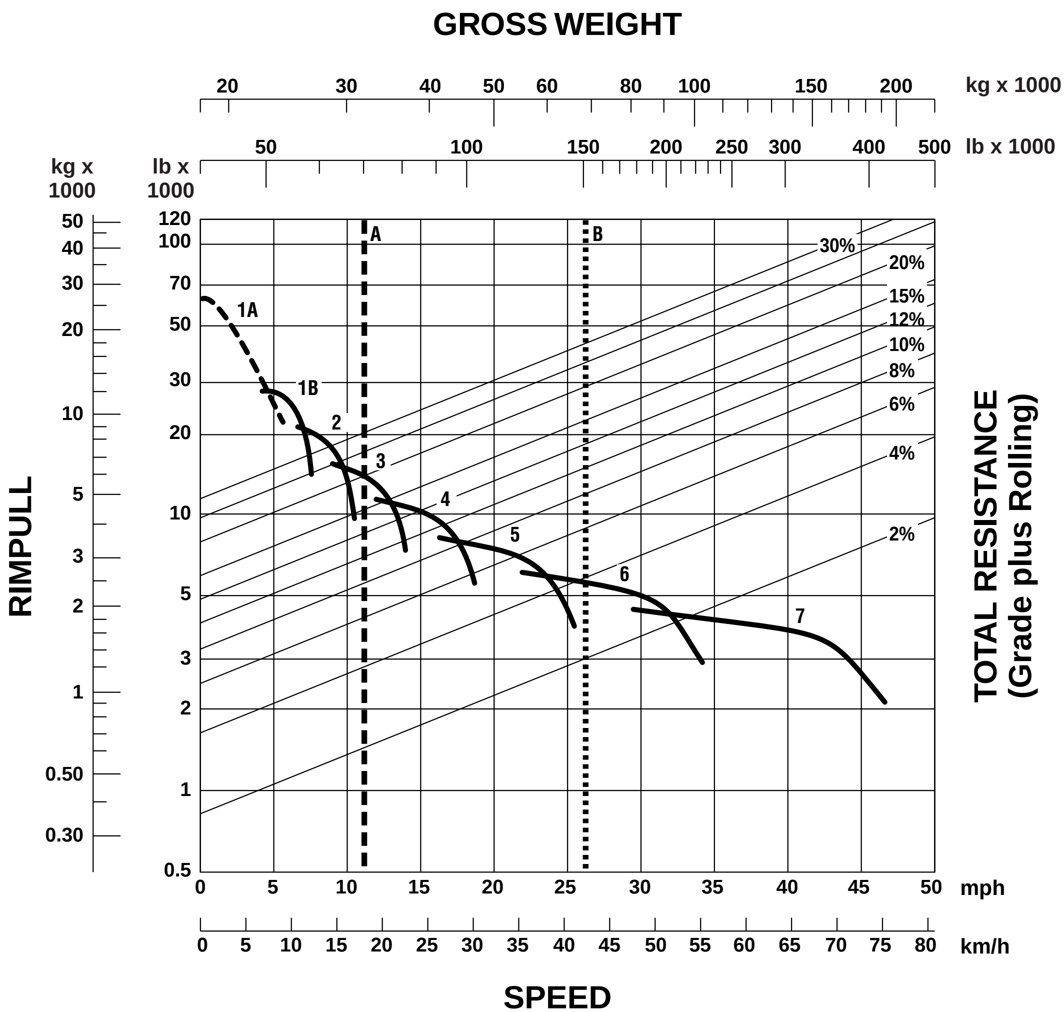
*At sea level.

725C2 Brake/Retarder Performance Curve
- 23.5R25 Tires
- Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final)



KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY
E — Empty 23 040 kg (50,795 lb)
L — Loaded 47 040 kg (103,707 lb)



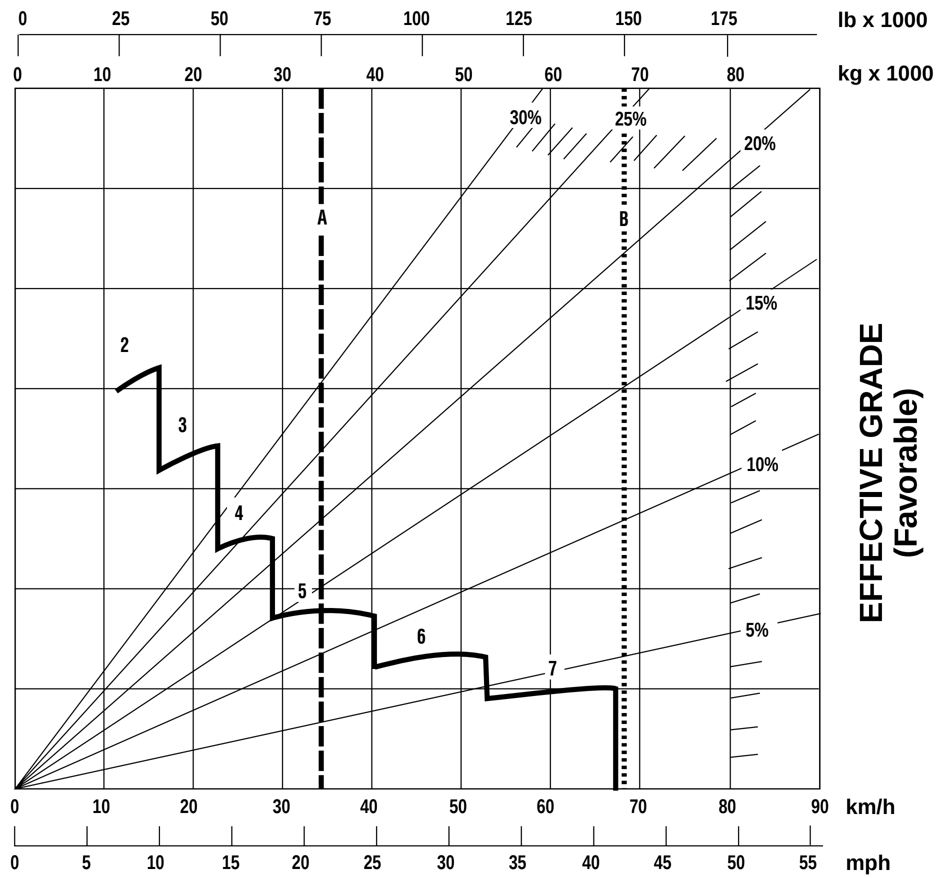
KEY

1A — 1st Gear (Torque Converter)
1B — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

A — Empty 31 250 kg (68,900 lb)
B — Max GMW 68 182 kg (150,000 lb)

GROSS WEIGHT



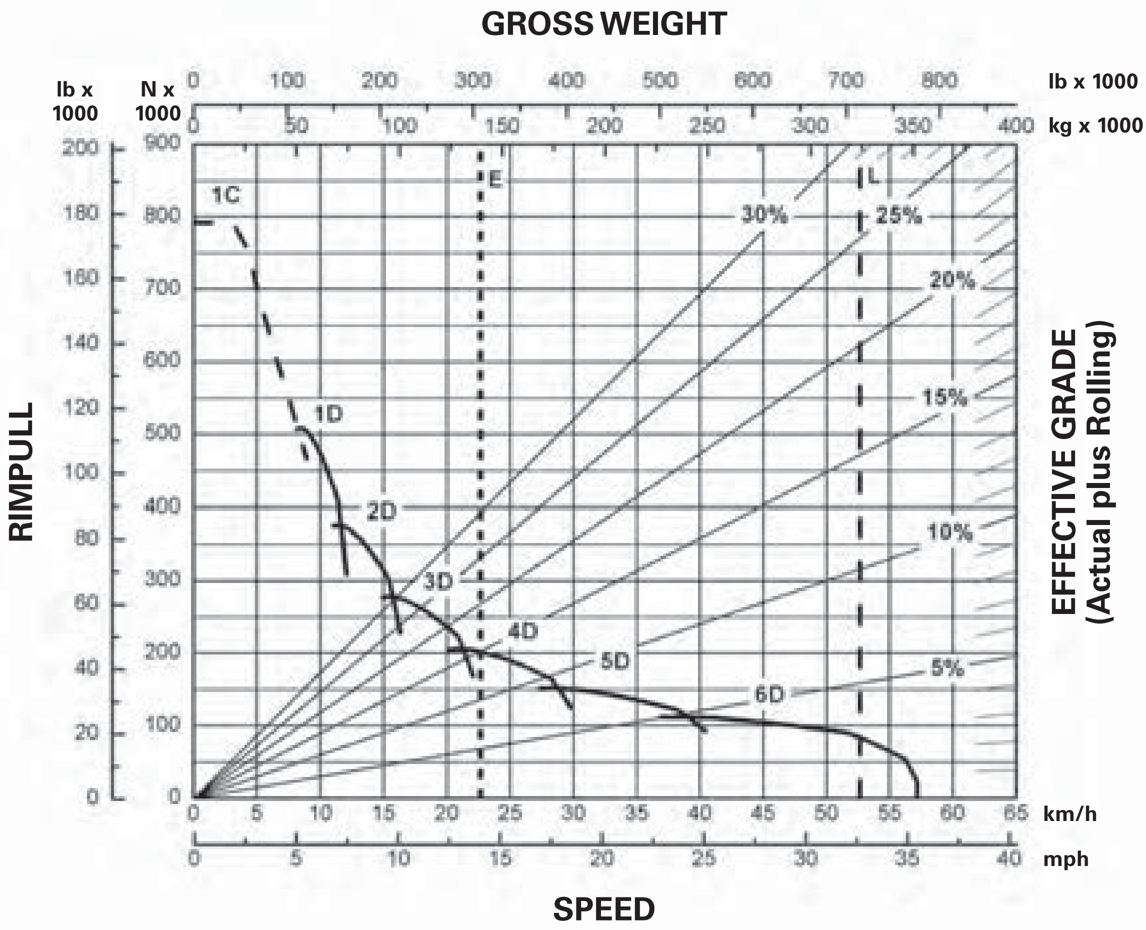
SPEED

CONTINUOUS GRADE LENGTH

KEY
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY
A — Empty 31 250 kg (68,900 lb)
B — Max GMW 68 182 kg (150,000 lb)

789D 2100 HP Rimpull-Speed-Gradeability
- 37.00R57 Tires**
- 1593 mm **(5'2.7")** Tire Radius



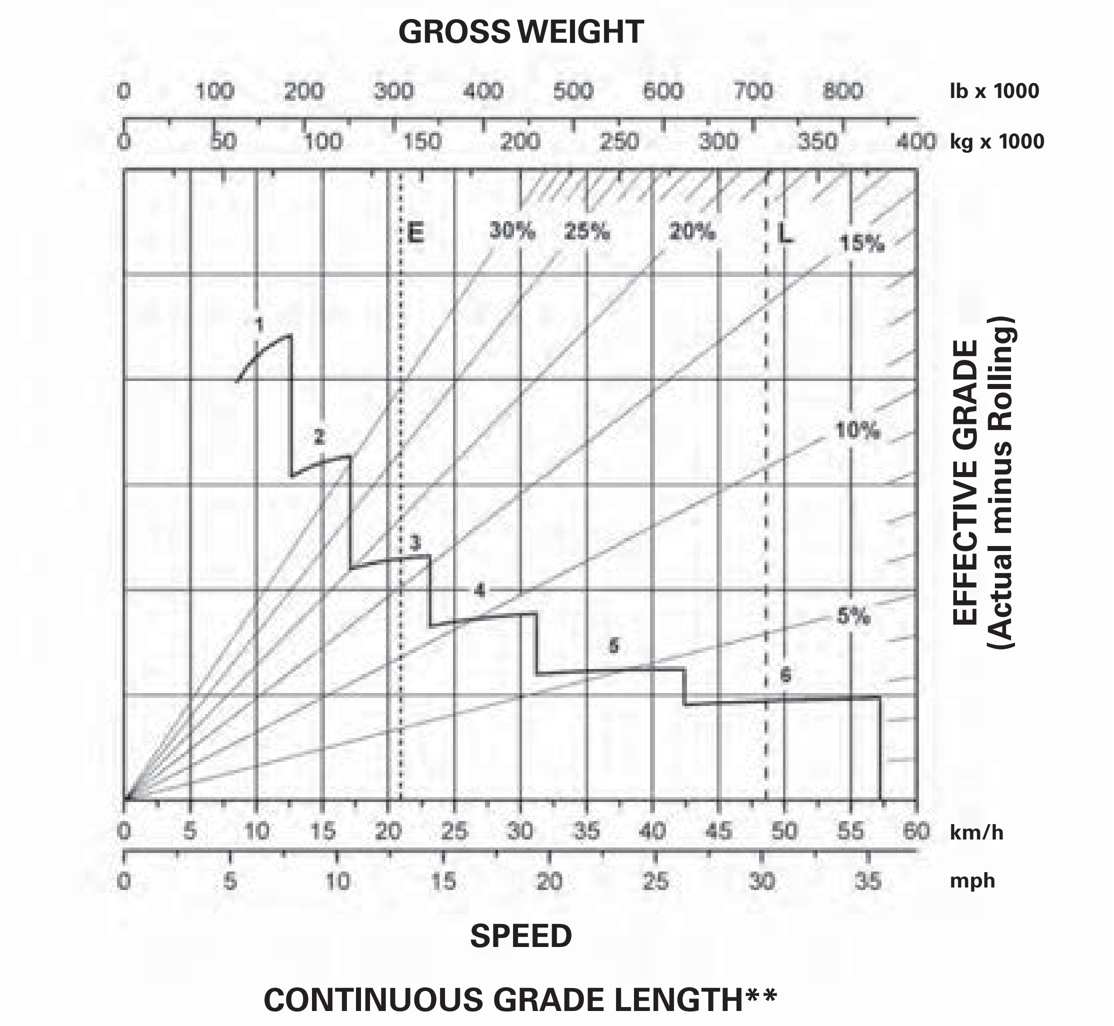
KEY

1C — 1st Gear (Torque Converter)
1D — 1st Gear
2D — 2nd Gear
3D — 3rd Gear
4D — 4th Gear
5D — 5th Gear
6D — 6th Gear

KEY

E — Empty Operating Weight 141 214 kg (311,324 lb)*
L — Target GMW 324 319 kg (715,000 lb)

*Truck equipped with sideboards and liners.
**At Sea Level.



KEY

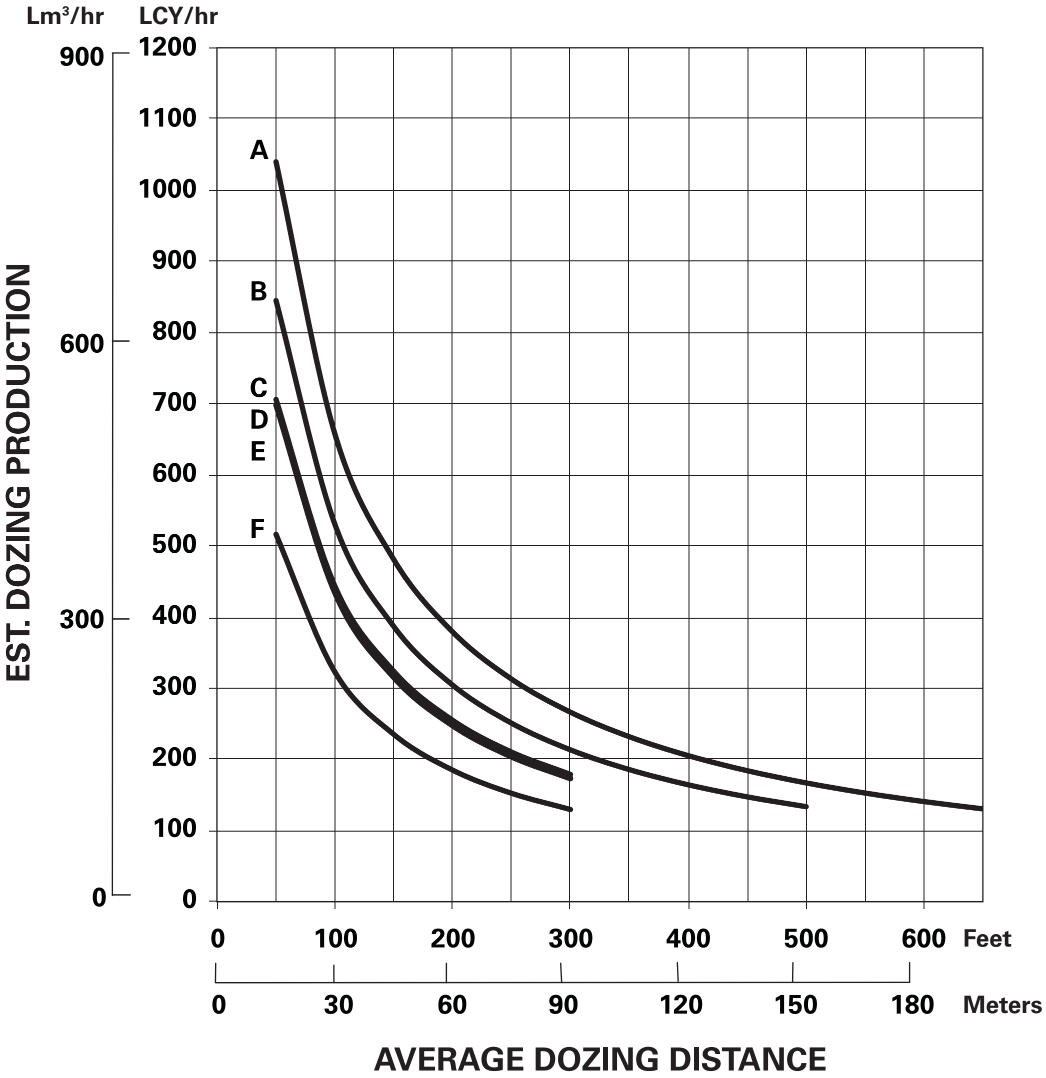
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear

KEY

E — Empty Operating Weight 141 214 kg (311,324 lb)*
L — Target GMW 324 319 kg (715,000 lb)

*Truck equipped with sideboards and liners.
**At Sea Level.

ESTIMATED DOZING PRODUCTION ● Semi-Universal Blades ● D6N through D8R

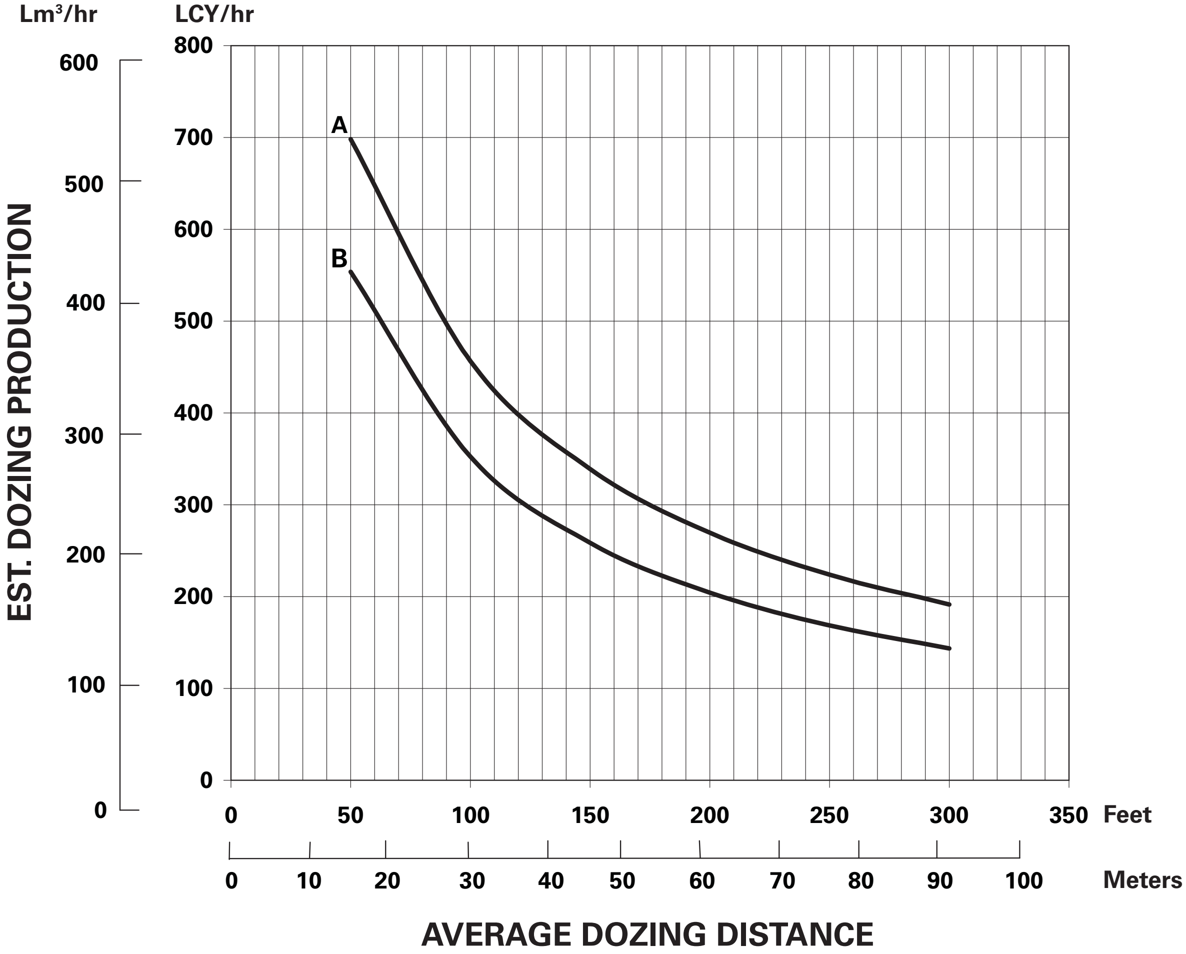


KEY

A — D8R
B — D7R
C — D6T Tier 4 Interim/Stage IIIB/Japan 2011 (Tier 4 Interim)
D — D6T
E — D6R
F — D6N

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

ESTIMATED DOZING PRODUCTION ● Straight Blades ● D6T through D7E

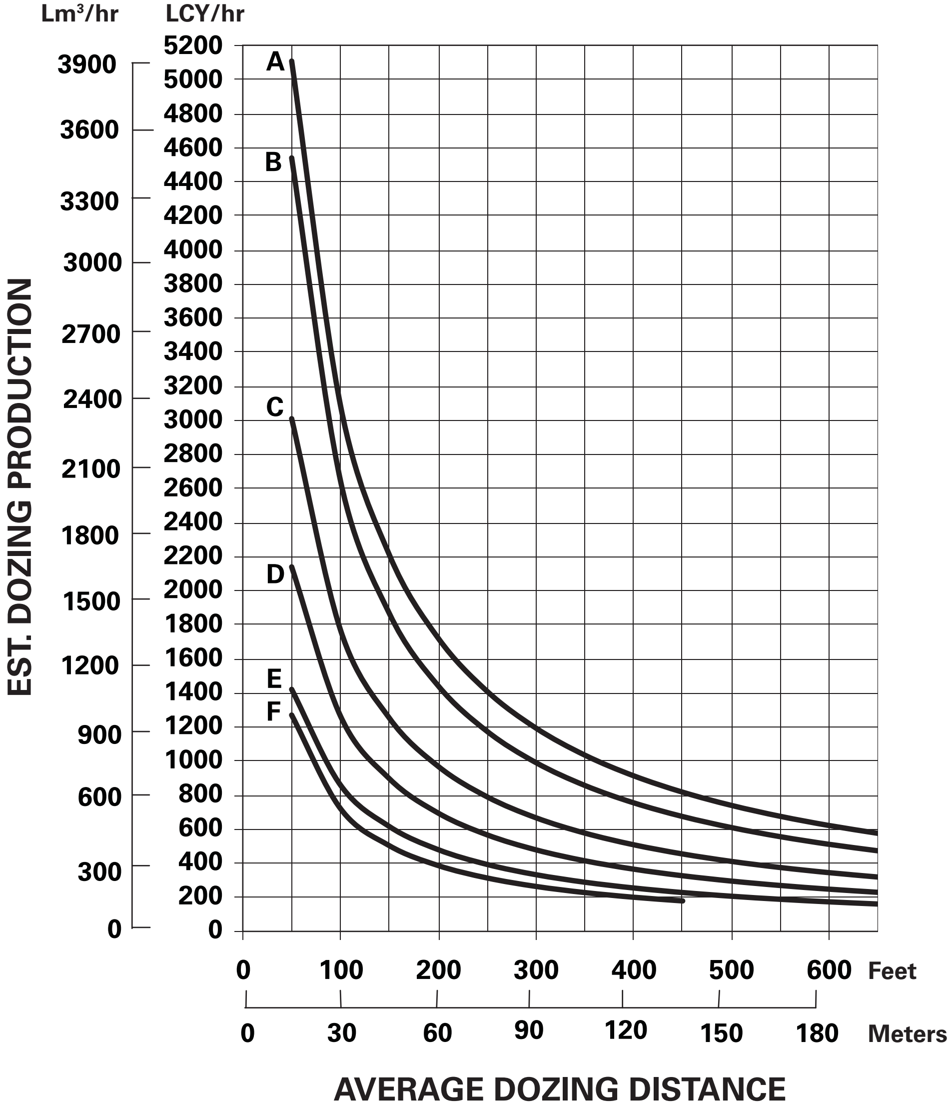


KEY

A — D7E
B — D6T

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

ESTIMATED DOZING PRODUCTION ● Universal Blades ● D7E through D11T CD

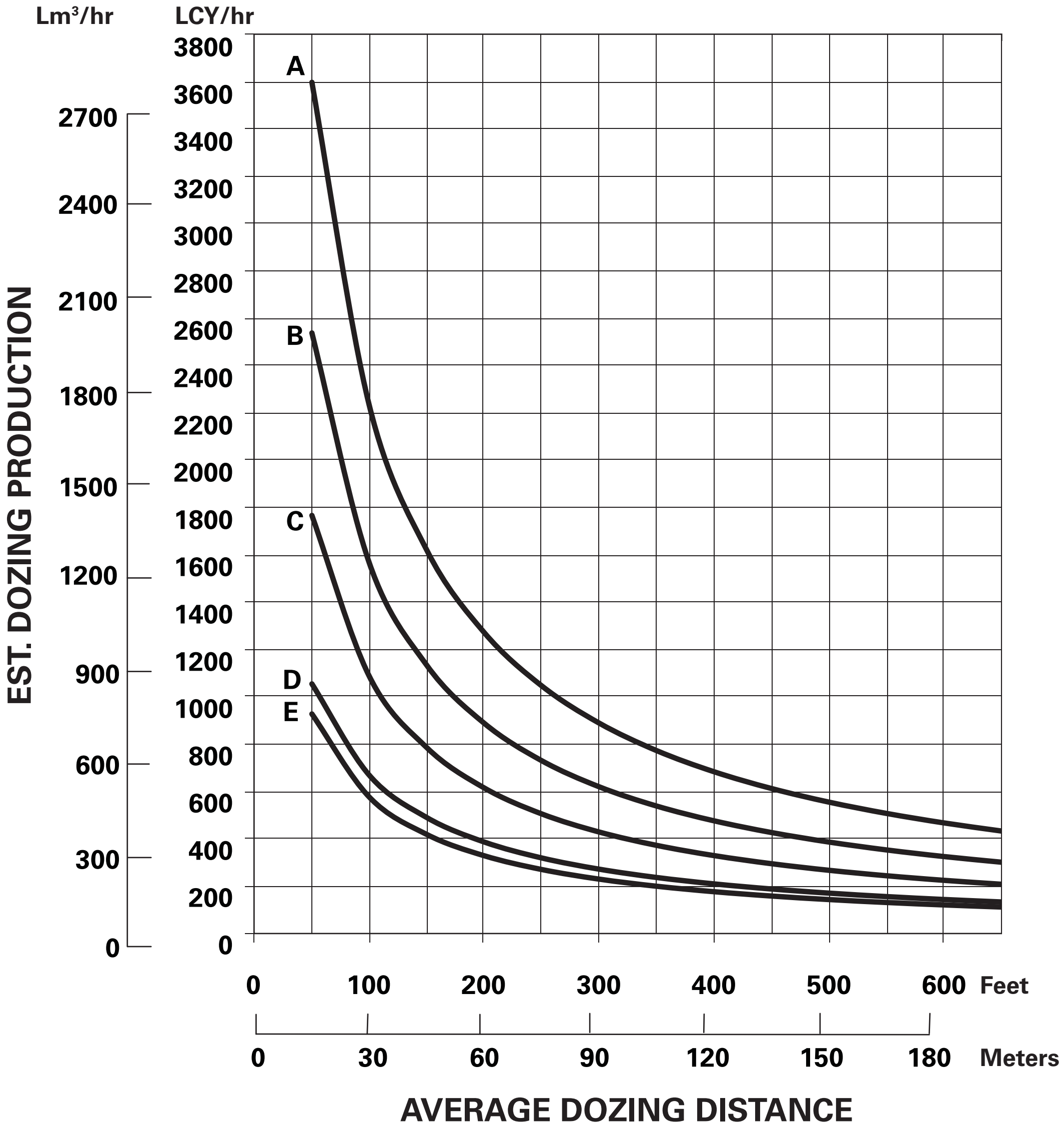


KEY

A — D11T CD
B — D11T
C — D10T2
D — D9T
E — D8T
F — D7E

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

ESTIMATED DOZING PRODUCTION ● Semi-Universal Blades ● D7E through D11T

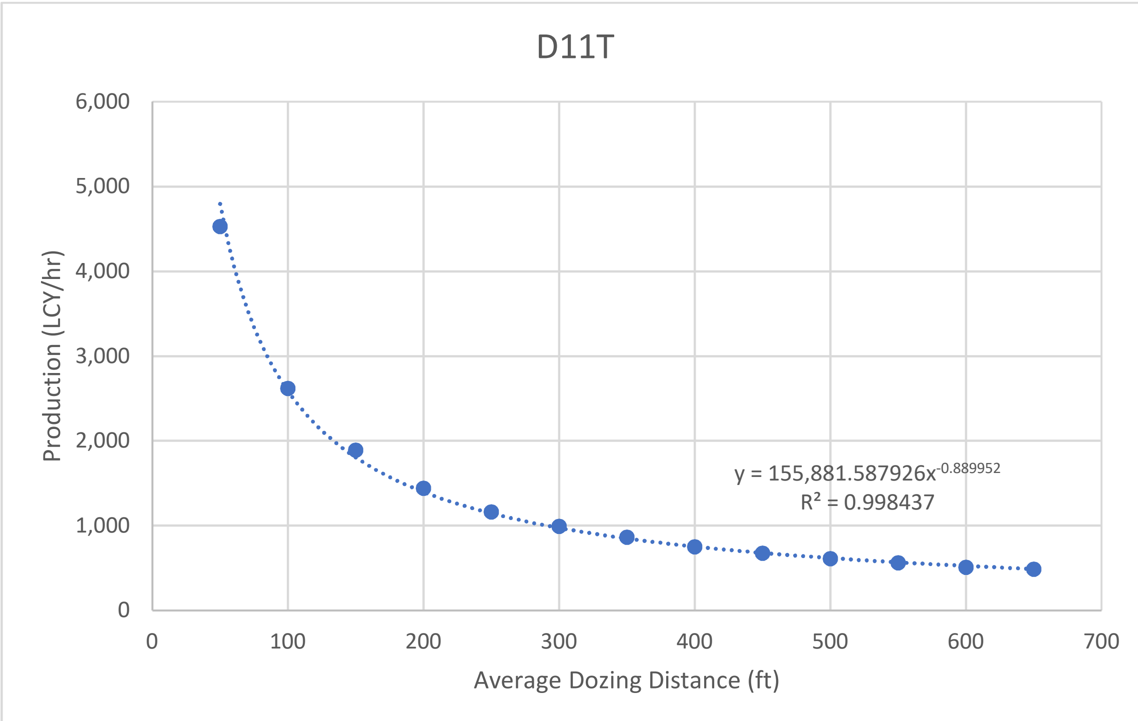


KEY

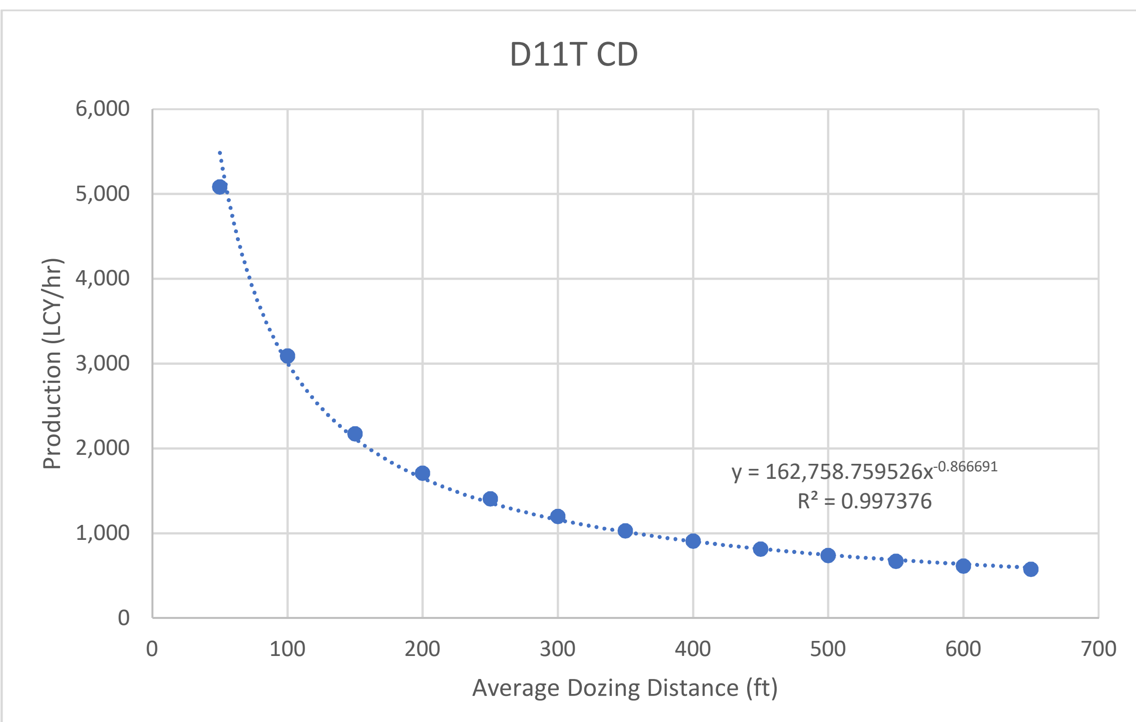
A — D11T
B — D10T2
C — D9T
D — D8T
E — D7E

NOTE: This chart is based on numerous field studies made under varying job conditions. Refer to correction factors following these charts.

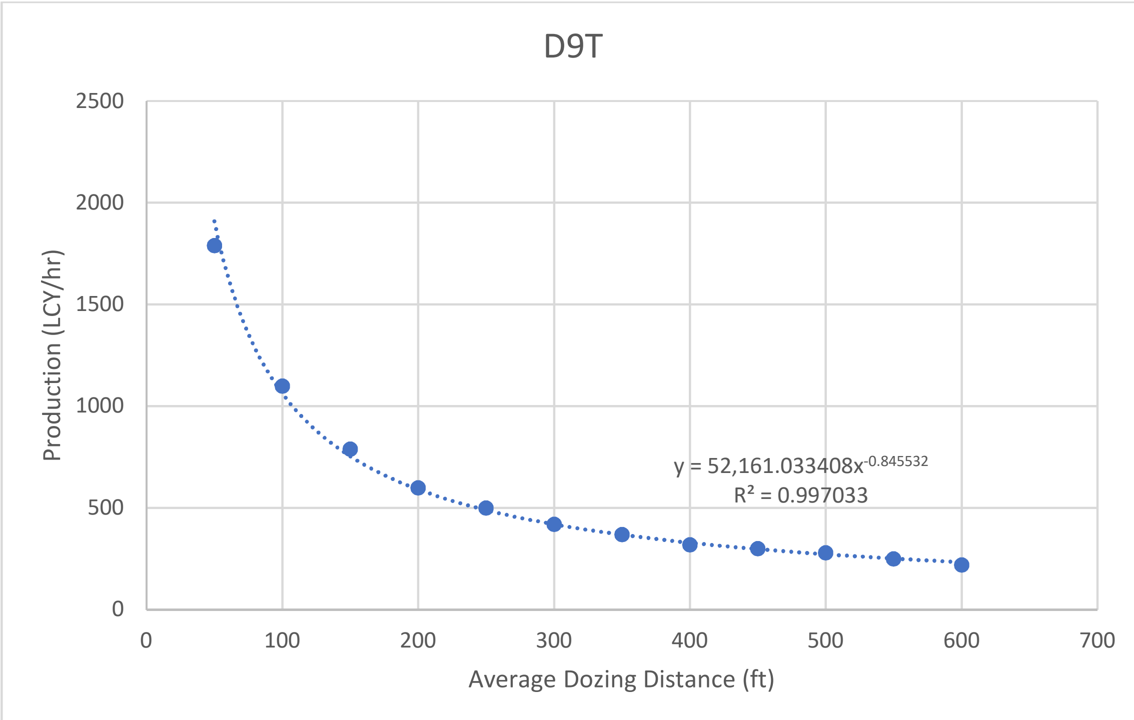
Dozing Production



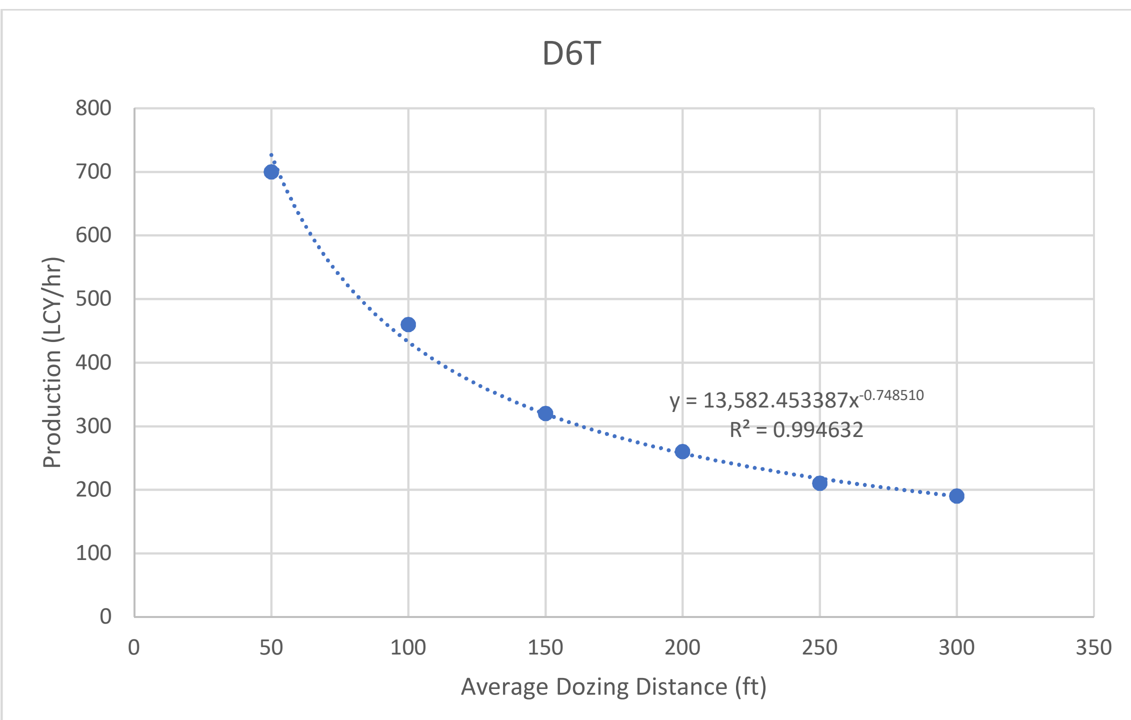
Caterpillar Performance Handbook Edition 47, 19-51



Caterpillar Performance Handbook Edition 47, 19-51

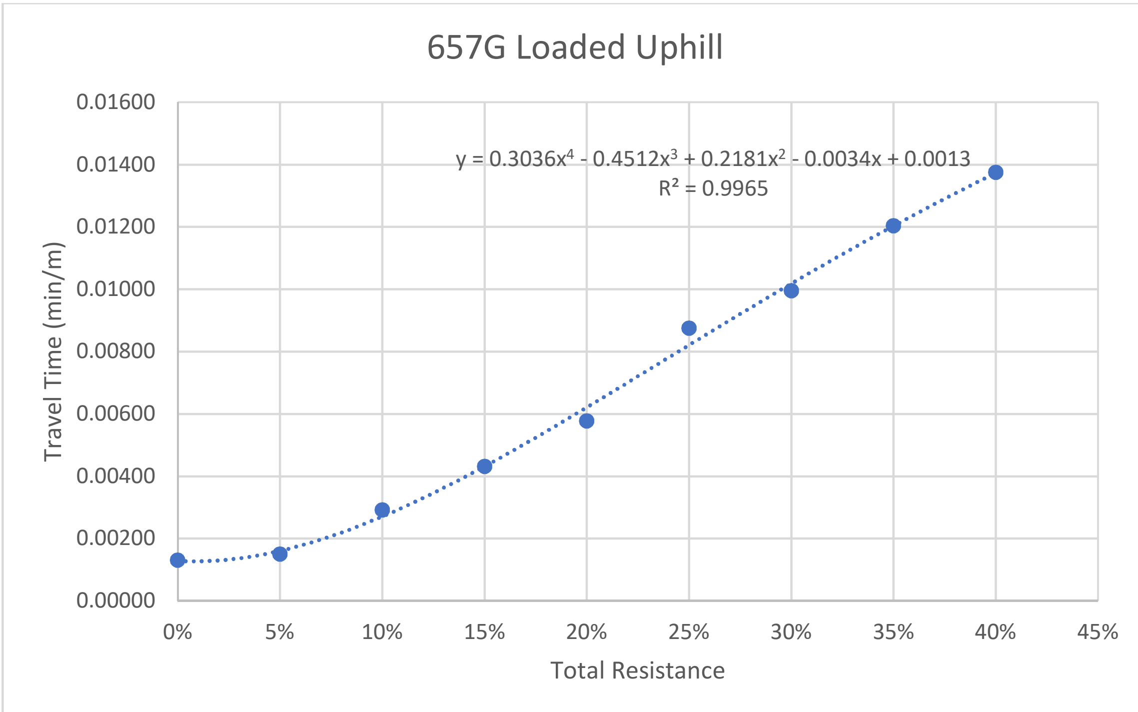


Caterpillar Performance Handbook Edition 47, 19-52

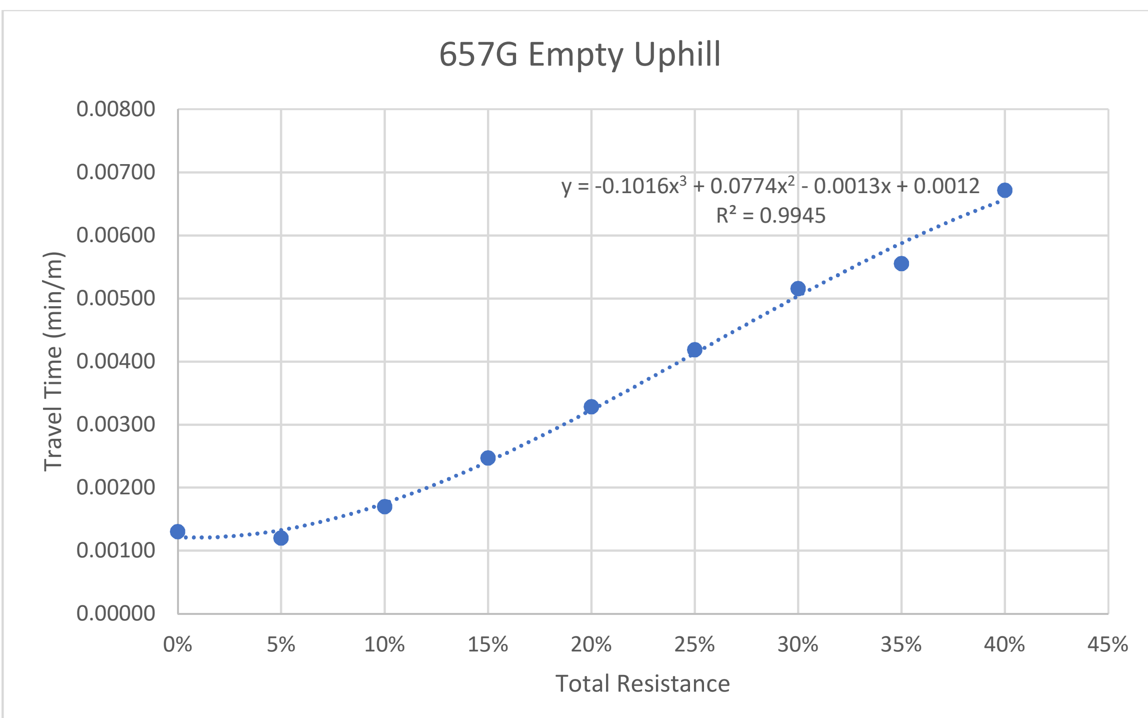


Caterpillar Performance Handbook Edition 47, 19-53

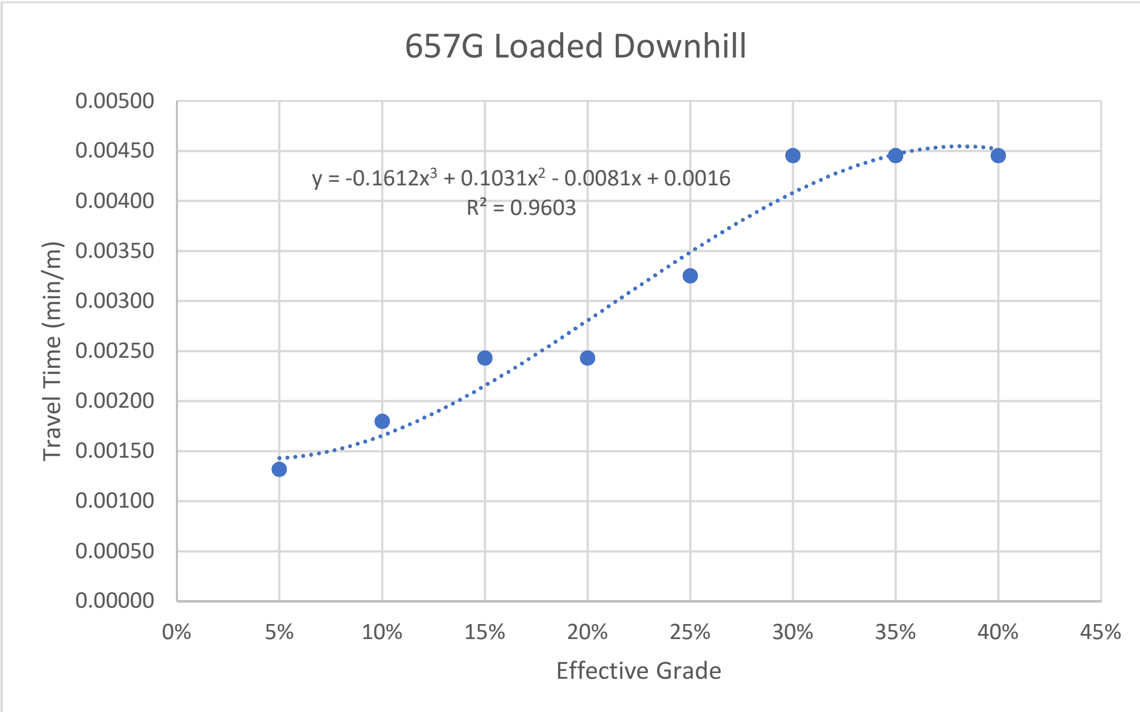
Scraper Haul Travel Time



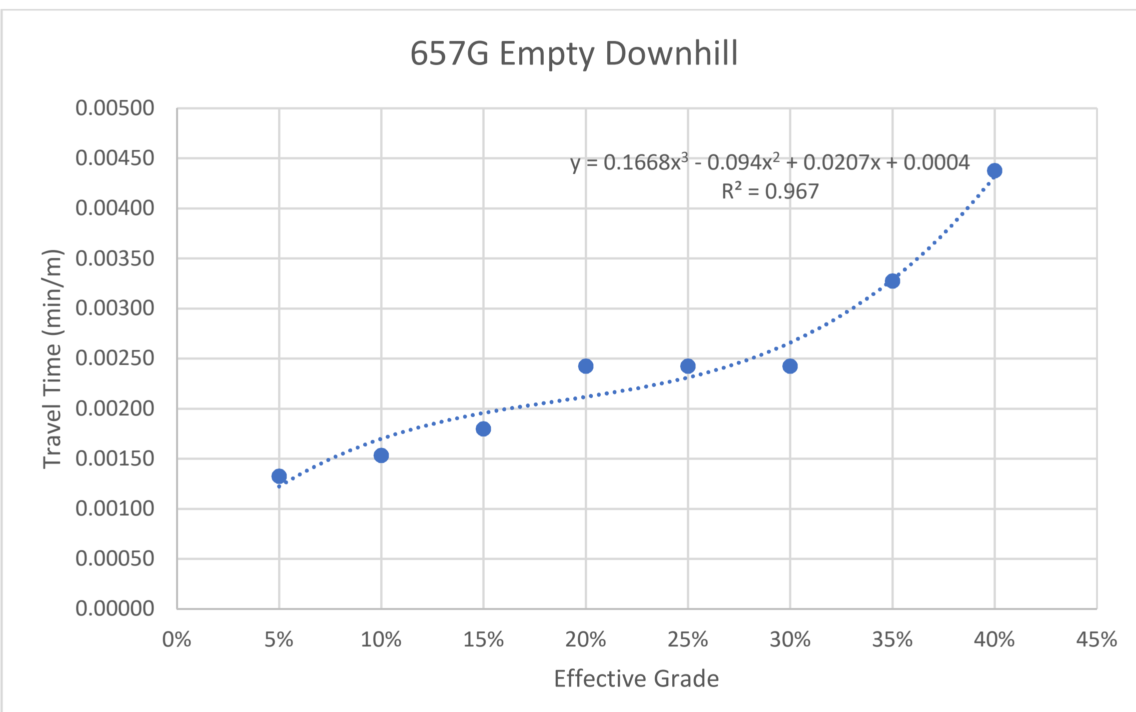
Caterpillar Performance Handbook Edition 47, 24-29



Caterpillar Performance Handbook Edition 47, 24-29

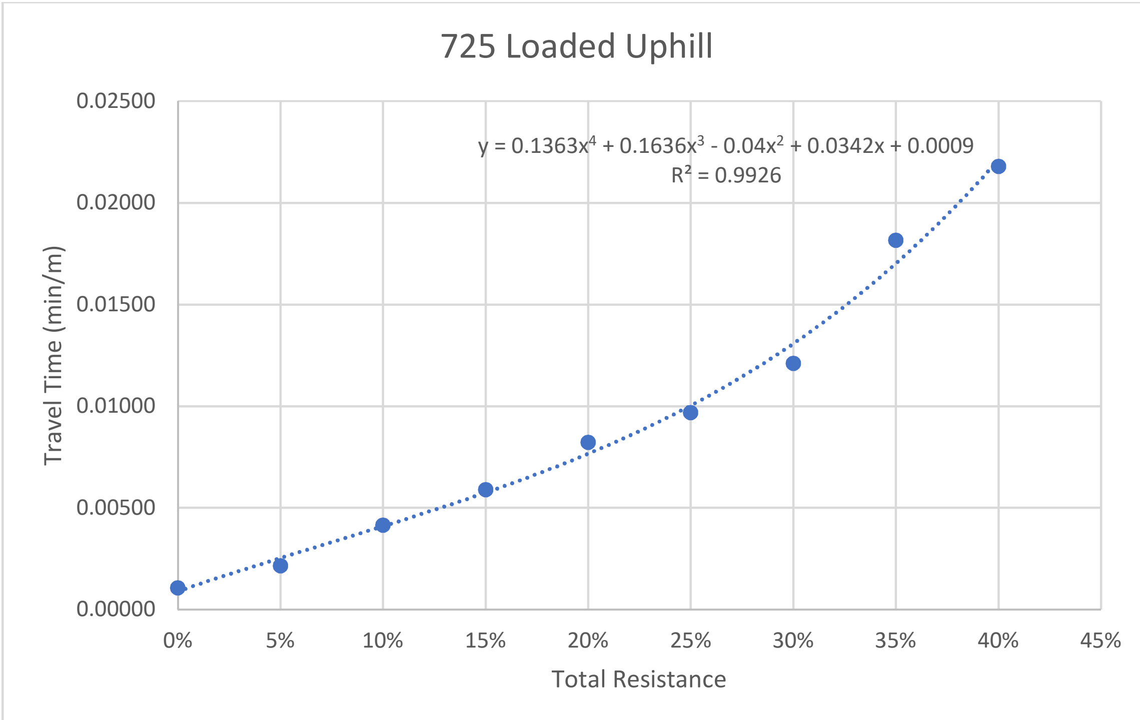


Caterpillar Performance Handbook Edition 47, 24-30

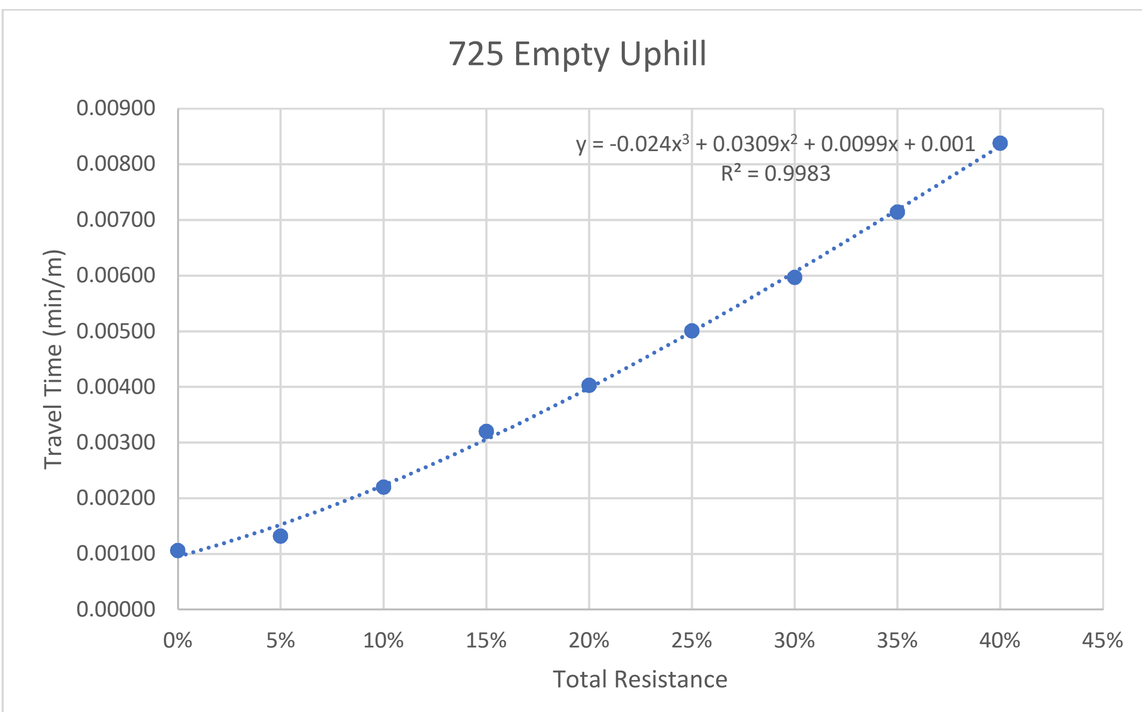


Caterpillar Performance Handbook Edition 47, 24-30

Truck Haul Travel Time



Caterpillar Performance Handbook Edition 47, 1-9



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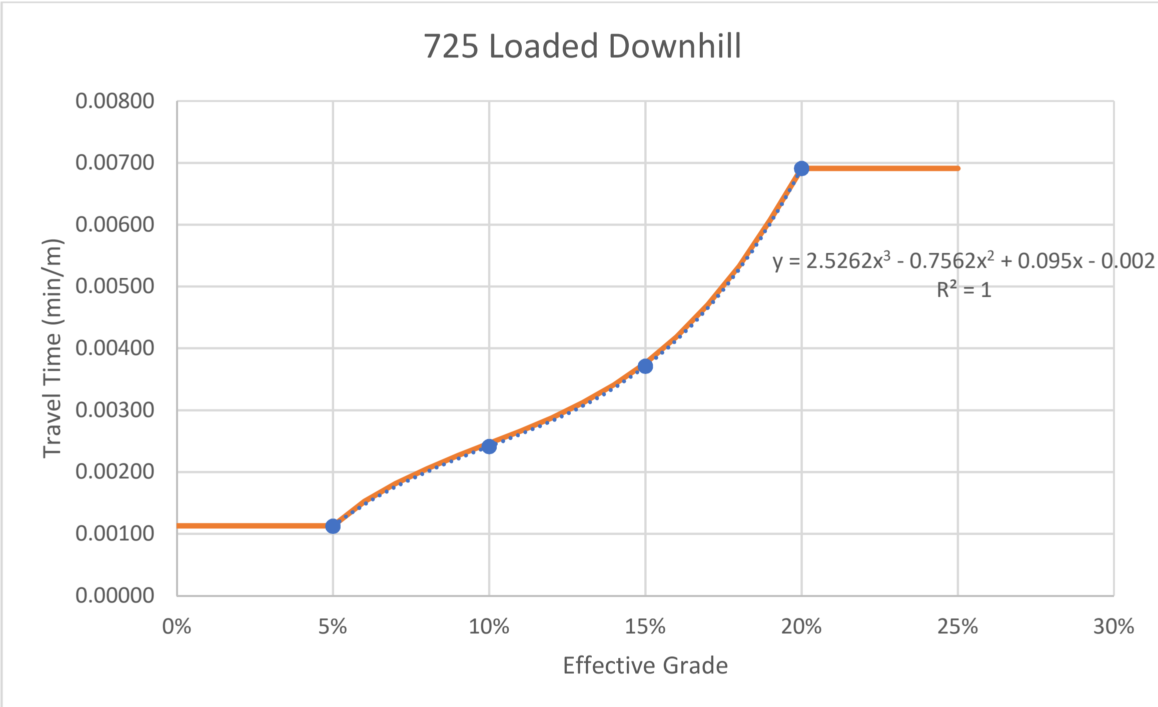

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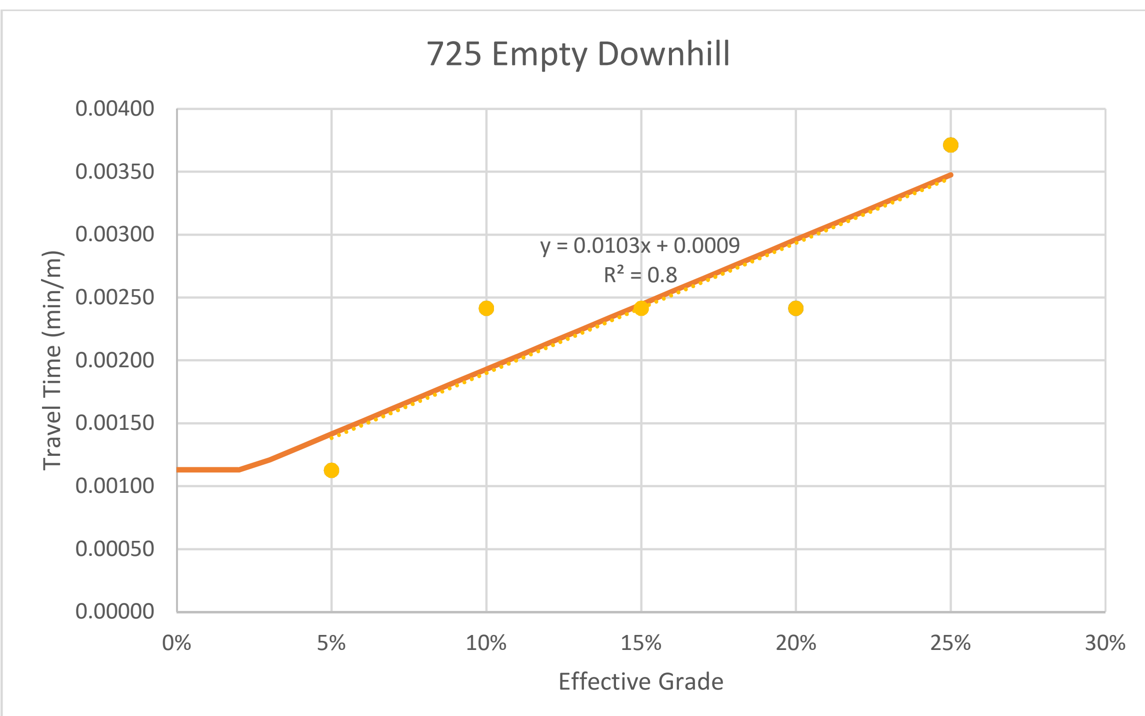

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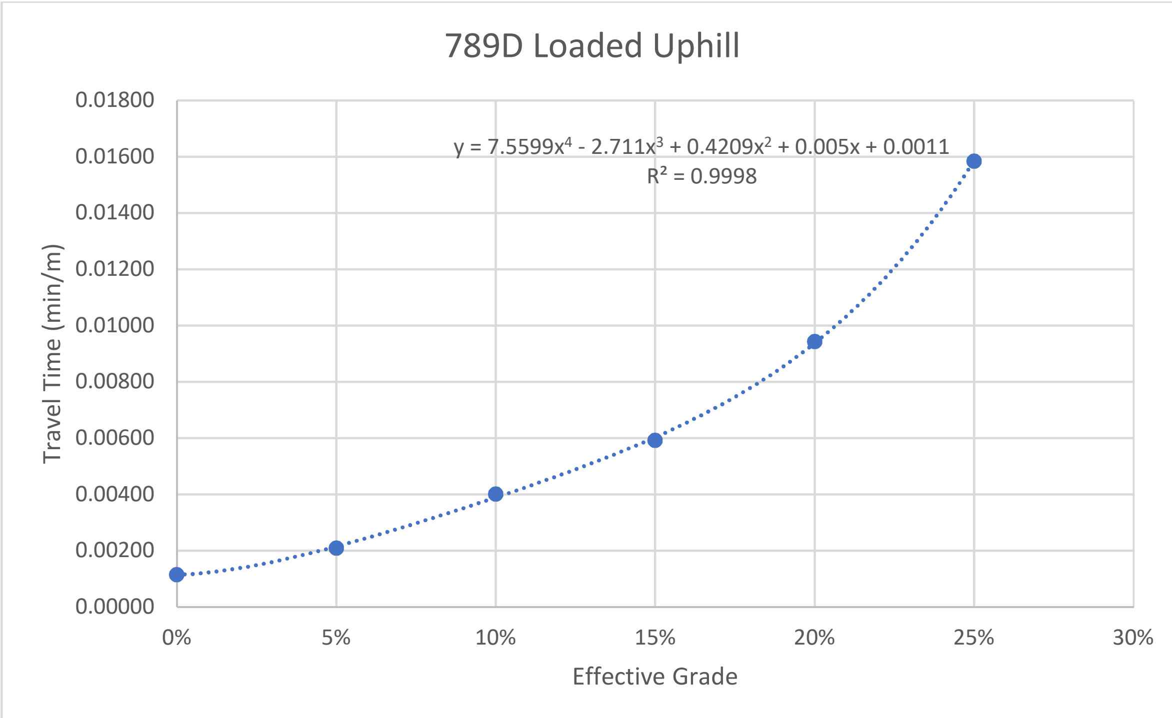
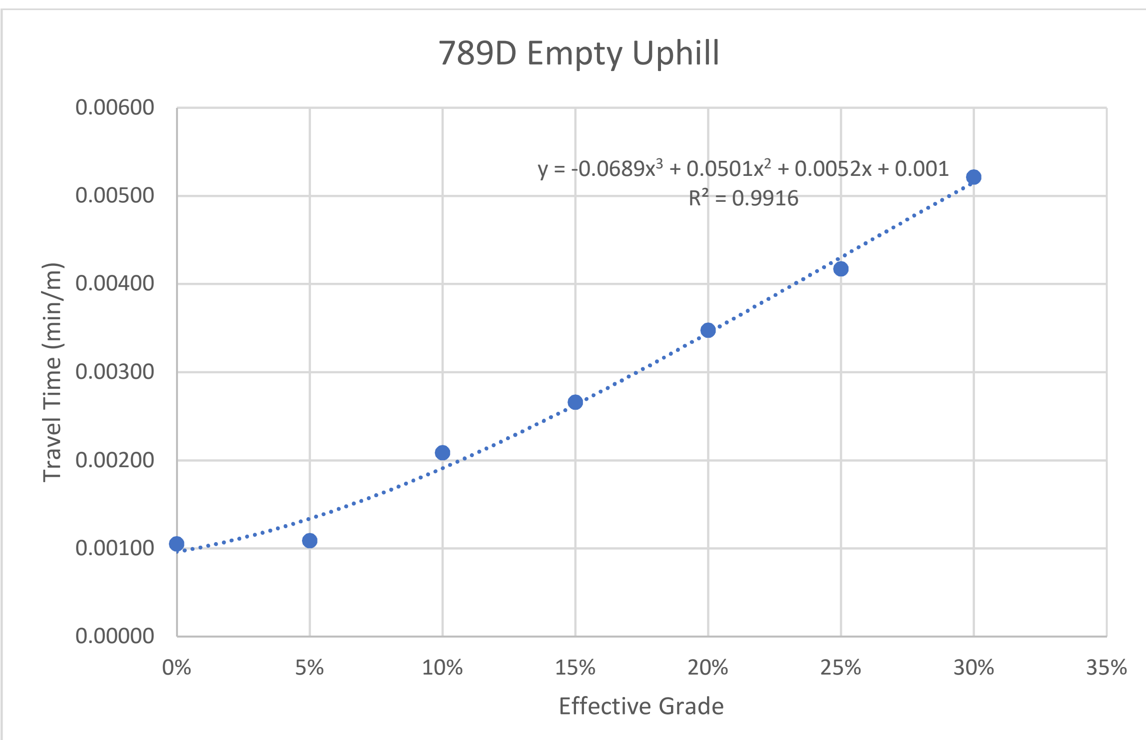
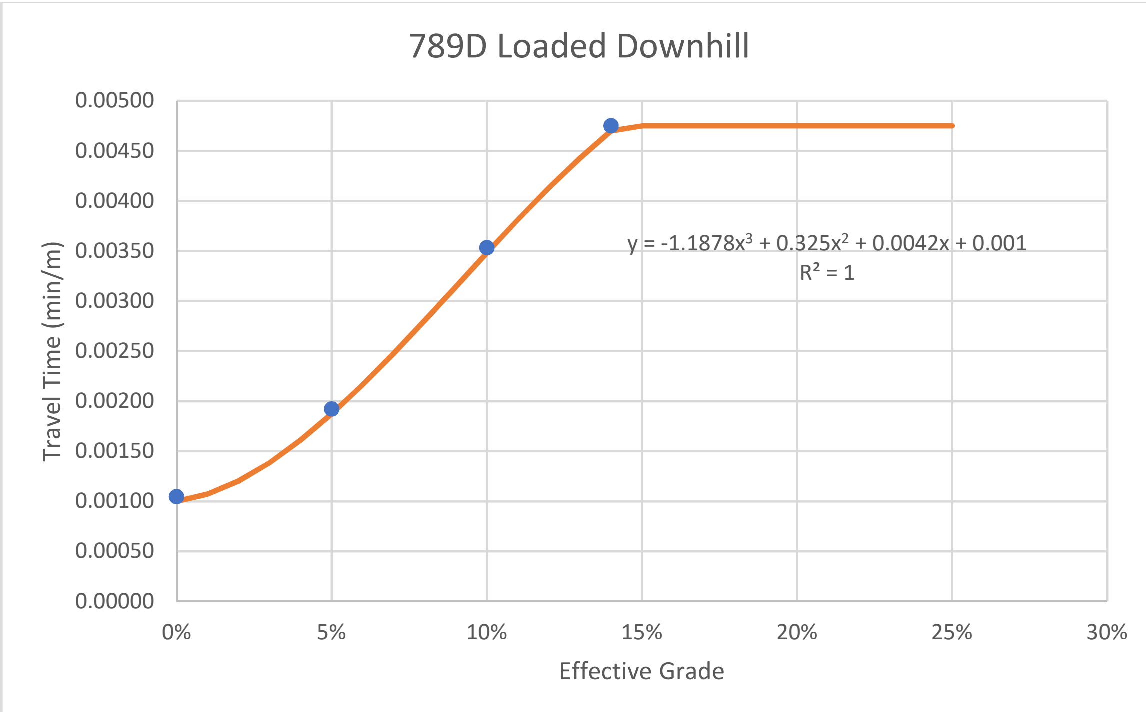


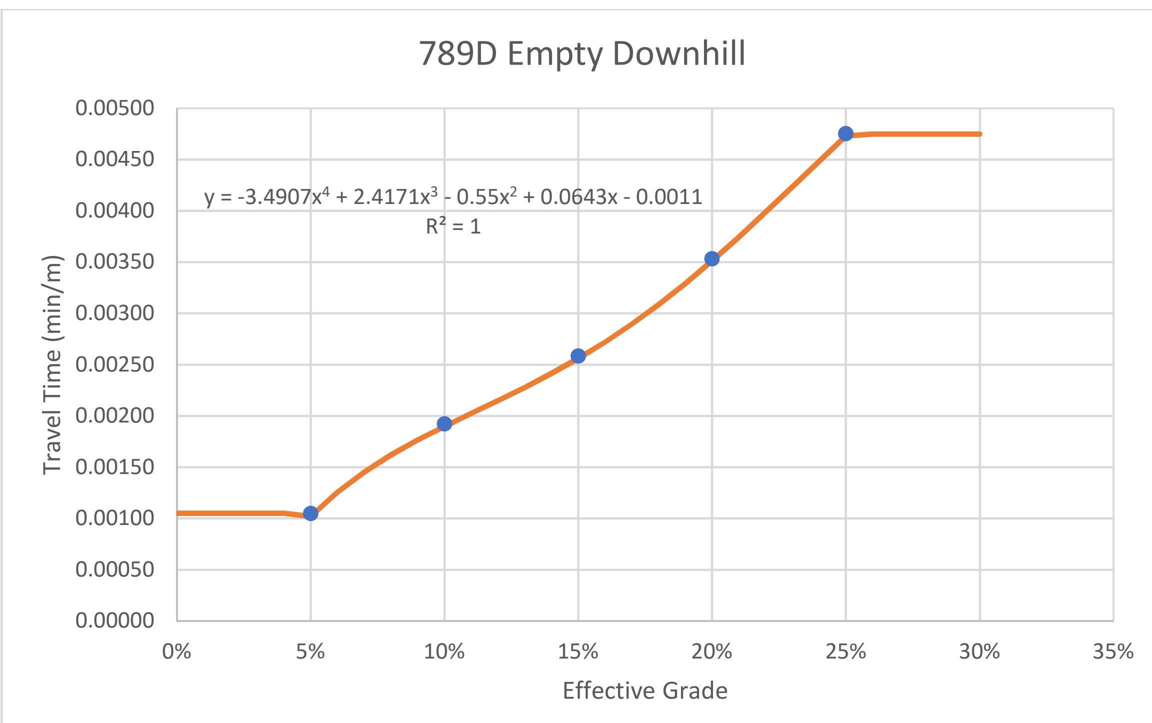
Caterpillar Performance Handbook Edition 47, 10-64



Caterpillar Performance Handbook Edition 47, 10-64



Caterpillar Performance Handbook Edition 47, 10-65



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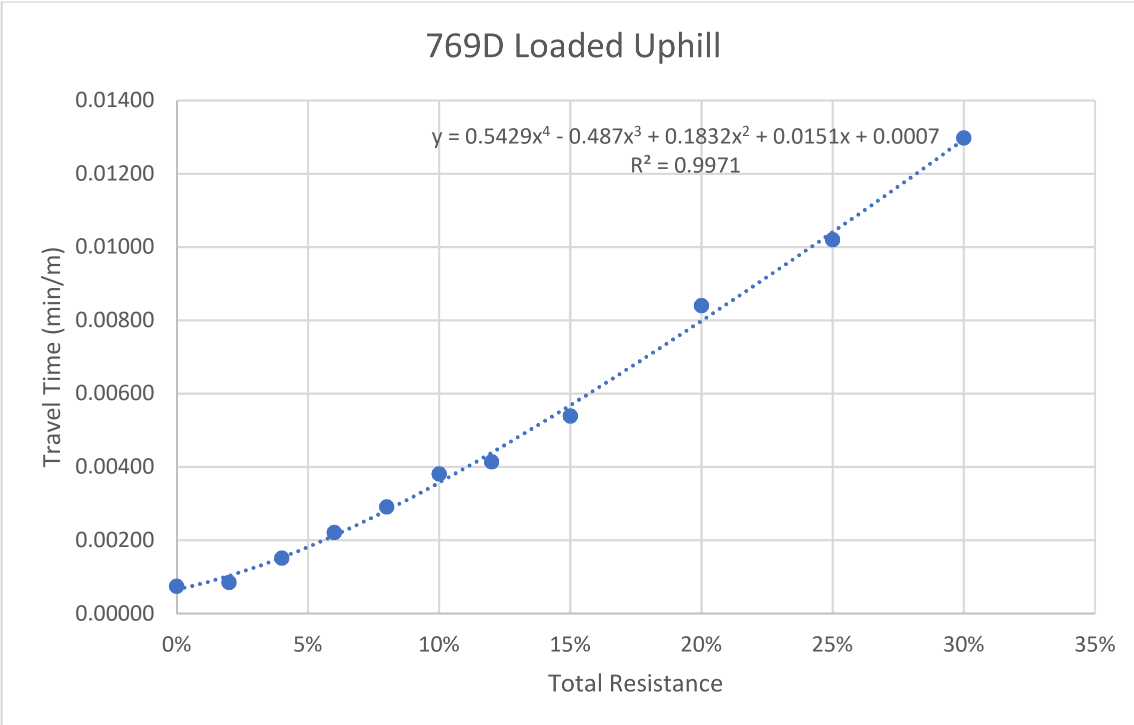
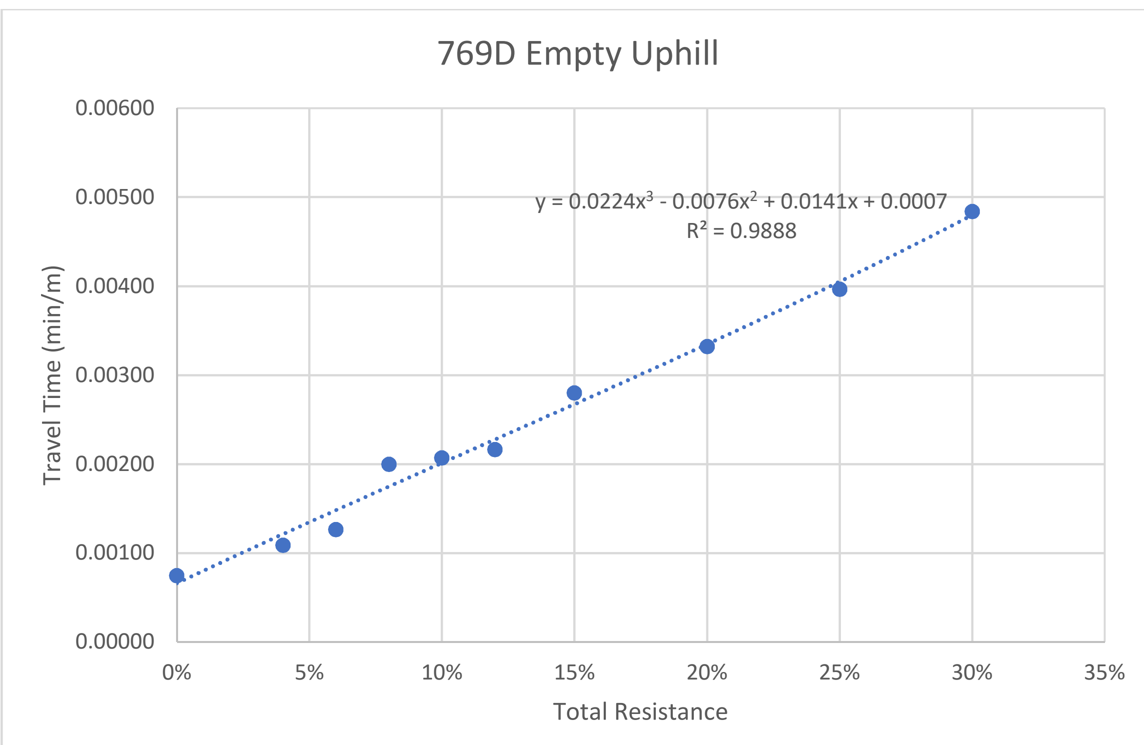
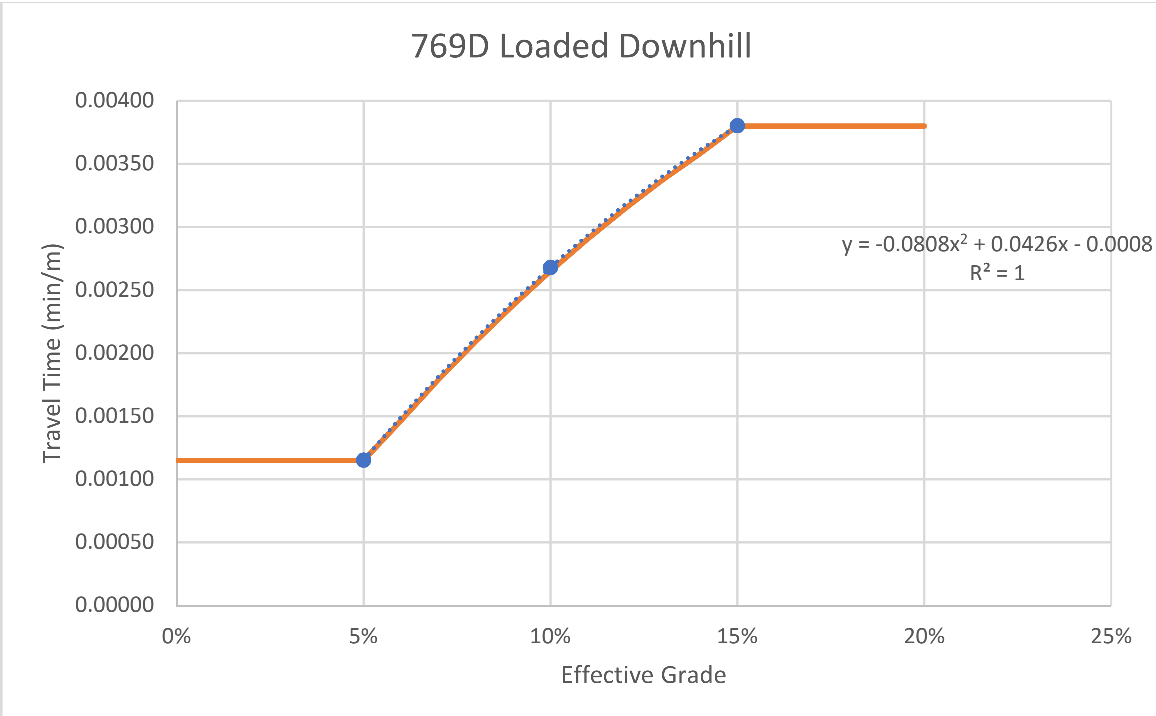


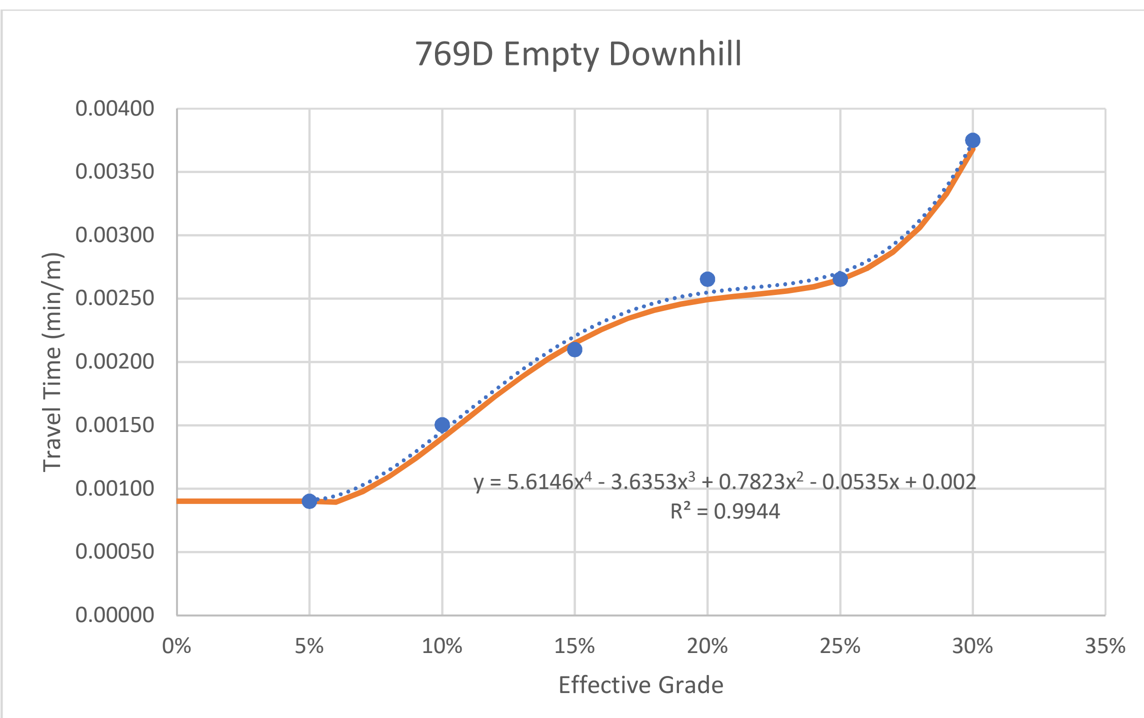
Caterpillar Performance Handbook Edition 29, 9-10



Caterpillar Performance Handbook Edition 29, 9-10



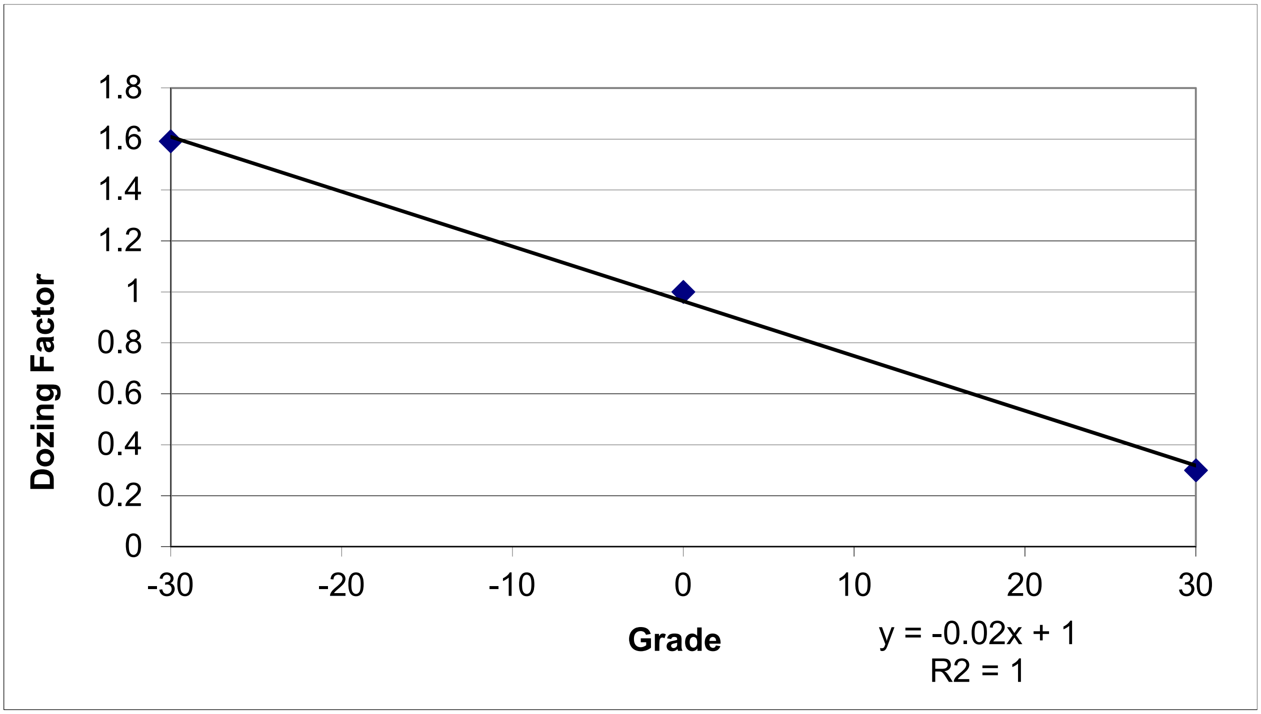
Caterpillar Performance Handbook Edition 29, 9-11



Caterpillar Performance Handbook Edition 29, 9-11

Grade vs. Dozing Factor

Grade %	Dozing Factor
0	1
-30	1.59
30	0.3



Appendix D.4

R.S. Means Data

RS Means Online Data

Demolition - accessed January 6, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
024116130100	Building demolition, large urban projects, mixture of types, excludes foundation demolition, dump fees	C.F.	$ -	$ 0.12	$ 0.11	$ 0.23	Year 2021	NEW MEXICO / LAS CRUCES (880)
024116170400	Buillding footings and foundations demolition, floors, concrete slab on grade, plain concrete, 6" thick, excludes disposal costs and dump fees	S.F.	$ -	$ 0.19	$ 0.43	$ 0.62	Year 2021	NEW MEXICO / LAS CRUCES (880)
260505100370	Non metallic sheathed cable, (Romex), #14, 3 wire, electrical demolition, remove	L.F.	$ -	$ 0.63	$ -	$ 0.63	Year 2021	NEW MEXICO / LAS CRUCES (880)
024113800200	Selective demolition, utility poles & cross arms, utility poles, wood, 35'-45' high	Ea.	$ -	$ 189.74	$ 30.82	$ 220.56	Year 2021	NEW MEXICO / LAS CRUCES (880)
130505750530	Steel tank, single wall, above ground, 5,000 thru 10,000 gallon, selective demolition, excluding foundation, pumps or piping	Ea.	$ -	$ 601.32	$ 458.22	$ 1,059.54	Year 2021	NEW MEXICO / LAS CRUCES (880)
130505750540	Steel tank, single wall, above ground, 15,000 thru 30,000 gallon, selective demolition, excluding foundation, pumps or piping	Ea.	$ -	$ 841.00	$ 1,257.05	$ 2,098.05	Year 2021	NEW MEXICO / LAS CRUCES (880)
024113230900	Utility removal, hydrants, fire, remove only, excludes hauling	Ea.	$ -	$ 328.68	$ 70.15	$ 398.83	Year 2021	NEW MEXICO / LAS CRUCES (880)
024113400190	Selective demolition, metal drainage piping, CMP, steel, 48"-60", diameter, excludes excavation	L.F.	$ -	$ 10.08	$ 2.38	$ 12.46	Year 2021	NEW MEXICO / LAS CRUCES (880)

Sludge/water removal from pipelines - accessed January 6, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
026510300320	Removal of underground storage tanks, petroleum storage tanks, non-leaking, remove sludge, water and remaining product from tank bottom of tank with vacuum truck, 9,000 - 12,000 gallon tank	Ea.	$ -	$ 103.60	$ 201.94	$ 305.54	Year 2021	NEW MEXICO / LAS CRUCES (880)

Revegetation - accessed January 6, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
015433201500	Rent disc harrow attchment for tractor, Excl. Hourly Oper. Cost.	Month	$ -	$ -	$ 670.65	$ 670.65	Year 2021	NEW MEXICO / LAS CRUCES (880)
329343100560	Planting, trees, shrubs, and ground cover, medium soil, bare root seedlings, 3" to 5", includes planting only	Clab	$ -	$ 0.37	$ -	$ 0.37	Year 2021	NEW MEXICO / LAS CRUCES (880)

Concrete cutoff wall (dissipater [dissipation basin]) & Grade Control Wall - accessed January 6, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
033053406200	Structural concrete, in place, gravity retaining wall (3000 psi), 4' high, includes forms(4 uses), Grade 60 rebar, concrete (Portland cement Type I), placing and finishing	C.Y.	$ 155.23	$ 101.84	$ 5.51	$ 262.58	Year 2021	NEW MEXICO / LAS CRUCES (880)
033053403945	Structural concrete, in place, continuous strip footing (3000 psi), 36" wide x 12" deep, unreinforced, includes forms(4 uses), concrete (Portland cement Type I), placing and finishing, excludes reinforcing	C.Y.	$ 127.01	$ 43.47	$ 0.31	$ 170.79	Year 2021	NEW MEXICO / LAS CRUCES (880)

Wastes requiring special handling (cleanup, transportation, and disposal) - accessed January 6, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
028120101120	Hazardous waste cleanup/pickup/disposal, solid pickup, bulk material, minimum	Ton	$ -	$ -	$ -	$ 161.88	Year 2021	NEW MEXICO / LAS CRUCES (880)
028120101130	Hazardous waste cleanup/pickup/disposal, solid pickup, bulk material, maximum	Ton	$ -	$ -	$ -	$ 506.94	Year 2021	NEW MEXICO / LAS CRUCES (880)
028120101260	Hazardous waste cleanup/pickup/disposal, transportation to disposal site, truckload = 80 drums or 25 C.Y. or 18 tons, minimum	Mile	$ -	$ -	$ -	$ 3.37	Year 2021	NEW MEXICO / LAS CRUCES (880)

028120101270	Hazardous waste cleanup/pickup/disposal, transportation to disposal site, truckload = 80 drums or 25 C.Y. or 18 tons, maximum	Mile	$ -	$ -	$ -	$ 6.18	Year 2021	NEW MEXICO / LAS CRUCES (880)
026510300320	Removal of underground storage tanks, petroleum storage tanks, non-leaking, remove sludge, water and remaining product from tank bottom of tank with vacuum truck, 9,000 - 12,000 gallon tank	Ea.	$ -	$ 103.60	$ 201.94	$ 305.54	Year 2021	NEW MEXICO / LAS CRUCES (880)

Perimeter Items - accessed January 6, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
323113200800	Fence, chain link industrial, galvanized steel, 6 ga. wire, 2" posts @ 10' OC, 6' high, includes excavation, & concrete, excludes barbed wire	L.F.	$ 20.63	$ 3.20	$ 0.82	$ 24.65	Year 2021	NEW MEXICO / LAS CRUCES (880)
323113205070	Fence, chain link industrial, double swing gates, 6' high, 20' opening, includes excavation, posts & hardware in concrete	Opng.	$ 568.54	$ 309.40	$ 79.07	$ 957.01	Year 2021	NEW MEXICO / LAS CRUCES (880)
101453200600	Signs, guide and directional signs, reflectorized, 12" x 18", excludes posts	Ea.	$ 42.50	$ 18.92	$ 12.21	$ 73.63	Year 2021	NEW MEXICO / LAS CRUCES (880)

Excavation- accessed January 6, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
312316466070	Excavating, bulk, dozer, open site, bank measure, common earth, 700 HP dozer, 300' haul	B.C.Y.	$ -	$ 0.54	$ 4.66	$ 5.20	Year 2021	NEW MEXICO / LAS CRUCES (880)
312316466010	Excavating, bulk, dozer, open site, bank measure, common earth, 700 HP dozer, 50' haul	B.C.Y.	$ -	$ 0.16	$ 1.39	$ 1.55	Year 2021	NEW MEXICO / LAS CRUCES (880)
312323205040	Cycle hauling(wait, load, travel, unload or dump & return) time per cycle, excavated or borrow, loose cubic yards, 15 min load/wait/unload, 22 C.Y. truck, cycle 1 mile, 5 MPH, excludes loading equipment	L.C.Y.	$ -	$ 0.82	$ 2.05	$ 2.87	Year 2021	NEW MEXICO / LAS CRUCES (880)

Clay Fill - accessed January 11, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
312323156075	Borrow, clay, till, or blasted rock, 5 C.Y. bucket, loading and/or spreading, front end loader, track mounted (material cost only)	L.C.Y.	$ 12.61	$ -	$ -	$ 12.61	Year 2021	NEW MEXICO / LAS CRUCES (880)

Substation Demo - accessed January 20, 2021

Line Number	Description	Unit	Material	Labor	Equipment	Total	Data Release	CCI Location
260505101570	Transformer, dry type, primary, 3 phase, to 600 V, 750 kVA, electrical demolition, remove, including removal of supports, wire & conduit terminations	Ea.	$ -	$ 928.05	$ 141.11	$ 1,069.16	Year 2021	NEW MEXICO / LAS CRUCES (880)
015433406300	Rent steam cleaner 100 gph, Incl. Hourly Oper. Cost.	Week	$ -	$ -	$ 313.04	$ 313.04	Year 2021	NEW MEXICO / LAS CRUCES (880)

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew A-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Concrete Saw, Gas Manual		113.70		125.07	14.21	15.63
8 L.H., Daily Totals		$468.90		$655.07	$58.61	$81.88
Crew A-1A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Skilled Worker	$57.10	$456.80	$85.90	$687.20	$57.10	$85.90
1 Shot Blaster, 20″		208.70		229.57	26.09	28.70
8 L.H., Daily Totals		$665.50		$916.77	$83.19	$114.60
Crew A-1B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Concrete Saw		112.85		124.14	14.11	15.52
8 L.H., Daily Totals		$468.05		$654.13	$58.51	$81.77
Crew A-1C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Chain Saw, Gas, 18″		52.20		57.42	6.53	7.18
8 L.H., Daily Totals		$407.40		$587.42	$50.92	$73.43
Crew A-1D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Vibrating Plate, Gas, 18″		31.90		35.09	3.99	4.39
8 L.H., Daily Totals		$387.10		$565.09	$48.39	$70.64
Crew A-1E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Vibrating Plate, Gas, 21″		165.60		182.16	20.70	22.77
8 L.H., Daily Totals		$520.80		$712.16	$65.10	$89.02
Crew A-1F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Rammer/Tamper, Gas, 8″		47.00		51.70	5.88	6.46
8 L.H., Daily Totals		$402.20		$581.70	$50.27	$72.71
Crew A-1G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Rammer/Tamper, Gas, 15″		54.65		60.12	6.83	7.51
8 L.H., Daily Totals		$409.85		$590.12	$51.23	$73.76
Crew A-1H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Exterior Steam Cleaner		77.20		84.92	9.65	10.62
8 L.H., Daily Totals		$432.40		$614.92	$54.05	$76.86
Crew A-1J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Cultivator, Walk-Behind, 5 H.P.		53.25		58.58	6.66	7.32
8 L.H., Daily Totals		$408.45		$588.58	$51.06	$73.57
Crew A-1K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Cultivator, Walk-Behind, 8 H.P.		92.20		101.42	11.53	12.68
8 L.H., Daily Totals		$447.40		$631.42	$55.92	$78.93
Crew A-1M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Building Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Snow Blower, Walk-Behind		68.30		75.13	8.54	9.39
8 L.H., Daily Totals		$423.50		$605.13	$52.94	$75.64

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew A-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	8.27	9.10
24 L.H., Daily Totals		$1299.30		$1862.35	$54.14	$77.60
Crew A-2A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Concrete Saw		112.85		124.14	12.97	14.27
24 L.H., Daily Totals		$1412.15		$1986.48	$58.84	$82.77
Crew A-2B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (light)	$48.80	$390.40	$73.00	$584.00	$48.80	$73.00
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	24.81	27.29
8 L.H., Daily Totals		$588.90		$802.35	$73.61	$100.29
Crew A-3A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43	22.09	24.30
8 L.H., Daily Totals		$620.75		$856.02	$77.59	$107.00
Crew A-3B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$55.15	$82.30
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28		
1 F.E. Loader, W.M., 2.5 C.Y.		638.30		702.13	76.10	83.71
16 L.H., Daily Totals		$2100.05		$2656.22	$131.25	$166.01
Crew A-3C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	55.79	61.37
8 L.H., Daily Totals		$890.30		$1152.53	$111.29	$144.07
Crew A-3D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (light)	$48.80	$390.40	$73.00	$584.00	$48.80	$73.00
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 25 Ton		137.20		150.92	39.24	43.17
8 L.H., Daily Totals		$704.35		$929.35	$88.04	$116.17
Crew A-3E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.38	$84.13
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43	11.05	12.15
16 L.H., Daily Totals		$1078.75		$1540.43	$67.42	$96.28
Crew A-3F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.38	$84.13
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Lowbed Trailer, 75 Ton		258.10		283.91	58.38	64.21
16 L.H., Daily Totals		$1836.00		$2373.40	$114.75	$148.34

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew A-3G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.38	$84.13
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Lowbed Trailer, 75 Ton		258.10		283.91	65.24	71.76
16 L.H., Daily Totals		$1945.80		$2494.18	$121.61	$155.89
Crew A-3H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$61.45	$91.55
1 Hyd. Crane, 12 Ton (Daily)		733.15		806.47	91.64	100.81
8 L.H., Daily Totals		$1224.75		$1538.87	$153.09	$192.36
Crew A-3I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$61.45	$91.55
1 Hyd. Crane, 25 Ton (Daily)		810.50		891.55	101.31	111.44
8 L.H., Daily Totals		$1302.10		$1623.95	$162.76	$202.99
Crew A-3J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$61.45	$91.55
1 Hyd. Crane, 40 Ton (Daily)		1287.00		1415.70	160.88	176.96
8 L.H., Daily Totals		$1778.60		$2148.10	$222.32	$268.51
Crew A-3K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.98	$84.90
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 55 Ton (Daily)		1377.00		1514.70		
1 P/U Truck, 3/4 Ton (Daily)		143.85		158.24	95.05	104.56
16 L.H., Daily Totals		$2432.45		$3031.34	$152.03	$189.46
Crew A-3L	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.98	$84.90
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 80 Ton (Daily)		2058.00		2263.80		
1 P/U Truck, 3/4 Ton (Daily)		143.85		158.24	137.62	151.38
16 L.H., Daily Totals		$3113.45		$3780.43	$194.59	$236.28
Crew A-3M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$56.98	$84.90
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 100 Ton (Daily)		2253.00		2478.30		
1 P/U Truck, 3/4 Ton (Daily)		143.85		158.24	149.80	164.78
16 L.H., Daily Totals		$3308.45		$3994.93	$206.78	$249.68
Crew A-3N	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$61.45	$91.55
1 Tower Crane (monthly)		1737.00		1910.70	217.13	238.84
8 L.H., Daily Totals		$2228.60		$2643.10	$278.57	$330.39
Crew A-3P	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 A.T. Forklift, 31' reach, 45' lift		346.45		381.10	43.31	47.64
8 L.H., Daily Totals		$790.45		$1042.69	$98.81	$130.34
Crew A-3Q	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 3 Ton		71.15		78.27	30.99	34.09
8 L.H., Daily Totals		$691.90		$934.29	$86.49	$116.79

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew A-3R	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Forklift, Smooth Floor, 8,000 Lb.		283.25		311.57	35.41	38.95
8 L.H., Daily Totals		$727.25		$973.17	$90.91	$121.65
Crew A-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$51.95	$77.40
1 Painter, Ordinary	46.45	371.60	68.90	551.20		
24 L.H., Daily Totals		$1246.80		$1857.60	$51.95	$77.40
Crew A-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$44.89	$67.00
.25 Truck Driver (light)	48.80	97.60	73.00	146.00		
.25 Flatbed Truck, Gas, 1.5 Ton		49.63		54.59	2.76	3.03
18 L.H., Daily Totals		$857.63		$1260.59	$47.65	$70.03
Crew A-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Instrument Man	$57.10	$456.80	$85.90	$687.20	$54.88	$82.15
1 Rodman/Chainman	52.65	421.20	78.40	627.20		
1 Level, Electronic		34.40		37.84	2.15	2.37
16 L.H., Daily Totals		$912.40		$1352.24	$57.02	$84.52
Crew A-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Chief of Party	$68.50	$548.00	$102.35	$818.80	$59.42	$88.88
1 Instrument Man	57.10	456.80	85.90	687.20		
1 Rodman/Chainman	52.65	421.20	78.40	627.20		
1 Level, Electronic		34.40		37.84	1.43	1.58
24 L.H., Daily Totals		$1460.40		$2171.04	$60.85	$90.46
Crew A-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Chief of Party	$68.50	$548.00	$102.35	$818.80	$57.73	$86.26
1 Instrument Man	57.10	456.80	85.90	687.20		
2 Rodmen/Chainmen	52.65	842.40	78.40	1254.40		
1 Level, Electronic		34.40		37.84	1.08	1.18
32 L.H., Daily Totals		$1881.60		$2798.24	$58.80	$87.44
Crew A-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.01	$93.34
7 Asbestos Workers	60.95	3413.20	93.25	5222.00		
64 L.H., Daily Totals		$3904.80		$5974.00	$61.01	$93.34
Crew A-10A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.12	$93.50
2 Asbestos Workers	60.95	975.20	93.25	1492.00		
24 L.H., Daily Totals		$1466.80		$2244.00	$61.12	$93.50
Crew A-10B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.08	$93.44
3 Asbestos Workers	60.95	1462.80	93.25	2238.00		
32 L.H., Daily Totals		$1954.40		$2990.00	$61.08	$93.44
Crew A-10C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Asbestos Workers	$60.95	$1462.80	$93.25	$2238.00	$60.95	$93.25
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	8.27	9.10
24 L.H., Daily Totals		$1661.30		$2456.35	$69.22	$102.35

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	

Crew A-10D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Asbestos Workers	$60.95	$975.20	$93.25	$1492.00	$58.96	$89.08
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hydraulic Crane, 33 Ton		983.15		1081.46	30.72	33.80
32 L.H., Daily Totals		$2869.95		$3931.86	$89.69	$122.87

Crew A-11	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.01	$93.34
7 Asbestos Workers	60.95	3413.20	93.25	5222.00		
2 Chip. Hammers, 12 Lb., Elec.		65.70		72.27	1.03	1.13
64 L.H., Daily Totals		$3970.50		$6046.27	$62.04	$94.47

Crew A-12	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Asbestos Foreman	$61.45	$491.60	$94.00	$752.00	$61.01	$93.34
7 Asbestos Workers	60.95	3413.20	93.25	5222.00		
1 Trk-Mtd Vac, 14 CY, 1500 Gal.		542.60		596.86		
1 Flatbed Truck, 20,000 GVW		204.05		224.46	11.67	12.83
64 L.H., Daily Totals		$4651.45		$6795.31	$72.68	$106.18

Crew A-13	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Trk-Mtd Vac, 14 CY, 1500 Gal.		542.60		596.86		
1 Flatbed Truck, 20,000 GVW		204.05		224.46	93.33	102.66
8 L.H., Daily Totals		$1190.65		$1482.92	$148.83	$185.36

Crew B-1	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
24 L.H., Daily Totals		$1081.60		$1614.00	$45.07	$67.25

Crew B-1A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
2 Cutting Torches		25.90		28.49		
2 Sets of Gases		347.20		381.92	15.55	17.10
24 L.H., Daily Totals		$1454.70		$2024.41	$60.61	$84.35

Crew B-1B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.16	$73.33
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
2 Cutting Torches		25.90		28.49		
2 Sets of Gases		347.20		381.92		
1 Hyd. Crane, 12 Ton		475.80		523.38	26.53	29.18
32 L.H., Daily Totals		$2422.10		$3280.19	$75.69	$102.51

Crew B-1C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
1 Telescoping Boom Lift, to 60'		292.45		321.69	12.19	13.40
24 L.H., Daily Totals		$1374.05		$1935.69	$57.25	$80.65

Crew B-1D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$44.40	$66.25
1 Small Work Boat, Gas, 50 H.P.		120.85		132.94		
1 Pressure Washer, 7 GPM		93.95		103.35	13.43	14.77
16 L.H., Daily Totals		$925.20		$1296.28	$57.83	$81.02

Crew B-1E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.90	$67.00
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Work Boat, Diesel, 200 H.P.		1436.00		1579.60		
2 Pressure Washers, 7 GPM		187.90		206.69	50.75	55.82
32 L.H., Daily Totals		$3060.70		$3930.29	$95.65	$122.82

Crew B-1F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Workers	$57.10	$913.60	$85.90	$1374.40	$52.87	$79.35
1 Laborer	44.40	355.20	66.25	530.00		
1 Small Work Boat, Gas, 50 H.P.		120.85		132.94		
1 Pressure Washer, 7 GPM		93.95		103.35	8.95	9.85
24 L.H., Daily Totals		$1483.60		$2140.68	$61.82	$89.19

Crew B-1G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$44.40	$66.25
1 Small Work Boat, Gas, 50 H.P.		120.85		132.94	7.55	8.31
16 L.H., Daily Totals		$831.25		$1192.93	$51.95	$74.56

Crew B-1H	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Workers	$57.10	$913.60	$85.90	$1374.40	$52.87	$79.35
1 Laborer	44.40	355.20	66.25	530.00		
1 Small Work Boat, Gas, 50 H.P.		120.85		132.94	5.04	5.54
24 L.H., Daily Totals		$1389.65		$2037.34	$57.90	$84.89

Crew B-1J	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (inside)	$44.90	$359.20	$67.00	$536.00	$44.65	$66.63
1 Laborer	44.40	355.20	66.25	530.00		
16 L.H., Daily Totals		$714.40		$1066.00	$44.65	$66.63

Crew B-1K	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (inside)	$55.20	$441.60	$82.40	$659.20	$54.95	$82.03
1 Carpenter	54.70	437.60	81.65	653.20		
16 L.H., Daily Totals		$879.20		$1312.40	$54.95	$82.03

Crew B-2	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.80	$66.85
4 Laborers	44.40	1420.80	66.25	2120.00		
40 L.H., Daily Totals		$1792.00		$2674.00	$44.80	$66.85

Crew B-2A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
1 Telescoping Boom Lift, to 60'		292.45		321.69	12.19	13.40
24 L.H., Daily Totals		$1374.05		$1935.69	$57.25	$80.65

Crew B-3	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.47	$73.84
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57	48.01	52.82
48 L.H., Daily Totals		$4679.10		$6079.57	$97.48	$126.66

Crew B-3A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
4 Laborers	$44.40	$1420.80	$66.25	$2120.00	$47.32	$70.58
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38	17.40	19.13
40 L.H., Daily Totals		$2588.60		$3588.58	$64.72	$89.71

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-3B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$49.77	$74.28
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Backhoe Loader, 80 H.P.		235.05		258.56		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	25.45	28.00
32 L.H., Daily Totals		$2407.20		$3272.64	$75.22	$102.27
Crew B-3C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$48.05	$71.66
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Crawler Loader, 4 C.Y.		1456.00		1601.60	45.50	50.05
32 L.H., Daily Totals		$2993.60		$3894.80	$93.55	$121.71
Crew B-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.88	$68.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Truck Tractor, 220 H.P.		310.80		341.88		
1 Flatbed Trailer, 40 Ton		188.45		207.29	10.40	11.44
48 L.H., Daily Totals		$2701.65		$3836.78	$56.28	$79.93
Crew B-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.86	$72.86
4 Laborers	44.40	1420.80	66.25	2120.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Air Compressor, 250 cfm		202.85		223.13		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
2 -50' Air Hoses, 1.5"		45.60		50.16		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60	26.82	29.50
56 L.H., Daily Totals		$4237.65		$5732.22	$75.67	$102.36
Crew B-5A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.08	$73.22
6 Laborers	44.40	2131.20	66.25	3180.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Air Compressor, 365 cfm		343.55		377.90		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
8 -50' Air Hoses, 1"		64.40		70.84		
2 Dump Trucks, 8 C.Y., 220 H.P.		815.20		896.72	13.86	15.24
96 L.H., Daily Totals		$6041.55		$8492.58	$62.93	$88.46
Crew B-5B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Powderman	$57.10	$456.80	$85.90	$687.20	$54.83	$81.97
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
3 Truck Drivers (heavy)	51.30	1231.20	76.70	1840.80		
1 F.E. Loader, W.M., 2.5 C.Y.		638.30		702.13		
3 Dump Trucks, 12 C.Y., 400 H.P.		1738.05		1911.86		
1 Air Compressor, 365 cfm		343.55		377.90	56.66	62.33
48 L.H., Daily Totals		$5351.90		$6926.29	$111.50	$144.30

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-5C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$51.09	$76.23
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57		
1 Crawler Loader, 4 C.Y.		1456.00		1601.60		
1 S.P. Crane, 4x4, 25 Ton		1155.00		1270.50	58.90	64.79
64 L.H., Daily Totals		$7039.70		$9025.47	$110.00	$141.02
Crew B-5D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.16	$73.34
4 Laborers	44.40	1420.80	66.25	2120.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Air Compressor, 250 cfm		202.85		223.13		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
2 -50' Air Hoses, 1.5"		45.60		50.16		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	32.52	35.77
64 L.H., Daily Totals		$5227.40		$6983.10	$81.68	$109.11
Crew B-5E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.16	$73.34
4 Laborers	44.40	1420.80	66.25	2120.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 High Pressure Water Jet 40 KSI		820.75		902.83		
2 -50' Air Hoses, 1.5"		45.60		50.16		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	42.90	47.19
64 L.H., Daily Totals		$5892.20		$7714.38	$92.07	$120.54
Crew B-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82	9.01	9.91
24 L.H., Daily Totals		$1370.60		$1959.42	$57.11	$81.64
Crew B-6A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.5 Labor Foreman (outside)	$46.40	$185.60	$69.25	$277.00	$50.64	$75.51
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Vacuum Truck, 5000 Gal.		371.95		409.14	18.60	20.46
20 L.H., Daily Totals		$1384.75		$1919.35	$69.24	$95.97
Crew B-6B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.07	$67.25
4 Laborers	44.40	1420.80	66.25	2120.00		
1 S.P. Crane, 4x4, 5 Ton		381.95		420.14		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Butt Fusion Mach., 4"-12" diam.		420.75		462.82	20.86	22.94
48 L.H., Daily Totals		$3164.40		$4329.32	$65.92	$90.19

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-6C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.07	$67.25
4 Laborers	44.40	1420.80	66.25	2120.00		
1 S.P. Crane, 4x4, 12 Ton		432.65		475.92		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Butt Fusion Mach., 8″-24″ diam.		1086.00		1194.60	49.35	54.28
48 L.H., Daily Totals		$4531.90		$5833.57	$94.41	$121.53

Crew B-6D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.5 Labor Foreman (outside)	$46.40	$185.60	$69.25	$277.00	$50.64	$75.51
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Hydro Excavator, 12 C.Y.		1277.00		1404.70	63.85	70.23
20 L.H., Daily Totals		$2289.80		$2914.90	$114.49	$145.75

Crew B-7	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.17	$70.36
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Brush Chipper, 12″, 130 H.P.		366.05		402.65		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Chain Saws, Gas, 36″ Long		83.30		91.63	33.24	36.56
48 L.H., Daily Totals		$3859.35		$5132.09	$80.40	$106.92

Crew B-7A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Rake w/Tractor		343.50		377.85		
2 Chain Saws, Gas, 18″		104.40		114.84	18.66	20.53
24 L.H., Daily Totals		$1602.30		$2214.29	$66.76	$92.26

Crew B-7B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.76	$71.26
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Brush Chipper, 12″, 130 H.P.		366.05		402.65		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Chain Saws, Gas, 36″ Long		83.30		91.63		
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36	35.77	39.34
56 L.H., Daily Totals		$4677.35		$6194.05	$83.52	$110.61

Crew B-7C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.76	$71.26
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Brush Chipper, 12″, 130 H.P.		366.05		402.65		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Chain Saws, Gas, 36″ Long		83.30		91.63		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	38.83	42.72
56 L.H., Daily Totals		$4849.10		$6382.97	$86.59	$113.98

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.04	$76.15
2 Laborers	44.40	710.40	66.25	1060.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Hyd. Crane, 25 Ton		586.70		645.37		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57	45.18	49.70
64 L.H., Daily Totals		$6157.80		$8054.14	$96.22	$125.85

Crew B-9	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.80	$66.85
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Air Compressor, 250 cfm		202.85		223.13		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
2 -50′ Air Hoses, 1.5″		45.60		50.16	8.89	9.78
40 L.H., Daily Totals		$2147.65		$3065.22	$53.69	$76.63

Crew B-9A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$46.70	$69.73
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 Truck Tractor, 220 H.P.		310.80		341.88		
2 -50′ Discharge Hoses, 3″		9.00		9.90	19.75	21.72
24 L.H., Daily Totals		$1594.70		$2194.89	$66.45	$91.45

Crew B-9B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$46.70	$69.73
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
2 -50′ Discharge Hoses, 3″		9.00		9.90		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 Truck Tractor, 220 H.P.		310.80		341.88		
1 Pressure Washer		97.35		107.08	23.80	26.18
24 L.H., Daily Totals		$1692.05		$2301.97	$70.50	$95.92

Crew B-9D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.80	$66.85
4 Common Laborers	44.40	1420.80	66.25	2120.00		
1 Air Compressor, 250 cfm		202.85		223.13		
2 -50′ Air Hoses, 1.5″		45.60		50.16		
2 Air Powered Tampers		79.50		87.45	8.20	9.02
40 L.H., Daily Totals		$2119.95		$3034.74	$53.00	$75.87

Crew B-9E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$48.10	$71.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Chip. Hammers, 12 Lb., Elec.		32.85		36.13	2.05	2.26
16 L.H., Daily Totals		$802.45		$1173.34	$50.15	$73.33

Crew B-10	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
12 L.H., Daily Totals		$649.60		$968.20	$54.13	$80.68

Crew B-10A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Roller, 2-Drum, W.B., 7.5 H.P.		166.75		183.43	13.90	15.29
12 L.H., Daily Totals		$816.35		$1151.63	$68.03	$95.97

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 200 H.P.		1520.00		1672.00	126.67	139.33
12 L.H., Daily Totals		$2169.60		$2640.20	$180.80	$220.02

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Vibratory Roller, Towed, 23 Ton		520.35		572.38	170.03	187.03
12 L.H., Daily Totals		$2689.95		$3212.59	$224.16	$267.72

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Sheepsft. Roller, Towed		426.95		469.64	162.25	178.47
12 L.H., Daily Totals		$2596.55		$3109.84	$216.38	$259.15

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Tandem Roller, 5 Ton		258.75		284.63	21.56	23.72
12 L.H., Daily Totals		$908.35		$1252.83	$75.70	$104.40

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Tandem Roller, 10 Ton		246.80		271.48	20.57	22.62
12 L.H., Daily Totals		$896.40		$1239.68	$74.70	$103.31

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10G	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Sheepsfoot Roller, 240 H.P.		1363.00		1499.30	113.58	124.94
12 L.H., Daily Totals		$2012.60		$2467.50	$167.72	$205.63

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10H	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Diaphragm Water Pump, 2″		87.70		96.47		
1 -20′ Suction Hose, 2″		3.55		3.90		
2 -50′ Discharge Hoses, 2″		8.00		8.80	8.27	9.10
12 L.H., Daily Totals		$748.85		$1077.38	$62.40	$89.78

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Diaphragm Water Pump, 4″		106.35		116.99		
1 -20′ Suction Hose, 4″		17.25		18.98		
2 -50′ Discharge Hoses, 4″		25.60		28.16	12.43	13.68
12 L.H., Daily Totals		$798.80		$1132.32	$66.57	$94.36

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10J	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Centrifugal Water Pump, 3″		74.40		81.84		
1 -20′ Suction Hose, 3″		8.75		9.63		
2 -50′ Discharge Hoses, 3″		9.00		9.90	7.68	8.45
12 L.H., Daily Totals		$741.75		$1069.57	$61.81	$89.13

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10K	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Centr. Water Pump, 6″		235.25		258.77		
1 -20′ Suction Hose, 6″		25.50		28.05		
2 -50′ Discharge Hoses, 6″		36.20		39.82	24.75	27.22
12 L.H., Daily Totals		$946.55		$1294.85	$78.88	$107.90

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10L	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 80 H.P.		405.85		446.44	33.82	37.20
12 L.H., Daily Totals		$1055.45		$1414.64	$87.95	$117.89

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10M	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 300 H.P.		1785.00		1963.50	148.75	163.63
12 L.H., Daily Totals		$2434.60		$2931.70	$202.88	$244.31

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10N	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, T.M., 1.5 C.Y.		572.00		629.20	47.67	52.43
12 L.H., Daily Totals		$1221.60		$1597.40	$101.80	$133.12

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10O	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, T.M., 2.25 C.Y.		925.50		1018.05	77.13	84.84
12 L.H., Daily Totals		$1575.10		$1986.25	$131.26	$165.52

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10P	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Crawler Loader, 3 C.Y.		1146.00		1260.60	95.50	105.05
12 L.H., Daily Totals		$1795.60		$2228.80	$149.63	$185.73

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10Q	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Crawler Loader, 4 C.Y.		1456.00		1601.60	121.33	133.47
12 L.H., Daily Totals		$2105.60		$2569.80	$175.47	$214.15

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10R	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, W.M., 1 C.Y.		305.60		336.16	25.47	28.01
12 L.H., Daily Totals		$955.20		$1304.36	$79.60	$108.70

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10S	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, W.M., 1.5 C.Y.		441.40		485.54	36.78	40.46
12 L.H., Daily Totals		$1091.00		$1453.74	$90.92	$121.15

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-10T	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, W.M., 2.5 C.Y.		638.30		702.13	53.19	58.51
12 L.H., Daily Totals		$1287.90		$1670.33	$107.33	$139.19

Crews - Standard

Crew B-10U	Bare Costs Hr.	Bare Costs Daily	Incl. Subs O&P Hr.	Incl. Subs O&P Daily	Cost Per Labor-Hour Bare Costs	Cost Per Labor-Hour Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, W.M., 5.5 C.Y.		967.95		1064.74	80.66	88.73
12 L.H., Daily Totals		$1617.55		$2032.94	$134.80	$169.41

Crew B-10V	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 700 H.P.		5175.00		5692.50	431.25	474.38
12 L.H., Daily Totals		$5824.60		$6660.70	$485.38	$555.06

Crew B-10W	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 105 H.P.		640.80		704.88	53.40	58.74
12 L.H., Daily Totals		$1290.40		$1673.08	$107.53	$139.42

Crew B-10X	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 410 H.P.		2807.00		3087.70	233.92	257.31
12 L.H., Daily Totals		$3456.60		$4055.90	$288.05	$337.99

Crew B-10Y	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Vibr. Roller, Towed, 12 Ton		584.80		643.28	48.73	53.61
12 L.H., Daily Totals		$1234.40		$1611.48	$102.87	$134.29

Crew B-11A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Dozer, 200 H.P.		1520.00		1672.00	95.00	104.50
16 L.H., Daily Totals		$2347.20		$2905.20	$146.70	$181.57

Crew B-11B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Oper. (light)	$55.50	$444.00	$82.70	$661.60	$49.95	$74.47
1 Laborer	44.40	355.20	66.25	530.00		
1 Air Powered Tamper		39.75		43.73		
1 Air Compressor, 365 cfm		343.55		377.90		
2 -50' Air Hoses, 1.5"		45.60		50.16	26.81	29.49
16 L.H., Daily Totals		$1228.10		$1663.39	$76.76	$103.96

Crew B-11C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Backhoe Loader, 48 H.P.		216.20		237.82	13.51	14.86
16 L.H., Daily Totals		$1043.40		$1471.02	$65.21	$91.94

Crew B-11J	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Ripper, Beam & 1 Shank		91.60		100.76	72.79	80.07
16 L.H., Daily Totals		$1991.80		$2514.26	$124.49	$157.14

Crew B-11K	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Trencher, Chain Type, 8' D		1894.00		2083.40	118.38	130.21
16 L.H., Daily Totals		$2721.20		$3316.60	$170.07	$207.29

Crew B-11L	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Grader, 30,000 Lbs.		1073.00		1180.30	67.06	73.77
16 L.H., Daily Totals		$1900.20		$2413.50	$118.76	$150.84

Crew B-11M	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Backhoe Loader, 80 H.P.		235.05		258.56	14.69	16.16
16 L.H., Daily Totals		$1062.25		$1491.76	$66.39	$93.23

Crew B-11N	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.47	$78.36
2 Equipment Operators (med.)	59.00	944.00	87.90	1406.40		
6 Truck Drivers (heavy)	51.30	2462.40	76.70	3681.60		
1 F.E. Loader, W.M., 5.5 C.Y.		967.95		1064.74		
1 Dozer, 410 H.P.		2807.00		3087.70		
6 Dump Trucks, Off Hwy., 50 Ton		11874.00		13061.40	217.35	239.08
72 L.H., Daily Totals		$19426.55		$22855.85	$269.81	$317.44

Crew B-11Q	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 140 H.P.		729.15		802.07	60.76	66.84
12 L.H., Daily Totals		$1378.75		$1770.27	$114.90	$147.52

Crew B-11R	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 200 H.P.		1520.00		1672.00	126.67	139.33
12 L.H., Daily Totals		$2169.60		$2640.20	$180.80	$220.02

Crew B-11S	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 300 H.P.		1785.00		1963.50		
1 Ripper, Beam & 1 Shank		91.60		100.76	156.38	172.02
12 L.H., Daily Totals		$2526.20		$3032.46	$210.52	$252.71

Crew B-11T	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 410 H.P.		2807.00		3087.70		
1 Ripper, Beam & 2 Shanks		140.40		154.44	245.62	270.18
12 L.H., Daily Totals		$3597.00		$4210.34	$299.75	$350.86

Crew B-11U	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 Dozer, 520 H.P.		3434.00		3777.40	286.17	314.78
12 L.H., Daily Totals		$4083.60		$4745.60	$340.30	$395.47

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	

Crew B-11V	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$44.40	$66.25
1 Roller, 2-Drum, W.B., 7.5 H.P.		166.75		183.43	6.95	7.64
24 L.H., Daily Totals		$1232.35		$1773.43	$51.35	$73.89

Crew B-11W	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$51.37	$76.76
1 Common Laborer	44.40	355.20	66.25	530.00		
10 Truck Drivers (heavy)	51.30	4104.00	76.70	6136.00		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Vibratory Roller, Towed, 23 Ton		520.35		572.38		
10 Dump Trucks, 8 C.Y., 220 H.P.		4076.00		4483.60	63.71	70.08
96 L.H., Daily Totals		$11047.55		$14097.18	$115.08	$146.85

Crew B-11Y	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.49	$73.80
5 Common Laborers	44.40	1776.00	66.25	2650.00		
3 Equipment Operators (med.)	59.00	1416.00	87.90	2109.60		
1 Dozer, 80 H.P.		405.85		446.44		
2 Rollers, 2-Drum, W.B., 7.5 H.P.		333.50		366.85		
4 Vibrating Plates, Gas, 21″		662.40		728.64	19.47	21.42
72 L.H., Daily Totals		$4964.95		$6855.52	$68.96	$95.22

Crew B-12A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 1 C.Y.		832.65		915.91	52.04	57.24
16 L.H., Daily Totals		$1679.45		$2178.32	$104.97	$136.14

Crew B-12B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38	43.49	47.84
16 L.H., Daily Totals		$1542.60		$2027.78	$96.41	$126.74

Crew B-12C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 2 C.Y.		942.70		1036.97	58.92	64.81
16 L.H., Daily Totals		$1789.50		$2299.37	$111.84	$143.71

Crew B-12D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 3.5 C.Y.		2184.00		2402.40	136.50	150.15
16 L.H., Daily Totals		$3030.80		$3664.80	$189.43	$229.05

Crew B-12E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, .5 C.Y.		457.00		502.70	28.56	31.42
16 L.H., Daily Totals		$1303.80		$1765.10	$81.49	$110.32

Crew B-12F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98	43.86	48.25
16 L.H., Daily Totals		$1548.60		$2034.38	$96.79	$127.15

Crew B-12G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 15 Ton		810.30		891.33		
1 Clamshell Bucket, .5 C.Y.		67.80		74.58	54.88	60.37
16 L.H., Daily Totals		$1724.90		$2228.31	$107.81	$139.27

Crew B-12H	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 25 Ton		1152.00		1267.20		
1 Clamshell Bucket, 1 C.Y.		69.25		76.17	76.33	83.96
16 L.H., Daily Totals		$2068.05		$2605.78	$129.25	$162.86

Crew B-12I	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 20 Ton		1013.00		1114.30		
1 Dragline Bucket, .75 C.Y.		61.85		68.03	67.18	73.90
16 L.H., Daily Totals		$1921.65		$2444.74	$120.10	$152.80

Crew B-12J	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Gradall, 5/8 C.Y.		850.65		935.72	53.17	58.48
16 L.H., Daily Totals		$1697.45		$2198.11	$106.09	$137.38

Crew B-12K	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Gradall, 3 Ton, 1 C.Y.		984.55		1083.01	61.53	67.69
16 L.H., Daily Totals		$1831.35		$2345.41	$114.46	$146.59

Crew B-12L	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 15 Ton		810.30		891.33		
1 F.E. Attachment, .5 C.Y.		66.05		72.66	54.77	60.25
16 L.H., Daily Totals		$1723.15		$2226.39	$107.70	$139.15

Crew B-12M	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 20 Ton		1013.00		1114.30		
1 F.E. Attachment, .75 C.Y.		71.25		78.38	67.77	74.54
16 L.H., Daily Totals		$1931.05		$2455.07	$120.69	$153.44

Crew B-12N	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 25 Ton		1152.00		1267.20		
1 F.E. Attachment, 1 C.Y.		77.35		85.08	76.83	84.52
16 L.H., Daily Totals		$2076.15		$2614.68	$129.76	$163.42

Crew B-12O	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 F.E. Attachment, 1.5 C.Y.		88.65		97.52	82.48	90.73
16 L.H., Daily Totals		$2166.45		$2714.01	$135.40	$169.63

Crew B-12P	Bare Costs Hr.	Bare Costs Daily	Incl. Subs O&P Hr.	Incl. Subs O&P Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Dragline Bucket, 1.5 C.Y.		65.70		72.27	81.04	89.15
16 L.H., Daily Totals		$2143.50		$2688.77	$133.97	$168.05

Crew B-12Q	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 5/8 C.Y.		604.75		665.23	37.80	41.58
16 L.H., Daily Totals		$1451.55		$1927.63	$90.72	$120.48

Crew B-12S	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70	97.94	107.73
16 L.H., Daily Totals		$2413.80		$2986.10	$150.86	$186.63

Crew B-12T	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 F.E. Attachment, 3 C.Y.		115.55		127.11	130.16	143.18
16 L.H., Daily Totals		$2929.35		$3553.20	$183.08	$222.08

Crew B-12V	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$52.92	$78.90
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 Dragline Bucket, 3 C.Y.		72.30		79.53	127.46	140.20
16 L.H., Daily Totals		$2886.10		$3505.63	$180.38	$219.10

Crew B-12Y	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$50.08	$74.68
2 Laborers	44.40	710.40	66.25	1060.00		
1 Hyd. Excavator, 3.5 C.Y.		2184.00		2402.40	91.00	100.10
24 L.H., Daily Totals		$3386.00		$4194.80	$141.08	$174.78

Crew B-12Z	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$50.08	$74.68
2 Laborers	44.40	710.40	66.25	1060.00		
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70	65.29	71.82
24 L.H., Daily Totals		$2769.00		$3516.10	$115.38	$146.50

Crew B-13	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 25 Ton		586.70		645.37	10.48	11.52
56 L.H., Daily Totals		$3290.30		$4677.77	$58.76	$83.53

Crew B-13A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.83	$75.85
2 Laborers	44.40	710.40	66.25	1060.00		
2 Equipment Operators (med.)	59.00	944.00	87.90	1406.40		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 Crawler Loader, 4 C.Y.		1456.00		1601.60		
2 Dump Trucks, 8 C.Y., 220 H.P.		815.20		896.72	75.68	83.25
56 L.H., Daily Totals		$7084.60		$8909.62	$126.51	$159.10

Crew B-13B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 55 Ton		990.15		1089.17	17.68	19.45
56 L.H., Daily Totals		$3693.75		$5121.56	$65.96	$91.46

Crew B-13C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 100 Ton		2310.00		2541.00	41.25	45.38
56 L.H., Daily Totals		$5013.60		$6573.40	$89.53	$117.38

Crew B-13D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, 1 C.Y.		832.65		915.91		
1 Trench Box		119.15		131.07	59.49	65.44
16 L.H., Daily Totals		$1798.60		$2309.38	$112.41	$144.34

Crew B-13E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38		
1 Trench Box		119.15		131.07	50.93	56.03
16 L.H., Daily Totals		$1661.75		$2158.84	$103.86	$134.93

Crew B-13F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, 3.5 C.Y.		2184.00		2402.40		
1 Trench Box		119.15		131.07	143.95	158.34
16 L.H., Daily Totals		$3149.95		$3795.86	$196.87	$237.24

Crew B-13G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98		
1 Trench Box		119.15		131.07	51.31	56.44
16 L.H., Daily Totals		$1667.75		$2165.45	$104.23	$135.34

Crew B-13H	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Gradall, 5/8 C.Y.		850.65		935.72		
1 Trench Box		119.15		131.07	60.61	66.67
16 L.H., Daily Totals		$1816.60		$2329.18	$113.54	$145.57

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-13I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Gradall, 3 Ton, 1 C.Y.		984.55		1083.01		
1 Trench Box		119.15		131.07	68.98	75.88
16 L.H., Daily Totals		$1950.50		$2476.47	$121.91	$154.78

Crew B-13J	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$52.92	$78.90
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70		
1 Trench Box		119.15		131.07	105.38	115.92
16 L.H., Daily Totals		$2532.95		$3117.17	$158.31	$194.82

Crew B-13K	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Equip. Opers. (crane)	$61.45	$983.20	$91.55	$1464.80	$61.45	$91.55
1 Hyd. Excavator, .75 C.Y.		701.80		771.98		
1 Hyd. Hammer, 4000 ft-lb		649.20		714.12		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98	128.30	141.13
16 L.H., Daily Totals		$3036.00		$3722.88	$189.75	$232.68

Crew B-13L	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Equip. Opers. (crane)	$61.45	$983.20	$91.55	$1464.80	$61.45	$91.55
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38		
1 Hyd. Hammer, 5000 ft-lb		705.60		776.16		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98	131.45	144.60
16 L.H., Daily Totals		$3086.40		$3778.32	$192.90	$236.15

Crew B-13M	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Equip. Opers. (crane)	$61.45	$983.20	$91.55	$1464.80	$61.45	$91.55
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70		
1 Hyd. Hammer, 8000 ft-lb		918.65		1010.52		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38	198.84	218.72
16 L.H., Daily Totals		$4164.65		$4964.40	$260.29	$310.27

Crew B-13N	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Equip. Opers. (crane)	$61.45	$983.20	$91.55	$1464.80	$61.45	$91.55
1 Hyd. Excavator, 3.5 C.Y.		2184.00		2402.40		
1 Hyd. Hammer, 12,000 ft-lb		882.20		970.42		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38	235.13	258.64
16 L.H., Daily Totals		$4745.20		$5603.00	$296.57	$350.19

Crew B-14	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82	4.50	4.95
48 L.H., Daily Totals		$2452.20		$3573.42	$51.09	$74.45

Crew B-14A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Excavator, 4.5 C.Y.		3450.00		3795.00	287.50	316.25
12 L.H., Daily Totals		$4119.20		$4792.40	$343.27	$399.37

Crew B-14B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Excavator, 6 C.Y.		3506.00		3856.60	292.17	321.38
12 L.H., Daily Totals		$4175.20		$4854.00	$347.93	$404.50

Crew B-14C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Excavator, 7 C.Y.		3475.00		3822.50	289.58	318.54
12 L.H., Daily Totals		$4144.20		$4819.90	$345.35	$401.66

Crew B-14F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Shovel, 7 C.Y.		4148.00		4562.80	345.67	380.23
12 L.H., Daily Totals		$4817.20		$5560.20	$401.43	$463.35

Crew B-14G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (crane)	$61.45	$491.60	$91.55	$732.40	$55.77	$83.12
.5 Laborer	44.40	177.60	66.25	265.00		
1 Hyd. Shovel, 12 C.Y.		6022.00		6624.20	501.83	552.02
12 L.H., Daily Totals		$6691.20		$7621.60	$557.60	$635.13

Crew B-14J	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, 8 C.Y.		2285.00		2513.50	190.42	209.46
12 L.H., Daily Totals		$2934.60		$3481.70	$244.55	$290.14

Crew B-14K	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.13	$80.68
.5 Laborer	44.40	177.60	66.25	265.00		
1 F.E. Loader, 10 C.Y.		2706.00		2976.60	225.50	248.05
12 L.H., Daily Totals		$3355.60		$3944.80	$279.63	$328.73

Crew B-15	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Oper. (med.)	$59.00	$472.00	$87.90	$703.20	$52.51	$78.41
.5 Laborer	44.40	177.60	66.25	265.00		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57		
1 Dozer, 200 H.P.		1520.00		1672.00	95.67	105.23
28 L.H., Daily Totals		$4149.10		$5141.97	$148.18	$183.64

Crew B-16	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.63	$69.61
2 Laborers	44.40	710.40	66.25	1060.00		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	18.10	19.92
32 L.H., Daily Totals		$2071.35		$2864.89	$64.73	$89.53

Crew B-17	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.90	$72.97
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82		
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36	19.49	21.44
32 L.H., Daily Totals		$2188.60		$3021.38	$68.39	$94.42

Crew B-17A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$47.54	$71.08
6 Laborers	44.40	2131.20	66.25	3180.00		
1 Skilled Worker Foreman (out)	59.10	472.80	88.90	711.20		
1 Skilled Worker	57.10	456.80	85.90	687.20		
80 L.H., Daily Totals		$3803.20		$5686.40	$47.54	$71.08

Crew B-17B	Bare Costs Hr.	Bare Costs Daily	Incl. Subs O&P Hr.	Incl. Subs O&P Daily	Cost Per Labor-Hour Bare Costs	Cost Per Labor-Hour Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.90	$72.97
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82		
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	24.86	27.35
32 L.H., Daily Totals		$2360.35		$3210.30	$73.76	$100.32

Crew B-18	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Laborers	44.40	710.40	66.25	1060.00		
1 Vibrating Plate, Gas, 21″		165.60		182.16	6.90	7.59
24 L.H., Daily Totals		$1247.20		$1796.16	$51.97	$74.84

Crew B-19	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 90' High		371.85		409.04		
1 Hammer, Diesel, 22k ft-lb		441.70		485.87	31.95	35.14
64 L.H., Daily Totals		$5699.75		$7820.60	$89.06	$122.20

Crew B-19A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 Lead, 90' High		371.85		409.04		
1 Hammer, Diesel, 41k ft-lb		583.55		641.90	45.66	50.23
64 L.H., Daily Totals		$6577.60		$8786.24	$102.78	$137.29

Crew B-19B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 90' High		371.85		409.04		
1 Hammer, Diesel, 22k ft-lb		441.70		485.87		
1 Barge, 400 Ton		869.15		956.07	45.53	50.08
64 L.H., Daily Totals		$6568.90		$8776.67	$102.64	$137.14

Crew B-19C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 75 Ton		1967.00		2163.70		
1 Lead, 90' High		371.85		409.04		
1 Hammer, Diesel, 41k ft-lb		583.55		641.90		
1 Barge, 400 Ton		869.15		956.07	59.24	65.17
64 L.H., Daily Totals		$7446.75		$9742.31	$116.36	$152.22

Crew B-20	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.30	$73.80
1 Skilled Worker	57.10	456.80	85.90	687.20		
1 Laborer	44.40	355.20	66.25	530.00		
24 L.H., Daily Totals		$1183.20		$1771.20	$49.30	$73.80

Crew B-20A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.16	$79.34
1 Laborer	44.40	355.20	66.25	530.00		
1 Plumber	67.70	541.60	101.05	808.40		
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
32 L.H., Daily Totals		$1701.20		$2538.80	$53.16	$79.34

Crew B-21	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.04	$76.34
1 Skilled Worker	57.10	456.80	85.90	687.20		
1 Laborer	44.40	355.20	66.25	530.00		
.5 Equip. Oper. (crane)	61.45	245.80	91.55	366.20		
.5 S.P. Crane, 4x4, 5 Ton		190.97		210.07	6.82	7.50
28 L.H., Daily Totals		$1619.97		$2347.47	$57.86	$83.84

Crew B-21A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$54.82	$81.78
1 Laborer	44.40	355.20	66.25	530.00		
1 Plumber	67.70	541.60	101.05	808.40		
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 12 Ton		432.65		475.92	10.82	11.90
40 L.H., Daily Totals		$2625.45		$3747.11	$65.64	$93.68

Crew B-21B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.21	$71.91
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	11.90	13.08
40 L.H., Daily Totals		$2404.20		$3399.78	$60.10	$84.99

Crew B-21C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Cutting Torches		25.90		28.49		
2 Sets of Gases		347.20		381.92		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30	37.25	40.98
56 L.H., Daily Totals		$4789.70		$6327.11	$85.53	$112.98

Crew B-22	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.73	$77.35
1 Skilled Worker	57.10	456.80	85.90	687.20		
1 Laborer	44.40	355.20	66.25	530.00		
.75 Equip. Oper. (crane)	61.45	368.70	91.55	549.30		
.75 S.P. Crane, 4x4, 5 Ton		286.46		315.11	9.55	10.50
30 L.H., Daily Totals		$1838.36		$2635.61	$61.28	$87.85

Crew B-22A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.75	$75.84
1 Skilled Worker	57.10	456.80	85.90	687.20		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equipment Operator, Crane	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 5 Ton		381.95		420.14		
1 Butt Fusion Mach., 4″-12″ diam.		420.75		462.82	20.07	22.07
40 L.H., Daily Totals		$2832.70		$3916.57	$70.82	$97.91

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-22B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.75	$75.84
1 Skilled Worker	57.10	456.80	85.90	687.20		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 5 Ton		381.95		420.14		
1 Butt Fusion Mach., 8"-24" diam.		1086.00		1194.60	36.70	40.37
40 L.H., Daily Totals		$3497.95		$4648.35	$87.45	$116.21
Crew B-22C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Skilled Worker	$57.10	$456.80	$85.90	$687.20	$50.75	$76.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Butt Fusion Mach., 2"-8" diam.		134.95		148.44	8.43	9.28
16 L.H., Daily Totals		$946.95		$1365.65	$59.18	$85.35
Crew B-23	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.80	$66.85
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Drill Rig, Truck-Mounted		768.40		845.24		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	40.46	44.51
40 L.H., Daily Totals		$3410.45		$4454.30	$85.26	$111.36
Crew B-23A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.93	$74.47
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Drill Rig, Truck-Mounted		768.40		845.24		
1 Pickup Truck, 3/4 Ton		112.20		123.42	36.69	40.36
24 L.H., Daily Totals		$2079.00		$2755.86	$86.63	$114.83
Crew B-23B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.93	$74.47
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Drill Rig, Truck-Mounted		768.40		845.24		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
1 Centr. Water Pump, 6"		235.25		258.77	46.49	51.14
24 L.H., Daily Totals		$2314.25		$3014.64	$96.43	$125.61
Crew B-24	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$50.30	$74.60
1 Laborer	44.40	355.20	66.25	530.00		
1 Carpenter	54.70	437.60	81.65	653.20		
24 L.H., Daily Totals		$1207.20		$1790.40	$50.30	$74.60
Crew B-25	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.56	$72.43
7 Laborers	44.40	2486.40	66.25	3710.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	31.13	34.25
88 L.H., Daily Totals		$7013.30		$9387.27	$79.70	$106.67
Crew B-25B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.43	$73.72
7 Laborers	44.40	2486.40	66.25	3710.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
2 Tandem Rollers, 10 Ton		493.60		542.96		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	31.11	34.22
96 L.H., Daily Totals		$7732.10		$10361.95	$80.54	$107.94

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-25C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.60	$73.97
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
1 Tandem Roller, 10 Ton		246.80		271.48	49.79	54.77
48 L.H., Daily Totals		$4770.60		$6179.18	$99.39	$128.73
Crew B-25D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.82	$74.30
3 Laborers	44.40	1065.60	66.25	1590.00		
2.125 Equip. Oper. (medium)	59.00	1003.00	87.90	1494.30		
.125 Truck Driver (heavy)	51.30	51.30	76.70	76.70		
.125 Truck Tractor, 6x4, 380 H.P.		62.39		68.63		
.125 Dist. Tanker, 3000 Gallon		41.76		45.94		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
1 Tandem Roller, 10 Ton		246.80		271.48	49.88	54.87
50 L.H., Daily Totals		$4985.06		$6458.35	$99.70	$129.17
Crew B-25E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.03	$74.61
3 Laborers	44.40	1065.60	66.25	1590.00		
2.250 Equip. Oper. (medium)	59.00	1062.00	87.90	1582.20		
.25 Truck Driver (heavy)	51.30	102.60	76.70	153.40		
.25 Truck Tractor, 6x4, 380 H.P.		124.79		137.27		
.25 Dist. Tanker, 3000 Gallon		83.53		91.88		
1 Asphalt Paver, 130 H.P.		2143.00		2357.30		
1 Tandem Roller, 10 Ton		246.80		271.48	49.96	54.96
52 L.H., Daily Totals		$5199.51		$6737.52	$99.99	$129.57
Crew B-26	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.23	$73.32
6 Laborers	44.40	2131.20	66.25	3180.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Paving Mach. & Equip.		2503.00		2753.30	40.64	44.70
88 L.H., Daily Totals		$7908.00		$10385.60	$89.86	$118.02
Crew B-26A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.23	$73.32
6 Laborers	44.40	2131.20	66.25	3180.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Paving Mach. & Equip.		2503.00		2753.30		
1 Concrete Saw		112.85		124.14	41.92	46.11
88 L.H., Daily Totals		$8020.85		$10509.74	$91.15	$119.43
Crew B-26B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.04	$74.53
6 Laborers	44.40	2131.20	66.25	3180.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Paving Mach. & Equip.		2503.00		2753.30		
1 Concrete Pump, 110' Boom		493.65		543.01	42.39	46.63
96 L.H., Daily Totals		$8873.65		$11631.82	$92.43	$121.16

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-26C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.25	$71.86
6 Laborers	44.40	2131.20	66.25	3180.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Paving Mach. & Equip.		2503.00		2753.30		
1 Concrete Saw		112.85		124.14	32.70	35.97
80 L.H., Daily Totals		$6475.85		$8626.24	$80.95	$107.83
Crew B-27	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.90	$67.00
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Berm Machine		253.55		278.90	7.92	8.72
32 L.H., Daily Totals		$1690.35		$2422.91	$52.82	$75.72
Crew B-28	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$51.27	$76.52
1 Laborer	44.40	355.20	66.25	530.00		
24 L.H., Daily Totals		$1230.40		$1836.40	$51.27	$76.52
Crew B-29	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.28	$72.01
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Gradall, 5/8 C.Y.		850.65		935.72	15.19	16.71
56 L.H., Daily Totals		$3554.25		$4968.11	$63.47	$88.72
Crew B-30	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$53.87	$80.43
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Hyd. Excavator, 1.5 C.Y.		695.80		765.38		
2 Dump Trucks, 12 C.Y., 400 H.P.		1158.70		1274.57	77.27	85.00
24 L.H., Daily Totals		$3147.30		$3970.35	$131.14	$165.43
Crew B-31	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.86	$69.93
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Carpenter	54.70	437.60	81.65	653.20		
1 Air Compressor, 250 cfm		202.85		223.13		
1 Sheeting Driver		7.45		8.20		
2 -50' Air Hoses, 1.5"		45.60		50.16	6.40	7.04
40 L.H., Daily Totals		$2130.30		$3078.69	$53.26	$76.97
Crew B-32	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$55.35	$82.49
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Dozer, 200 H.P.		1520.00		1672.00	88.74	97.62
32 L.H., Daily Totals		$4611.00		$5763.38	$144.09	$180.11
Crew B-32A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$54.13	$80.68
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Roller, Vibratory, 25 Ton		672.35		739.59	72.72	80.00
24 L.H., Daily Totals		$3044.55		$3856.28	$126.86	$160.68

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-32B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$54.13	$80.68
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Roller, Vibratory, 25 Ton		672.35		739.59	91.35	100.48
24 L.H., Daily Totals		$3491.55		$4347.98	$145.48	$181.17
Crew B-32C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.03	$77.58
2 Laborers	44.40	710.40	66.25	1060.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Dozer, 200 H.P.		1520.00		1672.00	59.16	65.08
48 L.H., Daily Totals		$5337.40		$6847.38	$111.20	$142.65
Crew B-33A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Scraper, Towed, 7 C.Y.		129.30		142.23		
1.25 Dozers, 300 H.P.		2231.25		2454.38	168.61	185.47
14 L.H., Daily Totals		$3128.15		$3740.61	$223.44	$267.19
Crew B-33B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Scraper, Towed, 10 C.Y.		161.65		177.82		
1.25 Dozers, 300 H.P.		2231.25		2454.38	170.92	188.01
14 L.H., Daily Totals		$3160.50		$3776.19	$225.75	$269.73
Crew B-33C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Scraper, Towed, 15 C.Y.		178.85		196.74		
1.25 Dozers, 300 H.P.		2231.25		2454.38	172.15	189.37
14 L.H., Daily Totals		$3177.70		$3795.11	$226.98	$271.08
Crew B-33D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 S.P. Scraper, 14 C.Y.		2424.00		2666.40		
.25 Dozer, 300 H.P.		446.25		490.88	205.02	225.52
14 L.H., Daily Totals		$3637.85		$4301.27	$259.85	$307.23
Crew B-33E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 S.P. Scraper, 21 C.Y.		2656.00		2921.60		
.25 Dozer, 300 H.P.		446.25		490.88	221.59	243.75
14 L.H., Daily Totals		$3869.85		$4556.48	$276.42	$325.46

Crew B-33F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Elev. Scraper, 11 C.Y.		1059.00		1164.90		
.25 Dozer, 300 H.P.		446.25		490.88	107.52	118.27
14 L.H., Daily Totals		$2272.85		$2799.78	$162.35	$199.98

Crew B-33G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.5 Laborer	44.40	177.60	66.25	265.00		
.25 Equip. Oper. (medium)	59.00	118.00	87.90	175.80		
1 Elev. Scraper, 22 C.Y.		1895.00		2084.50		
.25 Dozer, 300 H.P.		446.25		490.88	167.23	183.96
14 L.H., Daily Totals		$3108.85		$3719.38	$222.06	$265.67

Crew B-33H	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.5 Laborer	$44.40	$177.60	$66.25	$265.00	$54.83	$81.71
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
.25 Equipment Operator (med.)	59.00	118.00	87.90	175.80		
1 S.P. Scraper, 44 C.Y.		4695.00		5164.50		
.25 Dozer, 410 H.P.		701.75		771.92	385.48	424.03
14 L.H., Daily Totals		$6164.35		$7080.43	$440.31	$505.74

Crew B-33J	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 S.P. Scraper, 14 C.Y.		2424.00		2666.40	303.00	333.30
8 L.H., Daily Totals		$2896.00		$3369.60	$362.00	$421.20

Crew B-33K	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equipment Operator (med.)	$59.00	$472.00	$87.90	$703.20	$54.83	$81.71
.25 Equipment Operator (med.)	59.00	118.00	87.90	175.80		
.5 Laborer	44.40	177.60	66.25	265.00		
1 S.P. Scraper, 31 C.Y.		3707.00		4077.70		
.25 Dozer, 410 H.P.		701.75		771.92	314.91	346.40
14 L.H., Daily Totals		$5176.35		$5993.63	$369.74	$428.12

Crew B-34A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36	50.95	56.05
8 L.H., Daily Totals		$818.00		$1061.96	$102.25	$132.75

Crew B-34B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, 12 C.Y., 400 H.P.		579.35		637.28	72.42	79.66
8 L.H., Daily Totals		$989.75		$1250.89	$123.72	$156.36

Crew B-34C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Dump Trailer, 16.5 C.Y.		138.35		152.19	79.69	87.66
8 L.H., Daily Totals		$1047.90		$1314.85	$130.99	$164.36

Crew B-34D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Dump Trailer, 20 C.Y.		153.55		168.91	81.59	89.75
8 L.H., Daily Totals		$1063.10		$1331.57	$132.89	$166.45

Crew B-34E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 25 Ton		1427.00		1569.70	178.38	196.21
8 L.H., Daily Totals		$1837.40		$2183.30	$229.68	$272.91

Crew B-34F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 35 Ton		945.65		1040.21	118.21	130.03
8 L.H., Daily Totals		$1356.05		$1653.82	$169.51	$206.73

Crew B-34G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 50 Ton		1979.00		2176.90	247.38	272.11
8 L.H., Daily Totals		$2389.40		$2790.50	$298.68	$348.81

Crew B-34H	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 65 Ton		1938.00		2131.80	242.25	266.48
8 L.H., Daily Totals		$2348.40		$2745.40	$293.55	$343.18

Crew B-34I	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, 18 C.Y., 450 H.P.		753.60		828.96	94.20	103.62
8 L.H., Daily Totals		$1164.00		$1442.56	$145.50	$180.32

Crew B-34J	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Dump Truck, Off Hwy., 100 Ton		2769.00		3045.90	346.13	380.74
8 L.H., Daily Totals		$3179.40		$3659.50	$397.43	$457.44

Crew B-34K	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Lowbed Trailer, 75 Ton		258.10		283.91	108.38	119.22
8 L.H., Daily Totals		$1277.45		$1567.36	$159.68	$195.92

Crew B-34L	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	24.81	27.29
8 L.H., Daily Totals		$642.50		$879.95	$80.31	$109.99

Crew B-34M	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	106.26	116.88
8 L.H., Daily Totals		$1294.05		$1596.66	$161.76	$199.58

Crew B-34N	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$55.15	$82.30
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Flatbed Trailer, 40 Ton		188.45		207.29	42.98	47.27
16 L.H., Daily Totals		$1570.00		$2073.16	$98.13	$129.57

Crew B-34P	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Pipe Fitter	$68.35	$546.80	$102.00	$816.00	$58.72	$87.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Backhoe Loader, 48 H.P.		216.20		237.82	44.43	48.87
24 L.H., Daily Totals		$2475.45		$3276.07	$103.14	$136.50

Crew B-34Q	Bare Costs Hr.	Bare Costs Daily	Incl. Subs O&P Hr.	Incl. Subs O&P Daily	Cost Per Labor-Hour Bare Costs	Cost Per Labor-Hour Incl. O&P
1 Pipe Fitter	$68.35	$546.80	$102.00	$816.00	$59.53	$88.85
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36		
1 Hyd. Crane, 25 Ton		586.70		645.37	47.15	51.86
24 L.H., Daily Totals		$2560.30		$3377.05	$106.68	$140.71

Crew B-34R	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Pipe Fitter	$68.35	$546.80	$102.00	$816.00	$59.53	$88.85
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Dump Truck, 8 C.Y., 220 H.P.		407.60		448.36		
1 Hyd. Crane, 25 Ton		586.70		645.37		
1 Hyd. Excavator, 1 C.Y.		832.65		915.91	81.84	90.02
24 L.H., Daily Totals		$3392.95		$4292.97	$141.37	$178.87

Crew B-34S	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Pipe Fitters	$68.35	$1093.60	$102.00	$1632.00	$62.36	$93.06
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Flatbed Trailer, 40 Ton		188.45		207.29		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Hyd. Crane, 80 Ton		1458.00		1603.80		
1 Hyd. Excavator, 2 C.Y.		942.70		1036.97	96.51	106.16
32 L.H., Daily Totals		$5083.90		$6375.13	$158.87	$199.22

Crew B-34T	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Pipe Fitters	$68.35	$1093.60	$102.00	$1632.00	$62.36	$93.06
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Flatbed Trailer, 40 Ton		188.45		207.29		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	67.05	73.75
32 L.H., Daily Totals		$4141.20		$5338.16	$129.41	$166.82

Crew B-34U	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$53.40	$79.70
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Truck Tractor, 220 H.P.		310.80		341.88		
1 Flatbed Trailer, 25 Ton		137.20		150.92	28.00	30.80
16 L.H., Daily Totals		$1302.40		$1768.00	$81.40	$110.50

Crew B-34V	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$56.08	$83.65
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Equipment Trailer, 50 Ton		207.25		227.97		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43	41.37	45.51
24 L.H., Daily Totals		$2338.95		$3099.84	$97.46	$129.16

Crew B-34W	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
5 Truck Drivers (heavy)	$51.30	$2052.00	$76.70	$3068.00	$53.92	$80.50
2 Equip. Opers. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (mechanic)	61.50	492.00	91.65	733.20		
1 Laborer	44.40	355.20	66.25	530.00		
4 Truck Tractors, 6x4, 380 H.P.		1996.60		2196.26		
2 Equipment Trailers, 50 Ton		414.50		455.95		
2 Flatbed Trailers, 40 Ton		376.90		414.59		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 S.P. Crane, 4x4, 20 Ton		574.35		631.78	49.15	54.07
72 L.H., Daily Totals		$7421.50		$9689.01	$103.08	$134.57

Crew B-35	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$56.75	$84.76
1 Skilled Worker	57.10	456.80	85.90	687.20		
2 Welders	67.70	1083.20	101.05	1616.80		
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Welder, Electric, 300 amp		215.10		236.61		
1 Hyd. Excavator, .75 C.Y.		701.80		771.98	16.37	18.01
56 L.H., Daily Totals		$4094.90		$5754.99	$73.12	$102.77

Crew B-35A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.42	$79.79
2 Laborers	44.40	710.40	66.25	1060.00		
1 Skilled Worker	57.10	456.80	85.90	687.20		
1 Welder (plumber)	67.70	541.60	101.05	808.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Crawler Crane, 75 Ton		1967.00		2163.70	37.78	41.56
56 L.H., Daily Totals		$5107.35		$6795.32	$91.20	$121.35

Crew B-36	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.64	$75.51
2 Laborers	44.40	710.40	66.25	1060.00		
2 Equip. Oper. (medium)	59.00	944.00	87.90	1406.40		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Aggregate Spreader		59.95		65.94		
1 Tandem Roller, 10 Ton		246.80		271.48	45.67	50.24
40 L.H., Daily Totals		$3852.35		$5029.82	$96.31	$125.75

Crew B-36A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.03	$79.05
2 Laborers	44.40	710.40	66.25	1060.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Aggregate Spreader		59.95		65.94		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	38.87	42.76
56 L.H., Daily Totals		$5146.25		$6821.11	$91.90	$121.81

Crews - Standard

Crew B-36B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.81	$78.76
2 Laborers	44.40	710.40	66.25	1060.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 F.E. Loader, Crl, 1.5 C.Y.		668.35		735.18		
1 Dozer, 300 H.P.		1785.00		1963.50		
1 Roller, Vibratory, 25 Ton		672.35		739.59		
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51	77.53	85.28
64 L.H., Daily Totals		$8341.75		$10498.33	$130.34	$164.04

Crew B-36C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$54.94	$81.93
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Dozer, 300 H.P.		1785.00		1963.50		
1 Roller, Vibratory, 25 Ton		672.35		739.59		
1 Truck Tractor, 6x4, 450 H.P.		608.95		669.85		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51	107.33	118.07
40 L.H., Daily Totals		$6491.00		$7999.94	$162.28	$200.00

Crew B-36D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$55.85	$83.24
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Dozer, 300 H.P.		1785.00		1963.50		
1 Roller, Vibratory, 25 Ton		672.35		739.59	110.32	121.36
32 L.H., Daily Totals		$5317.55		$6546.98	$166.17	$204.59

Crew B-37	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Tandem Roller, 5 Ton		258.75		284.63	5.39	5.93
48 L.H., Daily Totals		$2494.75		$3620.22	$51.97	$75.42

Crew B-37A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Tar Kettle, T.M.		156.70		172.37	14.80	16.28
24 L.H., Daily Totals		$1456.00		$2034.72	$60.67	$84.78

Crew B-37B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$45.50	$67.94
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Tar Kettle, T.M.		156.70		172.37	11.10	12.21
32 L.H., Daily Totals		$1811.20		$2564.72	$56.60	$80.15

Crew B-37C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$46.60	$69.63
2 Truck Drivers (light)	48.80	780.80	73.00	1168.00		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70		
1 Tar Kettle, T.M.		156.70		172.37	17.30	19.03
32 L.H., Daily Totals		$2044.90		$2837.07	$63.90	$88.66

Crew B-37D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Pickup Truck, 3/4 Ton		112.20		123.42	7.01	7.71
16 L.H., Daily Totals		$857.80		$1237.42	$53.61	$77.34

Crew B-37E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$49.33	$73.62
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Truck Drivers (light)	48.80	780.80	73.00	1168.00		
4 Barrels w/ Flasher		16.60		18.26		
1 Concrete Saw		112.85		124.14		
1 Rotary Hammer Drill		52.25		57.48		
1 Hammer Drill Bit		25.25		27.77		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45		
1 Conc. Hammer Attach.		118.50		130.35		
1 Vibrating Plate, Gas, 18″		31.90		35.09		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70	16.68	18.34
56 L.H., Daily Totals		$3696.25		$5150.03	$66.00	$91.96

Crew B-37F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$45.50	$67.94
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
4 Barrels w/ Flasher		16.60		18.26		
1 Concrete Mixer, 10 C.F.		147.15		161.87		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50′ Air Hose, 3/4″		7.15		7.87		
1 Spade (Chipper)		8.55		9.40		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	16.62	18.28
32 L.H., Daily Totals		$1987.80		$2758.98	$62.12	$86.22

Crew B-37G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Berm Machine		253.55		278.90		
1 Tandem Roller, 5 Ton		258.75		284.63	10.67	11.74
48 L.H., Daily Totals		$2748.30		$3899.13	$57.26	$81.23

Crew B-37H	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Tandem Roller, 5 Ton		258.75		284.63		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Tar Kettle, T.M.		156.70		172.37	12.79	14.07
48 L.H., Daily Totals		$2849.95		$4010.95	$59.37	$83.56

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-37I	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$49.33	$73.62
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Truck Drivers (light)	48.80	780.80	73.00	1168.00		
4 Barrels w/ Flasher		16.60		18.26		
1 Concrete Saw		112.85		124.14		
1 Rotary Hammer Drill		52.25		57.48		
1 Hammer Drill Bit		25.25		27.77		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4"		7.15		7.87		
1 Spade (Chipper)		8.55		9.40		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45		
1 Conc. Hammer Attach.		118.50		130.35		
1 Concrete Mixer, 10 C.F.		147.15		161.87		
1 Vibrating Plate, Gas, 18"		31.90		35.09		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70	22.33	24.56
56 L.H., Daily Totals		$4012.95		$5498.40	$71.66	$98.19

Crew B-37J	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4"		7.15		7.87		
2 Concrete Mixers, 10 C.F.		294.30		323.73		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70		
1 Shot Blaster, 20"		208.70		229.57	22.10	24.31
48 L.H., Daily Totals		$3297.00		$4502.70	$68.69	$93.81

Crew B-37K	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4"		7.15		7.87		
2 Flatbed Trucks, Gas, 1.5 Ton		397.00		436.70		
1 Shot Blaster, 20"		208.70		229.57	15.97	17.57
48 L.H., Daily Totals		$3002.70		$4178.97	$62.56	$87.06

Crew B-38	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.94	$74.47
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Backhoe Loader, 48 H.P.		216.20		237.82		
1 Hyd. Hammer (1200 lb.)		177.25		194.97		
1 F.E. Loader, W.M., 4 C.Y.		759.00		834.90		
1 Pvmt. Rem. Bucket		63.80		70.18	30.41	33.45
40 L.H., Daily Totals		$3213.85		$4316.68	$80.35	$107.92

Crew B-39	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.58	$69.49
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
2 Breakers, Pavement, 60 lb.		107.20		117.92		
2 -50' Air Hoses, 1.5"		45.60		50.16	7.41	8.15
48 L.H., Daily Totals		$2591.65		$3726.82	$53.99	$77.64

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-40	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$57.11	$87.06
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Vibratory Hammer & Gen.		2298.00		2527.80	55.14	60.65
64 L.H., Daily Totals		$7184.20		$9453.50	$112.25	$147.71

Crew B-40B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.92	$72.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 40 Ton		2127.00		2339.70	44.31	48.74
48 L.H., Daily Totals		$4475.40		$5842.10	$93.24	$121.71

Crew B-41	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.91	$68.49
4 Laborers	44.40	1420.80	66.25	2120.00		
.25 Equip. Oper. (crane)	61.45	122.90	91.55	183.10		
.25 Equip. Oper. (oiler)	52.50	105.00	78.25	156.50		
.25 Crawler Crane, 40 Ton		307.75		338.52	6.99	7.69
44 L.H., Daily Totals		$2327.65		$3352.13	$52.90	$76.18

Crew B-42	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.78	$74.67
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Welder	60.30	482.40	93.30	746.40		
1 Hyd. Crane, 25 Ton		586.70		645.37		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Horz. Boring Csg. Mch.		329.75		362.73	16.64	18.31
64 L.H., Daily Totals		$4251.20		$5950.52	$66.43	$92.98

Crew B-43	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.92	$72.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Drill Rig, Truck-Mounted		768.40		845.24	16.01	17.61
48 L.H., Daily Totals		$3116.80		$4347.64	$64.93	$90.58

Crew B-44	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$56.10	$85.56
4 Pile Drivers	55.90	1788.80	86.40	2764.80		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Laborer	44.40	355.20	66.25	530.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 60' High		211.80		232.98		
1 Hammer, Diesel, 15K ft.-lbs.		624.45		686.89	32.30	35.53
64 L.H., Daily Totals		$5657.65		$7749.57	$88.40	$121.09

Crew B-45	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$55.15	$82.30
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Dist. Tanker, 3000 Gallon		334.10		367.51		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07	52.08	57.29
16 L.H., Daily Totals		$1715.65		$2233.38	$107.23	$139.59

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-46	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Pile Driver Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$50.48	$76.84
2 Pile Drivers	55.90	894.40	86.40	1382.40		
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Chain Saw, Gas, 36″ Long		41.65		45.81	.87	.95
48 L.H., Daily Totals		$2464.85		$3734.22	$51.35	$77.80

Crew B-47	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Blast Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.77	$72.73
1 Driller	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Track Drill, 4″		1127.00		1239.70		
1 Air Compressor, 600 cfm		426.55		469.20		
2 -50′ Air Hoses, 3″		76.70		84.37	67.93	74.72
24 L.H., Daily Totals		$2800.65		$3538.88	$116.69	$147.45

Crew B-47A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Drilling Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.45	$79.68
1 Equip. Oper. (heavy)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Air Track Drill, 5″		1127.00		1239.70	46.96	51.65
24 L.H., Daily Totals		$2409.80		$3152.10	$100.41	$131.34

Crew B-47C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.95	$74.47
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 750 cfm		596.30		655.93		
2 -50′ Air Hoses, 3″		76.70		84.37		
1 Air Track Drill, 4″		1127.00		1239.70	112.50	123.75
16 L.H., Daily Totals		$2599.20		$3171.60	$162.45	$198.22

Crew B-47E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.90	$67.00
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	26.56	29.22
32 L.H., Daily Totals		$2286.85		$3079.05	$71.46	$96.22

Crew B-47G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.67	$71.11
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Track Drill, 4″		1127.00		1239.70		
1 Air Compressor, 600 cfm		426.55		469.20		
2 -50′ Air Hoses, 3″		76.70		84.37		
1 Gunite Pump Rig		321.75		353.93	61.00	67.10
32 L.H., Daily Totals		$3477.60		$4422.80	$108.68	$138.21

Crew B-47H	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Skilled Worker Foreman (out)	$59.10	$472.80	$88.90	$711.20	$57.60	$86.65
3 Skilled Workers	57.10	1370.40	85.90	2061.60		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	26.56	29.22
32 L.H., Daily Totals		$2693.25		$3707.86	$84.16	$115.87

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-48	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.86	$74.36
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Centr. Water Pump, 6″		235.25		258.77		
1 -20′ Suction Hose, 6″		25.50		28.05		
1 -50′ Discharge Hose, 6″		18.10		19.91		
1 Drill Rig, Truck-Mounted		768.40		845.24	18.70	20.57
56 L.H., Daily Totals		$3839.65		$5315.98	$68.57	$94.93

Crew B-49	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.25	$78.46
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
2 Equip. Oper. (oilers)	52.50	840.00	78.25	1252.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
2 Pile Drivers	55.90	894.40	86.40	1382.40		
1 Hyd. Crane, 25 Ton		586.70		645.37		
1 Centr. Water Pump, 6″		235.25		258.77		
1 -20′ Suction Hose, 6″		25.50		28.05		
1 -50′ Discharge Hose, 6″		18.10		19.91		
1 Drill Rig, Truck-Mounted		768.40		845.24	18.57	20.42
88 L.H., Daily Totals		$6232.35		$8702.15	$70.82	$98.89

Crew B-50	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Pile Driver Foremen (outside)	$57.90	$926.40	$89.50	$1432.00	$54.27	$82.68
6 Pile Drivers	55.90	2683.20	86.40	4147.20		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 60′ High		211.80		232.98		
1 Hammer, Diesel, 15K ft.-lbs.		624.45		686.89		
1 Air Compressor, 600 cfm		426.55		469.20		
2 -50′ Air Hoses, 3″		76.70		84.37		
1 Chain Saw, Gas, 36″ Long		41.65		45.81	23.32	25.66
112 L.H., Daily Totals		$8690.55		$12133.37	$77.59	$108.33

Crew B-51	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.47	$67.88
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	4.14	4.55
48 L.H., Daily Totals		$2380.90		$3476.35	$49.60	$72.42

Crew B-52	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$50.76	$75.55
1 Carpenter	54.70	437.60	81.65	653.20		
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
.5 Rodman (reinf.)	58.90	235.60	88.05	352.20		
.5 Equip. Oper. (medium)	59.00	236.00	87.90	351.60		
.5 Crawler Loader, 3 C.Y.		573.00		630.30	10.23	11.26
56 L.H., Daily Totals		$3415.80		$4861.30	$61.00	$86.81

Crew B-53	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Trencher, Chain, 12 H.P.		158.60		174.46	19.82	21.81
8 L.H., Daily Totals		$602.60		$836.06	$75.33	$104.51

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-54	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Trencher, Chain, 40 H.P.		450.70		495.77	56.34	61.97
8 L.H., Daily Totals		$894.70		$1157.37	$111.84	$144.67
Crew B-54A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.17 Labor Foreman (outside)	$46.40	$63.10	$69.25	$94.18	$57.17	$85.19
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Wheel Trencher, 67 H.P.		1140.00		1254.00	121.79	133.97
9.36 L.H., Daily Totals		$1675.10		$2051.38	$178.96	$219.16
Crew B-54B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
.25 Labor Foreman (outside)	$46.40	$92.80	$69.25	$138.50	$56.48	$84.17
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Wheel Trencher, 150 H.P.		1238.00		1361.80	123.80	136.18
10 L.H., Daily Totals		$1802.80		$2203.50	$180.28	$220.35
Crew B-54C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.70	$77.08
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Wheel Trencher, 67 H.P.		1140.00		1254.00	71.25	78.38
16 L.H., Daily Totals		$1967.20		$2487.20	$122.95	$155.45
Crew B-54D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.70	$77.08
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Rock Trencher, 6″ Width		434.20		477.62	27.14	29.85
16 L.H., Daily Totals		$1261.40		$1710.82	$78.84	$106.93
Crew B-54E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.70	$77.08
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Rock Trencher, 18″ Width		1015.00		1116.50	63.44	69.78
16 L.H., Daily Totals		$1842.20		$2349.70	$115.14	$146.86
Crew B-55	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Truck-Mounted Earth Auger		394.15		433.57		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	51.84	57.03
24 L.H., Daily Totals		$2345.00		$3012.62	$97.71	$125.53
Crew B-56	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.95	$74.47
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Track Drill, 4″		1127.00		1239.70		
1 Air Compressor, 600 cfm		426.55		469.20		
1 -50′ Air Hose, 3″		38.35		42.19	99.49	109.44
16 L.H., Daily Totals		$2391.10		$2942.69	$149.44	$183.92

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-57	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.77	$75.71
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 25 Ton		1152.00		1267.20		
1 Clamshell Bucket, 1 C.Y.		69.25		76.17		
1 Centr. Water Pump, 6″		235.25		258.77		
1 -20′ Suction Hose, 6″		25.50		28.05		
20 -50′ Discharge Hoses, 6″		362.00		398.20	38.42	42.26
48 L.H., Daily Totals		$4281.20		$5662.40	$89.19	$117.97
Crew B-58	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Backhoe Loader, 48 H.P.		216.20		237.82		
1 Small Helicopter, w/ Pilot		2101.00		2311.10	96.55	106.21
24 L.H., Daily Totals		$3471.60		$4270.52	$144.65	$177.94
Crew B-59	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Truck Driver (heavy)	$51.30	$410.40	$76.70	$613.60	$51.30	$76.70
1 Truck Tractor, 220 H.P.		310.80		341.88		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51	58.11	63.92
8 L.H., Daily Totals		$875.30		$1124.99	$109.41	$140.62
Crew B-59A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$46.70	$69.73
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 Truck Tractor, 220 H.P.		310.80		341.88	19.37	21.31
24 L.H., Daily Totals		$1585.70		$2184.99	$66.07	$91.04
Crew B-60	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.45	$76.71
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
2 Equip. Oper. (light)	55.50	888.00	82.70	1323.20		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 40 Ton		1231.00		1354.10		
1 Lead, 60′ High		211.80		232.98		
1 Hammer, Diesel, 15K ft.-lbs.		624.45		686.89		
1 Backhoe Loader, 48 H.P.		216.20		237.82	40.78	44.85
56 L.H., Daily Totals		$5164.65		$6807.40	$92.23	$121.56
Crew B-61	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.02	$70.14
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Cement Mixer, 2 C.Y.		112.35		123.58		
1 Air Compressor, 160 cfm		212.30		233.53	8.12	8.93
40 L.H., Daily Totals		$2205.45		$3162.72	$55.14	$79.07
Crew B-62	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45	7.48	8.23
24 L.H., Daily Totals		$1333.90		$1919.05	$55.58	$79.96

Crew B-62A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$48.10	$71.73
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45		
1 Trencher Attachment		66.25		72.88	10.24	11.26
24 L.H., Daily Totals		$1400.15		$1991.93	$58.34	$83.00

Crew B-63	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
4 Laborers	$44.40	$1420.80	$66.25	$2120.00	$46.62	$69.54
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Loader, Skid Steer, 30 H.P.		179.50		197.45	4.49	4.94
40 L.H., Daily Totals		$2044.30		$2979.05	$51.11	$74.48

Crew B-63B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (inside)	$44.90	$359.20	$67.00	$536.00	$47.30	$70.55
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	13.95	15.34
32 L.H., Daily Totals		$1959.90		$2748.53	$61.25	$85.89

Crew B-64	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Power Mulcher (small)		201.00		221.10		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	24.97	27.47
16 L.H., Daily Totals		$1145.10		$1553.45	$71.57	$97.09

Crew B-65	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Power Mulcher (Large)		345.35		379.88		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35	33.99	37.39
16 L.H., Daily Totals		$1289.45		$1712.23	$80.59	$107.01

Crew B-66	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Loader-Backhoe, 40 H.P.		267.55		294.31	33.44	36.79
8 L.H., Daily Totals		$711.55		$955.90	$88.94	$119.49

Crew B-67	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Millwright	$58.75	$470.00	$84.90	$679.20	$57.13	$83.80
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 R.T. Forklift, 5,000 Lb., diesel		272.85		300.13	17.05	18.76
16 L.H., Daily Totals		$1186.85		$1640.93	$74.18	$102.56

Crew B-67B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Millwright Foreman (inside)	$59.25	$474.00	$85.60	$684.80	$59.00	$85.25
1 Millwright	58.75	470.00	84.90	679.20		
16 L.H., Daily Totals		$944.00		$1364.00	$59.00	$85.25

Crew B-68	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Millwrights	$58.75	$940.00	$84.90	$1358.40	$57.67	$84.17
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 R.T. Forklift, 5,000 Lb., diesel		272.85		300.13	11.37	12.51
24 L.H., Daily Totals		$1656.85		$2320.14	$69.04	$96.67

Crew B-68A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Millwright Foreman (inside)	$59.25	$474.00	$85.60	$684.80	$58.92	$85.13
2 Millwrights	58.75	940.00	84.90	1358.40		
1 Forklift, Smooth Floor, 8,000 Lb.		283.25		311.57	11.80	12.98
24 L.H., Daily Totals		$1697.25		$2354.78	$70.72	$98.12

Crew B-68B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Millwright Foreman (inside)	$59.25	$474.00	$85.60	$684.80	$62.79	$92.40
2 Millwrights	58.75	940.00	84.90	1358.40		
2 Electricians	63.70	1019.20	94.65	1514.40		
2 Plumbers	67.70	1083.20	101.05	1616.80		
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	5.06	5.56
56 L.H., Daily Totals		$3799.70		$5486.03	$67.85	$97.96

Crew B-68C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Millwright Foreman (inside)	$59.25	$474.00	$85.60	$684.80	$62.35	$91.55
1 Millwright	58.75	470.00	84.90	679.20		
1 Electrician	63.70	509.60	94.65	757.20		
1 Plumber	67.70	541.60	101.05	808.40		
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	8.85	9.74
32 L.H., Daily Totals		$2278.50		$3241.23	$71.20	$101.29

Crew B-68D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (inside)	$44.90	$359.20	$67.00	$536.00	$48.27	$71.98
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	11.80	12.98
24 L.H., Daily Totals		$1441.70		$2039.23	$60.07	$84.97

Crew B-68E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (inside)	$60.80	$486.40	$94.10	$752.80	$60.40	$93.46
3 Struc. Steel Workers	60.30	1447.20	93.30	2239.20		
1 Welder	60.30	482.40	93.30	746.40		
1 Forklift, Smooth Floor, 8,000 Lb.		283.25		311.57	7.08	7.79
40 L.H., Daily Totals		$2699.25		$4049.97	$67.48	$101.25

Crew B-68F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Skilled Worker Foreman (out)	$59.10	$472.80	$88.90	$711.20	$57.77	$86.90
2 Skilled Workers	57.10	913.60	85.90	1374.40		
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	11.80	12.98
24 L.H., Daily Totals		$1669.70		$2397.23	$69.57	$99.88

Crew B-68G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Structural Steel Workers	$60.30	$964.80	$93.30	$1492.80	$60.30	$93.30
1 R.T. Forklift, 5,000 Lb., gas		283.30		311.63	17.71	19.48
16 L.H., Daily Totals		$1248.10		$1804.43	$78.01	$112.78

Crew B-69	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.92	$72.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	30.38	33.41
48 L.H., Daily Totals		$3806.40		$5106.20	$79.30	$106.38

Crew B-69A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.40	$71.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Concrete Finisher	51.80	414.40	75.90	607.20		
1 Curb/Gutter Paver, 2-Track		1231.00		1354.10	25.65	28.21
48 L.H., Daily Totals		$3554.20		$4808.50	$74.05	$100.18

Crew B-69B	Bare Costs Hr.	Bare Costs Daily	Incl. Subs O&P Hr.	Incl. Subs O&P Daily	Cost Per Labor-Hour Bare Costs	Cost Per Labor-Hour Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.40	$71.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Curb/Gutter Paver, 4-Track		801.05		881.15	16.69	18.36
48 L.H., Daily Totals		$3124.25		$4335.56	$65.09	$90.32

Crew B-70	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.94	$75.96
3 Laborers	44.40	1065.60	66.25	1590.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Ripper, Beam & 1 Shank		91.60		100.76		
1 Road Sweeper, S.P., 8' wide		723.65		796.01		
1 F.E. Loader, W.M., 1.5 C.Y.		441.40		485.54	41.60	45.76
56 L.H., Daily Totals		$5182.45		$6816.22	$92.54	$121.72

Crew B-70A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$56.08	$83.57
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Grader, 40,000 Lbs.		1219.00		1340.90		
1 F.E. Loader, W.M., 2.5 C.Y.		638.30		702.13		
1 Dozer, 80 H.P.		405.85		446.44		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	65.33	71.86
40 L.H., Daily Totals		$4856.25		$6217.15	$121.41	$155.43

Crew B-71	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.94	$75.96
3 Laborers	44.40	1065.60	66.25	1590.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Pvmt. Profiler, 750 H.P.		3483.00		3831.30		
1 Road Sweeper, S.P., 8' wide		723.65		796.01		
1 F.E. Loader, W.M., 1.5 C.Y.		441.40		485.54	83.00	91.30
56 L.H., Daily Totals		$7500.85		$9366.45	$133.94	$167.26

Crew B-72	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.95	$77.45
3 Laborers	44.40	1065.60	66.25	1590.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Pvmt. Profiler, 750 H.P.		3483.00		3831.30		
1 Hammermill, 250 H.P.		857.40		943.14		
1 Windrow Loader		1461.00		1607.10		
1 Mix Paver, 165 H.P.		2172.00		2389.20		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	130.05	143.06
64 L.H., Daily Totals		$11648.10		$14112.43	$182.00	$220.51

Crew B-73	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.77	$80.16
2 Laborers	44.40	710.40	66.25	1060.00		
5 Equip. Oper. (medium)	59.00	2360.00	87.90	3516.00		
1 Road Mixer, 310 H.P.		1919.00		2110.90		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Hammermill, 250 H.P.		857.40		943.14		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
.5 F.E. Loader, W.M., 1.5 C.Y.		220.70		242.77		
.5 Truck Tractor, 220 H.P.		155.40		170.94		
.5 Water Tank Trailer, 5000 Gal.		77.05		84.75	71.08	78.19
64 L.H., Daily Totals		$7990.95		$10134.29	$124.86	$158.35

Crew B-74	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.67	$80.06
1 Laborer	44.40	355.20	66.25	530.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Ripper, Beam & 1 Shank		91.60		100.76		
2 Stabilizers, 310 H.P.		2808.00		3088.80		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Chem. Spreader, Towed		85.40		93.94		
1 Roller, Vibratory, 25 Ton		672.35		739.59		
1 Water Tank Trailer, 5000 Gal.		154.10		169.51		
1 Truck Tractor, 220 H.P.		310.80		341.88	94.46	103.90
64 L.H., Daily Totals		$9480.50		$11773.83	$148.13	$183.97

Crew B-75	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$54.01	$80.54
1 Laborer	44.40	355.20	66.25	530.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Grader, 30,000 Lbs.		1073.00		1180.30		
1 Ripper, Beam & 1 Shank		91.60		100.76		
2 Stabilizers, 310 H.P.		2808.00		3088.80		
1 Dist. Tanker, 3000 Gallon		334.10		367.51		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Roller, Vibratory, 25 Ton		672.35		739.59	97.83	107.61
56 L.H., Daily Totals		$8503.00		$10536.42	$151.84	$188.15

Crew B-76	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Dock Builder Foreman (outside)	$57.90	$463.20	$89.50	$716.00	$56.98	$86.98
5 Dock Builders	55.90	2236.00	86.40	3456.00		
2 Equip. Oper. (crane)	61.45	983.20	91.55	1464.80		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 50 Ton		1541.00		1695.10		
1 Barge, 400 Ton		869.15		956.07		
1 Hammer, Diesel, 15K ft.-lbs.		624.45		686.89		
1 Lead, 60' High		211.80		232.98		
1 Air Compressor, 600 cfm		426.55		469.20		
2 -50' Air Hoses, 3"		76.70		84.37	52.08	57.29
72 L.H., Daily Totals		$7852.05		$10387.42	$109.06	$144.27

Crew B-76A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.79	$71.29
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 50 Ton		1541.00		1695.10		
1 Barge, 400 Ton		869.15		956.07	37.66	41.42
64 L.H., Daily Totals		$5468.95		$7213.56	$85.45	$112.71

Crew B-77	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.68	$68.20
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Crack Cleaner, 25 H.P.		53.00		58.30		
1 Crack Filler, Trailer Mtd.		170.95		188.04		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	26.85	29.54
40 L.H., Daily Totals		$2901.20		$3909.40	$72.53	$97.73

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-78	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.47	$67.88
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, S.P., 40 Gallon		128.35		141.19		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Pickup Truck, 3/4 Ton		112.20		123.42	22.72	24.99
48 L.H., Daily Totals		$3273.00		$4457.66	$68.19	$92.87
Crew B-78A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Line Rem. (Metal Balls) 115 H.P.		996.25		1095.88	124.53	136.98
8 L.H., Daily Totals		$1440.25		$1757.47	$180.03	$219.68
Crew B-78B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.63	$68.08
.25 Equip. Oper. (light)	55.50	111.00	82.70	165.40		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
1 Line Rem.,11 H.P.,Walk Behind		114.75		126.22		
.25 Road Sweeper, S.P., 8' wide		180.91		199.00	22.66	24.92
18 L.H., Daily Totals		$1229.26		$1674.05	$68.29	$93.00
Crew B-78C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.47	$67.88
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Pickup Truck, 3/4 Ton		112.20		123.42	32.61	35.87
48 L.H., Daily Totals		$3747.75		$4979.89	$78.08	$103.75
Crew B-78D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.24	$67.53
7 Laborers	44.40	2486.40	66.25	3710.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
3 Pickup Trucks, 3/4 Ton		336.60		370.26		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4"		7.15		7.87		
1 Breaker, Pavement, 60 lb.		53.60		58.96	25.05	27.56
80 L.H., Daily Totals		$5623.55		$7606.78	$70.29	$95.08
Crew B-78E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.10	$67.31
9 Laborers	44.40	3196.80	66.25	4770.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
4 Pickup Trucks, 3/4 Ton		448.80		493.68		
2 Air Compressors, 60 cfm		307.70		338.47		
2 -50' Air Hoses, 3/4"		14.30		15.73		
2 Breakers, Pavement, 60 lb.		107.20		117.92	24.28	26.71
96 L.H., Daily Totals		$6660.75		$9026.26	$69.38	$94.02

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-78F	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.00	$67.16
11 Laborers	44.40	3907.20	66.25	5830.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
7 Pickup Trucks, 3/4 Ton		785.40		863.94		
3 Air Compressors, 60 cfm		461.55		507.70		
3 -50' Air Hoses, 3/4"		21.45		23.59		
3 Breakers, Pavement, 60 lb.		160.80		176.88	25.74	28.31
112 L.H., Daily Totals		$7922.35		$10692.58	$70.74	$95.47
Crew B-79	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.68	$68.20
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Heating Kettle, 115 Gallon		107.25		117.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
2 Pickup Trucks, 3/4 Ton		224.40		246.84	44.62	49.08
40 L.H., Daily Totals		$3612.00		$4691.28	$90.30	$117.28
Crew B-79A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1.5 Equip. Oper. (light)	$55.50	$666.00	$82.70	$992.40	$55.50	$82.70
.5 Line Remov. (Grinder) 115 H.P.		515.50		567.05		
1 Line Rem. (Metal Balls) 115 H.P.		996.25		1095.88	125.98	138.58
12 L.H., Daily Totals		$2177.75		$2655.32	$181.48	$221.28
Crew B-79B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Set of Gases		173.60		190.96	21.70	23.87
8 L.H., Daily Totals		$528.80		$720.96	$66.10	$90.12
Crew B-79C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.31	$67.64
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Heating Kettle, 115 Gallon		107.25		117.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
3 Pickup Trucks, 3/4 Ton		336.60		370.26		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4"		7.15		7.87		
1 Breaker, Pavement, 60 lb.		53.60		58.96	37.71	41.48
56 L.H., Daily Totals		$4649.20		$6110.76	$83.02	$109.12
Crew B-79D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.45	$67.84
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Heating Kettle, 115 Gallon		107.25		117.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
4 Pickup Trucks, 3/4 Ton		448.80		493.68		
1 Air Compressor, 60 cfm		153.85		169.24		
1 -50' Air Hose, 3/4"		7.15		7.87		
1 Breaker, Pavement, 60 lb.		53.60		58.96	34.75	38.22
64 L.H., Daily Totals		$5132.60		$6788.18	$80.20	$106.07

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-79E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Labor Foremen (outside)	$46.40	$742.40	$69.25	$1108.00	$45.24	$67.53
7 Laborers	44.40	2486.40	66.25	3710.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Paint Striper, T.M., 120 Gal.		603.10		663.41		
1 Heating Kettle, 115 Gallon		107.25		117.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
5 Pickup Trucks, 3/4 Ton		561.00		617.10		
2 Air Compressors, 60 cfm		307.70		338.47		
2 -50' Air Hoses, 3/4"		14.30		15.73		
2 Breakers, Pavement, 60 lb.		107.20		117.92	31.88	35.07
80 L.H., Daily Totals		$6169.80		$8207.66	$77.12	$102.60
Crew B-80	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.77	$72.80
1 Laborer	44.40	355.20	66.25	530.00		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Earth Auger, Truck-Mtd.		202.55		222.81	32.89	36.18
32 L.H., Daily Totals		$2613.40		$3487.46	$81.67	$108.98
Crew B-80A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$44.40	$66.25
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	35.42	38.96
24 L.H., Daily Totals		$1915.65		$2525.05	$79.82	$105.21
Crew B-80B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$47.17	$70.36
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Crane, Flatbed Mounted, 3 Ton		238.75		262.63	7.46	8.21
32 L.H., Daily Totals		$1748.35		$2514.22	$54.64	$78.57
Crew B-80C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$45.87	$68.50
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Manual Fence Post Auger, Gas		54.40		59.84	10.54	11.59
24 L.H., Daily Totals		$1353.70		$1922.19	$56.40	$80.09
Crew B-81	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.57	$76.95
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Hydromulcher, T.M., 3000 Gal.		256.85		282.54		
1 Truck Tractor, 220 H.P.		310.80		341.88	23.65	26.02
24 L.H., Daily Totals		$1805.25		$2471.22	$75.22	$102.97
Crew B-81A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Hydromulcher, T.M., 600 Gal.		118.15		129.97		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	60.51	66.56
16 L.H., Daily Totals		$1713.80		$2179.02	$107.11	$136.19
Crew B-82	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.95	$74.47
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Horiz. Borer, 6 H.P.		184.15		202.57	11.51	12.66
16 L.H., Daily Totals		$983.35		$1394.17	$61.46	$87.14

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-82A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$49.95	$74.47
2 Equip. Opers. (light)	55.50	888.00	82.70	1323.20		
2 Dump Truck, 8 C.Y., 220 H.P.		815.20		896.72		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Horiz. Dir. Drill, 20k lb. Thrust		544.10		598.51		
1 Mud Trailer for HDD, 1500 Gal.		312.15		343.37		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 3 Ton		71.15		78.27		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	78.21	86.04
32 L.H., Daily Totals		$4101.25		$5136.34	$128.16	$160.51
Crew B-82B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$49.95	$74.47
2 Equip. Opers. (light)	55.50	888.00	82.70	1323.20		
2 Dump Truck, 8 C.Y., 220 H.P.		815.20		896.72		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Horiz. Dir. Drill, 30k lb. Thrust		647.65		712.41		
1 Mud Trailer for HDD, 1500 Gal.		312.15		343.37		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 3 Ton		71.15		78.27		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	81.45	89.59
32 L.H., Daily Totals		$4204.80		$5250.24	$131.40	$164.07
Crew B-82C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Laborers	$44.40	$710.40	$66.25	$1060.00	$49.95	$74.47
2 Equip. Opers. (light)	55.50	888.00	82.70	1323.20		
2 Dump Truck, 8 C.Y., 220 H.P.		815.20		896.72		
1 Flatbed Trailer, 25 Ton		137.20		150.92		
1 Horiz. Dir. Drill, 50k lb. Thrust		824.05		906.46		
1 Mud Trailer for HDD, 1500 Gal.		312.15		343.37		
1 Pickup Truck, 4x4, 3/4 Ton		176.75		194.43		
1 Flatbed Trailer, 3 Ton		71.15		78.27		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	86.96	95.66
32 L.H., Daily Totals		$4381.20		$5444.28	$136.91	$170.13
Crew B-82D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$55.50	$82.70
1 Mud Trailer for HDD, 1500 Gal.		312.15		343.37	39.02	42.92
8 L.H., Daily Totals		$756.15		$1004.97	$94.52	$125.62
Crew B-83	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Tugboat Captain	$59.00	$472.00	$87.90	$703.20	$51.70	$77.08
1 Tugboat Hand	44.40	355.20	66.25	530.00		
1 Tugboat, 250 H.P.		726.10		798.71	45.38	49.92
16 L.H., Daily Totals		$1553.30		$2031.91	$97.08	$126.99
Crew B-84	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Rotary Mower/Tractor		371.15		408.26	46.39	51.03
8 L.H., Daily Totals		$843.15		$1111.46	$105.39	$138.93
Crew B-85	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$48.70	$72.67
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Telescoping Boom Lift, to 80'		387.75		426.52		
1 Brush Chipper, 12", 130 H.P.		366.05		402.65		
1 Pruning Saw, Rotary		26.40		29.04	19.50	21.46
40 L.H., Daily Totals		$2728.20		$3765.02	$68.20	$94.13

Crews - Standard

Crew B-86	Bare Costs Hr.	Bare Costs Daily	Incl. Subs O&P Hr.	Incl. Subs O&P Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Stump Chipper, S.P.		189.20		208.12	23.65	26.02
8 L.H., Daily Totals		$661.20		$911.32	$82.65	$113.92

Crew B-86A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Grader, 30,000 Lbs.		1073.00		1180.30	134.13	147.54
8 L.H., Daily Totals		$1545.00		$1883.50	$193.13	$235.44

Crew B-86B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Dozer, 200 H.P.		1520.00		1672.00	190.00	209.00
8 L.H., Daily Totals		$1992.00		$2375.20	$249.00	$296.90

Crew B-87	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$56.08	$83.57
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
2 Feller Bunchers, 100 H.P.		1257.60		1383.36		
1 Log Chipper, 22″ Tree		555.00		610.50		
1 Dozer, 105 H.P.		640.80		704.88		
1 Chain Saw, Gas, 36″ Long		41.65		45.81	62.38	68.61
40 L.H., Daily Totals		$4738.25		$6087.35	$118.46	$152.18

Crew B-88	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$56.91	$84.81
6 Equip. Oper. (medium)	59.00	2832.00	87.90	4219.20		
2 Feller Bunchers, 100 H.P.		1257.60		1383.36		
1 Log Chipper, 22″ Tree		555.00		610.50		
2 Log Skidders, 50 H.P.		1826.70		2009.37		
1 Dozer, 105 H.P.		640.80		704.88		
1 Chain Saw, Gas, 36″ Long		41.65		45.81	77.17	84.89
56 L.H., Daily Totals		$7508.95		$9503.13	$134.09	$169.70

Crew B-89	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$52.15	$77.85
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05		
1 Concrete Saw		112.85		124.14		
1 Water Tank, 65 Gal.		102.90		113.19	66.61	73.27
16 L.H., Daily Totals		$1900.20		$2417.98	$118.76	$151.12

Crew B-89A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Skilled Worker	$57.10	$456.80	$85.90	$687.20	$50.75	$76.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Core Drill (Large)		121.60		133.76	7.60	8.36
16 L.H., Daily Totals		$933.60		$1350.96	$58.35	$84.44

Crew B-89B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (light)	$55.50	$444.00	$82.70	$661.60	$52.15	$77.85
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Wall Saw, Hydraulic, 10 H.P.		86.40		95.04		
1 Generator, Diesel, 100 kW		521.85		574.03		
1 Water Tank, 65 Gal.		102.90		113.19		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	97.58	107.33
16 L.H., Daily Totals		$2395.60		$2962.92	$149.72	$185.18

Crew B-89C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$51.80	$75.90
1 Masonry cut-off saw, gas		58.15		63.97	7.27	8.00
8 L.H., Daily Totals		$472.55		$671.16	$59.07	$83.90

Crew B-90	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.15	$73.35
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Equip. Oper. (light)	55.50	888.00	82.70	1323.20		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Road Mixer, 310 H.P.		1919.00		2110.90		
1 Dist. Truck, 2000 Gal.		303.25		333.57	34.72	38.19
64 L.H., Daily Totals		$5367.85		$7138.88	$83.87	$111.54

Crew B-90A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$53.03	$79.05
2 Laborers	44.40	710.40	66.25	1060.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
2 Graders, 30,000 Lbs.		2146.00		2360.60		
1 Tandem Roller, 10 Ton		246.80		271.48		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89	48.98	53.87
56 L.H., Daily Totals		$5712.30		$7443.77	$102.01	$132.92

Crew B-90B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.03	$77.58
2 Laborers	44.40	710.40	66.25	1060.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89		
1 Road Mixer, 310 H.P.		1919.00		2110.90	47.27	52.00
48 L.H., Daily Totals		$4766.50		$6219.39	$99.30	$129.57

Crew B-90C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.45	$75.28
4 Laborers	44.40	1420.80	66.25	2120.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
3 Truck Drivers (heavy)	51.30	1231.20	76.70	1840.80		
3 Road Mixers, 310 H.P.		5757.00		6332.70	65.42	71.96
88 L.H., Daily Totals		$10196.20		$12957.10	$115.87	$147.24

Crew B-90D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.52	$73.89
6 Laborers	44.40	2131.20	66.25	3180.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
3 Truck Drivers (heavy)	51.30	1231.20	76.70	1840.80		
3 Road Mixers, 310 H.P.		5757.00		6332.70	55.36	60.89
104 L.H., Daily Totals		$10906.60		$14017.10	$104.87	$134.78

Crew B-90E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$50.26	$74.96
4 Laborers	44.40	1420.80	66.25	2120.00		
3 Equip. Oper. (medium)	59.00	1416.00	87.90	2109.60		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Road Mixer, 310 H.P.		1919.00		2110.90	26.65	29.32
72 L.H., Daily Totals		$5537.40		$7508.10	$76.91	$104.28

Crew B-91	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$52.81	$78.76
2 Laborers	44.40	710.40	66.25	1060.00		
4 Equip. Oper. (medium)	59.00	1888.00	87.90	2812.80		
1 Truck Driver (heavy)	51.30	410.40	76.70	613.60		
1 Dist. Tanker, 3000 Gallon		334.10		367.51		
1 Truck Tractor, 6x4, 380 H.P.		499.15		549.07		
1 Aggreg. Spreader, S.P.		859.10		945.01		
1 Roller, Pneum. Whl., 12 Ton		349.90		384.89		
1 Tandem Roller, 10 Ton		246.80		271.48	35.77	39.34
64 L.H., Daily Totals		$5669.05		$7558.35	$88.58	$118.10

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-91B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.70	$77.08
1 Equipment Oper. (med.)	59.00	472.00	87.90	703.20		
1 Road Sweeper, Vac. Assist.		879.45		967.39	54.97	60.46
16 L.H., Daily Totals		$1706.65		$2200.59	$106.67	$137.54

Crew B-91C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$46.60	$69.63
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Catch Basin Cleaning Truck		542.60		596.86	33.91	37.30
16 L.H., Daily Totals		$1288.20		$1710.86	$80.51	$106.93

Crew B-91D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$51.23	$76.42
5 Laborers	44.40	1776.00	66.25	2650.00		
5 Equip. Oper. (medium)	59.00	2360.00	87.90	3516.00		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
1 Aggreg. Spreader, S.P.		859.10		945.01		
2 Truck Tractors, 6x4, 380 H.P.		998.30		1098.13		
2 Dist. Tankers, 3000 Gallon		668.20		735.02		
2 Pavement Brushes, Towed		176.70		194.37		
2 Rollers Pneum. Whl., 12 Ton		699.80		769.78	32.71	35.98
104 L.H., Daily Totals		$8730.10		$11689.51	$83.94	$112.40

Crew B-92	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$44.90	$67.00
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Crack Cleaner, 25 H.P.		53.00		58.30		
1 Air Compressor, 60 cfm		153.85		169.24		
1 Tar Kettle, T.M.		156.70		172.37		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	37.92	41.72
32 L.H., Daily Totals		$2650.40		$3478.96	$82.83	$108.72

Crew B-93	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Equip. Oper. (medium)	$59.00	$472.00	$87.90	$703.20	$59.00	$87.90
1 Feller Buncher, 100 H.P.		628.80		691.68	78.60	86.46
8 L.H., Daily Totals		$1100.80		$1394.88	$137.60	$174.36

Crew B-94A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Diaphragm Water Pump, 2″		87.70		96.47		
1 -20′ Suction Hose, 2″		3.55		3.90		
2 -50′ Discharge Hoses, 2″		8.00		8.80	12.41	13.65
8 L.H., Daily Totals		$454.45		$639.17	$56.81	$79.90

Crew B-94B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Diaphragm Water Pump, 4″		106.35		116.99		
1 -20′ Suction Hose, 4″		17.25		18.98		
2 -50′ Discharge Hoses, 4″		25.60		28.16	18.65	20.52
8 L.H., Daily Totals		$504.40		$694.12	$63.05	$86.77

Crew B-94C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Centrifugal Water Pump, 3″		74.40		81.84		
1 -20′ Suction Hose, 3″		8.75		9.63		
2 -50′ Discharge Hoses, 3″		9.00		9.90	11.52	12.67
8 L.H., Daily Totals		$447.35		$631.37	$55.92	$78.92

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew B-94D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Centr. Water Pump, 6″		235.25		258.77		
1 -20′ Suction Hose, 6″		25.50		28.05		
2 -50′ Discharge Hoses, 6″		36.20		39.82	37.12	40.83
8 L.H., Daily Totals		$652.15		$856.64	$81.52	$107.08

Crew C-1	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Carpenters	$54.70	$1312.80	$81.65	$1959.60	$52.13	$77.80
1 Laborer	44.40	355.20	66.25	530.00		
32 L.H., Daily Totals		$1668.00		$2489.60	$52.13	$77.80

Crew C-2	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.32	$79.58
4 Carpenters	54.70	1750.40	81.65	2612.80		
1 Laborer	44.40	355.20	66.25	530.00		
48 L.H., Daily Totals		$2559.20		$3819.60	$53.32	$79.58

Crew C-2A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$52.83	$78.62
3 Carpenters	54.70	1312.80	81.65	1959.60		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Laborer	44.40	355.20	66.25	530.00		
48 L.H., Daily Totals		$2536.00		$3773.60	$52.83	$78.62

Crew C-3	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Rodman Foreman (outside)	$60.90	$487.20	$91.05	$728.40	$55.10	$82.31
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
2 Laborers	44.40	710.40	66.25	1060.00		
3 Stressing Equipment		56.85		62.53		
.5 Grouting Equipment		123.33		135.66	2.82	3.10
64 L.H., Daily Totals		$3706.57		$5465.79	$57.92	$85.40

Crew C-4	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Rodman Foreman (outside)	$60.90	$487.20	$91.05	$728.40	$59.40	$88.80
3 Rodmen (reinf.)	58.90	1413.60	88.05	2113.20		
3 Stressing Equipment		56.85		62.53	1.78	1.95
32 L.H., Daily Totals		$1957.65		$2904.14	$61.18	$90.75

Crew C-4A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Rodmen (reinf.)	$58.90	$942.40	$88.05	$1408.80	$58.90	$88.05
4 Stressing Equipment		75.80		83.38	4.74	5.21
16 L.H., Daily Totals		$1018.20		$1492.18	$63.64	$93.26

Crew C-5	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Rodman Foreman (outside)	$60.90	$487.20	$91.05	$728.40	$58.64	$87.58
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 25 Ton		586.70		645.37	10.48	11.52
56 L.H., Daily Totals		$3870.30		$5549.77	$69.11	$99.10

Crew C-6	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.97	$68.36
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
2 Gas Engine Vibrators		54.30		59.73	1.13	1.24
48 L.H., Daily Totals		$2260.70		$3340.93	$47.10	$69.60

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-6A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Cement Finishers	$51.80	$828.80	$75.90	$1214.40	$51.80	$75.90
1 Concrete Vibrator, Elec, 2 HP		45.80		50.38	2.86	3.15
16 L.H., Daily Totals		$874.60		$1264.78	$54.66	$79.05
Crew C-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.97	$71.39
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
2 Gas Engine Vibrators		54.30		59.73		
1 Concrete Bucket, 1 C.Y.		45.90		50.49		
1 Hyd. Crane, 55 Ton		990.15		1089.17	15.14	16.66
72 L.H., Daily Totals		$4543.95		$6339.78	$63.11	$88.05
Crew C-7A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.38	$69.24
5 Laborers	44.40	1776.00	66.25	2650.00		
2 Truck Drivers (heavy)	51.30	820.80	76.70	1227.20		
2 Conc. Transit Mixers		1176.30		1293.93	18.38	20.22
64 L.H., Daily Totals		$4144.30		$5725.13	$64.75	$89.46
Crew C-7B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.79	$71.29
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Equipment Operator, Crane	61.45	491.60	91.55	732.40		
1 Equipment Oiler	52.50	420.00	78.25	626.00		
1 Conc. Bucket, 2 C.Y.		55.65		61.22		
1 Lattice Boom Crane, 165 Ton		2403.00		2643.30	38.42	42.26
64 L.H., Daily Totals		$5517.45		$7266.92	$86.21	$113.55
Crew C-7C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.30	$72.04
5 Laborers	44.40	1776.00	66.25	2650.00		
2 Equipment Operators (med.)	59.00	944.00	87.90	1406.40		
2 F.E. Loaders, W.M., 4 C.Y.		1518.00		1669.80	23.72	26.09
64 L.H., Daily Totals		$4609.20		$6280.20	$72.02	$98.13
Crew C-7D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$46.77	$69.77
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Concrete Conveyer		206.25		226.88	3.68	4.05
56 L.H., Daily Totals		$2825.45		$4134.07	$50.45	$73.82
Crew C-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.89	$72.53
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Concrete Pump (Small)		423.65		466.01	7.57	8.32
56 L.H., Daily Totals		$3161.25		$4527.61	$56.45	$80.85
Crew C-8A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.20	$69.97
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
48 L.H., Daily Totals		$2265.60		$3358.40	$47.20	$69.97

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-8B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.72	$71.18
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Vibrating Power Screed		87.65		96.42		
1 Roller, Vibratory, 25 Ton		672.35		739.59		
1 Dozer, 200 H.P.		1520.00		1672.00	57.00	62.70
40 L.H., Daily Totals		$4188.80		$5355.20	$104.72	$133.88
Crew C-8C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.40	$71.97
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Shotcrete Rig, 12 C.Y./hr		269.20		296.12		
1 Air Compressor, 160 cfm		212.30		233.53		
4 -50' Air Hoses, 1"		32.20		35.42		
4 -50' Air Hoses, 2"		115.80		127.38	13.11	14.43
48 L.H., Daily Totals		$2952.70		$4146.85	$61.51	$86.39
Crew C-8D	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.52	$73.53
1 Laborer	44.40	355.20	66.25	530.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equipment Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
2 -50' Air Hoses, 1"		16.10		17.71	6.84	7.53
32 L.H., Daily Totals		$1803.75		$2593.65	$56.37	$81.05
Crew C-8E	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.82	$71.10
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equipment Oper. (light)	55.50	444.00	82.70	661.60		
1 Shotcrete Rig, 35 C.Y./hr.		301.05		331.15		
1 Air Compressor, 250 cfm		202.85		223.13		
4 -50' Air Hoses, 1"		32.20		35.42		
4 -50' Air Hoses, 2"		115.80		127.38	13.58	14.94
48 L.H., Daily Totals		$2947.10		$4129.89	$61.40	$86.04
Crew C-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$49.02	$72.78
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equipment Oper. (light)	55.50	444.00	82.70	661.60		
1 Grout Pump, 50 C.F./hr.		190.35		209.38		
1 Air Compressor, 160 cfm		212.30		233.53		
2 -50' Air Hoses, 1"		16.10		17.71		
2 -50' Air Hoses, 2"		57.90		63.69	14.90	16.38
32 L.H., Daily Totals		$2045.45		$2853.11	$63.92	$89.16
Crew C-10	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
24 L.H., Daily Totals		$1184.00		$1744.40	$49.33	$72.68
Crew C-10B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Laborers	$44.40	$1065.60	$66.25	$1590.00	$47.36	$70.11
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Concrete Mixer, 10 C.F.		147.15		161.87		
2 Trowels, 48" Walk-Behind		188.60		207.46	8.39	9.23
40 L.H., Daily Totals		$2230.15		$3173.72	$55.75	$79.34

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew C-10C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Trowel, 48″ Walk-Behind		94.30		103.73	3.93	4.32
24 L.H., Daily Totals		$1278.30		$1848.13	$53.26	$77.01

Crew C-10D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Vibrating Power Screed		87.65		96.42		
1 Trowel, 48″ Walk-Behind		94.30		103.73	7.58	8.34
24 L.H., Daily Totals		$1365.95		$1944.55	$56.91	$81.02

Crew C-10E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Vibrating Power Screed		87.65		96.42		
1 Cement Trowel, 96″ Ride-On		171.05		188.16	10.78	11.86
24 L.H., Daily Totals		$1442.70		$2028.97	$60.11	$84.54

Crew C-10F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$49.33	$72.68
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Telescoping Boom Lift, to 60′		292.45		321.69	12.19	13.40
24 L.H., Daily Totals		$1476.45		$2066.09	$61.52	$86.09

Crew C-11	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.78	$91.78
6 Struc. Steel Workers	60.30	2894.40	93.30	4478.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 150 Ton		2324.00		2556.40	32.28	35.51
72 L.H., Daily Totals		$6628.40		$9164.40	$92.06	$127.28

Crew C-12	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$54.44	$81.22
3 Carpenters	54.70	1312.80	81.65	1959.60		
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	9.91	10.90
48 L.H., Daily Totals		$3089.00		$4422.18	$64.35	$92.13

Crew C-13	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Worker	$60.30	$482.40	$93.30	$746.40	$58.43	$89.42
1 Welder	60.30	482.40	93.30	746.40		
1 Carpenter	54.70	437.60	81.65	653.20		
1 Welder, Gas Engine, 300 amp		148.75		163.63	6.20	6.82
24 L.H., Daily Totals		$1551.15		$2309.63	$64.63	$96.23

Crew C-14	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.39	$79.54
5 Carpenters	54.70	2188.00	81.65	3266.00		
4 Laborers	44.40	1420.80	66.25	2120.00		
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	10.13	11.14
144 L.H., Daily Totals		$9145.60		$13057.00	$63.51	$90.67

Crew C-14A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$54.68	$81.58
16 Carpenters	54.70	7001.60	81.65	10451.20		
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gas Engine Vibrator		27.15		29.86		
1 Concrete Pump (Small)		423.65		466.01	2.25	2.48
200 L.H., Daily Totals		$11387.60		$16811.88	$56.94	$84.06

Crew C-14B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$54.57	$81.36
16 Carpenters	54.70	7001.60	81.65	10451.20		
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
2 Laborers	44.40	710.40	66.25	1060.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gas Engine Vibrator		27.15		29.86		
1 Concrete Pump (Small)		423.65		466.01	2.17	2.38
208 L.H., Daily Totals		$11802.00		$17419.08	$56.74	$83.75

Crew C-14C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$52.29	$77.96
6 Carpenters	54.70	2625.60	81.65	3919.20		
2 Rodmen (reinf.)	58.90	942.40	88.05	1408.80		
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Gas Engine Vibrator		27.15		29.86	.24	.27
112 L.H., Daily Totals		$5883.95		$8761.86	$52.54	$78.23

Crew C-14D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$54.35	$81.07
18 Carpenters	54.70	7876.80	81.65	11757.60		
2 Rodmen (reinf.)	58.90	942.40	88.05	1408.80		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gas Engine Vibrator		27.15		29.86		
1 Concrete Pump (Small)		423.65		466.01	2.25	2.48
200 L.H., Daily Totals		$11320.40		$16709.48	$56.60	$83.55

Crew C-14E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.34	$79.52
2 Carpenters	54.70	875.20	81.65	1306.40		
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
3 Laborers	44.40	1065.60	66.25	1590.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Gas Engine Vibrator		27.15		29.86	.31	.34
88 L.H., Daily Totals		$4720.75		$7027.86	$53.64	$79.86

Crew C-14F	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.56	$73.02
2 Laborers	44.40	710.40	66.25	1060.00		
6 Cement Finishers	51.80	2486.40	75.90	3643.20		
1 Gas Engine Vibrator		27.15		29.86	.38	.41
72 L.H., Daily Totals		$3595.15		$5287.06	$49.93	$73.43

Crew C-14G	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.91	$72.19
2 Laborers	44.40	710.40	66.25	1060.00		
4 Cement Finishers	51.80	1657.60	75.90	2428.80		
1 Gas Engine Vibrator		27.15		29.86	.48	.53
56 L.H., Daily Totals		$2766.35		$4072.67	$49.40	$72.73

Crew C-14H	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.53	$79.68
2 Carpenters	54.70	875.20	81.65	1306.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
1 Laborer	44.40	355.20	66.25	530.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Gas Engine Vibrator		27.15		29.86	.57	.62
48 L.H., Daily Totals		$2596.75		$3854.67	$54.10	$80.31

Crew C-14L	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$51.19	$76.28
6 Carpenters	54.70	2625.60	81.65	3919.20		
4 Laborers	44.40	1420.80	66.25	2120.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Gas Engine Vibrator		27.15		29.86	.28	.31
96 L.H., Daily Totals		$4941.55		$7353.06	$51.47	$76.59

Crew C-14M	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$53.08	$79.03
2 Carpenters	54.70	875.20	81.65	1306.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
2 Laborers	44.40	710.40	66.25	1060.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gas Engine Vibrator		27.15		29.86		
1 Concrete Pump (Small)		423.65		466.01	7.04	7.75
64 L.H., Daily Totals		$3847.60		$5553.88	$60.12	$86.78

Crew C-15	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$51.31	$76.28
2 Carpenters	54.70	875.20	81.65	1306.40		
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Rodman (reinf.)	58.90	471.20	88.05	704.40		
72 L.H., Daily Totals		$3694.40		$5492.00	$51.31	$76.28

Crew C-16	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$48.89	$72.53
3 Laborers	44.40	1065.60	66.25	1590.00		
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gunite Pump Rig		321.75		353.93		
2 -50' Air Hoses, 3/4"		14.30		15.73		
2 -50' Air Hoses, 2"		57.90		63.69	7.03	7.74
56 L.H., Daily Totals		$3131.55		$4494.94	$55.92	$80.27

Crew C-16A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$51.75	$76.49
2 Cement Finishers	51.80	828.80	75.90	1214.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Gunite Pump Rig		321.75		353.93		
2 -50' Air Hoses, 3/4"		14.30		15.73		
2 -50' Air Hoses, 2"		57.90		63.69		
1 Telescoping Boom Lift, to 60'		292.45		321.69	21.45	23.59
32 L.H., Daily Totals		$2342.40		$3202.64	$73.20	$100.08

Crew C-17	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.50	$86.50
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
80 L.H., Daily Totals		$4600.00		$6920.00	$57.50	$86.50

Crew C-17A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.55	$86.56
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
.125 Equip. Oper. (crane)	61.45	61.45	91.55	91.55		
.125 Hyd. Crane, 80 Ton		182.25		200.47	2.25	2.48
81 L.H., Daily Totals		$4843.70		$7212.02	$59.80	$89.04

Crew C-17B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.60	$86.62
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
.25 Equip. Oper. (crane)	61.45	122.90	91.55	183.10		
.25 Hyd. Crane, 80 Ton		364.50		400.95		
.25 Trowel, 48" Walk-Behind		23.57		25.93	4.73	5.21
82 L.H., Daily Totals		$5110.98		$7529.98	$62.33	$91.83

Crew C-17C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.64	$86.68
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
.375 Equip. Oper. (crane)	61.45	184.35	91.55	274.65		
.375 Hyd. Crane, 80 Ton		546.75		601.42	6.59	7.25
83 L.H., Daily Totals		$5331.10		$7796.07	$64.23	$93.93

Crew C-17D	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.69	$86.74
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
.5 Equip. Oper. (crane)	61.45	245.80	91.55	366.20		
.5 Hyd. Crane, 80 Ton		729.00		801.90	8.68	9.55
84 L.H., Daily Totals		$5574.80		$8088.10	$66.37	$96.29

Crew C-17E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.50	$86.50
8 Skilled Workers	57.10	3654.40	85.90	5497.60		
1 Hyd. Jack with Rods		36.70		40.37	.46	.50
80 L.H., Daily Totals		$4636.70		$6960.37	$57.96	$87.00

Crew C-18	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.125 Labor Foreman (outside)	$46.40	$46.40	$69.25	$69.25	$44.62	$66.58
1 Laborer	44.40	355.20	66.25	530.00		
1 Concrete Cart, 10 C.F.		116.95		128.65	12.99	14.29
9 L.H., Daily Totals		$518.55		$727.89	$57.62	$80.88

Crew C-19	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.125 Labor Foreman (outside)	$46.40	$46.40	$69.25	$69.25	$44.62	$66.58
1 Laborer	44.40	355.20	66.25	530.00		
1 Concrete Cart, 18 C.F.		138.95		152.85	15.44	16.98
9 L.H., Daily Totals		$540.55		$752.10	$60.06	$83.57

Crew C-20	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.40	$70.54
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Gas Engine Vibrators		54.30		59.73		
1 Concrete Pump (Small)		423.65		466.01	7.47	8.21
64 L.H., Daily Totals		$3511.55		$5040.15	$54.87	$78.75

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	

Crew C-21	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$47.40	$70.54
5 Laborers	44.40	1776.00	66.25	2650.00		
1 Cement Finisher	51.80	414.40	75.90	607.20		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
2 Gas Engine Vibrators		54.30		59.73		
1 Concrete Conveyer		206.25		226.88	4.07	4.48
64 L.H., Daily Totals		$3294.15		$4801.01	$51.47	$75.02

Crew C-22	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Rodman Foreman (outside)	$60.90	$487.20	$91.05	$728.40	$59.19	$88.47
4 Rodmen (reinf.)	58.90	1884.80	88.05	2817.60		
.125 Equip. Oper. (crane)	61.45	61.45	91.55	91.55		
.125 Equip. Oper. (oiler)	52.50	52.50	78.25	78.25		
.125 Hyd. Crane, 25 Ton		73.34		80.67	1.75	1.92
42 L.H., Daily Totals		$2559.29		$3796.47	$60.94	$90.39

Crew C-23	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.48	$86.30
6 Skilled Workers	57.10	2740.80	85.90	4123.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30	21.41	23.55
80 L.H., Daily Totals		$6311.00		$8788.30	$78.89	$109.85

Crew C-23A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$49.83	$74.31
2 Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Crawler Crane, 100 Ton		2310.00		2541.00		
3 Conc. Buckets, 8 C.Y.		337.95		371.75	66.20	72.82
40 L.H., Daily Totals		$4641.15		$5885.15	$116.03	$147.13

Crew C-24	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Skilled Worker Foremen (out)	$59.10	$945.60	$88.90	$1422.40	$57.48	$86.30
6 Skilled Workers	57.10	2740.80	85.90	4123.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 150 Ton		2324.00		2556.40	29.05	31.95
80 L.H., Daily Totals		$6922.00		$9460.40	$86.53	$118.26

Crew C-25	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Rodmen (reinf.)	$58.90	$942.40	$88.05	$1408.80	$47.42	$73.15
2 Rodmen Helpers	35.95	575.20	58.25	932.00		
32 L.H., Daily Totals		$1517.60		$2340.80	$47.42	$73.15

Crew C-27	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Cement Finishers	$51.80	$828.80	$75.90	$1214.40	$51.80	$75.90
1 Concrete Saw		112.85		124.14	7.05	7.76
16 L.H., Daily Totals		$941.65		$1338.54	$58.85	$83.66

Crew C-28	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$51.80	$75.90
1 Portable Air Compressor, Gas		38.80		42.68	4.85	5.34
8 L.H., Daily Totals		$453.20		$649.88	$56.65	$81.23

Crew C-29	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Pressure Washer		97.35		107.08	12.17	13.39
8 L.H., Daily Totals		$452.55		$637.09	$56.57	$79.64

Crew C-30	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Concrete Mixer, 10 C.F.		147.15		161.87	18.39	20.23
8 L.H., Daily Totals		$502.35		$691.87	$62.79	$86.48

Crew C-31	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$51.80	$75.90
1 Grout Pump		321.75		353.93	40.22	44.24
8 L.H., Daily Totals		$736.15		$961.13	$92.02	$120.14

Crew C-32	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Cement Finisher	$51.80	$414.40	$75.90	$607.20	$48.10	$71.08
1 Laborer	44.40	355.20	66.25	530.00		
1 Crack Chaser Saw, Gas, 6 H.P.		73.25		80.58		
1 Vacuum Pick-Up System		74.95		82.44	9.26	10.19
16 L.H., Daily Totals		$917.80		$1300.22	$57.36	$81.26

Crew D-1	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Bricklayer	$53.70	$429.60	$80.90	$647.20	$48.70	$73.38
1 Bricklayer Helper	43.70	349.60	65.85	526.80		
16 L.H., Daily Totals		$779.20		$1174.00	$48.70	$73.38

Crew D-2	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$50.15	$75.50
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
.5 Carpenter	54.70	218.80	81.65	326.60		
44 L.H., Daily Totals		$2206.80		$3321.80	$50.15	$75.50

Crew D-3	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$49.94	$75.20
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
.25 Carpenter	54.70	109.40	81.65	163.30		
42 L.H., Daily Totals		$2097.40		$3158.50	$49.94	$75.20

Crew D-4	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Bricklayer	$53.70	$429.60	$80.90	$647.20	$49.15	$73.83
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Grout Pump, 50 C.F./hr.		190.35		209.38	5.95	6.54
32 L.H., Daily Totals		$1763.15		$2571.78	$55.10	$80.37

Crew D-5	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Bricklayer	53.70	429.60	80.90	647.20	53.70	80.90
8 L.H., Daily Totals		$429.60		$647.20	$53.70	$80.90

Crew D-6	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$48.94	$73.71
3 Bricklayer Helpers	43.70	1048.80	65.85	1580.40		
.25 Carpenter	54.70	109.40	81.65	163.30		
50 L.H., Daily Totals		$2447.00		$3685.30	$48.94	$73.71

Crew D-7	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Tile Layer	$51.70	$413.60	$75.55	$604.40	$46.65	$68.17
1 Tile Layer Helper	41.60	332.80	60.80	486.40		
16 L.H., Daily Totals		$746.40		$1090.80	$46.65	$68.17

Crew D-8	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$49.70	$74.88
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
40 L.H., Daily Totals		$1988.00		$2995.20	$49.70	$74.88

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew D-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$48.70	$73.38
3 Bricklayer Helpers	43.70	1048.80	65.85	1580.40		
48 L.H., Daily Totals		$2337.60		$3522.00	$48.70	$73.38

Crew D-10	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Bricklayer Foreman (outside)	$55.70	$445.60	$83.90	$671.20	$53.64	$80.55
1 Bricklayer	53.70	429.60	80.90	647.20		
1 Bricklayer Helper	43.70	349.60	65.85	526.80		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 12 Ton		432.65		475.92	13.52	14.87
32 L.H., Daily Totals		$2149.05		$3053.51	$67.16	$95.42

Crew D-11	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Bricklayer Foreman (outside)	$55.70	$445.60	$83.90	$671.20	$51.03	$76.88
1 Bricklayer	53.70	429.60	80.90	647.20		
1 Bricklayer Helper	43.70	349.60	65.85	526.80		
24 L.H., Daily Totals		$1224.80		$1845.20	$51.03	$76.88

Crew D-12	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Bricklayer Foreman (outside)	$55.70	$445.60	$83.90	$671.20	$49.20	$74.13
1 Bricklayer	53.70	429.60	80.90	647.20		
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
32 L.H., Daily Totals		$1574.40		$2372.00	$49.20	$74.13

Crew D-13	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Bricklayer Foreman (outside)	$55.70	$445.60	$83.90	$671.20	$52.16	$78.28
1 Bricklayer	53.70	429.60	80.90	647.20		
2 Bricklayer Helpers	43.70	699.20	65.85	1053.60		
1 Carpenter	54.70	437.60	81.65	653.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 12 Ton		432.65		475.92	9.01	9.91
48 L.H., Daily Totals		$2936.25		$4233.52	$61.17	$88.20

Crew D-14	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Bricklayers	$53.70	$1288.80	$80.90	$1941.60	$51.20	$77.14
1 Bricklayer Helper	43.70	349.60	65.85	526.80		
32 L.H., Daily Totals		$1638.40		$2468.40	$51.20	$77.14

Crew E-1	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.37	$90.80
1 Welder	60.30	482.40	93.30	746.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Welder, Gas Engine, 300 amp		148.75		163.63	6.20	6.82
24 L.H., Daily Totals		$1573.55		$2342.82	$65.56	$97.62

Crew E-2	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.64	$91.34
4 Struc. Steel Workers	60.30	1929.60	93.30	2985.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30	30.59	33.65
56 L.H., Daily Totals		$5052.60		$6999.50	$90.22	$124.99

Crew E-3	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.97	$94.33
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
1 Welder	60.30	482.40	93.30	746.40		
1 Welder, Gas Engine, 300 amp		148.75		163.63	6.20	6.82
24 L.H., Daily Totals		$1611.95		$2427.63	$67.16	$101.15

Crew E-3A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.97	$94.33
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
1 Welder	60.30	482.40	93.30	746.40		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Telescoping Boom Lift, to 40'		281.90		310.09	17.94	19.74
24 L.H., Daily Totals		$1893.85		$2737.72	$78.91	$114.07

Crew E-4	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.80	$94.08
3 Struc. Steel Workers	60.30	1447.20	93.30	2239.20		
1 Welder, Gas Engine, 300 amp		148.75		163.63	4.65	5.11
32 L.H., Daily Totals		$2094.35		$3174.03	$65.45	$99.19

Crew E-5	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Struc. Steel Foremen (outside)	$62.30	$996.80	$96.40	$1542.40	$60.03	$92.24
5 Struc. Steel Workers	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Welder	60.30	482.40	93.30	746.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
1 Welder, Gas Engine, 300 amp		148.75		163.63	23.27	25.60
80 L.H., Daily Totals		$6664.55		$9427.13	$83.31	$117.84

Crew E-6	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Struc. Steel Foremen (outside)	$62.30	$1495.20	$96.40	$2313.60	$59.96	$92.17
9 Struc. Steel Workers	60.30	4341.60	93.30	6717.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Welder	60.30	482.40	93.30	746.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Air Compressor, 160 cfm		212.30		233.53		
2 Impact Wrenches		90.30		99.33	16.91	18.60
128 L.H., Daily Totals		$9839.15		$14178.39	$76.87	$110.77

Crew E-7	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.03	$92.24
4 Struc. Steel Workers	60.30	1929.60	93.30	2985.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Welder Foreman (outside)	62.30	498.40	96.40	771.20		
2 Welders	60.30	964.80	93.30	1492.80		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
2 Welder, Gas Engine, 300 amp		297.50		327.25	25.13	27.64
80 L.H., Daily Totals		$6813.30		$9590.75	$85.17	$119.88

Crew E-8	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.73	$91.67
4 Struc. Steel Workers	60.30	1929.60	93.30	2985.60		
1 Welder Foreman (outside)	62.30	498.40	96.40	771.20		
4 Welders	60.30	1929.60	93.30	2985.60		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
4 Welder, Gas Engine, 300 amp		595.00		654.50	22.19	24.41
104 L.H., Daily Totals		$8519.60		$12072.40	$81.92	$116.08

Crew E-9	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Struc. Steel Foremen (outside)	$62.30	$996.80	$96.40	$1542.40	$59.96	$92.17
5 Struc. Steel Workers	60.30	2412.00	93.30	3732.00		
1 Welder Foreman (outside)	62.30	498.40	96.40	771.20		
5 Welders	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Lattice Boom Crane, 90 Ton		1713.00		1884.30		
5 Welder, Gas Engine, 300 amp		743.75		818.13	19.19	21.11
128 L.H., Daily Totals		$10131.55		$14500.03	$79.15	$113.28

Crew E-10	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.30	$94.85
1 Welder	60.30	482.40	93.30	746.40		
1 Welder, Gas Engine, 300 amp		148.75		163.63		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	62.42	68.67
16 L.H., Daily Totals		$1979.60		$2616.28	$123.72	$163.52

Crew E-11	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Painters, Struc. Steel	$47.20	$755.20	$75.80	$1212.80	$48.58	$75.14
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
1 Sandblaster, Portable, 3 C.F.		83.85		92.23		
1 Set Sand Blasting Accessories		15.55		17.11	9.45	10.39
32 L.H., Daily Totals		$1856.65		$2736.88	$58.02	$85.53

Crew E-11A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Painters, Struc. Steel	$47.20	$755.20	$75.80	$1212.80	$48.58	$75.14
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
1 Sandblaster, Portable, 3 C.F.		83.85		92.23		
1 Set Sand Blasting Accessories		15.55		17.11		
1 Telescoping Boom Lift, to 60'		292.45		321.69	18.58	20.44
32 L.H., Daily Totals		$2149.10		$3058.57	$67.16	$95.58

Crew E-11B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Painters, Struc. Steel	$47.20	$755.20	$75.80	$1212.80	$46.27	$72.62
1 Building Laborer	44.40	355.20	66.25	530.00		
2 Paint Sprayer, 8 C.F.M.		88.40		97.24		
1 Telescoping Boom Lift, to 60'		292.45		321.69	15.87	17.46
24 L.H., Daily Totals		$1491.25		$2161.74	$62.14	$90.07

Crew E-12	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$58.90	$89.55
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Welder, Gas Engine, 300 amp		148.75		163.63	9.30	10.23
16 L.H., Daily Totals		$1091.15		$1596.43	$68.20	$99.78

Crew E-13	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.03	$91.83
.5 Equip. Oper. (light)	55.50	222.00	82.70	330.80		
1 Welder, Gas Engine, 300 amp		148.75		163.63	12.40	13.64
12 L.H., Daily Totals		$869.15		$1265.63	$72.43	$105.47

Crew E-14	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$62.30	$96.40
1 Welder, Gas Engine, 300 amp		148.75		163.63	18.59	20.45
8 L.H., Daily Totals		$647.15		$934.83	$80.89	$116.85

Crew E-16	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.30	$94.85
1 Welder	60.30	482.40	93.30	746.40		
1 Welder, Gas Engine, 300 amp		148.75		163.63	9.30	10.23
16 L.H., Daily Totals		$1129.55		$1681.22	$70.60	$105.08

Crew E-17	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.30	$94.85
1 Structural Steel Worker	60.30	482.40	93.30	746.40		
16 L.H., Daily Totals		$980.80		$1517.60	$61.30	$94.85

Crew E-18	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.44	$92.84
3 Structural Steel Workers	60.30	1447.20	93.30	2239.20		
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Lattice Boom Crane, 20 Ton		1526.00		1678.60	38.15	41.97
40 L.H., Daily Totals		$3943.60		$5392.20	$98.59	$134.81

Crew E-19	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.37	$90.80
1 Structural Steel Worker	60.30	482.40	93.30	746.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Lattice Boom Crane, 20 Ton		1526.00		1678.60	63.58	69.94
24 L.H., Daily Totals		$2950.80		$3857.80	$122.95	$160.74

Crew E-20	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.72	$91.59
5 Structural Steel Workers	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Lattice Boom Crane, 40 Ton		2127.00		2339.70	33.23	36.56
64 L.H., Daily Totals		$5949.00		$8201.30	$92.95	$128.15

Crew E-22	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Skilled Worker Foreman (out)	$59.10	$472.80	$88.90	$711.20	$57.77	$86.90
2 Skilled Workers	57.10	913.60	85.90	1374.40		
24 L.H., Daily Totals		$1386.40		$2085.60	$57.77	$86.90

Crew E-24	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Structural Steel Workers	$60.30	$1447.20	$93.30	$2239.20	$59.98	$91.95
1 Equipment Operator (med.)	59.00	472.00	87.90	703.20		
1 Hyd. Crane, 25 Ton		586.70		645.37	18.33	20.17
32 L.H., Daily Totals		$2505.90		$3587.77	$78.31	$112.12

Crew E-25	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Welder Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$62.30	$96.40
1 Cutting Torch		12.95		14.24	1.62	1.78
8 L.H., Daily Totals		$511.35		$785.45	$63.92	$98.18

Crew E-26	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.64	$94.84
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
1 Welder	60.30	482.40	93.30	746.40		
.25 Electrician	63.70	127.40	94.65	189.30		
.25 Plumber	67.70	135.40	101.05	202.10		
1 Welder, Gas Engine, 300 amp		148.75		163.63	5.31	5.84
28 L.H., Daily Totals		$1874.75		$2819.03	$66.96	$100.68

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew E-27	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$59.72	$91.59
5 Struc. Steel Workers	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 12 Ton		475.80		523.38		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	30.22	33.24
64 L.H., Daily Totals		$5755.80		$7988.78	$89.93	$124.82

Crew F-3	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
4 Carpenters	$54.70	$1750.40	$81.65	$2612.80	$56.05	$83.63
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	11.90	13.08
40 L.H., Daily Totals		$2717.80		$3868.58	$67.94	$96.71

Crew F-4	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
4 Carpenters	$54.70	$1750.40	$81.65	$2612.80	$55.46	$82.73
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 55 Ton		990.15		1089.17	20.63	22.69
48 L.H., Daily Totals		$3652.15		$5060.36	$76.09	$105.42

Crew F-5	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$55.20	$82.39
3 Carpenters	54.70	1312.80	81.65	1959.60		
32 L.H., Daily Totals		$1766.40		$2636.40	$55.20	$82.39

Crew F-6	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$51.93	$77.47
2 Building Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	11.90	13.08
40 L.H., Daily Totals		$2553.00		$3622.18	$63.83	$90.55

Crew F-7	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$49.55	$73.95
2 Building Laborers	44.40	710.40	66.25	1060.00		
32 L.H., Daily Totals		$1585.60		$2366.40	$49.55	$73.95

Crew G-1	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Roofer Foreman (outside)	$50.20	$401.60	$81.35	$650.80	$44.99	$72.92
4 Roofers Composition	48.20	1542.40	78.15	2500.80		
2 Roofer Helpers	35.95	575.20	58.25	932.00		
1 Application Equipment		194.80		214.28		
1 Tar Kettle/Pot		209.95		230.94		
1 Crew Truck		168.15		184.97	10.23	11.25
56 L.H., Daily Totals		$3092.10		$4713.79	$55.22	$84.17

Crew G-2	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Plasterer	$49.85	$398.80	$74.25	$594.00	$46.27	$68.95
1 Plasterer Helper	44.55	356.40	66.35	530.80		
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Grout Pump, 50 C.F./hr.		190.35		209.38	7.93	8.72
24 L.H., Daily Totals		$1300.75		$1864.18	$54.20	$77.67

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew G-2A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Roofer Composition	$48.20	$385.60	$78.15	$625.20	$42.85	$67.55
1 Roofer Helper	35.95	287.60	58.25	466.00		
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Foam Spray Rig, Trailer-Mtd.		530.15		583.16		
1 Pickup Truck, 3/4 Ton		112.20		123.42	26.76	29.44
24 L.H., Daily Totals		$1670.75		$2327.78	$69.61	$96.99

Crew G-3	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Sheet Metal Workers	$65.45	$1047.20	$98.70	$1579.20	$54.92	$82.47
2 Building Laborers	44.40	710.40	66.25	1060.00		
32 L.H., Daily Totals		$1757.60		$2639.20	$54.92	$82.47

Crew G-4	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (outside)	$46.40	$371.20	$69.25	$554.00	$45.07	$67.25
2 Building Laborers	44.40	710.40	66.25	1060.00		
1 Flatbed Truck, Gas, 1.5 Ton		198.50		218.35		
1 Air Compressor, 160 cfm		212.30		233.53	17.12	18.83
24 L.H., Daily Totals		$1492.40		$2065.88	$62.18	$86.08

Crew G-5	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Roofer Foreman (outside)	$50.20	$401.60	$81.35	$650.80	$43.70	$70.83
2 Roofers Composition	48.20	771.20	78.15	1250.40		
2 Roofer Helpers	35.95	575.20	58.25	932.00		
1 Application Equipment		194.80		214.28	4.87	5.36
40 L.H., Daily Totals		$1942.80		$3047.48	$48.57	$76.19

Crew G-6A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Roofers Composition	$48.20	$771.20	$78.15	$1250.40	$48.20	$78.15
1 Small Compressor, Electric		39.30		43.23		
2 Pneumatic Nailers		55.40		60.94	5.92	6.51
16 L.H., Daily Totals		$865.90		$1354.57	$54.12	$84.66

Crew G-7	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$54.70	$81.65
1 Small Compressor, Electric		39.30		43.23		
1 Pneumatic Nailer		27.70		30.47	8.38	9.21
8 L.H., Daily Totals		$504.60		$726.90	$63.08	$90.86

Crew H-1	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Glaziers	$52.65	$842.40	$78.40	$1254.40	$56.48	$85.85
2 Struc. Steel Workers	60.30	964.80	93.30	1492.80		
32 L.H., Daily Totals		$1807.20		$2747.20	$56.48	$85.85

Crew H-2	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Glaziers	$52.65	$842.40	$78.40	$1254.40	$49.90	$74.35
1 Building Laborer	44.40	355.20	66.25	530.00		
24 L.H., Daily Totals		$1197.60		$1784.40	$49.90	$74.35

Crew H-3	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Glazier	$52.65	$421.20	$78.40	$627.20	$47.35	$71.03
1 Helper	42.05	336.40	63.65	509.20		
16 L.H., Daily Totals		$757.60		$1136.40	$47.35	$71.03

Crew H-4	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$51.44	$77.05
1 Carpenter Helper	42.05	336.40	63.65	509.20		
.5 Electrician	63.70	254.80	94.65	378.60		
20 L.H., Daily Totals		$1028.80		$1541.00	$51.44	$77.05

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew J-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Plasterers	$49.85	$1196.40	$74.25	$1782.00	$47.73	$71.09
2 Plasterer Helpers	44.55	712.80	66.35	1061.60		
1 Mixing Machine, 6 C.F.		113.35		124.69	2.83	3.12
40 L.H., Daily Totals		$2022.55		$2968.28	$50.56	$74.21
Crew J-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
3 Plasterers	$49.85	$1196.40	$74.25	$1782.00	$48.79	$72.41
2 Plasterer Helpers	44.55	712.80	66.35	1061.60		
1 Lather	54.10	432.80	79.00	632.00		
1 Mixing Machine, 6 C.F.		113.35		124.69	2.36	2.60
48 L.H., Daily Totals		$2455.35		$3600.28	$51.15	$75.01
Crew J-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Terrazzo Worker	$51.75	$414.00	$75.60	$604.80	$47.65	$69.63
1 Terrazzo Helper	43.55	348.40	63.65	509.20		
1 Floor Grinder, 22" Path		96.05		105.66		
1 Terrazzo Mixer		162.90		179.19	16.18	17.80
16 L.H., Daily Totals		$1021.35		$1398.85	$63.83	$87.43
Crew J-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Cement Finishers	$51.80	$828.80	$75.90	$1214.40	$49.33	$72.68
1 Laborer	44.40	355.20	66.25	530.00		
1 Floor Grinder, 22" Path		96.05		105.66		
1 Floor Edger, 7" Path		44.05		48.45		
1 Vacuum Pick-Up System		74.95		82.44	8.96	9.86
24 L.H., Daily Totals		$1399.05		$1980.95	$58.29	$82.54
Crew J-4A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Cement Finishers	$51.80	$828.80	$75.90	$1214.40	$48.10	$71.08
2 Laborers	44.40	710.40	66.25	1060.00		
1 Floor Grinder, 22" Path		96.05		105.66		
1 Floor Edger, 7" Path		44.05		48.45		
1 Vacuum Pick-Up System		74.95		82.44		
1 Floor Auto Scrubber		179.55		197.51	12.33	13.56
32 L.H., Daily Totals		$1933.80		$2708.46	$60.43	$84.64
Crew J-4B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Laborer	$44.40	$355.20	$66.25	$530.00	$44.40	$66.25
1 Floor Auto Scrubber		179.55		197.51	22.44	24.69
8 L.H., Daily Totals		$534.75		$727.51	$66.84	$90.94
Crew J-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Painters	$46.45	$743.20	$68.90	$1102.40	$48.20	$71.69
1 Building Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Air Compressor, 250 cfm		202.85		223.13		
1 Sandblaster, Portable, 3 C.F.		83.85		92.23		
1 Set Sand Blasting Accessories		15.55		17.11	9.45	10.39
32 L.H., Daily Totals		$1844.65		$2626.47	$57.65	$82.08
Crew J-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Painters	$46.45	$743.20	$68.90	$1102.40	$46.45	$68.90
1 Floor Belt Sander		50.20		55.22		
1 Floor Sanding Edger		25.20		27.72	4.71	5.18
16 L.H., Daily Totals		$818.60		$1185.34	$51.16	$74.08

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew K-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$51.75	$77.33
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	53.13	58.44
16 L.H., Daily Totals		$1678.05		$2172.26	$104.88	$135.77
Crew K-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$57.13	$87.57
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
1 Truck Driver (light)	48.80	390.40	73.00	584.00		
1 Flatbed Truck, Gas, 3 Ton		850.05		935.05	35.42	38.96
24 L.H., Daily Totals		$2221.25		$3036.66	$92.55	$126.53
Crew L-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician	$63.70	$509.60	$94.65	$757.20	$65.70	$97.85
1 Plumber	67.70	541.60	101.05	808.40		
16 L.H., Daily Totals		$1051.20		$1565.60	$65.70	$97.85
Crew L-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$48.38	$72.65
1 Carpenter Helper	42.05	336.40	63.65	509.20		
16 L.H., Daily Totals		$774.00		$1162.40	$48.38	$72.65
Crew L-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter	$54.70	$437.60	$81.65	$653.20	$59.64	$89.16
.5 Electrician	63.70	254.80	94.65	378.60		
.5 Sheet Metal Worker	65.45	261.80	98.70	394.80		
16 L.H., Daily Totals		$954.20		$1426.60	$59.64	$89.16
Crew L-3A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Carpenter Foreman (outside)	$56.70	$453.60	$84.60	$676.80	$59.62	$89.30
.5 Sheet Metal Worker	65.45	261.80	98.70	394.80		
12 L.H., Daily Totals		$715.40		$1071.60	$59.62	$89.30
Crew L-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Skilled Workers	$57.10	$913.60	$85.90	$1374.40	$52.08	$78.48
1 Helper	42.05	336.40	63.65	509.20		
24 L.H., Daily Totals		$1250.00		$1883.60	$52.08	$78.48
Crew L-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$60.75	$93.49
5 Struc. Steel Workers	60.30	2412.00	93.30	3732.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 25 Ton		586.70		645.37	10.48	11.52
56 L.H., Daily Totals		$3988.70		$5880.97	$71.23	$105.02
Crew L-5A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.09	$93.64
2 Structural Steel Workers	60.30	964.80	93.30	1492.80		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 25 Ton		1155.00		1270.50	36.09	39.70
32 L.H., Daily Totals		$3109.80		$4266.90	$97.18	$133.34

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	

Crew L-5B	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$62.33	$94.01
2 Structural Steel Workers	60.30	964.80	93.30	1492.80		
2 Electricians	63.70	1019.20	94.65	1514.40		
2 Steamfitters/Pipefitters	68.35	1093.60	102.00	1632.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (oiler)	52.50	420.00	78.25	626.00		
1 Hyd. Crane, 80 Ton		1458.00		1603.80	20.25	22.27
72 L.H., Daily Totals		$5945.60		$8372.60	$82.58	$116.29

Crew L-6	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Plumber	$67.70	$541.60	$101.05	$808.40	$66.37	$98.92
.5 Electrician	63.70	254.80	94.65	378.60		
12 L.H., Daily Totals		$796.40		$1187.00	$66.37	$98.92

Crew L-7	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$53.04	$79.11
1 Building Laborer	44.40	355.20	66.25	530.00		
.5 Electrician	63.70	254.80	94.65	378.60		
28 L.H., Daily Totals		$1485.20		$2215.00	$53.04	$79.11

Crew L-8	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Carpenters	$54.70	$875.20	$81.65	$1306.40	$57.30	$85.53
.5 Plumber	67.70	270.80	101.05	404.20		
20 L.H., Daily Totals		$1146.00		$1710.60	$57.30	$85.53

Crew L-9	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Labor Foreman (inside)	$44.90	$359.20	$67.00	$536.00	$50.19	$75.58
2 Building Laborers	44.40	710.40	66.25	1060.00		
1 Struc. Steel Worker	60.30	482.40	93.30	746.40		
.5 Electrician	63.70	254.80	94.65	378.60		
36 L.H., Daily Totals		$1806.80		$2721.00	$50.19	$75.58

Crew L-10	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.35	$93.75
1 Structural Steel Worker	60.30	482.40	93.30	746.40		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	19.82	21.81
24 L.H., Daily Totals		$1948.20		$2773.38	$81.17	$115.56

Crew L-11	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Wreckers	$44.40	$710.40	$67.40	$1078.40	$51.44	$77.26
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Hyd. Excavator, 2.5 C.Y.		1567.00		1723.70		
1 Loader, Skid Steer, 78 H.P.		446.30		490.93	62.92	69.21
32 L.H., Daily Totals		$3659.30		$4687.03	$114.35	$146.47

Crew M-1	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
3 Elevator Constructors	$90.30	$2167.20	$133.80	$3211.20	$85.79	$127.11
1 Elevator Apprentice	72.25	578.00	107.05	856.40		
5 Hand Tools		50.50		55.55	1.58	1.74
32 L.H., Daily Totals		$2795.70		$4123.15	$87.37	$128.85

Crew M-3	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Electrician Foreman (outside)	$65.70	$525.60	$97.65	$781.20	$67.62	$100.41
1 Common Laborer	44.40	355.20	66.25	530.00		
.25 Equipment Operator (med.)	59.00	118.00	87.90	175.80		
1 Elevator Constructor	90.30	722.40	133.80	1070.40		
1 Elevator Apprentice	72.25	578.00	107.05	856.40		
.25 S.P. Crane, 4x4, 20 Ton		143.59		157.95	4.22	4.65
34 L.H., Daily Totals		$2442.79		$3571.75	$71.85	$105.05

Crew M-4	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Electrician Foreman (outside)	$65.70	$525.60	$97.65	$781.20	$66.92	$99.38
1 Common Laborer	44.40	355.20	66.25	530.00		
.25 Equipment Operator, Crane	61.45	122.90	91.55	183.10		
.25 Equip. Oper. (oiler)	52.50	105.00	78.25	156.50		
1 Elevator Constructor	90.30	722.40	133.80	1070.40		
1 Elevator Apprentice	72.25	578.00	107.05	856.40		
.25 S.P. Crane, 4x4, 40 Ton		190.45		209.50	5.29	5.82
36 L.H., Daily Totals		$2599.55		$3787.09	$72.21	$105.20

Crew Q-1	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Plumber	$67.70	$541.60	$101.05	$808.40	$60.92	$90.92
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
16 L.H., Daily Totals		$974.80		$1454.80	$60.92	$90.92

Crew Q-1A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.25 Plumber Foreman (outside)	$69.70	$139.40	$104.00	$208.00	$68.10	$101.64
1 Plumber	67.70	541.60	101.05	808.40		
10 L.H., Daily Totals		$681.00		$1016.40	$68.10	$101.64

Crew Q-1C	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Plumber	$67.70	$541.60	$101.05	$808.40	$60.28	$89.92
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Trencher, Chain Type, 8' D		1894.00		2083.40	78.92	86.81
24 L.H., Daily Totals		$3340.80		$4241.40	$139.20	$176.72

Crew Q-2	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Plumbers	$67.70	$1083.20	$101.05	$1616.80	$63.18	$94.30
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
24 L.H., Daily Totals		$1516.40		$2263.20	$63.18	$94.30

Crew Q-3	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Plumber Foreman (inside)	$68.20	$545.60	$101.80	$814.40	$64.44	$96.17
2 Plumbers	67.70	1083.20	101.05	1616.80		
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
32 L.H., Daily Totals		$2062.00		$3077.60	$64.44	$96.17

Crew Q-4	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Plumber Foreman (inside)	$68.20	$545.60	$101.80	$814.40	$64.44	$96.17
1 Plumber	67.70	541.60	101.05	808.40		
1 Welder (plumber)	67.70	541.60	101.05	808.40		
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Welder, Electric, 300 amp		107.55		118.31	3.36	3.70
32 L.H., Daily Totals		$2169.55		$3195.91	$67.80	$99.87

Crew Q-5	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Steamfitter	$68.35	$546.80	$102.00	$816.00	$61.52	$91.83
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
16 L.H., Daily Totals		$984.40		$1469.20	$61.52	$91.83

Crews - Standard

Crew Q-6	Bare Costs Hr.	Bare Costs Daily	Incl. Subs O&P Hr.	Incl. Subs O&P Daily	Cost Per Labor-Hour Bare Costs	Cost Per Labor-Hour Incl. O&P
2 Steamfitters	$68.35	$1093.60	$102.00	$1632.00	$63.80	$95.22
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
24 L.H., Daily Totals		$1531.20		$2285.20	$63.80	$95.22

Crew Q-7	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Steamfitter Foreman (inside)	$68.85	$550.80	$102.75	$822.00	$65.06	$97.10
2 Steamfitters	68.35	1093.60	102.00	1632.00		
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
32 L.H., Daily Totals		$2082.00		$3107.20	$65.06	$97.10

Crew Q-8	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Steamfitter Foreman (inside)	$68.85	$550.80	$102.75	$822.00	$65.06	$97.10
1 Steamfitter	68.35	546.80	102.00	816.00		
1 Welder (steamfitter)	68.35	546.80	102.00	816.00		
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Welder, Electric, 300 amp		107.55		118.31	3.36	3.70
32 L.H., Daily Totals		$2189.55		$3225.51	$68.42	$100.80

Crew Q-9	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Sheet Metal Worker	$65.45	$523.60	$98.70	$789.60	$58.90	$88.83
1 Sheet Metal Apprentice	52.35	418.80	78.95	631.60		
16 L.H., Daily Totals		$942.40		$1421.20	$58.90	$88.83

Crew Q-10	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Sheet Metal Workers	$65.45	$1047.20	$98.70	$1579.20	$61.08	$92.12
1 Sheet Metal Apprentice	52.35	418.80	78.95	631.60		
24 L.H., Daily Totals		$1466.00		$2210.80	$61.08	$92.12

Crew Q-11	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Sheet Metal Foreman (inside)	$65.95	$527.60	$99.50	$796.00	$62.30	$93.96
2 Sheet Metal Workers	65.45	1047.20	98.70	1579.20		
1 Sheet Metal Apprentice	52.35	418.80	78.95	631.60		
32 L.H., Daily Totals		$1993.60		$3006.80	$62.30	$93.96

Crew Q-12	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Sprinkler Installer	$66.50	$532.00	$99.35	$794.80	$59.85	$89.42
1 Sprinkler Apprentice	53.20	425.60	79.50	636.00		
16 L.H., Daily Totals		$957.60		$1430.80	$59.85	$89.42

Crew Q-13	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Sprinkler Foreman (inside)	$67.00	$536.00	$100.10	$800.80	$63.30	$94.58
2 Sprinkler Installers	66.50	1064.00	99.35	1589.60		
1 Sprinkler Apprentice	53.20	425.60	79.50	636.00		
32 L.H., Daily Totals		$2025.60		$3026.40	$63.30	$94.58

Crew Q-14	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Asbestos Worker	$60.95	$487.60	$93.25	$746.00	$54.85	$83.90
1 Asbestos Apprentice	48.75	390.00	74.55	596.40		
16 L.H., Daily Totals		$877.60		$1342.40	$54.85	$83.90

Crew Q-15	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Plumber	$67.70	$541.60	$101.05	$808.40	$60.92	$90.92
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Welder, Electric, 300 amp		107.55		118.31	6.72	7.39
16 L.H., Daily Totals		$1082.35		$1573.11	$67.65	$98.32

Crew Q-16	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Plumbers	$67.70	$1083.20	$101.05	$1616.80	$63.18	$94.30
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Welder, Electric, 300 amp		107.55		118.31	4.48	4.93
24 L.H., Daily Totals		$1623.95		$2381.51	$67.66	$99.23

Crew Q-17	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Steamfitter	$68.35	$546.80	$102.00	$816.00	$61.52	$91.83
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Welder, Electric, 300 amp		107.55		118.31	6.72	7.39
16 L.H., Daily Totals		$1091.95		$1587.51	$68.25	$99.22

Crew Q-17A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Steamfitter	$68.35	$546.80	$102.00	$816.00	$61.50	$91.73
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38		
1 Welder, Electric, 300 amp		107.55		118.31	24.31	26.74
24 L.H., Daily Totals		$2059.35		$2843.28	$85.81	$118.47

Crew Q-18	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Steamfitters	$68.35	$1093.60	$102.00	$1632.00	$63.80	$95.22
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Welder, Electric, 300 amp		107.55		118.31	4.48	4.93
24 L.H., Daily Totals		$1638.75		$2403.51	$68.28	$100.15

Crew Q-19	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Steamfitter	$68.35	$546.80	$102.00	$816.00	$62.25	$92.77
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Electrician	63.70	509.60	94.65	757.20		
24 L.H., Daily Totals		$1494.00		$2226.40	$62.25	$92.77

Crew Q-20	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Sheet Metal Worker	$65.45	$523.60	$98.70	$789.60	$59.86	$89.99
1 Sheet Metal Apprentice	52.35	418.80	78.95	631.60		
.5 Electrician	63.70	254.80	94.65	378.60		
20 L.H., Daily Totals		$1197.20		$1799.80	$59.86	$89.99

Crew Q-21	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
2 Steamfitters	$68.35	$1093.60	$102.00	$1632.00	$63.77	$95.08
1 Steamfitter Apprentice	54.70	437.60	81.65	653.20		
1 Electrician	63.70	509.60	94.65	757.20		
32 L.H., Daily Totals		$2040.80		$3042.40	$63.77	$95.08

Crew Q-22	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Plumber	$67.70	$541.60	$101.05	$808.40	$60.92	$90.92
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	29.74	32.71
16 L.H., Daily Totals		$1450.60		$1978.18	$90.66	$123.64

Crew Q-22A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Plumber	$67.70	$541.60	$101.05	$808.40	$56.92	$84.91
1 Plumber Apprentice	54.15	433.20	80.80	646.40		
1 Laborer	44.40	355.20	66.25	530.00		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Hyd. Crane, 12 Ton		475.80		523.38	14.87	16.36
32 L.H., Daily Totals		$2297.40		$3240.58	$71.79	$101.27

Crews - Standard

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew Q-23	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Plumber Foreman (outside)	$69.70	$557.60	$104.00	$832.00	$65.47	$97.65
1 Plumber	67.70	541.60	101.05	808.40		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Lattice Boom Crane, 20 Ton		1526.00		1678.60	63.58	69.94
24 L.H., Daily Totals		$3097.20		$4022.20	$129.05	$167.59
Crew R-1	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$59.53	$88.46
3 Electricians	63.70	1528.80	94.65	2271.60		
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
48 L.H., Daily Totals		$2857.60		$4246.00	$59.53	$88.46
Crew R-1A	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician	$63.70	$509.60	$94.65	$757.20	$57.33	$85.17
1 Electrician Apprentice	50.95	407.60	75.70	605.60		
16 L.H., Daily Totals		$917.20		$1362.80	$57.33	$85.17
Crew R-1B	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician	$63.70	$509.60	$94.65	$757.20	$55.20	$82.02
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
24 L.H., Daily Totals		$1324.80		$1968.40	$55.20	$82.02
Crew R-1C	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
2 Electricians	$63.70	$1019.20	$94.65	$1514.40	$57.33	$85.17
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
1 Portable cable puller, 8000 lb.		102.65		112.92	3.21	3.53
32 L.H., Daily Totals		$1937.05		$2838.51	$60.53	$88.70
Crew R-2	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$59.81	$88.90
3 Electricians	63.70	1528.80	94.65	2271.60		
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 S.P. Crane, 4x4, 5 Ton		381.95		420.14	6.82	7.50
56 L.H., Daily Totals		$3731.15		$5398.55	$66.63	$96.40
Crew R-3	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$63.45	$94.33
1 Electrician	63.70	509.60	94.65	757.20		
.5 Equip. Oper. (crane)	61.45	245.80	91.55	366.20		
.5 S.P. Crane, 4x4, 5 Ton		190.97		210.07	9.55	10.50
20 L.H., Daily Totals		$1459.97		$2096.67	$73.00	$104.83
Crew R-4	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Struc. Steel Foreman (outside)	$62.30	$498.40	$96.40	$771.20	$61.38	$94.19
3 Struc. Steel Workers	60.30	1447.20	93.30	2239.20		
1 Electrician	63.70	509.60	94.65	757.20		
1 Welder, Gas Engine, 300 amp		148.75		163.63	3.72	4.09
40 L.H., Daily Totals		$2603.95		$3931.22	$65.10	$98.28

Crew No.	Bare Costs		Incl. Subs O&P		Cost Per Labor-Hour	
Crew R-5	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$55.87	$83.45
4 Electrician Linemen	63.70	2038.40	94.65	3028.80		
2 Electrician Operators	63.70	1019.20	94.65	1514.40		
4 Electrician Groundmen	42.05	1345.60	63.65	2036.80		
1 Crew Truck		168.15		184.97		
1 Flatbed Truck, 20,000 GVW		204.05		224.46		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
.2 Hyd. Crane, 55 Ton		198.03		217.83		
.2 Hyd. Crane, 12 Ton		95.16		104.68		
.2 Earth Auger, Truck-Mtd.		40.51		44.56		
1 Tractor w/Winch		377.65		415.42	13.59	14.95
88 L.H., Daily Totals		$6112.55		$8658.52	$69.46	$98.39
Crew R-6	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$55.87	$83.45
4 Electrician Linemen	63.70	2038.40	94.65	3028.80		
2 Electrician Operators	63.70	1019.20	94.65	1514.40		
4 Electrician Groundmen	42.05	1345.60	63.65	2036.80		
1 Crew Truck		168.15		184.97		
1 Flatbed Truck, 20,000 GVW		204.05		224.46		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
.2 Hyd. Crane, 55 Ton		198.03		217.83		
.2 Hyd. Crane, 12 Ton		95.16		104.68		
.2 Earth Auger, Truck-Mtd.		40.51		44.56		
1 Tractor w/Winch		377.65		415.42		
3 Cable Trailers		194.25		213.68		
.5 Tensioning Rig		55.75		61.33		
.5 Cable Pulling Rig		306.65		337.32	19.91	21.91
88 L.H., Daily Totals		$6669.20		$9270.84	$75.79	$105.35
Crew R-7	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$45.74	$68.94
5 Electrician Groundmen	42.05	1682.00	63.65	2546.00		
1 Crew Truck		168.15		184.97	3.50	3.85
48 L.H., Daily Totals		$2363.75		$3494.17	$49.24	$72.80
Crew R-8	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$56.57	$84.44
3 Electrician Linemen	63.70	1528.80	94.65	2271.60		
2 Electrician Groundmen	42.05	672.80	63.65	1018.40		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
1 Crew Truck		168.15		184.97	5.84	6.42
48 L.H., Daily Totals		$2995.55		$4361.59	$62.41	$90.87
Crew R-9	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$52.94	$79.24
1 Electrician Lineman	63.70	509.60	94.65	757.20		
2 Electrician Operators	63.70	1019.20	94.65	1514.40		
4 Electrician Groundmen	42.05	1345.60	63.65	2036.80		
1 Pickup Truck, 3/4 Ton		112.20		123.42		
1 Crew Truck		168.15		184.97	4.38	4.82
64 L.H., Daily Totals		$3668.35		$5379.98	$57.32	$84.06
Crew R-10	**Hr.**	**Daily**	**Hr.**	**Daily**	**Bare Costs**	**Incl. O&P**
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$60.17	$89.61
4 Electrician Linemen	63.70	2038.40	94.65	3028.80		
1 Electrician Groundman	42.05	336.40	63.65	509.20		
1 Crew Truck		168.15		184.97		
3 Tram Cars		219.60		241.56	8.08	8.89
48 L.H., Daily Totals		$3276.15		$4727.73	$68.25	$98.49

Crews - Standard

Crew R-11	Bare Costs Hr.	Bare Costs Daily	Incl. Subs O&P Hr.	Incl. Subs O&P Daily	Cost Per Labor-Hour Bare Costs	Cost Per Labor-Hour Incl. O&P
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$60.69	$90.26
4 Electricians	63.70	2038.40	94.65	3028.80		
1 Equip. Oper. (crane)	61.45	491.60	91.55	732.40		
1 Common Laborer	44.40	355.20	66.25	530.00		
1 Crew Truck		168.15		184.97		
1 Hyd. Crane, 12 Ton		475.80		523.38	11.50	12.65
56 L.H., Daily Totals		$4042.75		$5762.74	$72.19	$102.91

Crew R-12	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Carpenter Foreman (inside)	$55.20	$441.60	$82.40	$659.20	$51.90	$77.75
4 Carpenters	54.70	1750.40	81.65	2612.80		
4 Common Laborers	44.40	1420.80	66.25	2120.00		
1 Equip. Oper. (medium)	59.00	472.00	87.90	703.20		
1 Steel Worker	60.30	482.40	93.30	746.40		
1 Dozer, 200 H.P.		1520.00		1672.00		
1 Pickup Truck, 3/4 Ton		112.20		123.42	18.55	20.40
88 L.H., Daily Totals		$6199.40		$8637.02	$70.45	$98.15

Crew R-13	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$61.55	$91.52
3 Electricians	63.70	1528.80	94.65	2271.60		
.25 Equip. Oper. (crane)	61.45	122.90	91.55	183.10		
1 Equipment Oiler	52.50	420.00	78.25	626.00		
.25 Hydraulic Crane, 33 Ton		245.79		270.37	5.85	6.44
42 L.H., Daily Totals		$2831.09		$4114.27	$67.41	$97.96

Crew R-15	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$62.42	$92.78
4 Electricians	63.70	2038.40	94.65	3028.80		
1 Equipment Oper. (light)	55.50	444.00	82.70	661.60		
1 Telescoping Boom Lift, to 40'		281.90		310.09	5.87	6.46
48 L.H., Daily Totals		$3277.90		$4763.69	$68.29	$99.24

Crew R-15A	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$55.98	$83.32
2 Electricians	63.70	1019.20	94.65	1514.40		
2 Common Laborers	44.40	710.40	66.25	1060.00		
1 Equip. Oper. (light)	55.50	444.00	82.70	661.60		
1 Telescoping Boom Lift, to 40'		281.90		310.09	5.87	6.46
48 L.H., Daily Totals		$2969.10		$4309.29	$61.86	$89.78

Crew R-18	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.25 Electrician Foreman	$64.20	$128.40	$95.40	$190.80	$55.89	$83.05
1 Electrician	63.70	509.60	94.65	757.20		
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
26 L.H., Daily Totals		$1453.20		$2159.20	$55.89	$83.05

Crew R-19	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.5 Electrician Foreman	$64.20	$256.80	$95.40	$381.60	$63.80	$94.80
2 Electricians	63.70	1019.20	94.65	1514.40		
20 L.H., Daily Totals		$1276.00		$1896.00	$63.80	$94.80

Crew R-21	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Electrician Foreman	$64.20	$513.60	$95.40	$763.20	$63.71	$94.67
3 Electricians	63.70	1528.80	94.65	2271.60		
.1 Equip. Oper. (medium)	59.00	47.20	87.90	70.32		
.1 S.P. Crane, 4x4, 25 Ton		115.50		127.05	3.52	3.87
32.8 L.H., Daily Totals		$2205.10		$3232.17	$67.23	$98.54

Crew R-22	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.66 Electrician Foreman	$64.20	$338.98	$95.40	$503.71	$58.30	$86.62
2 Electricians	63.70	1019.20	94.65	1514.40		
2 Electrician Apprentices	50.95	815.20	75.70	1211.20		
37.28 L.H., Daily Totals		$2173.38		$3229.31	$58.30	$86.62

Crew R-30	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.25 Electrician Foreman (outside)	$65.70	$131.40	$97.65	$195.30	$51.98	$77.40
1 Electrician	63.70	509.60	94.65	757.20		
2 Laborers (Semi-Skilled)	44.40	710.40	66.25	1060.00		
26 L.H., Daily Totals		$1351.40		$2012.50	$51.98	$77.40

Crew R-31	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
1 Electrician	$63.70	$509.60	$94.65	$757.20	$63.70	$94.65
1 Core Drill, Electric, 2.5 H.P.		62.65		68.92	7.83	8.61
8 L.H., Daily Totals		$572.25		$826.12	$71.53	$103.26

Crew W-41E	Hr.	Daily	Hr.	Daily	Bare Costs	Incl. O&P
.5 Plumber Foreman (outside)	$69.70	$278.80	$104.00	$416.00	$58.78	$87.72
1 Plumber	67.70	541.60	101.05	808.40		
1 Laborer	44.40	355.20	66.25	530.00		
20 L.H., Daily Totals		$1175.60		$1754.40	$58.78	$87.72

Appendix D.4 (continued)

Caterpillar Handbook Pages

Caterpillar Performance Handbook

Edition 29

CATERPILLAR®

CONSTRUCTION & MINING TRUCKS
CONSTRUCTION & MINING TRACTORS

CONTENTS

Features:

- **Caterpillar four-stroke-cycle diesels** ... turbocharged, aftercooled, adjustment-free fuel system (direct injection).
- **Electronically-controlled automatic transmission** ... speed sensing device automatically shifts transmission between 1st and gear selected by operator.
- **Truck Production Management System (TPMS)** utilizes strut pressure sensors and an on-board microprocessor to determine payload weight, cycle segment times, delay times, actual clock time and date of each cycle.
- **Vital Information Management System (VIMS)** Monitors all vital machine functions. Keeps operator informed of current machine operating conditions, helps reduce downtime and allows service personnel easy access to data for fast accurate diagnosis. VIMS includes Production Management System.
- **Electronic Unit Injection (EUI)** in the 776D-793C and **Hydraulic Electronic Unit Injection (HEUI)** on 769D-775D electronically maintains fuel settings, provides automatic altitude and air filter restriction compensation, automatic variable timing, improved diagnostics and increased fuel efficiency.
- **Oil cooled disc brakes** provide retarding, service, parking, and secondary braking in one sealed, fade-resistant, maintenance-free unit. 769D-777D front brakes are caliper disc, can be switched out of the service system when not needed but activate as part of the secondary system. (Front oil-cooled brakes optional on 777D.) 784C-793C front brakes are oil-cooled disc.
- **Automatic Retarder Control (ARC)** electronically controls braking on grade to maintain faster downhill speeds and consistently higher engine speed.
- **Full hydraulic steering,** with front suspension cylinders serving as kingpins.
- **Four independent,** self-contained, oil-pneumatic suspension cylinders absorb loading and road shocks. Wide spacing for stability.
- **Dual slope body** has V-bottom for load balance and retention. Low loading height and center of gravity.
- **Quarry trucks** have single-slope flat floor for smooth, metered dumping into crushers or hoppers. Optional flat floor body available for 769D, 773D.
- **Integral Roll Over Protective Structure (ROPS)** cab standard on all models.
- **Separate hydraulic systems** prevents cross contamination.

Tractor Features:

- **Yoke type hitch** oscillates four ways to reduce frame stresses. Rugged turn stops prevent excessive wagon rotation either direction.
- **Rear platform** functions as a power train guard and provides safe, stable work area. Fenders and mud flaps protect from material thrown by tires.

NOTE: Listed features may be standard on some models. Optional on others. Contact your Caterpillar Dealer for specific information.

MODEL	**769D**		**769D**		**771D**	
Body Type	**Flat Floor**		**Dual Slope**		**Quarry**	
Gross Vehicle Weight	68 180 kg	**150,000 lb**	68 180 kg	**150,000 lb**	73 970 kg	**163,100 lb**
Chassis Weight*	22 950 kg	**50,600 lb**	22 950 kg	**50,600 lb**	22 950 kg	**50,600 lb**
Body Weight	7800 kg	**17,200 lb**	7330 kg	**16,170 lb**	10 350 kg	**22,820 lb**
Maximum Payload**	37 430 kg	**82,533 lb**	37 900 kg	**83,570 lb**	40 670 kg	**89,680 lb**
Standard Liner Weight	3300 kg	**7280 lb**	3160 kg	**6970 lb**	—	
Payload with Standard Liner	34 130 kg	**75,250 lb**	34 740 kg	**76,600 lb**	—	
Capacity:						
Struck (SAE)	16.5 m^3	**21.6 yd^3**	17 m^3	**22.2 yd^3**	20.2 m^3	**26.4 yd^3**
Heaped (2:1) (SAE)	24.2 m^3	**31.7 yd^3**	24.2 m^3	**31.7 yd^3**	27.5 m^3	**36 yd^3**
Distribution Empty:						
Front	**49.7%**		**49.8%**		**46.3%**	
Rear	**50.3%**		**50.2%**		**53.7%**	
Distribution Loaded:						
Front	**33.2%**		**33.3%**		**32.9%**	
Rear	**66.8%**		**66.7%**		**67.1%**	
Engine Model	**3408E**		**3408E**		**3408E**	
Number of Cylinders	**8**		**8**		**8**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	152 mm	**6"**	152 mm	**6"**	152 mm	**6"**
Displacement	18 L	**1099 in^3**	18 L	**1099 in^3**	18 L	**1099 in^3**
Flywheel Power	362 kW	**485 hp**	362 kW	**485 hp**	362 kW	**485 hp**
Gross Power	380 kW	**510 hp**	380 kW	**510 hp**	380 kW	**510 hp**
Standard Tires	**18.00R33(E-4)**		**18.00R33(E-4)**		**18.00R33(E-4)**	
Machine Clearance Turning Circle	19.8 m	**65'0"**	19.8 m	**65'0"**	19.8 m	**65'0"**
Fuel Tank Refill Capacity	530 L	**140 U.S. gal**	530 L	**140 U.S. gal**	530 L	**140 U.S. gal**
Top Speed (Loaded)	75 km/h	**47 mph**	75 km/h	**47 mph**	56 km/h	**35 mph**
GENERAL DIMENSIONS (Empty):						
Height to Canopy Rock Guard Rail	4.07 m	**13'4"**	4.03 m	**13'3"**	4.02 m	**13'2"**
Wheelbase	3.71 m	**12'2"**	3.71 m	**12'2"**	3.71 m	**12'2"**
Overall Length	8.73 m	**28'7"**	8.57 m	**28'1"**	8.73 m	**28'7"**
Loading Height (Empty)	3.19 m	**10'6"**	3.14 m	**10'4"**	3.40 m	**11'2"**
Height at Full Dump	7.75 m	**25'5"**	7.71 m	**25'3"**	7.74 m	**25'5"**
Body Length (Target Length)	5.43 m	**17'10"**	5.28 m	**17'4"**	5.52 m	**18'1"**
Width (Operating)	5.01 m	**16'5"**	5.01 m	**16'5"**	5.01 m	**16'5"**
Width (Shipping)***	3.95 m	**12'11"**	3.95 m	**12'11"**	3.95 m	**12'11"**
Front Tire Tread	3.10 m	**10'2"**	3.10 m	**10'2"**	3.10 m	**10'2"**

*Weights include lubricants, coolants, and 10% fuel.
**Maximum rating requires selection of proper tires and is dependent on selection of optional equipment. Gross vehicle weight should not be exceeded.
***Disassembled.

Caterpillar Performance Handbook

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CATERPILLAR PERFORMANCE HANDBOOK

a publication by Caterpillar Inc., Peoria, Illinois, U.S.A.

JANUARY 2011

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Performance information in this booklet is intended for estimating purposes only. Because of the many variables peculiar to individual jobs (including material characteristics, operator efficiency, underfoot conditions, altitude, etc.), neither Caterpillar Inc. nor its dealers warrant that the machines described will perform as estimated.

NOTE: Always refer to the appropriate Operation and Maintenance Manual for specific product information.

Materials and specifications are subject to change without notice.

WHEEL TRACTOR-SCRAPERS
TOWED SCRAPERS

CONTENTS

WHEEL TRACTOR-SCRAPERS

TOWED SCRAPERS

Specifications
- Tandem Powered
- Push-Pull

  

MODEL	627G		637G		657G	
Flywheel Power: Tractor	246/272 kW	**330/365 hp**	345/373 kW	**462/500 hp**	421/447 kW	**564/600 hp**
Scraper	178/198 kW	**239/266 hp**	198/211 kW	**266/283 hp**	306/337 kW	**410/451 hp**
Approx. Operating Weight (Empty)◀	37 922 kg	**83,604 lb**	51 963 kg	**114,559 lb**	68 384 kg	**150,760 lb**
Scraper Capacity: Struck	12 m^3	**15.7 yd^3**	18.3 m^3	**24 yd^3**	24.5 m^3	**32 yd^3**
Heaped	17 m^3	**22 yd^3**	26 m^3	**34 yd^3**	33.6 m^3	**44 yd^3**
Rated Load	23 950 kg	**52,800 lb**	37 013 kg	**81,600 lb**	47 174 kg	**104,000 lb**
Weight Distribution — Empty: Front	**59%**		**59%**		**58%**	
Rear	**41%**		**41%**		**42%**	
Weight Distribution — Loaded: Front	**50%**		**50%**		**50%**	
Rear	**50%**		**50%**		**50%**	
Engine Model: Tractor	**C15 ACERT**		**C18 ACERT**		**C18 ACERT**	
Scraper	**C9 ACERT**		**C9 ACERT**		**C15 ACERT**	
Rated Engine RPM: Tractor	**1800**		**1800**		**1800**	
Scraper	**2000**		**2000**		**1800**	
Displacement: Tractor	15.2 L	**928 in^3**	18.1 L	**1105 in^3**	18.1 L	**1105 in^3**
Scraper	8.8 L	**538 in^3**	8.8 L	**538 in^3**	15.2 L	**928 in^3**
Top Speed (Loaded)	51 km/h	**32 mph**	53 km/h	**33 mph**	53 km/h	**33 mph**
180° Curb-to-Curb Turning Width	11.7 m	**38'5"**	12.2 m	**40'1"**	14.2 m	**46'7"**
Tires — Tractor Drive	**33.25R29★★E3**		**37.25R35★★E3**		**40.5/75R39★★E3**	
Scraper	**33.25R29★★E3**		**37.25R35★★E3**		**40.5/75R39★★E3**	
Width of Cut	3.02 m	**9'11"**	3.51 m	**11'6"**	3.85 m	**12'8"**
Maximum Depth of Cut	333 mm	**13.1"**	437 mm	**17"**	440 mm	**17.3"**
Maximum Depth of Spread	522 mm	**20.6"**	480 mm	**18.9"**	660 mm	**26"**
Fuel Tank Refill Capacity: Tractor	**—**		**—**		**—**	
Scraper	1105 L	**292 U.S. gal**	1268 L	**335 U.S. gal**	1597 L	**424 U.S. gal**
GENERAL DIMENSIONS:						
Height to Top of Scraper	3.81 m	**12'6"**	4.18 m	**13'9"**	4.62 m	**15'2"**
Wheelbase	7.72 m	**25'4"**	8.77 m	**28'9"**	9.96 m	**32'8"**
Overall Length	12.88 m	**42'3"**	14.71 m	**48'3"**	16.2 m	**53'1"**
Overall Width	3.58 m	**11'9"**	3.94 m **	**12'11"**	4.35 m	**14'4"**
Shipping Width (Draft Arm on Inside of Bowl)	**—**		3.63 m *	**11'11"**	3.91 m **	**12'10"**
Scraper Tread	2.23 m	**7'4"**	2.46 m	**8'1"**	2.81 m	**9'3"**
Tractor Tread	2.20 m	**7'3"**	2.46 m	**8'1"**	2.63 m	**8'8"**
PUSH-PULL GENERAL DIMENSIONS:						
Operating Weight (Empty)◀	39 443 kg	**86,957 lb**	54 057 kg	**119,175 lb**	72 804 kg	**160,505 lb**
Overall Length	15.2 m	**49'7"**	16.64 m	**54'7"**	18.01 m	**59'1"**
Weight Distribution — Empty: Front	**59%**		**60%**		**58%**	
Rear	**41%**		**40%**		**42%**	
Weight Distribution — Loaded: Front	**51%**		**51%**		**51%**	
Rear	**49%**		**49%**		**49%**	

*Optional Shipping Configuration.
**Standard Shipping Configuration.
◀ Operating weight includes standard machine, coolant, lubricants, full fuel tank, and operator.

 

MODEL	637G			657G		
Flywheel Power: Tractor	345/373 kW		**462/500 hp**	421/447 kW		**564/600 hp**
Scraper	198/211 kW		**266/283 hp**	306/337 kW		**410/451 hp**
Approx. Operating Weight (Empty)	54 050 kg		**118,909 lb**	72 190 kg		**158,817 lb**
Scraper Capacity: Struck	31 m^3		**41 yd^3**	45 m^3		**59 yd^3**
Heaped	38 m^3		**50 yd^3**	56 m^3		**73 yd^3**
Rated Load	34 473 kg		**76,000 lb**	49 895 kg		**110,000 lb**
Approx. Operating Weight (Loaded)	88 409 kg		**194,909 lb**	121 933 kg		**268,817 lb**
Top Speed (Loaded)	53 km/h		**33 mph**	53 km/h		**33 mph**
180° Curb-to-Curb Turning Width	13.7 m		**44'10"**	15.6 m		**51'3"**
GENERAL DIMENSIONS:						
Height to Top of Scraper	4.18 m		**13'9"**	4.62 m		**15'2"**
Wheelbase	9.53 m		**31'3"**	11.01 m		**36'1"**
Overall Length	15.47 m		**50'9"**	17.21 m		**56'5"**
Overall Width	3.94 m	**	**12'11"**	4.35 m		**14'4"**
Shipping Width (Draft Arm on Inside of Bowl)	3.63 m	*	**11'11"**	3.91 m	**	**12'10"**
Scraper Tread	2.46 m		**8'1"**	2.81 m		**9'3"**
Tractor Tread	2.46 m		**8'1"**	2.63 m		**8'8"**

*Optional Shipping Configuration.
**Standard Shipping Configuration.

Coal Bowl

Coal Bowl Wheel Tractor-Scrapers are typically used for building and maintaining coal stockpiles and hauling coal to the supply system at coal power plants. The self-loading capability, large capacity, coal pile compaction, and high speed of Coal Bowl Wheel Tractor-Scrapers make them the tool of choice for moving coal both short and long distances. Coal Bowl Wheel Tractor-Scrapers are available in the 637G and 657G tandem engine models.

Coal Bowl Advantages:

- Load hoppers
- Manage coal stockpiles
- Compaction reduces risk of spontaneous combustion in coal stockpile
- Exclusively designed large capacity coal bowls

Notes:

- The 637G Coal Scraper is 736 mm **(29.0")** longer, the bowl sides are 476 mm **(18.7")** taller, and the apron is 499 mm **(19.6")** taller than its earthmoving counterpart.
- The 657G Coal Scraper is 1072 mm **(42.2")** longer, the bowl sides are 1010 mm **(39.8")** taller, the apron is 677 mm **(26.7")** taller, and the ejector is 944 mm **(37.2")** taller than its earthmoving counterpart.

WHEEL LOADERS
INTEGRATED TOOLCARRIERS

CONTENTS

WHEEL LOADERS

Features:

- **Cat heavy duty diesel engine.**
- **Productive operator environment. Excellent visibility.**
- **Automatic lift and bucket controls.**
- **Adjustable suspension seat and steering column.**
- **Four wheel enclosed wet disc brakes.**
- **Automatic power shift transmissions.** Allows operator to select automatic or manual mode.
- **Hydrostatic drive on 906H, 908H and 914G.**
- **Transmission neutralizer switch (924H, 924Hz, 928Hz, 930H, 938H-980H).**
- **Computerized machine function monitoring.**
- **Command control steering** with integrated transmission controls and electro-hydraulic controls … 950H-980H.
- **Lock up clutch on 990H and 994F (optional on 988H).**
- **Impeller clutch on 988H, 990H, 992K, 993K and 994F.**
- **Tilting hood … 938H-980H.**
- **Brake wear indicator.**
- **Limited slip differentials.**
- **Differential locks … 938H.**
- **Automatic Ride Control suspension system.** Operator select "on", "off" or "automatic".
- **Payload control system.**
- **Optional Fusion™ coupler system** for work tool interchangeability with pin-on performance. Work tools can interchange across the entire SWL/MWL/IT line.

Listed features may be standard on some models, optional or unavailable on others. Contact your Cat dealer for specific information.

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MODEL	**972H**		**980H**		**988H**		**990H**	
Flywheel Power: Net	214 kW	**287 hp**	260 kW	**349 hp**	373 kW	**501 hp**	468 kW	**627 hp**
Gross	229 kW	**307 hp**	293 kW	**392 hp**	414 kW	**555 hp**	512 kW	**687 hp**
Rated Payload*	—		—		11.4 t	**12.5 T**	15 t	**16.5 T**
Gross Rated Bucket Payload*	—		—		16 300 kg	**36,000 lb**	22 700 kg	**50,000 lb**
Engine Model	**C13 ATAAC**		**C15 ATAAC**		**C18 ACERT**		**C27 ACERT**	
Rated Engine RPM	**1800**		**1800**		**1800**		**2000**	
Bore	130 mm	**5.1"**	137 mm	**5.4"**	145 mm	**5.7"**	137 mm	**5.4"**
Stroke	157 mm	**6.2"**	171 mm	**6.75"**	183 mm	**7.2"**	152 mm	**6"**
No. Cylinders	**6**		**6**		**6**		**12**	
Displacement	12.5 L	**763 in³**	15.2 L	**928 in³**	18.1 L	**1104.5 in³**	27.1 L	**1666 in³**
Speeds Forward	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	7.2	**4.5**	6.6	**4.1**	6.7	**4.2**	7.0	**4.3**
2nd	12.6	**7.8**	11.8	**7.3**	11.8	**7.3**	12.1	**7.5**
3rd	21.4	**13.3**	20.7	**12.9**	20.8	**12.9**	20.8	**13.0**
4th	36.9	**22.9**	36.3	**22.6**	36.0	**22.3**	—	
Speeds Reverse								
1st	8.2	**5.1**	7.6	**4.7**	7.6	**4.7**	7.7	**4.8**
2nd	14.2	**8.8**	13.5	**8.4**	13.5	**8.4**	13.4	**8.3**
3rd	24.3	**15.1**	23.6	**14.7**	23.7	**14.7**	22.9	**14.2**
4th	38.8	**24.0**	41.5	**25.8**	—		—	
Hydraulic Cycle Time, Rated Load in Bucket:	**Seconds**		**Seconds**		**Seconds**		**Seconds**	
Raise	**5.9**		**6.0**		**9.4**		**9.2**	
Dump	**2.1**		**2.1**		**2.4**		**2.9**	
Lower (Empty, Float Down)	**2.4**		**3.4**		**3.8**		**3.8**	
Total	**10.4**		**11.5**		**15.6**		**15.9**	
Tread Width	2.23 m	**7'4"**	2.44 m	**8'0"**	2.59 m	**8'6"**	3.1 m	**10'2"**
Width Over Tires	3.00 m	**9'10"**	3.23 m	**10'7"**	3.54 m	**11'7"**	4.1 m	**13'5"**
Ground Clearance	494 mm	**20"**	442 mm	**17.4"**	549 mm	**22"**	478 mm	**18.8"**
Fuel Tank Capacity	380 L	**100 U.S. gal**	479 L	**127 U.S. gal**	712 L	**188 U.S. gal**	1074 L	**284 U.S. gal**
Hydraulic Tank Capacity	110 L	**29 U.S. gal**	125 L	**33 U.S. gal**	267 L	**70 U.S. gal**	174 L†	**46 U.S. gal**
Hydraulic System Capacity (includes tank)	200 L	**52 U.S. gal**	250 L	**66 U.S. gal**	470 L	**124 U.S. gal**	435 L†	**115 U.S. gal**

*Changes in bucket weight, including field installed wear iron, can impact rated payload. Consult your Cat dealer for assistance in selecting and configuring the proper bucket for the application. The Cat Large Wheel Loader Payload Policy is a guideline intended to maximize wheel loader structural and component life. The Cat Payload Policy is that the "Gross Bucket plus Payload Capacity" is the MAXIMUM weight that should be carried on the end of the Lift Arm/Boom.

†990H has a separate hydraulic system for steering and engine cooling fan. System (including tank) 194 L **(51 U.S. gal)**, tank only 132 L **(35 U.S. gal)**.

Wheel Loaders (cont'd)

Model	Product Ident. No. Prefix	Years Built	Flywheel Horse-power	Approx. Shipping Wt. kg (lb)	Rated Capacity m^3 (yd^3)	Breakout Force kg (lb)	Width Over Tires m (ft)	Ground Clearance mm (in)	Max. Reach at max. height mm (ft)	Dump Clearance at max. height m (ft)	Maximum Speeds km/h (mph) Fwd.	Rev.	Remarks
988	87A	63-76	325	35 800 **(79,000)**	4.6-5.4 **(6.0-7.0)**	21 380 **(47,130)**	3.20 **(10'7")**	570 **(22.5")**	1450 **(4'9")**	3.33 **(10'11")**	30.6 **(19.0)**	30.6 **(19.0)**	
988B	50W	76-93	375	43 365 **(95,600)**	5.4-6.3 **(7.0-8.25)**	36 330 **(80,100)**	3.52 **(11'7")**	474 **(18")**	2150 **(7'1")**	3.19 **(10'5")**	36.2 **(22.5)**	41.4 **(25.7)**	3408 Engine Z Bar Linkage
988F	8YG	93-95	400	43 540 **(95,900)**	5.4-6.1 **(7.0-8.0)**	37 363 **(82,371)**	3.52 **(11'7")**	496 **(19")**	1830 **(6'0")**	3.21 **(10'6")**	35.1 **(21.8)**	23.5 **(14.6)**	Bucket/HP increase STIC Steer
988F Series II	2ZR	95-00	475	45 678 **(100,492)**	6.1-6.9 **(8.0-9.0)**	37 400 **(82,282)**	3.52 **(11'7")**	496 **(1'7")**	1611 **(5'3")**	3.22 **(10'7")**	35.1 **(21.8)**	23.5 **(14.6)**	3048E HEUI Engine Axle Shaft Brakes
988G	2TW	01	475	50 040 **(110,320)**	6.3-7.0 **(8.2-9.2)**	46 950 **(103,500)**	3.47 **(11'5")**	549 **(21.6")**	2113 **(6'11")**	4.0 **(13'1")**	38.7 **(24.0)**	22.3 **(13.8)**	6 Bar Linkage "G" Series
988G	BNH	01-05	475	50 040 **(110,320)**	6.3-7.0 **(8.2-9.2)**	46 950 **(103,500)**	3.47 **(11'5")**	549 **(21.6")**	2113 **(6'11")**	4.0 **(13'11")**	38.6 **(24.0)**	25.1 **(15.6)**	6 Bar Linkage "G" Series
988H	BXY	05	501	49 546 **(109,249)**	6.4-7.0 **(8.33-9.2)**	378.4 **(85,068)**	3.47 **(11'5")**	549 **(22")**	5.85 **(19'2")**	3466 **(11'37")**	36 **(22.3)**	23.7 **(14.7)**	3.88 Meter Linkage
990	7HK	93-95	610	72 910 **(160,600)**	8.6 **(11.2)**	59 776 **(131,784)**	4.13 **(13'6")**	552 **(21.7")**	2070 **(6'10")**	3.99 **(13'1")**	22.5 **(14.0)**	25.0 **(15.5)**	ICTC & New Model
990 Series II	4FR	96-05	625	72 200 **(159,170)**	8.4-9.2 **(11-12)**	63 100 **(138,800)**	4.0 **(13'1")**	490 **(19.3")**	1990 **(6'6")**	4.05 **(13'3")**	22.5 **(14.0)**	25.0 **(15.5)**	HEUI Engine
990H	BWX	05	627	77 842 **(171,642)**	8.6-9.2 **(11.25-12)**	602 **(135,429)**	4.16 **(13'3")**	478 **(18'8")**	8.07 **(26'6")**	4220 **(13'10")**	22.4 **(13.92)**	24.8 **(15.41)**	Standard Lift 8.6 m^3/**11.2 yd^3** Bucket
992	25K	68-73	550	47 670 **(105,100)**	7.65 **(10.0)**	36 900 **(81,360)**	3.93 **(12'11")**	530 **(21")**	2820 **(8'3")**	4.52 **(14'10")**	35.6 **(22.1)**	38.5 **(23.8)**	
992B	25K	73-77	550	64 320 **(141,800)**	7.65 **(10.0)**	29 330 **(84,660)**	— **—**	— **—**	1930 **(6'4")**	4.34 **(14'3")**	40.2 **(25.0)**	43.6 **(27.1)**	
992C	42X	77-81	690	85 640 **(188,800)**	9.6 **(12.5)**	66 240 **(146,030)**	4.55 **(14'11")**	533 **(21")**	2310 **(7'7")**	4.17 **(13'8")**	21.1 **(13.1)**	23.3 **(14.5)**	3412 PCT Engine Z Bar Linkage
992C	49Z	81-92	690	88 430 **(194,950)**	10.4 **(13.5)**	66 285 **(146,132)**	4.50 **(14'9")**	544 **(21")**	2310 **(7'7")**	4.17 **(13'8")**	21.0 **(13.0)**	22.9 **(14.2)**	3412 DIT Engine
992D	7MJ	92-97	710	88 690 **(195,125)**	10.7 **(14.0)**	62 670 **(137,870)**	4.50 **(14'9")**	544 **(21")**	2300 **(7'7")**	4.17 **(13'8")**	21.0 **(13.0)**	22.9 **(14.2)**	
992G	7HR	98-00	800	91 540 **(201,810)**	11.5-12.3 **(15-16)**	62 650 **(137,840)**	4.5 **(14'9")**	691 **(27.2")**	2300 **(7'7")**	4.6 **(15'3")**	20.2 **(12.5)**	22.7 **(14.1)**	6 Bar Linkage "G" Series
992K	H4C	07	801	97 294 **(214,535)**	10.7-12.3 **(14-16)**	584.66 **(128,917)**	— **—**	682 **(2'2")**	9313 **(30'6")**	4480 **(14'8")**	20.6 **(12.8)**	22.4 **(13.9)**	10.7 m^3/**14 yd^3** Bucket
993K	Z9K	07	945	133 637 **(294,800)**	12.8-14.5 **(16.7-19)**	709 **(159,500)**	4.93 **(16'2")**	783 **(30'8")**	9313 **(30'7")**	4849 **(15'11")**	20.1 **(22.1)**	12.5 **(13.7)**	12.8 m^3/**16.7 yd^3** Bucket
994	9YF	90-98	1250	177 000 **(390,300)**	10.3 **(13.4)**	103 420 **(228,000)**	5.20 **(17'1")**	662 **(26")**	2692 **(8'10")**	6.20 **(20'4")**	24.7 **(15.0)**	26.6 **(16.5)**	

CATERPILLAR PERFORMANCE HANDBOOK

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Performance information in this booklet is intended for estimating purposes only. Because of the many variables peculiar to individual jobs (including material characteristics, operator efficiency, underfoot conditions, altitude, etc.), neither Caterpillar nor its dealers warrant that the machines described will perform as estimated.

NOTE: Always refer to the appropriate Operation and Maintenance Manual for specific product information.

Materials and specifications are subject to change without notice.

SEBD0351-48

ARTICULATED TRUCKS

CONTENTS

Features:

- **Cat® engines with ACERT™ Technology** meet U.S. EPA Tier 4 Final/EU Stage IV/Japan 2014 (Tier 4 Final), or Tier 2/Stage II/Japan 2001 (Tier 2) equivalent emission standards. The four core elements of meeting these standards are:

  I) Common Rail;

  II) Electronics, ADEM™ A4;

  III) Fuel delivery, Mechanical-activated Electronic Unit Injection (MEUI™ A-C);

  IV) Air Management, Wastegate Turbocharging, Air to Air Aftercooling (ATAAC) with the proven technology of a crossflow cylinder head.

- **Cat electronically controlled transmissions** … Transmissions purpose built and designed for articulated trucks and their applications. Advanced Productivity Electronic Control Strategy (APECS) delivering smooth shifting transmissions with improved acceleration and high productivity. Providing complete integration with the engines for efficient power delivery as well as offering advanced diagnostic and troubleshooting capabilities.

- **Articulating and fully oscillating hitch** … Links front and rear frames for exceptional maneuverability and traction on uneven terrain while eliminating damaging twisting of the frames. Bolted hitch design allows optimum material choices for the cast hitch head and the hard-wearing tube. Bolted design allows easier rebuild and repair.

- **Three-point front suspension** … Three-point front suspension with long-stroke, low-pressure suspension cylinders provide unparalleled ride quality for operator comfort and higher average haul speeds. Front and rear suspension together with the hitch provide for excellent traction in all conditions.

- **Wide, long and low dump body design** … For excellent loadability and high fill factors, excellent machine stability and load retention as well as a good match for other Cat loading systems. Diverging flow design also gives excellent material ejection.

- **Standard ROPS/FOPS, low sound level cab** … Two man cab common across the range. Large cab with excellent visibility, ergonomic control layout and plentiful storage.

- **High capacity low pressure tires in single formation** … For superior traction and flotation in poor underfoot conditions.

- **Bare Chassis offerings** … For certain applications the Caterpillar OEM Solutions Group offers non-dumper/Bare Chassis arrangements.

  Bare Chassis arrangements applications could include: water, service (fuel and lube), high capacity body (waste, coal, etc.), open body (log, pipe, etc.), container carrier, hook lift, tow, cable reel, etc. Please refer to specific OEM for additional information.

MODEL	725C2		730C2		730C2 EJ	
Gross Power — SAE J1995	239 kW	**320 hp**	280 kW	**375 hp**	280 kW	**375 hp**
Net Power — SAE J1349	234 kW	**314 hp**	274 kW	**367 hp**	274 kW	**367 hp**
Net Power — ISO 14396	236 kW	**316 hp**	276 kW	**370 hp**	276 kW	**370 hp**
Operating Weight (Empty)*	23 040 kg	**50,795 lb**	23 725 kg	**52,305 lb**	26 395 kg	**57,277 lb**
Top Speed (Loaded)	55 km/h	**34 mph**	55 km/h	**34 mph**	55 km/h	**34 mph**
Gross Machine Weight	47 040 kg	**103,707 lb**	51 725 kg	**114,034 lb**	54 515 kg	**119,270 lb**
Distribution Empty:						
Front	**63%**		**62%**		**59%**	
Center	**19%**		**19%**		**21%**	
Rear	**18%**		**19%**		**20%**	
Distribution Loaded:						
Front	**36%**		**34%**		**30%**	
Center	**32%**		**33%**		**35%**	
Rear	**32%**		**33%**		**35%**	
Max. Capacity**	24.0 t	**26.5 T**	28 t	**31 T**	28 t	**31 T**
Struck (SAE)	11 m^3	**14.4 yd^3**	13.3 m^3	**17.4 yd^3**	13.5 m^3	**17.7 yd^3**
Heaped (2:1) (SAE)	15 m^3	**19.6 yd^3**	17.5 m^3	**23 yd^3**	16.9 m^3	**22.1 yd^3**
Tailgate Heaped SAE 2:1	15.6 m^3	**20.4 yd^3**	18.8 m^3	**24.6 yd^3**	—	
Tailgate Struck	11.1 m^3	**14.5 yd^3**	13.9 m^3	**18.2 yd^3**	—	
Engine Model	**C9.3 ACERT**		**C13 ACERT**		**C13 ACERT**	
No. Cylinders	**6**		**6**		**6**	
Bore	115 mm	**4.53"**	130 mm	**5.12"**	130 mm	**5.12"**
Stroke	149 mm	**5.87"**	157 mm	**6.18"**	157 mm	**6.18"**
Displacement	9.3 L	**567 in^3**	12.5 L	**763 in^3**	12.5 L	**763 in^3**
Tires	**23.5R25**		**23.5R25**		**750/65/R26**	
Clearance Radius	8075 mm	**317.9"**	8075 mm	**317.9"**	8075 mm	**317.9"**
Fuel Tank Refill Capacity	412 L	**108.8 U.S. gal**	412 L	**108.8 U.S. gal**	412 L	**108.8 U.S. gal**
DEF Tank Capacity	20 L	**5.3 U.S. gal**	20 L	**5.3 U.S. gal**	20 L	**5.3 U.S. gal**
General Dimensions (Empty):						
Height to Cab Top	3482 mm	**137.1"**	3482 mm	**137.1"**	3461 mm	**136"**
Overall Length	10 547 mm	**415.2"**	10 555 mm	**415.6"**	10 376 mm	**408.5"**
Loading Height (Empty)	2725 mm	**107.3"**	2911 mm	**114.6"**	3025 mm	**119.1"**
Height at Full Dump	6306 mm	**248.3"**	6464 mm	**254.5"**	—	
Body Length	5696 mm	**224.3"**	5783 mm	**227.7"**	5340 mm	**210.2"**
Width (Operating — Over Mirrors)	3704 mm	**145.8"**	3704 mm	**145.8"**	3704 mm	**145.8"**

*Includes coolant, lubricant and full fuel tank.
**Rating dependent on optional equipment. Maximum gross weight (empty weight plus payload) should not be exceeded.

MODEL	725C2		730C2		730C2 EJ	
Gross Power — SAE J1995	239 kW	**320 hp**	280 kW	**375 hp**	280 kW	**375 hp**
Net Power — SAE J1349	234 kW	**314 hp**	274 kW	**367 hp**	274 kW	**367 hp**
Net Power — ISO 14396	236 kW	**316 hp**	276 kW	**370 hp**	276 kW	**370 hp**
Operating Weight (Empty)*	22 775 kg	**50,211 lb**	23 305 kg	**51,378 lb**	25 980 kg	**57,277 lb**
Top Speed (Loaded)	55 km/h	**34 mph**	55 km/h	**34 mph**	55 km/h	**34 mph**
Gross Machine Weight	46 775 kg	**103,121 lb**	51 305 kg	**113,107 lb**	54 100 kg	**119,270 lb**
Distribution Empty:						
Front	**62%**		**62%**		**58%**	
Center	**19%**		**19%**		**21%**	
Rear	**19%**		**19%**		**21%**	
Distribution Loaded:						
Front	**35%**		**34%**		**29%**	
Center	**33%**		**33%**		**36%**	
Rear	**32%**		**33%**		**35%**	
Max. Capacity**	24.0 t	**26.5 T**	28 t	**31 T**	28 t	**31 T**
Struck (SAE)	11 m^3	**14.4 yd^3**	13.3 m^3	**17.4 yd^3**	13.5 m^3	**17.7 yd^3**
Heaped (2:1) (SAE)	15 m^3	**19.6 yd^3**	17.5 m^3	**23 yd^3**	16.9 m^3	**22.1 yd^3**
Tailgate Heaped SAE 2:1	15.6 m^3	**20.4 yd^3**	18.8 m^3	**24.6 yd^3**	—	
Tailgate Struck	11.1 m^3	**14.5 yd^3**	13.9 m^3	**18.2 yd^3**	—	
Engine Model	**C9.3 ACERT**		**C13 ACERT**		**C13 ACERT**	
No. Cylinders	**6**		**6**		**6**	
Bore	115 mm	**4.53"**	130 mm	**5.12"**	130 mm	**5.12"**
Stroke	149 mm	**5.87"**	157 mm	**6.18"**	157 mm	**6.18"**
Displacement	9.3 L	**567 in^3**	12.5 L	**763 in^3**	12.5 L	**763 in^3**
Tires	**23.5R25**		**23.5R25**		**750/65/R26**	
Clearance Radius	8075 mm	**317.9"**	8075 mm	**317.9"**	8075 mm	**317.9"**
Fuel Tank Refill Capacity	412 L	**108.8 U.S. gal**	412 L	**108.8 U.S. gal**	412 L	**108.8 U.S. gal**
General Dimensions (Empty):						
Height to Cab Top	3482 mm	**137.1"**	3482 mm	**137.1"**	3461 mm	**136"**
Overall Length	10 547 mm	**415.2"**	10 555 mm	**415.6"**	10 376 mm	**408.5"**
Loading Height (Empty)	2725 mm	**107.3"**	2911 mm	**114.6"**	3025 mm	**119.1"**
Height at Full Dump	6306 mm	**248.3"**	6464 mm	**254.5"**	—	
Body Length	5696 mm	**224.3"**	5783 mm	**227.7"**	5340 mm	**210.2"**
Width (Operating — Over Mirrors)	3704 mm	**145.8"**	3704 mm	**145.8"**	3704 mm	**145.8"**

*Includes coolant, lubricant and full fuel tank.
**Rating dependent on optional equipment. Maximum gross weight (empty weight plus payload) should not be exceeded.

HYDRAULIC EXCAVATORS

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HYDRAULIC EXCAVATORS

Cycle Time Estimating Chart

Model		308E2 CR SB	311D LRR	312D, 312D L	315D L	319D L, 319D LN	M314F, M315D2	M316F, M317D2, M318F	M320F, M320D2	M322F, M322D2
Bucket Size	L	220	450	520	520	800	610	750	900	1050
	yd³	**0.30**	**0.59**	**0.68**	**0.68**	**1.05**	**0.80**	**0.98**	**1.18**	**1.37**
Soil Type		Packed Earth					Sand/Gravel			
Digging Depth	m	1.8	1.5	1.8	3.0	3.0	3.0	3.0	3.0	3.0
	ft	**6'0"**	**5'0"**	**6'0"**	**10'0"**	**10'0"**	**10'0"**	**10'0"**	**10'0"**	**10'0"**
Load Bucket	min	0.08	0.07	0.07	0.07	0.09	0.05	0.06	0.06	0.08
Swing Loaded	min	0.03	0.06	0.06	0.08	0.09	0.05	0.05	0.06	0.06
Dump Bucket	min	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.04
Swing Empty	min	0.08	0.05	0.05	0.06	0.07	0.04	0.04	0.05	0.05
Total Cycle Time	min	0.22	0.21	0.21	0.24	0.28	0.17	0.18	0.20	0.23

Cycle Time Estimating Chart

Model		320D2	320D RR, 321D CR, 323D2	324D	328D LCR	329D	336D	349D2, 349E, 349F	365C L	385C
Bucket Size	L	800	800	1000	N/A	1100	1400	2400	1900	3760
	yd³	**1.05**	**1.05**	**1.31**		**1.44**	**1.83**	**3.0**	**2.5**	**5.0**
Soil Type		Hard Clay								
Digging Depth	m	2.3	2.3	3.2	N/A	3.2	3.4	4.0	4.2	5.6
	ft	**8**	**8**	**10**		**10**	**11**	**13**	**14**	**18**
Load Bucket	min	0.09	0.09	0.09	N/A	0.09	0.09	0.13	0.10	0.19
Swing Loaded	min	0.06	0.06	0.06	N/A	0.06	0.07	0.07	0.09	0.06
Dump Bucket	min	0.03	0.03	0.04	N/A	0.04	0.04	0.02	0.04	0.03
Swing Empty	min	0.05	0.05	0.06	N/A	0.06	0.07	0.06	0.07	0.07
Total Cycle Time	min	0.23	0.23	0.25	N/A	0.25	0.27	0.28	0.30	0.35

N/A = Not Applicable

MINING & OFF-HIGHWAY TRUCKS

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MODEL	785C		785D		789D	
Body Type	**Dual Slope**		**Dual Slope**		**Dual Slope**	
Target Gross Machine Weight §	249 476 kg	**550,000 lb**	249 476 kg	**550,000 lb**	324 319 kg	**715,000 lb**
Basic Machine Weight*	59 385 kg	**130,922 lb**	46 240 kg	**101,942 lb**	48 554 kg	**107,043 lb**
Attachments**	21 602 kg	**47,624 lb**	35 781 kg	**78,885 lb**	52 249 kg	**115,190 lb**
Body Weight without Liners***	22 997 kg	**50,700 lb**	22 997 kg	**50,700 lb**	26 606 kg	**58,656 lb**
Full Liner	8113 kg	**17,886 lb**	8113 kg	**17,886 lb**	9692 kg	**21,367 lb**
Operating Machine Weight	112 097 kg	**247,132 lb**	113 131 kg	**249,412 lb**	137 101 kg	**302,256 lb**
Debris (3% of Operating Machine Weight)	3363 kg	**7414 lb**	3394 kg	**7482 lb**	4113 kg	**9068 lb**
Empty Operating Weight	115 460 kg	**254,546 lb**	116 525 kg	**256,894 lb**	141 214 kg	**311,324 lb**
Target Payload §	134.0 m tons	**147.7 tons**	133.0 m tons	**146.6 tons**	183.1 m tons	**201.8 tons**
Capacity:						
Heaped (2:1) (SAE) Base Body	78 m^3	**102 yd^3**	78 m^3	**102 yd^3**	108 m^3	**141 yd^3**
Heaped (2:1) (SAE) with Std. Sideboards	91 m^3	**119 yd^3**	91 m^3	**119 yd^3**	125 m^3	**161 yd^3**
Distribution Empty:						
Front	**45%**		**45.5%**		**46%**	
Rear	**55%**		**54.5%**		**54%**	
Distribution Loaded:						
Front	**33.3%**		**33.3%**		**33%**	
Rear	**66.7%**		**66.7%**		**66%**	
Engine Model	**3512B EUI**		**3512C HD-EUI**		**3516C HD**	
Number of Cylinders	**12**		**12**		**16**	
Bore	170 mm	**6.7"**	170 mm	**6.7"**	170 mm	**6.7 in**
Stroke	190 mm	**7.5"**	215 mm	**8.46"**	210 mm	**8.3 in**
Displacement	51.8 L	**3158 in^3**	58.56 L	**3574 in^3**	78.1 L	**4766 in^3**
Net Power	979 kW	**1313 hp**	979 kW	**1313 hp**	1468 kW	**1969 hp**
Gross Power	1082 kW	**1450 hp**	1082 kW	**1450 hp**	1566 kW	**2100 hp**
Standard Tires	**33.00R51**		**33.00R51**		**37.00R57**	
Machine Clearance Turning Circle	30.6 m	**100'5"**	33.2 m	**108'11"**	30.23 m	**99'2"**
Fuel Tank Refill Capacity	1893 L	**500 U.S. gal**	1893 L	**500 U.S. gal**	2082 L	**550 U.S. gal**
Top Speed (Loaded)	56.5 km/h	**35.1 mph**	56.5 km/h	**35.1 mph**	57.2 km/h	**35.5 mph**
GENERAL DIMENSIONS (Empty):						
Height to Canopy Rock Guard Rail	5.77 m	**19'0"**	5.68 m	**18'7"**	6.50 m	**21'4"**
Wheelbase	5.18 m	**17'0"**	5.18 m	**17'0"**	5.70 m	**18'8"**
Overall Length (Base Body)	11.02 m	**36'3"**	11.55 m	**37'9"**	12.72 m	**41'9"**
Loading Height (Base Body)	4.97 m	**16'4"**	4.97 m	**16'4"**	5.60 m	**18'4"**
Height at Full Dump	11.21 m	**36'10"**	11.81 m	**38'9"**	13.20 m	**43'4"**
Body Length (Target Length)	7.65 m	**25'2"**	7.65 m	**25'2"**	8.29 m	**27'3"**
Width (Operating)	6.64 m	**21'10"**	7.06 m	**23'2"**	7.65 m	**25'1"**
Width (Shipping)****	3.91 m	**12'10"**	3.91 m	**12'10"**	3.84 m	**12'7"**
Front Tire Tread	4.85 m	**15'11"**	4.85 m	**15'11"**	5.37 m	**17'8"**

*See Weight Definitions and Relations on page 18 of this section. Note: No mandatory or optional attachments or fuel.
**Typical selection of mandatory and optional attachments.
***Data provided is for a representative body and liner package. Several dual slope, flat floor, and mine specific design (MSD) bodies and liner packages are available. All weights, capacities, and dimensions are dependent on the machine configuration (body type, attachments, tires, and optional equipment selected).
****Disassembled.
§Reference Caterpillar's latest 10/10/20 Payload Policy for information on gross machine operating weight and target payload.
NOTE: Contact Mining Representative to use Caterpillar Weight Configurator for application specific weights.

USE OF BRAKE PERFORMANCE CURVES

The speed that can be maintained when the machine is descending a grade with retarder applied can be determined from the retarder curves in this section when gross machine weight and total effective grade are known.

Select appropriate grade distance chart that covers total downhill haul; don't break haul into individual segments.

To determine brake performance: Read from gross weight down to the percent effective grade. (Effective grade equals actual % grade *minus* 1% for each 10 kg/metric ton (20 lb/U.S. ton) of rolling resistance.) From this weight-effective grade point, read horizontally to the curve with the highest obtainable speed range, then down to maximum descent speed brakes can safely handle without exceeding cooling capacity. When braking, engine RPM should be maintained at the highest possible level without overspeeding. If cooling oil overheats, reduce ground speed to allow transmission to shift to next lower speed range.

Brake Performance Curves are made in compliance with ISO 10268 and applicable to Sea Level and 32° C (90° F) temperature. Contact Factory for Application Specific Performance.

USE OF RIMPULL-SPEED-GRADEABILITY CURVES

For best results, use Caterpillar Fleet Production and Cost Analysis (FPC) to simulate cycle time, fuel burn, and production for Application Specific Performance inquiries. Contact Factory Representative or visit catminer.cat.com/stb for more information.

(See Wheel Tractor Scraper Section)

Total Effective Grade (or Total Resistance) is grade assistance *minus* rolling resistance.

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example —

With a favorable grade of 20% and rolling resistance of 50 kg/metric ton (100 lb/U.S. ton), find Total Effective Grade.

(50 kg/metric ton) = 50 ÷ 10 = 5% Effective Grade
(from Rolling Resistance)
100 lb/ton = 100 ÷ 20 = 5% Effective Grade
20% (grade) – 5% (resistance) =
15% Total Effective Grade

TYPICAL FIXED TIMES FOR HAULING UNITS

Wait time, delays and operator efficiency all impact cycle time. Minimizing truck exchange time can have a significant effect on productivity.

Fixed time for hauling units include:
1. Truck load time (various with loading tool)
2. Truck maneuver in load area (Truck exchange) (Typically 0.6-0.8 min.)
3. Maneuver and dump time at dump point (Typically 1.0-1.2 min.)

Total cycle time is the combination of:
1. The above fixed time
2. Hauling time (Loaded)
3. Return time (Empty)

Example — assume load tool spots hauler with full bucket

		988F	5130B
cycle times		.60	.45
First pass	(dump time)	.10 min.	.05 min.
2 passes	(full cycle)	.70	.50
3 passes	"	1.30	.95
4 passes	"	1.90	1.40
5 passes	"	2.50	1.85
6 passes	"	3.10	2.30
7 passes	"	3.70	2.75
8 passes	"	4.30	3.20
9 passes	"	4.90	3.65
10 passes	"	5.40	4.10

NOTE: Other sizes of loading tools will have different cycle times. See Wheel Loader section for **average** cycle times for truck loading.

MOTOR GRADERS

CONTENTS

INDUSTRIES SERVED

The motor grader is one of the most versatile work tools in the Cat® product line. The M Series machines are used in numerous applications within a wide range of industries. The major industries using Cat motor graders, along with the typical applications within each, are summarized below.

- **Heavy Construction**
  - Highway Construction
  - Paving/Resurfacing
  - Airport Construction
  - Railroad Construction
  - Dam and Levee Construction
  - Haul Road Maintenance
- **Governmental**
  - Road Maintenance
  - Road Construction
  - Ditch Building/Cleaning
  - Snow Removal
- **Building Construction**
  - Residential Construction
  - Commercial Construction
  - Industrial Construction
  - Sewer and Water Systems
- **Industrial**
  - Waste Disposal
  - Pipeline Construction
- **Mining**
  - Haul Road Maintenance
  - Snow Removal
- **Forestry**
  - Access Road Construction
  - Forest Development
  - Snow Removal
  - Haul Road Maintenance
- **Geographic Versions** — Cat motor graders were specifically designed to meet the needs of different geographic regions and regulations. K/K2 Series for less regulated locations and M/M2/M3 Series are available with an assortment of standard features and optional equipment. All motor graders feature advanced electronically controlled Cat engines, power train components, hydraulics and machine structures.

FEATURES, M Series Motor Graders:

Building on the strong heritage of the H Series, the M Series delivers multiple technological breakthroughs, setting the new standard for motor graders. The H Series has been the industry standard in a variety of heavy construction, mining, road building and governmental applications. The M Series continues this tradition, incorporating revolutionary, customer-driven enhancements by:

– Improving ease of operation and operation training time
– Offering best-in-class operator station and unmatched visibility
– Delivering maximum productivity
– Improving availability and decreasing maintenance time

The M Series line includes eleven models: 120, 120 AWD, 140, 140 AWD, 160, 160 AWD, 12, 12 AWD, 14, 16, 24. The 120 through 14 meet construction, road building, and governmental applications. The All Wheel Drive models improve traction in poor underfoot conditions such as snow, mud, and sand. The 16 and 24 meet the specialized needs of large mining customers.

- **Operation Station:** The 120 through 16 models feature a revolutionary cab design that provides unmatched comfort, visibility, storage and ease of use, which can enhance operator confidence and productivity. The interior noise level is maintained between 70 and 74 dB(A) with the doors and windows closed.

  Ease of Operation. The revolutionary joystick controls and exceptional visibility make operating easier without sacrificing control. The intuitive joystick control pattern allows both new and experienced operators to become productive quickly. Logical grouping of hydraulic functions in the joysticks allow any operator to easily control several functions at the same time. This allows the operator to be more productive and remain comfortable throughout the work shift.

  Advanced Joystick Controls. Two electro-hydraulic joysticks reduce hand and wrist movement as much as 78% compared to conventional lever controls for greatly enhanced operator efficiency. The intuitive pattern is easy to learn and provides the precise implement control to allow both new and experienced operators to become productive quickly. Logical grouping of hydraulic functions in the joysticks allow any operator to control several functions at the same time for more productivity.

  Visibility. The 120 through 16 models boast excellent visibility to the work area, made possible with angled cab doors, a tapered engine enclosure and a patented sloped rear window. Ample glass area and carefully placed components provide excellent visibility to enhance operator confidence and productivity in all motor grader applications. The cab design gives the operator an exceptional view forward to the blade, working surface and front tires. The black glare-reducing paint on the front frame and engine enclosure enhances visibility.

- **Drawbar, Circle and Moldboard:** The 120 through 16 models provide a broad range of extended blade positions particularly beneficial in mid-range bank sloping, ditch cutting and ditch cleaning. A long wheel base allows for an aggressive blade angle permitting material to roll more freely, reducing power requirements. Top-accessible drawbar wear inserts and the shimless moldboard retention system make DCM adjustments fast and simple, delivering more precise material control while lowering operating costs.

  Top-Adjust Drawbar Wear Strips. The patented top-adjust wear strips dramatically reduce drawbar/circle adjustment time. By removing the access plates on top of the drawbar, shims and wear strips can easily be added or replaced. This feature reduces service downtime and lowers overall machine operating costs.

  Shimless Moldboard Retention System. The unique shimless moldboard retention system reduces the potential for blade chatter. Adjusting screws keep the moldboard's wear strips aligned for precise blade control and dramatic reductions in service time.

- **Power Train:** Integrated, electronically controlled systems, deliver smooth reliable performance with reduced operating costs.

  Smooth Shifting Transmission. The transmission design combines several key innovations to ensure smooth, powerful shifts throughout the gear range.

  Advanced Productivity Electronics Control Strategy (APECS). APECS utilizes an electronic control strategy to read the input from sensors to shift the transmission at the optimal point. Event based shifting allows operators to experience faster, smoother and more consistent shifts. Note: M Series 3 Only.

  Electronically Controlled Shifting. The full Electronic Clutch Pressure Control (ECPC) system optimizes inching modulation and smoothes shifting between all gears and directional changes. This provides outstanding control and also extends the life of the transmission by reducing stress on gears.

  Load Compensation. This standard feature ensures consistent shift quality regardless of blade or machine load.

  Hydraulic Brakes. The oil bathed, multi-disc service brakes are hydraulically actuated, providing smooth predictable braking and lower operating costs. With brakes located at each tandem wheel, the Cat motor graders offer the largest total brake surface area in the industry, delivering dependable stopping power and longer brake life.

- **Engine:** The Cat motor grader combines power management with ACERT™ Technology to deliver maximum power and efficiency while reducing the environmental impact.

  ACERT Technology. ACERT Technology allows Cat engines to supply more power per unit of displacement without causing premature wear. This breakthrough technology reduces emissions during the combustion process by using advanced technology in the air and fuel systems, in conjunction with integrated electronics. ACERT Technology enhances overall engine performance while dramatically reducing exhaust emissions.

  Power Management. Power Management utilizes Variable Horse Power (VHP) and Variable Horse Power Plus (VHP Plus) to optimize motor grader performance. VHP delivers additional power in the working gear while balancing fuel consumption, traction and horsepower. VHP Plus, delivers additional power in each forward gear 5th through 8th for increased speed on grade and performance.

  Exhaust Emission Standards. The Cat ACERT Technology engines in the M Series Motor Graders meet U.S. EPA Tier 3/EU Stage IIIA equivalent/Japan 2006 (Tier 3) emission standards. The M Series 2 machines meet U.S. EPA Tier 4 Interim/EU Stage IIIB/Japan 2011 (Tier 4 Interim) equivalent emission standards. The M Series 3 machines meet U.S. EPA Tier 4 Final/EU Stage IV/Japan 2014 (Tier 4 Final) emission standards.

- **Hydraulics:** Electro-hydraulics enable advanced machine controls with precise and predictable movements.

  Advanced Electro-Hydraulic System. The Cat motor grader product line incorporates a state-of-the-art electro-hydraulic system. This technology is the foundation for revolutionary changes of the machine and implement controls. Advanced joystick controls provide unmatched controllability with precise, predictable hydraulic movements and the reliability you expect from Cat products.

  Load Sensing Hydraulics (PPPC). The time proven load-sensing system and the advanced Proportional Priority Pressure-Compensating (PPPC, or "triple-PC") electro-hydraulic valves are designed to provide superior implement control and enhanced machine performance in all applications. Continuous matching of hydraulic flow and pressure to power demands creates less heat and reduces power consumption.

- **Serviceability:**

  Grouped Service Points. Grouped daily service points in the left side service center help ensure proper maintenance and inspection routines.

  Extended Service Intervals. Extended service intervals, such as 500-hour engine oil changes and 4000-hour hydraulic oil changes, reduce machine service time and increase availability.

  Ecology Drains. Conveniently located ecology drains shorten service times and help keep the environment safe by preventing spills.

  Diagnostics and Monitoring. Cat Messenger and Cat Message are offered as standard equipment to enhance diagnostic capabilities by displaying machine system errors and fault codes. Cat Electronic Technician is a two way communication tool that provides easy access to stored diagnostic data and lets technicians configure machine parameters through the Cat Data Link. Product Link™ provides a communication flow of vital machine data and location. Cat motor graders integrate Cat Messenger, Cat Electronic Technician, and S•O•S℠ analysis for easy monitoring and fast troubleshooting, keeping your machine up and running. Note: Cat Messenger is standard on M Series and M Series 2 only. Cat Message is standard on M Series 3 only.

- **Safety.** Safety is an integral part of all machine and system designs. Cat motor graders provide a safe working environment for both the operator and ground personnel. ROPS and FOPS structures meeting current SAE and ISO requirements are standard on all Global machines. Back-up alarms are a standard feature.

  Operator Presence System. The Operator Presence System keeps the parking brake engaged until the operator is seated for safe operation.

  Secondary Steering System. The standard secondary steering system automatically engages in case of a drop in steering pressure, allowing the operator to steer the machine to a stop.

  Speed Sensitive Steering. The steering software automatically provides an infinitely variable ratio between the joystick and the steer tires, resulting in less sensitive steering as the groundspeed increases.

  Hydraulic Lockout. A simple switch located in the cab disables all implement functions while still providing machine steering control. This safety feature is especially useful while the machine is roading.

  Circle Drive Slip Clutch. This standard feature protects the drawbar, circle and moldboard from shock loads when the end of the blade encounters immovable objects. It also reduces the possibility of abrupt directional changes in poor traction conditions, protecting the machine, operator and surroundings.

  Blade Lift Accumulators. This optional feature uses accumulators to help absorb impact loads to the moldboard by allowing vertical blade travel. Blade lift accumulators reduce unnecessary wear and help to avoid unintended machine movement for increased operator safety.

  Drop-Down Rear Lights. Optional drop-down lights fold out from the rear of the machine. This creates a wider, lower profile, to be better aligned with passenger cars.

  Rearview Camera. Visibility is further enhanced with an optional Work Area Vision System (WAVS) LCD color monitor in the cab.

- **Automatic Differential Lock/Unlock.** The Auto Diff-Lock feature automatically unlocks the differential during a turn, re-locks when straight, for easier operation and improved power train protection.

- **Swing Out Cooling Fan.** This standard feature allows for easy access to the cooling cores reducing time required for clean out. The latched door requires no tools for opening and closing. Note: M Series 2 and M Series 3 Only.

APPLICATIONS, Motor Graders:

The broad line of Cat motor graders allows the customer to choose a motor grader that best fits the intended application. Below is a summary of the typical motor grader applications.

Finish Grading

This application involves preparing a roadway or site surface for future paving or other construction activity. The material being moved is usually a hard, dry base material on a solid underfoot. Finish blading is the motor grader application that requires the highest degree of accuracy. Thus, it is primarily done at low operating speeds — usually less than 5 km/h (3 mph) — in gears 1 and 2. To ensure a smooth, even finished surface, one gear is usually maintained for a given pass. Pass lengths during this application are usually less than 600 m (2000 feet) for road construction and 150 m (500 feet) for site development. Most finish blading is performed by contractors in the Heavy Construction and Building Construction industries.

Heavy Blading

This application involves cutting, moving, and mixing material, usually in the initial stages of surface preparation. A variety of material types are moved in this manner, and the blade tip position varies accordingly. Full blade loads are usually experienced during heavy blading, since moving material is the primary goal. Pass lengths within this application vary, but are usually less than 600 m (2000 feet). Unlike finish blading, the speed of the machine is dependent on the load being moved when heavy blading material. Typical operating speeds are from 0-10 km/h (0 to 6 mph). Therefore, gears 2 through 4 are frequently used in this application. Most heavy blading activity is performed by contractors in the Heavy Construction, Governmental, Industrial, and Forestry industries.

Site Preparation

This application involves any material cutting, moving, and mixing necessary to prepare a residential, commercial, or industrial site for construction. A variety of materials are encountered in this application. Blade loads vary depending on the activity being performed. Both heavy blading and finish blading are performed when preparing a site. Pass lengths are typically in the range of 30-300 m (100 to 1000 feet). Typical operating speeds for site preparation vary depending on whether heavy blading or finish blading activities are being performed. Most site preparation activities are performed by contractors in the Building Construction industry.

Road Maintenance

This application involves reshaping dirt or gravel roads to maintain a crown or superelevation, or restoring the surface itself. This generally involves secondary roads maintained by governmental bodies such as townships and counties. Materials being moved in this application vary from extremely hard dirt bases to moist gravel surfaces. The typical blade load falls between that of finish blading and heavy blading. Pass lengths are frequently longer than 600 m (2000 feet) and can extend for miles. The general speed range for this application is 5-16 km/h (3 to 10 mph), corresponding to gears 2 (heavy dirt) through 5 (soft gravel). As with finish blading, accuracy of the graded surface is the primary concern in this application. Thus, frequent shifts should be avoided whenever possible. A gear should be chosen and maintained unless there is a significant change in the material being moved. Most road maintenance activities are performed by the Governmental industry.

Haul Road Maintenance

This application of the motor grader involves reshaping haul roads at mining, construction, or forestry work sites, usually for the purpose of maintaining smooth travel surfaces for equipment. Materials being moved while maintaining haul roads vary widely. Typical blade loads are about one-third to half of full capacity. Haul roads that experience large hauling units travelling on soft material may require heavy blade loads in order to reshape the road surface. Pass lengths vary depending on the application but can extend for miles on remote forestry or large mine haul roads. The general speed range for haul road maintenance is heavily dependent on the material being moved as well as the grade of the haul road. Many mine sites are in mountainous areas, requiring haul roads with steep grades. Generally, haul-road maintenance is performed at speeds similar to those required for general road maintenance 5-16 km/h (3 to 10 mph).

A travel surface that allows for the safe and efficient movement of machinery is the ultimate goal with this motor grader application. Very precise roadway elevations and slopes are desired but less crucial than when finish blading. Most haul road maintenance activities are performed by the Mining, Heavy Construction, and Forestry industries.

Side/Bank Slope Work

This application involves preparing side slopes or bank slopes along roadways by placing the moldboard on a sloped surface. Slopes of up to a 2:1 angle can be cut using a motor grader. Often the motor grader is operated on the level surface adjacent to the slope, and the moldboard is extended outward to the sloped surface. Fine soils are generally encountered in this application of the motor grader. Blade loads are usually less than half of the full blade capacity, and pass lengths are seldom longer than 600 m (2000 feet). A smooth-graded sloped surface is the primary concern in this application so frequent shifts should be avoided. The typical speed range is 0-6 km/h (0 to 4 mph), corresponding to a gear selection of 1 to 3. The nominal speed is heavily dependent on the type of material being moved and on the slope of the surface. Most side/bank slope work is performed by the Heavy Construction and Governmental industries.

Ditch Building/Cleaning

This application involves cutting "V" and flat-bottom ditches for drainage purposes and rebuilding them when necessary. Due to excessive rain and/or poor material, ditches often need cleaning and reshaping. When building ditches, materials with a wide range of densities are encountered. Blade loads vary accordingly, from half to full-blade capacity. Pass lengths are usually less than 600 m (2000 feet). The primary objective is to move material in a manner that yields a ditch with the desired slope. Ditch building often involves cutting and moving material of high density. Therefore, typical speed ranges vary. Most ditch building work, however, is performed in gears 1 through 3, corresponding to a maximum speed of about 8 km/h (5 mph). Ditch cleaning usually involves blading moist materials underneath a sod cover. Blade loads are usually less than half of full blade capacity when cleaning ditches, and pass lengths are similar to those encountered in ditch building. Typical maximum speeds for this activity are similar to that of ditch building, but less of a blade load is experienced. Ditch building and cleaning activities are usually performed by the Heavy Construction and Governmental industries.

Ripping/Scarifying

This application involves conditioning hard, rough soils before they are bladed. Shanks on the ripper and/or scarifier are pushed into the ground, thus breaking up otherwise hard surfaces. Hard materials such as asphalt can also be loosened in order to make grading operations less damaging to the moldboard. Rippers and scarifiers can also be used to mix aggregates together. The materials being ripped/ scarified are usually hard and dry. Rippers generally penetrate 150-300 mm (6 to 12 inches) into the ground, while scarifiers typically penetrate to a depth of 25-200 mm (1 to 8 inches). Pass lengths are generally less than 600 m (2000 feet) for both activities. Since the material being ripped/scarified is generally hard, the typical maximum speed for this application is about 6 km/h (4 mph) gears 1-2. If the ripper/scarifier is used for mixing aggregates, the typical operating range becomes 6-20 km/h (4 to 12 mph) gears 3-6. Most ripping/scarifying activities are performed by the Heavy Construction and Governmental industries.

Snow Removal

Snow removal is the process of cutting and removing snow or ice from the roadway. In addition to the standard motor grader moldboard, other attachments such as a snow wing, V-plow, one-way plow, or reversible plow can be used to remove the snow. The moldboard itself is the most commonly used attachment for snow plowing. It is used in areas where snow depths are low, the terrain is relatively flat, and where excessive drifting does not occur. A snow wing is a moldboard that attaches to the machine's right side. The wing's curvature lifts the snow and "wings" it off the plowed surface. The snow wing is often used in conjunction with the standard moldboard, where the moldboard cuts the material and feeds it onto the wing. V-plows are mounted in front of the motor grader and are designed to dig into and lift packed snow. The typical speed range for snow removal is 10-30 km/h (6 to 18 mph), corresponding to a gear range of 3 to 7. Snow plowing often involves lower speeds than snow removal. The typical operating range for snow plowing is 8-19 km/h (5 to 12 mph) gears 2 to 4. The majority of Snow Removal/Plowing operations are performed by the Governmental, Mining, and Forestry industries.

TRUCK TO MOTOR GRADER MATCH

	740	770	775	777	785	789	793	797
12/140/160								
14								
16								
18								
24								

NOTE: Calculations based on 30 degree blade angle, standard moldboard width.
May not be applicable in all applications depending on haul road damage.
Rule of thumb 2.5 times the truck width.

MODEL	14M3		16M3	
Base Power — Net	178 kW	**238 hp**	216 kW	**290 hp**
VHP Range — Net	178-213 kW	**238-285 hp**	216-259 kW	**290-348 hp**
VHP Plus Range — Net	180-215 kW	**241-289 hp**	—	
Operating Weight*	25 968 kg	**57,250 lb**	32 411 kg	**71,454 lb**
Engine Model	**C13 ACERT**		**C13 ACERT**	
Rated Engine RPM	**1850**		**2000**	
No. of Cylinders	**6**		**6**	
Displacement	12.5 L	**763 in^3**	12.5 L	**763 in^3**
Max. Torque:				
Tier 4 Final[1]	1542 N·m	**1137 lb-ft**	1771 N·m	**1306 lb-ft**
Tier 2 and Tier 3 Equivalent[2]	1542 N·m	**1137 lb-ft**	1721 N·m	**1270 lb-ft**
No. of Speeds Forward/Reverse	**8/6**		**8/6**	
Top Speed: Forward	50.5 km/h	**31.4 mph**	51.7 km/h	**32.1 mph**
Reverse	39.9 km/h	**24.8 mph**	40.8 km/h	**25.3 mph**
Std. Tires — Front and Rear	**20.5R25**		**23.5R25**	
Front Axle/Steering:				
Oscillation Angle	**32°**		**35°**	
Wheel Lean Angle — Left/Right	**17.1°/17.1°**		**18°/17°**	
Steering Angle	**50°**		**47.5°**	
Articulation Angle	**20°**		**20°**	
Minimum Turning Radius**	7.9 m	**25'11"**	9.3 m	**30'6"**
No. Circle Support Shoes	**6**		**6**	
Hydraulics:				
Pump Type	**Variable Piston**		**Variable Piston**	
Max. Pump Flow	257 L/min	**68 gpm**	280 L/min	**74 gpm**
Tank Capacity	64 L	**16.9 U.S. gal**	70 L	**18.5 U.S. gal**
Implement Pressure: Max.	24 100 kPa	**3495 psi**	24 750 kPa	**3590 psi**
Min.	3400 kPa	**493 psi**	3400 kPa	**493 psi**
Interior Sound Level/SAE J919:				
Tier 4 Final/EU Certified[1]	**73 dB(A)**		**71 dB(A)**	
Tier 2 and Tier 3 Equivalent[2]	**73 dB(A)**		**72 dB(A)**	
Electrical:				
System Size	**24V**		**24V**	
Std. Battery CCA @ 0° F	**1125**		**1400**	
Std. Alternator	**150**		**150**	
GENERAL DIMENSIONS:				
Height (to top of ROPS)	3566 mm	**140.4"**	3719 mm	**146.4"**
Overall Length	9677 mm	**381"**	10 593 mm	**417"**
With Ripper and Pushplate	10 899 mm	**429.1"**	12 051 mm	**474.4"**
Wheelbase	6616 mm	**260.5"**	7365 mm	**290"**
Blade Base	2880 mm	**113.4"**	3066 mm	**120.7"**
Overall Width (at top of front tires)	3050 mm	**120.1"**	3411 mm	**134.3"**
Standard Blade: Length	4267 mm	**14'0"**	4877 mm	**16'0"**
Height	585 mm	**23.0"**	787 mm	**31.0"**
Thickness	25.4 mm	**1.0"**	25 mm	**1.0"**
Lift Above Ground	438 mm	**17.2"**	400 mm	**15.7"**
Max. Shoulder Reach:***				
Frame Straight — Left	3460 mm	**136.2"**	2311 mm	**91"**
Frame Straight — Right	3350 mm	**131.9"**	2311 mm	**91"**
Fuel Tank Capacity	416 L	**109.9 U.S. gal**	496 L	**131 U.S. gal**

***Operating Weight** — based on standard machine configuration with full fuel tank, coolant, lubricants and operator.
****Minimum Turning Radius** — combining the use of articulated frame steering, front wheel steer and unlocked differential.
***Applicable for the standard blade with hydraulic sideshift and tip control. Maximum shoulder reach is obtainable to the right.
[1] Meets Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.
[2] Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent and Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.

TRAVEL SPEEDS @ MAXIMUM RPM WITH STD. TIRES (M/M2/M3 SERIES)

Gear		1		2		3		4		5		6		7		8	
		km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
120M	Forward	4.1	**2.6**	5.6	**3.5**	8.2	**5.1**	11.2	**7.0**	17.5	**10.8**	23.7	**14.8**	32.7	**20.3**	47.5	**29.5**
	Reverse	3.3	**2.0**	6.1	**3.8**	8.9	**5.5**	13.8	**8.6**	25.8	**16.0**	37.5	**23.3**	—	—	—	—
120M2	Forward	4.0	**2.5**	5.4	**3.4**	7.8	**4.8**	10.8	**6.7**	16.8	**10.4**	22.8	**14.2**	31.4	**19.5**	45.7	**28.4**
	Reverse	3.1	**1.9**	5.9	**3.9**	8.5	**5.3**	13.2	**8.2**	24.8	**15.4**	36.1	**22.4**	—	—	—	—
12M	Forward	4.0	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.8**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**22.9**	—	—	—	—
12M2	Forward	4.1	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**22.9**	—	—	—	—
12M3	Forward	4.1	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**23.0**	—	—	—	—
140M	Forward	4.0	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**22.9**	—	—	—	—
140M2	Forward	4.1	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**22.9**	—	—	—	—
140M3	Forward	4.1	**2.5**	5.5	**3.4**	8.0	**5.0**	11.0	**6.9**	17.1	**10.6**	23.3	**14.5**	32.0	**19.9**	46.6	**29.0**
	Reverse	3.2	**2.0**	6.0	**3.7**	8.7	**5.4**	13.5	**8.4**	25.3	**15.7**	36.8	**23.0**	—	—	—	—
160M	Forward	4.1	**2.5**	5.6	**3.5**	8.1	**5.0**	11.2	**7.0**	17.4	**10.8**	23.7	**14.7**	32.6	**20.3**	47.4	**29.5**
	Reverse	3.3	**2.0**	6.1	**3.8**	8.8	**5.5**	13.7	**8.5**	25.7	**16.0**	37.4	**23.3**	—	—	—	—
160M2	Forward	4.1	**2.6**	5.6	**3.5**	8.1	**5.1**	11.2	**7.0**	17.4	**10.8**	23.7	**14.7**	32.6	**20.3**	47.4	**29.5**
	Reverse	3.3	**2.0**	6.1	**3.8**	8.9	**5.5**	13.7	**8.5**	25.7	**16.0**	37.4	**23.3**	—	—	—	—
160M3	Forward	4.1	**2.6**	5.6	**3.5**	8.1	**5.1**	11.2	**7.0**	17.4	**10.8**	23.7	**14.7**	32.6	**20.3**	47.4	**29.5**
	Reverse	3.3	**2.0**	6.1	**3.8**	8.8	**5.5**	13.7	**8.5**	25.7	**16.0**	37.4	**23.3**	—	—	—	—
14M3	Forward	4.4	**2.7**	5.9	**3.7**	8.6	**5.3**	11.8	**7.4**	18.4	**11.4**	24.9	**15.5**	34.3	**21.3**	49.9	**31.0**
	Reverse	3.4	**2.1**	6.4	**4.0**	9.4	**5.8**	14.5	**9.0**	27.0	**16.8**	39.4	**24.5**	—	—	—	—
16M3	Forward	4.5	**2.8**	6.1	**3.8**	8.9	**5.5**	12.3	**7.6**	19.0	**11.8**	25.8	**16.0**	35.5	**22.0**	51.7	**32.1**
	Reverse	3.6	**2.2**	6.6	**4.1**	9.7	**6.0**	15.0	**9.3**	28.0	**17.4**	40.8	**25.3**	—	—	—	—
18M3	Forward	4.5	**2.8**	6.1	**3.8**	8.9	**5.5**	12.3	**7.6**	19.0	**11.8**	25.8	**16.0**	35.5	**22.0**	51.7	**32.1**
	Reverse	3.6	**2.2**	6.6	**4.1**	9.7	**6.0**	15.0	**9.3**	28.0	**17.4**	40.8	**25.3**	—	—	—	—
24M	Forward	3.7	**2.3**	5.7	**3.6**	9.7	**6.0**	15.1	**9.4**	28.0	**17.4**	43.4	**27.0**	—	—	—	—
	Reverse	5.5	**3.4**	14.5	**9.0**	41.6	**25.8**	—	—	—	—	—	—	—	—	—	—

NOTE: 120M speeds were calculated with a 628 mm **(24.7")** tire at 2000 rpm rated speed.
120M2 speeds were calculated with a 620 mm **(24.4")** tire at high idle, 2150 rpm.
12M2-160M2 speeds were calculated with a 655 mm **(25.8")** tire at high idle, 2150 rpm.
12M3-160M3 speeds were calculated with a 655 mm **(25.8")** tire at 2000 rpm rated speed.

11

PRODUCTION

The motor grader is used in a variety of applications in a variety of industries. Therefore, there are many ways to measure its operating capacity, or production. One method expresses a motor grader's production in relation to the area covered by the moldboard.

Formula:

$$A = S \times (L_e - L_o) \times 1000 \times E \quad \text{(Metric)}$$
$$A = S \times (L_e - L_o) \times 5280 \times E \quad \text{(English)}$$

where A: Hourly operating area (m^2/h or ft^2/h)
S: Operating speed (km/h or mph)
L_e: Effective blade length (m or ft)
L_o: Width of overlap (m or ft)
E: Job efficiency

Operating Speeds:

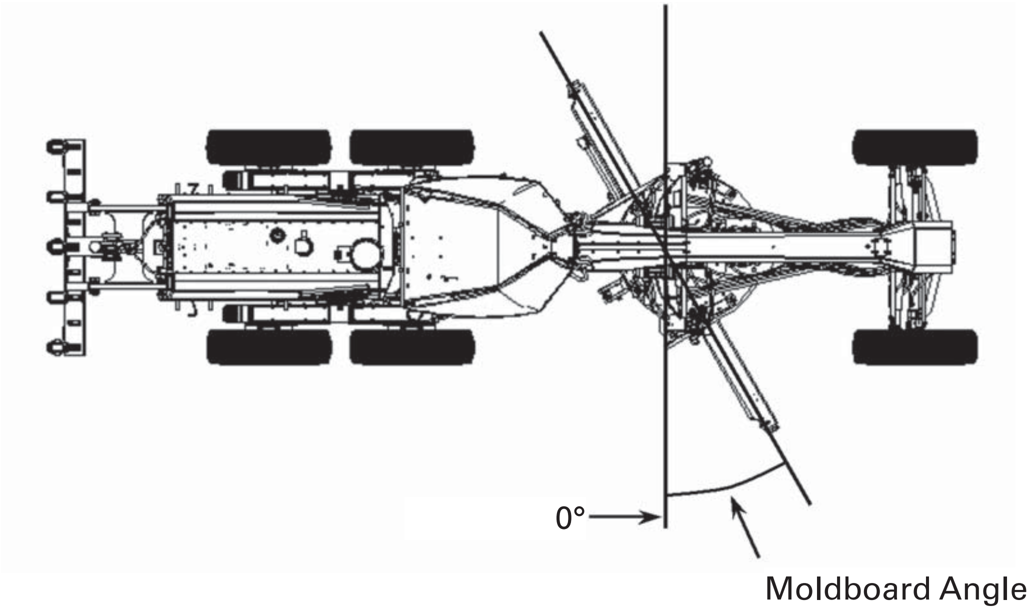
Typical operating speeds by application

Finish Grading:	0-4 km/h	(0-2.5 mph)
Heavy Blading:	0-9 km/h	(0-6 mph)
Ditch Repair:	0-5 km/h	(0-3 mph)
Ripping:	0-5 km/h	(0-3 mph)
Road Maintenance:	5-16 km/h	(3-9.5 mph)
Haul Road Maintenance:	5-16 km/h	(3-9.5 mph)
Snow Plowing:	7-21 km/h	(4-13 mph)
Snow Winging:	15-28 km/h	(9-17 mph)

Effective Blade Length:

Since the moldboard is usually angled when moving material, an effective blade length must be computed to account for this angle. This is the actual width of material swept by the moldboard.

NOTE: Angles are measured as shown below. The effective length becomes shorter as the angle increases.



Moldboard Length, m (ft)	Effective Length, m (ft) 30 degree blade angle	Effective Length, m (ft) 45 degree blade angle
3.658 **(12)**	3.17 **(10.4)**	2.59 **(8.5)**
4.267 **(14)**	3.70 **(12.1)**	3.02 **(9.9)**
4.877 **(16)**	4.22 **(13.9)**	3.45 **(11.3)**
7.315 **(24)**	6.33 **(20.8)**	5.17 **(17.0)**

For other blade lengths and carry angles:
Effective length = COS [Radians (Blade L)] 3 Blade Length

Width of Overlap:

The width of overlap is generally 0.6 m (2.0 ft). This overlap accounts for the need to keep the tires out of the windrow on the return pass.

Job Efficiency:

Job efficiencies vary based on job conditions, operator skill, etc.

A good estimation for efficiency is approximately 0.70 to 0.85, but actual operating conditions should be used to determine the best value.

Example problem:

A Cat motor grader with a 3.66 m (12 ft) moldboard is performing road maintenance on a township road. The machine is working at an average speed of 13 km/h (8 mph) with a moldboard carry angle of 30 degrees. What is the motor grader's production based on coverage area?

Note: Due to the long passes involved in road maintenance — fewer turnarounds — a higher job efficiency of 0.90 is chosen.

Solution:

From the table, the effective blade length is 3.17 m (10.4 ft).

Metric

Production, A = 13 km/h × (3.17 m − 0.6 m) × 1000 × 0.90
= 30 069 m²/hr (3.07 hectares/hr)

English

Production, A = 8 mph × (10.4 ft − 2.0 ft) × 5280 × 0.90
= 319,334 ft²/hr (7.33 acres/hr)

To pinpoint the theoretical number of motor graders required to properly maintain your haul roads, based on your specific mining applications, please download the haul road maintenance calculator on *https://catminer.cat.com.*

Haul road maintenance impacts cycle time, tire, frame and drive train components, safety and ultimately your cost per ton. To achieve optimal truck productivity, your haul roads must be properly maintained.

Moderate:
- Road Maintenance
- Pad Cleaning
- Rock Clearing
- Shoulder Sweeping

Difficult:
- Ripping
- Spreading Dump Material
- Road Profiling/Reshaping

BLADE PULL

This specification is also known as drawbar pull. This spec can be calculated as follows:

Variables:

Rear weight of machine = Wr

Tire traction coefficient = T (Look up the table entitled "Coefficient of Traction Factors")

Wr × T = Blade Pull

Example problem:

Calculate the blade pull for a 140M Global Version version machine operating in a quarry pit...

Metric

RW = 10 501 kg

T = 0.65

10 501 × 0.65 = 6825.65

English

RW = 23,151 lb

T = 0.65

23,151 × 0.65 = 15,048.15

BLADE DOWN PRESSURE

This spec can be calculated as follows:

Variables:

Blade to front axle length = BA

Wheel base length = WB

Weight on front wheels = FW

Blade down pressure = BD

$$\frac{\mathbf{WB}}{\mathbf{(WB - BA)}} \times \mathbf{FW = BD}$$

Example problem:

Calculate the blade down pressure for a 140M Global Version version machine...

Metric

BA = 2565 mm FW = 4223 kg

WB = 6086 mm BD = ?

$$\frac{\mathbf{6086}}{\mathbf{(6086 - 2565)}} \times \mathbf{4223 = 7299\ kg}$$

English

BA = 101 in FW = 9310 lb

WB = 240 in BD = ?

$$\frac{\mathbf{240}}{\mathbf{(240 - 101)}} \times \mathbf{9310 = 16{,}075\ lb}$$

This specification is only a minor indicator of a motor grader's productivity. It alone gives no measure of overall machine productivity. When considering motor grader production you need an optimum balance between the machine's front and rear weights. If a machine has too much weight on the front axle, it might have a high blade down pressure spec. It will, however, lack the essential rear weight and traction needed to push through the load. Too much weight in the rear and it will not have the necessary weight in the front during heavy cuts to maintain proper steering control.

Cat machines are built with this optimum balance in mind. A Cat motor grader is engineered with the proper weight distribution necessary for maximum productivity.

Effective Blade Length*

		Moldboard							
		3.66 m (12')		4.27 m (14')		4.88 m (16')		7.32 m (24')	
		m	ft	m	ft	m	ft	m	ft
Angle°	0°	3.66	**12.00**	4.27	**14.00**	4.88	**16.00**	7.32	**24.00**
	5°	3.64	**11.95**	4.25	**13.95**	4.86	**15.94**	7.29	**23.91**
	10°	3.60	**11.82**	4.20	**13.79**	4.80	**15.76**	7.21	**23.64**
	15°	3.53	**11.59**	4.12	**13.52**	4.71	**15.45**	7.07	**23.18**
	20°	3.44	**11.28**	4.01	**13.16**	4.58	**15.04**	6.87	**22.55**
	25°	3.32	**10.88**	3.87	**12.69**	4.42	**14.50**	6.63	**21.75**
	30°	3.17	**10.39**	3.69	**12.12**	4.22	**13.86**	6.33	**20.78**
	35°	3.00	**9.83**	3.50	**11.47**	4.00	**13.11**	5.99	**19.66**
	40°	2.80	**9.19**	3.27	**10.72**	3.74	**12.26**	5.61	**18.39**
	45°	2.59	**8.49**	3.02	**9.90**	3.45	**11.31**	5.17	**16.97**

*Effective blade length is the amount of blade coverage the machine is capable of when the blade is at a given angle.

11

EXTREME SLOPE OPERATION

There are two ways of defining slope work. The slope perpendicular to the machine's direction of travel is commonly referred to as "Side Sloping." The slope parallel to the machine's direction of travel — the machines ability to travel up or down terrain, is commonly referred to as "Gradeability."

Side Sloping capability for our Cat graders is somewhat subjective, but general agreement among professional operators is that working on a slope ratio of 2.5:1 (21.8 degrees) is the safe limit … an experienced operator may be able to operate on a 2:1 (28 degrees) slope. Many factors influence this limit such as operator experience, machine configuration, tires and soil conditions, but a 2.5:1 is achievable. Further, a 3:1 slope is the approximate maximum side slope a grader can work on in straight frame configuration. The steeper side slopes all require the machine be articulated to safely navigate the slope.

Gradeability is approximately 22 degrees. This is established by the grader's ability to stop without skidding the tires while moving downhill. The motor grader can, however, *climb* grades steeper than 22 degrees. The traction coefficient is the critical factor in determining whether a grader can safely navigate the slope. Caterpillar recommends that you never climb a slope steeper than you can safely descend.

Maximum lubrication angle: We have measured the graders on a tilt table and pump cavitation occurs around 30 degrees (58% or 1.7:1). This is beyond the grade or slope a motor grader can operate on.

When working side hills and slopes, consideration should be given to the following important points.

- **Speed of Travel** — At higher speeds, inertia forces tend to make the grader less stable.
- **Roughness of Terrain or Surface** — Ample allowance should be made where the terrain or surface is uneven.
- **Mounted Equipment** — Mounted attachments such as front plows, snow wings, rippers and other mounted equipment cause the tractor to balance differently.
- **Nature of Surface** — New earthen fills may give way with the weight of the grader. Rocky surfaces may promote side slipping of grader.
- **Excessive Loads or Side Draft** — This may cause wheel slippage, where the downhill tires "dig in," increasing the angle of grader.
- **Tire Selection and Maintenance** — Consideration should be given to proper tire selection and air pressure. For more information, consult Caterpillar publications — Motor Grader Tire Selection Guide and Operation and Maintenance Manual.
- **Drawbar, Circle and Blade Position** — The position of the blade can affect the stability of the machine.
- **Articulation Angle** — Articulation angle can affect the stability of the machine.
- **Wheel Lean Angle** — Wheel lean angle can affect the stability of the machine.

NOTE: Safe operation on steep slopes may require special machine maintenance as well as excellent operator skill and proper equipment setup for the specific application. Consult Caterpillar publications for further operating tips — Operation & Maintenance Manual, Motor Grader Application Guide, and the Grade Comparison Chart in the Tables section of this Performance Handbook.

Work Tool	120M/ 120M2	12M/ 12M2/ 12M3	140M/ 140M2/ 140M3	160M/ 160M2/ 160M3	16M3/ 18M3	14M3	24M
Lift Group	x	x	x	x	x	x	—
V-Plow	x	x	x	x	—	x	—
One Way Plow	x	x	x	x	—	x	—
Manual Reversible Plow	—	—	—	—	—	x	—
Hydraulic Reversible Plow	x	x	x	x	—	x	—
Snow Wing	x	x	x	x	—	x	—
Mid Mount Scarifier	x	x	x	—	—	—	—
Front Scarifier	x	x	x	x	—	x	—
Manual Angle Blade	x	x	x	x	—	x	—
Hydraulic Angle Blade	x	x	x	x	—	x	—
Straight Blade	x	x	x	x	x	x	—

This list is not all-inclusive.

See Price Lists, Cat Work Tools (Cat WT) Price List, and your Cat dealer for special attachment needs.

Attachments for Cat motor graders require additional hydraulics.

Most front-mounted attachments require a Quick Attach-Detach Parallel Lift Group.

TRACK LOADERS

CONTENTS

Features common to all D Series models (953D-963D-973D):

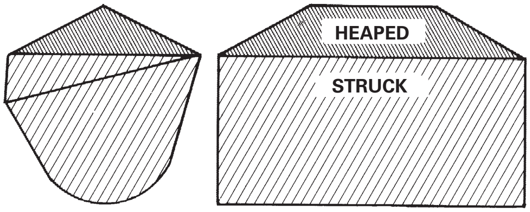
- **Improved serviceability.** All D Series Track-Type Loaders are equipped with a tiltable cab that allows complete service of the hydraulic system. Most daily maintenance checks are performed from the machine's right side, facilitating quick start up. Easy access to major components enhances serviceability and increase uptime.

- **Operator station.** Experience a high level of efficiency, comfort and productivity with the new D Series cab. The cab features a new gauge cluster, a fully air-suspension seat, the new seat mounted controls, an automatic air climate control and provides excellent visibility.

- **Messenger.** Messenger is a new electronic monitoring system with real time, visual feedback on engine and machine operating conditions. It provides information on diagnostic data, maintenance, and allows operating settings such as implement reactions.

- **Hydrostatic drive.** The closed loop hydrostatic drive with electronic control provides precise modulation for quick, smooth operation and superior maneuverability. Shorter cycle times, high efficiency, and excellent maneuverability results in increased productivity.

SAE BUCKET RATING



SAE Bucket Capacities

Struck capacity is that volume contained in a bucket after a load is leveled by drawing a straight edge resting on the cutting edge and the back of the bucket.

Heaped capacity is a struck capacity *plus* that additional material that would heap on the struck load at a 2:1 angle of repose with the struck line parallel to the ground.

SAE J742 (Oct. 79) specifies that the addition of any auxiliary spill guard to protect against spillage of material which might injure the operator will not be included in bucket capacity ratings. Buckets with irregular shaped cutting edges (vee edge) the strike plane should be drawn at one-third the distance of the protruding portion of the cutting edge. Cat rock buckets are built with integral see-through rock guards. Cat light material buckets come standard with bolt-on edges. These features which add to actual bucket capacity are included in published ratings.

Dump Height

SAE J732 JUN92 specifies that dump height is the vertical distance from the ground to the lowest point of the cutting edge with the bucket hinge pin at maximum height and the bucket at a 45° dump angle. Dump angle is the angle in degrees that the longest flat section of the inside bottom of the bucket will rotate below horizontal.

Static Tipping Load

The minimum weight at center of gravity of "SAE Rated" load in bucket which will rotate rear of machine to a point where, on track loaders, front rollers are clear of the track under the following conditions:

a. Loader on hard level surface and stationary.
b. Unit at standard operating weight.
c. Bucket at maximum rollback position.
d. Load at maximum forward position during raising cycle.
e. Unit with standard equipment as described in specifications unless otherwise noted under the heading.

Operating Load

In order to comply with SAE standard J818 MAY87, the operating load for track loaders should not exceed 35% of the Static Tipping load rating. See "Performance Data" of each machine in this handbook for increases to static tipping load by adding cab, counterweights, ripper-scarifier, etc.

SELECTING A MACHINE

Steps in selecting the proper size loader:

1. Determine production required or desired.
2. Determine loader cycle time and cycles per hour. A machine size must be assumed to select a basic cycle time.
3. Determine required payload per cycle in loose cubic yards and pounds (meters and kilograms).
4. Determine bucket size needed.
5. Make machine selection using bucket size and payload as criteria to meet production requirements.
6. Compare the loader cycle time used in calculations to the cycle time of the machine selected. If there is a difference, rework the process beginning at step 2.

1. Production Required

The production required of a track loader should be slightly greater than the production capability of the other critical units in the earth or material moving system. For example, if a hopper can handle 300 tons per hour, a loader capable of slightly more than 300 tons should be used. Required production should be carefully calculated so the proper machine and bucket selections are made.

2. Loader Cycle Times

Material type, pile height, and other factors may improve or reduce production, and should be added to or subtracted from the basic cycle time when applicable.

When hauls are involved, obtain haul and return portions of the cycle from the estimated travel chart (this section). Add the haul and return times to the estimated basic cycle time to obtain total cycle time.

CYCLE TIME FACTORS

A basic cycle time (Load, Dump, Maneuver) of 0.25-0.35 minutes is average for a track loader [the basic cycle for large track loaders, 2 m^3 (2.6 yd^3) and up, can be slightly longer], but variations can be authenticated in the field. The following values for many variable elements are based on normal operations. Adding or subtracting any of the variable times will give the total basic cycle time.

Estimating Cycle Time

Cycle time of a track loader needs to be determined to find loads per hour. Total cycle time includes the following segments:

Load Time + Maneuver Time + Travel Time + Dump Time

Load Time —

Material	Minutes
Uniform aggregates	0.03-0.05
Moist mixed aggregates	0.03-0.06
Moist loam	0.03-0.07
Soil, boulders, roots	0.04-0.20
Cemented materials	0.05-0.20

Maneuver Time — includes basic travel, four changes of direction and turning time, and will be about 0.20 minutes with a competent operator.

Travel Time — in a load and carry operation is comprised of haul and return times which can be determined by the travel charts in this section.

Dump Time — is dictated by the size and strength of the dump target and varies from 0.00 to 0.10 minutes. Typical dump times into highway trucks are from 0.04 to 0.07 minutes.

NOTE: When comparing hydrostatic track loaders with former power shift models (using the production estimating method) two factors must be considered: (1) The hydrostatic track loaders on the average outcycle power shift models by up to 10 percent due to faster machine speed and easier operation. (2) Larger, rear engine hydrostatic track loaders incorporate Z-bar linkage, which provides substantially better bucket fill factors. The degree to which each factor affects estimated production should be left to the user's judgment depending on the particular job application and conditions.

Example: Moist loam is being excavated from a bank and loaded into trucks.

	Minutes
Load — moist loam	0.05
Maneuver Time	0.20
Travel — none required	0.00
Dump	0.05
Total Cycle	0.30 min. or 200 cycles per 60 min. hour

	Minutes added (+) or Subtracted (–) From Basic Cycle
Materials	
— Mixed	+0.02
— Up to 3 mm (1/8 in)	+0.02
— 3 mm (1/8 in) to 20 mm (3/4 in)	–0.02
— 20 mm (3/4 in) to 150 mm (6 in)	0.00
— 150 mm (6 in) and over	+0.03 and Up
— Bank or broken	+0.04 and Up
Pile	
— Conveyor or Dozer piled 3 m (10 ft) and up	0.00
— Conveyor or Dozer piled 3 m (10 ft) or less	+0.01
— Dumped by truck	+0.02
Miscellaneous	
— Common ownership of trucks and loaders	Up to –0.04
— Independently owned trucks	Up to +0.04
— Constant operation	Up to –0.04
— Inconsistent operation	Up to +0.04
— Small target	Up to +0.04
— Fragile target	Up to +0.05

Using actual job conditions and the above factors, total cycle time can be estimated. Convert total cycle time to cycles per hour.

$$\text{Cycles per hour at 100\% Efficiency} = \frac{\text{60 Min}}{\text{Total Cycle Time in Minutes}}$$

Job efficiency is an important factor in machine selection. Efficiency is the actual number of minutes worked during an hour. Job efficiency accounts for operator breaks, and other work interruptions. See "Efficiency Considerations" in this section.

Bucket Fill Factors

The following indicates the approximate amounts of material as a percent of rated bucket capacity which will actually be delivered per bucket per cycle. This is known as "Bucket Fill Factor."

Loose Material	Fill Factor
Mixed Moist Aggregates	95-110%
Uniform Aggregates	
up to 3 mm (1/8 in)	95-110
3 mm-9 mm (1/8 in-3/8 in)	90-110
12 mm-20 mm (1/2 in-3/4 in)	90-110
24 mm and over (1 in)	90-110
Blasted Rock	
Well	80-95%
Average	75-90
Poor	60-75
Other	
Rock Dirt Mixtures	100-120%
Moist Loam	100-120
Soil, Boulders, Roots	80-100
Cemented Materials	85-100

Fill factors on track loaders are affected by bucket penetration, breakout force, rack back angle, bucket profile and ground engaging tools such as bucket teeth and segments or bolt-on replaceable cutting edges.

GENERAL PURPOSE BUCKET W/TEETH & SEGMENTS MAXIMUM OPERATING CAPACITIES

MODEL	GENERAL PURPOSE BUCKET SIZE m^3	GENERAL PURPOSE BUCKET SIZE yd^3	MAXIMUM OPERATING CAPACITY kg	MAXIMUM OPERATING CAPACITY lb
953D/953K	1.85	**2.4**	3182	**7015**
963D/963K	2.45	**3.2**	4214	**9290**
973D	3.21	**4.2**	5521	**12,174**

LOADER PRODUCTION

Loader production equals quantity of material the bucket carries per load × number of bucket loads per hour.

Estimating Bucket Load

The quantity of material in a loader bucket is estimated by two methods, depending on whether the material being loaded is in a loose or bank state.

1. When the material is loose, as in stockpile loading, the bucket load is estimated in loose meters (or cubic yards) by a Bucket Fill Factor (see Tables Section or chart following this discussion). The quantity of material is determined as follows:

   Rated Bucket Capacity × Bucket Fill Factor = Bucket Payload in Loose m^3 (yd^3)

   For example, a 973 with a 3.2 m^3 (4.2 yd^3) General Purpose bucket loading moist loam material will carry:

   3.2 m^3 × 1.15 = 3.68 loose cubic meters
   (4.2 yd^3 × 1.15 = 4.83 loose cubic yards)

   Once the potential bucket load has been determined, check the static tipping load ratings on the specific machine to determine if bucket load is in fact a safe operating load. *(Safe operating load as defined by SAE for track loaders should not exceed 35% of static tipping load.)*

   Productivity in many applications is measured in tons. See Tables Section for material densities if conversion to tons is desired.

2. When material is in the bank state, as in excavation, productivity is measured in bank meters (cubic yards). Bucket load in Bm^3 (BCY) is estimated by applying one of the load factors from the Tables section to convert the excavated material in the bucket from Bm^3 (BCY) to Lm^3 (LCY) to allow for the digging and carrying characteristics of the material. The quantity of excavated material a bucket carries is then determined as follows:

   Rated Bucket Capacity × Load Factor × Bucket Fill Factor = Bucket Payload in Bm^3 (BCY)

   Example: a 953D with a 1.85 m^3 (2.4 yd^3) General Purpose bucket loading wet loam earth from bank:

   1.85 m^3 × 0.79 × 1.15 = 1.68 Bm^3
   (2.4 yd^3 × 0.79 × 1.15 = 2.18 BCY)

Estimating Production

Machine and job considerations include:
- Machine model and bucket size
- Material type, particle size, density and load factor (see Tables Section)
- Bucket fill factor
- Haul distance
- Underfoot conditions
- Altitude
- Dump target size, height, and type

Example:

Conditions —

Machine	953D
Bucket size	1.85 m^3 (2.4 yd^3)
Material	Moist Loam
Bucket fill factor	1.15
Haul length	30 m (100 ft)
Dump target	Pile
Travel in forward speed	
Cycle Time	**Minutes**
Load time	0.15
Maneuver time	0.20
Travel time (from curves)	0.40
Dump time	0.05
Total	0.80

Loads Per Hour —

$$\frac{60\ \text{min/hr}}{0.80\ \text{min/cycle}} = \text{75 cycles per hour @ 100\% efficiency}$$

Load Per Cycle —

1.85 m^3 × 1.15 BFF = 2.13 Lm^3 × 0.81 LF = 1.72 Bm^3
(2.4 yd^3 × 1.15 BFF = 2.76 LCY × 0.81 LF = 2.24 BCY)

Hourly Production —

1.72 Bm^3 × 75 cycles/h = 129 Bm^3/h
(2.24 BCY × 75 cycles/hr = 168 BCY/hr)

More accurate production estimates can be made by recording actual machine cycle times in the same or similar application. Then visually verify the approximate bucket fill factor.

Efficiency Considerations

Loader capacity should always be matched to peak production requirements of the job. Actual "on-the-job" loader productivity will be influenced by factors such as operator skill, personal delays, job layout and other delays. Experience and knowledge of local conditions will be the best indicators of actual job efficiency.

Operation	Working Hour	Efficiency Factor
Day	50 min/Hr	0.83

An Alternative Machine Selection Method

Another method of selecting the right Track Loader and bucket to meet production requirements is by use of the nomographs on the following pages. The method is quicker and easier than the proceding example because it does not require as many calculations, yet the accuracy is about the same within the normal limits of input data.

Be careful when entering and reading data from the nomographs because some scales increase from bottom to top, while others are the reverse. Do not be overly concerned with the precision as affected by pencil line width or reading to the hundredth of a m^3 (yd^3). Remember that bucket fill factor, material density, and cycle time are at best close estimates.

Example problem

A track loader must produce 200 Lm^3 (262 LCY) per hour. Estimated cycle time is 0.5 minutes, working 50 minutes per hour. Bucket fill factor is 110% and the material density is 1600 kg/Lm^3 (2700 lb/LCY).

Determine bucket size, machine model and hourly production in tons and yards.

Solution

At full efficiency, it will cycle 120 times per hour. Since only an average 50 minutes are available, only 100 cycles will be completed per hour.

Starting on Scale A at 100 cycles per hour draw a straight line intersecting 200 m^3/hr (262 yd^3/hr) on Scale B and continuing the line on to Scale C giving 2.0 m^3 (2.62 yd^3) required payload.

Follow steps 1 through 7 on the next two pages.

● ● ●

TRACK-TYPE TRACTORS
Hydraulic Controls
Bulldozers
Rippers and Winches

CONTENTS

TRACK-TYPE TRACTORS

HYDRAULIC CONTROLS

BULLDOZERS

RIPPERS

WINCHES

PACCAR

Allied

TRACK-TYPE TRACTORS

Features:

- **Cat® Diesel Engines** provide the power, high torque rise, reliability and performance you can depend on.
- **HEUI™** on D6R and D7R increases fuel efficiency, reduces smoke, improves cold starting and enhances diagnostic capabilities.
- **Mechanical Electronic Unit Injector (MEUI™)** on D8T, D9T, D10T2 and D11T excels in its ability to control injection pressure over the entire engine operating speed range. It combines the technical advancement of an electronic control system with the simplicity of direct mechanically controlled unit fuel injection. These features allow the engine to have complete control over injection timing, duration, and pressure.
- **Common Rail fuel injection system** on D3K2, D4K2, D5K2, D6K2, D5R2, D6N, D6T and D7E machines; optimizes performance and fuel consumption, minimizes heat rejection, and lowers emissions.

- **Oil cooled steering clutches and brakes** standard on D9R, D10T2 and D11T.
- **Finger Tip Controls (FTC)** of transmission, steering clutches and brakes on D10T2 and D11T.
- **Differential steering** allows infinitely variable turning radius. Standard on the D5R2, D6N, D6R2, D6T, D7R, D7E, D8R, D8T and D9T, allows the tractor to make a "power turn" keeping both tracks working for more traction and higher performance.
- **Electronic Hydrostatic Power Train System** on D3K2 through D6K2 allows power turns, stepless speed range, smooth modulation, dynamic hydrostatic braking, superior maneuverability and excellent controllability.
- **Electric Drive Power Train System** on D7E allows stepless speed range, smooth modulation, and excellent efficiency. When coupled with differential steer it provides superior maneuverability with locked-track pivot turn capability and excellent controllability.
- **Combined hand lever steering** located left of operator provides easier operation on D9R.
- **Standard Tractors** designed for heavy dozing and general grading.
- **XL Tractor D6T** offers higher horsepower and longer roller frames for increased finish grading capability, flotation and productivity.
- **Extra Wide (XW) gauge** on D6T length roller frame provides wider shoes for greater flotation and stability for steep slope grading.
- **Sealed and Lubricated Track** reduces pin and bushing wear for lower undercarriage repair costs. Sealed and lubricated track is standard on the D3K2, D4K2, and D5K2 while heavy duty track chain is available on D5R, D6K2, D6N, D6T, and D7E improves wear life and reduces pin/bore stretching and cracking.
- **SystemOne™ Undercarriage** extends undercarriage system life, improves reliability, and reduces owning and operating costs. Optional on D6T (all sources), D5R2, D6K2, D6N, D6R2, optional on D8T and D8R (all sources), D3K2, D4K2, D5K2.
- **Elevated sprockets** (not on D6K2 or D7E) eliminate final drive stress induced by roller frame movement and ground impact loads. Final drives pull chain only. Seals moved up out of dirt, sand and water for longer life. Blade visibility improved because operator sits higher.
- **Resilient mounted bogie undercarriage** on D8R, D8T, D9T, D10T2 and D11T reduces shock transmitted to tractor. Allows track to conform to rough ground for better traction.
- **Solid mounted undercarriage** standard on D3K2 through D5K2 provides stable platform for low impact, and high abrasion applications. Provides optimum finish grading performance.
- **Oscillating undercarriage** on D6K2 through D7E and optional on the D8R and D8T decreases ground shock to the machine and provides a smoother, more comfortable ride for the operator.
- **Accessible modular design** on D6N XL and up greatly reduces drive train removal and installation time resulting in reduced repair costs.
- **Tag link** on D7R, D8R/D8T and up; L-shaped push arms on D6N, D6T and D7E. Both designs allow closer mounting of dozer blades. This reduces total tractor length, improves maneuverability, balance, blade penetration and pryout.
- **Low ground pressure (LGP)** tractors offer greater flotation in soft, swampy conditions. Available on D3K2 through D8T.

MODEL	D6T		D6T XL	
Emission Standards	**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent**		**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent**	
Flywheel Power	149 kW	**200 hp**	149 kW	**200 hp**
Operating Weight:[1]				
Power Shift Differential Steer				
SU Blade	20 580 kg	**45,370 lb**	21 600 kg	**47,620 lb**
Engine Model	**C9 ACERT**		**C9 ACERT**	
Rated Engine RPM: Power Shift	**1850**		**1850**	
No. of Cylinders	**6**		**6**	
Bore	112 mm	**4.4"**	112 mm	**4.4"**
Stroke	149 mm	**5.9"**	149 mm	**5.9"**
Displacement	8.8 L	**537 in^3**	8.8 L	**537 in^3**
Track Rollers (Each Side)	**6**		**7**	
Width of Standard Track Shoe	560 mm	**22"**	560 mm	**22"**
Length of Track on Ground	2.61 m	**8'7"**	2.81 m	**9'3"**
Ground Contact Area (w/Std. Shoe)	2.92 m^2	**4531 in^2**	3.15 m^2	**4878 in^2**
Track Gauge	1.88 m	**74"**	1.88 m	**74"**
GENERAL DIMENSIONS:				
Height[2] (Stripped Top)[3]	2.40 m	**7'11"**	2.40 m	**7'11"**
Height[2] (To Top of ROPS Canopy)	3.11 m	**10'2"**	3.11 m	**10'2"**
Height[2] (To Top of ROPS Cab)	3.11 m	**10'2"**	3.11 m	**10'2"**
Overall Length (without Blade)	3.85 m	**12'7"**	3.85 m	**12'7"**
with SU Blade	5.08 m	**16'8"**	5.33 m	**17'6"**
with Angle Blade	5.00 m	**16'5"**	5.21 m	**17'1"**
Width (over Trunnion)	2.64 m	**8'8"**	2.64 m	**8'8"**
Width (w/o Trunnion — Std. Track)	2.44 m	**8'0"**	2.44 m	**8'0"**
Ground Clearance[2]	384 mm	**1'3"**	384 mm	**1'3"**
Blade Types and Widths:				
Angle Straight	4.16 m	**13'8"**	4.16 m	**13'8"**
Full 25° Angle	3.77 m	**12'5"**	3.77 m	**12'5"**
Semi-U	3.26 m	**10'8"**	3.26 m	**10'8"**
Fuel Tank Refill Capacity	425 L	**112 U.S. gal**	425 L	**112 U.S. gal**

[1] Operating weight includes cab, operator, lubricants, coolant, full fuel tank, standard track, hydraulic controls and fluid, SU blade, drawbar and counterweight.
[2] Dimensions measured from ground line. Add grouser height for total dimension on hard surfaces.
[3] Height (Stripped Top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.

Track-Type Tractor Sustainability

Well matched engine and power train systems enhance productivity and fuel efficiency.

MODEL	D6T XL		D6T XW		D6T LGP	
Emission Standards	**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**	
Flywheel Power	151 kW	**202 hp**	151 kW	**202 hp**	151 kW	**202 hp**
Operating Weight:[1]						
Power Shift Differential Steer	20 985 kg	**46,263 lb**	21 788 kg	**48,034 lb**	22 902 kg	**50,490 lb**
VPAT	23 663 kg	**52,167 lb**	24 118 kg	**53,170 lb**	24 336 kg	**53,651 lb**
Engine Model	**C9.3 ACERT**		**C9.3 ACERT**		**C9.3 ACERT**	
Advertised Engine RPM	**2000**		**2000**		**2000**	
No. of Cylinders	**6**		**6**		**6**	
Bore	115 mm	**4.5"**	115 mm	**4.5"**	115 mm	**4.5"**
Stroke	149 mm	**5.9"**	149 mm	**5.9"**	149 mm	**5.9"**
Displacement	9.3 L	**567 in³**	9.3 L	**567 in³**	9.3 L	**567 in³**
Track Rollers (Each Side)	**7**		**7**		**8**	
VPAT	**7**		**8**		**8**	
Width of Standard Track Shoe	560 mm	**22"**	760 mm	**30"**	915 mm	**36"**
VPAT	560 mm	**22"**	710 mm	**28"**	785 mm	**31"**
Length of Track on Ground	2.84 m	**9'5"**	2.84 m	**9'5"**	3.25 m	**10'9"**
VPAT	2.84 m	**9'5"**	3.25 m	**10'9"**	3.25 m	**10'9"**
Ground Contact Area (w/Std. Shoe)	3.54 m²	**5489 in²**	4.81 m²	**7449 in²**	6.53 m²	**10,122 in²**
VPAT	3.54 m²	**5489 in²**	5.10 m²	**7909 in²**	5.60 m²	**8684 in²**
Track Gauge	1.88 m	**74"**	2.03 m	**80"**	2.29 m	**90"**
VPAT	2.13 m	**84"**	2.29 m	**90"**	2.29 m	**90"**
GENERAL DIMENSIONS:						
Height[2] (Stripped Top[3])	2.46 m	**8'1"**	2.46 m	**8'1"**	2.51 m	**8'3"**
VPAT	2.46 m	**8'1"**	2.51 m	**8'3"**	2.51 m	**8'3"**
Height[2] (To Top of ROPS Canopy)	3.11 m	**10'2"**	3.11 m	**10'2"**	3.16 m	**10'4"**
VPAT	3.11 m	**10'2"**	3.16 m	**10'4"**	3.16 m	**10'4"**
Height[2] (To Top of ROPS Cab)	3.15 m	**10'4"**	3.15 m	**10'4"**	3.20 m	**10'6"**
VPAT	3.15 m	**10'4"**	3.20 m	**10'6"**	3.20 m	**10'6"**
Overall Length (without Blade)	3.89 m	**12'9"**	3.89 m	**12'9"**	4.25 m	**13'11"**
VPAT	3.89 m	**12'9"**	4.25 m	**13'11"**	4.25 m	**13'11"**
with S Blade	—		—		5.50 m	**18'1"**
with SU Blade	5.33 m	**17'6"**	5.33 m	**17'6"**	—	
with VPAT Blade	5.39 m	**17'8"**	5.53 m	**18'2"**	5.53 m	**18'2"**
with Angle Blade	5.21 m	**17'1"**	5.29 m	**17'4"**	5.81 m	**19'1"**
Width (over Trunnion)	2.69 m	**8'10"**	2.94 m	**9'8"**	3.48 m	**11'5"**
Width (w/o Trunnion — Std. Track)	2.59 m	**8'6"**	2.79 m	**9'2"**	3.20 m	**10'6"**
VPAT	2.72 m	**8'11"**	3.00 m	**9'10"**	3.14 m	**10'4"**
Ground Clearance[2]	372 mm	**1'3"**	372 mm	**1'3"**	406 mm	**1'4"**
VPAT	372 mm	**1'3"**	406 mm	**1'4"**	406 mm	**1'4"**
Blade Types and Widths:						
Straight	—		—		4.06 m	**13'4"**
Angle Straight	4.16 m	**13'8"**	4.52 m	**14'10"**	5.07 m	**16'8"**
Full 25° Angle	3.77 m	**12'5"**	4.11 m	**13'6"**	4.63 m	**15'2"**
Semi-U	3.26 m	**12'8"**	3.56 m	**11'8"**	—	
VPAT						
Straight	3.88 m	**12'9"**	4.16 m	**13'8"**	4.16 m	**13'8"**
Full 24° Angle	3.54 m	**11'7"**	3.79 m	**12'5"**	3.79 m	**12'5"**
Fuel Tank Refill Capacity	411 L	**109 U.S. gal**	411 L	**109 U.S. gal**	411 L	**109 U.S. gal**
DEF Tank Refill Capacity	17.1 L	**4.5 U.S. gal**	17.1 L	**4.5 U.S. gal**	17.1 L	**4.5 U.S. gal**

[1] Operating weight includes cab, operator, lubricants, coolant, full fuel tank, standard track, hydraulic controls and fluid, SU blade and drawbar.
[2] Dimensions measured from ground line. Add grouser height for total dimension on hard surfaces.
[3] Height (Stripped Top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.

MODEL	D9R		D9T		D9T	
Emission Standards	—		**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent[1]**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**	
Flywheel Power	302 kW	**405 hp**	306 kW	**410 hp**	325 kW	**436 hp**
Operating Weight:[2]						
Power Shift Clutch Brake	48 784 kg	**107,548 lb**	—		—	
Power Shift Differential Steer	—		47 872 kg	**105,539 lb**	48 361 kg	**106,618 lb**
Engine Model	**3408C SCAC**		**C18 ACERT**		**C18 ACERT**	
Rated Engine RPM	**1900**		**1833**		**1800**	
No. of Cylinders	**8**		**6**		**6**	
Bore	137 mm	**5.4"**	145 mm	**5.7"**	145 mm	**5.7"**
Stroke	152 mm	**6"**	183 mm	**7.2"**	183 mm	**7.2"**
Displacement	18 L	**1099 in³**	18.1 L	**1106 in³**	18.1 L	**1106 in³**
Track Rollers (Each Side)	**8**		**8**		**8**	
Width of Standard Track Shoe	610 mm	**24"**	610 mm	**24"**	610 mm	**24"**
Length of Track on Ground	3.47 m	**11'5"**	3.47 m	**11'5"**	3.47 m	**11'5"**
Ground Contact Area (w/Std. Shoe)	4.24 m²	**6569 in²**	4.24 m²	**6569 in²**	4.24 m²	**6569 in²**
Track Gauge	2.25 m	**7'5"**	2.25 m	**7'5"**	2.25 m	**7'5"**
GENERAL DIMENSIONS:						
Height[3] (Stripped Top)[4]	3.69 m	**12'1"**	3.69 m	**12'1"**	3.69 m	**12'1"**
Height[3] (To Top of ROPS Canopy)	4.00 m	**13'1"**	4.00 m	**13'1"**	4.00 m	**13'1"**
Height[3] (To Top of FOPS Cab)	3.82 m	**12'6"**	3.82 m	**12'6"**	3.82 m	**12'6"**
Overall Length (with SU Blade)[5]	6.88 m	**22'6"**	6.88 m	**22'6"**	6.88 m	**22'6"**
(without Blade)	5.18 m	**17'0"**	5.18 m	**17'0"**	5.18 m	**17'0"**
(with SU Blade and Ripper)[5]	8.23 m	**27'0"**	8.23 m	**27'0"**	8.23 m	**27'0"**
(without Blade and Ripper)	4.91 m	**16'1"**	4.91 m	**16'1"**	4.91 m	**16'1"**
Width (over Trunnion)	3.30 m	**10'8"**	3.30 m	**10'8"**	3.30 m	**10'8"**
Width (w/o Trunnion — Std. Shoe)	2.88 m	**9'5"**	2.88 m	**9'5"**	2.88 m	**9'5"**
Ground Clearance[6]	496 mm	**1'7"**	496 mm	**1'7"**	496 mm	**1'7"**
Blade Types and Widths:						
Universal	4.65 m	**15'3"**	4.65 m	**15'3"**	4.65 m	**15'3"**
Semi-U	4.31 m	**14'2"**	4.31 m	**14'2"**	4.31 m	**14'2"**
Fuel Tank Refill Capacity	818 L	**216 U.S. gal**	889 L	**235 U.S. gal**	821 L	**217 U.S. gal**
DEF Tank Refill Capacity	—		—		36 L	**9.5 U.S. gal**

[1] Product available to meet Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.
[2] Operating weight includes ROPS canopy, operator, lubricants, coolant, full fuel tank, hydraulic controls and fluids, semi universal blade with tilt, back-up alarm, seat belts, lights, and single shank ripper.
— D9R equipped with track guides, ROPS/FOPS cab, single shank ripper and SU blade.
[3] Dimensions measured from ground line. Add grouser height for total dimension on hard surfaces.
[4] Height (Stripped Top) — without ROPS canopy, exhaust, seat back or other easily removed encumbrances.
[5] Includes drawbar.
[6] Per ISO 6746 — Must add grouser height for total dimension on hard surfaces.

MODEL	**D10T2**		**D11T**		**D11T CD**	
Emission Standards	**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)[1]**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)[1]**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)[1]**	
Flywheel Power	447 kW	**600 hp**	634 kW	**850 hp**	634 kW	**850 hp**
Reverse Gears	538 kW	**722 hp**	—		—	
Operating Weight:[2]						
Power Shift Clutch Brake	70 171 kg	**154,700 lb**	104 236 kg	**229,800 lb**	112 718 kg	**248,500 lb**
Engine Model	**C27 ACERT**		**C32 ACERT**		**C32 ACERT**	
Rated Engine RPM	**1800**		**1800**		**1800**	
No. of Cylinders	**12**		**12**		**12**	
Bore	137 mm	**5.4"**	145 mm	**5.71"**	145 mm	**5.71"**
Stroke	152 mm	**6"**	162 mm	**6.38"**	162 mm	**6.38"**
Displacement	27 L	**1648 in³**	32.1 L	**1959 in³**	32.1 L	**1959 in³**
Track Rollers (Each Side)	**8**		**8**		**8**	
Width of Standard Track Shoe	610 mm	**24"**	710 mm	**28"**	915 mm	**36"**
Length of Track on Ground (Idler to Idler)	3.88 m	**12'9"**	4.44 m	**14'7"**	4.44 m	**14'7"**
Ground Contact Area (w/Std. Shoe)	4.74 m^2	**7347 in^2**	6.31 m^2	**9781 in^2**	8.13 m^2	**12,605 in^2**
Track Gauge	2.55 m	**8'4"**	2.89 m	**9'6"**	2.89 m	**9'6"**
GENERAL DIMENSIONS:						
Height (Stripped Top)[3]	3.222 m	**10'7"**	3.64 m	**11'11"**	3.64 m	**11'11"**
Height (To Top of ROPS Canopy)	4.41 m	**14'5"**	4.70 m	**15'5"**	4.70 m	**15'5"**
Height (To Top of FOPS Cab)	4.10 m	**13'5"**	4.39 m	**14'5"**	4.39 m	**14'5"**
Overall Length:						
(with SU Blade and SS Ripper)[4]	9.16 m	**30'1"**	10.59 m	**34'9"**	10.70 m	**35'1"**
(without Blade and Ripper)[5]	5.32 m	**17'5"**	6.16 m	**20'3"**	6.16 m	**20'3"**
Width (over Trunnion)	3.74 m	**12'3"**	4.38 m	**14'4"**	4.38 m	**14'4"**
Width (w/o Trunnion — Std. Shoe)	3.30 m	**10'10"**	3.78 m	**12'5"**	3.81 m	**12'6"**
Ground Clearance[6]	632 mm	**2'1"**	675 mm	**2'3"**	675 mm	**2'3"**
Blade Types and Widths:						
CarryDozer	—		—		6.71 m	**22'0"**
Universal	5.26 m	**17'3"**	6.36 m	**20'10"**	—	
Semi-U	4.94 m	**16'3"**	5.60 m	**18'4"**	—	
Fuel Tank Refill Capacity	1204 L	**314 U.S. gal**	1609 L	**425 U.S. gal**	1609 L	**425 U.S. gal**
Fuel Tank Refill Capacity (Extra Capacity)	—		1987 L	**505 U.S. gal**	1987 L	**505 U.S. gal**

[1] Product available to meet Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.
[2] Operating weight includes coolant, lubricants, full fuel tank, ROPS, FOPS cab, SU ABR bulldozer (D10T2) or U ABR bulldozer (D11T), dual tilt, single-shank ripper with pin-puller, fast fuel, standard ES shoes, and operator.
D11T CD has 11 Carrydozer and single-shank Carrydozer ripper.
[3] Height (Stripped Top) — without ROPS canopy, cab, exhaust, lift cylinders, seat back or other easily removed encumbrances.
[4] Overall length of D11T CD includes Straight (CarryDozer) Blade and SS Ripper.
[5] Overall length of machine from front tag link trunnion to rigid drawbar and excludes track grouser height.
[6] Per ISO 6746 — Must add grouser height for total dimension on hard surfaces.

All dimensions are approximate.

TRAVEL SPEED

POWER SHIFT MODEL	D3K2[1] All Models		D3K2 All Models		D4K2[1] All Models		D4K2 All Models		D5K2[1] All Models		D5K2 All Models		D6K2 All Models	
HYDROSTATIC	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
FORWARD	9.0	**5.6**	9.0	**5.6**	9.0	**5.6**	9.0	**5.6**	9.0	**5.6**	9.0	**5.6**	10.0	**6.2**
REVERSE	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**	10.0	**6.2**

[1] Meets Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.

POWER SHIFT MODEL	D5R2 Powershift with AutoShift		D6R2 Powershift with AutoShift		D6T		D7E		D7E LGP		D7R	
FORWARD	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph	km/h	mph
1	3.3	**2.1**	3.8	**2.4**	3.8	**2.3**	—	—	—	—	3.52	**2.19**
1.5	4.2	**2.6**	4.8	**3.0**	—	—	—	—	—	—	—	—
2	5.8	**3.6**	6.5	**4.1**	6.5	**4.0**	—	—	—	—	6.10	**3.79**
2.5	7.3	**4.5**	8.4	**5.2**	—	—	—	—	—	—	—	—
3	10.1	**6.3**	11.5	**7.1**	11.3	**7.0**	—	—	—	—	10.54	**6.55**
REVERSE												
1	4.2	**2.6**	4.8	**3.0**	4.7	**2.9**	—	—	—	—	4.54	**2.82**
1.5	5.2	**3.2**	6.2	**3.9**	—	—	—	—	—	—	—	—
2	7.3	**4.5**	8.4	**5.2**	8.3	**5.1**	—	—	—	—	7.85	**4.88**
2.5	7.3	**4.5**	8.4	**5.2**	—	—	—	—	—	—	—	—
3	12.5	**7.8**	14.5	**9.1**	14.6	**9.0**	—	—	—	—	13.58	**8.44**
ELECTRIC												
FORWARD	—	—	—	—	—	—	11.3	**7.0**	11.3	**7.0**	—	—
REVERSE	—	—	—	—	—	—	11.3	**7.0**	11.3	**7.0**	—	—

GEAR	D6N* Powershift with AutoShift		D6N* Powershift with AutoShift — Sound Suppressed	
FORWARD	km/h	mph	km/h	mph
0.5	2.5	**1.6**	2.4	**1.5**
0.7	2.8	**1.7**	2.7	**1.6**
1.0	3.3	**2.1**	3.0	**1.9**
1.5	4.4	**2.7**	4.4	**2.7**
1.7	4.9	**3.0**	4.9	**3.0**
2.0	5.8	**3.6**	5.8	**3.6**
2.5	7.5	**4.7**	7.5	**4.7**
2.7	8.3	**5.2**	8.3	**5.2**
3.0	9.8	**6.1**	9.8	**6.1**
REVERSE				
0.5	3.1	**1.9**	2.9	**1.8**
0.7	3.4	**2.1**	3.1	**1.9**
1.0	4.1	**2.5**	3.5	**2.2**
1.5	5.4	**3.4**	5.4	**3.4**
1.7	6.0	**3.7**	6.0	**3.7**
2.0	7.1	**4.4**	7.1	**4.4**
2.5	9.5	**5.9**	9.5	**5.9**
2.7	10.5	**6.5**	10.5	**6.5**
	12.2	**7.6**	12.2	**7.6**

*Meets Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.

TRAVEL SPEED

POWER SHIFT MODEL	Differential Steer D8R		D8T		D9R		D9T		D10T2		D11T/CD		D11T/CD High Altitude	
FORWARD	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1	3.5	**2.2**	3.4	**2.1**	3.8	**2.4**	3.9	**2.4**	4.0	**2.5**	3.9	**2.4**	4.0	**2.5**
2	6.2	**3.9**	6.0	**3.7**	6.8	**4.2**	6.8	**4.2**	7.2	**4.5**	6.8	**4.2**	7.0	**4.4**
3	10.8	**6.7**	10.6	**6.6**	11.9	**7.4**	11.7	**7.3**	12.7	**7.9**	11.8	**7.3**	12.0	**7.5**
REVERSE														
1	4.7	**2.9**	4.5	**2.8**	4.7	**2.9**	4.7	**2.9**	5.2	**3.2**	4.7	**2.9**	4.8	**3.0**
2	8.1	**5.0**	7.9	**4.9**	8.4	**5.2**	8.4	**5.2**	9.0	**5.6**	8.2	**5.1**	8.3	**5.2**
3	13.9	**8.6**	14.2	**8.8**	14.7	**9.1**	14.3	**8.9**	15.8	**9.8**	14.0	**8.7**	14.9	**9.0**

GEAR	D6T Powershift with AutoShift		D6T Powershift with AutoShift — Sound Suppressed	
FORWARD	**km/h**	**mph**	**km/h**	**mph**
0.5	2.7	**1.7**	2.7	**1.7**
0.7	3.3	**2.0**	3.2	**2.0**
1.0	3.7	**2.3**	3.2	**2.0**
1.5	4.7	**2.9**	4.7	**2.9**
1.7	5.7	**3.6**	5.7	**3.6**
2.0	6.5	**4.0**	6.3	**3.9**
2.5	8.2	**5.1**	8.2	**5.1**
2.7	10.0	**6.2**	10.0	**6.2**
3.0	11.3	**7.0**	10.9	**6.8**
REVERSE				
0.5	3.5	**2.2**	3.5	**2.2**
0.7	4.2	**2.6**	3.9	**2.4**
1.0	4.7	**2.9**	3.9	**2.4**
1.5	6.0	**3.7**	6.0	**3.7**
1.7	7.3	**4.5**	7.3	**4.5**
2.0	8.3	**5.1**	8.0	**5.0**
2.5	10.4	**6.5**	10.4	**6.5**
2.7	12.7	**7.9**	12.7	**7.9**
3.0	14.4	**9.0**	13.8	**8.6**

HYDRAULIC CONTROLS

CONTENTS

Features:

- **Designed and built for specific tractor applications.** Valves and components sized for exacting quality and performance.
- **Job requirements matched** through various arrangements.
- **Hydraulic blade and ripper controls:** Mechanical controls on G Series. Electro hydraulic controls on D6N and D6K2. Pilot blade and ripper controls on D6T Tier 3/Stage IIIA, Japan 2006 (Tier 3) equivalent with optional electro hydraulic blade control. Electro hydraulic blade and ripper controls on D6T Tier 4 Interim/ Stage IIIB/Japan 2011 (Tier 4 Interim) equivalent Mechanical controls on D9R. Electro hydraulic blade and ripper controls on D7E, D8T, D9T, D10T2, and D11T.
- **Full flow filters***… all oil completely filtered.
- **Dual tilt** — standard on D11T and D11T CD, attachment option on D7E, D8R, D8T, D9R, D9T, D10T2.

*Exception — D8R 2-pump.

BULLDOZERS

CONTENTS

Features:

- **Straight Bulldozers** — adjustable tilt angle controls blade penetration.
- **Variable cutting edge Power Angle and Tilt (VPAT)** — blade is available on the D3K2, D4K2, D5K2, D6K2, D6N, and D6T. The blade can be mechanically tipped forward for improved penetration or back for more productivity and easier finish grading.
- **Angling Bulldozers** — 25° right/left angling; C-frame allows mounting other tools.
- **Universal Bulldozers** — 25° wings provide increased capacity, less spillage.
- **Semi-Universal Bulldozers** — combines penetration ability of straight blade with increased load capacity provided by short 25° wings.
- **Wheel Dozer blades** are offered in straight and universal blade design with hydraulic pitch and tilt control.
- **Box-section construction** on blades adds rigidity and strength.
- **Cutting edges** are heat treated and reversible for extra life.

BLADE SELECTION

Properly matching tractor and dozer is a basic requirement for maximizing production. First consider the kind of work the tractor will be doing most of its life. Then evaluate:

- Material to be moved.
- Tractor limitations.

Materials to be moved

Most materials are dozeable. However, dozer performance will vary with material characteristics such as:

Particle Size and Shape — The larger the individual particle size, the harder it is for a cutting edge to penetrate. Particles with sharp edges resist the natural rolling action of a dozer blade. These particles require more horsepower to move than a similar volume of material with rounded edges.

Voids — Few voids or the absence of voids means the individual particles have most or all of their surface area in contact with other particles. This forms a bond which must be broken. A well graded material, which lacks voids, is generally heavy, and will be hard to remove from the bank state.

Water Content — In most materials the lack of moisture increases the bond between particles and makes the material difficult to remove from the bank state. A high moisture content makes dozing difficult because the material is heavy and requires more force to move. Optimum moisture reduces dust and offers the best condition for dozing ease and operator comfort.

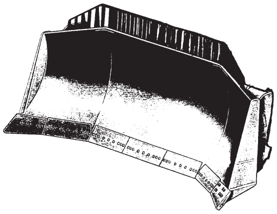
The effect of freezing depends on the moisture content. When frozen, the material's bond strengthens as moisture content increases and temperature decreases. However, freezing a completely dry material does not change its characteristics.

An indication of a blade's ability to penetrate and obtain a blade load is kW per meter (or horsepower per foot) of cutting edge. The higher the kW/meter (HP/foot), the more aggressive the blade. Kilowatt per Lm^3 (horsepower per loose cubic yard) indicates a blade's ability to push material. The higher the kW/Lm^3 (HP/LCY), the greater the blade's potential capability for carrying material at a greater speed.

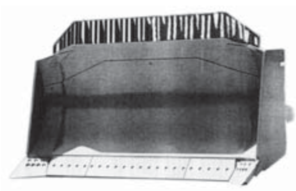
Tractor Limitations

The weight and horsepower of the machine determines its ability to push. No tractor can exert more pounds push than the machine itself weighs and its power train can develop. Various terrain and underfoot conditions on the job limit the tractor's ability to use its weight and horsepower. The "approximate coefficient of traction factors" chart in the Tables Section presents these traction factors for common materials. To use the chart, take the total tractor weight (with attachments) times the factor to arrive at the maximum usable push the dozer can exert.

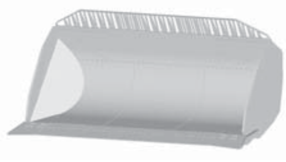
Production Dozing Tools



"U" — Universal blade — the large wings on this blade include one end bit and at least one section of cutting edge which make it efficient for moving big loads over long distances as in land reclamation, stockpile work, charging hoppers and trapping for loaders. As this blade has a lower kW/meter (HP/foot) of cutting edge than an "S" or "SU", penetration should not be a prime objective. With a lower kW/Lm^3 (HP/LCY) than an "S" or "SU", this blade is best for lighter or relatively easily dozed material. If equipped with tilt cylinders the U blade can be used to pry out, level, cut ditches and steer the tractor.

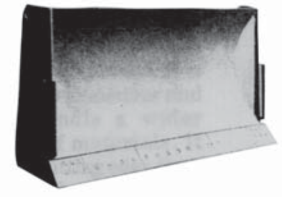


"SU" — The Semi-U blade combines the desirable characteristics of S and U-blades into one package. It has increased capacity by the addition of short wings which include only the dozer end bits. The wings provide improved load retention capabilities while maintaining the blade's ability to penetrate and load quickly in tightly packed materials and to handle a wide variety of materials in production oriented applications. Tilt cylinder(s) increase both the productivity and versatility of this dozer. Equipped with a push plate, it is effectively used for push loading scrapers.



"CD" — The CD or CarryDozer Blade is available for the D11T CarryDozer only. It is built to the same high standard of structural integrity as the "U" and "SU" Dozers. The CD Blade has a unique "bucket" shape that allows it to carry several cubic yards or cubic meters of material in the blade. This acts as a disposable counterweight that allows the CarryDozer to push more material per pass than a standard D11T. The CarryDozer will not be as effective as the "U" or "SU" dozer in tightly packed or poorly shot material. It is also more sensitive to the carry-back in sticky materials.

General Purpose Dozing Tools



"S" — The Straight blade provides excellent versatility. Since it is physically smaller than the SU or U-blade, it is easier to maneuver and can handle a wider range of materials. It has a higher kW/ meter (HP/foot) of cutting edge than the SU or U-blade; consequently, the "S" is more aggressive in penetrating and obtaining a blade load. A tilt cylinder increases both the productivity and versatility of this dozer. With a high kW/Lm^3 (HP/LCY), the S-blade can handle heavy material easily.

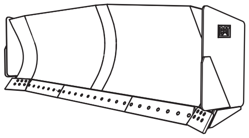
Power Angle and Tilt Blade — Versatility is its key feature with its ability to perform a variety of site development to general dozing work as well as heavy-duty applications. Angle and tilt control is with 2 levers on some machines, 1 lever on others.

Variable Power Angle and Tilt (VPAT) blade can be mechanically tipped forward for improved penetration or shedding sticky material and backward for finish grading and improved productivity.

Special Application Dozing Tools

Caterpillar provides specialty bulldozers for specific applications. The blades are designed to increase production while performing certain tasks. Following are the most popular special applications blades.

Variable Radius (VR) Blades



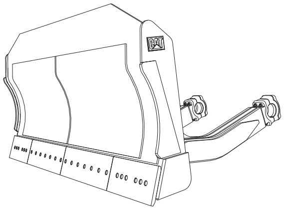
Variable Radius Semi-U Blades are excellent tools for land improvement, soil conservation, site development or general construction. They combine the penetration ability of a Semi-U Blade with the load retention and high capacity of a U-blade.

They provide the aggressive cutting action needed for digging, while having the material retention characteristics needed for moving high volumes over a distance. This is accomplished through a moldboard which varies in radius from the edge to the center. This creates a rolling action in the material being moved, pushing it to the center of the blade for better retention. The extended side wings, angled to thirty degrees, further increase the capacity over a standard blade.

Angle Blade (A-Blade)

"A" — Or Angling blade can be positioned straight or angled 25 degrees to either side. It is designed for side-casting, pioneering roads, backfilling, cutting ditches and other similar tasks. It can reduce the amount of maneuvering required to do these jobs. Its "C" frame can be used for attachments such as pushing, land clearing, or snow removal tools. A-blades are not recommended for rock or severe applications.

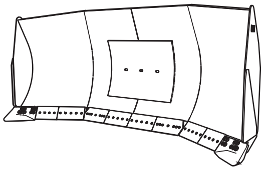
Cushion Dozers



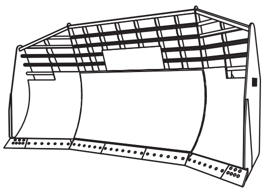
Cushion Dozers are designed to push-load wheel-tractor scrapers, or track-type tractors. The heavy-duty design includes reinforcement to transfer machine power without damaging the blade or the tractor. Blade cylinders are pinned to the C-frame, and the blade height is such that the blade lift cylinders are isolated from damaging forces.

The taller blade allows pushing from a higher position, eliminating blade drag and increasing productivity. The blade curvature is matched to the curve of the Cat Push Block for maximum contact area, preventing the block from riding over the top of the blade. Extended side plates make it easier for operators to "catch" the stinger when repositioning for a new pass. The center of the blade is armored with T-1 plate steel for maximum service life. The narrow width of the cushion blade increases machine maneuverability in congested cuts and reduces the possibility of cutting tires associated with SU and U-blades.

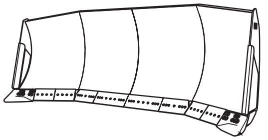
When not push-loading, the dozer can be used for cut maintenance and other general dozing jobs.



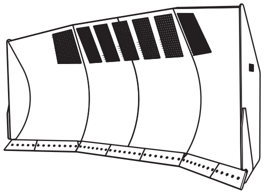
Coal U-Blades are designed specifically to move large volumes of coal in coal piles, at powerplants and transshipment points. The wing angle of thirty degrees crowds material to the center of the blade, maximizing capacity by minimizing side spill. The moldboard is much higher and wider than standard, specifically to match the material density and loading characteristics of coal. The curve of the moldboard rolls the material forward, enhancing the carrying capacity. With this design, coal-moving capacity can be as much as 200 percent greater than a standard U-blade.



Landfill U-Blades provide capacity increases of up to fifty percent over a straight blade. Landfill blades have the height and width to handle large volumes of low-density refuse, but are tough enough to dig and bulldoze ground cover. Vision to the load is provided by areas of screen in the upper blade. Angled wings slice into natural bed earth for trenches or cover material, adding to the versatility in the landfill.

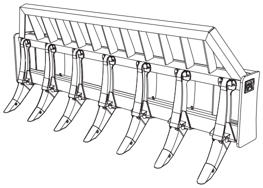


Reclamation U-Blades — are purpose-built for reclamation of mine spoil piles. The blade has a larger capacity than a standard U-blade. The wing angle of 28 degrees provides a good balance between load retention and shearing action, keeping the optimal load in front of the blade, but cutting cleanly through the material when necessary.



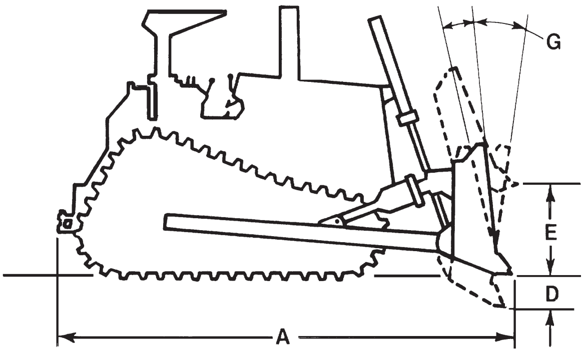
The width of **Woodchip U-Blades** gives operators maximum control and greater confidence, even in steep chip piles. Deep curvature of the moldboard keeps material flowing to liven dead chips and optimize production on long pushes. Blade height and wings angled at thirty degrees combine for excellent material retention – giving better production with every pass. An operator visibility window in the top section is standard.

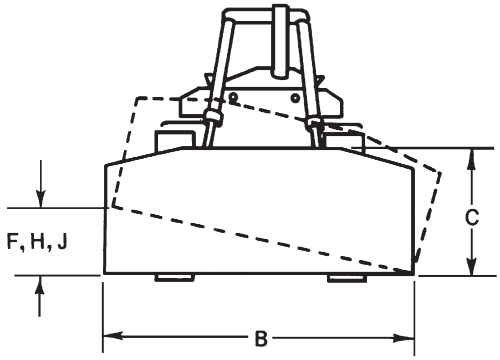
Multi-Application/Rock and Root Rakes



Multi-Application/Rock and Root Rakes are perfectly suited for heavy duty land clearing including removal of stumps, large rocks or large trees and for work in clay and other heavy soils. Frames are constructed of high strength steel for longer life. Cast teeth, with replaceable tips, are designed for maximum ground penetration and resistance to shock loading when prying or pushing trees, stumps and rocks. Brush rack is standard and increases height and capacity by as much as 40%.

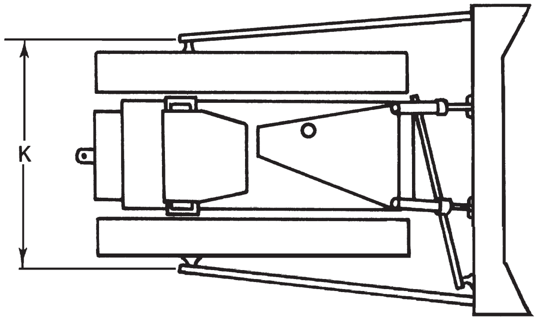
Rake is a direct replacement for existing blade, and utilizes existing push arms and C-frames.





KEY

A Length (Blade Straight)
Blade:
B Width (including standard end bits)
C Height
D Maximum Digging Depth
E Ground Clearance @ Full Lift
F Maximum Tilt (Manual)
G Maximum Pitch Adjustment
H Maximum Hydraulic Tilt
J Hydraulic Tilt (manual brace centered)
K Push Arm Trunnion Width (to Ball Centers)



Blade capacities on the following pages are as determined by SAE recommended practice J1265. Capacities are defined as:

$Vs = 0.8\ WH^2$.

$Vu = ZH\ (W\text{-}Z)\ \tan X$.

Where: Vs = Capacity of straight or angling blade.
Vu = Capacity of semi-U or full U-blade.
W = Blade width exclusive of end bits.
H = Effective blade height considering tapered top corners, etc.
Z = Wing length measured parallel to blade width @ ground line of cutting edges.
X = Wing angle.

	D6R2							
MODEL	**6S**		**6SU**		**6SU XL**		**6S LGP**	
Gauge	—		1880 mm	**74"**	1880 mm	**74"**	2286 mm	**90"**
Type	**Straight**		**Semi-Universal**		**Semi-Universal**		**Straight**	
Blade Capacities*	3.89 m^3	**5.1 yd^3**	5.61 m^3	**7.3 yd^3**	5.55 m^3	**7.26 yd^3**	3.75 m^3	**4.9 yd^3**
Weight, Shipping** (Dozer)	2251 kg	**4963 lb**	2333 kg	**5143 lb**	2570 kg	**5666 lb**	2418 kg	**5331 lb**
Tractor and Dozer Dimensions:								
A Length (Blade Straight)	4903 mm	**193.1"**	5095 mm	**200.6"**	5332 mm	**210.0"**	5465 mm	**215.2"**
Blade Dimensions:								
B Width (including std. end bits)	3360 mm	**132.3"**	3260 mm	**128.3"**	3260 mm	**128.3"**	4063 mm	**160"**
C Height	1257 mm	**49.5"**	1412 mm	**55.6"**	1412 mm	**55.6"**	1101 mm	**43.3"**
D Max. Digging Depth	473 mm	**18.6"**	473 mm	**18.6"**	459 mm	**18.1"**	655 mm	**25.8"**
E Ground Clearance @ Full Lift	1104 mm	**43.5"**	1104 mm	**43.5"**	1195 mm	**47.0"**	1083 mm	**42.6"**
G Max. Pitch Adjustment	**+5.3 to 4.8°**		**+5.6 to –5.2°**		**+5.6 to –5.2°**		**+4.4 to –4.4°**	
H Max. Hydraulic Tilt	765 mm	**30.1"**	743 mm	**29.3"**	743 mm	**29.3"**	701 mm	**27.6"**
K Push Arm Trunnion Width (to Ball Centers)	2640 mm	**103.9"**	2640 mm	**103.9"**	2640 mm	**103.9"**	3490 mm	**137.4"**

	D6R2				D6T			
MODEL	**6A**		**6A XL**		**6A**		**6SU**	
Gauge	1880 mm	**74"**	1880 mm	**74"**	1880 mm	**74"**	1880 mm	**74"**
Type	**Angling**		**Angling**		**Angling**		**Semi-Universal**	
Blade Capacities*	3.93 m^3	**5.1 yd^3**	3.89 m^3	**5.1 yd^3**	3.64 m^3	**4.75 yd^3**	5.35 m^3	**6.99 yd^3**
Weight, Shipping** (Dozer)	2715 kg	**5986 lb**	2625 kg	**5787 lb**	3138 kg	**6904 lb**	2973 kg	**6540 lb**
Tractor and Dozer Dimensions:								
A Length (Blade Straight)	5007 mm	**197.2"**	5209 mm	**205.1"**	5.00 m	**16'5"**	5.08 m	**17'6"**
Length (Blade Angled)	—		—		5.83 m	**19'2"**	—	
Width (Blade Angled)	—		—		3.78 m	**12'5"**	—	
Width (with C-Frame only)	—		—		2.93 m	**9'8"**	—	
Blade Dimensions:								
B Width (including std. end bits)	4166 mm	**164.0"**	4166 mm	**164.0"**	4.16 m	**13'8"**	3.26 m	**10'8"**
C Height	1155 mm	**45.5"**	1155 mm	**45.5"**	1154 mm	**3'10"**	1411 mm	**4'8"**
D Max. Digging Depth	506 mm	**19.9"**	524 mm	**20.6"**	506 mm	**1'8"**	453 mm	**1'6"**
E Ground Clearance @ Full Lift	1142 mm	**45.0"**	1205 mm	**47.4"**	1144 mm	**3'9"**	1204 mm	**3'11"**
G Max. Pitch Adjustment	**25°**		**25°**		—		**+5.6° to –5.2°**	
H Max. Hydraulic Tilt	408 mm	**16.1"**	408 mm	**16.1"**	519 mm	**1'8"**	811 mm	**2'8"**
Blade Angle	—		—		**25°**		—	
J Hydraulic Tilt (Manual Brace Centered)	—		—		—		455 mm	**1'6"**
K Push Arm Trunnion Width (to Ball Centers)	2640 mm	**103.9"**	2625 mm	**103.9"**	2.58 m	**8'6"**	2.58 m	**8'6"**

*Blade capacities as determined by SAE J1265. Tractor and dozer dimensions variations due to SystemOne undercarriage products are negligible. Notice that the capacity of the SU-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the SU-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

MODEL	D6T 6A XL		6SU XL		6VPAT XL		6A XW	
Gauge	1.88 m	**74"**	1.88 m	**74"**	2.13 m	**84"**	2.03 m	**80"**
Type	**Angling**		**Semi-Universal**		**VPAT**		**Angling**	
Blade Capacities*	3.94 m^3	**5.15 yd^3**	5.55 m^3	**7.26 yd^3**	4.64 m^3	**6.07 yd^3**	4.35 m^3	**5.69 yd^3**
Weight, Shipping** (Dozer)	3086 kg	**6803 lb**	2831 kg	**6242 lb**	3464 kg	**7637 lb**	3731 kg	**8226 lb**
Tractor and Dozer Dimensions:								
A Length (Blade Straight)	5.21 m	**17'1"**	5.33 m	**17'6"**	5.39 m	**17'8"**	5.29 m	**17'4"**
Length (Blade Angled)	6.05 m	**19'10"**	—		3.54 m	**11'7"**	6.20 m	**20'4"**
Width (Blade Angled)	3.77 m	**12'5"**	—		3.49 m	**11'5"**	4.11 m	**13'6"**
Width (with C-Frame only)	2.99 m	**9'10"**	—		—		3.29 m	**10'10"**
Blade Dimensions:								
B Width (including std. end bits)	4.16 m	**13'8"**	3.26 m	**10'8"**	3.88 m	**12'9"**	4.52 m	**14'10"**
C Height	1154 mm	**3'10"**	1407 mm	**4'7"**	1294 mm	**4'3"**	1153 mm	**3'9"**
D Max. Digging Depth	555 mm	**1'10"**	501 mm	**1'7"**	792 mm	**2'7"**	541 mm	**1'9"**
E Ground Clearance @ Full Lift	1112 mm	**3'7"**	1180 mm	**3'10"**	1053 mm	**3'5"**	1139 mm	**3'9"**
G Max. Pitch Adjustment	—		**+4.0° to –4.0°**		**+0.5° to –3.1°**		—	
H Max. Hydraulic Tilt	424 mm	**1'5"**	811 mm	**2'8"**	410 mm	**1'4"**	424 mm	**1'5"**
Blade Angle	**25°**		—		**24°**		**25°**	
J Hydraulic Tilt (Manual Brace Centered)	—		455 mm	**1'6"**	—		—	
K Push Arm Trunnion Width (to Ball Centers)	2.58 m	**8'6"**	2.58 m	**8'6"**	—		2.89 m	**9'8"**

MODEL	D6T 6SU XW		6A LGP		6S LGP		6VPAT LGP/XW	
Gauge	2.03 m	**80"**	2.29 m	**90"**	2.29 m	**90"**	2.29 m	**90"**
Type	**Semi-Universal**		**Angling**		**Straight**		**VPAT**	
Blade Capacities*	5.64 m^3	**7.38 yd^3**	4.94 m^3	**6.46 yd^3**	3.79 m^3	**4.96 yd^3**	5.02 m^3	**6.57 yd^3**
Weight, Shipping** (Dozer)	2976 kg	**6562 lb**	3745 kg	**8255 lb**	2720 kg	**5997 lb**	3558 kg	**7845 lb**
Tractor and Dozer Dimensions:								
A Length (Blade Straight)	5.33 m	**17'6"**	5.81 m	**19'1"**	5.50 m	**18'1"**	5.53 m	**18'2"**
Length (Blade Angled)	—		6.81 m	**22'4"**	—		—	
Width (Blade Angled)	—		4.63 m	**15'2"**	—		3.72 m	**12'2"**
Width (with C-Frame only)	—		3.77 m	**12'5"**	—		—	
Blade Dimensions:								
B Width (including std. end bits)	3.56 m	**11'8"**	5.07 m	**16'8"**	4.06 m	**13'3"**	4.16 m	**13'8"**
C Height	1407 mm	**4'7"**	1150 mm	**3'9"**	1108 mm	**3'8"**	1294 mm	**4'3"**
D Max. Digging Depth	502 mm	**1'7"**	853 mm	**2'10"**	590 mm	**1'11"**	743 mm	**2'5"**
E Ground Clearance @ Full Lift	1180 mm	**3'10"**	1004 mm	**3'3"**	1094 mm	**3'7"**	1102 mm	**3'7"**
G Max. Pitch Adjustment	**+4.0° to –4.0°**		—		**+4.4° to –4.4°**		**+0.5° to –3.1°**	
H Max. Hydraulic Tilt	791 mm	**2'7"**	618 mm	**2'0"**	747 mm	**2'5"**	435 mm	**1'5"**
Blade Angle	—		**24.2°**		—		**24°**	
J Hydraulic Tilt (Manual Brace Centered)	442 mm	**1'5"**	—		399 mm	**1'4"**	—	
K Push Arm Trunnion Width (to Ball Centers)	2.89 m	**9'8"**	3.42 m	**11'5"**	3.42 m	**11'5"**	—	

*Blade capacities as determined by SAE J1265.
Notice that the capacity of the SU-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the SU-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

MODEL	D9R/D9T			
	9SU		**9U**	
Type	**Semi-U**		**Universal**	
Blade Capacities*	13.5 m^3	**17.7 yd^3**	16.4 m^3	**21.4 yd^3**
Weight, Shipping** (Dozer)	6863 kg	**15,130 lb**	7388 kg	**16,288 lb**
Tractor and Dozer Dimensions:				
A Length (Blade Straight)	6.60 m	**21'6"**	6.96 m	**22'8"**
Blade Dimensions:				
B Width (including std. end bits)	4.31 m	**14'1"**	4.65 m	**15'2"**
C Height	1934 mm	**6'4.1"**	1934 mm	**6'4.1"**
D Max. Digging Depth	606 mm	**1'11.9"**	606 mm	**1'11.9"**
E Ground Clearance @ Full Lift	1422 mm	**4'8"**	1422 mm	**4'8"**
G Max. Pitch Adjustment	**+3.4° to 2.9°**		**+3.4° to 2.9°**	
H Max. Hydraulic Tilt	940 mm	**3'1"**	1014 mm	**3'3.9"**
J Hydraulic Tilt (Manual Brace Centered)	570 mm	**1'10.4"**	616 mm	**2'0.3"**
K Push Arm Trunnion Width (to Ball Centers)	3.30 m	**10'8"**	3.30 m	**10'8"**
Maximum Track Width Permitted	762 mm	**2'6"**	762 mm	**2'6"**
Dual Tilt Option				
G Dual Pitch Adj.	**+4.8° to 5.2°**		**+4.8° to 4.9°**	
H Dual Max. Hyd. Tilt	1139 mm	**3'8.8"**	1231 mm	**4'0.5"**

*Blade capacities as determined by SAE J1265.
Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes**, and not for predicting capacities or productivities in actual field conditions.
Notice that the capacity of the SU-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the SU-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.

MODEL	D11T					
	11SU		11U		11 CD	
Type	Semi-U		Universal		CarryDozer	
Blade Capacities*	27.2 m^3	**35.5 yd^3**	34.4 m^3	**45.0 yd^3**	43.6 m^3	**57.0 yd^3**
Weight, Shipping**						
Standard Dozer	14 813 kg	**32,658 lb**	17 296 kg	**38,131 lb**	24 085 kg	**53,099 lb**
Abrasion Dozer	16 192 kg	**35,698 lb**	18 823 kg	**41,498 lb**	—	
Tractor and Dozer Dimensions:						
A Length	8.58 m	**28'2"**	8.64 m	**28'4"**	8.77 m	**28'9"**
Width	5.50 m	**18'1"**	6.26 m	**20'7"**	6.43 m	**21'1"**
Blade Dimensions:						
B Width (including std. end bits)	5.58 m	**18'4"**	6.35 m	**20'10"**	6.71 m	**22'0"**
C Height	2.75 m	**9'0"**	2.83 m	**9'3"**	2.96 m***	**9'8"*** **
D Max. Digging Depth	766 mm	**2'6.2"**	766 mm	**2'6.2"**	688 mm	**2'3"**
E Ground Clearance @ Full Lift	1533 mm	**5'0.4"**	1533 mm	**5'0.4"**	1850 mm	**6'1"**
G Max. Pitch Adjustment	**+2.1° to 2.2°**		**+2.1° to 2.2°**		—	
H Max. Hydraulic Tilt	1184 mm	**3'10.6"**	1344 mm	**4'4.9"**	1800 mm	**5'11"**
J Hydraulic Tilt (Manual Brace Centered)	886 mm	**2'10.9"**	1006 mm	**3'3.6"**	—	
K Push Arm Trunnion Width (to Ball Centers)	4.18 m	**13'9"**	4.18 m	**13'9"**	4.18 m	**13'9"**
Maximum Track Width Permitted	914 mm	**3'0"**	914 mm	**3'0"**	914 mm	**3'0"**
Dual Tilt Option	**+7.5° to 7.6°**		**+7.5° to 7.6°**			
	or		or			
G Dual Pitch Adjustment	**+0° to 13°**		**+0° to 13°**		**+47.8° to 10.4°**	
H Dual Max. Hyd. Tilt	1706 mm	**5'7.2"**	1938 mm	**6'4.3"**	—	

*Blade capacities as determined by SAE J1265.
Notice that the capacity of the U-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the U-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
Notice that the capacity of the SU-blade is the volume carried by a straight blade of the same dimensions plus the volume included in the "cup" of the SU-blade. It is intended for **relative comparisons of dozer sizes,** and not for predicting capacities or productivities in actual field conditions.
**Shipping Weight — Total Bulldozer Arrangement includes: Blade, push arms or C-frame, braces, cylinders, lines, trunnions and lift cylinder mountings.
***Blade height with cutting edge at 53°.

All dimensions are approximate.

BULLDOZER PRODUCTION OFF-THE-JOB

You can estimate bulldozer production using the production curves that follow and the correction factors that are applicable. Use this formula:

$$\text{Production } (Lm^3/hr) \ (LCY/hr) = \text{Maximum production} \times \text{Correction factors}$$

The bulldozer production curves give maximum uncorrected production for universal, semi-universal, and straight blades and are based on the following conditions:

1. 100% efficiency (60 minute hour — level cycle).
2. Power shift machines with 0.05 min. fixed times.
3. Machine cuts for 15 m (50 feet), then drifts blade load to dump over a high wall. (Dump time — 0 sec.)
4. Soil density of 1370 kg/Lm^3 (2300 lb/LCY).
5. Coefficient of traction:*
   a. Track machines — 0.5 or better
   b. Wheel machines — 0.4 or better
6. Hydraulic controlled blades used.
7. Dig 1F**
   Carry 2F**
   Return 2R**

To obtain estimated production in bank cubic meters or bank cubic yards, appropriate load factor from the Tables section should be applied to the corrected production as calculated above.

$$\text{Production } Bm^3/hr \ (BCY/h) = Lm^3/hr \ (LCY/h) \times LF$$

*Coefficient of traction assumed to be at least 0.4. While poor traction affects both track and wheel vehicles, causing them to take smaller blade loads, wheeled units are affected more severely and production falls much more rapidly. While no fixed rules can predict this production loss, a rough rule of thumb is that wheel dozer production falls off 4% for each one-hundredth decrease in coefficient of traction below 0.40. If, for example, coefficient of traction is 0.30, the difference is ten-hundredths (0.10), and production is 60% (10 × 4% = 40% decrease).

**This gear sequence is based on level to downhill terrain, light to medium density material, and no blade extensions such as spill plates, rock guards, etc. Exceeding these conditions may require carry in 1F, but productivity should equal or exceed "standard conditions" due to the larger loads that can be carried in 1F.

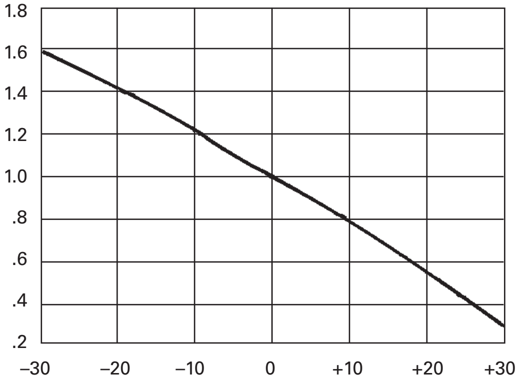
JOB CONDITION CORRECTION FACTORS

	TRACK-TYPE TRACTOR
OPERATOR —	
Excellent	1.00
Average	0.75
Poor	0.60
MATERIAL —	
Loose stockpile	1.20
Hard to cut; frozen —	
with tilt cylinder	0.80
without tilt cylinder	0.70
Hard to drift; "dead" (dry, non-cohesive material) or very sticky material	0.80
Rock, ripped or blasted	0.60-0.80
SLOT DOZING	1.20
SIDE BY SIDE DOZING	1.15-1.25
VISIBILITY —	
Dust, rain, snow, fog or darkness	0.80
JOB EFFICIENCY —	
50 min/hr	0.83
40 min/hr	0.67
BULLDOZER*	
Adjust based on SAE capacity relative to the base blade used in the Estimated Dozing Production graphs.	
GRADES — See following graph.	

***NOTE:** Angling blades and cushion blades are not considered production dozing tools. Depending on job conditions, the A-blade and C-blade will average 50-75% of straight blade production.

% Grade vs. Dozing Factor

(–) Downhill
(+) Uphill



ESTIMATING DOZER PRODUCTION OFF-THE-JOB

Example problem:

Determine average hourly production of a D8T/8SU (with tilt cylinder) moving hard-packed clay an average distance of 45 m (150 feet) down a 15% grade, using a slot dozing technique.

Estimated material weight is 1600 kg/Lm³ (2650 lb/LCY). Operator is average. Job efficiency is estimated at 50 min/hr.

Uncorrected Maximum Production — 458 Lm³/h (600 LCY/hr) (example only)

Applicable Correction Factors:

Hard-packed clay is "hard to cut" material . . .–0.80
Grade correction (from graph) . . . .–1.30
Slot dozing. . . . .–1.20
Average operator . . . .–0.75
Job efficiency (50 min/hr) . . . .–0.83
Weight correction. . . . . (2300/2650)–0.87

Production = Maximum Production × Correction Factors
= (600 LCY/hr) (0.80) (1.30) (1.20) (0.75) (0.83) (0.87)
= 405.5 LCY/hr

To obtain production in metric units, the same procedure is used substituting maximum uncorrected production in Lm³.

= 458 Lm³/h × Factors
= 309.6 Lm³/h

RIPPERS

CONTENTS

Features:

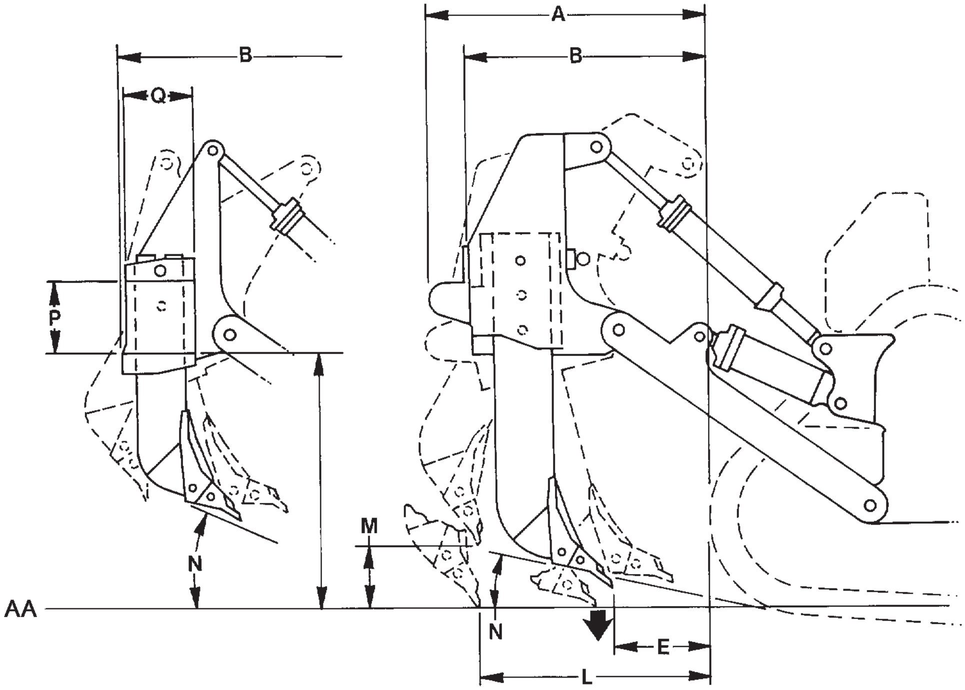
- **Parallelogram linkage with hydraulically variable pitch** on D7E, D7R, D8R/D8T, D9R/D9T, D10T2 and D11T. Operator can adjust angle of ripper tip to the material for penetration at all ripping depths to increase production.
- **Fixed Parallelogram linkage design** used on D3K2, D4K2, D5K2, D6K2, D6N, D6R, D6R XL, D6T and D6T XL. This design holds tooth angle constant at all ripping depths.
- **Adjustable Single shank** arrangements available for D8R/D8T, D9R/D9T, D10T2 and D11T for tough ripping applications and deep ripping requirements.
- **Hydraulically Variable Pitch Multi-shank** arrangements available on D7E, D7R, D8R/D8T, D9R/D9T, D10T2 and D11T allow wide-beam coverage in easier-to-rip materials.
- **Counterweighted CarryDozer Ripper single shank** available for D11T and D11T CD, multi-shank available for D11T CD.

DEFINITION OF FORCES SHOWN IN TABLES THAT FOLLOW

"Pryout," (Breakout) kilonewtons (and pounds) — the maximum sustained upward force, generated by the lift cylinders measured at the ripper tip. Breakout force is measured with the shank in the top hole, shank vertical and ripper full down. Breakout force may be hydraulically or balance limited.

"Penetration force," kilonewtons (and pounds) — the maximum sustained downward force, generated by the ripper lift cylinders measured at the ripper tip, which is required to raise the back end of the vehicle with the tip on ground and the shank (pinned in the top hole) vertical.

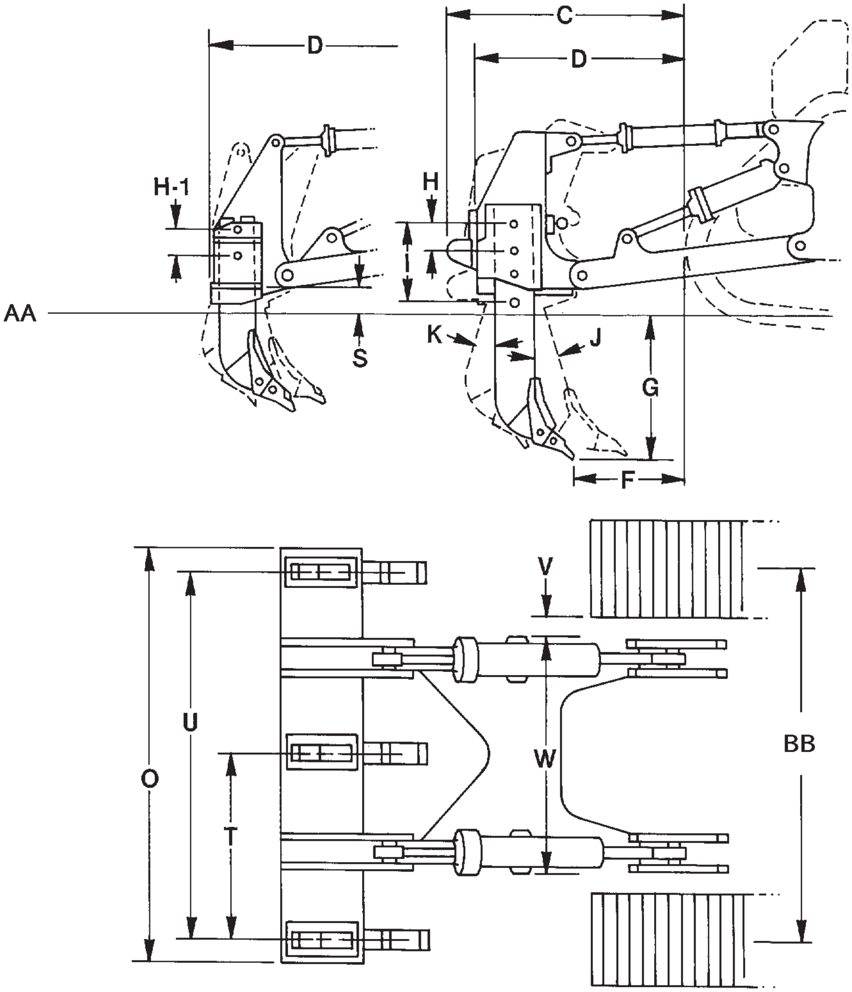
Adjustable Parallelogram Ripper



NOTE: Letters correspond to ripper specifications on pages that follow.

KEY
AA — Ground Line

Adjustable Parallelogram Ripper

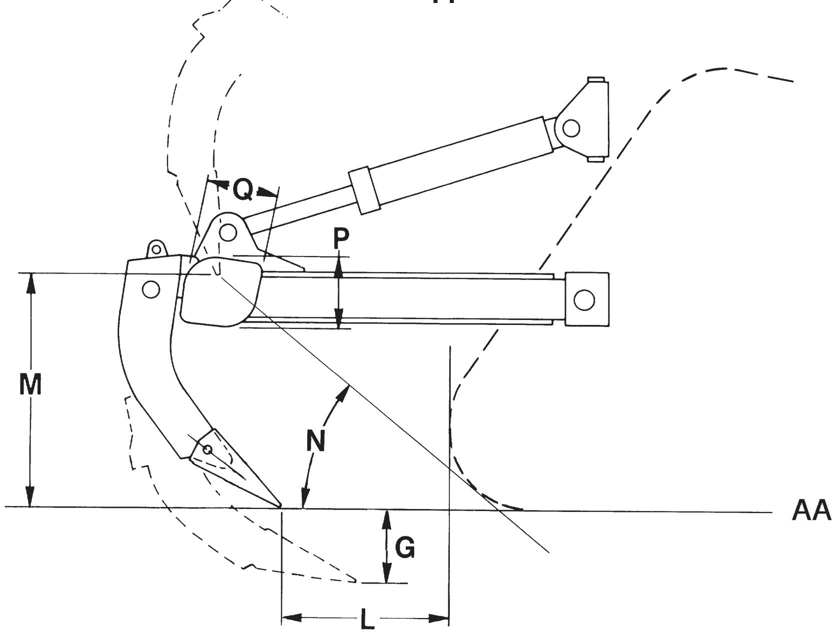


NOTE: Letters correspond to ripper specifications on pages that follow.

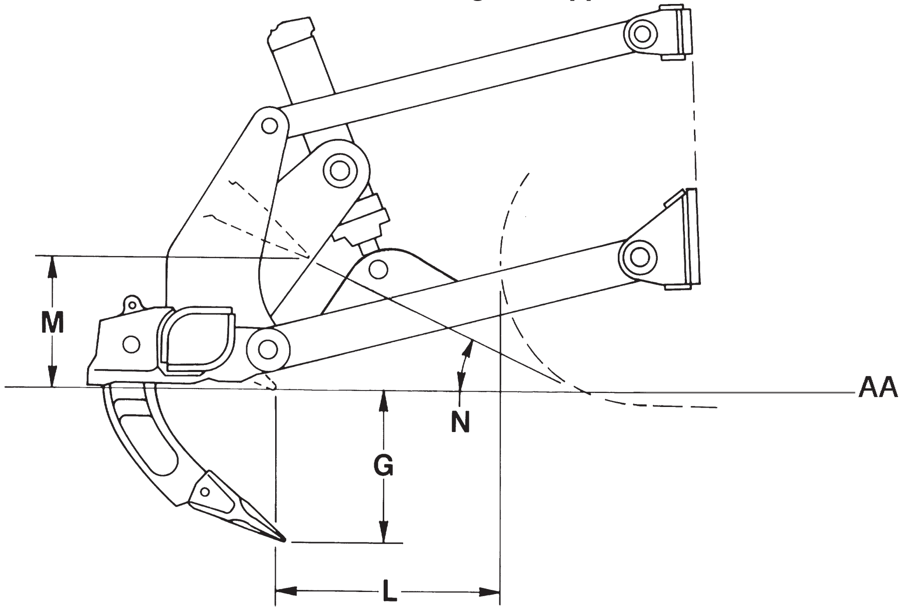
KEY

AA — Ground Line
BB — Track Gauge

Radial Ripper*



Fixed Parallelogram Ripper



NOTE: Letters correspond to ripper specifications on pages that follow.

KEY

AA — Ground Line
* — Tip Standard

TRACTOR/RIPPER	D11T		D11T	
	Adjustable Parallelogram			
Ripper Type	**Multi-shank**		**CD Multi-shank**	
Dimensions:				
Ripper to Track				
Ripper length behind track, shank vertical, ripper up (A)				
A With Pushblock	**N/A**		**N/A**	
B Without Pushblock	1.69 m	**5'6"**	1.71 m	**5'8"**
Ripper length behind track, shank vertical, ripper down (A)				
C With Pushblock	**N/A**		**N/A**	
D Without Pushblock	2.16 m	**7'1"**	2.16 m	**7'1"**
Tip to track distance, shank vertical (A)				
E Ripper Up	0.78 m	**2'7"**	0.78 m	**2'7"**
F Ripper Down	1.95 m	**6'5"**	1.96 m	**6'5"**
Shank*				
G Maximum digging depth	1100 mm	**3'7.3"**	1100 mm	**3'7.3"**
H Dig adjustment per hole	280 mm	**11"**	280 mm	**11"**
I Total dig adjustment	280 mm	**11"**	280 mm	**11"**
Pitch Adjustment, ripper down:				
J Forward	**12.2°**		**12.2°**	
K Backward	**31.8°**		**31.8°**	
L Maximum reach at ground line	1.71 m	**5'7"**	1.71 m	**5'7"**
M Maximum ground clearance under tooth (shank pinned in bottom hole)	1090 mm	**3'6.9"**	1090 mm	**3'6.9"**
N Maximum ramp angle, ripper up (shank pinned in bottom hole)	**36.4°**		**36.4°**	
Shank Section	100 × 400 mm	**3.9" × 15.7"**	100 × 400 mm	**3.9" × 15.7"**
Ripper Beam				
O Overall width	3.33 m	**10'11"**	3.34 m	**10'11.5"**
P Height	560 mm	**22"**	595 mm	**23.4"**
Q Length	560 mm	**22"**	595 mm	**23.4"**
Clearance under beam, shank vertical				
R Ripper Up	2.06 m	**6'9"**	2.03 m	**6'8"**
S Ripper Down	282 mm	**11.1"**	247 mm	**9.7"**
Number of Pockets	**3**		**3**	
T Pocket Spacing	1.5 m	**4'11"**	1.5 m	**4'11"**
U Shank Gauge	3.0 m	**9'10"**	3.0 m	**9'10"**
V Track Clearance with standard shoe	166 mm	**5.6"**	166 mm	**5.6"**
W Width across widest part of lift cylinders	1.9 m	**6'3"**	1.9 m	**6'3"**
Installed Weights:				
Ripper with standard shank	8674 kg	**19,123 lb**	11 790 kg	**25,993 lb**
Each additional tooth group	689 kg	**1519 lb**	689 kg	**1519 lb**
Ripper Forces:**				
Penetration Force, shank vertical	335 kN	**75,311 lb**	365 kN	**82,055 lb**
Pryout Force, shank vertical	632 kN	**142,079 lb**	636 kN	**142,978 lb**

*Hydraulic pin puller is standard with deep ripping shank. Deep Ripping Arrangement maximum digging depth is 2.18 m **(7'2")**.
**Forces are for a ripper on a tractor equipped with an EROPS, U-Dozer and performance track. Forces will vary slightly with other vehicle configurations.

TIP SELECTION FOR THE D8R/D8T, D9R/D9T, D10T2 AND D11T RIPPERS

Three tip configurations (short, intermediate and long) in two styles (centerline and penetration) are available for economical operation in a variety of conditions.

RECOMMENDED TIP USAGE

Short — Use in high impact conditions where breakage problems occur. The shorter the tip, the more it resists breakage.

Intermediate — Most effective in moderate impact conditions where abrasion is not excessive.

Long — Use in loose, abrasive materials where breakage is not a problem. Generally offers the most wear material.

Centerline vs Penetration

The materials being ripped and the tractor doing the ripping will both have an effect on which tip will do the best job. High density material requires a "penetration" tip. High impact material requires a "centerline" tip. The following is a general guide to tip application.

	Tips to use		
Ripping Condition	**D8R/D8T D9R/D9T**	**D10T2**	**D11T**
Tandem Tractors	Short	Short	Short
Single Shank and Multi-shank			
Extreme Duty	Int.	Short	Short
Medium Duty	Long	Int.	Int.
Abrasive Duty	Long	Long	Long

Always use the longest tip that will wear without excessive breakage. Different tips should be tried to determine the most economical.

ESTIMATING RIPPING PRODUCTION

Ripping costs must be compared to other methods of loosening the material — usually drilling and blasting — on a cost per ton or bank cubic yard basis. Thus, an accurate estimation of ripper production is needed to determine unit ripping costs.

There are three general methods of estimating ripping production:

1. The best method is to record the time spent ripping, then remove (using scrapers or loaders and trucks) and weigh the ripped material. The total weight divided by the time spent will give hourly production. If the contractor is paid by volume, then a density must be used and the accuracy is only as good as the density used. For payment by volume removed, method 2 may be desirable. Some care will be needed to assure that only ripped material is removed.
2. Another method is to cross-section the area and then record the time spent ripping. After the material has been removed, cross-section the area again to determine the volume of rock removed. The volume divided by the time spent ripping gives the ripping rate per minute or hour.
3. Timing the ripper over a measured distance is the least accurate method, but valuable for quick estimating on the job. An average cycle time should be determined from a number of timed cycles. Turn-around or back-up time must be included. Measure the average rip distance, rip spacing and depth of penetration. This data will give the volume per cycle from which the production in bank cubic yards can be calculated. Experience has shown results obtained from this method are about 10 to 20% higher than the more accurate method of cross-sectioning.

An example of the measured distance method for calculating ripper production is:

Data — D10T2 — No. 10 with one shank.
910 mm (36 in) between passes.
1.6 km/h (1 mph) average speed (including slippage and stalls).
Every 91 m (300 ft) requires 0.25 min to raise, pivot, turn, and lower again: 91 m (300 ft) = 1 pass.
610 mm (24 in) penetration.
Full time ripping (no pushing or dozing assignment).

Example of Estimating Production (Metric)

Time per pass:

1.6 km/h = 26.7 m/min. Then $\frac{91\text{ m}}{26.7\text{ m/min}} = 3.41$ min;

3.41 min + 0.25 min (turn time) = 3.66 min/pass.

If the operator works an average of 45 min per h, it is possible to make = $\frac{45}{3.66}$ = 12.3 passes per h

Volume ripped: 91 m × 0.9 m × 0.6 m = 49.1 BCM per pass

Production = 49.1 × 12.3 = 604 BCM per h

Remember the results from this method are usually 10 to 20 per cent higher than the actual production that can be expected on the job.

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Example of Estimating Production (English)

Time per pass:

MPH = 88 fpm. Then $\frac{300\text{ ft}}{88\text{ fpm}} = 3.41$ min;

3.41 min + 0.25 min. (turn time) = 3.66 min/pass.

If the operator works an average of 45 min per h, it is possible to make = $\frac{45}{3.66}$ = 12.3 passes per h

Volume ripped: $\frac{300 \times 3 \times 2}{27}$ = 66.7 BCY per pass

Production = 66.7 × 12.3 = 820 BCY per hr

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NOTE: The demands of heavy ripping will increase the normal owning and operating costs of the tractor.

These costs should be increased no less than 30-40% in heavy ripping applications to estimate rock loosening costs.

There is no ready answer or rule-of-thumb solution to predict ripping production. Even if everything is known about the seismic velocity of the material, its composition, job conditions, equipment and operator, only a "guesstimate" can be given. The final answer must come from a production study obtained on the job site.

Sample problem (Metric)

Determine the loosening costs in the following situation:

Machine	— D10T2 Tractor with No. 10 Single Shank Ripper
Rip Spacing	— 915 mm
Ripper Penetration	— 610 mm
Rip Distance	— 91 m
Rip Time	— 3.41 minutes
Maneuver Time	— 0.25 minutes
Seismic Velocity	— 1830 meters per second

Assume 60 min. hour

Solution:

1. Total Cycle Time = 3.41 + 0.25 = 3.66 min

   Cycles/hour = $\frac{60\text{ min/hr}}{3.66\text{ min/cycle}} = 16.4$

2. Production per cycle = 91 m × 0.9 m × 0.6 m = 49.1 BCM/cycle
3. Production = 49.1 BCM/cycle × 16.4 cycles/h = 805 BCM/h
4. Remember results of this method are usually 10 to 20% high.

   Actual Production = 80% of 805 BCM/h = 644 BCM/h

   Or 90% of 805 BCM/h = 725 BCM/h

5. Owning and Operating Costs

   A D10T2 (ripping only) could have a \$115.00/h O & O costs including \$30/h operator.

6. Loosening Costs

   \$115.00/hr ÷ 644 BCM/h = \$0.179/BCM

   \$115.00/hr ÷ 725 BCM/h = \$0.159/BCM

   The loosening cost should range from 15.9¢ to 17.9¢/BCM

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Sample problem (English)

Determine the loosening costs in the following situation:

Machine	— D10T2 Tractor with No. 10 Single Shank Ripper
Rip Spacing	— 3 feet
Ripper Penetration	— 2 feet
Rip Distance	— 300 feet
Rip Time	— 3.41 minutes
Maneuver Time	— 0.25 minutes
Seismic Velocity	— 6000 feet per second

Assume 60 min. hour

Solution:

1. Total Cycle Time = 3.41 + 0.25 = 3.66 min

   $$\text{Cycles/hour} = \frac{60 \text{ min/hr}}{3.66 \text{ min/cycle}} = 16.4$$

2. Production per cycle = $\dfrac{300 \times 3 \times 2}{27}$ = 66.7 BCY/cycle

3. Production = 66.7 BCY/cycle × 16.4 cycles/hr = 1094 BCY/hour

4. Remember results of this method are usually 10 to 20% high.

   Actual Production = 80% × 1094
   = 875 BCY/hr
   or 90% × 1094 = 984 BCY/hr

5. Owning and Operating Costs

   A D10T2 (ripping only) could have a $115.00/hr O & O costs including $30/hr operator

6. Loosening Costs

   $115.00/hr ÷ 875 BCY/hr = $0.131/BCY
   $115.00/hr ÷ 984 BCY/hr = $0.117/BCY

   The loosening cost should range from 11.7¢ to 13.1¢/BCY

●●●

USE OF SEISMIC VELOCITY CHARTS

The charts of ripper performance estimated by seismic wave velocities have been developed from field tests conducted in a variety of materials. Considering the extreme variations among materials and even among rocks of a specific classification, the charts must be recognized as being at best only one indicator of rippability.

Accordingly, consider the following precautions when evaluating the feasibility of ripping a given formation:

— Tooth penetration is often the key to ripping success, regardless of seismic velocity. This is particularly true in homogeneous materials such as mudstones and claystones and the fine-grained caliches. It is also true in tightly cemented formations such as conglomerates, some glacial tills and caliches containing rock fragments.

— Low seismic velocities of sedimentaries can indicate probable rippability. However, if the fractures and bedding joints do not allow tooth penetration, the material may not be ripped effectively.

— Pre-blasting or "popping" may induce sufficient fracturing to permit tooth entry, particularly in the caliches, conglomerates and some other rocks; but the economics should be checked carefully when considering popping in the higher grades of sandstones, limestones and granites.

Ripping is still more art than science, and much will depend on operator skill and experience. Ripping for scraper loading may call for different techniques than if the same material is to be dozed away. Cross-ripping requires a change in approach. The number of shanks used, length and depth of shank, tooth angle, direction, throttle position — all must be adjusted according to field conditions. Ripping success may well depend on the operator finding the proper combination for those conditions.

WHEEL LOADERS
INTEGRATED TOOLCARRIERS

CONTENTS

WHEEL LOADERS

Features:

- **Cat® heavy duty diesel engine.**
- **Productive operator environment. Excellent visibility.**
- **Automatic lift and bucket controls.**
- **Adjustable suspension seat and steering column.**
- **Four wheel enclosed wet disc brakes.**
- **Automatic power shift transmissions.** Allows operator to select automatic or manual mode.
- **Hydrostatic drive on 903C2, 906K/M, 907K/M, 908K/M, 910K/M, 914K/M, 918M, 924K, 926M, 930K/M and 938K/M.**
- **Transmission neutralizer switch (950H-980H, 950K-980K, 950L-980L and 950M-982M).**
- **Advanced power train with continuously variable transmission** available on the 966M XE and 972M XE.
- **Computerized machine function monitoring.**
- **Command control steering** with integrated transmission controls and electro-hydraulic controls … 950H-980H.
- **Electro-Hydraulic (EH) Joystick Steering with Force Feedback (Speed Sensitive) on 966K, 966M, 972K, 972M, 980K, 980M and 982M (optional on 950M and 962M).**
- **Lock up clutch on 950L, 950M, 962L, 962M, 966L, 966M, 972L, 972M, 980L, 980M, 982M, 988K, 990K and 994K (optional on the 980K, 992K and 993K).**
- **Impeller clutch on 988K, 990K, 992K, 993K and 994K.**
- **Tilting hood … 950H-980H, 950K-980K, 950L-980L and 950M-982M.**
- **Brake wear indicator.**
- **Limited slip differentials on 924K, 926M, 930K/M, 938K/M (optional on 950H-980H, 950K-980K, 980L, 980M and 982M).**
- **Differential locks … 903C2, 906K/M, 907K/M, 908K/M, 910K/M, 914K/M, 918M, 924K, 926M, 930K/M, 938K/M, 950M, 962M, 966M and 972M (optional on 950L, 962L, 966L and 972L).**
- **Automatic Ride Control suspension system.** Operator select "on," "off" or "automatic" (excluding 903C2).
- **Payload control system** (excluding models below 924K).
- **Optional Fusion coupler system** for attachment interchangeability with pin-on performance. Attachments can interchange across the entire SWL/MWL/IT line (excluding models below 924K).
- **Performance Series Buckets** — Reduced dig times and better material retention lead to significant productivity and fuel efficiency improvements (910K/M, 914K/M, 918M, 924K, 926M, 930K/M, 938K/M, 950H-980H, 950K- 980K, 950L-980L and 950M-982M).

Listed features may be standard on some models, optional or unavailable on others. Contact your Cat dealer for specific information.

MODEL	950H		962H		966H	
Emission Standards	**Tier 3 equivalent***		**Tier 3 equivalent***		**Tier 3 equivalent***	
Maximum Engine: Net	147 kW	**197 hp**	156 kW	**209 hp**	195 kW	**262 hp**
Gross	162 kW	**217 hp**	172 kW	**231 hp**	211 kW	**283 hp**
Engine Model	**C7 ACERT**		**C7 ACERT**		**C11 ACERT**	
Maximum Net Power Engine RPM	**1800**		**1800**		**1800**	
Bore	110 mm	**4.3"**	110 mm	**4.3"**	130 mm	**5.1"**
Stroke	127 mm	**5"**	127 mm	**5"**	140 mm	**5.5"**
No. Cylinders	**6**		**6**		**6**	
Displacement	7.2 L	**439 in³**	7.2 L	**439 in³**	11.1 L	**677 in³**
Speeds Forward:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	6.9	**4.3**	7.0	**4.4**	6.7	**4.2**
2nd	12.7	**7.9**	13.0	**8.1**	12.6	**7.8**
3rd	22.3	**13.9**	22.6	**14.0**	22.1	**13.7**
4th	37.0	**23.0**	38.0	**23.6**	37.4	**23.2**
Speeds Reverse:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	7.6	**4.7**	7.6	**4.7**	7.4	**4.6**
2nd	13.9	**8.6**	13.9	**8.6**	13.9	**8.6**
3rd	24.5	**15.2**	24.5	**15.2**	24.3	**15.1**
4th	40.0	**24.9**	40.0	**24.9**	37.4	**23.2**
Hydraulic Cycle Time, Rated Load in Bucket:	**Seconds**		**Seconds**		**Seconds**	
Raise (from Carry Position)	**6.2**		**6.2**		**5.9**	
Dump (at Maximum Raise)	**2.0**		**2.0**		**1.6**	
Lower (Empty, Float Down)	**2.5**		**2.5**		**2.4**	
Total	**10.7**		**10.7**		**9.9**	
Tread Width	2.14 m	**7'0"**	2.14 m	**7'0"**	2.23 m	**7'4"**
Width Over Tires	2.79 m	**9'2"**	2.79 m	**9'2"**	3.06 m	**9'10"**
Ground Clearance	412 mm	**16"**	412 mm	**16"**	434 mm	**17"**
Fuel Tank Capacity	264 L	**70 U.S. gal**	264 L	**70 U.S. gal**	380 L	**100 U.S. gal**
Hydraulic Tank Capacity	110 L	**29 U.S. gal**	110 L	**29 U.S. gal**	110 L	**29 U.S. gal**
Hydraulic System Capacity (includes tank)	186 L	**48.4 U.S. gal**	186 L	**48.4 U.S. gal**	200 L	**52 U.S. gal**

*Meets Tier 3, Stage IIIA, Japan 2006 (Tier 3) equivalent emission standards.

NOTE: Net Engine Power is provided according to SAE J1349 and ISO 9249. Gross Engine Power is provided according to SAE J1995. Machines may only be available in certain regions. Contact your local Cat dealer for product availability.

MODEL	972H		980H		986H		990K	
Emission Standards	**Tier 3 equivalent***		**Tier 3 equivalent***		**Tier 2 equivalent or Tier 3 equivalent****		**Tier 2 equivalent or Tier 4 Final*****	
Maximum Engine: Net	214 kW	**287 hp**	260 kW	**349 hp**	305 kW	**409 hp**	521 kW	**699 hp**
Gross	232 kW	**311 hp**	293 kW	**392 hp**	335 kW	**449 hp**	561 kW	**752 hp**
Rated Payload†	—		—		10 tonnes	**11 tons**	15.9 tonnes	**17.5 tons**
Gross Rated Bucket Payload†	—		—		—		24 249 kg	**53,460 lb**
Engine Model	**C13 ACERT**		**C15 ACERT**		**C15 ACERT**		**C27 ACERT**	
Maximum Net Power Engine RPM	**1800**		**1800**		**1800**		**1800**	
Bore	130 mm	**5.1"**	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	157 mm	**6.2"**	171 mm	**6.75"**	171 mm	**6.75"**	152 mm	**6"**
No. Cylinders	**6**		**6**		**6**		**12**	
Displacement	12.5 L	**763 in³**	15.2 L	**928 in³**	15.2 L	**928 in³**	27.0 L	**1650 in³**
Speeds Forward:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	7.2	**4.5**	6.6	**4.1**	7.3	**5**	7.3	**4.5**
2nd	12.6	**7.8**	11.8	**7.3**	12.7	**8**	13.3	**8.3**
3rd	21.4	**13.3**	20.7	**12.9**	22	**14**	22.9	**14.2**
4th	36.9	**22.9**	36.3	**22.6**	39	**24**	—	
Speeds Reverse:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	8.2	**5.1**	7.6	**4.7**	7.6	**5**	7.9	**4.9**
2nd	14.2	**8.8**	13.5	**8.4**	14.1	**9**	14.7	**9.1**
3rd	24.3	**15.1**	23.6	**14.7**	25	**12**	24.9	**15.5**
4th	38.8	**24.0**	41.5	**25.8**	—		—	
Hydraulic Cycle Time, Rated Load in Bucket:	**Seconds**		**Seconds**		**Seconds**		**Seconds**	
Raise††	**5.9**		**6.0**		**8.5**		**8.2**	
Dump (at Maximum Raise)	**2.1**		**2.1**		**3**		**2.9**	
Lower (Empty, Float Down)	**2.4**		**3.4**		**4.3**		**3.6**	
Total	**10.4**		**11.5**		**15.8**		**13.8**	
Tread Width	2.23 m	**7'4"**	2.43 m	**8'0"**	2.59 m	**8'6"**	3.1 m	**10'2"**
Width Over Tires	3.00 m	**9'10"**	3.18 m	**10'5"**	3.54 m	**11'7"**	4.1 m	**13'5"**
Ground Clearance	434 mm	**17"**	430 mm	**16.9"**	459 mm	**18"**	596 mm	**23.5"**
Fuel Tank Capacity	380 L	**100 U.S. gal**	453 L	**120 U.S. gal**	600 L	**159 U.S. gal**	1114 L	**294 U.S. gal**
Hydraulic Tank Capacity	110 L	**29 U.S. gal**	125 L	**33 U.S. gal**	130 L	**34 U.S. gal**	—	
Implement and Fan	—		—		—		261 L	**68.9 U.S. gal**
Steering and Braking	—		—		—		132 L	**34.9 U.S. gal**
Hydraulic System Capacity (includes tank)	200 L	**52 U.S. gal**	250 L	**66 U.S. gal**	330 L	**87 U.S. gal**	795 L	**210 U.S. gal**

*Meets Tier 3, Stage IIIA, Japan 2006 (Tier 3) equivalent emission standards.
**Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.
***Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.
†Changes in bucket weight, including field installed wear iron, can impact rated payload. Consult your Cat dealer for assistance in selecting and configuring the proper bucket for the application. The Cat Large Wheel Loader Payload Policy is a guideline intended to maximize wheel loader structural and component life. The Cat Payload Policy is that the "Gross Bucket plus Payload Capacity" is the MAXIMUM weight that should be carried on the end of the Lift Arm/Boom.
††Raise is from carry position for the 972H and 980H.

NOTE: 972H and 980H Net Engine Power is provided according to SAE J1349 and ISO 9249. Gross Engine Power is provided according to SAE J1995. The 972H and 980H are not available in all regions. Contact your local Cat dealer for product availability.

MODEL	992K		993K		994K	
Maximum Engine: Net	607 kW	**814 hp**	764 kW	**1024 hp**	1297 kW	**1739 hp**
Gross	671 kW	**900 hp**	773 kW	**1036 hp**	1377 kW	**1847 hp**
Rated Payload:*						
STD	21.8 tonnes	**24 tons**	22.7 tonnes	**30 tons**	40.8 tonnes	**45 tons**
HL, EHL, SHL	19 tonnes	**21 tons**	24.9 tonnes	**27.5 tons**	38.1 tonnes	**42 tons**
Gross Rated Bucket Payload:*						
STD	33 687 kg	**74,265 lb**	42 912 kg	**94,603 lb**	64 791 kg	**142,838 lb**
HL	30 138 kg	**66,441 lb**	40 459 kg	**89,195 lb**	61 458 kg	**135,489 lb**
Engine Model	**C32 ACERT****		**C32 ACERT****		**3516E**	
Emission Level						
Rated Engine RPM	**1750**		**1900**		**1600**	
Bore	145 mm	**5.7"**	145 mm	**5.7"**	170 mm	**6.7"**
Stroke	162 mm	**6.4"**	162 mm	**6.4"**	215 mm	**8.5"**
No. Cylinders	**12**		**12**		**16**	
Displacement	32.1 L	**1959 in^3**	32.1 L	**1959 in^3**	78 L	**4766 in^3**
Speeds Forward:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	7.1	**4.4**	6.8	**4.2**	7.4	**4.6**
2nd	12.2	**7.6**	11.9	**7.4**	12.9	**8.0**
3rd	20.6	**12.8**	20.5	**12.7**	24.0	**14.9**
Speeds Reverse:	**km/h**	**mph**	**km/h**	**mph**	**km/h**	**mph**
1st	7.4	**4.6**	7.5	**4.7**	8.1	**5.0**
2nd	13.0	**8.1**	13.1	**8.1**	14.1	**8.8**
3rd	22.4	**13.9**	22.5	**13.9**	24.0	**14.9**
Hydraulic Cycle Time, Rated Load in Bucket:	**Seconds**		**Seconds**		**Seconds**	
Raise	**9.4**		**9.2**		**12.6**	
Dump	**1.8**		**1.8**		**3.1**	
Lower (Empty, Float Down)	**3.7**		**3.1**		**4.2**	
Total	**14.9**		**14.1**		**19.9**	
Tread Width	3.3 m	**10'10"**	3.54 m	**11'6"**	4.3 m	**14'1"**
Width Over Tires	4.5 m	**14'9"**	4.93 m	**16'2"**	5.49 m	**18'10"**
Ground Clearance	682 mm	**26.8"**	721 mm	**2'5"**	898 mm	**33"**
Fuel Tank Capacity	1610 L	**425 U.S. gal**	2170 L	**573 U.S. gal**	3445 L	**910 U.S. gal**
Hydraulic Systems:						
Lift, Tilt	646 L	**171 U.S. gal**	755 L	**199 U.S. gal**	1022 L	**270 U.S. gal**
Tank Only	326 L	**86 U.S. gal**	553 L	**146 U.S. gal**	756 L	**200 U.S. gal**
Steering and Brakes	231 L	**61 U.S. gal**	227 L	**60 U.S. gal**	379 L	**100 U.S. gal**
Tank Only	159 L	**42 U.S. gal**	185 L	**48.9 U.S. gal**	340 L	**90 U.S. gal**

*Changes in bucket weight, including field installed wear iron, can impact rated payload. Consult your Cat dealer for assistance in selecting and configuring the proper bucket for the application. The Cat Large Wheel Loader Payload Policy is a guideline intended to maximize wheel loader structural and component life. The Cat Payload Policy is that the "Gross Bucket plus Payload Capacity" is the MAXIMUM weight that should be carried on the end of the Lift Arm/Boom.
**Products available to meet Tier 2/Stage II/Japan 2001 (Tier 2) equivalent OR Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.
NOTE: The 994K meets Tier 1 equivalent emission standards.

Bucket Type		General Purpose — Pin On								High Lift Delta
Edge Type		**Bolt-on Cutting Edges**	**Teeth & Segments**	**Bolt-on Cutting Edges**	**Teeth & Segments**	**Bolt-on Cutting Edges**	**Teeth & Segments**	**Bolt-on Cutting Edges**	**Teeth & Segments**	
Capacity — rated	m³	3.80	3.80	4.00	4.00	4.20	4.20	4.60	4.60	—
	yd³	**4.97**	**4.97**	**5.23**	**5.23**	**5.49**	**5.49**	**6.02**	**6.02**	**—**
Capacity — 110%	m³	4.18	4.18	4.40	4.40	4.62	4.62	5.06	5.06	—
	yd³	**5.47**	**5.47**	**5.75**	**5.75**	**6.04**	**6.04**	**6.62**	**6.62**	**—**
Width	mm	3220	3271	3220	3271	3220	3271	3220	3271	—
	ft/in	**10'6"**	**10'8"**	**10'6"**	**10'8"**	**10'6"**	**10'8"**	**10'6"**	**10'8"**	**—**
Dump clearance at maximum lift and 45° discharge	mm	3067	2915	3058	2905	2991	2837	2977	2823	558
	ft/in	**10'0"**	**9'6"**	**10'0"**	**9'6"**	**9'9"**	**9'3"**	**9'9"**	**9'3"**	**1'9"**
Reach at maximum lift and 45° discharge	mm	1327	1467	1334	1473	1388	1525	1400	1537	–25
	ft/in	**4'4"**	**4'9"**	**4'4"**	**4'10"**	**4'6"**	**5'0"**	**4'7"**	**5'0"**	**–1"**
Reach at level lift arm and bucket level	mm	2739	2943	2750	2955	2838	3043	2857	3062	404
	ft/in	**8'11"**	**9'7"**	**9'0"**	**9'8"**	**9'3"**	**9'11"**	**9'4"**	**10'0"**	**1'3"**
Digging depth	mm	124	124	124	124	124	124	124	124	–25
	in	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**4.9**	**–1"**
Overall length	mm	8681	8906	8693	8918	8780	9005	8799	9024	697
	ft/in	**28'6"**	**29'3"**	**28'7"**	**29'4"**	**28'10"**	**29'7"**	**28'11"**	**29'8"**	**2'3"**
Overall height with bucket at maximum lift	mm	5788	5788	5902	5902	5902	5902	5874	5874	558
	ft/in	**19'0"**	**19'0"**	**19'5"**	**19'5"**	**19'5"**	**19'5"**	**19'4"**	**19'4"**	**1'9"**
Loader clearance circle with bucket at carry position	mm	14 727	14 899	14 733	14 905	14 778	14 951	14 787	14 961	481
	ft/in	**48'4"**	**48'11"**	**48'5"**	**48'11"**	**48'6"**	**49'1"**	**48'7"**	**49'1"**	**1'6"**
Static tipping load, straight (ISO)*	kg	16 045	15 863	16 024	15 842	15 831	15 648	15 822	15 636	372
	lb	**35,364**	**34,963**	**35,319**	**34,915**	**34,893**	**34,488**	**34,872**	**34,463**	**821**
Static tipping load, straight (rigid tire)*	kg	17 316	17 131	17 305	17 120	17 104	16 917	17 120	16 931	299
	lb	**38,164**	**37,757**	**38,141**	**37,733**	**37,697**	**37,287**	**37,732**	**37,318**	**658**
Static tipping load, articulated (ISO)*	kg	14 052	13 869	14 028	13 845	13 848	13 664	13 829	13 643	166
	lb	**30,971**	**30,569**	**30,918**	**30,514**	**30,522**	**30,117**	**30,479**	**30,070**	**366**
Static tipping load, articulated (rigid tire)*	kg	15 312	15 128	15 298	15 113	15 111	14 925	15 116	14 928	112
	lb	**33,749**	**33,342**	**33,718**	**33,309**	**33,304**	**32,894**	**33,316**	**32,901**	**248**
Breakout force**	kN	187	185	185	183	173	171	170	168	–14
	lbf	**42,151**	**41,781**	**41,695**	**41,326**	**38,984**	**38,618**	**38,277**	**37,912**	**–3170**
Operating weight*	kg	23 073	23 211	23 125	23 263	23 181	23 319	23 221	23 359	1763
	lb	**50,853**	**51,157**	**50,968**	**51,272**	**51,091**	**51,395**	**51,179**	**51,483**	**3888**

*Static tipping loads and operating weights shown are based on standard machine configuration with 26.5R25 L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolants, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

Bucket Type		Rock — Pin On		Material Handling/Standard — Pin On				
Edge Type		**Bolt-on Cutting Edges**	**Teeth & Segments**	**Bolt-on Cutting Edges**	**Teeth & Segments**	**Bolt-on Cutting Edges**	**Teeth & Segments**	**High Lift Delta**
Capacity — rated	m³	3.40	3.40	4.00	4.00	4.60	4.60	—
	yd³	**4.45**	**4.45**	**5.23**	**5.23**	**6.02**	**6.02**	**—**
Capacity — 110%	m³	3.74	3.74	4.40	4.40	5.06	5.06	—
	yd³	**4.89**	**4.89**	**5.75**	**5.75**	**6.62**	**6.62**	**—**
Width	mm	3252	3252	3220	3271	3220	3271	—
	ft/in	**10'8"**	**10'8"**	**10'6"**	**10'8"**	**10'6"**	**10'8"**	**—**
Dump clearance at maximum lift and 45° discharge	mm	3124	3026	2978	2815	2893	2730	558
	ft/in	**10'2"**	**9'11"**	**9'9"**	**9'2"**	**9'5"**	**8'11"**	**1'9"**
Reach at maximum lift and 45° discharge	mm	1454	1576	1252	1379	1337	1464	–25
	ft/in	**4'9"**	**5'2"**	**4'1"**	**4'6"**	**4'4"**	**4'9"**	**–1"**
Reach at level lift arm and bucket level	mm	2818	2974	2769	2973	2889	3093	404
	ft/in	**9'2"**	**9'9"**	**9'1"**	**9'9"**	**9'5"**	**10'1"**	**1'3"**
Digging depth	mm	68	68	124	124	124	124	–25
	in	**2.7**	**2.7**	**4.9**	**4.9**	**4.9**	**4.9**	**–1"**
Overall length	mm	8745	8906	8711	8936	8831	9056	697
	ft/in	**28'9"**	**29'3"**	**28'7"**	**29'4"**	**29'0"**	**29'9"**	**2'3"**
Overall height with bucket at maximum lift	mm	5845	5845	5858	5858	5982	5982	558
	ft/in	**19'3"**	**19'3"**	**19'3"**	**19'3"**	**19'8"**	**19'8"**	**1'9"**
Loader clearance circle with bucket at carry position	mm	14 813	14 901	14 742	14 914	14 804	14 978	481
	ft/in	**48'8"**	**48'11"**	**48'5"**	**49'0"**	**48'7"**	**49'2"**	**1'6"**
Static tipping load, straight (ISO)*	kg	16 255	16 185	15 834	15 653	15 622	15 438	372
	lb	**35,826**	**35,672**	**34,899**	**34,499**	**34,431**	**34,026**	**821**
Static tipping load, straight (rigid tire)*	kg	17 542	17 471	17 078	16 894	16 885	16 699	299
	lb	**38,663**	**38,507**	**37,640**	**37,235**	**37,216**	**36,805**	**658**
Static tipping load, articulated (ISO)*	kg	14 217	14 147	13 861	13 680	13 655	13 471	166
	lb	**31,334**	**31,180**	**30,551**	**30,151**	**30,096**	**29,690**	**366**
Static tipping load, articulated (rigid tire)*	kg	15 496	15 425	15 097	14 913	14 909	14 723	112
	lb	**34,153**	**33,998**	**33,274**	**32,870**	**32,861**	**32,450**	**248**
Breakout force**	kN	186	185	182	181	166	165	–14
	lbf	**41,828**	**41,704**	**41,111**	**40,742**	**37,481**	**37,117**	**–3170**
Operating weight*	kg	24 004	24 056	23 134	23 272	23 267	23 404	1763
	lb	**52,905**	**53,019**	**50,987**	**51,291**	**51,279**	**51,583**	**3888**

*Static tipping loads and operating weights shown are based on standard machine configuration with 26.5R25 L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolants, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

Bucket Type		**General Purpose — Pin On**						
Edge Type		**Bolt-on Cutting Edges**	**Teeth & Segments**	**Bolt-on Cutting Edges**	**Teeth & Segments**	**Bolt-on Cutting Edges**	**Teeth & Segments**	**High Lift Delta**
Capacity — rated	**m³**	5.40	5.40	5.70	5.70	6.00	6.00	—
	yd³	**7.06**	**7.06**	**7.46**	**7.46**	**7.85**	**7.85**	**—**
Capacity — 110%	**m³**	5.94	5.94	6.27	6.27	6.60	6.60	—
	yd³	**7.77**	**7.77**	**8.20**	**8.20**	**8.63**	**8.63**	**—**
Width	**mm**	3447	3535	3447	3535	3447	3535	—
	ft/in	**11'3"**	**11'7"**	**11'3"**	**11'7"**	**11'3"**	**11'7"**	**—**
Dump clearance at maximum lift and 45° discharge	**mm**	3242	3077	3174	3007	3156	2989	220
	ft/in	**10'7"**	**10'1"**	**10'4"**	**9'10"**	**10'4"**	**9'9"**	**8"**
Reach at maximum lift and 45° discharge	**mm**	1580	1717	1628	1762	1649	1784	2
	ft/in	**5'2"**	**5'7"**	**5'4"**	**5'9"**	**5'4"**	**5'10"**	**0"**
Reach at level lift arm and bucket level	**mm**	3064	3276	3148	3360	3176	3388	160
	ft/in	**10'0"**	**10'8"**	**10'3"**	**11'0"**	**10'5"**	**11'1"**	**6"**
Digging depth	**mm**	133	133	133	133	133	133	–1
	in	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**5.2**	**–0**
Overall length	**mm**	9637	9878	9721	9962	9749	9990	200
	ft/in	**31'8"**	**32'5"**	**31'11"**	**32'9"**	**32'0"**	**32'10"**	**8"**
Overall height with bucket at maximum lift	**mm**	6391	6391	6213	6213	6239	6239	221
	ft/in	**21'0"**	**21'0"**	**20'5"**	**20'5"**	**20'6"**	**20'6"**	**9"**
Loader clearance circle with bucket at carry position	**mm**	15 857	16 080	15 902	16 125	15 917	16 141	175
	ft/in	**52'1"**	**52'10"**	**52'3"**	**52'11"**	**52'3"**	**53'0"**	**7"**
Static tipping load, straight (ISO)*	**kg**	20 504	20 322	20 272	20 089	20 136	19 952	–1720
	lb	**45,192**	**44,790**	**44,681**	**44,277**	**44,379**	**43,974**	**–3792**
Static tipping load, straight (rigid tire)*	**kg**	22 086	21 900	21 855	21 667	21 719	21 531	–1950
	lb	**48,678**	**48,268**	**48,168**	**47,755**	**47,870**	**47,456**	**–4299**
Static tipping load, articulated (ISO)*	**kg**	17 895	17 710	17 677	17 492	17 544	17 358	–1550
	lb	**39,441**	**39,035**	**38,961**	**38,552**	**38,667**	**38,257**	**–3416**
Static tipping load, articulated (rigid tire)*	**kg**	19 764	19 578	19 546	19 358	19 414	19 226	–1787
	lb	**43,561**	**43,150**	**43,079**	**42,666**	**42,789**	**42,375**	**–3939**
Breakout force**	**kN**	201	199	190	188	186	184	3
	lbf	**45,379**	**44,838**	**42,792**	**42,264**	**41,931**	**41,407**	**719**
Operating weight*	**kg**	29 945	30 084	30 028	30 167	30 124	30 263	115
	lb	**65,999**	**66,304**	**66,182**	**66,487**	**66,393**	**66,698**	**253**

*Static tipping loads and operating weights shown are based on standard machine configuration with 29.5R25, L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolant, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

Bucket Type		Material Handling — Pin On		Rock — Pin On		Coal — Pin On	General Purpose/ Heavy Duty — Pin On		
Edge Type		**Bolt-on Cutting Edges**	**Teeth & Segments**	**Bolt-on Cutting Edges**	**Teeth & Segments**	**Bolt-on Cutting Edges**	**Bolt-on Cutting Edges**	**Teeth & Segments**	**High Lift Delta**
Capacity — rated	**m³**	5.70	5.70	4.40	4.40	8.20	5.70	5.70	—
	yd³	**7.46**	**7.46**	**5.75**	**5.75**	**10.73**	**7.46**	**7.46**	**—**
Capacity — 110%	**m³**	6.27	6.27	4.84	4.84	9.02	6.27	6.27	—
	yd³	**8.20**	**8.20**	**6.33**	**6.33**	**11.80**	**8.20**	**8.20**	**—**
Width	**mm**	3447	3535	3504	3504	3638	3447	3535	—
	ft/in	**11'3"**	**11'7"**	**11'5"**	**11'5"**	**11'11"**	**11'3"**	**11'7"**	**—**
Dump clearance at maximum lift and 45° discharge	**mm**	3075	2898	3101	3101	2887	3174	3007	220
	ft/in	**10'1"**	**9'6"**	**10'2"**	**10'2"**	**9'5"**	**10'4"**	**9'10"**	**8"**
Reach at maximum lift and 45° discharge	**mm**	1543	1665	1844	1844	1724	1628	1762	2
	ft/in	**5'0"**	**5'5"**	**6'0"**	**6'0"**	**5'7"**	**5'4"**	**5'9"**	**0"**
Reach at level lift arm and bucket level	**mm**	3173	3385	3360	3360	3435	3148	3360	160
	ft/in	**10'4"**	**11'1"**	**11'0"**	**11'0"**	**11'3"**	**10'3"**	**11'0"**	**6"**
Digging depth	**mm**	133	133	106	106	138	133	133	–1
	in	**5.2**	**5.2**	**4.1**	**4.1**	**5.4**	**5.2**	**5.2**	**–0**
Overall length	**mm**	9746	9987	9949	9949	10 011	9721	9962	200
	ft/in	**32'0"**	**32'10"**	**32'8"**	**32'8"**	**32'11"**	**31'11"**	**32'9"**	**8"**
Overall height with bucket at maximum lift	**mm**	6212	6212	6184	6184	6506	6213	6213	221
	ft/in	**20'5"**	**20'5"**	**20'4"**	**20'4"**	**21'5"**	**20'5"**	**20'5"**	**9"**
Loader clearance circle with bucket at carry position	**mm**	15 916	16 139	16 094	16 093	16 236	15 902	16 125	175
	ft/in	**52'3"**	**53'0"**	**52'10"**	**52'10"**	**53'4"**	**52'3"**	**52'11"**	**7"**
Static tipping load, straight (ISO)*	**kg**	19 825	19 643	21 253	21 285	19 512	20 116	19 932	–1720
	lb	**43,694**	**43,295**	**46,843**	**46,913**	**43,006**	**44,336**	**43,932**	**–3792**
Static tipping load, straight (rigid tire)*	**kg**	21 360	21 175	22 897	22 940	21 151	21 694	21 507	–1950
	lb	**47,078**	**46,670**	**50,466**	**50,560**	**46,616**	**47,815**	**47,402**	**–4299**
Static tipping load, articulated (ISO)*	**kg**	17 271	17 088	18 537	18 550	16 932	17 519	17 334	–1550
	lb	**38,067**	**37,663**	**40,857**	**40,884**	**37,318**	**38,613**	**38,204**	**–3416**
Static tipping load, articulated (rigid tire)*	**kg**	19 091	18 906	20 482	20 509	18 854	19 385	19 198	–1787
	lb	**42,078**	**41,670**	**45,144**	**45,202**	**41,556**	**42,726**	**42,313**	**–3939**
Breakout force**	**kN**	187	184	190	189	157	189	187	3
	lbf	**42,029**	**41,504**	**42,739**	**42,551**	**35,358**	**42,665**	**42,136**	**719**
Operating weight*	**kg**	30 153	30 292	31 109	31 184	30 532	30 175	30 313	115
	lb	**66,457**	**66,762**	**68,564**	**68,730**	**67,293**	**66,504**	**66,809**	**253**

*Static tipping loads and operating weights shown are based on standard machine configuration with 29.5R25, L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolant, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

Bucket Type		Rock — Pin On					Rock/ Heavy Duty/Extra Wide Bucket — Pin On	
Edge Type		**Teeth & Segments + Side Protector**	**Teeth + Side Protector**	**Teeth & Segments + Side Protector**	**Teeth + Side Protector**	**Teeth + Side Protector**	**Teeth & Segments + Side Protector**	**High Lift Delta**
Capacity — rated	m³	4.48	4.31	5.66	5.38	5.38	5.41	—
	yd³	**5.86**	**5.64**	**7.40**	**7.03**	**7.03**	**7.07**	**—**
Capacity — 110%	m³	4.93	4.75	6.22	5.91	5.91	5.95	—
	yd³	**6.45**	**6.21**	**8.14**	**7.74**	**7.74**	**7.78**	**—**
Width	mm	3504	3504	3504	3504	3510	3645	—
	ft/in	**11'5"**	**11'5"**	**11'5"**	**11'5"**	**11'6"**	**11'11"**	**—**
Dump clearance at maximum lift and 45° discharge	mm	3051	3051	2890	2890	2983	2941	220
	ft/in	**10'0"**	**10'0"**	**9'5"**	**9'5"**	**9'9"**	**9'7"**	**8"**
Reach at maximum lift and 45° discharge	mm	1788	1788	1979	1979	1930	1965	2
	ft/in	**5'10"**	**5'10"**	**6'5"**	**6'5"**	**6'4"**	**6'5"**	**0"**
Reach at level lift arm and bucket level	mm	3359	3359	3608	3608	3512	3561	160
	ft/in	**11'0"**	**11'0"**	**11'10"**	**11'10"**	**11'6"**	**11'8"**	**6"**
Digging depth	mm	106	71	106	71	77	77	–1
	in	**4.1**	**2.8**	**4.1**	**2.8**	**3.0**	**3.0**	**–0**
Overall length	mm	9948	9948	10 197	10 197	10 069	10 156	200
	ft/in	**32'8"**	**32'8"**	**33'6"**	**33'6"**	**33'1"**	**33'4"**	**8"**
Overall height with bucket at maximum lift	mm	6204	6204	6378	6378	6378	6378	221
	ft/in	**20'5"**	**20'5"**	**21'0"**	**21'0"**	**21'0"**	**21'0"**	**9"**
Loader clearance circle with bucket at carry position	mm	16 093	16 093	16 235	16 235	16 156	16 340	175
	ft/in	**52'10"**	**52'10"**	**53'4"**	**53'4"**	**53'1"**	**53'8"**	**7"**
Static tipping load, straight (ISO)*	kg	20 998	21 519	20 119	20 693	20 705	19 813	–1720
	lb	**46,279**	**47,428**	**44,343**	**45,607**	**45,635**	**43,669**	**–3792**
Static tipping load, straight (rigid tire)*	kg	22 649	23 190	21 764	22 361	22 374	21 461	–1950
	lb	**49,918**	**51,112**	**47,968**	**49,285**	**49,313**	**47,301**	**–4299**
Static tipping load, articulated (ISO)*	kg	18 265	18 775	17 439	17 995	18 008	17 091	–1550
	lb	**40,257**	**41,381**	**38,436**	**39,663**	**39,690**	**37,669**	**–3416**
Static tipping load, articulated (rigid tire)*	kg	20 223	20 750	19 387	19 965	19 977	19 053	–1787
	lb	**44,572**	**45,733**	**42,730**	**44,003**	**44,031**	**41,993**	**–3939**
Breakout force**	kN	188	204	159	172	184	173	3
	lbf	**42,289**	**45,879**	**35,932**	**38,725**	**41,402**	**38,896**	**719**
Operating weight*	kg	31 475	31 175	31 821	31 521	31 517	32 239	115
	lb	**69,370**	**68,709**	**70,132**	**69,471**	**69,463**	**71,055**	**253**

*Static tipping loads and operating weights shown are based on standard machine configuration with 29.5R25, L3 Michelin XHA2 radial tires, power train guard, full fuel tank, coolant, lubricants, air conditioner and operator.
Static tipping loads conform to the international standard as defined in ISO 14397-1 (SEPT2007).
Measured 100 mm **(4") behind tip of cutting edge with bucket hinge pin as pivot point in accordance with SAE J732 (APR2007).

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society of Automotive Engineers, including SAE Standard J732 (APR2007) which governs loader ratings.

NOTE: Bucket availability varies by region. Consult your local dealer for availability.

		Standard Lift						
Bucket Type		**Rock**			**Heavy Duty Rock**		**High Abrasion Rock**	
Ground Engaging Tools		**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**
Cutting Edge Type		**Spade**	**Spade**	**Spade**	**Spade**	**Spade**	**Spade**	**Spade**
Rated bucket capacity (§)	**m³**	10.7	11.5	12.3	10.7	11.5	10.7	10.7
	yd³	**14.0**	**15.0**	**16.0**	**14.0**	**15.0**	**14.0**	**14.0**
Operating load at rated capacity	**kg**	21 773	21 773	21 773	21 773	21 773	21 773	21 773
	lb	**48,000**	**48,000**	**48,000**	**48,000**	**48,000**	**48,000**	**48,000**
Struck capacity (§)	**m³**	8.9	9.5	10.2	8.9	9.5	8.9	8.9
	yd³	**11.6**	**12.4**	**13.3**	**11.6**	**12.4**	**11.6**	**11.6**
Bucket width (§)	**mm**	4824	4884	4824	5068	4824	5165	5068
	ft/in	**15'10"**	**16'0"**	**15'10"**	**16'7"**	**15'10"**	**16'11"**	**16'7"**
Dump clearance at full lift SAE 45° discharge (§)	**mm**	4849	4785	4741	4849	4788	4935	4935
	ft/in	**15'11"**	**15'8"**	**15'7"**	**15'11"**	**15'8"**	**16'2"**	**16'2"**
Tooth tip	**mm**	4607	4548	4495	4612	4545	4699	4699
	ft/in	**15'1"**	**14'11"**	**14'8"**	**15'1"**	**14'11"**	**15'5"**	**15'5"**
Reach at full lift SAE 45° discharge (§)	**mm**	2092	2149	2194	2092	2151	2036	2036
	ft/in	**6'11"**	**7'0"**	**7'2"**	**6'11"**	**7'11"**	**6'10"**	**6'10"**
Tooth tip	**mm**	2326	2378	2427	2322	2385	2292	2292
	ft/in	**7'7"**	**7'10"**	**8'0"**	**7'7'**	**7'10"**	**7'6"**	**7'6"**
Reach with boom horizontal and bucket level	**mm**	5114	5193	5265	5108	5200	5025	5025
	ft/in	**16'10"**	**17'0"**	**17'4"**	**16'10"**	**17'1"**	**16'6"**	**16'6"**
Digging depth (segment) (§)	**mm**	196	201	201	196	198	175	175
	in	**7.7**	**7.9**	**7.9**	**7.7**	**7.8**	**6.9**	**6.9**
Overall length — bucket level ground (§)	**mm**	15 736	15 818	15 890	15 729	15 823	15 632	15 632
	ft/in	**51'7"**	**51'11"**	**51'1"**	**51'7"**	**51'11"**	**51'4"**	**51'4"**
Overall height with bucket at full raise (§)	**mm**	9313	9313	9492	9313	9313	9392	9313
	ft/in	**30'7"**	**30'7"**	**31'1"**	**30'7"**	**30'7"**	**30'10"**	**30'7"**
Loader clearance radius with bucket in carry position (§)	**mm**	11 097	11 121	11 131	11 096	11 122	11 085	11 085
	ft/in	**36'5"**	**36'6"**	**36'6"**	**36'5"**	**36'6"**	**36'5"**	**36'5"**
Tipping load straight* (§)	**kg**	55 216	54 526	54 184	53 745	54 784	51 692	53 325
	lb	**121,730**	**120,209**	**119,455**	**118,487**	**120,778**	**113,961**	**117,561**
Static tipping load full 35° turn* (§)	**kg**	48 361	47 695	47 341	46 893	47 953	44 839	46 474
	lb	**106,618**	**105,149**	**104,369**	**103,381**	**105,718**	**98,853**	**102,458**
Static tipping load full 40° turn* (§)	**kg**	46 440	45 780	45 422	44 972	46 037	42 919	44 554
	lb	**102,383**	**100,928**	**100,138**	**99,146**	**101,494**	**94,620**	**98,225**
Static tipping load full 43° turn* (§)	**kg**	45 201	44 546	44 185	43 735	44 803	41 681	43 316
	lb	**99,651**	**98,207**	**97,411**	**96,419**	**98,774**	**91,891**	**95,495**
Tipping load straight** (§)	**kg**	57 096	56 402	56 093	55 615	56 662	53 564	55 194
	lb	**125,874**	**124,344**	**123,663**	**122,610**	**124,918**	**118,088**	**121,681**
Static tipping load full 35° turn** (§)	**kg**	51 328	50 653	50 338	49 847	50 913	47 796	49 426
	lb	**113,158**	**111,671**	**110,976**	**109,893**	**112,244**	**105,372**	**108,965**
Static tipping load full 40° turn** (§)	**kg**	49 634	48 965	48 648	48 153	49 225	46 102	47 732
	lb	**109,424**	**107,950**	**107,250**	**106,159**	**108,523**	**101,638**	**105,231**
Static tipping load full 43° turn** (§)	**kg**	48 527	47 863	47 544	47 047	48 123	44 996	46 625
	lb	**106,984**	**105,519**	**104,817**	**103,720**	**106,092**	**99,198**	**102,791**
Breakout force*** (§)	**kg**	58 466	55 998	54 249	57 842	56 147	59 381	60 218
	lbf	**128,894**	**123,454**	**119,599**	**127,519**	**123,782**	**130,913**	**132,758**
Operating weight*** (§)	**kg**	98 610	99 012	99 391	100 786	97 469	102 956	101 232
	lb	**217,398**	**218,284**	**219,119**	**222,195**	**214,882**	**226,979**	**223,178**

*Tipping loads were calculated within guidelines of ISO 14397-1:2007 to include tire squash (Tire pressure at 683 kPa **[99 psi]**).
**Tipping load is calculated without tire squash.
***Static tipping load and operating weight shown are based on standard machine configurations with a fuel tank, coolant, lubricants, and operator.

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society for Automotive Engineers. SAE Standards J732C govern loader ratings and are denoted in the text by (§).

		High Lift						
Bucket Type		**Rock**			**Heavy Duty Rock**		**High Abrasion Rock**	
Ground Engaging Tools		**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**	**Teeth & Segments**
Cutting Edge Type		**Spade**	**Spade**	**Spade**	**Spade**	**Spade**	**Spade**	**Spade**
Rated bucket capacity (§)	**m³**	10.7	11.5	12.3	10.7	11.5	10.7	10.7
	yd³	**14.0**	**15.0**	**16.0**	**14.0**	**15.0**	**14.0**	**14.0**
Operating load at rated capacity	**kg**	19 051	19 051	19 051	19 051	19 051	19 051	19 051
	lb	**42,000**	**42,000**	**42,000**	**42,000**	**42,000**	**42,000**	**42,000**
Struck capacity (§)	**m³**	8.9	9.5	10.2	8.9	9.5	8.9	8.9
	yd³	**11.6**	**12.4**	**13.3**	**11.6**	**12.4**	**11.6**	**11.6**
Bucket width (§)	**mm**	4824	4884	4824	4884	4824	4900	4900
	ft/in	**15'10"**	**16'0"**	**15'10"**	**16'7"**	**15'10"**	**16'11"**	**16'7"**
Dump clearance at full lift SAE 45° discharge (§) **Tooth tip**	**mm**	5224	5166	5112	5229	5162	5316	5316
	ft/in	**17'2"**	**16'11"**	**16'9"**	**17'2"**	**16'11"**	**17'5"**	**17'5"**
Reach at full lift SAE 45° discharge (§) **Tooth tip**	**mm**	2193	2246	2294	2189	2252	2159	2159
	ft/in	**7'2"**	**7'4"**	**7'6"**	**7'2"**	**7'5"**	**7'1"**	**7'1"**
Reach with boom horizontal and bucket level	**mm**	5504	5583	5655	5498	5590	5415	5415
	ft/in	**18'1"**	**18'4"**	**18'7"**	**18'0"**	**18'4"**	**17'9"**	**17'9"**
Digging depth (segment) (§)	**mm**	176	181	181	176	178	155	155
	in	**7.0**	**7.0**	**7.0**	**7.0**	**7.0**	**6.0**	**6.0**
Overall length — bucket level ground (§)	**mm**	16 197	16 279	16 351	16 191	16 284	16 095	16 095
	ft/in	**53'2"**	**53'5"**	**53'8"**	**53'1"**	**53'5"**	**52'10"**	**52'10"**
Overall height with bucket at full raise (§)	**mm**	9930	9930	9930	9930	9930	9930	9930
	ft/in	**32'7"**	**32'7"**	**32'7"**	**32'7"**	**32'7"**	**32'7"**	**32'7"**
Loader clearance radius with bucket in carry position (§)	**mm**	11 326	11 352	11 349	11 324	11 352	11 313	11 313
	ft/in	**37'2"**	**37'3"**	**37'3"**	**37'2"**	**37'3"**	**37'1"**	**37'1"**
Tipping load straight* (§)	**kg**	51 408	50 761	50 436	49 938	51 017	47 875	49 522
	lb	**113,335**	**111,909**	**111,192**	**110,094**	**112,473**	**105,546**	**109,177**
Static tipping load full 35° turn* (§)	**kg**	44 798	44 172	43 833	43 332	44 427	41 268	42 916
	lb	**98,763**	**97,382**	**96,635**	**95,531**	**97,945**	**90,980**	**94,613**
Static tipping load full 40° turn* (§)	**kg**	42 946	42 325	41 981	41 481	42 580	39 417	41 065
	lb	**94,680**	**93,311**	**92,552**	**91,450**	**93,873**	**86,900**	**90,533**
Static tipping load full 43° turn* (§)	**kg**	41 753	41 135	40 789	40 288	41 390	38 224	39 873
	lb	**92,049**	**90,687**	**89,924**	**88,820**	**91,249**	**84,269**	**87,905**
Tipping load straight** (§)	**kg**	53 044	52 396	52 099	51 567	52 653	49 505	51 149
	lb	**116,942**	**115,513**	**114,858**	**113,686**	**116,080**	**109,140**	**112,764**
Static tipping load full 35° turn** (§)	**kg**	47 472	46 840	46 535	45 994	47 097	43 932	45 577
	lb	**104,658**	**103,264**	**102,592**	**101,399**	**103,831**	**96,853**	**100,480**
Static tipping load full 40° turn** (§)	**kg**	45 835	45 209	44 901	44 358	45 466	42 296	43 940
	lb	**101,049**	**99,669**	**98,990**	**97,793**	**100,235**	**93,247**	**96,871**
Static tipping load full 43° turn** (§)	**kg**	44 766	44 143	43 834	43 289	44 400	41 227	42 871
	lb	**98,692**	**97,319**	**96,637**	**95,436**	**97,885**	**90,890**	**94,514**
Breakout force*** (§)	**kg**	57 948	55 495	53 760	57 324	55 656	58 856	59 693
	lbf	**127,753**	**122,345**	**118,520**	**126,378**	**122,700**	**129,755**	**131,600**
Operating weight*** (§)	**kg**	99 788	100 182	100 561	101 956	99 963	104 126	102 404
	lb	**219,995**	**220,863**	**221,699**	**224,774**	**220,380**	**229,558**	**225,762**

*Tipping loads were calculated within guidelines of ISO 14397-1:2007 to include tire squash (Tire pressure at 683 kPa **[99 psi]**).
**Tipping load is calculated without tire squash.
***Static tipping load and operating weight shown are based on standard machine configurations with a fuel tank, coolant, lubricants, and operator.

NOTE: Specifications and ratings conform to all applicable standards recommended by the Society for Automotive Engineers. SAE Standards J732C govern loader ratings and are denoted in the text by (§).

SPECIFICATION DEFINITIONS FOR FRONT END LOADERS

Cat wheel and track loader specifications conform to Society of Automotive Engineers (SAE) definitions as expressed in standards J732 (JUN92), as follows:

Description of Specification Machine

On wheel loaders the tire inflation pressure at which specifications are taken must be described in addition to the current written basic machine description. On track loaders the type of grouser must be specified.

Hydraulic Cycle Times

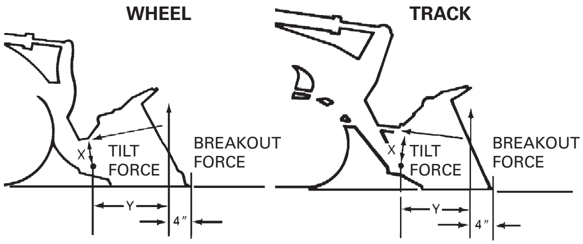
a. "Raise Time" — Time in seconds required to raise the bucket from level position on the ground.
b. "Lower Time" — Time in seconds required to lower the empty bucket from the full height to a level position on the ground.
c. "Dump Time" — Time in seconds required to move the bucket at maximum height from the maximum rollback position to full dump position while dumping the SAE loose material operating load.

Breakout Force

"Breakout force," pounds (and kilonewtons or kilograms) — the maximum sustained vertical upward force exerted 100 mm (4") behind the tip of the bucket cutting edge and achieved through the ability to lift and/or rollback about the specified pivot point under the following conditions:

a. Loader on a hard level surface with transmission in neutral.
b. All brakes released.
c. Unit at standard operating weight — rear of loader not tied down.
d. Bottom of cutting edge parallel to and not more than 20 mm (0.75") above or below the ground line.
e. When bucket circuit is used the pivot point must be specified as the bucket hinge pin, and the unit blocked under the bucket hinge pin pivot point in order to minimize linkage movement.
f. When the lift circuit is used, the pivot point must be specified as the lift arm hinge pin. Wheel loaders shall have front axle blocked to eliminate change in position of pivot pins due to tire deflection.
g. If both circuits are used simultaneously, the dominating pivot point listed in (e) or (f) must be specified.
h. If the circuit used causes the rear of the vehicle to leave the ground, then the vertical force value required to raise the rear of the vehicle is the breakout force.
i. For irregular shaped buckets, the tip of the bucket cutting edge referred to above shall mean the farther forward point of the cutting edge.

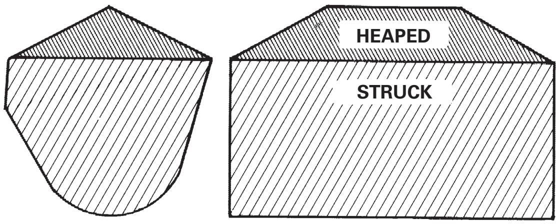
The following are illustrations used (according to provisions of SAE J732 JUN92) to measure Cat Loader breakout forces.



a. Breakout force resulting from rack back:
(Tilt Force) × (Dist. "X") = ("Y" Dist.) × (Breakout Force)

$$\frac{(\text{Tilt Force}) \times (\text{Dist. "X"})}{\text{"Y" Dist.}} = \text{Breakout Force}$$

SAE BUCKET RATING



SAE Bucket Capacities

Struck capacity is that volume contained in a bucket after a load is leveled by drawing a straight edge resting on the cutting edge and the back of the bucket.

Heaped capacity is a struck capacity plus that additional material that would heap on the struck load at a 2:1 angle of repose with the struck line parallel to the ground.

SAE J742 (FEB85) specifies that the addition of any auxiliary spill guard to protect against spillage which might injure the operator will not be included in bucket capacity ratings. Buckets with irregular shaped cutting edges (vee edge) the strike plane should be drawn at one-third the distance of the protruding portion of the cutting edge. Cat rock buckets are built with integral see-through rock guards. Cat light material buckets come standard with bolt-on edges. These features which add to actual bucket capacity are included in published ratings.

Dump Height

SAE J732 JUN92 specifies that dump height is the vertical distance from the ground to the lowest point of the cutting edge with the bucket hinge pin at maximum height and the bucket at a 45° dump angle. Dump angle is the angle in degrees that the longest flat section of the inside bottom of the bucket will rotate below horizontal.

SELECTING A MACHINE

Steps in selecting the proper size loader:

1. Determine production required or desired.
2. Determine loader cycle time and cycles per hour. A machine size must be assumed to select a basic cycle time.
3. Determine required payload per cycle in loose cubic yards and pounds (meters and kilograms).
4. Determine bucket size needed.
5. Make machine selection using bucket size and payload as criteria to meet production requirements.
6. Compare the loader cycle time used in calculations to the cycle time of the machine selected. If there is a difference, rework the process beginning at step 2.

1. Production Required

The production required of a wheel or track loader should be slightly greater than the production capability of the other critical units in the earth or material moving system. For example, if a hopper can handle 300 tons per hour, a loader capable of slightly more than 300 tons should be used. Required production should be carefully calculated so the proper machine and bucket selections are made.

2. Loader Cycle Times

When hauling loose granular material on a hard smooth operating surface, a .45-.55 minute basic cycle time is considered reasonable for Cat articulated loaders with a competent operator. This includes load, dump, four reversals of direction, full cycle of hydraulics and minimum travel.

Material type, pile height, and other factors may improve or reduce production, and should be added to or subtracted from the basic cycle time when applicable.

When hauls are involved, obtain the haul and return portion of the cycle from the estimated travel chart (this section). Add the haul and return times to the estimated basic cycle time to obtain total cycle time.

CYCLE TIME FACTORS

A basic cycle time (Load, Dump, Maneuver) of .45-.55 minutes is average for an articulated loader [the basic cycle for large loaders, 3 m^3 (4 yd^3) and up, can be slightly longer], but variations can be anticipated in the field. The following values for many variable elements are based on normal operations. Adding or subtracting any of the variable times will give the total basic cycle time.

	Minutes added (+) or Subtracted (–) From Basic Cycle
Machine	
— Material handler	–.05
Materials	
— Mixed	+.02
— Up to 3 mm (1/8 in)	+.02
— 3 mm (1/8 in) to 20 mm (3/4 in)	–.02
— 20 mm (3/4 in) to 150 mm (6 in)	.00
— 150 mm (6 in) and over	+.03 and Up
— Bank or broken	+.04 and Up
Pile	
— Conveyor or Dozer piled 3 m (10 ft) and up	.00
— Conveyor or Dozer piled 3 m (10 ft) or less	+.01
— Dumped by truck	+.02
Miscellaneous	
— Common ownership of trucks and loaders	Up to –.04
— Independently owned trucks	Up to +.04
— Constant operation	Up to –.04
— Inconsistent operation	Up to +.04
— Small target	Up to +.04
— Fragile target	Up to +.05

Using actual job conditions and the above factors, total cycle time can be estimated. Convert total cycle time to cycles per hour.

$$\textit{Cycles per hour at 100\% Efficiency} = \frac{\textit{60 min}}{\textit{Total Cycle Time in Minutes}}$$

Job efficiency is an important factor in machine selection. Efficiency is the actual number of minutes worked during an hour. Job efficiency accounts for bathroom breaks and other work interruptions.

$$\text{Cycles per hour at 50 minutes per hour (83\% efficiency)} = \text{Cycles per hour at 100\% efficiency} \times \frac{\text{50 min actual work time}}{\text{60 min hour}}$$

TRUCK LOADING

Average loader cycle times

910K-962H	0.45-0.50 min
966H-980H	0.50-0.55 min
986H-990K	0.55-0.60 min
992K-994K	0.60-0.70 min

3. Required Payload Per Cycle

Required payload per cycle is determined by dividing required hourly production by the number of cycles per hour.

4. Bucket Selection

After required payload per cycle has been calculated, the payload should be divided by the loose cubic yard (meter) material weight to determine number of loose cubic yards (meters) required per cycle.

The bulk of material handled does not weigh 1800 kg/m^3 (3000 lb/yd^3), so a reasonable knowledge of material weight is necessary for accurate production estimates. The Tables Section has average weight for certain materials when actual weights are not known.

The percentage of rated capacity a bucket carries in various materials is estimated below. The bucket size required to handle the required volume per cycle is found with the aid of the percentage of rated bucket capacity called "Bucket Fill Factor."

The bucket size needed is determined by dividing loose cubic meters (or yards) required per cycle by the bucket fill factor.

$$\textit{Bucket size} = \frac{\textit{Volume Required/Cycle}}{\textit{Bucket Fill Factor}}$$

BUCKET FILL FACTORS

The following indicates the approximate amounts of material as a percent of rated bucket capacity which will actually be delivered per bucket per cycle. This is known as "Bucket Fill Factor."

Loose Material	Fill factor
Mixed moist aggregates	95-100%
Uniform aggregates up to 3 mm (1/8 in)	95-100
3 mm (1/8 in) to 9 mm (3/8 in)	90-95
12 mm (1/2 in) to 20 mm (3/4 in)	85-90
24 mm (1.0 in) and over	85-90

Blasted Rock

Well blasted	80-95%
Average	75-90
Poor	60-75

Other

Rock dirt mixtures	100-120%
Moist loam	100-110
Soil, boulders, roots	80-100
Cemented materials	85-95

NOTE: Fill factors on wheel loaders are affected by bucket penetration, breakout force, rack back angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges.

Example:

12 mm (1/2 in) material and 3 m^3 (4 yd^3) bucket.
$0.90 \times 3\ m^3 = 2.75$ Loose m^3 delivered per cycle.
$0.90 \times 4\ yd^3 = 3.6$ Loose yd^3 delivered per cycle.

NOTE: Check the static tipping load on the specific machine to determine if bucket load is in fact a safe operating load.

Bucket Selection

$$\textit{Tons Required/Cycle} = \frac{\textit{Tons Required/Hour}}{\textit{Cycles/Hour}}$$

$$\textit{Kg (Pounds) Required/Cycle} = \textit{Tons Required/Cycle} \times \textit{907 kg (2000 lb)}$$

$$\textit{Volume Required/Cycle} = \frac{\textit{kg (Pounds) Cycle}}{\textit{Material Weight kg/m}^3\ \textit{(lb/yd}^3\textit{)}}$$

Always select a machine with a greater capacity than the calculated required operating capacity. For most applications, payload above recommended and excessive counterweight can hinder machine performance and reduce dynamic stability and machine life.

For optimum performance in fast cycling situations such as truck loading, operating loads should not exceed the recommended capacity. To provide extra stability, calcium chloride ($CaCl_2$) ballast may be desired when operating at recommended operating load, see SAE Loader rating pages in this section. For specific stability data and optional tire sizes, see the "Performance Data" pages in this section.

When selecting special application buckets, such as multi-purpose and side dump the additional bucket weight must be deducted from recommended capacity.

Specific circumstances may involve other conditions which would also affect loader capacity. Because of the greatly varied applications and conditions, your Cat dealer should be contacted for guidance.

Example problem:

JOB CONDITIONS

Application	Truck loading
Production Required	450 metric ton (496 Tons) per hour
Material	9 mm (3/8") gravel in 6 m (20 ft) high stockpile
Density	1660 kg/m^3 (2800 lb/yd^3)

Trucks are 6-9 m^3 (8-12 yd^3) capacity and are owned by three contractors. Loading is constant. Hard level surface for loader maneuvering.

1. *PRODUCTION REQUIRED:* Given

2. *CYCLE TIME:* Assume loader size between 910K and 962H for initial choice of basic cycle.

(Refer to Cycle Time Factors in this section)

Independent trucks	.04 min
Basic Cycle	.50 min
Material	–.02 min
Independent trucks	+.04 min
Constant operation	–.02 min
Total Cycle	.50 min

NOTE: Load and carry times not required in total cycle.

$$\text{Cycles/hr at 83\% efficiency} = 120 \text{ cycles/hr} \times \frac{\text{50 min actual work time}}{\text{60 min per hr}} = 100 \text{ cycles/hr}$$

3. *VOLUME REQUIRED PER CYCLE*
(Density in tons)
Density in this example was given. When not given, refer to Tables Section to obtain an estimated density for the material being handled.

$$\textit{Metric:}\ \frac{1660 \text{ kg/m}^3}{1000 \text{ kg/ton}} = 1.66 \text{ ton/m}^3$$

$$\textit{English:}\ \frac{2800 \text{ lb/yd}^3}{2000 \text{ lb/ton}} = 1.4 \text{ tons/yd}^3$$

Production Rate Required

Metric: $\dfrac{450 \text{ tons/hr}}{1.66 \text{ tons/m}^3} = 271 \text{ m}^3\text{/hr}$

English: $\dfrac{496 \text{ tons/hr}}{1.4 \text{ tons/yd}^3} = 354 \text{ yd}^3\text{/hr}$

Volume Required per Cycle

Metric: $\dfrac{271 \text{ m}^3\text{/hr}}{100 \text{ cycles/hr}} = 2.71 \text{ m}^3\text{/cycle}$

English: $\dfrac{354 \text{ yd}^3\text{/hr}}{100 \text{ cycles/hr}} = 3.54 \text{ yd}^3\text{/cycle}$

4. *DETERMINE BUCKET SIZE*

BUCKET FILL FACTOR

The volume of material required per cycle has been determined. Because of varying material fill factors, buckets do not always carry their rated load, a larger capacity bucket may be needed to carry the volume required. For fill factors, refer to Bucket Fill Factor Chart in this section.

Rated Bucket Capacity Required (Heaped)

$\dfrac{2.71 \text{ m}^3\text{/cycle}}{0.95 \text{ fill factor}} = 2.85 \text{ m}^3$

$\dfrac{3.54 \text{ yd}^3\text{/cycle}}{0.95 \text{ fill factor}} = 3.73 \text{ yd}^3$

A 2.9 m^3 (3.75 yd^3) bucket would provide the required capacity.

5. *MACHINE SELECTION*

The bucket size required and material density lead to the choice of a 950H with a 2.9 m^3 (3.75 yd^3) General Purpose Bucket (see bucket selection guide pages which follow.)

Finally, SAE payload criteria must be satisfied as follows:

The required operating capacity must not exceed one-half of the full turn static tipping load of the loader as equipped with a specific bucket.

The required operating capacity of the machine is determined by the volume the machine will carry per load times the density.

2.9 m^3 $\times$ 1660 kg/m^3 = 4814 kg
(3.75 yd^3 $\times$ 2800 lb/yd^3 = 10,500 lb)

One half of full turn static tipping load for the 950H with a 2.9 m^3 (3.75 yd^3) General Purpose Bucket is 5410 kg (11,925 lb). SAE criteria is satisfied.

● ● ●

An Alternative Method of Machine Selection

Another method of selecting the right Wheel Loader and bucket to meet production requirements is by use of the nomographs on the following pages. The method is quicker and easier than the preceding example because it does not require as many calculations, yet the accuracy is about the same within the normal limits of input data.

Be careful when entering and reading data from the nomographs because some scales increase from bottom to top, while others are the reverse. Do not be overly concerned with the precision as affected by pencil line width or reading to the hundredth of a m^3 (yd^3). Remember that bucket fill factor, material density and cycle time are at best close estimates.

Example problem:

A Wheel Loader must produce 230 m^3 (300 yd^3) per hour in a truck loading application. Estimated cycle time is .6 minutes, working 45 minutes per hour. Bucket fill factor is 95% and material density is 1780 kg/m^3 (3000 lb/yd^3).

Determine bucket size and machine model.

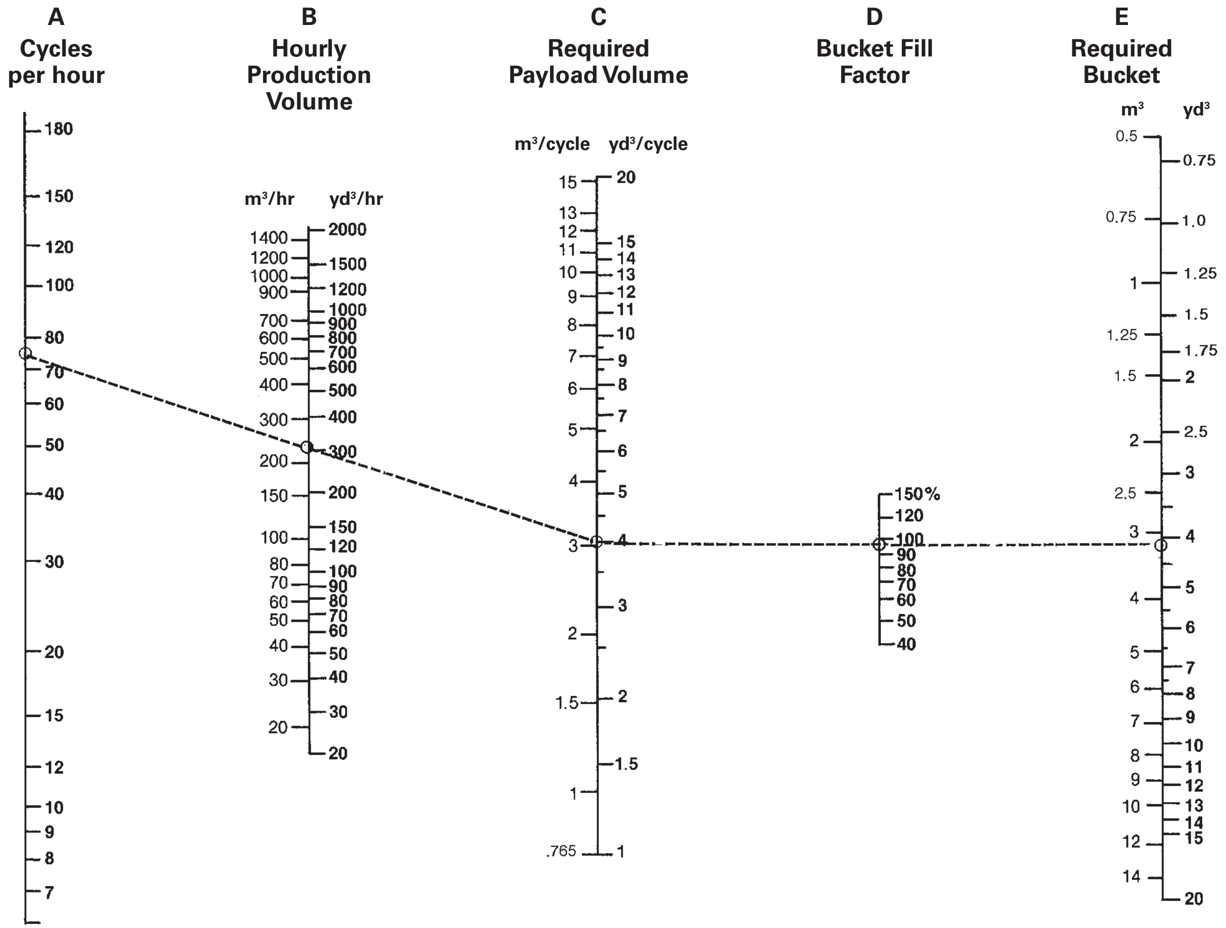
Solution:

At full efficiency, the Wheel Loader will cycle 100 times per hour. Since only an average of 45 minutes are available, only 75 cycles will be completed.

Starting on Scale A at 75 cycles per hour draw a straight line intersecting 230 m^3/hr (300 yd^3/hr) on Scale B and extending it on to Scale C giving 3 m^3/cycle (4 yd^3/cycle) required payload. Follow solution steps 1-10.

Production and Machine Selection Nomograph
● To find required bucket payload and bucket size

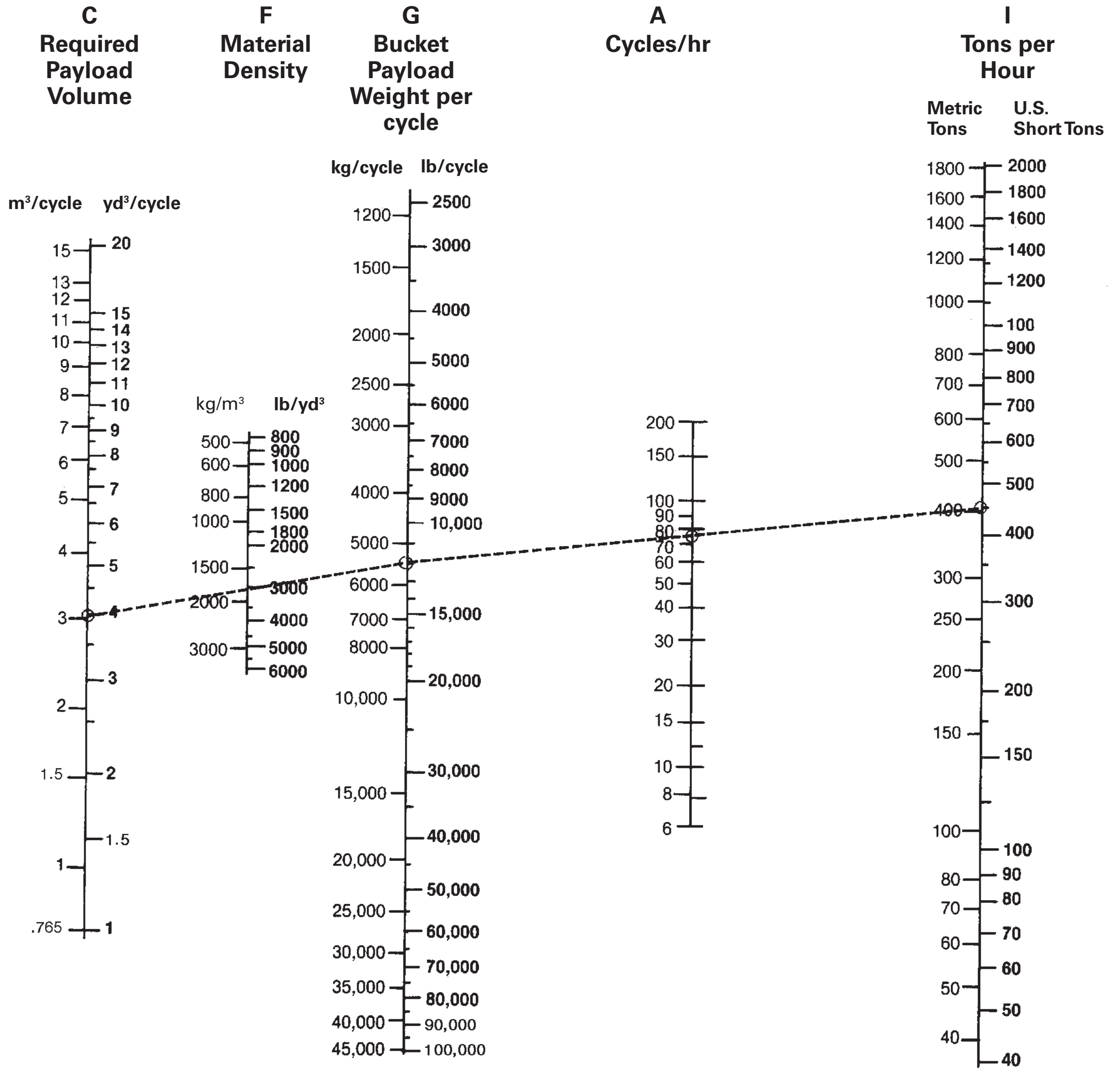
1. Enter required hourly production on Scale B 230 m^3/hr (300 yd^3/hr).
2. Enter cycles per hour on Scale A (60 ÷ .6 = 100 × .75 = 75 cycles/hr).
3. Connect A through B to C. This shows a required payload of 3 m^3 (4 yd^3) per cycle.
4. Enter estimated bucket fill factor on Scale D (0.95).
5. Connect C through Scale D to E for required bucket size 3 m^3 (4 yd^3).
6. Transfer cycles per hour Scale A and required payload Scale C to the following page.



7. Enter material density on Scale F 1780 kg/m³ (3000 lb/yd³).
8. Connect C through Scale F to Scale G to give payload weight per cycle 5300 kg (11,500 lb).
9. Compare Scale G quantity 5300 kg (11,500 lb) with recommended machine working range listed on the following bucket selection pages.

Operating capacity for the 950H with 3.1 m³ (4 yd³) bucket is dependent on material density and bucket capacity (see bucket selection pages that follow).

10. For hourly tonnage, draw a straight line from Scale G through Scale A to Scale I 400 metric tons (450 U.S. tons).



Model	Interface	Bucket Type	Width Range		Capacity Range		Weight Range		GET
			mm	in	m^3	yd^3	kg	lb	
986H	Pin On	General Purpose Performance Series	3695	**145**	6.1-7.7	**8.0-10.0**	3648-4065	**8042-8962**	K110
		Rock Performance Series	3772	**149**	5.4-6.1	**7.0-8.0**	3726-3941	**8214-8688**	K110
		Heavy Duty Rock Performance Series	4014	**158**	5.4	**7.0**	5061	**11,158**	K130
		Extreme Duty Rock	4146	**163**	5.0	**6.5**	5195	**12,050**	K130
		Serrated Edge Rock	3812	**150**	6.1	**8.0**	4232	**9330**	N/A
		Coal	3692	**145**	10.0	**13.5**	5195	**11,453**	BOCE Included
988K	Pin On	General Purpose Performance Series	3855	**152**	6.9-8.4	**9.0-11.0**	4539-4994	**10,007-11,010**	K110
		Rock Performance Series	4020	**158**	6.4-7.7	**8.3-10.0**	4880-5263	**10,759-11,603**	K130
		Heavy Duty Rock Performance Series	4080	**161**	6.4	**8.3**	6360	**14,021**	K130
		Heavy Duty Granite Performance Series	3986	**157**	6.4	**8.3**	7433	**16,385**	K130
		Serrated Edge Rock	3968	**156**	6.4-6.9	**8.3-9.0**	5455-5634	**12,026-12,421**	N/A
		Iron Ore	3922	**154**	4.7	**6.2**	5771	**12,723**	K130
		Coal	4120	**162**	11.5-13.0	**15.0-17.0**	6023-6435	**13,278-14,186**	BOCE Included
		Slag	3900-4032	**154-159**	5.4-6.4	**7.0-8.3**	7633-8454	**16,828-18,638**	J600/Serrated Edge

N/A = Not Applicable

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Model	Interface	Bucket Type	Width Range		Capacity Range		Weight Range		GET
			mm	in	m³	yd³	kg	lb	
990K	Pin On	Rock Performance Series	4610	**182**	8.6-10.0	**11.25-13.0**	7247-7497	**15,977-16,528**	K130
		Heavy Duty Rock Performance Series	4670	**184**	8.6	**11.25**	8980	**19,798**	K130
		Heavy Duty Granite Performance Series	4634	**182**	8.6	**11.25**	12 055	**26,520**	K150
		Slag	4450-4500	**175-177**	8.5-9.2	**11.2-12.0**	9149-9613	**20,127-21,149**	Weld-on edge included
		Coal	4370	**172**	13.4	**17.5**	7460	**16,410**	BOCE Included
		Iron Ore	4450	**175**	7.0	**9.2**	8525	**18,750**	K150
		Serrated Edge Rock	4610	**182**	9.5	**12.4**	8140	**17,910**	N/A
992K	Pin On	Rock	4824-4884	**190-192**	10.7-12.2	**14.0-16.0**	9382-10 574	**20,684-23,262**	K150/K170
		Heavy Duty Rock	5068	**200**	10.7	**14.0**	11 560	**25,485**	K170
		High Abrasion Rock	5068	**200**	10.7	**14.0**	11 927	**26,295**	K150
		Heavy Duty Granite	5165	**203**	10.7	**14.0**	13 720	**30,247**	K150
		Coal	6170	**243**	19.0	**25.0**	12 504	**27,506**	BOCE Included
		Iron Ore	4900	**193**	9.0	**11.8**	11 172	**24,577**	K150
		Serrated Edge Rock	4824	**190**	12.3	**16.0**	10 282	**22,620**	N/A
993K	Pin On	Rock	5068	**200**	12.2-14.5	**16.0-19.0**	12 864-14 209	**28,301-31,260**	K170
		High Abrasion Rock	5160	**203**	12.2-13.0	**16.0-17.0**	15 205-15 456	**33,451-34,004**	K170
		Heavy Duty Granite	5160	**203**	13.0	**17.0**	17 418	**38,320**	K170
		Coal	6300	**248**	23.0	**31.0**	17 673	**38,880**	K170
		Iron Ore	5160	**203**	10.0	**13.0**	14 063	**30,940**	K170
		Serrated Edge Rock	5080	**200**	15.0	**19.5**	13 915	**30,615**	N/A
994K	Pin On	Rock	6223	**245**	19.1-24.5	**25-32**	19 205-21 293	**42,340-46,942**	Spade edge*
		Heavy Duty Rock	6240	**246**	19.1-21.4	**25-28**	20 699-21 303	**45,633-46,966**	Spade edge*
		Coal	6964	**274**	32.1-39.8	**42-52**	20 862-22 773	**45,992-50,206**	Straight edge*
		Iron Ore	6240	**246**	17.2	**22.5**	19 518	**43,029**	Spade edge*

*With teeth and segments.
N/A = Not Applicable

986H — Standard Lift

Material Density				Bucket Volume	
kg/m³	**tonnes/m³**	**lb/yd³**	**tons/yd³**	**m³**	**yd³**
1632-1795	1.63-1.80	**2750-3025**	**1.38-1.51**	6.1	**8**
1740-1914	1.74-1.91	**2933-3227**	**1.46-1.61**	5.7	**7.5**
1865-2051	1.86-2.05	**3143-3457**	**1.57-1.73**	5.4	**7**

*Density range covers 100% rated payload to 110% rated payload in accordance with Large Wheel Loader payload policy.

988K

Material Density				Bucket Volume	
kg/m³	**tonnes/m³**	**lb/yd³**	**tons/yd³**	**m³**	**yd³**
1468-1614	1.47-1.61	**2500-2750**	**1.25-1.38**	7.7	**10**
1638-1801	1.64-1.80	**2778-3056**	**1.39-1.53**	6.9	**9**
1766-1942	1.77-1.94	**3001-3300**	**1.50-1.65**	6.4	**8.33**

990K

Material Density				Bucket Volume	
kg/m³	**tonnes/m³**	**lb/yd³**	**tons/yd³**	**m³**	**yd³**
1590-1749	1.59-1.75	**2692-2962**	**1.35-1.48**	10	**13**
1728-1901	1.73-1.90	**2917-3208**	**1.46-1.60**	9.2	**12**
1849-2034	1.85-2.03	**3111-3422**	**1.56-1.71**	8.6	**11.25**

992K — Standard

Up to specified density for 100% fill factor

Bucket Volume		Material Density	
m³	**yd³**	**kg/m³**	**lb/yd³**
12.2	**16**	1780	**3000**
11.5	**15**	1890	**3200**
10.7	**14**	2030	**3430**

992K — High Lift

Up to specified density for 100% fill factor

Bucket Volume		Material Density	
m³	**yd³**	**kg/m³**	**lb/yd³**
12.2	**16**	1560	**2630**
11.5	**15**	1560	**2630**
10.7	**14**	1560	**2630**

993K — Standard

Up to specified density for 100% fill factor

Bucket Volume		Material Density	
m³	**yd³**	**kg/m³**	**lb/yd³**
15.3	**20**	1780	**3000**
14.5	**19**	1870	**3160**
13.8	**18**	1970	**3330**

993K — High Lift

Up to specified density for 100% fill factor

Bucket Volume		Material Density	
m³	**yd³**	**kg/m³**	**lb/yd³**
14.5	**19**	1720	**2890**
13.8	**18**	1810	**3060**
13.0	**17**	1920	**3240**

WHEEL TRACTOR-SCRAPERS

CONTENTS

WHEEL TRACTOR-SCRAPERS

Specifications
● Twin Engine Open Bowl
● Optional Push-Pull

MODEL	627K		637K		657G	
Flywheel Power: Tractor	304 kW	**407 hp**	425 kW	**570 hp**	421/447 kW	**564/600 hp**
Scraper	216 kW	**290 hp**	216 kW	**290 hp**	306/337 kW	**410/451 hp**
Approx. Operating Weight (Empty)◀	40 811 kg	**89,973 lb**	52 140 kg	**114,950 lb**	68 384 kg	**150,760 lb**
Scraper Capacity: Struck	13 m^3	**17.1 yd^3**	18.3 m^3	**24 yd^3**	24.5 m^3	**32 yd^3**
Heaped	18.4 m^3	**24 yd^3**	26 m^3	**34 yd^3**	33.6 m^3	**44 yd^3**
Rated Load	26 127 kg	**57,610 lb**	37 285 kg	**82,200 lb**	47 174 kg	**104,000 lb**
Weight Distribution — Empty: Front	**59%**		**59%**		**58%**	
Rear	**41%**		**41%**		**42%**	
Weight Distribution — Loaded: Front	**50%**		**50%**		**50%**	
Rear	**50%**		**50%**		**50%**	
Engine Model: Tractor	**C13 ACERT**		**C18 ACERT**		**C18 ACERT**	
Scraper	**C9.3 ACERT**		**C9 ACERT**		**C15 ACERT**	
Emission Standards	**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent**	
Rated Engine RPM: Tractor	**2000**		**1900**		**1800**	
Scraper	**2150**		**2150**		**1800**	
Displacement: Tractor	12.5 L	**763 in^3**	18.1 L	**1105 in^3**	18.1 L	**1105 in^3**
Scraper	9.3 L	**567 in^3**	9.3 L	**567 in^3**	15.2 L	**928 in^3**
Top Speed (Loaded)	53.9 km/h	**33.5 mph**	55.8 km/h	**34.7 mph**	53 km/h	**33 mph**
180° Curb-to-Curb Turning Width	18.25 m	**59'11"**	19.94 m	**65'5"**	22.33 m	**73'3"**
Tires — Tractor/Scraper	**33.25R29★★E3**		**37.25R35★★E3**		**40.5/75R39★★E3**	
Width of Cut	3.14 m	**10'4"**	3.51 m	**11'6"**	3.85 m	**12'8"**
Maximum Depth of Cut	315 mm	**12.4"**	475 mm	**18.7"**	440 mm	**17.3"**
Maximum Depth of Spread	540 mm	**21.3"**	451 mm	**17.8"**	660 mm	**26"**
Fuel Tank Refill Capacity	1272 L	**336 U.S. gal**	1400 L	**370 U.S. gal**	1597 L	**424 U.S. gal**
Tractor DEF Tank	31.5 L	**8.3 U.S. gal**	31.5 L	**8.3 U.S. gal**	—	
Scraper DEF Tank	23.1 L	**6.1 U.S. gal**	22.9 L	**6.0 U.S. gal**	—	
GENERAL DIMENSIONS: Non Push-Pull						
Height — Overall Shipping	4.03 m	**13'2"**	4.15 m	**13'7"**	4.62 m	**15'2"**
Wheelbase	7.99 m	**26'2"**	8.81 m	**28'11"**	9.96 m	**32'8"**
Overall Length	14.02 m	**45'10"**	15.04 m	**49'4"**	16.2 m	**53'1"**
Overall Width	3.57 m	**11'7"**	3.94 m	**12'11"**	4.35 m	**14'4"**
Shipping Width (Draft Arm on Inside of Bowl)	—		—		3.91 m *	**12'10"**
Center Line of Scraper Tread	2.29 m	**7'5"**	2.46 m	**8'1"**	2.81 m	**9'3"**
Center Line of Tractor Tread	2.28 m	**7'4"**	2.46 m	**8'1"**	2.63 m	**8'8"**
GENERAL DIMENSIONS: Push-Pull						
Operating Weight (Empty)◀	42 158 kg	**92,942 lb**	54 005 kg	**119,060 lb**	72 804 kg	**160,505 lb**
Overall Length	15.58 m	**51'1"**	16.64 m	**54'7"**	18.01 m	**59'1"**
Weight Distribution — Empty:						
Front	**59%**		**61%**		**58%**	
Rear	**41%**		**39%**		**42%**	
Weight Distribution — Loaded:						
Front	**50%**		**51%**		**51%**	
Rear	**50%**		**49%**		**49%**	

*Standard Shipping Configuration.

◀ Operating weight includes standard machine, coolant, lubricants, full fuel tank, and operator. Operating weights for the 627K and 637K are based on Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) platform machines. Deduct 569 kg **(1254 lb)** for the operating weight for the 627K Tier 2/Stage II/Japan 2001 (Tier 2) equivalent. Deduct 650 kg **(1433 lb)** for the operating weight for the 637K Tier 2/Stage II/Japan 2001 (Tier 2) equivalent. 657G is not available in Tier 2/Stage II/Japan 2001 (Tier 2) equivalent.

NOTE: Wheel Tractor-Scrapers are not emission certified in Japan market.

MODEL	637K		657G	
Flywheel Power: Tractor	425 kW	**570 hp**	421/447 kW	**564/600 hp**
Scraper	216 kW	**290 hp**	306/337 kW	**410/451 hp**
Approx. Operating Weight (Empty)	53 425 kg	**117,782 lb**	72 190 kg	**158,817 lb**
Scraper Capacity: Struck	31 m³	**41 yd³**	45 m³	**59 yd³**
Heaped	38 m³	**50 yd³**	56 m³	**73 yd³**
Emission Standards	**Tier 4 Final/Stage IV/ Japan 2014 (Tier 4 Final)**		**Tier 3/Stage IIIA/ Japan 2006 (Tier 3) equivalent**	
Rated Load	37 285 kg	**82,200 lb**	49 895 kg	**110,000 lb**
Approx. Operating Weight (Loaded)	90 710 kg	**199,982 lb**	121 933 kg	**268,817 lb**
Top Speed (Loaded)	55.8 km/h	**34.7 mph**	53 km/h	**33 mph**
180° Curb-to-Curb Turning Width	21.46 m	**70'5"**	24.43 m	**80'2"**
GENERAL DIMENSIONS:				
Height — Overall Shipping	4.15 m	**13'7"**	4.62 m	**15'2"**
Wheelbase	9.57 m	**31'5"**	11.01 m	**36'1"**
Overall Length	15.48 m	**50'10"**	17.21 m	**56'5"**
Overall Width	3.94 m	**12'11"**	4.35 m	**14'4"**
Shipping Width (Draft Arm on Inside of Bowl)	—		3.91 m *	**12'10"**
Center Line of Scraper Tread	2.46 m	**8'1"**	2.81 m	**9'3"**
Center Line of Tractor Tread	2.46 m	**8'1"**	2.63 m	**8'8"**

*Standard Shipping Configuration.

◀Operating weight includes standard machine, coolant, lubricants, full fuel tank, and operator. Operating weights for the 637K are based on Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) and operating weights for the 657G are based on Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent platform machines. Deduct 650 kg **(1433 lb)** for the operating weight for the 637K Tier 2/Stage II/Japan 2001 (Tier 2) equivalent.

NOTE: Wheel Tractor-Scrapers are not emission certified in Japan market.

Coal Bowl

Coal Bowl Wheel Tractor-Scrapers are typically used for building and maintaining coal stockpiles and hauling coal to the supply system at coal power plants. The self-loading capability, large capacity, coal pile compaction, and high speed of Coal Bowl Wheel Tractor-Scrapers make them the tool of choice for moving coal both short and long distances. Coal Bowl Wheel Tractor-Scrapers are available in the 637K and 657G tandem engine models.

Coal Bowl Advantages:

- Load hoppers
- Manage coal stockpiles
- Compaction reduces risk of spontaneous combustion in coal stockpile
- Exclusively designed large capacity coal bowls

Notes:

- The 637K Coal Scraper is 736 mm **(29.0")** longer, the bowl sides are 476 mm **(18.7")** taller, and the apron is 499 mm **(19.6")** taller than its earthmoving counterpart.
- The 657G Coal Scraper is 1072 mm **(42.2")** longer, the bowl sides are 1010 mm **(39.8")** taller, the apron is 677 mm **(26.7")** taller, and the ejector is 944 mm **(37.2")** taller than its earthmoving counterpart.

USE OF RIMPULL-SPEED-GRADEABILITY CURVES

The following explanation applies to Rimpull-Speed-Gradeability curves for Wheel Tractor-Scrapers, Construction & Mining Trucks/Tractors and Articulated Trucks.

Maximum speed attainable, gear range and available rimpull can be determined from curves on the following pages when machine weight and total effective grade (or total resistance) are known.

Rimpull is the force (in kg, lb or kN) available between the tire and the ground to propel the machine (limited by traction).

Weight is defined as Gross Machine Weight (kg or lb) = Machine + Payload.

Total Effective Grade (or Total Resistance) is grade resistance plus rolling resistance expressed as percent grade.

Grade is measured or estimated.

Rolling resistance is estimated (see Tables section for typical values.)

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example

With a 6% grade and a rolling resistance of 40 kg/metric ton (80 lb/U.S. ton), find total resistance.

Rolling resistance = 40 kg/t ÷ 10 = 4% Effective Grade

(English: 80 lb ÷ 20 = 4%)

Total resistance = 4% rolling + 6% grade = 10%

Altitude Derating

Rimpull force and speed must be derated for altitude similar to flywheel horsepower. The percentage loss in rimpull force approximately corresponds to the percentage loss in flywheel horsepower. See Tables Section for altitude derations.

Rimpull-Speed-Gradeability

To determine gradeability performance: Read from gross weight down to the % of total resistance. (Total resistance equals actual % grade *plus* 1% for each 10 kg/metric ton (20 lb./U.S. ton) of rolling resistance.) From this weight-resistance point, read horizontally to the curve with the highest obtainable speed range, then down to the maximum speed. Usable rimpull depends upon traction and weight on drive wheels.

Example problem:

A 631K with an estimated payload of 37 013 kg (81,600 lb) is operating on a total effective grade of 10%. Find the available rimpull and maximum attainable speed.

Empty weight payload = Gross Weight

47 628 kg + 37 013 kg = 84 641 kg

(105,002 lb + 81,600 lb = 186,602 lb)

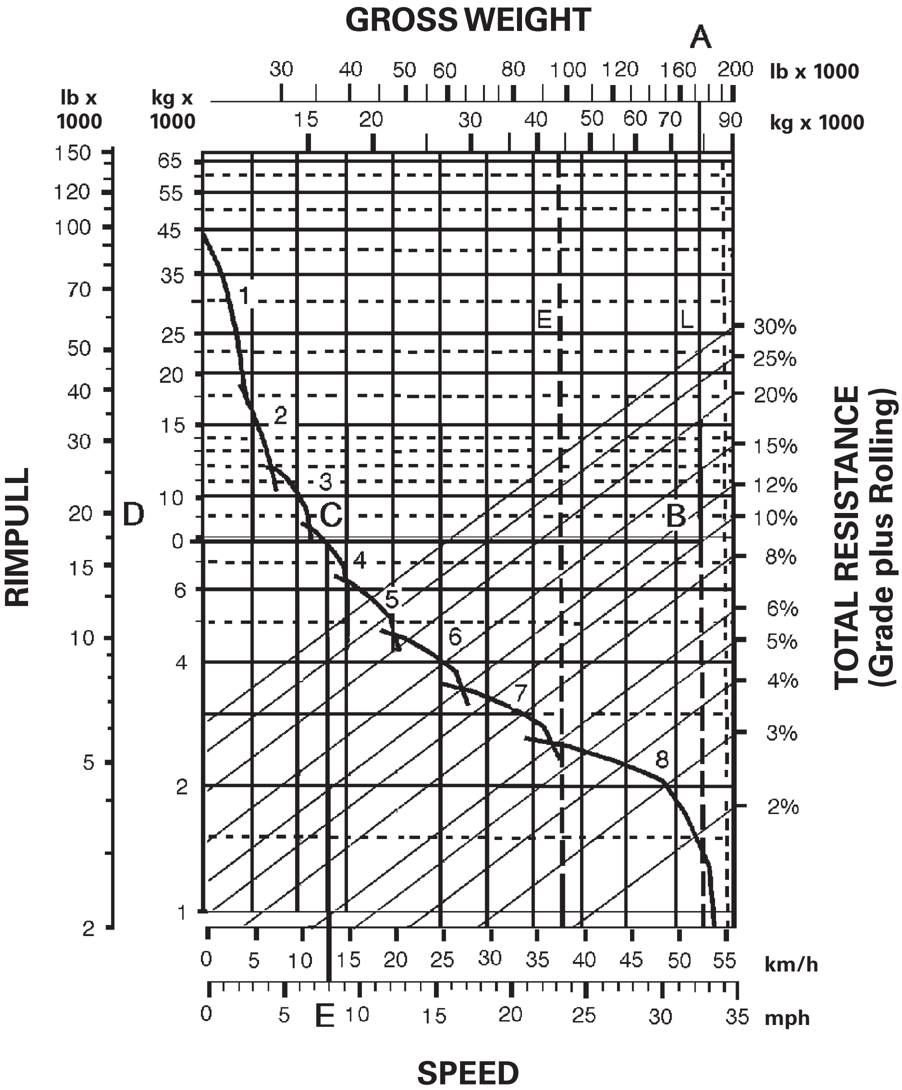
Solution: Using graph on the next page, read from 84 641 kg (186,602 lb) (point A) on top of gross weight scale down the line to the intersection of the 10% total resistance line (point B).

Go across horizontally from B to the Rimpull Scale on the left (point D). This gives the required rimpull: 7756 kg (17,100 lb).

Where the line cuts the speed curve (point C), read down vertically (point E) to obtain the maximum speed attainable for the 10% effective grade: 12.9 km/h (8 mph).

ANSWER: The machine will climb the 10% effective grade at a maximum speed of 12.9 km/h (8 mph) in 4th gear. Available rimpull is 7756 kg (17,100 lb).

● ● ●



KEY	
1 — 1st Gear Torque Converter Drive	
2 — 2nd Gear Torque Converter Drive	
3 — 3rd Gear Direct Drive	
4 — 4th Gear Direct Drive	
5 — 5th Gear Direct Drive	
6 — 6th Gear Direct Drive	
7 — 7th Gear Direct Drive	
8 — 8th Gear Direct Drive	

KEY
A — Loaded 84 641 kg (186,602 lb)
B — Intersection with 10% total resistance line
C — Intersection with rimpull curve (4th gear)
D — Required rimpull 7756 kg (17,100 lb)
E — Speed 12.9 km/h (8 mph)

TYPICAL FIXED TIMES FOR SCRAPERS
(Times may vary depending on job conditions)

Model	Loaded By	Load Time (Min.)	Maneuver and Spread or Maneuver and Dump (Min.)
613G	Self	0.9	0.7
623K	Self	0.9	0.7
621K	One D8	0.5	0.7
627K	One D8	0.5	0.6
621K	One D9	0.4	0.7
627K	One D9	0.4	0.6
627K/PP	Self	0.9*	0.6
631K	One D9	0.6	0.7
637K	One D9	0.6	0.6
631K	One D10	0.5	0.7
637K	One D10	0.5	0.6
637K/PP	Self	1.0*	0.6
657G	One D11	0.6	0.6
657G	Push Pull Self	1.1*	0.6
637K	Coal	0.8	0.7
657G	Coal	0.8	0.6

*Load time per pair, including transfer time.

NOTE: Empty Weights shown on the Wheel Tractor-Scraper charts includes ROPS Canopy. When calculating TMPH loadings *any* additional weight must be considered in establishing mean tire loads.

USE OF RETARDER CURVES

The following explanation applies to retarder curves for Wheel Tractor-Scrapers and Articulated Trucks.

The speed that can be maintained (without use of service brake) when the machine is descending a grade with retarder fully on can be determined from the retarder curves in this section if gross machine weight and total effective grade are known.

Total Effective Grade (or Total Resistance) is grade assistance *minus* rolling resistance.

10 kg/metric ton (20 lb/U.S. ton) = 1% adverse grade.

Example

15% favorable grade with 5% rolling resistance. Find Total Effective Grade.

Total Effective Grade = 15% Grade Assistance — 5%

Rolling Resistance = 10% Total Effective Grade Assistance.

Example problem:

A 651E with an estimated payload of 47 175 kg (104,000 lb) descends a 10% total effective grade. Find constant speed and gear range with maximum retarder effort. Find travel time if the slope is 610 m (2000 ft) long.

Empty Weight + Payload = Gross Weight
= 60 950 kg + 47 175 kg = 108 125 kg
(134,370 lb + 104,000 lb = 238,370 lb)

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Solution: Using the retarder curve below, read from 108 125 kg (238,370 lb) (point A) on top of gross weight scale down the line to the intersection of the 10% effective grade line (point B).

Go across horizontally from point B to the intersection of the retarder curve (point C). Point C intersects at the 5 (5th gear) range.

Where point C intersects the retarder curve, read down vertically to point D on the bottom scale to obtain the constant speed: 21.7 km/h (13.5 mph).

ANSWER: The 651E will descend the slope at 21.7 km/h (13.5 mph) in 5th gear. Travel time is 1.68 minutes.

$$\frac{610\ \text{m}}{363\ \text{m/min}} = 1.68\ \text{min}$$

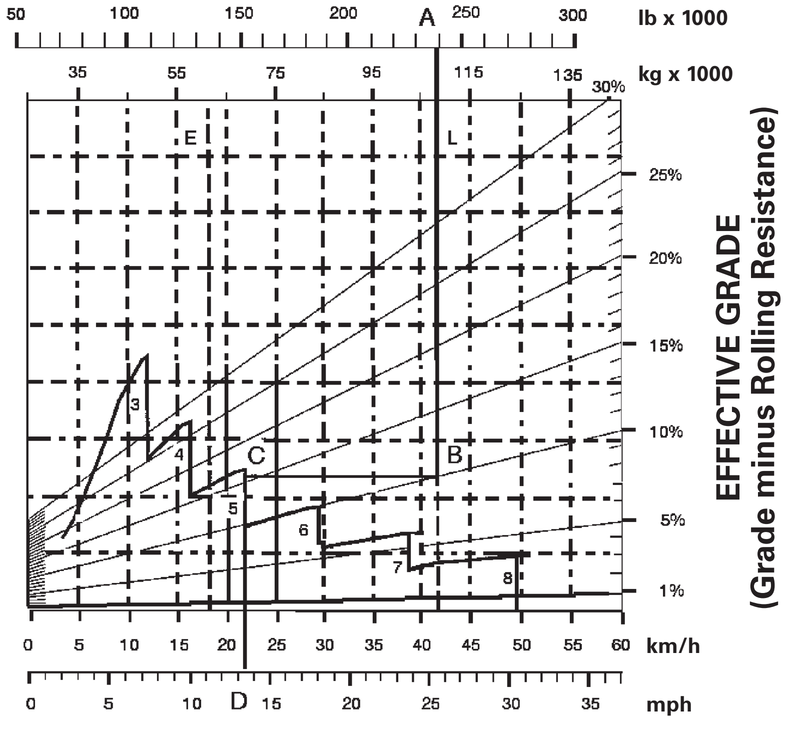
*(mph × 88 = F.P.M.)

$$\frac{2000\ \text{ft}}{13.5\ \text{mph} \times 88^*} = 1.68\ \text{min}$$

NOTE: The basic Distance-Speed-Time formula is 60 D ÷ S = T (or "60 D Street"), where 60 is minutes, D is distance, S is speed and T is time. In the above problem, 60 × 610 m ÷ 21.7 km/h × 1000 = T.

$$\frac{60 \times 610}{21.7 \times 1000} = T = (1.68)$$

GROSS WEIGHT



SPEED

KEY
3 — 3rd Gear Direct Drive
4 — 4th Gear Direct Drive
5 — 5th Gear Direct Drive
6 — 6th Gear Direct Drive
7 — 7th Gear Direct Drive
8 — 8th Gear Direct Drive

KEY
A — Loaded 108 125 kg (238,370 lb)
B — Intersection with 10% effective grade line
C — Intersection with retarder curve (5th gear)
D — Constant speed 21.7 km/h (13.5 mph)

MINING AND EARTHMOVING

CONTENTS

INTRODUCTION

This section explains the earthmoving principles used to determine machine productivity. It shows how to calculate production on-the-job or estimate production off-the-job.

ELEMENTS OF PRODUCTION

Production is the hourly rate at which material is moved. Production can be expressed in various units:

Metric

Bank Cubic Meters	— BCM —	bank m^3
Loose Cubic Meters	— LCM —	loose m^3
Compacted Cubic Meters	— CCM —	compacted m^3
Tonnes		

English

Bank Cubic Yards	— BCY —	bank yd^3
Loose Cubic Yards	— LCY —	loose yd^3
Compacted Cubic Yards	— CCY —	compacted yd^3
Tons		

For most earthmoving and material handling applications, production is calculated by multiplying the quantity of material (load) moved per cycle by the number of cycles per hour.

Production = Load/cycle × cycles/hour

The load can be determined by
1) load weighing with scales
2) load estimating based on machine rating
3) surveyed volume divided by load count
4) machine payload measurement system

Generally, earthmoving and overburden removal for coal mines are calculated by volume (bank cubic meters or bank cubic yards). Metal mines and aggregate producers usually work in weight (tons or tonnes).

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Volume Measure — Material volume is defined according to its state in the earthmoving process. The three measures of volume are:

BCM (BCY) — one cubic meter (yard) of material as it lies in the natural bank state.

LCM (LCY) — one cubic meter (yard) of material which has been disturbed and has swelled as a result of movement.

CCM (CCY) — one cubic meter (yard) of material which has been compacted and has become more dense as a result of compaction.

In order to estimate production, the relationships between bank measure, loose measure, and compacted measure must be known.

Swell — Swell is the percentage of original volume (cubic meters or cubic yards) that a material increases when it is removed from the natural state. When excavated, the material breaks up into different size particles that do not fit together, causing air pockets or voids to reduce the weight per volume. For example to hold the same weight of one cubic unit of bank material it takes 30% more volume (1.3 times) after excavation. (Swell is 30%.)

$$1 + \text{Swell} = \frac{\text{Loose cubic volume for a given weight}}{\text{Bank cubic volume for the same given weight}}$$

$$\text{Bank} = \frac{\text{Loose}}{(1 + \text{Swell})}$$

$$\text{Loose} = \text{Bank} \times (1 + \text{Swell})$$

Example Problem:

If a material swells 20%, how many loose cubic meters (loose cubic yards) will it take to move 1000 bank cubic meters (1308 bank cubic yards)?

$$\text{Loose} = \text{Bank} \times (1 + \text{Swell}) =$$
$$1000 \text{ BCM} \times (1 + 0.2) = 1200 \text{ LCM}$$
$$1308 \text{ BCY} \times (1 + 0.2) = 1570 \text{ LCY}$$

How many bank cubic meters (yards) were moved if a total of 1000 loose cubic meters (1308 yards) have been moved? Swell is 25%.

$$\text{Bank} = \text{Loose} \div (1 + \text{Swell}) =$$
$$1000 \text{ LCM} \div (1 + 0.25) = 800 \text{ BCM}$$
$$1308 \text{ LCY} \div (1 + 0.25) = 1046 \text{ BCY}$$

Load Factor — Assume one bank cubic yard of material weighs 3000 lb. Because of material characteristics, this bank cubic yard swells 30% to 1.3 loose cubic yards when loaded, with no change in weight. If this 1.0 bank cubic yard or 1.3 loose cubic yards is compacted, its volume may be reduced to 0.8 compacted cubic yard, and the weight is still 3000 lb.

Instead of dividing by 1 + Swell to determine bank volume, the loose volume can be multiplied by the load factor.

If the percent of material swell is known, the load factor (L.F.) may be obtained by using the following relationship:

$$\text{L.F.} = \frac{100\%}{100\% + \%\text{ swell}}$$

Load factors for various materials are listed in the Tables Section of this handbook.

To estimate the machine payload in bank cubic yards, the volume in loose cubic yards is multiplied by the load factor:

$$\text{Load (BCY)} = \text{Load (LCY)} \times \text{L.F.}$$

The ratio between compacted measure and bank measure is called shrinkage factor (S.F.):

$$\text{S.F.} = \frac{\text{Compacted cubic yards (CCY)}}{\text{Bank cubic yards (BCY)}}$$

Shrinkage factor is either estimated or obtained from job plans or specifications which show the conversion from compacted measure to bank measure. Shrinkage factor should not be confused with percentage compaction (used for specifying embankment density, such as Modified Proctor or California Bearing Ratio [CBR]).

Material Density — Density is the weight per unit volume of a material. Materials have various densities depending on particle size, moisture content and variations in the material. The denser the material the more weight there is per unit of equal volume. Density estimates are provided in the Tables Section of this handbook.

$$\text{Density} = \frac{\text{Weight}}{\text{Volume}} = \frac{\text{kg (lb)}}{\text{m}^3\,(\text{yd}^3)}$$

$$\text{Weight} = \text{Volume} \times \text{Density}$$

A given material's density changes between bank and loose. One cubic unit of loose material has less weight than one cubic unit of bank material due to air pockets and voids. To correct between bank and loose use the following equations.

$$1 + \text{Swell} = \frac{\text{kg/BCM}}{\text{kg/LCM}} \text{ or } \frac{\text{lb/BCY}}{\text{lb/LCY}}$$

$$\text{lb/LCY} = \frac{\text{lb/BCY}}{(1 + \text{Swell})}$$

$$\text{lb/BCY} = \text{lb/LCY} \times (1 + \text{Swell})$$

Fill Factor — The percentage of an available volume in a body, bucket, or bowl that is actually used is expressed as the fill factor. A fill factor of 87% for a hauler body means that 13% of the rated volume is not being used to carry material. Buckets often have fill factors over 100%.

Example Problem:

A 14 cubic yard (heaped 2:1) bucket has a 105% fill factor when operating in a shot sandstone (4125 lb/BCY and a 35% swell).

a) What is the loose density of the material?
b) What is the usable volume of the bucket?
c) What is the bucket payload per pass in BCY?
d) What is the bucket payload per pass in tons?

a) lb/LCY = lb/BCY ÷ (1 + Swell) = 4125 ÷ (1.35) = 3056 lb/LCY
b) LCY = rated LCY × fill factor = 14 × 1.05 = 14.7 LCY
c) lb/pass = volume × density lb/LCY = 14.7 × 3056 = 44,923 lb
BCY/pass = weight ÷ density lb/BCY = 44,923 ÷ 4125 = 10.9 BCY
or bucket LCY from part b ÷ (1 + Swell) = 14.7 ÷ 1.35 = 10.9 BCY
d) tons/pass = lb ÷ 2000 lb/ton = 44,923 ÷ 2000 = 22.5 tons

Example Problem:

Construct a 10,000 compacted cubic yard (CCY) bridge approach of dry clay with a shrinkage factor (S.F.) of 0.80. Haul unit is rated 14 loose cubic yards struck and 20 loose cubic yards heaped.

a) How many bank yards are needed?
b) How many loads are required?

a) $\text{BCY} = \frac{\text{CCY}}{\text{S.F.}} = \frac{10{,}000}{0.80} = 12{,}500 \text{ BCY}$

b) Load (BCY) = Capacity (LCY)
× Load factor (L.F.) = 20 × 0.81
= 16.2 BCY/Load

(L.F. of 0.81 from Tables)

$$\text{Number of loads required} = \frac{12{,}500 \text{ BCY}}{16.2 \text{ BCY/Load}} = 772 \text{ Loads}$$

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Soil Density Tests — There are a number of acceptable methods that can be used to determine soil density. Some that are currently in use are:

Nuclear density moisture gauge
Sand cone method
Oil method
Balloon method
Cylinder method

All these except the nuclear method use the following procedure:

1. Remove a soil sample from bank state.
2. Determine the volume of the hole.
3. Weigh the soil sample.
4. Calculate the bank density kg/BCM (lb/BCY).

The nuclear density moisture gauge is one of the most modern instruments for measuring soil density and moisture. A common radiation channel emits either neutrons or gamma rays into the soil. In determining soil density, the number of gamma rays absorbed and back scattered by soil particles is *indirectly* proportional to the soil density. When measuring moisture content, the number of moderated neutrons reflected back to the detector after colliding with hydrogen particles in the soil is *directly* proportional to the soil's moisture content.

All these methods are satisfactory and will provide accurate densities when performed correctly. Several repetitions are necessary to obtain an average.

NOTE: Several newer methods have been successfully applied, along with weigh scales to determine volume and loose density of material moved in hauler bodies. These measurements include photogrammatic and laser scanning technologies.

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FIGURING PRODUCTION ON-THE-JOB

Load Weighing — The most accurate method of determining the actual load carried is by weighing. This is normally done by weighing the haul unit one wheel or axle at a time with portable scales. Any scales of adequate capacity and accuracy can be used. While weighing, the machine must be level to reduce error caused by weight transfer. Enough loads must be weighed to provide a good average. Machine weight is the sum of the individual wheel or axle weights.

The weight of the load can be determined using the empty and loaded weight of the unit.

Weight of load = gross machine weight – empty weight

To determine the bank cubic measure carried by a machine, the load weight is divided by the bankstate density of the material being hauled.

$$\text{BCY} = \frac{\text{Weight of load}}{\text{Bank density}}$$

Times Studies — To estimate production, the number of complete trips a unit makes per hour must be determined. First obtain the unit's cycle time with the help of a stop watch. Time several complete cycles to arrive at an average cycle time. By allowing the watch to run continuously, different segments such as load time, wait time, etc. can be recorded for each cycle. Knowing the individual time segments affords a good opportunity to evaluate the balance of the spread and job efficiency. The following is an example of a scraper load time study form. Numbers in the white columns are stop watch readings; numbers in the shaded columns are calculated:

Total Cycle Times (less delays)	Arrive Cut	Wait Time	Begin Load	Load Time	End Load	Begin Delay	Delay Time	End Delay
	0.00	0.30	0.30	0.60	0.90			
3.50	3.50	0.30	3.80	0.65	4.45			
4.00	7.50	0.35	7.85	0.70	8.55	9.95	1.00	10.95
4.00	12.50	0.42	12.92	0.68	13.60			

NOTE: All numbers are in minutes

This may be easily extended to include other segments of the cycle such as haul time, dump time, etc. Haul roads may be further segmented to more accurately define performance, including measured speed traps. Similar forms can be made for pushers, loaders, dozers, etc. *Wait Time* is the time a unit must wait for another unit so that the two can function together (haul unit waiting for pusher). *Delay Time* is any time, other than wait time, when a machine is not performing in the work cycle (scraper waiting to cross railroad track).

To determine trips-per-hour at 100% efficiency, divide 60 minutes by the average cycle time less all wait and delay time. Cycle time may or may not include wait and/or delay time. Therefore, it is possible to figure different kinds of production: measured production, production without wait or delay, maximum production, etc. For example:

Actual Production: includes all wait and delay time.

Normal Production (without delays): includes wait time that is considered normal, but no delay time.

Maximum Production: to figure maximum (or optimum) production, both wait time and delay time are eliminated. The cycle time may be further altered by using an optimum load time.

Example (English)

A job study of a Wheel Tractor-Scraper might yield the following information:

Average wait time	= 0.28 minute
Average load time	= 0.65
Average delay time	= 0.25
Average haul time	= 4.26
Average dump time	= 0.50
Average return time	= 2.09
Average total cycle	= 8.03 minutes
Less wait & delay time	= 0.53
Average cycle 100% eff.	= 7.50 minutes

Weight of haul unit empty — 48,650 lb

Weights of haul unit loaded —

Weighing unit #1 — 93,420 lb
Weighing unit #2 — 89,770 lb
Weighing unit #3 — 88,760 lb

271,950 lb;
average = 90,650 lb

1. Average load weight = 90,650 lb – 48,650 lb = 42,000 lb
2. Bank density = 3125 lb/BCY
3. $\text{Load} = \frac{\text{Weight of load}}{\text{Bank density}}$

   $= \frac{42{,}000 \text{ lb}}{3125 \text{ lb/BCY}} = 13.4 \text{ BCY}$
4. Cycles/hr =

   $\frac{60 \text{ min/hr}}{\text{Cycle time}} = \frac{60 \text{ min/hr}}{7.50 \text{ min/cycle}} = 80 \text{ cycles/hr}$
5. Production = Load/cycle × cycles/hr
   (less delays) = 13.4 BCY/cycle × 8.0 cycles/hr
   = 107.2 BCY/hr

Example (Metric)

A job study of a Wheel Tractor-Scraper might yield the following information:

Average wait time	= 0.28 minute
Average load time	= 0.65
Average delay time	= 0.25
Average haul time	= 4.26
Average dump time	= 0.50
Average return time	= 2.09
Average total cycle	= 8.03 minutes
Less wait & delay time	= 0.53
Average cycle 100% eff.	= 7.50 minutes

Weight of haul unit empty — 22 070 kg

Weights of haul unit loaded —

Weighing unit #1 — 42 375 kg
Weighing unit #2 — 40 720 kg
Weighing unit #3 — 40 260 kg

123 355 kg;
average = 41 120 kg

1. Average load weight = 41 120 kg – 22 070 kg = 19 050 kg
2. Bank density = 1854 kg/BCM
3. $\text{Load} = \dfrac{\text{Weight of load}}{\text{Bank density}}$

   $= \dfrac{19\,050 \text{ kg}}{1854 \text{ kg/BCM}} = 10.3 \text{ BCM}$
4. Cycles/hr =

   $\dfrac{60 \text{ min/hr}}{\text{Cycle time}} = \dfrac{60 \text{ min/hr}}{7.50 \text{ min/cycle}} = 80 \text{ cycles/hr}$
5. Production = Load/cycle × cycles/hr
   (less delays) = 10.3 BCM/cycle × 8.0 cycles/hr
   = 82 BCM/hrr

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ESTIMATING PRODUCTION OFF-THE-JOB

It is often necessary to estimate production of earthmoving machines which will be selected for a job. As a guide, the remainder of the section is devoted to discussions of various factors that may affect production. Some of the figures have been rounded for easier calculation.

Rolling Resistance (RR) is a measure of the force that must be overcome to roll or pull a wheel over the ground. It is affected by ground conditions and load — the deeper a wheel sinks into the ground, the higher the rolling resistance. Internal friction and tire flexing also contribute to rolling resistance. Experience has shown that minimum resistance is 1%-1.5% (see Typical Rolling Resistance Factors in Tables section) of the gross machine weight (on tires). A 2% base resistance is quite often used for estimating. Resistance due to tire penetration is approximately 1.5% of the gross machine weight for each inch of tire penetration (0.6% for each cm of tire penetration). Thus rolling resistance can be calculated using these relationships in the following manner:

RR = 2% of GMW + 0.6% of GMW per cm tire penetration

RR = 2% of GMW + 1.5% of GMW per inch tire penetration

It's *not* necessary for the tires to actually penetrate the road surface for rolling resistance to increase above the minimum. If the road surface flexes under load, the effect is nearly the same — the tire is always running "uphill." Only on very hard, smooth surfaces with a well compacted base will the rolling resistance approach the minimum.

When actual penetration takes place, some variation in rolling resistance can be noted with various inflation pressures and tread patterns.

NOTE: When figuring "pull" requirements for track-type tractors, rolling resistance applies only to the trailed unit's *weight on wheels*. Since track-type tractors utilize steel wheels moving on steel "roads," a tractor's rolling resistance is relatively constant and is accounted for in the Drawbar Pull rating.

Grade Resistance is a measure of the force that must be overcome to move a machine over unfavorable grades (uphill). Grade assistance is a measure of the force that assists machine movement on favorable grades (downhill).

Grades are generally measured in percent slope, which is the ratio between vertical rise or fall and the horizontal distance in which the rise or fall occurs. For example, a 1% grade is equivalent to a 1 m (ft) rise or fall for every 100 m (ft) of horizontal distance; a rise of 4.6 m (15 ft) in 53.3 m (175 ft) equals an 8.6% grade.

$$\frac{4.6 \text{ m (rise)}}{53.3 \text{ m (horizontal distance)}} = 8.6\% \text{ grade}$$

$$\frac{15 \text{ ft (rise)}}{175 \text{ ft (horizontal distance)}} = 8.6\% \text{ grade}$$

Uphill grades are normally referred to as adverse grades and downhill grades as favorable grades. Grade resistance is usually expressed as a positive (+) percentage and grade assistance is expressed as a negative (–) percentage.

It has been found that for each 1% increment of adverse grade an additional 10 kg (20 lb) of resistance must be overcome for each metric (U.S.) ton of machine weight. This relationship is the basis for determining the Grade Resistance Factor which is expressed in kg/metric ton (lb/U.S. ton):

Grade Resistance Factor = 10 kg/m ton × % grade
= 20 lb/U.S. ton × % grade

Grade resistance (assistance) is then obtained by multiplying the Grade Resistance Factor by the machine weight (GMW) in metric (U.S.) tons.

Grade Resistance = GR Factor × GMW in metric (U.S.) tons

Grade resistance may also be calculated using percentage of gross weight. This method is based on the relationship that grade resistance is approximately equal to 1% of the gross machine weight for 1% of grade.

Grade Resistance = 1% of GMW × % grade

Grade resistance (assistance) affects both wheel and track-type machines.

Total Resistance is the combined effect of rolling resistance (wheel vehicles) and grade resistance. It can be computed by summing the values of rolling resistance and grade resistance to give a resistance in kilogram (pounds) force.

Total Resistance = Rolling Resistance + Grade Resistance

Total resistance can also be represented as consisting completely of grade resistance expressed in percent grade. In other words, the rolling resistance component is viewed as a corresponding quantity of additional adverse grade resistance. Using this approach, total resistance can then be considered in terms of percent grade.

This can be done by converting the contribution of rolling resistance into a corresponding percentage of grade resistance. Since 1% of adverse grade offers a resistance of 10 kg (20 lb) for each metric or (U.S.) ton of machine weight, then each 10 kg (20 lb) of resistance per ton of machine weight can be represented as an additional 1% of adverse grade. Rolling resistance in percent grade and grade resistance in percent grade can then be summed to give Total Resistance in percent or Effective Grade. The following formulas are useful in arriving at Effective Grade.

Rolling Resistance (%) = 2% + 0.6% per cm tire penetration
= 2% + 1.5% per inch tire penetration
Grade Resistance (%) = % grade
Effective Grade (%) = RR (%) + GR (%)

Effective grade is a useful concept when working with Rimpull-Speed-Gradeability curves, Retarder curves, Brake Performance curves, and Travel Time curves.

Traction — is the driving force developed by a wheel or track as it acts upon a surface. It is expressed as usable Drawbar Pull or Rimpull. The following factors affect traction: weight on the driving wheel or tracks, gripping action of the wheel or track, and ground conditions. The coefficient of traction (for any roadway) is the ratio of the maximum pull developed by the machine to the total weight on the drivers.

$$\text{Coeff. of traction} = \frac{\text{Pull}}{\text{weight on drivers}}$$

Therefore, to find the usable pull for a given machine:
Usable pull = Coeff. of traction × weight on drivers

Example: Track-Type Tractor

What usable drawbar pull (DBP) can a 26 800 kg (59,100 lb) Track-type Tractor exert while working on firm earth? on loose earth? (See table section for coefficient of traction.)

Answer:
Firm earth — Usable DBP =
0.90 × 26 800 kg = 24 120 kg
(0.90 × 59,100 lb = 53,190 lb)
Loose earth — Usable DBP =
0.60 × 26 800 kg = 16 080 kg
(0.60 × 59,100 lb = 35,460 lb)

If a load required 21 800 kg (48,000 lb) pull to move it, this tractor could move the load on firm earth. However, if the earth were loose, the tracks would spin.

NOTE: D8R through D11R Tractors may attain higher coefficients of traction due to their suspended undercarriage.

Example: Wheel Tractor-Scraper

What usable rimpull can a 621F size machine exert while working on firm earth? on loose earth? The total loaded weight distribution of this unit is:

Drive unit wheels: 23 600 kg (52,000 lb)	Scraper unit wheels: 21 800 kg (48,000 lb)

Remember, use weight on drivers only.
Answer:
Firm earth — 0.55 × 23 600 kg = 12 980 kg
(0.55 × 52,000 lb = 28,600 lb)
Loose earth — 0.45 × 23 600 kg = 10 620 kg
(0.45 × 52,000 lb = 23,400 lb)

On firm earth this unit can exert up to 12 980 kg (28,600 lb) rimpull without excessive slipping. However, on loose earth the drivers would slip if more than 10 620 kg (23,400 lb) rimpull were developed.

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Altitude — Specification sheets show how much pull a machine can produce for a given gear and speed when the engine is operating at rated horsepower. When a standard machine is operated in high altitudes, the engine may require derating to maintain normal engine life. This engine deration will produce less drawbar pull or rimpull.

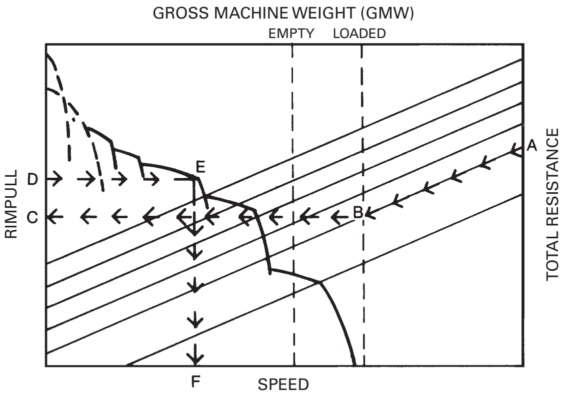
The Tables Section gives the altitude deration in percent of flywheel horsepower for current machines. It should be noted that some turbocharged engines can operate up to 4570 m (15,000 ft) before they require derating. Most machines are engineered to operate up to 1500-2290 m (5000-7500 ft) before they require deration.

The horsepower deration due to altitude must be considered in any job estimating. The amount of power deration will be reflected in the machine's gradeability and in the load, travel, and dump and load times (unless loading is independent of the machine itself). Altitude may also reduce retarding performance. Consult a Cat representative to determine if deration is applicable. Fuel grade (heat content) can have a similar effect of derating engine performance.

The example job problem that follows indicates one method of accounting for altitude deration: by increasing the appropriate components of the total cycle time by a percentage equal to the percent of horsepower deration due to altitude. (i.e., if the travel time of a hauling unit is determined to be 1.00 minute at full HP, the time for the same machine derated to 90% of full HP will be 1.10 min.) This is an approximate method that yields reasonably accurate estimates up to 3000 m (10,000 feet) elevation.

Travel time for hauling units derated more than 10% should be calculated as follows using Rimpull-Speed-Gradeability charts.

1) Determine total resistance (grade plus rolling) in percent.



2) Beginning at point A on the chart follow the total resistance line diagonally to its intersection, B, with the vertical line corresponding to the appropriate gross machine weight. (Rated loaded and empty GMW lines are shown dotted.)

3) Using a straight-edge, establish a horizontal line to the left from point B to point C on the rim-pull scale.

4) Divide the value of point C as read on the rimpull scale by the percent of total horsepower available after altitude deration from the Tables Section. This yields rimpull value D higher than point C.

5) Establish a horizontal line right from point D. The farthest right intersection of this line with a curved speed range line is point E.

6) A vertical line down from point E determines point F on the speed scale.

7) Multiply speed in kmh by 16.7 (mph by 88) to obtain speed in m/min (ft/min). Travel time in minutes for a given distance in feet is determined by the formula:

$$\text{Time (min)} = \frac{\text{Distance in m (ft)}}{\text{Speed in m/min (ft/min)}}$$

The Travel Time Graphs in sections on Wheel Tractor-Scrapers and Construction & Mining Trucks can be used as an alternative method of calculating haul and/or return times.

Job Efficiency is one of the most complex elements of estimating production since it is influenced by factors such as operator skill, minor repairs and adjustments, personnel delays, and delays caused by job layout. An approximation of efficiency, if no job data is available, is given below.

Operation	Working Hour	Efficiency Factor
Day	50 min/hr	0.83
Night	45 min/hr	0.75

These factors do not account for delays due to weather or machine downtime for maintenance and repairs. You must account for such factors based on experience and local conditions.

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The following example provides a method to manually estimate production and cost. Today, computer programs, such as Caterpillar's Fleet Production and Cost Analysis (FPC), provide a much faster and more accurate means to obtain those application results.

Example problem (English)

A contractor is planning to put the following spread on a dam job. What is the estimated production?

Equipment:
- 11 — 631G Wheel Tractor-Scrapers
- 2 — D9T Tractors with C-dozers
- 2 — 12H Motor Graders
- 1 — 825G Tamping Foot Compactor

Material:
- Description — Sandy clay; damp, natural bed
- Bank Density — 3000 lb/BCY
- Load Factor — 0.80
- Shrinkage Factor — 0.85
- Traction Factor — 0.50
- Altitude — 7500 ft

1. Estimate Payload:
Est. load (LCY) × L.F. × Bank Density = payload
31 LCY × 0.80 × 3000 lb/BCY = 74,400 lb payload

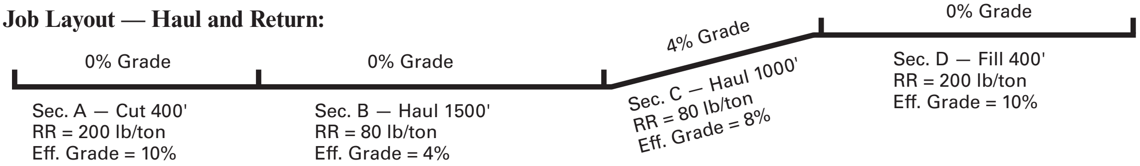
2. Establish Machine Weight:
Empty Wt. — 102,460 lb or 51.27 tons
Wt. of Load — 74,400 lb or 37.2 tons
Total (GMW) — 176,860 lb or 88.4 tons

3. Calculate Usable Pull (traction limitation):
Loaded: (weight on driving wheels = 54%) (GMW)
Traction Factor × Wt. on driving wheels =
0.50 × 176,860 lb × 54% = 47,628 lb
Empty: (weight on driving wheels = 69%) (GMW)
Traction Factor × Wt. on driving wheels =
0.50 × 102,460 lb × 69% = 35,394 lb

4. Derate for Altitude:
Check power available at 7500 ft from altitude deration table in the Tables Section.

631G — 100%	12H — 83%
D9T — 100%	825G —100%

Job Layout — Haul and Return:



Total Effective Grade = RR (%) ± GR (%)
Sec. A: Total Effective Grade = 10% + 0% = 10%
Sec. B: Total Effective Grade = 4% + 0% = 4%
Sec. C: Total Effective Grade = 4% + 4% = 8%
Sec. D: Total Effective Grade = 10% + 0% = 10%

Then adjust if necessary:

Load Time — controlled by D9T, at 100% power, no change.

Travel, Maneuver and Spread time — 631G, no change.

5. Compare Total Resistance to Tractive Effort on haul:

Grade Resistance —

GR = lb/ton × tons × adverse grade in percent

Sec. C: = 20 lb/ton × 88.4 tons × 4% grade = 7072 lb

Rolling Resistance —

RR = RR Factor (lb/ton) × GMW (tons)

Sec. A: = 200 lb/ton × 88.4 tons = 17,686 lb
Sec. B: = 80 lb/ton × 88.4 tons = 7072 lb
Sec. C: = 80 lb/ton × 88.4 tons = 7072 lb
Sec. D: = 200 lb/ton × 88.4 tons = 17,686 lb

Total Resistance —

TR = RR + GR

Sec. A: = 17,686 lb + 0 = 17,686 lb
Sec. B: = 7072 lb + 0 = 7072 lb
Sec. C: = 7072 lb + 6496 lb = 14,144 lb
Sec. D: = 17,686 lb + 0 = 17,686 lb

Check usable pounds pull against maximum pounds pull required to move the 631G.

Pull usable … 47,628 lb loaded

Pull required … 17,686 lb maximum total resistance

Estimate travel time for haul from 631G (loaded) travel time curve; read travel time from distance and effective grade.

Travel time (from curves):

Sec. A: 0.60 min
Sec. B: 1.00
Sec. C: 1.20
Sec. D: 0.60

3.40 min

NOTE: This is an estimate only; it *does not account for all the acceleration and deceleration tim*e, therefore it is not as accurate as the information obtained from a computer program.

6. Compare Total Resistance to Tractive Effort on return:

Grade Assistance —

GA = 20 lb/ton × tons × negative grade in percent

Sec. C: = 20 lb/ton × 51.2 tons × 4% grade = 4096 lb

Rolling Resistance —

RR = RR Factor × Empty Wt (tons)

Sec. D: = 200 lb/ton × 51.2 tons = 10,240 lb
Sec. C: = 80 lb/ton × 51.2 tons = 4091 lb
Sec. B: = 80 lb/ton × 51.2 tons = 4091 lb
Sec. A: = 200 lb/ton × 51.2 tons = 10,240 lb

Total Resistance —

TR = RR – GA

Sec. D: = 10,240 lb – 0 = 10,240 lb
Sec. C: = 4096 lb – 4096 lb = 0
Sec. B: = 4096 lb – 0 = 4096 lb
Sec. A: = 10,240 lb – 0 = 10,240 lb

Check usable pounds pull against maximum pounds pull required to move the 631G.

Pounds pull usable … 35,349 lb empty

Pounds pull required … 10,240 lb

Estimate travel time for return from 631G empty travel time curve.

Travel time (from curves):

Sec. A: 0.40 min
Sec. B: 0.55
Sec. C: 0.80
Sec. D: 0.40

2.15 min

7. Estimate Cycle Time:

Total Travel Time (Haul plus Return)	=	5.55 min
Adjusted for altitude: 100% × 5.55 min	=	5.55 min
Load Time		0.7 min
Maneuver and Spread Time		0.7 min
Total Cycle Time		6.95 min

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8. Check pusher-scraper combinations:

Pusher cycle time consists of load, boost, return and maneuver time. Where actual job data is not available, the following may be used.

Boost time = 0.10 minute
Return time = 40% of load time
Maneuver time = 0.15 minute
Pusher cycle time = 140% of load time + 0.25 minute
Pusher cycle time = 140% of 0.7 min + 0.25 minute
= 0.98 + 0.25 = 1.23 minute

Scraper cycle time divided by pusher cycle time indicates the number of scrapers which can be handled by each pusher.

$$\frac{6.95 \text{ min}}{1.23 \text{ min}} = 5.65$$

Each push tractor is capable of handling five plus scrapers. Therefore the two pushers can adequately serve the eleven scrapers.

9. Estimate Production:

Cycles/hour = 60 min ÷ Total cycle time
= 60 min/hr ÷ 6.95 min/cycle
= 8.6 cycles/hr
Estimated load = Heaped capacity × L.F.
= 31 LCY × 0.80
= 24.8 BCY
Hourly unit production = Est. load × cycles/hr
= 24.8 BCY × 8.6 cycles/hr
= 213 BCY/hr
Adjusted production = Efficiency factor × hourly production
= 0.83 (50 min hour) × 213 BCY
= 177 BCY/hr
Hourly fleet production = Unit production × No. of units
= 177 BCY/hr × 11
= 1947 BCY/hr

10. Estimate Compaction:

Compaction requirement = S.F. × hourly fleet production
= 0.85 × 1947 BCY/hr
= 1655 CCY/hr

Compaction capability (given the following):
Compacting width, 7.4 ft (W)
Average compacting speed, 6 mph (S)
Compacted lift thickness, 7 in (L)
No. of passes required, 3 (P)

825G production =

$$\text{CCY/hr} = \frac{W \times S \times L \times 16.3}{P} \text{ (conversion constant)}$$

$$= \frac{7.4 \times 6 \times 7 \times 16.3}{3}$$

= 1688 CCY/hr

Given the compaction requirement of 1655 CCY/hr, the 825G is an adequate compactor match-up for the rest of the fleet. However, any change to job layout that would increase fleet production would upset this balance.

● ● ●

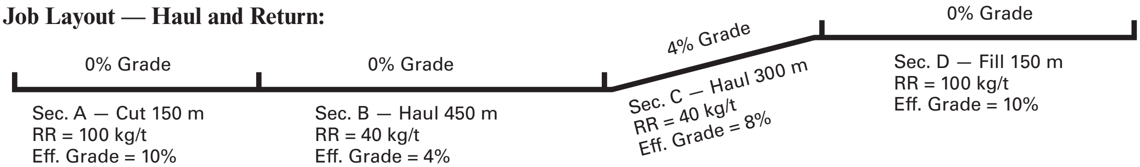
Example problem (Metric)

A contractor is planning to put the following spread on a dam job. What is the estimated production?

Equipment:
11 — 631G Wheel Tractor-Scrapers
2 — D9T Tractors with C-dozers
2 — 12H Motor Graders
1 — 825G Tamping Foot Compactor

Material:
Description — Sandy clay; damp, natural bed
Bank Density — 1770 kg/BCM
Load Factor — 0.80
Shrinkage Factor — 0.85
Traction Factor — 0.50
Altitude — 2300 meters

Job Layout — Haul and Return:



Total Effective Grade = RR (%) ± GR (%)
Sec. A: Total Effective Grade = 10% + 0% = 10%
Sec. B: Total Effective Grade = 4% + 0% = 4%
Sec. C: Total Effective Grade = 4% + 4% = 8%
Sec. D: Total Effective Grade = 10% + 0% = 10%

1. Estimate Payload:
Est. load (LCM) × L.F. × Bank Density = payload
24 LCM × 0.80 × 1770 kg/BCM = 34 000 kg payload

2. Machine Weight:
Empty Wt. — 46 475 kg or 46.48 metric tons
Wt. of Load — 34 000 kg or 34 metric tons
Total (GMW) — 80 475 kg or 80.48 metric tons

3. Calculate Usable Pull (traction limitation):
Loaded: (weight on driving wheels = 54%) (GMW)
Traction Factor × Wt. on driving wheels =
0.50 × 80 475 kg × 54% = 21 728 kg
Empty: (weight on driving wheels = 69%) (GMW)
Traction Factor × Wt. on driving wheels =
0.50 × 46 475 kg × 69% = 16 034 kg

4. Derate for Altitude:
Check power available at 2300 m from altitude deration table in the Tables Section.
631G — 100% 12H — 83%
D9T — 100% 825G — 100%

Then adjust if necessary:
Load Time — controlled by D9T, at 100% power, no change.
Travel, Maneuver and Spread time — 631G, no change.

5. Compare Total Resistance to Tractive Effort on haul:
Grade Resistance —
GR = 10 kg/metric ton × tons × adverse grade in percent
Sec. C: = 10 kg/metric ton × 80.48 metric tons × 4% grade = 3219 kg

Rolling Resistance —
RR = RR Factor (kg/mton) × GMW (metric tons)
Sec. A: = 100 kg/metric ton × 80.48 metric tons = 8048 kg
Sec. B: = 40 kg/metric ton × 80.48 metric tons = 3219 kg
Sec. C: = 40 kg/metric ton × 80.48 metric tons = 3219 kg
Sec. D: = 100 kg/metric ton × 80.48 metric tons = 8048 kg

Total Resistance —
TR = RR + GR
Sec. A: = 8048 kg + 0 = 8048 kg
Sec. B: = 3219 kg + 0 = 3219 kg
Sec. C: = 3219 kg + 3219 kg = 6438 kg
Sec. D: = 8048 kg + 0 = 8048 kg

Check usable kilogram force against maximum kilogram force required to move the 631G.
Force usable … 21 728 kg loaded
Force required … 8048 kg maximum total resistance

Estimate travel time for haul from 631G (loaded) travel time curve; read travel time from distance and effective grade.

Travel time (from curves):
Sec. A: 0.60 min
Sec. B: 1.00
Sec. C: 1.20
Sec. D: 0.60
3.40 min

NOTE: This is an estimate only; it *does not account for all the acceleration and deceleration tim*e, therefore it is not as accurate as the information obtained from a computer program.

6. Compare Total Resistance to Tractive Effort on return:
Grade Assistance —
GA = 10 kg/mton × metric tons × negative grade in percent
Sec. C: = 10 kg/metric ton × 46.48 metric tons × 4% grade = 1859 kg

Rolling Resistance —

RR = RR Factor × Empty Wt.

Sec. D: = 100 kg/metric ton × 46.48 metric tons = 4648 kg
Sec. C: = 40 kg/metric ton × 46.48 metric tons = 1859 kg
Sec. B: = 40 kg/metric ton × 46.48 metric tons = 1859 kg
Sec. A: = 100 kg/metric ton × 46.48 metric tons = 4648 kg

Total Resistance —

TR = RR – GA

Sec. D: = 4648 kg – 0 = 4648 kg
Sec. C: = 1859 kg – 1859 kg = 0
Sec. B: = 1859 kg – 0 = 1859 kg
Sec. A: = 4648 kg – 0 = 4648 kg

Check usable kilogram force against maximum force required to move the 631G.

Kilogram force usable … 16 034 kg empty
Kilogram force required … 4645 kg

Estimate travel time for return from 631G empty travel time curve.

Travel time (from curves):

Sec. A: 0.40 min
Sec. B: 0.55
Sec. C: 0.80
Sec. D: 0.40
2.15 min

7. Estimate Cycle Time:

Total Travel Time (Haul plus Return)	= 5.55 min
Adjusted for altitude: 100% × 5.55 min	= 5.55 min
Load Time	0.7 min
Maneuver and Spread Time	0.7 min
Total Cycle Time	6.95 min

8. Check pusher-scraper combinations:

Pusher cycle time consists of load, boost, return and maneuver time. Where actual job data is not available, the following may be used.

Boost time = 0.10 minute
Return time = 40% of load time
Maneuver time = 0.15 minute
Pusher cycle time = 140% of load time + 0.25 minute
Pusher cycle time = 140% of 0.7 min + 0.25 minute
= 0.98 + 0.25 = 1.23 minute

Scraper cycle time divided by pusher cycle time indicates the number of scrapers which can be handled by each pusher.

$$\frac{6.95\ \text{min}}{1.23\ \text{min}} = 5.65$$

Each push tractor is capable of handling five plus scrapers. Therefore the two pushers can adequately serve the eleven scrapers.

9. Estimate Production:

Cycles/hour = 60 min ÷ Total cycle time
= 60 min/hr ÷ 6.95 min/cycle
= 8.6 cycles/hr

Estimated load = Heaped capacity × L.F.
= 24 LCM × 0.80
= 19.2 BCM

Hourly unit production = Est. load × cycles/hr
= 19.2 BCM × 8.6 cycles/hr
= 165 BCM

Adjusted production = Efficiency factor × hourly production
= 0.83 (50 min hour) × 165 BCM
= 137 BCM/hour

Hourly fleet production = Unit production × No. of units
= 137 BCM/hr × 11 units
= 1507 BCM/hr

10. Estimate Compaction:

Compaction requirement = S.F. × hourly fleet production
= 0.85 × 1507 BCM/hr
= 1280 CCM/hr

Compaction capability (given the following):

Compacting width, 2.26 m	(W)
Average compacting speed, 9.6 km/h	(S)
Compacted lift thickness, 18 cm	(L)
No. of passes required, 3	(P)

825G production =

$$\text{CCY/hr} = \frac{W \times S \times L \times 10}{P}\ \text{(conversion factor)}$$

$$= \frac{2.26 \times 9.6 \times 18 \times 10}{3}$$

$$= 1302$$

Given the compaction requirement of 1280 CCM/h, the 825G is an adequate compactor match-up for the rest of the fleet. However, any change to job layout that would increase fleet production would upset this balance.

●●●

PRODUCTION ESTIMATING

Loading Match — Loading tools have a production range that varies with material, bucket configuration, target size, operator skill and load area conditions. The loader/truck matches given in the following table are with the typical number of passes and production range.

Your Cat® dealer can provide advice and estimates based on your specific conditions.

FUEL CONSUMPTION AND PRODUCTIVITY

Fuel efficiency is the term used to relate fuel consumption and machine productivity. It is expressed in units of material moved per volume of fuel consumed. Common units are cubic meters or tonnes per liter of fuel (cubic yards or tons/gal). Determining fuel efficiency requires measuring both fuel consumption and production.

Measuring fuel consumption involves tapping into the vehicle's fuel supply system — without contaminating the fuel. The amount of fuel consumed during operation is then measured on a weight or volumetric basis and correlated with the amount of work the machine has done. Cat machines equipped with VIMS™ system can record fuel consumed with relative accuracy, given the engine is performing close to specifications.

Cat Earthmoving and Mining Systems Production/50 Min. Hr.

Please refer to the individual machine section for production targets.

Cat Aggregate Systems Production/50 Min. Hr.

Please refer to the individual machine section for production targets.

FORMULAS AND RULES OF THUMB

Production, hourly = Load (BCM)/cycle × cycles/hr
= Load (BCY)/cycle × cycles/hr

Load Factor (L.F.) $= \dfrac{100\%}{100\% + \%\text{ swell}}$

Load (bank measure) = Loose cubic meters (LCM) × L.F.
= Loose cubic yards (LCY) × L.F.

Shrinkage Factor (S.F.) $= \dfrac{\text{Compacted cubic meters (or yards)}}{\text{Bank cubic meters (or yards)}}$

Density = Weight/Unit Volume

Load (bank measure) $= \dfrac{\text{Weight of load}}{\text{Bank density}}$

Rolling Resistance Factor
= 20 kg/t + (6 kg/t/cm × cm)
= 40 lb/ton + (30 lb/ton/inch × inches)

Rolling Resistance
= RR Factor (kg/t) × GMW (tons)
= RR Factor (lb/ton) × GMW (tons)

Rolling Resistance (general estimation)
= 2% of GMW + 0.6% of GMW per cm tire penetration
= 2% of GMW + 1.5% of GMW per inch tire penetration

$$\%\text{ Grade} = \frac{\text{vertical change in elevation (rise)}}{\text{corresponding horizontal distance (run)}}$$

Grade Resistance Factor = 10 kg/m ton × % grade
= 20 lb/ton × % grade

Grade Resistance = GR Factor (kg/t) × GMW (tons)
= GR Factor (lb/ton) × GMW (tons)

Grade Resistance = 1% of GMW × % grade

Total Resistance
= Rolling Resistance (kg or lb) + Grade Resistance (kg or lb)

Total Effective Grade (%) = RR (%) + GR (%)

Usable pull (traction limitation)
= Coeff. of traction × weight on drivers
= Coeff. of traction × (Total weight × % on drivers)

Pull required = Rolling Resistance + Grade Resistance
= Total Resistance

Total Cycle Time = Fixed time + Variable time

Fixed time: See respective machine production section.

Variable time = Total haul time + Total return time

Travel Time $= \dfrac{\text{Distance (m)}}{\text{Speed (m/min)}}$
$= \dfrac{\text{Distance (ft)}}{\text{Speed (fpm)}}$

Cycles per hour $= \dfrac{\text{60 min/hr}}{\text{Total cycle time (min/cycle)}}$

Adjusted production = Hourly production × Efficiency factor

No. of units required $= \dfrac{\text{Hourly production required}}{\text{Unit hourly production}}$

No. of scrapers a pusher will load $= \dfrac{\text{Scraper cycle time}}{\text{Pusher cycle time}}$

Pusher cycle time (min) = 1.40 Load time (min) + 0.25 min

Grade Horsepower $= \dfrac{\text{GMW (kg)} \times \text{Total Effective Grade} \times \text{Speed (km/h)}}{273.75}$
$= \dfrac{\text{GMW (lb)} \times \text{Total Effective Grade} \times \text{Speed (mph)}}{375}$

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TABLES

CONTENTS

SWELL — VOIDS — LOAD FACTORS

SWELL (%)	VOIDS (%)	LOAD FACTOR
5	4.8	0.952
10	9.1	0.909
15	13.0	0.870
20	16.7	0.833
25	20.0	0.800
30	23.1	0.769
35	25.9	0.741
40	28.6	0.714
45	31.0	0.690
50	33.3	0.667
55	35.5	0.645
60	37.5	0.625
65	39.4	0.606
70	41.2	0.588
75	42.9	0.571
80	44.4	0.556
85	45.9	0.541
90	47.4	0.526
95	48.7	0.513
100	50.0	0.500

Throughout this document, references to Tier 4 Interim/Stage IIIB/Japan 2011 (Tier 4 Interim) include U.S. EPA Tier 4 Interim, EU Stage IIIB, and Japan 2011 (Tier 4 Interim) equivalent emission standards. References to Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) include U.S. EPA Tier 4 Final, EU Stage IV, and Japan 2014 (Tier 4 Final) emission standards.

Throughout this document, references to Tier 1/Stage I include U.S. EPA Tier 1 and EU Stage I equivalent emission standards. References to Tier 2/Stage II/Japan 2001 (Tier 2) equivalent include U.S. EPA Tier 2, EU Stage II, and Japan 2001 (Tier 2) equivalent emission standards. References to Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent include U.S. EPA Tier 3, EU Stage IIIA, and Japan 2006 (Tier 3) equivalent emission standards.

BUCKET FILL FACTORS

Loose Material	Fill Factor
Mixed Moist Aggregates	95-100%
Uniform Aggregates up to 3 mm (1/8")	95-100
3 mm-9 mm (1/8"-3/8")	90-95
12 mm-20 mm (1/2"-3/4")	85-90
24 mm (1") and over	85-90
Blasted Rock	
Well Blasted	80-95%
Average Blasted	75-90
Poorly Blasted	60-75
Other	
Rock Dirt Mixtures	100-120%
Moist Loam	100-110
Soil, Boulders, Roots	80-100
Cemented Materials	85-95

NOTE: Loader bucket fill factors are affected by bucket penetration, breakout force, rack back angle, bucket profile and ground engaging tools such as bucket teeth or bolt-on replaceable cutting edges.

NOTE: For bucket fill factors for hydraulic excavators, see bucket payloads in the hydraulic excavator section.

NOTE: Above values are not valid for Hydraulic Mining Shovels.

ANGLE OF REPOSE OF VARIOUS MATERIALS

MATERIAL	ANGLE BETWEEN HORIZONTAL AND SLOPE OF HEAPED PILE — Ratio	Degrees
Coal, industrial	1.4:1—1.3:1	35-38
Common earth, Dry	2.8:1—1.0:1	20-45
Moist	2.1:1—1.0:1	25-45
Wet	2.1:1—1.7:1	25-30
Gravel, Round to angular	1.7:1—0.9:1	30-50
Sand & clay	2.8:1—1.4:1	20-35
Sand, Dry	2.8:1—1.7:1	20-30
Moist	1.8:1—1.0:1	30-45
Wet	2.8:1—1.0:1	20-45

TYPICAL ROLLING RESISTANCE FACTORS

Various tire sizes and inflation pressures will greatly reduce or increase the rolling resistance. The values in this table are approximate, particularly for the track and track + tire machines. These values can be used for estimating purposes when specific performance information on particular equipment and given soil conditions is not available. See Mining and Earthmoving Section for more detail.

UNDERFOOTING	ROLLING RESISTANCE, PERCENT* — Tires: Bias	Tires: Radial	Track **	Track +Tires
A very hard, smooth roadway, concrete, cold asphalt or dirt surface, no penetration or flexing	1.5%*	1.2%	0%	1.0%
A hard, smooth, stabilized surfaced roadway without penetration under load, watered, maintained	2.0%	1.7%	0%	1.2%
A firm, smooth, rolling roadway with dirt or light surfacing, flexing slightly under load or undulating, maintained fairly regularly, watered	3.0%	2.5%	0%	1.8%
A dirt roadway, rutted or flexing under load, little maintenance, no water, 25 mm (1") tire penetration or flexing	4.0%	4.0%	0%	2.4%
A dirt roadway, rutted or flexing under load, little maintenance, no water, 50 mm (2") tire penetration or flexing	5.0%	5.0%	0%	3.0%
Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 100 mm (4") tire penetration or flexing	8.0%	8.0%	0%	4.8%
Loose sand or gravel	10.0%	10.0%	2%	7.0%
Rutted dirt roadway, soft under travel, no maintenance, no stabilization, 200 mm (8") tire penetration and flexing	14.0%	14.0%	5%	10.0%
Very soft, muddy, rutted roadway, 300 mm (12") tire penetration, no flexing	20.0%	20.0%	8%	15.0%

*Percent of combined machine weight.

**Assumes drag load has been subtracted to give Drawbar Pull for good to moderate conditions. Some resistance added for very soft conditions.

WEIGHT* OF MATERIALS	LOOSE		BANK		LOAD FACTORS
	kg/m³	lb/yd³	kg/m³	lb/yd³	
Basalt	1960	**3300**	2970	**5000**	0.67
Bauxite, Kaolin	1420	**2400**	1900	**3200**	0.75
Caliche	1250	**2100**	2260	**3800**	0.55
Carnotite, uranium ore	1630	**2750**	2200	**3700**	0.74
Cinders	560	**950**	860	**1450**	0.66
Clay — Natural bed	1660	**2800**	2020	**3400**	0.82
Dry	1480	**2500**	1840	**3100**	0.81
Wet	1660	**2800**	2080	**3500**	0.80
Clay & gravel — Dry	1420	**2400**	1660	**2800**	0.85
Wet	1540	**2600**	1840	**3100**	0.85
Coal — Anthracite, Raw	1190	**2000**	1600	**2700**	0.74
Washed	1100	**1850**			0.74
Ash, Bituminous Coal	530-650	**900-1100**	590-890	**1000-1500**	0.93
Bituminous, Raw	950	**1600**	1280	**2150**	0.74
Washed	830	**1400**			0.74
Decomposed rock —					
75% Rock, 25% Earth	1960	**3300**	2790	**4700**	0.70
50% Rock, 50% Earth	1720	**2900**	2280	**3850**	0.75
25% Rock, 75% Earth	1570	**2650**	1960	**3300**	0.80
Earth — Dry packed	1510	**2550**	1900	**3200**	0.80
Wet excavated	1600	**2700**	2020	**3400**	0.79
Loam	1250	**2100**	1540	**2600**	0.81
Granite — Broken	1660	**2800**	2730	**4600**	0.61
Gravel — Pitrun	1930	**3250**	2170	**3650**	0.89
Dry	1510	**2550**	1690	**2850**	0.89
Dry 6-50 mm (1/4"-2")	1690	**2850**	1900	**3200**	0.89
Wet 6-50 mm (1/4"-2")	2020	**3400**	2260	**3800**	0.89
Gypsum — Broken	1810	**3050**	3170	**5350**	0.57
Crushed	1600	**2700**	2790	**4700**	0.57
Hematite, iron ore, high grade	1810-2450	**4000-5400**	2130-2900	**4700-6400**	0.85
Limestone — Broken	1540	**2600**	2610	**4400**	0.59
Crushed	1540	**2600**	—	**—**	—
Magnetite, iron ore	2790	**4700**	3260	**5500**	0.85
Pyrite, iron ore	2580	**4350**	3030	**5100**	0.85
Sand — Dry, loose	1420	**2400**	1600	**2700**	0.89
Damp	1690	**2850**	1900	**3200**	0.89
Wet	1840	**3100**	2080	**3500**	0.89
Sand & clay — Loose	1600	**2700**	2020	**3400**	0.79
Compacted	2400	**4050**			
Sand & gravel — Dry	1720	**2900**	1930	**3250**	0.89
Wet	2020	**3400**	2230	**3750**	0.91
Sandstone	1510	**2550**	2520	**4250**	0.60
Shale	1250	**2100**	1660	**2800**	0.75
Slag — Broken	1750	**2950**	2940	**4950**	0.60
Snow — Dry	130	**220**			
Wet	520	**860**			
Stone — Crushed	1600	**2700**	2670	**4500**	0.60
Taconite	1630-1900	**3600-4200**	2360-2700	**5200-6100**	0.58
Top Soil	950	**1600**	1370	**2300**	0.70
Taprock — Broken	1750	**2950**	2610	**4400**	0.67
Wood Chips**	—	**—**	—	**—**	—

*Varies with moisture content, grain size, degree of compaction, etc. Tests must be made to determine exact material characteristics.

**Weights of commercially important wood species can be found in the last pages of the Logging & Forest Products section. To obtain wood weights use the following equations: lb/yd³ = (lb/ft³) × .4 × 27

kg/m³ = (kg/m³) × .4

ALTITUDE DERATION

PERCENT FLYWHEEL HORSEPOWER AVAILABLE AT SPECIFIED ALTITUDES

MODEL	0-760 m (0-2500')	760-1500 m (2500-5000')	1500-2300 m (5000-7500')	2300-3000 m (7500-10,000')	3000-3800 m (10,000-12,500')	3800-4600 m (12,500-15,000')
D3K XL	100	100	100	100	88	85
D3K LGP	100	100	100	100	88	85
D4K XL	100	100	100	100	88	85
D4K LGP	100	100	100	100	88	85
D5K XL	100	100	100	100	88	85
D5K LGP	100	100	100	100	88	85
D5R2 XL & LGP	100	100	100	100	N/A	N/A
D5T XL	100	100	100	100	N/A	N/A
D6K2 XL & LGP	100	100	100	100	N/A	N/A
D6N XL & LGP*	100	100	100	100	100	100
D6R Series 3 (All)	100	100	100	100	92	84
D6R2	100	100	100	100	92	84
D6T[1]	100	100	100	100	100	100
D7E	100	100	100	100	99	95
D7R	100	100	100	100	100	96
D8R	100	100	100	93	85	77
D8T	100	100	100	100	100	100
D9R	100	100	100	93	85	77
D9T[1]	100	100	100	100	100	100
D9T[2]	100	100	100	99	92	83
D9T[3]	100	100	100	100	100	100
D9T[4]	100	100	100	98	91	80
D9T[5]	100	100	100	100	99	88
D10T2[5]**	100	100	100	100	100	100
D10T2[6]**	100	100	100	100	100	100
D11T/D11T CD[5]***	100	100	100	100	100	86
D11T/D11T CD[6]***	100	100	100	100	83	67

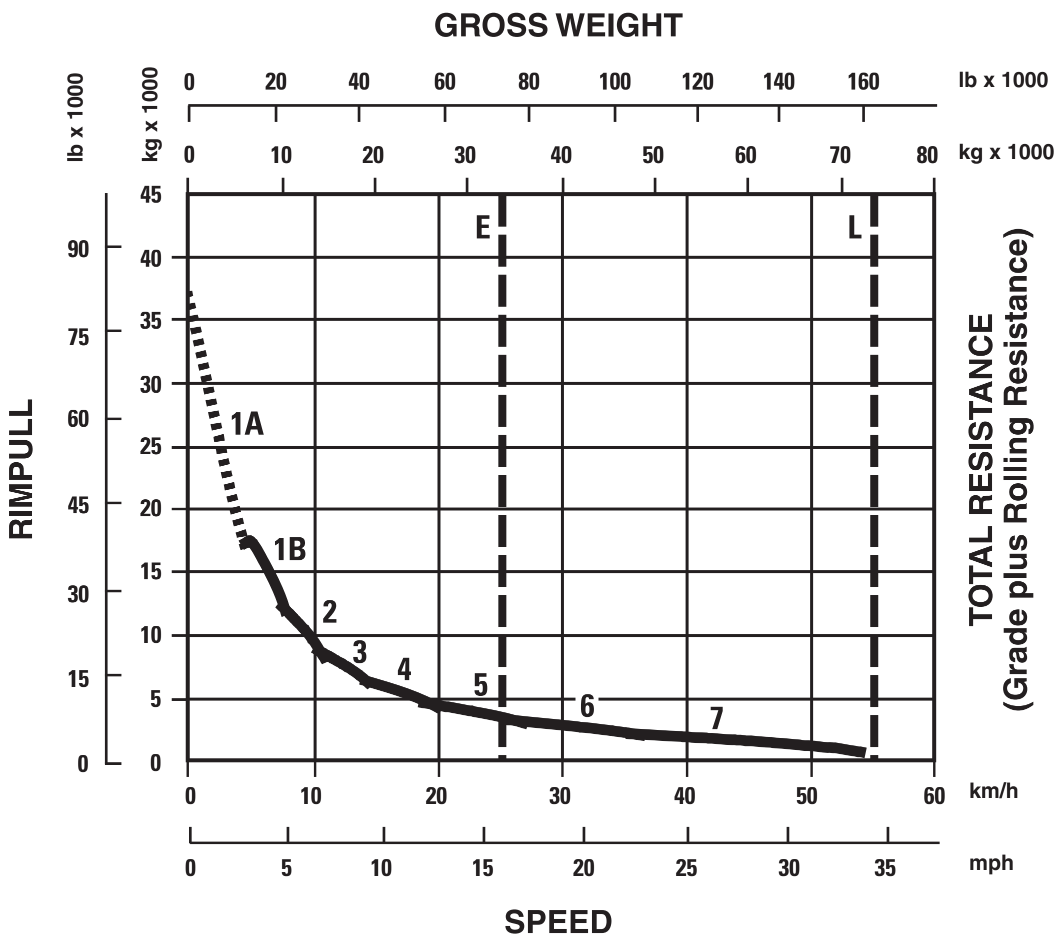
*Information not available at time of printing.
**In forward gears.
***D11T — High altitude arrangement available.
[1] Meets Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.
[2] Meets Tier 3 equivalent emission standards, North America — Standard Altitude.
[3] Meets Tier 3 equivalent emission standards, North America — High Altitude.
[4] Meets Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.
[5] Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent emission standards.
[6] Meets Tier 4 Final.

ALTITUDE DERATION (Continued)

MODEL	0-760 m (0-2500')	760-1500 m (2500-5000')	1500-2300 m (5000-7500')	2300-3000 m (7500-10,000')	3000-3800 m (10,000-12,500')	3800-4600 m (12,500-15,000')
120K	100	100	100	97	92	85
120K2	100	100	100	97	92	85
120M	100	100	100	100	95	88
120M AWD	100	98	96	94	89	85
120M2	100	100	100	100	94	82
120M2 AWD	100	100	100	100	94	82
12K	100	99	98	94	89	85
12M	100	100	100	100	95	88
12M2	100	100	100	100	100	100
12M2 AWD	100	100	100	100	100	99
12M3	100	100	100	100	100	100
12M3 AWD	100	100	100	100	100	98
140K	100	100	100	100	92	90
140K2	100	100	100	100	92	90
140M	100	100	100	100	92	90
140M AWD	100	100	100	100	92	90
140M2	100	100	100	100	100	99
140M2 AWD	100	100	100	100	97	93
140M3	100	100	100	100	100	98
140M3 AWD	100	100	100	100	100	90
160K	100	100	100	100	92	90
160M	100	100	100	100	92	90
160M AWD	100	100	100	100	92	90
160M2	100	100	100	99	95	91
160M2 AWD	100	100	100	99	94	88
160M3	100	100	100	100	100	90
160M3 AWD	100	100	100	100	98	83
14M3*	100	100	100	100	100	97
14M3**	100	100	100	100	100	100
14M3***	100	100	100	100	100	100
16M3*	100	100	100	100	100	100
16M3**	100	100	100	100	100	95
16M3***	100	100	100	100	100	100
18M3*	100	100	100	100	100	100
18M3**	100	100	100	100	100	95
18M3***	100	100	100	100	100	100
24M B9K**	100	100	95	90	80	70
24M B9K Unregulated	100	100	100	100	90	85
24M B93**	100	100	100	98	89	75
24M B93*	100	100	100	100	91	86

*Meets Tier 2/Stage II/Japan 2001 (Tier 2) equivalent emission standards.
**Meets Tier 3/Stage IIIA/Japan 2006 (Tier 3) equivalent emission standards.
***Meets Tier 4 Final/Stage IV/Japan 2014 (Tier 4 Final) emission standards.

STANDARD*



KEY

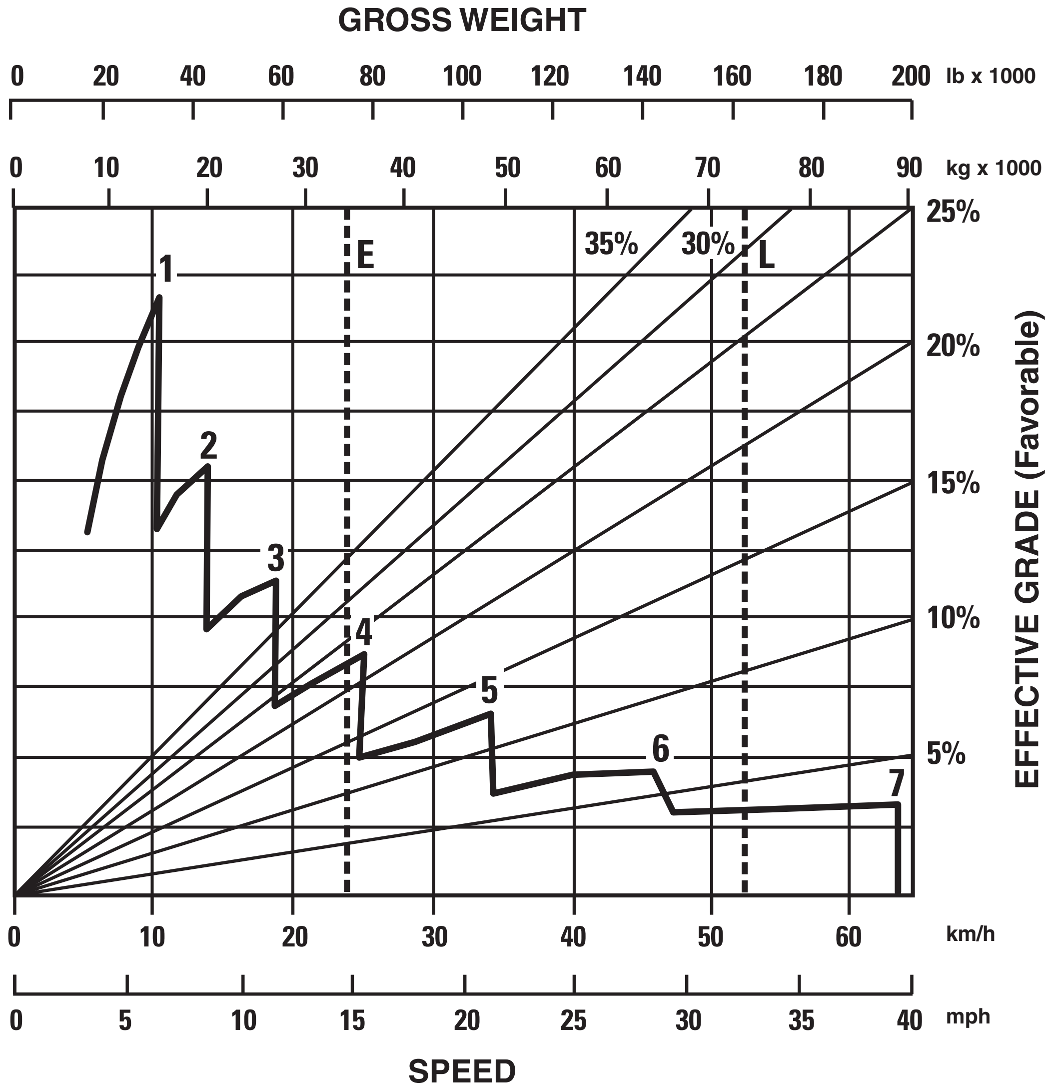
1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

E — Empty 34 393 kg (75,824 lb)
L — Loaded 73 975 kg (163,087 lb)

*At sea level.

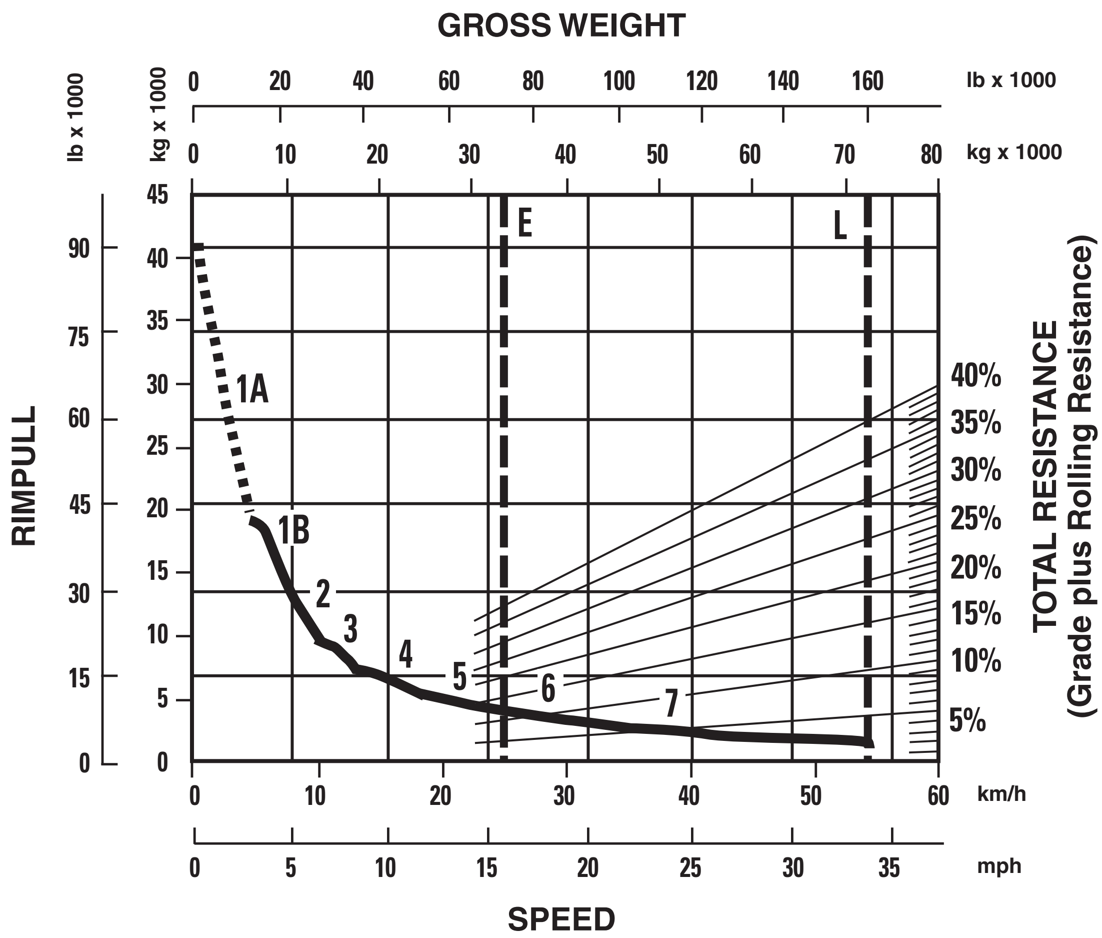
740B Series Brake/Retarder Performance Curve
● 29.5R25 Tires



KEY
- 1 — 1st Gear
- 2 — 2nd Gear
- 3 — 3rd Gear
- 4 — 4th Gear
- 5 — 5th Gear
- 6 — 6th Gear
- 7 — 7th Gear

KEY
- E — Empty 34 393 kg (75,824 lb)
- L — Loaded 73 975 kg (163,087 lb)

STANDARD*



KEY

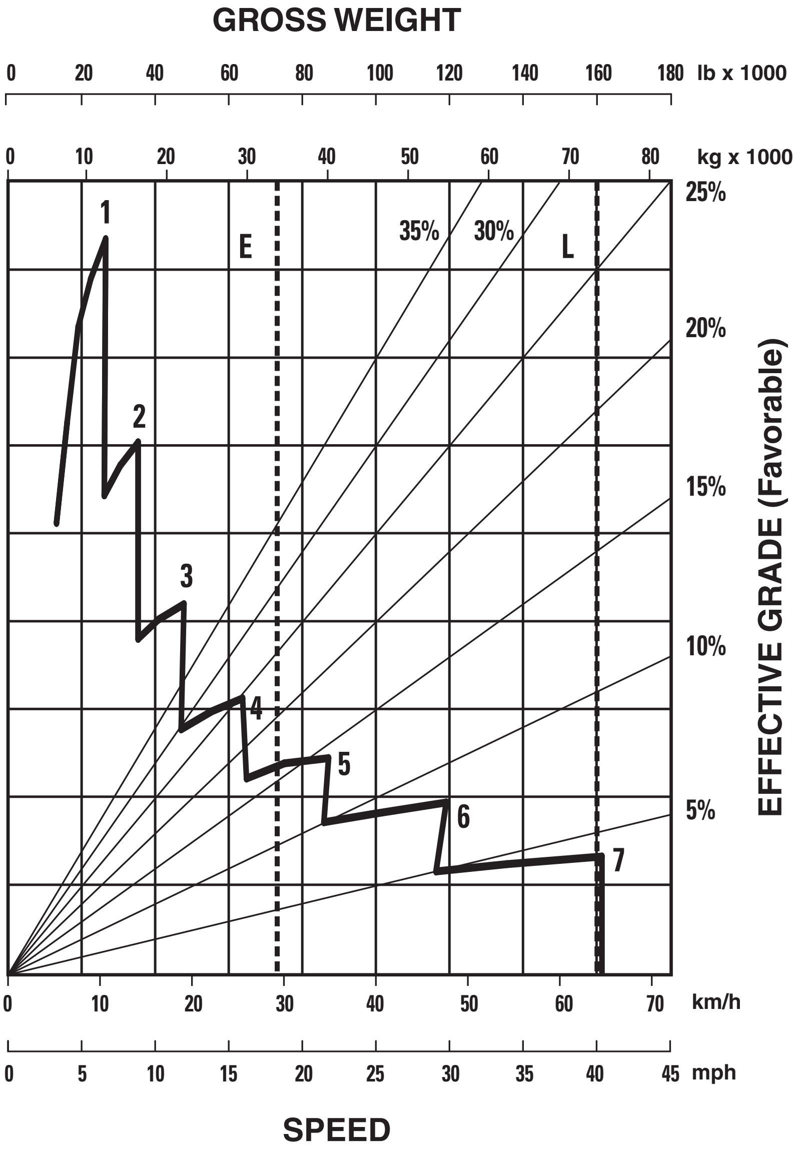
1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

E — Empty 34 127 kg (75,237 lb)
L — Loaded 73 709 kg (162,500 lb)

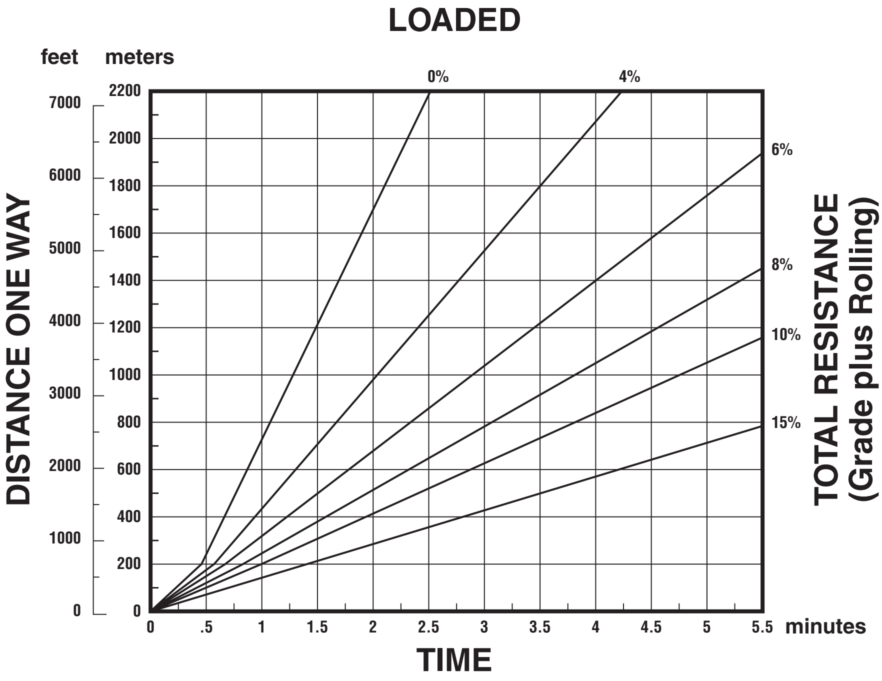
*At sea level.

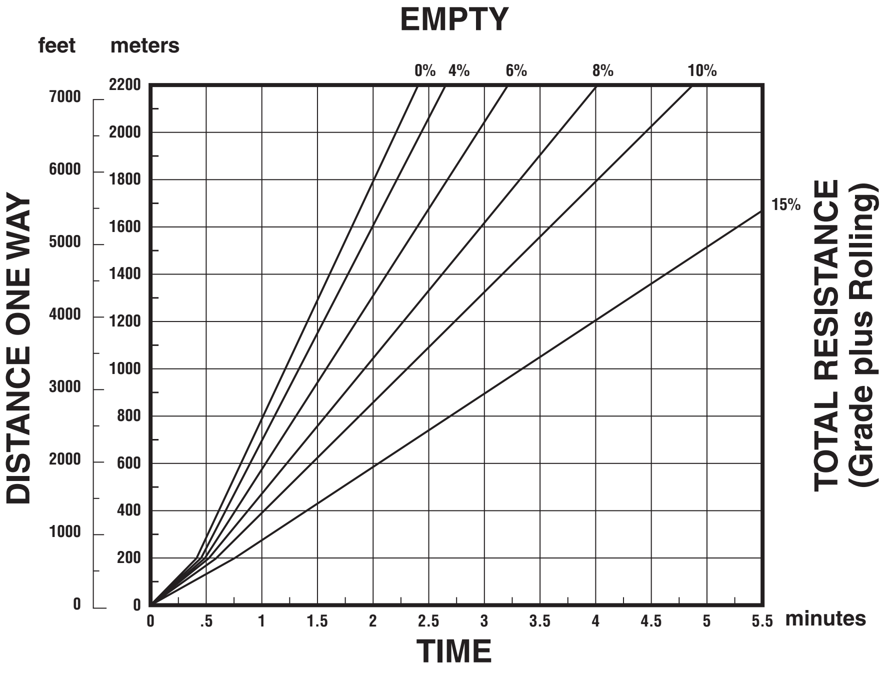
740B Series Brake/Retarder Performance Curve
- 29.5R25 Tires
- Tier 2



KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY
E — Empty 34 127 kg (75,237 lb)
L — Loaded 73 709 kg (162,500 lb)


LOADED
feet
meters
0%
4%
6%
8%
10%
15%
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
0
1000
2000
3000
4000
5000
6000
7000
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
0
.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
minutes
TIME


EMPTY
feet
meters
0%
4%
6%
8%
10%
15%
DISTANCE ONE WAY
TOTAL RESISTANCE (Grade plus Rolling)
0
1000
2000
3000
4000
5000
6000
7000
0
200
400
600
800
1000
1200
1400
1600
1800
2000
2200
0
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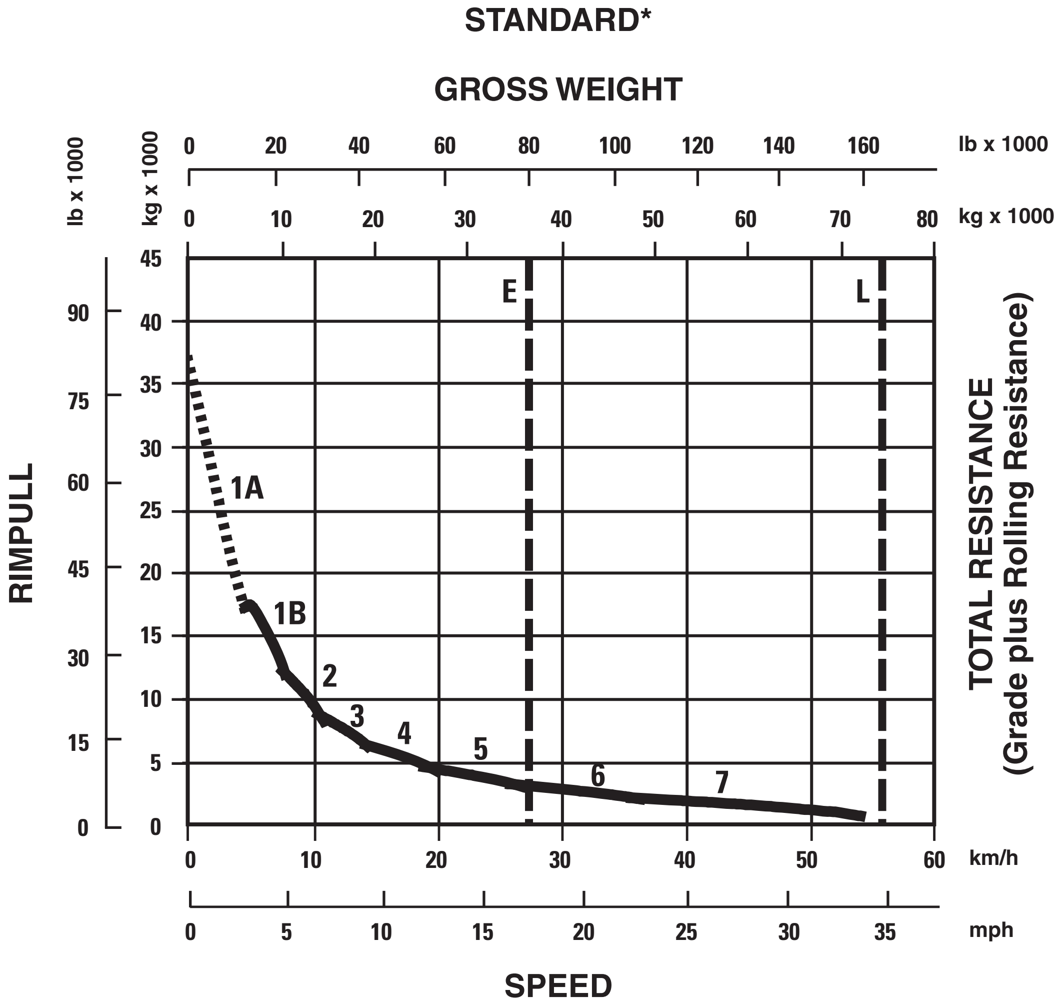
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
minutes
TIME



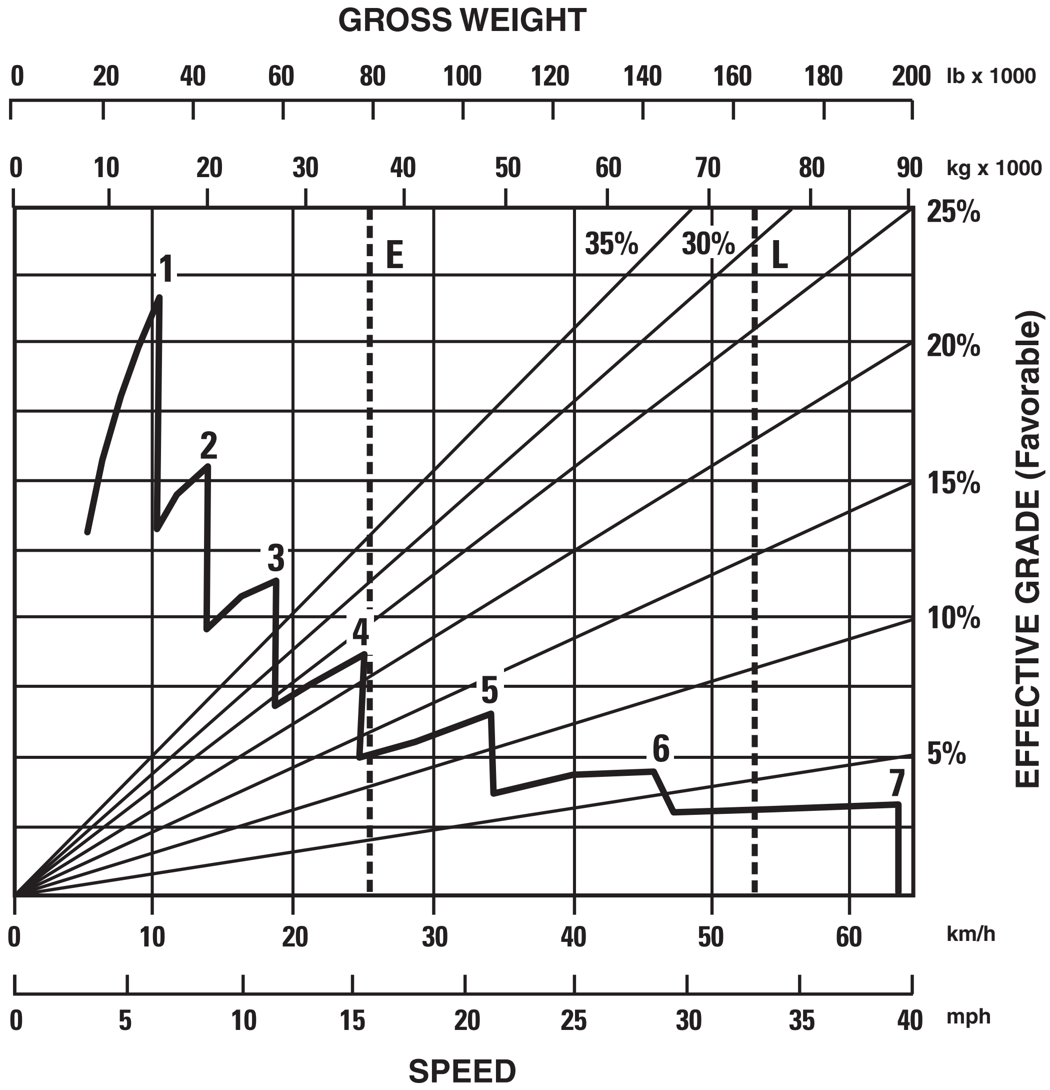
KEY

1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

E — Empty 36 895 kg (81,340 lb)
L — Loaded 74 895 kg (165,115 lb)

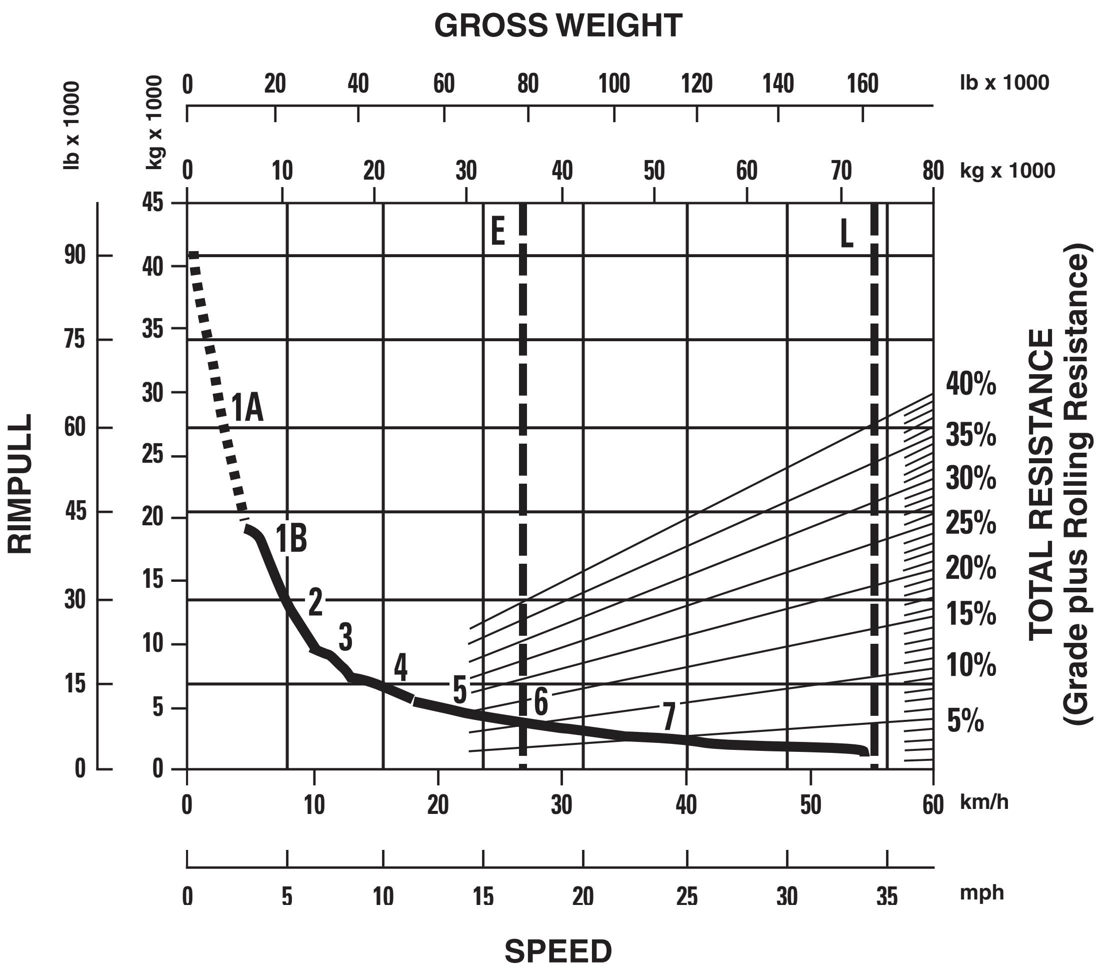
*At sea level.



KEY
1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY
E — Empty 36 895 kg (81,340 lb)
L — Loaded 74 895 kg (165,115 lb)

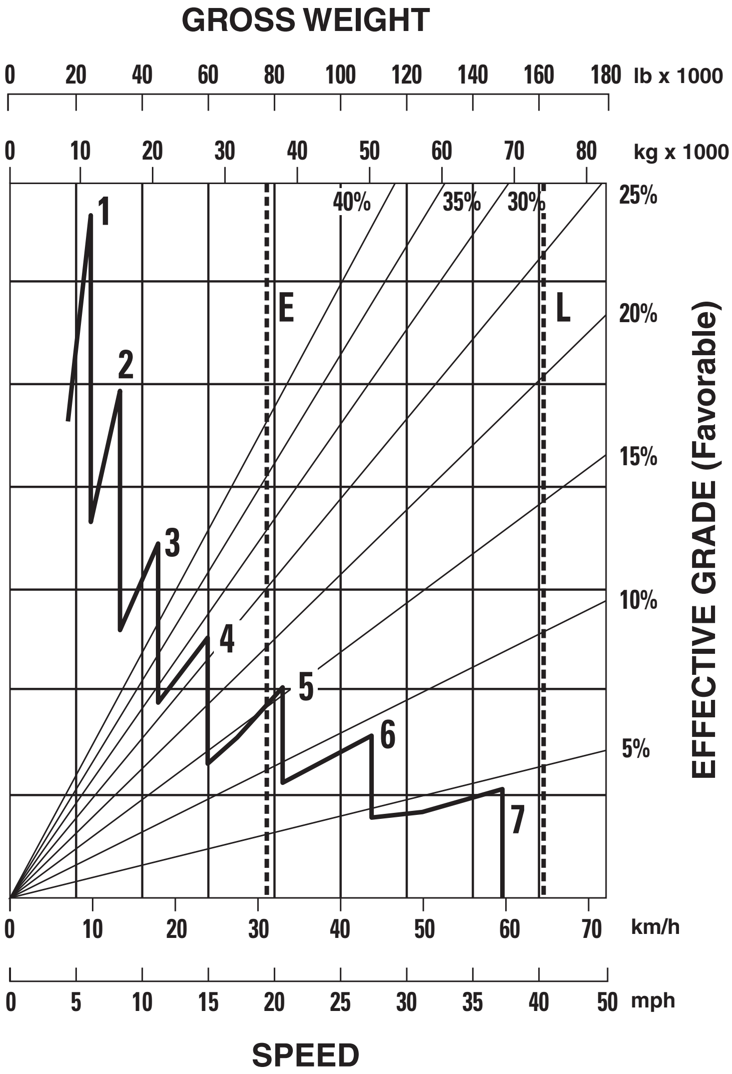
STANDARD*



KEY
1A — 1st Gear (Converter Drive)
1B — 1st Gear (Direct Drive)
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY
E — Empty 36 629 kg (80,753 lb)
L — Loaded 74 629 kg (164,529 lb)

*At sea level.



KEY

1 — 1st Gear
2 — 2nd Gear
3 — 3rd Gear
4 — 4th Gear
5 — 5th Gear
6 — 6th Gear
7 — 7th Gear

KEY

E — Empty 36 629 kg (80,753 lb)
L — Loaded 74 629 kg (164,529 lb)

MODEL	735B Series		740B Series		740B EJ Series	
Gross Power — SAE J1995	337 kW	**452 hp**	365 kW	**489 hp**	365 kW	**489 hp**
Net Power — SAE J1349	326 kW	**437 hp**	354 kW	**474 hp**	354 kW	**474 hp**
Net Power — ISO 14396	333 kW	**447 hp**	361 kW	**484 hp**	361 kW	**484 hp**
Operating Weight (Empty)*	32 473 kg	**71,591 lb**	34 393 kg	**75,824 lb**	36 895 kg	**81,340 lb**
Top Speed (Loaded)	51.1 km/h	**31.7 mph**	54.7 km/h	**34 mph**	54.7 km/h	**34 mph**
GMW — Gross Machine Weight	65 173 kg	**143,682 lb**	73 975 kg	**163,087 lb**	74 895 kg	**165,115 lb**
Distribution Empty:						
Front	**61.9%**		**60.1%**		**58.0%**	
Center	**20.2%**		**21.0%**		**22.0%**	
Rear	**18.0%**		**18.9%**		**20.0%**	
Distribution Loaded:						
Front	**36.0%**		**35.0%**		**30.8%**	
Center	**33.0%**		**33.0%**		**35.1%**	
Rear	**32.0%**		**32.0%**		**34.1%**	
Max. Capacity**	32.7 t	**36 T**	39.5 t	**43.5 T**	38 t	**42 T**
Struck (SAE)	14.7 m^3	**19.2 yd^3**	18.5 m^3	**24.2 yd^3**	17.8 m^3	**23.3 yd^3**
Heaped (2:1) (SAE)	19.7 m^3	**25.8 yd^3**	24 m^3	**31.4 yd^3**	23.1 m^3	**30.2 yd^3**
Tailgate Heaped SAE 2:1	20.9 m^3	**27.3 yd^3**	25.5 m^3	**33.5 yd^3**	—	
Tailgate Struck	15.2 m^3	**19.9 yd^3**	19.5 m^3	**25.5 yd^3**	—	
Engine Model	**ACERT C15**		**ACERT C15**		**ACERT C15**	
No. Cylinders	**6**		**6**		**6**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	171.5 mm	**6.75"**	171.5 mm	**6.75"**	171.5 mm	**6.75"**
Displacement	15.2 L	**926 in^3**	15.2 L	**926 in^3**	15.2 L	**926 in^3**
Tires, Front, Center, Rear	**26.5R25 Radials**		**29.5R25 Radials**		**29.5R25 Radials**	
Circular Clearance Diameter	17.2 m	**56'5"**	17.2 m	**56'5"**	18.2 m	**59'6"**
Fuel Tank Refill Capacity	565 L	**149.3 U.S. gal**	565 L	**149.3 U.S. gal**	565 L	**149.3 U.S. gal**
General Dimensions (Empty):						
Height to Cab Top	3.7 m	**12'1"**	3.75 m	**12'3"**	3.75 m	**12'3"**
Wheel Base (Front-Center of Bogie)	5.23 m	**17'2"**	5.23 m	**17'2"**	5.58 m	**18'3"**
Overall Length	10.99 m	**36'1"**	10.99 m	**36'1"**	11.69 m	**38'4"**
Loading Height (Empty)	2.98 m	**9'8"**	3.2 m	**10'6"**	3.07 m	**10'1"**
Height at Full Dump	6.81 m	**22'4"**	7.1 m	**23'4"**	—	
Body Length	6.09 m	**20'0"**	6.3 m	**20'6"**	6.73 m	**22'1"**
Width (Operating — Over Mirrors)	3.82 m	**12'6"**	3.82 m	**12'6"**	3.82 m	**12'6"**
Front Tire Tread	2.69 m	**8'8"**	2.69 m	**8'8"**	2.69 m	**8'8"**

*Includes coolant, lubricant and full fuel tank.
**Rating dependent on optional equipment. Maximum gross weight (empty weight plus payload) should not be exceeded.

MODEL	735B Series		740B Series		740B EJ Series	
Gross Power — SAE J1995	336 kW	**450 hp**	361 kW	**484 hp**	361 kW	**484 hp**
Net Power — SAE J1349	326 kW	**438 hp**	352 kW	**472 hp**	352 kW	**472 hp**
Net Power — ISO 9249	330 kW	**442 hp**	356 kW	**477 hp**	356 kW	**477 hp**
Net Power — EEC 80/1269	330 kW	**442 hp**	356 kW	**477 hp**	356 kW	**477 hp**
Operating Weight (Empty)*	32 206 kg	**71,002 lb**	34 127 kg	**75,237 lb**	36 629 kg	**80,753 lb**
Top Speed (Loaded)	51.1 km/h	**31.7 mph**	54.7 km/h	**34 mph**	54.7 km/h	**34 mph**
GMW — Gross Machine Weight	64 906 kg	**143,093 lb**	73 709 kg	**162,500 lb**	74 629 kg	**164,529 lb**
Distribution Empty:						
Front	**61.2%**		**59.5%**		**57.4%**	
Center	**20.5%**		**21.3%**		**22.3%**	
Rear	**18.3%**		**19.2%**		**20.3%**	
Distribution Loaded:						
Front	**35.6%**		**34.6%**		**30.4%**	
Center	**32.8%**		**33.2%**		**35.3%**	
Rear	**31.7%**		**32.2%**		**34.3%**	
Max. Capacity**	32.7 t	**36 T**	39.5 t	**43.5 T**	38 t	**42 T**
Struck (SAE)	14.7 m^3	**19.2 yd^3**	18.5 m^3	**24.2 yd^3**	17.8 m^3	**23.3 yd^3**
Heaped (2:1) (SAE)	19.7 m^3	**25.8 yd^3**	24 m^3	**31.4 yd^3**	23.1 m^3	**30.2 yd^3**
Tailgate Heaped SAE 2:1	20.9 m^3	**27.3 yd^3**	25.5 m^3	**33.5 yd^3**	—	
Tailgate Struck	15.2 m^3	**19.9 yd^3**	19.5 m^3	**25.5 yd^3**	—	
Engine Model	**ACERT C15**		**ACERT C15**		**ACERT C15**	
No. Cylinders	**6**		**6**		**6**	
Bore	137 mm	**5.4"**	137 mm	**5.4"**	137 mm	**5.4"**
Stroke	171.5 mm	**6.75"**	171.5 mm	**6.75"**	171.5 mm	**6.75"**
Displacement	15.2 L	**926 in^3**	15.2 L	**926 in^3**	15.2 L	**926 in^3**
Tires, Front, Center, Rear	**26.5R25 Radials**		**29.5R25 Radials**		**29.5R25 Radials**	
Circular Clearance Diameter	17.2 m	**56'5"**	17.2 m	**56'5"**	18.2 m	**59'6"**
Fuel Tank Refill Capacity	565 L	**149.3 U.S. gal**	565 L	**149.3 U.S. gal**	565 L	**149.3 U.S. gal**
General Dimensions (Empty):						
Height to Cab Top	3.7 m	**12'1"**	3.75 m	**12'3"**	3.75 m	**12'3"**
Wheel Base (Front-Center of Bogie)	5.23 m	**17'2"**	5.23 m	**17'2"**	5.58 m	**18'3"**
Overall Length	10.99 m	**36'1"**	10.99 m	**36'1"**	11.69 m	**38'4"**
Loading Height (Empty)	2.98 m	**9'8"**	3.2 m	**10'6"**	3.07 m	**10'1"**
Height at Full Dump	6.81 m	**22'4"**	7.1 m	**23'4"**	—	
Body Length	6.09 m	**20'0"**	6.3 m	**20'6"**	6.73 m	**22'1"**
Width (Operating — Over Mirrors)	3.82 m	**12'6"**	3.82 m	**12'6"**	3.82 m	**12'6"**
Front Tire Tread	2.69 m	**8'8"**	2.69 m	**8'8"**	2.69 m	**8'8"**

*Includes coolant, lubricant and full fuel tank.
**Rating dependent on optional equipment. Maximum gross weight (empty weight plus payload) should not be exceeded.

				
MODEL	**777D†**		**777F**	
Body Type	**Dual Slope Lined**		**Dual Slope Lined**	
Target Gross Machine Weight §	163 360 kg	**360,143 lb**	163 293 kg	**360,000 lb**
Basic Machine Weight*	33 951 kg	**74,849 lb**	33 438 kg	**73,718 lb**
Attachments**	17 377 kg	**38,310 lb**	17 114 kg	**37,730 lb**
Body Weight without Liners***	16 070 kg	**35,428 lb**	16 420 kg	**36,200 lb**
Full Liner	5432 kg	**11,975 lb**	5767 kg	**12,714 lb**
Operating Machine Weight	72 830 kg	**160,562 lb**	72 739 kg	**160,360 lb**
Debris (2% of Operating Machine Weight)	1457 kg	**3211 lb**	1455 kg	**3207 lb**
Empty Operating Weight	74 287 kg	**163,774 lb**	74 194 kg	**163,568 lb**
Target Payload §	90.9 m tons	**100 tons**	90.7 m tons	**100 tons**
Capacity:				
Heaped (2:1) (SAE) Base Body	60.1 m^3	**78.6 yd^3**	60.2 m^3	**78.8 yd^3**
Distribution Empty:				
Front	**47%**		**45%**	
Rear	**53%**		**55%**	
Distribution Loaded:				
Front	**33%**		**33%**	
Rear	**67%**		**67%**	
Engine Model	**3508B EUI**		**C32 ACERT**	
Number of Cylinders	**8**		**12**	
Bore	170 mm	**6.7"**	145 mm	**5.7"**
Stroke	190 mm	**7.5"**	162 mm	**6.4"**
Displacement	34.5 L	**2105 in^3**	32.1 L	**1959 in^3**
Net Power	699 kW	**938 hp**	700 kW	**938 hp**
Gross Power	746 kW	**1000 hp**	758 kW	**1016 hp**
Standard Tires	**27.00-R49 (E4)**		**27.00R49 (E4)**	
Machine Clearance Turning Circle	28.4 m	**93'2"**	28.4 m	**93'2"**
Fuel Tank Refill Capacity	1137 L	**300 U.S. gal**	1136 L	**300 U.S. gal**
Top Speed (Loaded)	60.4 km/h	**39.9 mph**	64.5 km/h	**40.1 mph**
GENERAL DIMENSIONS (Empty):				
Height to Canopy Rock Guard Rail	5.14 m	**16'10"**	5.17 m	**17'0"**
Wheelbase	4.57 m	**15'0"**	4.56 m	**15'0"**
Overall Length (Base Body)	9.78 m	**32'1"**	10.54 m	**34'7"**
Loading Height (Base Body)	4.38 m	**14'4"**	4.38 m	**14'4"**
Height at Full Dump	10.06 m	**33'0"**	10.33 m	**33'11"**
Body Length (Target Length)	7.23 m	**23'9"**	9.83 m	**32'3"**
Width (Operating)	6.11 m	**20'0"**	6.49 m	**21'4"**
Width (Shipping)***	3.51 m	**11'5"**	3.51 m	**11'5"**
Front Tire Tread	4.17 m	**13'8"**	4.17 m	**13'8"**

*See Weight Definitions and Relations on 9-11. Note: No mandatory or optional attachments or fuel.
**Typical selection of mandatory and optional attachments.
***Data provided is for a representative body and liner package. Several dual slope, flat floor, and mine specific design (MSD) bodies and liner packages are available. All weights, capacities, and dimensions are dependent on the machine configuration (body type, attachments, tires, and optional equipment selected).
§ Reference Caterpillar's latest 10/10/20 Payload Policy for information on gross machine operating weight and target payload.
† India sourced, only available in Asia Pacific.

Appendix D.5

Direct Quotes

Fred Charles

From: Fawcett, Clayton <CFawcett@conteches.com>
Sent: Tuesday, February 5, 2019 9:25 AM
To: Fred Charles
Subject: RE: confirm or update costs for ACBs (reply requested by end of day Monday Feb 4, if possible)

Fred,

Hello and good morning. I hope this message finds you doing well. I made it back in to the office this morning and saw your e-mails.

Material and installation costs we discussed in September are still good. Please feel free to use those to complete your estimate.

Regarding your questions:

1. Yes, installation costs are the same for both downchutes and dissipator basins.
2. Yes, installation cost does include crushed stone infill (purchase and install)

Regarding your follow up e-mail with questions pertaining to cut-off walls.

1. Cut-off walls are not always required, however they are a good idea. The use of cut-off walls has increased in the last five years and as such, they are now recommended for inclusion at dissipator basins.
2. Material and installation costs for the installation of a cut-off wall <u>are not</u> included in the costs previously discussed and should be added.

I hope this information helps. Feel free to contact me directly with any additional questions.

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager - West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Fred Charles [mailto:fcharles@telesto-inc.com]
Sent: Sunday, February 3, 2019 3:28 PM
To: Fawcett, Clayton <CFawcett@conteches.com>
Subject: confirm or update costs for ACBs (reply requested by end of day Monday Feb 4, if possible)

Hi Clayton. This email is a follow up to our email correspondence in September 2018 regarding material and installation costs for articulated concrete blocks (ACBs) used for downdrains at Chino. We've been using the cost info you passed along to me at that time. Now, I need you to confirm those costs or update them. We will use this information in a reclamation cost estimate (financial assurance for closure bonding) which we are currently finalizing for Chino and other mines in that area.

<u>Costs</u>
As we had discussed, the material costs for ACBs (includes non-woven geotextile and microgrid/geogrid) are as follows:

- $7.42/square foot (Block Class 40T, for the channel of each downdrain)

- $10.65/square foot (Block Class 70T, for the dissipation basin at bottom of each downdrain)

Also, you quoted $4.63/square foot for installation costs, which covers the following installation process: off-load the truck and place delivered ACBs in temporary storage area, fine grade base/subgrade soils, compact soils to 90% Standard Proctor (D698), place and secure filter fabric (non-woven geotextile), place 4-6” drainage layer overlaid by geogrid, place ACBs in final configuration, grout seams, and backfill ACBs with crushed stone.

2 questions

In addition to you confirming or updating the material and installation costs, I have two questions: (1) Is the installation cost ($4.63/square foot) the same for both channel downdrains and dissipation basins? (2) Does the installation or material cost include the crushed stone used to backfill the ACBs?

Please create a new email to me with updated unit costs or reply to this email to confirm what I show is still correct. I will present what you provide for documentation in the cost estimate we submit to the state agencies.

Thanks,

Fred Charles, Ph.D., P.E. Senior Engineer
Office: 970-484-7704, Ext 120 Cell: 720-318-5021
3801 Automation Way, Suite 201, Fort Collins, CO 80525
fcharles@telesto-inc.com

TELESTO SOLUTIONS • INCORPORATED

www.telesto-inc.com

Taryn Tigges

From: Clayton Fawcett <Clayton.Fawcett@ContechLLC.com>
Sent: Monday, January 11, 2021 10:45 AM
To: Taryn Tigges
Subject: RE: [EXTERNAL] RE: Tyrone Mine Armorflex Analysis 40T

That make sense.

We are including the geotextile, geogrid, ACB, and freight to the jobsite.

Clayton Fawcett PE (co)
Armortec Area Manager - West

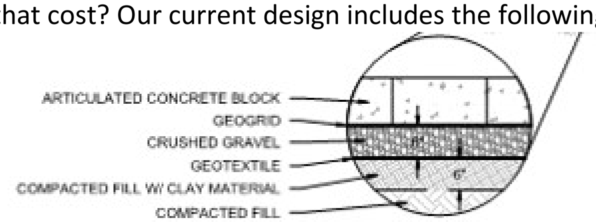
CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Taryn Tigges [mailto:ttigges@telesto-inc.com]
Sent: Monday, January 11, 2021 10:44 AM
To: Clayton Fawcett <Clayton.Fawcett@ContechLLC.com>
Subject: [EXTERNAL] RE: Tyrone Mine Armorflex Analysis 40T

Hi Clayton,

You too! Weekends go by too quickly.

Thanks for the information. They are just updating costing information. Can you also confirm again what's included in that cost? Our current design includes the following:



Can you let me know what I need to account for separately? I believe you had mentioned geotextile is part of the cost.

Thanks,

Taryn Tigges, PE | Civil Engineer
Office: 970-484-7704 | Cell: 515-520-9454
750 14th St SW | Loveland, CO 80537

www.telesto-inc.com

From: Clayton Fawcett <Clayton.Fawcett@ContechLLC.com>
Sent: Monday, January 11, 2021 10:39 AM
To: Taryn Tigges <ttigges@telesto-inc.com>; CFawcett@conteches.com
Cc: KMeyer@conteches.com
Subject: RE: Tyrone Mine Armorflex Analysis 40T

Hi Taryn,

I hope the weekend treated you well. Current pricing as of January 2021 is 10.27 / sf delivered for this material.

Are they getting ready to proceed or just updating the costing information?

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager - West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Taryn Tigges [mailto:ttigges@telesto-inc.com]
Sent: Thursday, January 7, 2021 2:15 PM
To: CFawcett@conteches.com
Cc: KMeyer@conteches.com
Subject: FW: Tyrone Mine Armorflex Analysis 40T

Hi Clayton,

It has been a few months since I talked to you but I was wondering if you could send an updated cost for current (January 2021) prices for the Armorflex 50T ACB system? Let me know if you need any additional information.

Thanks,

Taryn Tigges, PE | Civil Engineer
Office: 970-484-7704 | Cell: 515-520-9454
750 14th St SW | Loveland, CO 80537

www.telesto-inc.com

From: Fawcett, Clayton <CFawcett@conteches.com>
Sent: Thursday, May 28, 2020 3:28 PM
To: Taryn Tigges <ttigges@telesto-inc.com>
Cc: Meyer, Kenneth <KMeyer@conteches.com>
Subject: RE: Tyrone Mine Armorflex Analysis 40T

Taryn,

Good speaking with you this afternoon. See attached for revised calculations per your direction below. That is, with the exception of the Manning's *n* value which is 0.025.

Cost for the Armorflex 50T ACB system is $9.77 / sf delivered. This does include ACB mats with galvanized cable, geotextile fabric, and freight to the jobsite via Over the Road Flatbed Trucks.

Feel free to let me know if you have any additional questions.

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager - West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Taryn Tigges [mailto:ttigges@telesto-inc.com]
Sent: Thursday, May 28, 2020 2:16 PM
To: Fawcett, Clayton <CFawcett@conteches.com>
Subject: RE: Tyrone Mine Armorflex Analysis 40T

Hi Clayton,

You previously spoke with our intern, Jessica, for ACB selection on a Freeport project. I have a couple questions for you regarding that project:

1. I had run some calculations with the following factor of safety method, which is giving me different results than your spreadsheet: https://www.conteches.com/knowledge-center/pdh-article-series/articulated-concrete-block-design
   Are you using a newer method?

2. Can you revise your calculations for the following channel design and flow rate:
   a. Manning's n = 0.015
   b. Bed Slope = 0.05
   c. Side slope = 2:1
   d. Bottom width = 15 feet, Top width = 28 feet
   e. Hydraulic Depth = 3.3 feet
   f. Radius of curvature = 240 feet

g. Flow rate = 2717 cfs (velocity = 38.8 ft/s for area of 70.1 sf)

A side slope of 3:1 is not obtainable for this project so you don't need to run that calculation. Let me know if you need additional information and let me know what block type you recommend based on these conditions.

Thank you for your time!

Taryn Tigges, PE | Civil Engineer
Office: 970-484-7704 | Cell: 515-520-9454
750 14th St SW | Loveland, CO 80537

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www.telesto-inc.com

From: Jessica Menconi <jmenconi@telesto-inc.com>
Sent: Wednesday, April 22, 2020 2:12 PM
To: Taryn Tigges <ttigges@telesto-inc.com>
Subject: FW: Tyrone Mine Armorflex Analysis 40T

From: Fawcett, Clayton <CFawcett@conteches.com>
Sent: Wednesday, April 22, 2020 12:29 PM
To: Jessica Menconi <jmenconi@telesto-inc.com>
Cc: Taryn Tigges <taryn.tigges@gmail.com>
Subject: RE: Tyrone Mine Armorflex Analysis 40T

Jessica,

I have to apologize. I thought I sent that already.

See attached. My guess is that Freeport won't accept it as it is below the minimum 1.8 Factor of Safety that they have previously established.

Regards,

Clayton Fawcett PE (co)
Armortec Area Manager - West

CONTECH Engineered Solutions
970-290-2971 (cell)
cfawcett@conteches.com

From: Jessica Menconi [mailto:jmenconi@telesto-inc.com]
Sent: Wednesday, April 22, 2020 12:15 PM

Revegetation/Reclamation
Rangeland Rehabilitation
Landscaping / Fencing
Hydroseeding
Environmental Consulting

ROCKY MOUNTAIN RECLAMATION

Phone (307) 745-5235
(307) 745-5230

ron@reveg.us
www.reveg.us

P.O. Box 1695
Laramie, WY 82073

FREEPORT MCMORAN – NEW MEXICO MINING OPERATIONS

PRICE ESTIMATES FOR REVEGETATION SERVICES FOR BUDGETING ESTIMATES

Table 1 –Freeport McMoRan, New Mexico Mining Operations – Price Estimates for Revegetation Services for Budgeting Estimates, prepared April, 2018.

	REVEGETATION OPERATION	ESTIMATED QUANTITY	UNITS	COST/UNIT ($)	TOTAL COST
I.	**OPERATIONS:**				
1	**SCARIFYING**	500	Acres	$30.00	$15,000.00
2	**DISCING**	500	Acres	$20.00	$10,000.00
3	**DRILL SEEDING (special Rangeland Drill)**	500	Acres	$80.00	$40,000.00
4	**MULCHING**	500	Acres	$148.00	$74,000.00
5	**CRIMPING**	500	Acres	$55.00	$27,500.00
6	**DAILY PER DIEM, ETC.**	50	Days	$385.00	$19,250.00
7	**MOBILIZATION**	1	Each	$13,500.00	$13,500.00
	Subtotal				**$199,250.00**
II.	**MATERIALS:**				
1	**SEED** at 8.9 PLS/acre	500	Acres	$210.00	$105,000.00
2	**HAY MULCH** - nox. weed free, native	1000	Tons	$245.00	$245,000.00
	Subtotal				**$350,000.00**
	TOTAL ESTIMATED REVEGETATION COST BEFORE TAX				**$549,250.00**
	Add New Mexico Gross Receipts Tax	5.9375	%		**$32,611.72**
	ESTIMATED REVEGETATION COST PER ACRE:			**$1,163.72**	
	TOTAL ESTIMATED REVEGETATION COST				**$581,861.72**

Estimate prepared by Ron Schreibeis, Rocky Mountain Reclamation, for use for Budgeting Estimates.

Fred Charles

From: Medhurst, Audie <Audie.Medhurst@gcinc.com>
Sent: Tuesday, July 9, 2019 1:38 PM
To: Fred Charles
Subject: RE: request for cost information - well/exploratory borehole abandonment

Hi Fred
The information as written in the mail below is correct
Thank you
Audie

Audie Medhurst

General Manager
Mineral Services Division

12030 E Riggs Road
Chandler AZ 85249

Direct: 602-824-0934|**Cell:** 602-359-3010
Email: Audie.Medhurst@gcinc.com

www.graniteconstruction.com

From: Fred Charles <fcharles@telesto-inc.com>
Sent: Tuesday, July 9, 2019 11:12 AM
To: Medhurst, Audie <Audie.Medhurst@gcinc.com>
Subject: request for cost information - well/exploratory borehole abandonment

Hi Audie (with Layne, A Granite Company – formerly Layne Christensen Company). Thanks for the updated cost information you provided for abandonment of wells and boreholes. Please confirm the following is correct in an email reply to me. We will include this email in documentation we provide to the State for the reclamation cost estimate.

Estimate 7000.00 per day rig time- estimate 300 days to complete. $2,100,000.00

Estimate 6.00 per foot abandonment material costs. $ 1,035,786.00

Mob 15,000.00
Demob 15,000.00

As I communicated with you, the estimated costs reflect requirements for the work which include:

1. All work done in conformance with New Mexico requirements/guidance
2. Costs include mobilization/demobilization (site is in Grant County, NM), which includes moving between wells assumed at 1,000 ft apart
3. Costs include labor, equipment, and materials
4. Wells/boreholes will be plugged and abandoned from bottom of hole to the surface – total well lengths and diameters are combined for monitoring wells and exploration boreholes, as follows:
   - 2-inch diameter PVC – 431 ft total well length
   - 4-inch diameter PVC – 102,876 ft total well length
   - 5.5-inch diameter PVC – 63,240 ft total well length

- 6-inch diameter PVC – 6,084 ft total well length

Thanks,

Fred Charles, Ph.D., P.E. Senior Engineer
Office: 970-484-7704, Ext 120 Cell: 720-318-5021
3801 Automation Way, Suite 201, Fort Collins, CO 80525
fcharles@telesto-inc.com

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SOLUTIONS • INCORPORATED

www.telesto-inc.com

Layne Christensen Company

12030 E. Riggs Road
Chandler, Arizona 85249
Office: 480.895.9336
Fax: 480.895.9536

WATER · MINERAL · ENERGY

Estimate

Company:	**Freeport McMoRan Tyrone**	**Date:**	**July 31, 2018**
Contact:	**David Princehouse**	**Project:**	**Tyrone Hole Abandonment**
Address:	**Box 571 Hwy 90 South**	**Location:**	**Tyrone Mine**
City:	**Tyrone**	**Estimated By:**	**Joel Campbell**
State:	**NM**	**Proposal Number:**	**18-000-RC**
Postal Code:	**88065**	**Estimated Footage:**	**1,500 feet**
Phone:	**575 912 5752**	**Number of Holes:**	**1**
Cell:	**575 654 5246**	**Max. Depth:**	**1,500 feet**
Email:	dprinceh@fmi.com	**Average Depths:**	**1,500 feet**

HAMMER DRILLING	RATE PER HOUR	
FOOTAGE RANGE	**Hole Size**	**Hourly**
0-1,500 Feet	5.5-inch	$375.00

OPERATING HOURLY RIG RATE ACTIVITIES	PER HOUR
DRILL HOLE ABANDONMENT	$375.00

MOB / DEMOB	LUMP SUM	HOURLY
*MOBILIZATION	$5,000.00	
DEMOBILIZATION	$5,000.00	

ADDITIONAL EQUIPMEN	PER MONTH	PER HOUR
FORKLIFT RENTAL		N/A
AUX. AIR OP RATE	N/A	$20.00

STANDBY HOURLY RIG RATE ACTIVITIES	PER HOUR
CLIENT DIRECTED STANDBY WITH CREW	$300.00
WEATHER DELAY- NON OPERATING RATE	$300.00

SUPPLIES	RATE
CEMENT 47lb BAG EACH	$7.61
ABANTONITE 50lb BAG EACH	$16.00
LOST TOOLING / DRILL STEEL	Cost
DRILLING FLUID ADDITIVES	Cost plus 10%
OTHER MATERIALS / SUPPLIES AS NEEDED	Cost plus 10%

PER DIEM CHARGE	PER MAN/PER DAY
3 MAN CREW	$85.00

FUEL	RATE
SUPPLIED BY TYRONE	COST

CREW TRAVEL TIME	RATE
Included in Footage Rate	N/C

PROPOSED LAYNE SUPPLIED RC DRILLING EQUIPMENT:

One (1) Schramm 450 Track Rotary rig complete with 1,500 ft. of drill pipe, conventional downhole hammer, bit and tool subs, lubricants, wet rotary splitter, and tools necessary
One (1) 4 X 4 water truck with 1,600 gallon capacity.
One (1) 4 X 4 pipe truck
CREW: One (1) Driller; Two (2) Helpers
One (1) Ford F-250 4 x 4 Crew truck

BID CONDITIONS:
- RIG WILL WORK 1 (ONE) - 12 HOUR SHIFT PER DAY ON A 10 DAYS ON WITH 4 DAYS OFF SCHEDULE OR AS AGREED BY THE PARTIES.
- WATER SUPPLY, ACCESS, DRILL SITES, AND ALL REQUIRED PERMITS ARE THE RESPONSIBILITY OF THE

Layne Christensen Company
12030 E. Riggs Road
Chandler, Arizona 85249
Office: 480.895.9336
Fax: 480.895.9536

WATER · MINERAL · ENERGY

Estimate

Company:	**Freeport McMoRan Tyrone**	**Date:**	**July 31, 2018**
Contact:	**David Princehouse**	**Project:**	**Tyrone Hole Abandonment**
Address:	**Box 571 Hwy 90 South**	**Location:**	**Tyrone Mine**
City:	**Tyrone**	**Estimated By:**	**Joel Campbell**
State:	**NM**	**Proposal Number:**	**18-000-RC**
Postal Code:	**88065**	**Estimated Footage:**	**1,500 feet**
Phone:	**575 912 5752**	**Number of Holes:**	**1**
Cell:	**575 654 5246**	**Max. Depth:**	**1,500 feet**
Email:	dprinceh@fmi.com	**Average Depths:**	**1,500 feet**

Description	Quantity	Unit	Cost	Total
Mobilization and Moving				
Move Rig and Equipment	1	LS	$5,000.00	$5,000.00
De -Mobilize Rig and Equipment	1	LS	$5,000.00	$5,000.00
Move between holes 12hrs / move		HR	$375.00	$0.00
			Job Total	**$10,000.00**
Abandon 1 x 5.5-inch Hole to 1,500 Feet				
Mix and Pump Cement Grout Whilst Pulling Rods	6	HR	$375.00	$2,250.00
Cement Materials	454	Bag	$7.61	$3,454.94
Sundry Materials Supplied - cost plus 15%				$0.00
				$0.00
				$0.00
				$0.00
			Total 1 Well	**$5,704.94**

WATER · MINERAL · ENERGY

July 31, 2018

To: David Princehouse
Tyrone Mining NM

Re: Abandonment of Exploration Holes

Layne intends to abandon the exploration holes drilled for Tyrone Mining for the RC Exploration program adhering to the following procedures

1. Upon reaching total depth the hole will be backfilled filling from the bottom up through the drill rods with a neat cement grout.

2. Verification of proper sealing is that the volume of sealing material placed in the hole during abandonment operations equals or exceeds the volume of the borehole to be filled and sealed

Regards

Audie Medhurst
General Manager, Mineral Exploration
Mineral Services Western US
LAYNE | water + mineral + energy
12030 E. Riggs Road | Chandler, AZ | 85249
Office: 602-824-0934 | Cell: 602-359-3010
audie.medhurst@layne.com | layne.com

August 23, 2011
Revised August 25, 2011

Wilcox
PROFESSIONAL SERVICES
CREATING INDUSTRY LEADING RESULTS
1055 S 63rd Avenue
Phoenix, Arizona 85043
t 602.442.0667 I f.602.442.0669

Kurt Stauder
Telesto Solutions, Inc.
2950 E. Harmony Rd. Suite 200
Fort Collins, CO 80528
Phone: (970) 484-7704

RE: Shramrock Exploration Project
Silver City, New Mexico
Wilcox Proposal No.: 14.00645

Via Email: kstauder@telesto-inc.com

Dear Mr. Stauder:

Wilcox Professional Services, LLC (Wilcox) is pleased to submit this proposal to provide exploratory drilling services in connection with the Shamrock Exploration Project located West of Silver City, New Mexico. Wilcox appreciates this opportunity and looks forward to working with you to make this a successful endeavor for all involved.

This proposal is based upon scope of work and bid sheets dated August 23, 2011 and are subject to negotiations between Wilcox and Hoffman Consulting & NV Gold Corp. (Client), if needed.

Drilling Scope of Work:

- Consists of 10 to 25 exploration holes to an anticipated depth of 300' each
- Reverse Circulation (RC)
- Vertical holes
- Schedule and Crew: One 12 hr. shift per day, drill till complete
- Commence October 2011

It is understood that to facilitate this drilling program the Client will provide the following at no cost to Wilcox:

- A suitable water supply (if required)
- Full time on site Geologist capable of making decisions on program to avoid delays
- Legal access to the site from public roads
- Staging area for unloading and loading equipment
- Drill pad construction and reclamation (if required)
- Road and mud pit construction and reclamation (if required)
- Any bonding and all permitting fees (if required)

The Client will be responsible for reimbursing Wilcox for the following items at suppliers' list price plus 10 percent (10%). Client may provide certain items as mutually agreed.

- Drilling mud and additives
- Cement and cementing services
- Chip boxes and lids, sample bags and marker blocks
- Special tools or drilling accessories, rig well for testing purposes or which may be a lift in the hole upon client request
- All casing shoes
- Down Hole Survey Interment (Reflex EZ-SHOT or equivalent)

- Core drilling bits, reamers and tricones
- Casing lost/left in holes or recovered but damaged
- All materials lost in the hole
- Sump liners/tank, if required
- Sanitary facilities
- Disposal of all liquids and solid waste generated on site
- Other items as negotiated

Wilcox will provide specialized equipment and services for completion of your drilling program, including in Drilling Unit Price:

- 1 RC Drill Rig
- RC Drilling System
- MSHA Certified Drill Crews (2 man)
- Water transport (if required)
- Support equipment (welding, pickup & tools)

General Provisions

a. Lost Materials

In the event that drill rods, casing, or other equipment become lost, broken, or stuck in the hole while drilling at the footage rates, the Client agrees to reimburse the Contractor at field cost rates. These rates will include time and materials expended in recovery attempts. If materials are unrecoverable, the Contractor shall be reimbursed for same at replacement cost.

b. Unsatisfactory Progress In Hole and Hole Abandonment

In the event that excessive water flows, cavities, loose, swelling, caving materials, or hole stability problems are encountered, and they prevent the completion or satisfactory progress of a hole the Contractor does not guarantee to drill to a predetermined depth. If it becomes necessary to abandon the hole the Contractor shall charge the Client for the holes abandoned. Such charges will include the depth of abandonment and the rates specified in our proposal. If the Client requests the Contractor to proceed in the hole, the Contractor has the option to revert to the operating field cost rates plus all materials, supplies, and equipment required at replacement cost plus ten percent (10%). These charges will be subject to the Client's approval.

c. Field Cost Definitions

1. Operating

   It is agreed that the operating rates shall include the labor of a regular three-man crew per shift, and drill and support equipment rental. The cost of rods, casing, below-the-head consumables, and other materials and supplies consumed onsite shall be charged to the Client at cost plus ten percent (10%).

   In the event that extra labor over and above the regular two-man crew per shift is utilized, the Contractor agrees to supply such additional labor at the rates specified in Bid Prices, Section 5.

2. Non-Operating (Standby)

   It is agreed that the non-operating rates shall prevail when work is interrupted due to delays not caused by the Contractor, or delays beyond his control.

Pricing of Services

3000 ft Estimate

Item	Quantity	Unit	Cost	Price
DRILLING COSTS				
Mobilization	1	LS	5,000	$5,000.00
Demobilization	1	LS	5,000	$5,000.00
SURFACE CASING				
Vertical Casing Advancement Drilling	40	HR	150	$6,000.00
DRILLING WITH DOWN HOLE HAMMER				
Vertical DHH Drilling; 5 1/2" Borehole, 0'-Up to 300'	300	FT	32	$96,000.00
RIG TIME OTHER THAN DRILLING - OPERATING				
Plugging	100	HR	150	$15,000.00
RIG TIME OTHER THAN DRILLING - NON-OPERATING				
Move-on, Set-up, Take-down Between Holes	50	HR	150	$7,500.00
MATERIALS				
Portland Cement; 97lb. Sack	700	EA	15	$10,500.00
Bentonite- AquaGuard or e; 50lb. Sack	90	EA	25	$2,250.00
DAILY CHARGES				
Daily Crew Travel and/or Per Diem (Per Shift)	25	EA	300	$7,500.00
Stand-by Time	25	HR	150	$3,750.00
Contingency			10%	$15,000.00
		Total		$173,500

4500 ft Estimate

Item	Quantity	Unit	Cost	Price
DRILLING COSTS				
Mobilization	1	LS	5,000	$5,000.00
Demobilization	1	LS	5,000	$5,000.00
SURFACE CASING				
Vertical Casing Advancement Drilling	50	HR	150	$7,500.00
DRILLING WITH DOWN HOLE HAMMER				
Vertical DHH Drilling; 5 1/2" Borehole, 0'-Up to 300'	4500	FT	30	$135,000.00
RIG TIME OTHER THAN DRILLING - OPERATING				
Plugging	125	HR	150	$18,750.00
RIG TIME OTHER THAN DRILLING - NON-OPERATING				
Move-on, Set-up, Take-down Between Holes	100	HR	150	$15,000.00
MATERIALS				
Portland Cement; 97lb. Sack	1000	EA	15	$15,000.00
Bentonite- AquaGuard or e; 50lb. Sack	100	EA	25	$2,500.00
DAILY CHARGES				
Daily Crew Travel and/or Per Diem (Per Shift)	35	EA	300	$10,500.00
Stand-by Time	35	HR	150	$5,250.00
Contingency			10%	$20,000.00
		Total		$239,500.00

This proposal is not a binding contract. It is a submission for information purposes only and until bound by a contract, is subject to revision by either party.

ASSUMES FULL CHARGE

7500 ft Estimate

Item	Quantity	Unit	Cost	Price
DRILLING COSTS				
Mobilization	1	LS	5,000	$5,000.00
Demobilization	1	LS	5,000	$5,000.00
SURFACE CASING				
Vertical Casing Advancement Drilling	50	HR	125	$6,250.00
DRILLING WITH DOWN HOLE HAMMER				
Vertical DHH Drilling; 5 1/2" Borehole, 0'-Up to 300'	7500	FT	27.5	$206,250.00
RIG TIME OTHER THAN DRILLING - OPERATING				
Plugging	150	HR	125	$18,750.00
RIG TIME OTHER THAN DRILLING - NON-OPERATING				
Move-on, Set-up, Take-down Between Holes	100	HR	125	$12,500.00
MATERIALS				
Portland Cement; 97lb. Sack	1500	EA	15	$22,500.00
Bentonite- AquaGuard or e; 50lb. Sack	125	EA	25	$3,125.00
DAILY CHARGES				
Daily Crew Travel and/or Per Diem (Per Shift)	50	EA	300	$15,000.00
Stand-by Time	50	HR	150	$6,250.00
Contingency			10%	$30,000.00
			Total	$330,625.00

$1.5/ft

$\frac{\$18,750}{7,500\ ft} = 2.5$

$\frac{\$22,500}{7500} = 3$

= $1

= 3 $1

≈ $9/FT

Wilcox Professional Services 2011 Billing Rates

Standard Hourly Rates are set forth in this Exhibit and include salaries and wages paid to Personnel in each billing class plus the cost of customary and statutory benefits, general Administrative overhead, non-project operating costs, and operating margin or profit.

Personnel

Project Director .... $190.00/per hour

Project Manager / Sr. Professional .... $150.00/per hour

Project Engineer / Surveyor .... $130.00/per hour

Sr. Technician / Sr. Designer .... $110.00/per hour

Technician / CAD Drafter .... $90.00/per hour

Superintendent .... $150.00/per hour

Survey Crew .... $150.00/per hour

Clerical .... $60.00/per hour

Outside Consultants (Client Authorized)

Coordination at Personnel Hourly Rates listed above Cost + 10%

This proposal is not a binding contract. It is a submission for information purposes only and until bound by a contract, is subject to revision by either party.

Wilcox will require a deposit amount of $30,000.00 be received upon authorization of the contract to hold the drilling rig, crew and equipment. The deposit will be applied towards the final invoice. A 15 days notice to prepare and transport rig to project site will also be required.

We appreciate your confidence in Wilcox and look forward to working with you on this and other projects. Thanks again for this opportunity to submit out proposal. Wilcox is ready to commence work upon receipt of authorization. If you have questions, please do not hesitate to call me at 602-442-0667.

Sincerely,
WILCOX PROFESSIONAL SERVICES, LLC

Richard D. Wilcox

Richard D. Wilcox, P.E.
President

Enclosures

CC:

This proposal is not a binding contract. It is a submission for information purposes only and until bound by a contract, is subject to revision by either party.

O'KEEFE DRILLING

P.O. Box 3810 ~ Butte, MT 59702
Office: (406) 494-3310 Fax: (406) 494-3301
Email: info@okeefedrilling.com

Item	Description	Unit	Estimated Quantity	Unit Cost	Total
Drilling					
1	Mobilization/ Demobilization (RC/ Dual Rotary)	LS	1	$ 7,000.00	$ 7,000.00
2	Mobilization-Pump Truck	LS	1	$ 2,500.00	$ 2,500.00
3	Set-up between holes	Each	54	$ 1,500.00	$ 81,000.00
4	Decontamination-Drilling	LS	54	$ 1,000.00	$ 54,000.00
5	Drilling (Pilot Holes-Mud Rotary)*	Ft	3600	$ -	$ -
6	Abandonment-Pilot Holes	Ft	3600	$ -	$ -
7	Drilling (Reverse Circulation) *	Ft	4650	$ 34.00	$ 158,100.00
8	Drilling (Dual Rotary) *	Ft	4650	$ 40.00	$ 186,000.00
9	4-inch SCH-40 PVC Well - Installed				$ -
	Screen	Ft	1080	$ 65.00	$ 70,200.00
	Sand (5' above screen)	Ft	1350	$ 55.00	$ 74,250.00
	Blank Casing	Ft	8220	$ 12.00	$ 98,640.00
	Grout	Ft	7950	$ 6.00	$ 47,700.00
10	Surface Completion	Each	54	$ 375.00	$ 20,250.00

Item	Description	Unit	Estimated Quantity	Unit Cost	Total
Well Development and Sampling					
11	Well Development	Hour	400	$ 165.00	$ 66,000.00
12	Decontamination-Development	LS	54	$ 165.00	$ 8,910.00
13	Stand-by Time (Pump Truck)	Hour		$ 115.00	$ -
14	Per diem	Day	113	$ 275.00	$ 31,075.00
15	Stand-by Time (Drill Rig)	Hour		$ 220.00	$ -
16	Interm Travel	Per Hour	96	$ 100.00	$ 9,600.00
				Total	$ 915,225.00

$9300

Note: The Mud Rotary Drilling will be drilled by others

$100/ft

9300

Appendix D.6

Fuel
Cost

Fuel Price Data

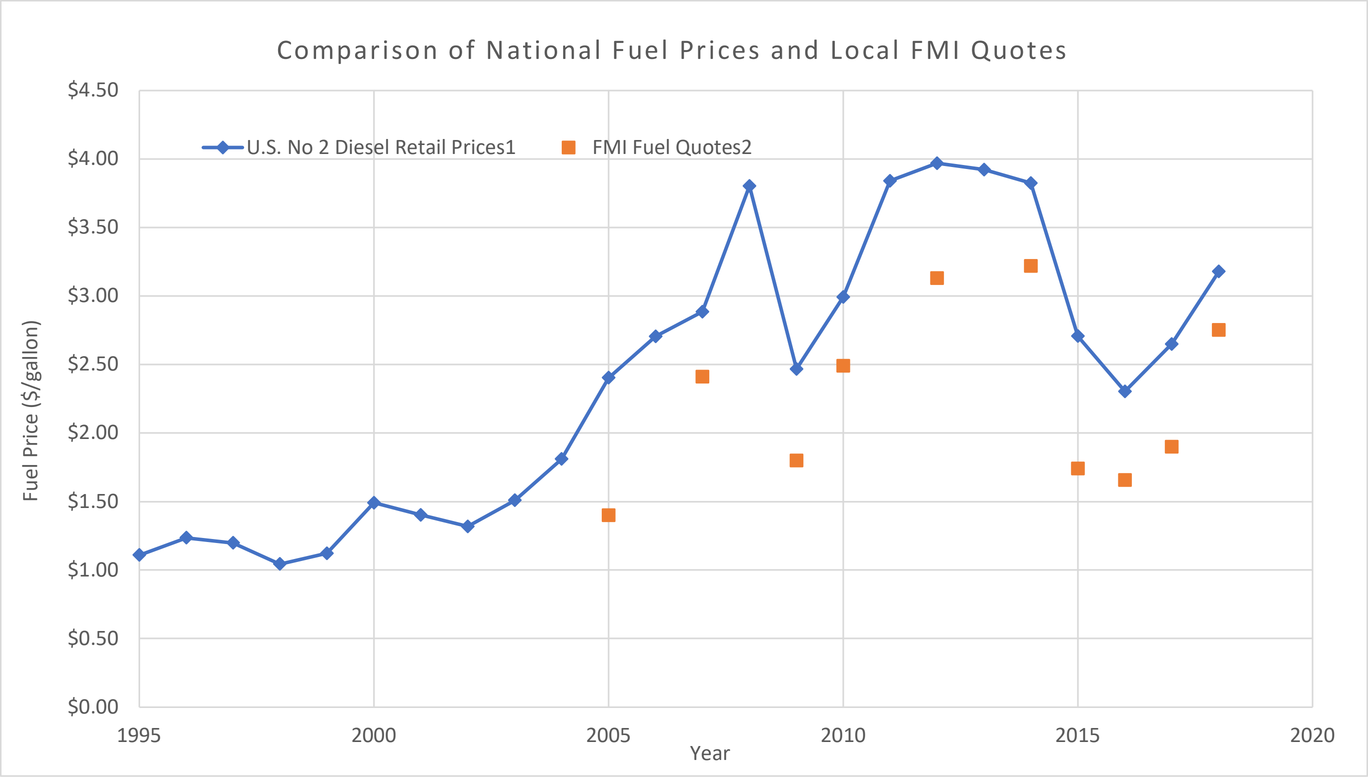
Data 1: U.S. No 2 Diesel Retail Prices (Dollars per Gallon)	
Date	U.S. No 2 Diesel Retail Prices[1]
1995	1.109
1996	1.235
1997	1.198
1998	1.044
1999	1.121
2000	1.491
2001	1.401
2002	1.319
2003	1.509
2004	1.81
2005	2.402
2006	2.705
2007	2.885
2008	3.803
2009	2.467
2010	2.992
2011	3.84
2012	3.968
2013	3.922
2014	3.825
2015	2.707
2016	2.304
2017	2.65
2018	3.178
2019	3.056
2020	2.551
2021	3.125
Date	U.S. No 2 Diesel Retail Prices[1]
Aug 2021	3.350

FMI Fuel Quotes[2]			
Site	Date	Dyed, low-sulfur diesel	Notes
Continental	1/21/2005	$1.40	Tom Shelley - quote from fuel broker
Chino & Tyrone	5/9/2007	$2.41	Porter Oil Quote (7500 gal capacity)
Continental	1/23/2009	$1.80	Porter Oil Quote (7500 gal capacity)
Tyrone (Little Rock)	1/14/2010	$2.49	Porter Oil Quote (7500 gal capacity)
Tyrone	7/7/2012	$3.13	Western Refining Oil
Continental	6/18/2014	$3.22	Western Refining Oil
Chino (North Lampbright)	11/5/2015	$1.74	Western Refining Oil
Chino	5/20/2016	$1.66	Western Refining Oil
Tyrone (Little Rock)	4/24/2017	$1.90	Western Refining Oil
Continental	3/12/2018	$2.75	Griffin Propane
Chino	10/10/2018	$2.75	Griffin Propane

1. U.S. Energy Information Administration
https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

Correlation Between U.S. No.2 Diesel Retail Prices and FMI Fuel Quotes Since 1995

Year	U.S. No 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]
1995	1.109	
1996	1.235	
1997	1.198	
1998	1.044	
1999	1.121	
2000	1.491	
2001	1.401	
2002	1.319	
2003	1.509	
2004	1.81	
2005	2.402	$1.40
2006	2.705	
2007	2.885	$2.41
2008	3.803	
2009	2.467	$1.80
2010	2.992	$2.49
2011	3.84	
2012	3.968	$3.13
2013	3.922	
2014	3.825	$3.22
2015	2.707	$1.74
2016	2.304	$1.66
2017	2.65	$1.90
2018	3.178	$2.75
2019	3.056	
2020	2.551	
2021	3.125	

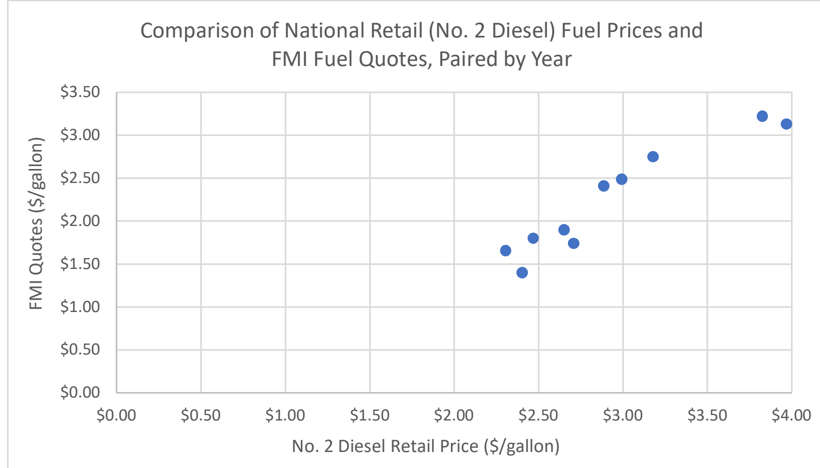


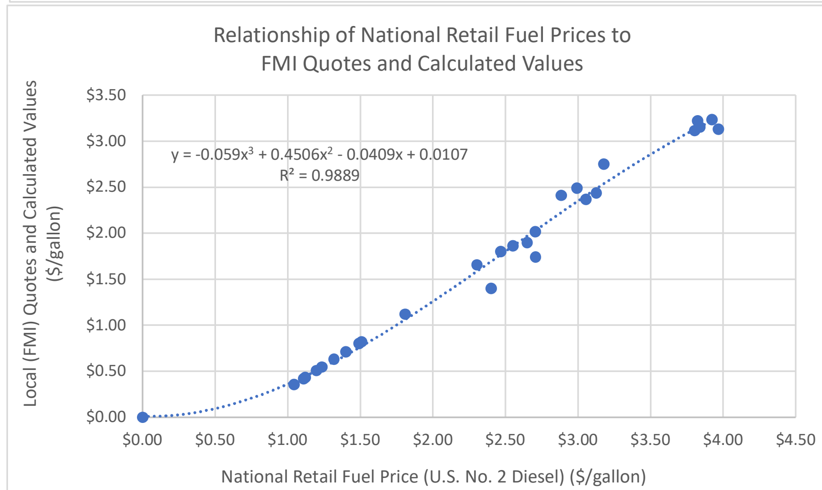
Correlatior 0.952

1. U.S. Energy Information Administration
https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

Calculations and Results for Fuel Price Prediction

U.S. No. 2 Diesel Retail Prices[1]	FMI Fuel Quotes[2]	Difference Between Retail Prices and FMI Quotes	Calculated FMI Values Based on Average Difference	Calculated FMI Values and Quotes	y = -0.05904x3 + 0.450612x2 - 0.04089x + 0.010713
$0.00				*$0.00*	$0.01
$1.11			$0.42	*$0.42*	$0.44
$1.24			$0.55	*$0.55*	$0.54
$1.20			$0.51	*$0.51*	$0.51
$1.04			$0.36	*$0.36*	$0.39
$1.12			$0.43	*$0.43*	$0.45
$1.49			$0.80	*$0.80*	$0.76
$1.40			$0.71	*$0.71*	$0.68
$1.32			$0.63	*$0.63*	$0.61
$1.51			$0.82	*$0.82*	$0.77
$1.81			$1.12	*$1.12*	$1.06
$2.40	$1.40	$1.00		$1.40	$1.69
$2.71			$2.02	*$2.02*	$2.03
$2.89	$2.41	$0.47		$2.41	$2.23
$3.80			$3.11	*$3.11*	$3.13
$2.47	$1.80	$0.67		$1.80	$1.77
$2.99	$2.49	$0.50		$2.49	$2.34
$3.84			$3.15	*$3.15*	$3.16
$3.97	$3.13	$0.84		$3.13	$3.25
$3.92			$3.23	*$3.23*	$3.22
$3.83	$3.22	$0.61		$3.22	$3.14
$2.71	$1.74	$0.97		$1.74	$2.03
$2.30	$1.66	$0.65		$1.66	$1.59
$2.65	$1.90	$0.75		$1.90	$1.97
$3.18	$2.75	$0.43		$2.75	$2.54
$3.06			$2.37	*$2.37*	$2.41
$2.55			$1.86	*$1.86*	$1.86
$3.13			$2.44	*$2.44*	$2.48
	Average	$0.69			





Correlations

Between No. 2 Retail Price and FMI Quotes	0.95
Between No. 2 Retail Price and 3rd order polynomial FMI Quotes	0.99
Between New FMI quotes and 3rd order polynomial FMI Quotes	0.96
Between FMI quotes and 3rd order polynomial FMI Quotes	0.99

New Fuel Rate	U.S. No 2 Diesel Retail Prices[1]		Proposed Fuel Quote
	Aug 2021	$3.35	$2.71

1. U.S. Energy Information Administration
https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=PET&s=EMD_EPD2D_PTE_NUS_DPG&f=M
2. Quotes obtained from Freeport-McMoRan (FMI)

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

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May 28, 2022

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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 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.

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 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.

- 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 Tertiary Quartz Monzonite dikes (Tqmd), 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 Tqmd 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 (QTg/Qg), 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 are dominated by high angle east-west to northeast striking faults and northeast striking dikes.

3.3.1 Lithology

The distribution of the lithologic units in the Little Rock Mine area 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€g), containing dikes of Tertiary Quartz Monzonite (Tqmd) and Tertiary Granodiorite (Tgd). Local occurrences of

Quaternary-Tertiary Gila Conglomerate (QTg/Qg) occur north of the Little Rock Mine open pit area and will underly the NRW Waste stockpile. Holocene alluvium (Qal) is present along alluvial valleys in Deadman Canyon, Whitewater Canyon, and their larger tributaries.

The p€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€g is intruded by the Tqmd. The Tqmd is a very light gray to pinkish-gray, medium-grained, hypidiomorphic-granular rock containing 15% orthoclase, 60% oligoclase 20% quartz 4% biotite. The Tqmd 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 quartz monzonite and is considered to be mechanically similar to the Burro Mountain Granite (Tyrone geologists, verbal communication).

The Miocene-Pliocene-Pleistocene Gila Conglomerate (QTg/Qg) 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, Hedlund reports these deposits as being derived from the underlying Gila Conglomerate. Where Hedlund mapped older fanglomerate deposits, others have mapped the Upper and Lower Mangas Conglomerate (QTg).

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 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 talus 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 (QTg). 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 (Qal) 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 northeast and are shown on Figure 2. The main faults in the Little Rock Mine area include the Austin-Amazon, the Southern Star, the Mangas faults, and various unnamed smaller faults in the vicinity of the Tqmd 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/southwest-northeast north of the Little Rock Mine open pit and under the NRW Waste stockpile. The Austin-Amazon passes southwest-northeast in a forked branch under the NRW 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.

The geologic map by Hedlund (1978) includes a Quaternary Talus (Qt) unit; however, more recent mapping by Tyrone geologists includes this unit as part of the Gila Conglomerate (QTg).

A Tertiary Granodiorite (Tgd) lithologic unit is present at Little Rock which has not previously had material parameters applied. The Tertiary Granodiorite unit (Tgd) 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 (Qal)	M-C	125	138	29.0	0

Material	Strength Model	Moist Unit Weight (pcf)	Saturated Unit Weight (pcf)	ϕ (°)	c (psi)
Liquified Alluvium	M-C	125	138	8.0	0
Gila Conglomerate (QTg)	M-C	125	138	35	6.94
Granodiorite (Tgd)	M-C	160	160	35	340
Quartz Monzonite Porphyry Dike (Tqmd)	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 elevation of 5630 ft amsl in ten years and reaching the maximum predicted lake level of 5670 ft amsl in 100 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 (20.6,7,33 NMAC). 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 Copper Rule states that stability analyses for waste rock stockpiles will include an evaluation for static or seismically induced liquefaction. 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 modelled 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 is 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
NRW Waste	Local toe, circular type	2.28	1.66	1.16
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 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 (p€g) and the lower slopes are underlain by the QTg and Qal units. 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 Qal. 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 2.28 (Figure A2) and the minimum pseudo-static factor of safety is 1.66 (Figure A5). Post-liquefaction conditions were considered assuming that the Qal below the assumed water table is liquefiable, 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 1.16 (Figure A3). Based on the results of stability analyses that exceed factor of safety of 1.0, applying conservative assumptions regarding the liquefaction potential and groundwater levels, the likelihood for stockpile failure due to liquefaction is low.

Table 3: NRW Waste Stability Results

NRW Waste Stockpile Configuration	Section Name	Failure Type	Crest El.	Toe El.	Slope Height (ft)	Critical Failure Type	Factor of Safety		
							Static	Seismic (k = 0.094g)	Liquified FOS
Closure	LR-N1	Circular	6010	5690	320	Global	2.29	1.68	NA
		Circular – Liquefied Qal				Toe	NA	NA	1.16

6.2 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 5670 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 and the minimum pseudo-static FS is 1.64. In dry pit conditions, the static FS is 1.82 and the pseudo-static conditions are 1.54. 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 and 1.52 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 4: East In-Pit Waste Stability Results

East In-pit Waste Stockpile Configuration	Section Name	Failure Type	Crest El.	Toe El.	Slope Height (ft)	Critical Failure Type	Factor of Safety	
							Static	Seismic (k = 0.094g)
Closure with pit lake at El. 5670 ft	LR-E1	Circular	5815	5550	265	Global	2.10	1.59
Closure with no pit lake		Circular				Global	1.83	1.54
Raised WT to Deadman Canyon		Circular				Global	2.08	1.57
Closure with pit lake at El. 5670 ft	LR-E2	Circular	5815	5510	305	Global	2.79	1.90
Closure with no pit lake		Circular				Global	2.99	2.18
Raised WT to Deadman Canyon		Circular				Global	2.22	1.56

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 1.83 under static conditions and 1.54 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 factor of safety. All were above 1.5.

The stability analyses also considered the potential for liquefaction. The potential for liquefaction of Qal 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.

8.0 REFERENCES

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Golder Associates USA Inc.

Kathrine Price, PE
Project Engineer

Thomas Wythes, PE
Associate and Senior Engineer

KDP/TJW/kg

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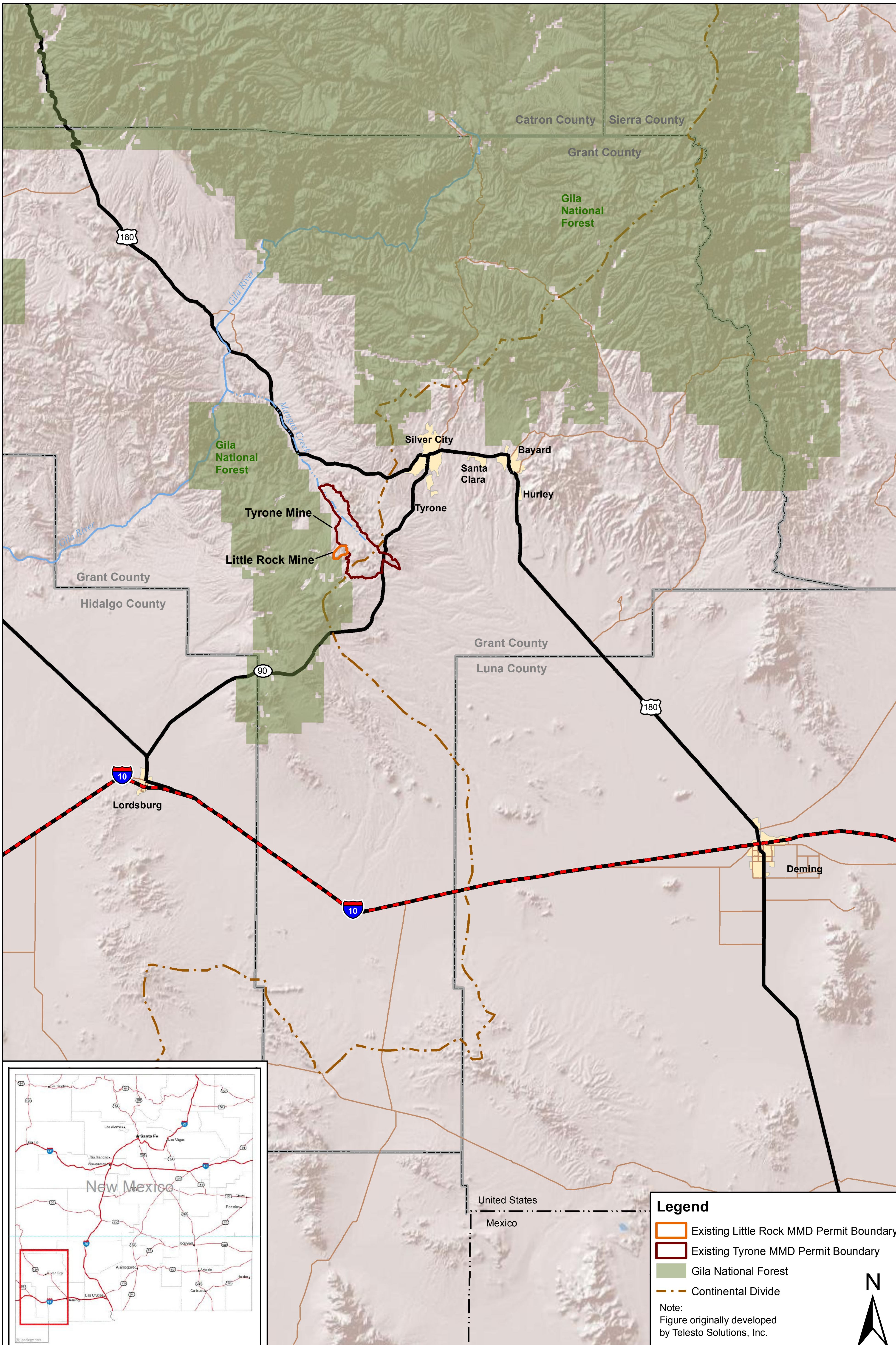
FIGURES



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FREEPORT-MCMORAN COPPER & GOLD

PROJECT No. 113-01155

FIGURE 1

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

TITLE
MINE LOCATION MAP

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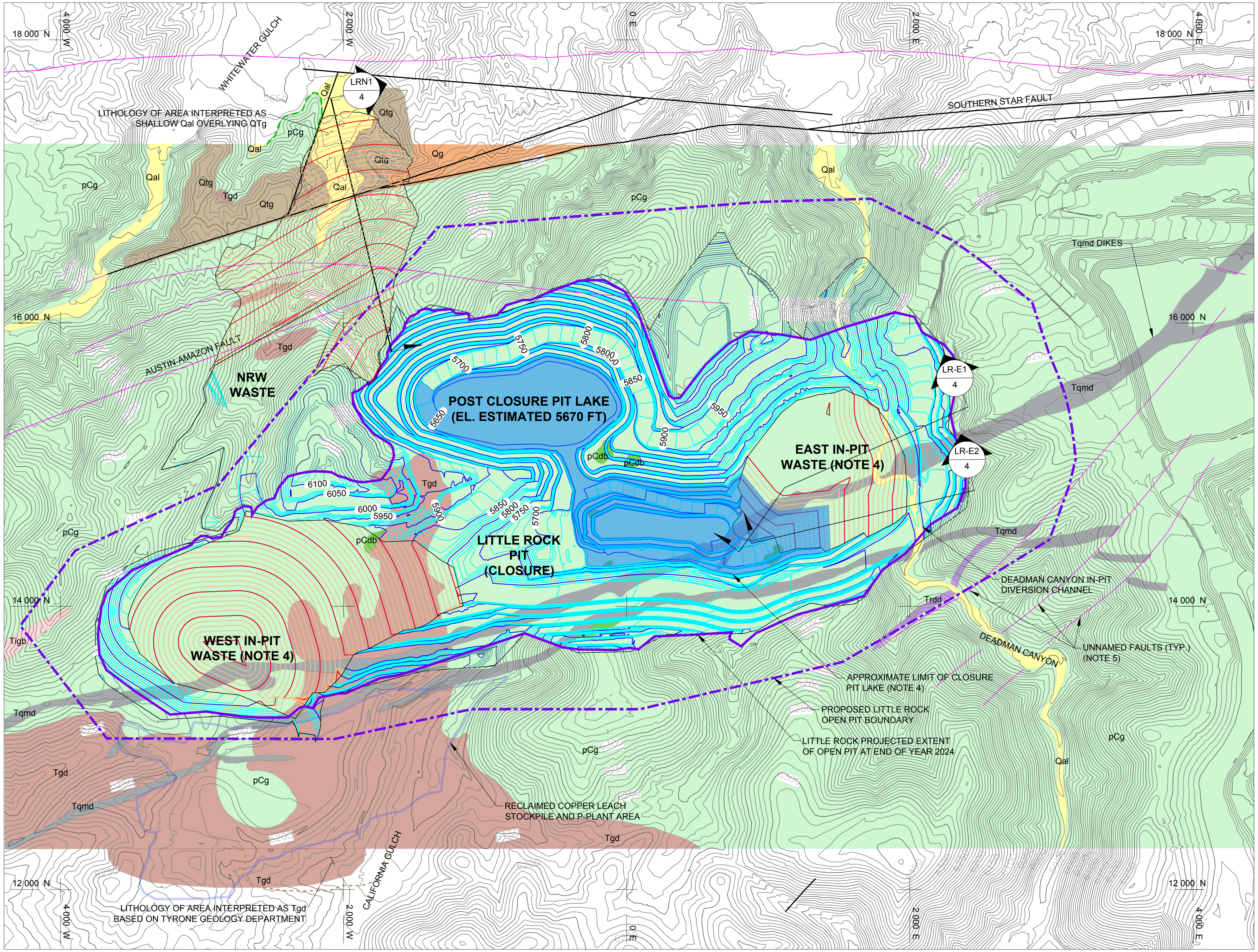

LEGEND

	EXISTING 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)
	MAPPED FAULT TRACE (NOTE 5)
	INTERPRETED FAULT (NOTE 5)
	RECLAIMED COPPER LEACH STOCKPILE AND P-PLANT AREA
	PROPOSED LITTLE ROCK OPEN PIT BOUNDARY
Qal	QUATERNARY ALLUVIAL DEPOSITS (NOTE 1)
Qg	QUATERNARY MANGAS CONGLOMERATE (NOTE 1)
QTg	QUATERNARY-TERTIARY GILA CONGLOMERATE (NOTE 1)
Tgd	TERTIARY GRANODIORITE (NOTE 1)
Tqmd	TERTIARY QUARTZ MONZONITE PORPHYRY DIKE (NOTE 1)
pCg	PRECAMBRIAN GRANITE (NOTE 1)
Trdd	TERTIARY RHYODACITE DIKE (NOTE 1)
pCdb	PRECAMBRIAN DIABASE (NOTE 1)
Tigb	TERTIARY IGNEOUS BRECCIA (NOTE 1)
	APPROXIMATE LIMIT OF CLOSURE PIT LAKE (NOTE 4)

SOURCE

1. EXISTING LOCAL GEOLOGY FROM TYRONE CLOSURE/CLOSEOUT PLAN FIGURE 2-4, DBS&A, 2021. MAP WAS DEVELOPED BASED ON DATA FROM TYRONE BLOCK MODEL (2003) AND HEDLUND, 1978, GEOLOGIC MAP OF THE TYRONE QUADRANGLE, GRANT CO., NM, USGS MISC.
2. EXISTING TOPOGRAPHY CONTOURS PROVIDED BY FREEPORT MCMORAN IN 2021 IN AN ELECTRONIC FILE TITLED '_JUN_2019_EOM_CONTOURS.dwg'.
3. NRW WASTE STOCKPILE CONTOURS PROVIDED BY TELESTO SOLUTIONS INCORPORATED IN AN ELECTRONIC FILE TITLED '20200330_Yr5 Surfaces.dwg'.
4. 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'.
5. EXISTING FAULT TRACES PROVIDED BY FMI TYRONE IN APRIL 2020 IN A ELECTRONIC FILE TITLED 'FAULTS.dwg'. UPDATED BASED ON INFORMATION PROVIDED BY TYRONE GEOLOGY DEPARTMENT.

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1" = 400' FEET
PAPER SIZE: ANSI D 34"X11"

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

PROJECT
LITTLE ROCK 2020 CCP UPDATE
STOCKPILE STABILITY

CONSULTANT

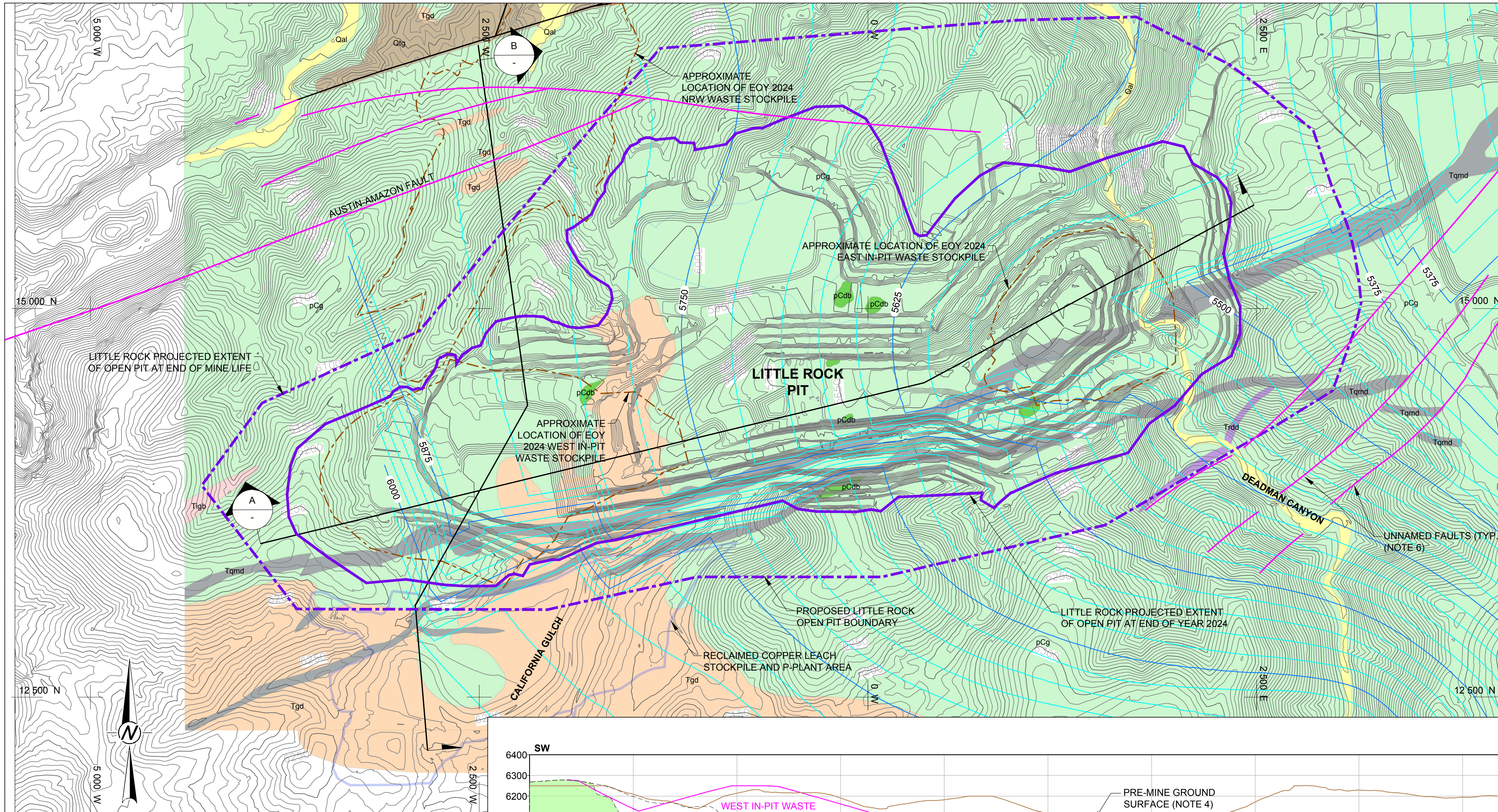
wsp GOLDER

YYYY-MM-DD	2022-03-28
DESIGNED	KDP
PREPARED	KDP
REVIEWED	TS
APPROVED	TW

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

PROJECT NO. 20136957
REV. 3
FIGURE 2

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D



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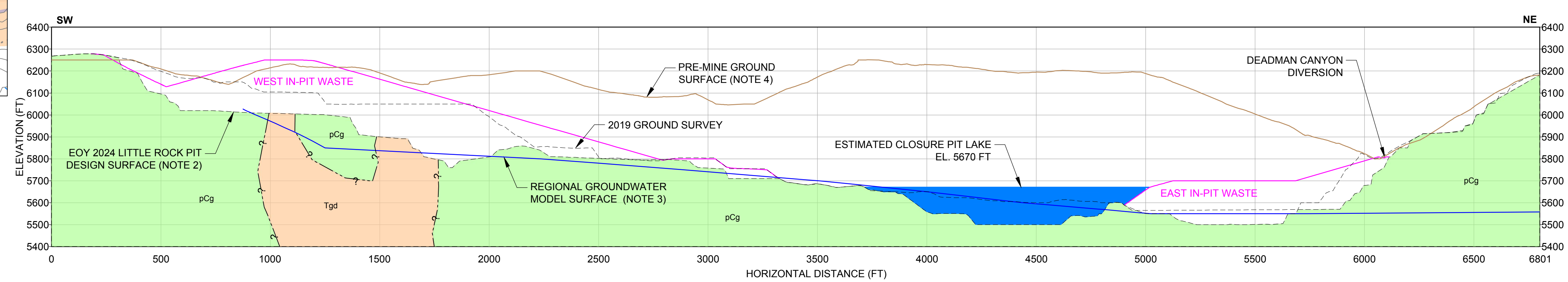
1" = 400' FEET
PAPER SIZE: ANSI D 34"X11"

LEGEND

- PREMINE SURFACE CONTOURS (NOTE 5, 10 FT CONTOUR INTERVAL)
- REGIONAL GROUNDWATER MODEL CONTOURS WITH DEWATERING EFFORTS (NOTE 4, 25 FT CONTOUR INTERVALS)
- APPROXIMATE EXISTING PIT AND DUMP LIMITS
- RECLAIMED COPPER LEACH STOCKPILE AND P-PLANT AREA
- Qal QUATERNARY ALLUVIAL DEPOSITS (NOTE 1)
- Qg QUATERNARY MANGAS CONGLOMERATE (NOTE 1)
- QTg QUATERNARY-TERTIARY GILA CONGLOMERATE (NOTE 1)
- Tgd TERTIARY GRANODIORITE (NOTE 1)
- Tqmd TERTIARY QUARTZ MONZONITE PORPHYRY DIKE (NOTE 1)
- pCg PRECAMBRIAN GRANITE (NOTE 1)
- Trdd TERTIARY RHYODACITE DIKE (NOTE 1)
- pCdb PRECAMBRIAN DIABASE (NOTE 1)
- Tigb TERTIARY IGNEOUS BRECCIA (NOTE 1)

SOURCE

1. EXISTING LOCAL GEOLOGY FROM TYRONE CLOSURE/CLOSEOUT PLAN REVISED FIGURE 2-4, DBS&A, 2021. MAP WAS DEVELOPED BASED ON DATA FROM TYRONE BLOCK MODEL (2003) AND HEDLUND, 1978, GEOLOGIC MAP OF THE TYRONE QUADRANGLE, GRANT CO., NM, USGS MISC.
2. EXISTING TOPOGRAPHY CONTOURS PROVIDED BY FREEPORT MCMORAN IN 2021 IN AN ELECTRONIC FILE TITLED '_JUN_2019_EOM_CONTOURS.dwg'.
3. REGIONAL GROUNDWATER MODEL CONTOURS PROVIDED BY FMI TYRONE ON APRIL 3, 2020 IN AN ELECTRONIC FILE TITLED 'wle_regional_2019_2Q.DWG'.
4. PRE-MINE BEDROCK SURFACE INTERPRETED FROM CONTOURS PROVIDED BY FMI TYRONE IN AN ELECTRONIC FILE TITLED 'Underdump.dwg'.
5. 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'.
6. EXISTING FAULT TRACES PROVIDED BY FMI TYRONE IN APRIL 2020 IN A ELECTRONIC FILE TITLED 'FAULTS.dwg'. UPDATED BASED ON INFORMATION PROVIDED BY TYRONE GEOLOGY DEPARTMENT IN 2021.



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A WEST TO EAST CROSS SECTION

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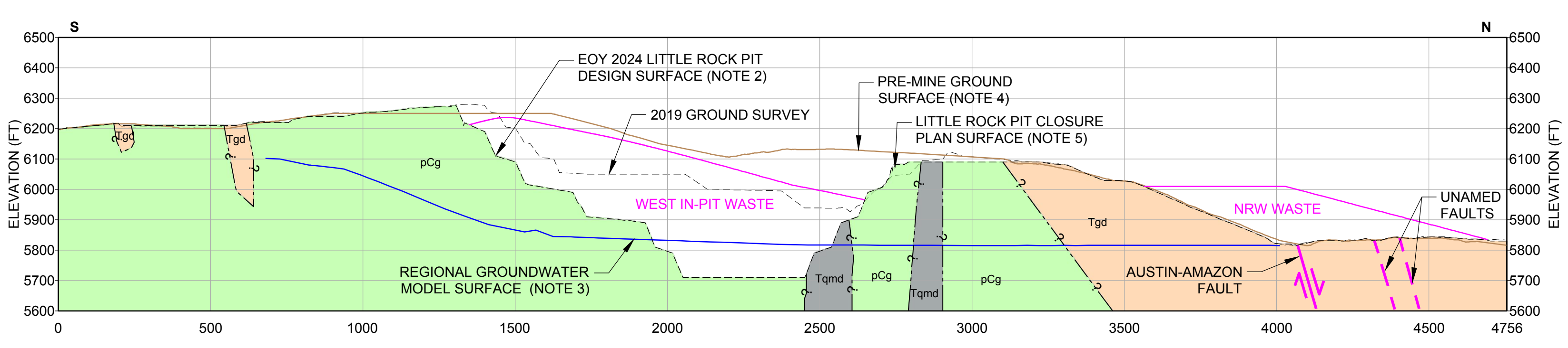

HOR. SCALE 1" = 300'
VERT. SCALE 1" = 300'
B NORTH TO SOUTH CROSS SECTION

CLIENT	FREEPORT-MCMORAN TYRONE INC. GRANT COUNTY, NEW MEXICO
PROJECT	TYRONE CLOSURE/CLOSEOUT PLAN TYRONE MINE STOCKPILE STABILITY
CONSULTANT	WSP GOLDER
YYYY-MM-DD	2022-03-28
DESIGNED	KDP
PREPARED	KDP
REVIEWED	TS
APPROVED	TW
TITLE	LITTLE ROCK AREA BEDROCK AND GROUNDWATER
PROJECT NO.	20136957
REV.	3
FIGURE	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI D

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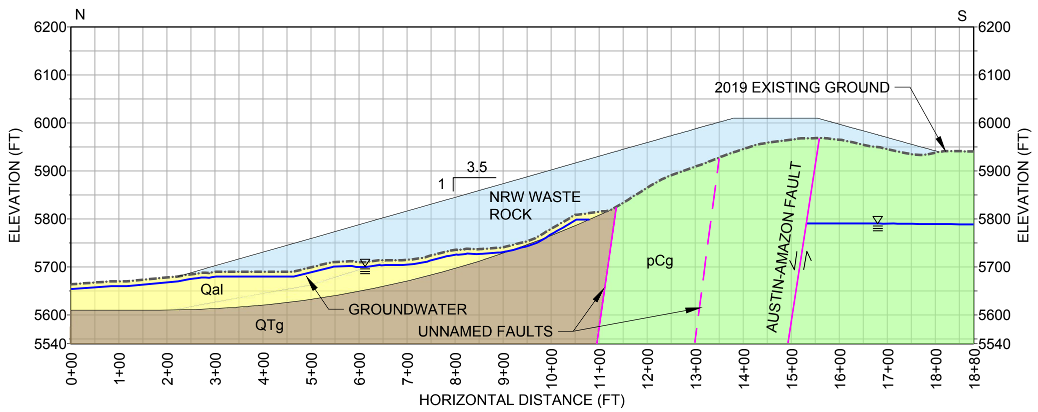

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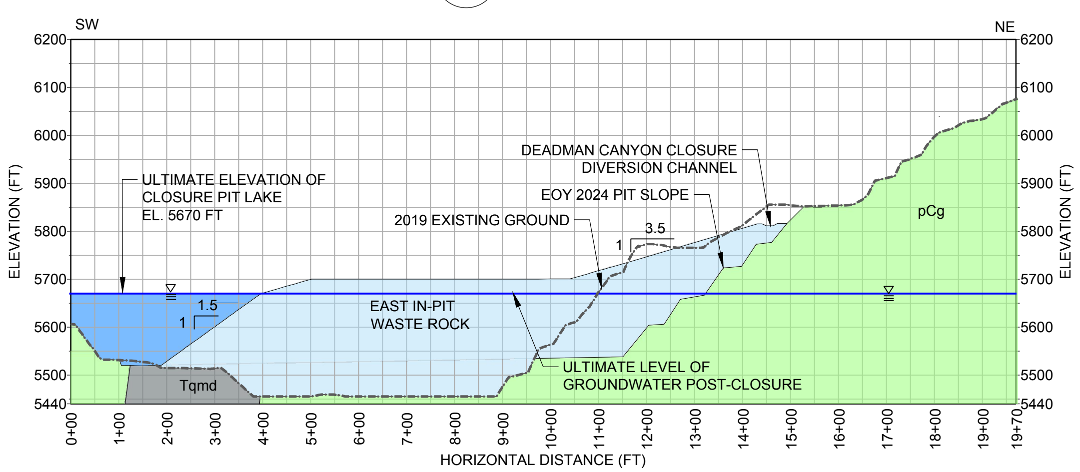

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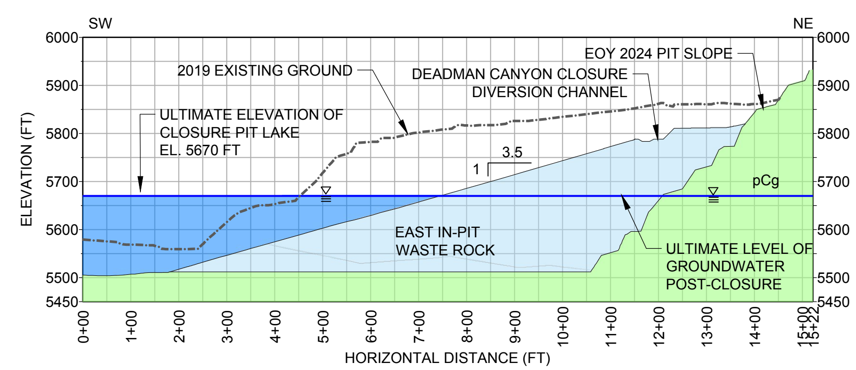


SCALE 1" = 200' LR-E2 / 2 EAST IN-PIT WASTE SECTION

LEGEND

- 2019 Q2 REGIONAL GROUND WATER LEVEL (NOTE 7)
- MAPPED FAULT TRACE (NOTE 6)
- Qal — QUATERNARY ALLUVIAL DEPOSITS (NOTE 1)
- Qg — QUATERNARY MANGAS CONGLOMERATE (NOTE 1)
- QTg — QUATERNARY-TERTIARY GILA CONGLOMERATE (NOTE 1)
- Tgd — TERTIARY GRANODIORITE (NOTE 1)
- Tqmd — TERTIARY QUARTZ MONZONITE PORPHYRY DIKE (NOTE 1)
- pCg — PRECAMBRIAN GRANITE (NOTE 1)
- Trdd — TERTIARY RHYODACITE DIKE (NOTE 1)
- pCdb — PRECAMBRIAN DIABASE (NOTE 1)
- Tigb — TERTIARY IGNEOUS BRECCIA (NOTE 1)
- APPROXIMATE LIMIT OF CLOSURE PIT LAKE (NOTE 5)

0 200 400
1" = 200' FEET

SOURCE

1. EXISTING LOCAL GEOLOGY FROM TYRONE CLOSURE/CLOSEOUT PLAN REVISED FIGURE 2-4, DBS&A, 2021. MAP WAS DEVELOPED BASED ON DATA FROM TYRONE BLOCK MODEL (2003) AND HEDLUND, 1978, GEOLOGIC MAP OF THE TYRONE QUADRANGLE, GRANT CO., NM, USGS MISC.
2. EXISTING 2019 TOPOGRAPHY CONTOURS PROVIDED BY FREEPORT MCMORAN IN 2021 IN AN ELECTRONIC FILE TITLED '_JUN_2019_EOM_CONTOURS.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. LITHOLOGY OUTSIDE OF BLOCK MODEL INTERPRETED FROM DISCUSSIONS WITH TYRONE GEOLOGY DEPARTMENT IN 2021.
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'. ADDITIONAL UPDATES PROVIDED BY TYRONE GEOLOGY DEPARTMENT IN 2021.
7. REGIONAL GROUNDWATER MODEL CONTOURS PROVIDED BY FMI TYRONE ON APRIL 3, 2020 IN AN ELECTRONIC FILE TITLED 'wle_regional_2019_2Q.DWG'. PERCHED WATER TABLE DEPTH WITHIN THE Qal ASSUMED TO BE AT 10 FEET BELOW GROUND SURFACE FOR STABILITY MODELS.

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

PROJECT
LITTLE ROCK 2020 CCP UPDATE
STOCKPILE STABILITY

CONSULTANT
WSP GOLDER

YYYY-MM-DD	2022-03-28
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	3	4

APPENDIX A

Stability Output

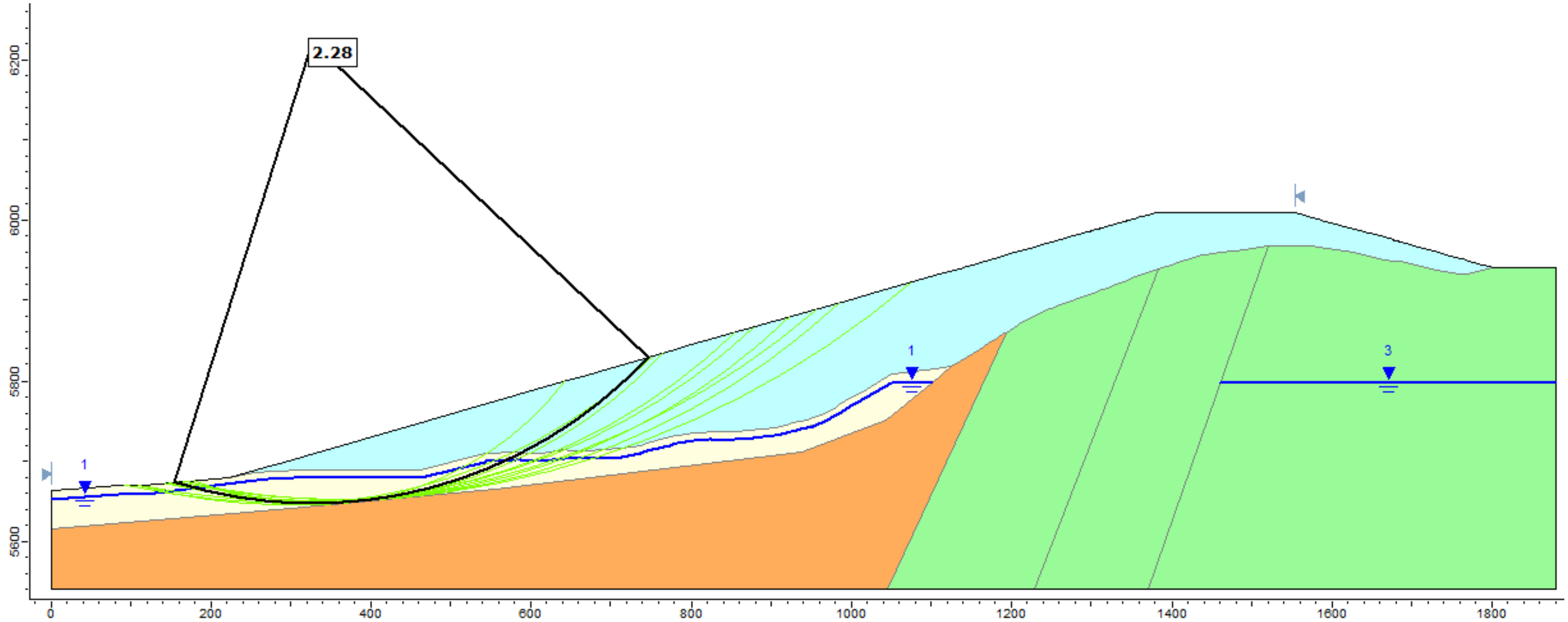
Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Qal - Quaternary Alluvial Deposits		125	138	Mohr-Coulomb	0	29	Water Surface	Custom	1	
Qal - Alluvium (liquefied)		125	138	Mohr-Coulomb	0	8	Water Surface	Custom	1	
QTg - Quaternary Mangas Congolomerate		125	138	Mohr-Coulomb	1000	35	Water Surface	Custom	1	
Tgd - Tertiary Granodiorite		160	160	Mohr-Coulomb	48960	35	Water Surface	Custom	1	
Tqmd - Tertiary Quartz Monzonite Porphyry Dike		160	160	Mohr-Coulomb	96336	43	Water Surface	Custom	1	
pCg - Precambrian Granite		160	160	Mohr-Coulomb	48960	35	Water Surface	Custom	1	
Waste Rock		125	138	Mohr-Coulomb	1656	30.9	Water Surface	Custom	1	
Water		62.4		No strength			None			0

MODELLED MATERIAL PROPERTIES

GOLDER

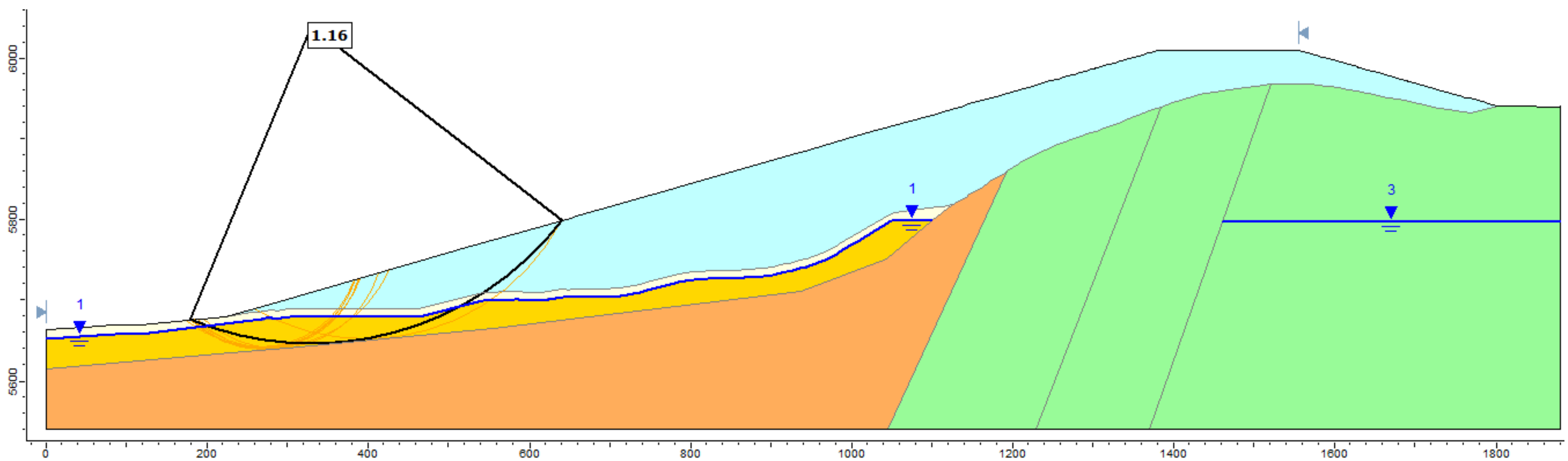
SLIDEINTERPRET 8.014

Project	FMI – Tyrone: Little Rock Closure Close-out Plan Update REV 2
Analysis Description	SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
Figure	A1
Company	FMI - Tyrone
Date	2-25-2022
File Name	



SECTION: *NSW 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		REV 2
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A2		*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 2-25-2022		*File Name*

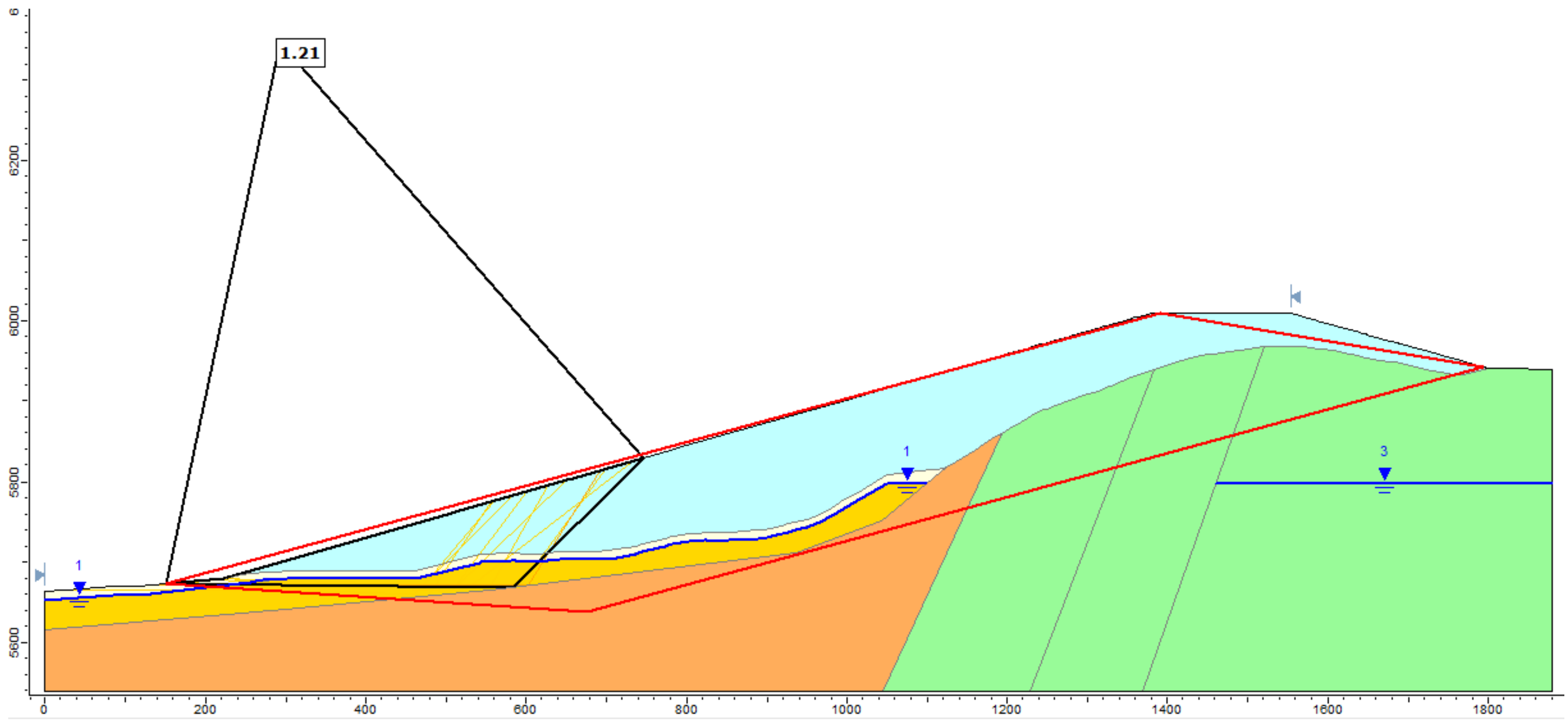


SECTION: *NSW WASTE: LR-N1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *CIRCULAR, STATIC, Post-Liquefied Qal*

GOLDER

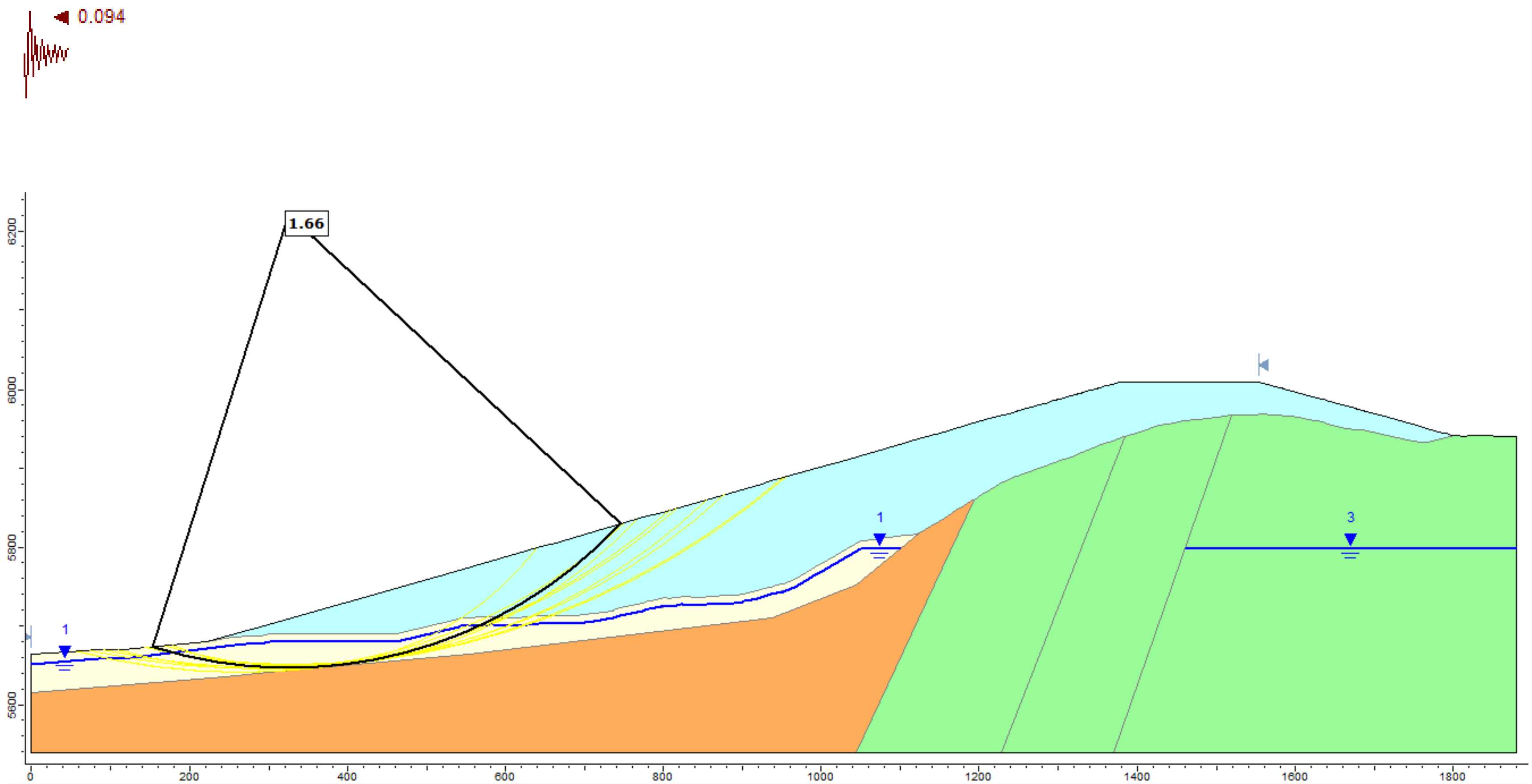
Project FMI – Tyrone: Little Rock Closure Close-out Plan Update	REV 2
Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)	
Figure A3	*Company* FMI - Tyrone
Date 2-25-2022	*File Name*

SLIDEINTERPRET 8.014



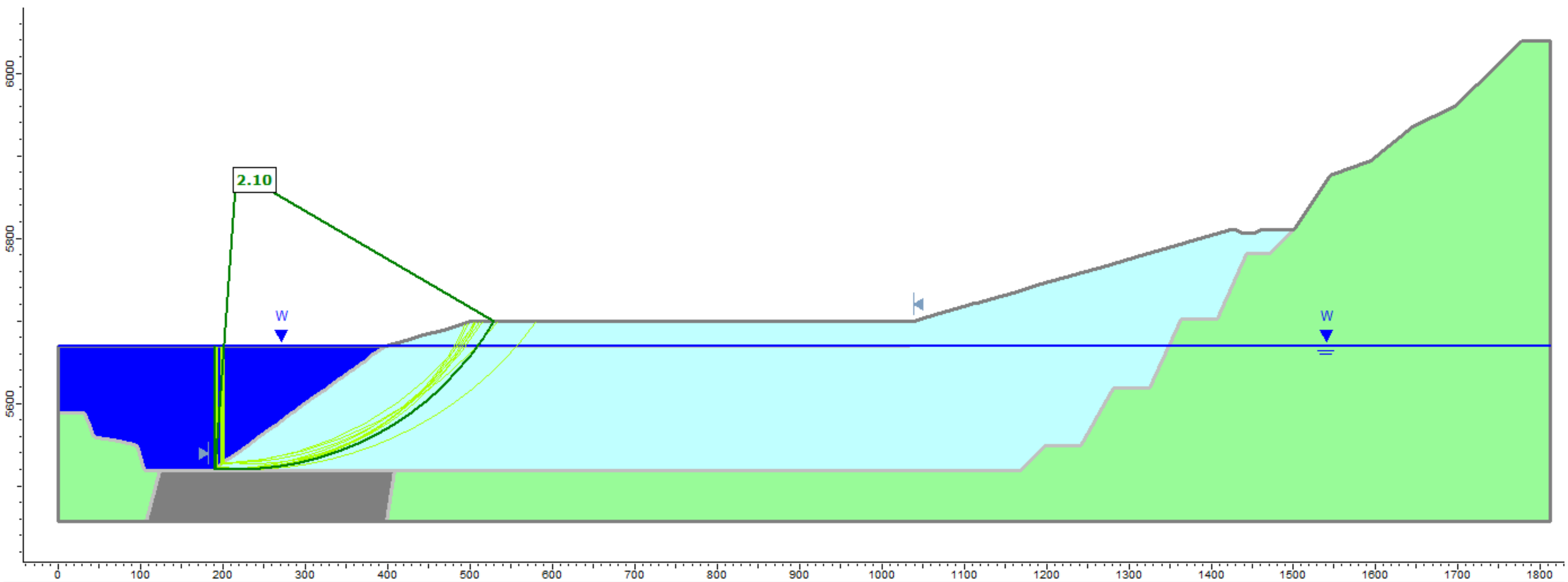
SECTION: *NSW WASTE: LR-N1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *BLOCK, STATIC, Post-Liquefied Qal*

GOLDER	Project: FMI – Tyrone: Little Rock Closure Close-out Plan Update		REV 2
	Analysis Description: SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure: A4	Company: FMI - Tyrone	
SLIDEINTERPRET 8.014	Date: 2-25-2022	File Name	



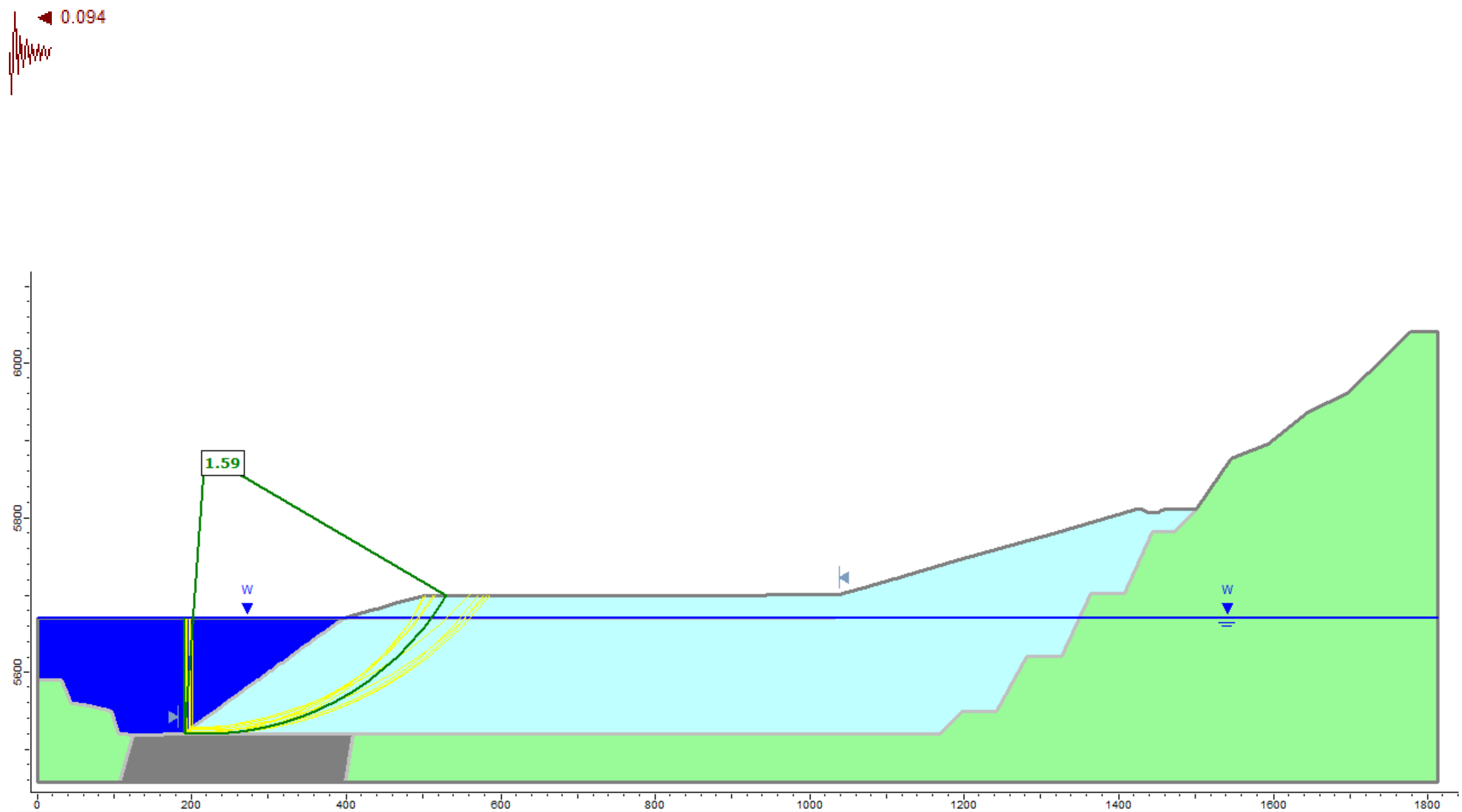
SECTION: *NSW WASTE: LR-N1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *MODELLED WATER TABLE*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update REV 2
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
	Figure A5 — *Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 2-25-2022 — *File Name*



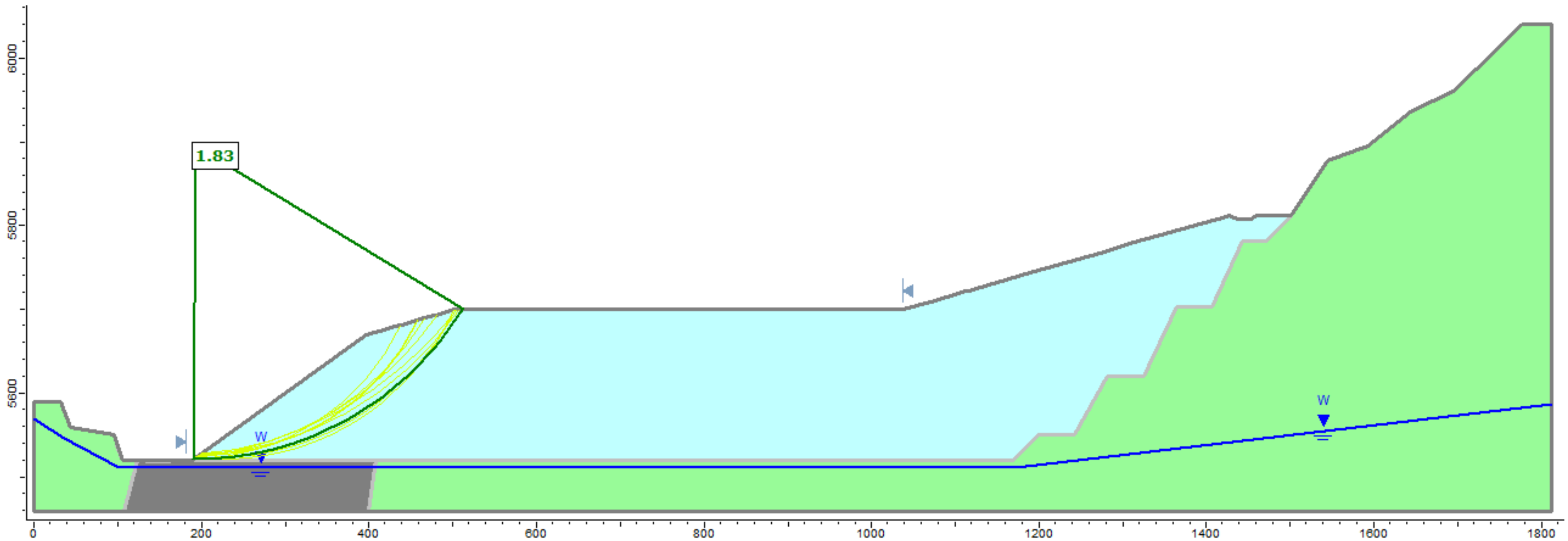
SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER	Project: FMI – Tyrone: Little Rock Closure Close-out Plan Update		REV 2
	Analysis Description: SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure: A6	Company: FMI - Tyrone	
SLIDEINTERPRET 8.014	Date: 2-25-2022	File Name	



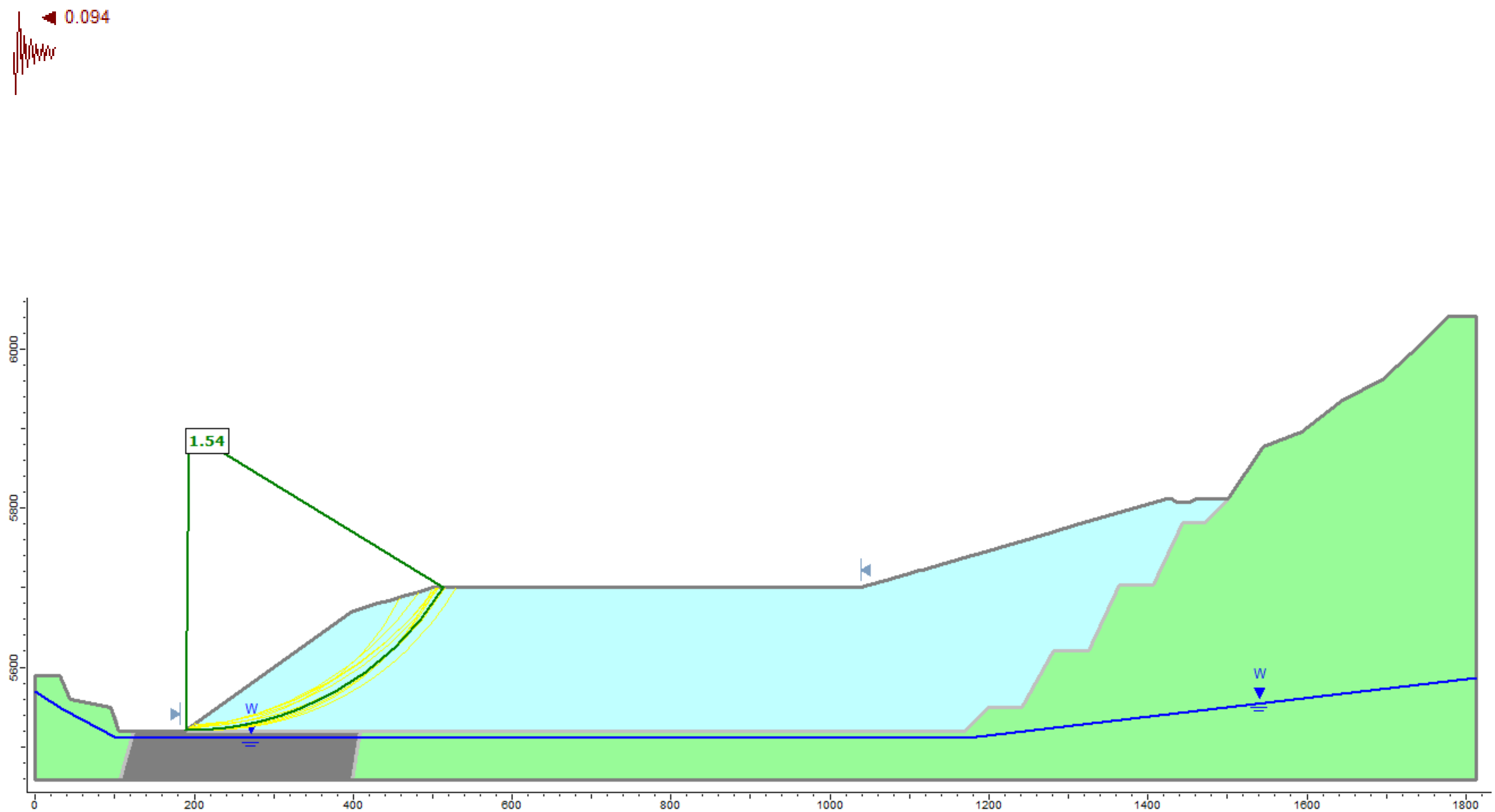
SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	Project	FMI – Tyrone: Little Rock Closure Close-out Plan Update	REV 2
	Analysis Description	SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)	
	Figure	A7	Company: FMI - Tyrone
SLIDEINTERPRET 8.014	Date	2-25-2022	File Name



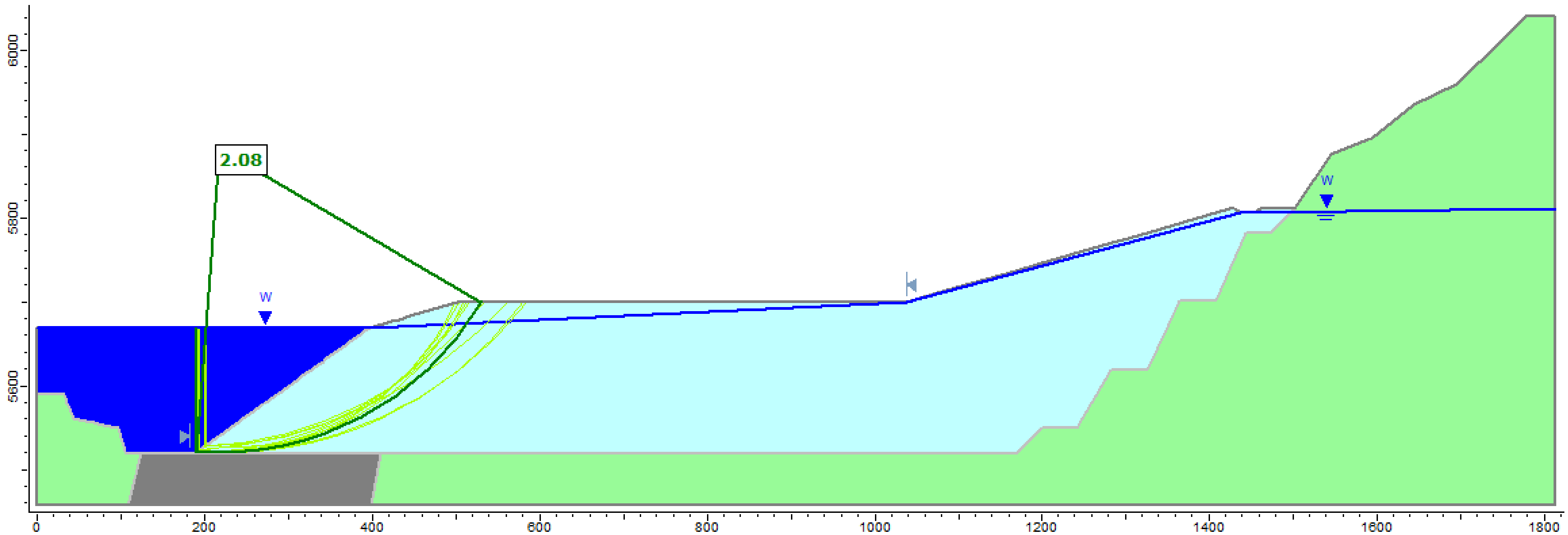
SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *NO PIT LAKE – DEWATERED PIT*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER	Project: FMI – Tyrone: Little Rock Closure Close-out Plan Update		REV 2
	Analysis Description: SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure: A8	Company: FMI - Tyrone	
SLIDEINTERPRET 8.014	Date: 2-25-2022	File Name:	



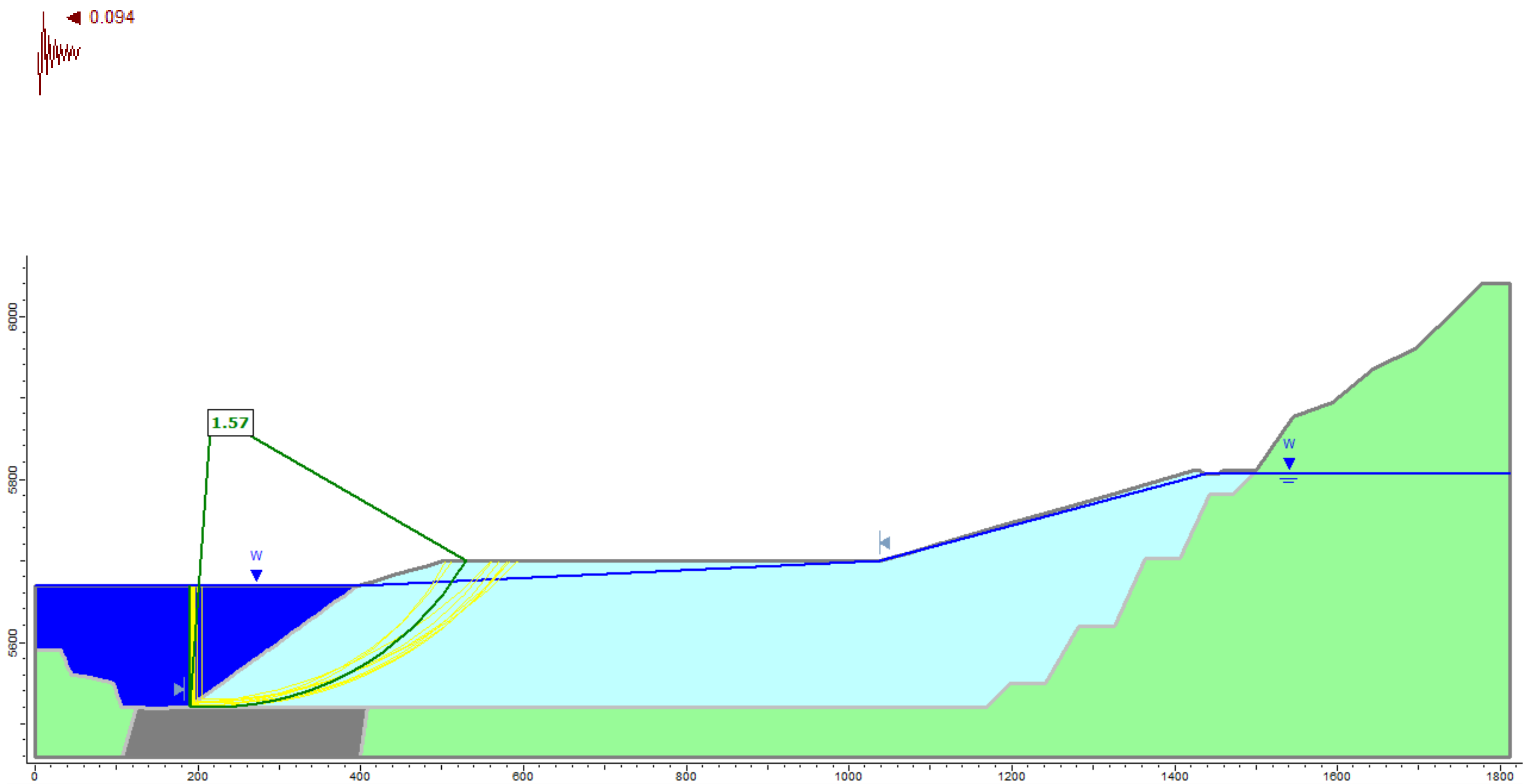
SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *NO PIT LAKE – DEWATERED PIT*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	Project: FMI – Tyrone: Little Rock Closure Close-out Plan Update		REV 2
	Analysis Description: SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure: A9		Company: FMI - Tyrone
SLIDEINTERPRET 8.014	Date: 2-25-2022		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		REV 2
	Analysis Description: SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure: A10		Company: FMI - Tyrone
SLIDEINTERPRET 8.014	Date: 2-25-2022		File Name:

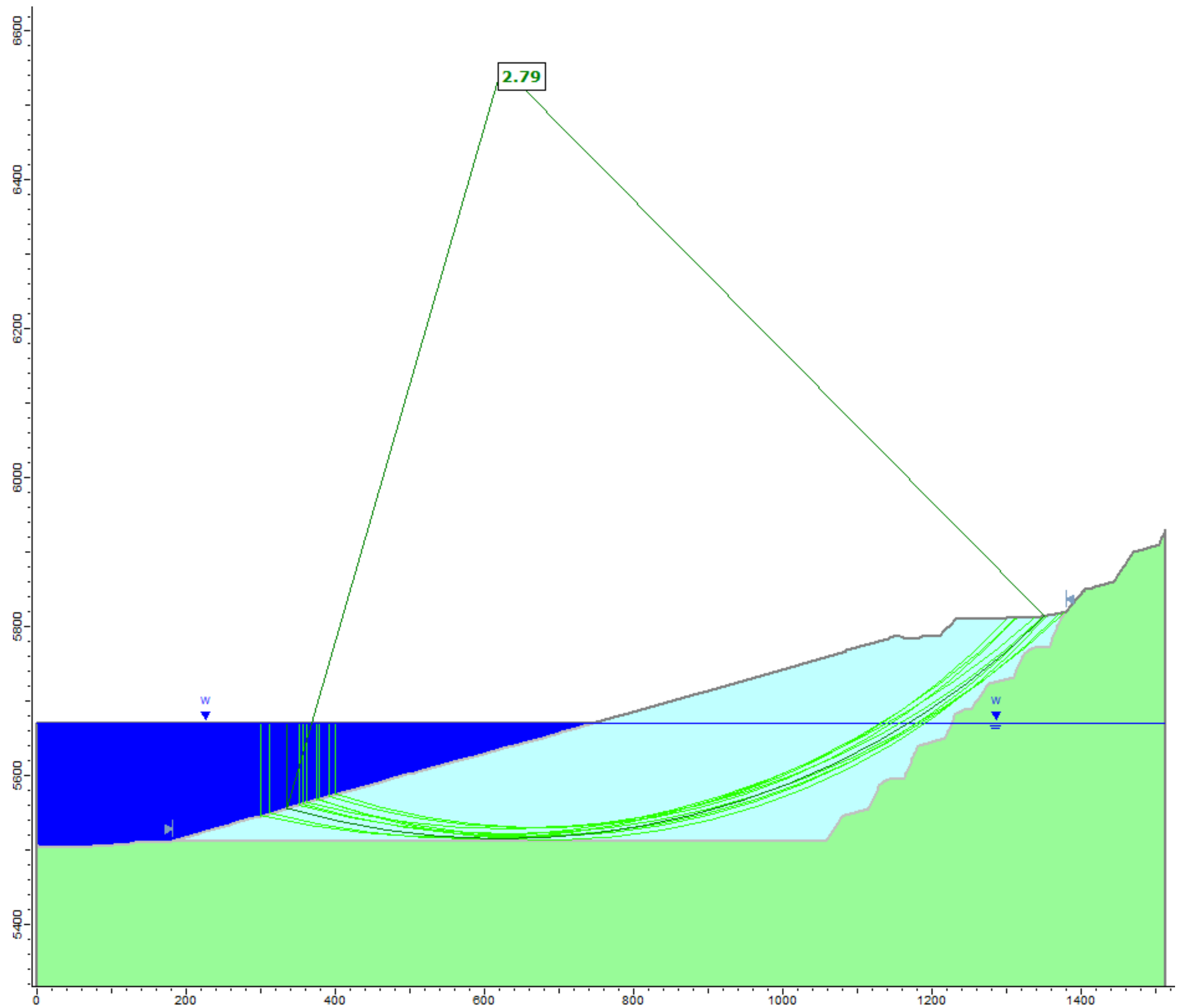


SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT AND RAISED WATER TABLE FROM DEADMAN CANYON IN-PIT DIVERSION*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER

Project FMI – Tyrone: Little Rock Closure Close-out Plan Update	REV 2
Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)	
Figure A11	*Company* FMI - Tyrone
Date 2-25-2022	*File Name*

SLIDEINTERPRET 8.014

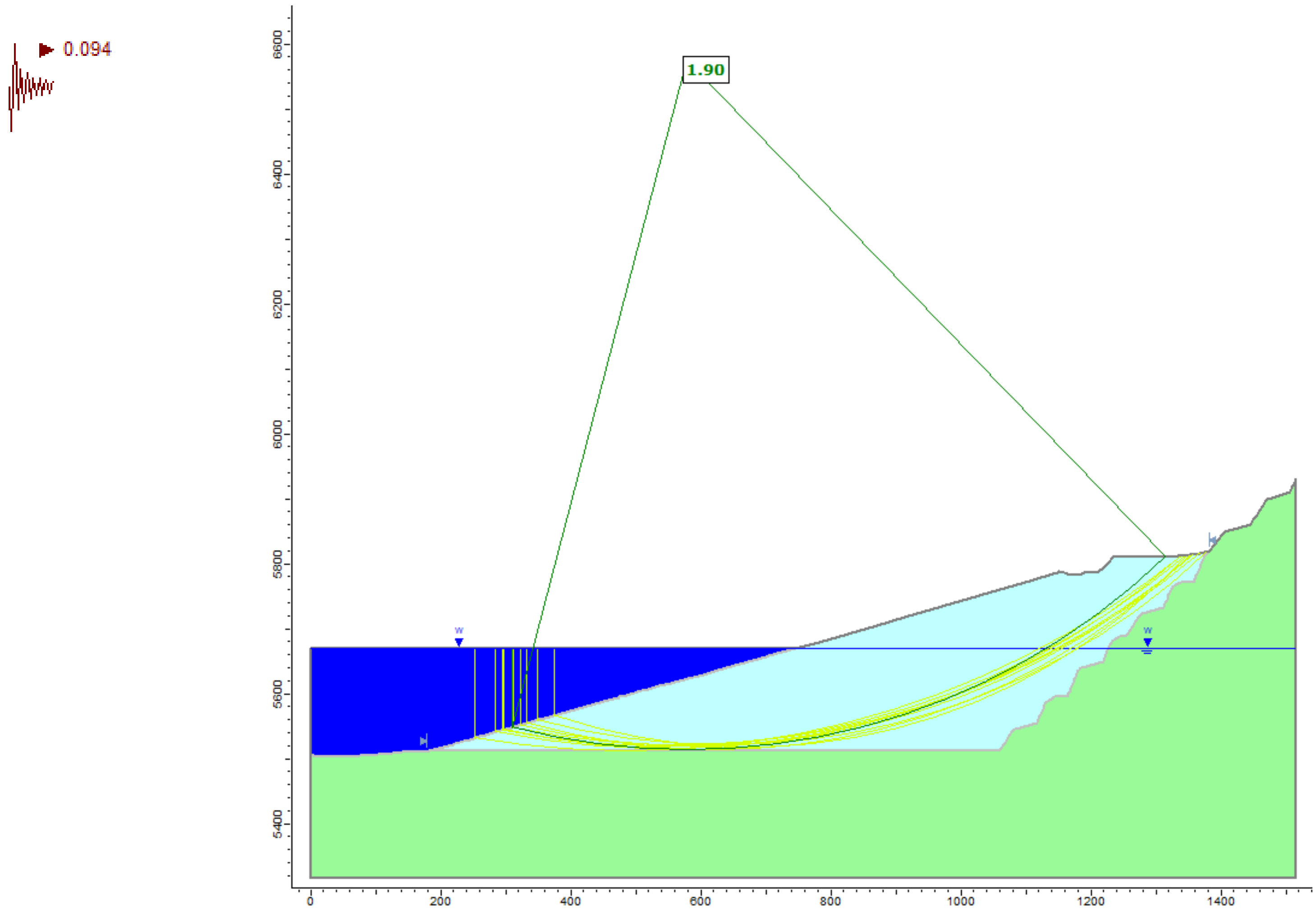


SECTION: *EAST IN-PIT WASTE: LR-E2*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER

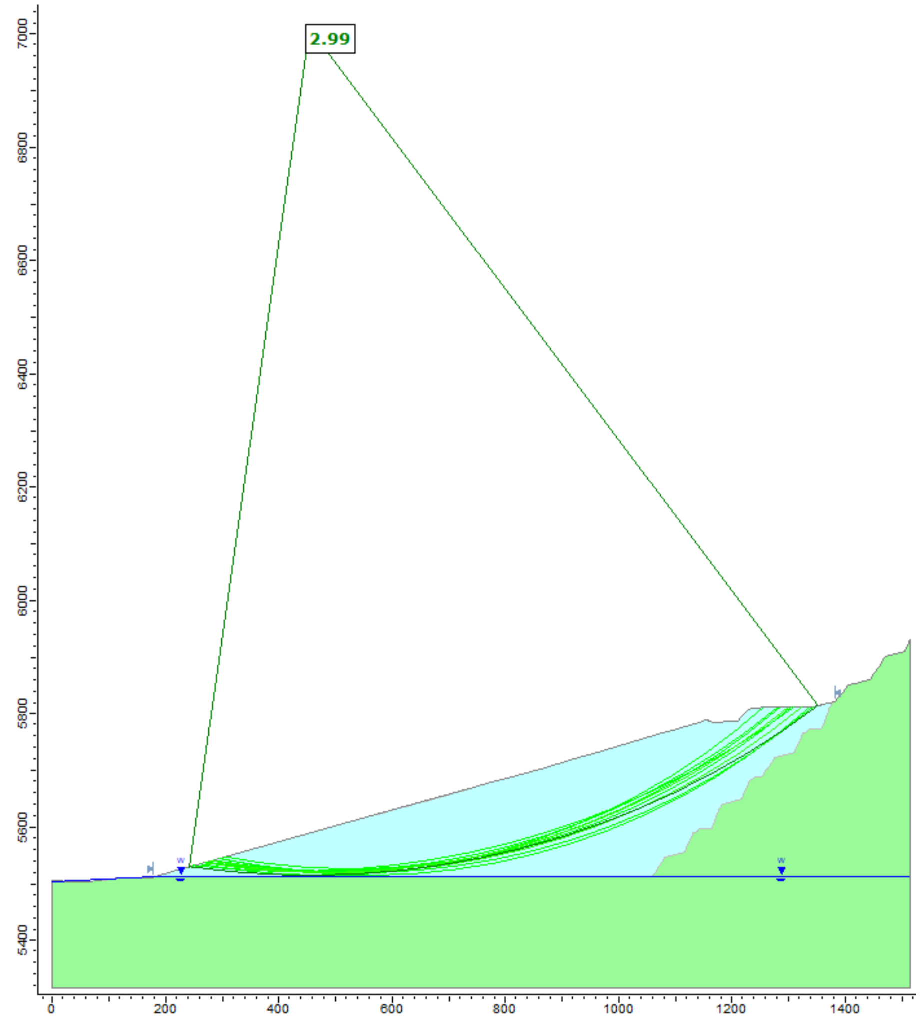
SLIDEINTERPRET 8.014

Project	FMI – Tyrone: Little Rock Closure Close-out Plan Update — REV 2
Analysis Description	SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)
Figure	A12
Company	FMI - Tyrone
Date	2-25-2022
File Name	



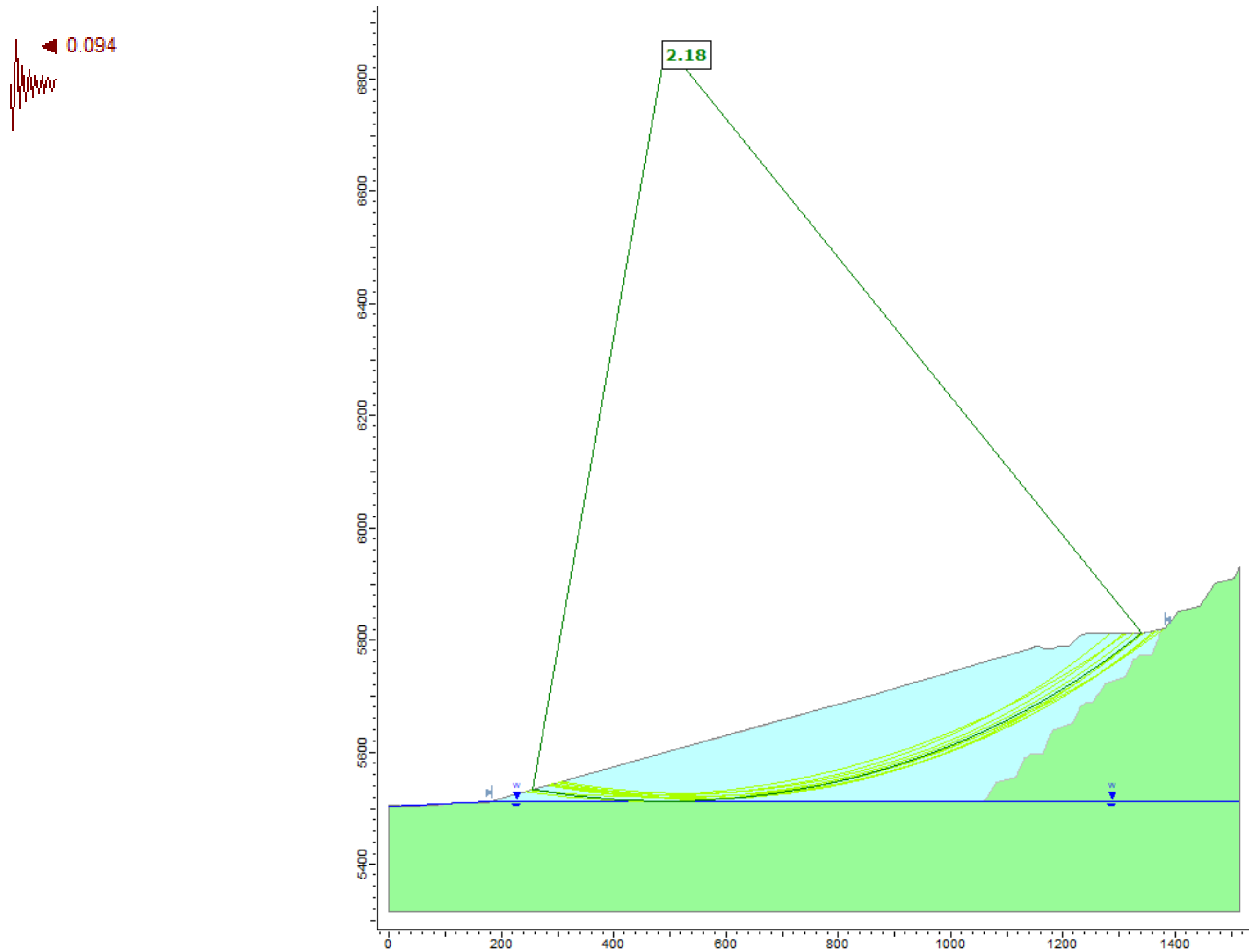
SECTION: *EAST IN-PIT WASTE: LR-E2*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *PIT LAKE AT EL. 5670 FT*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		REV 2
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A13	*Company* FMI - Tyrone	
SLIDEINTERPRET 8.014	*Date* 2-25-2022	*File Name*	



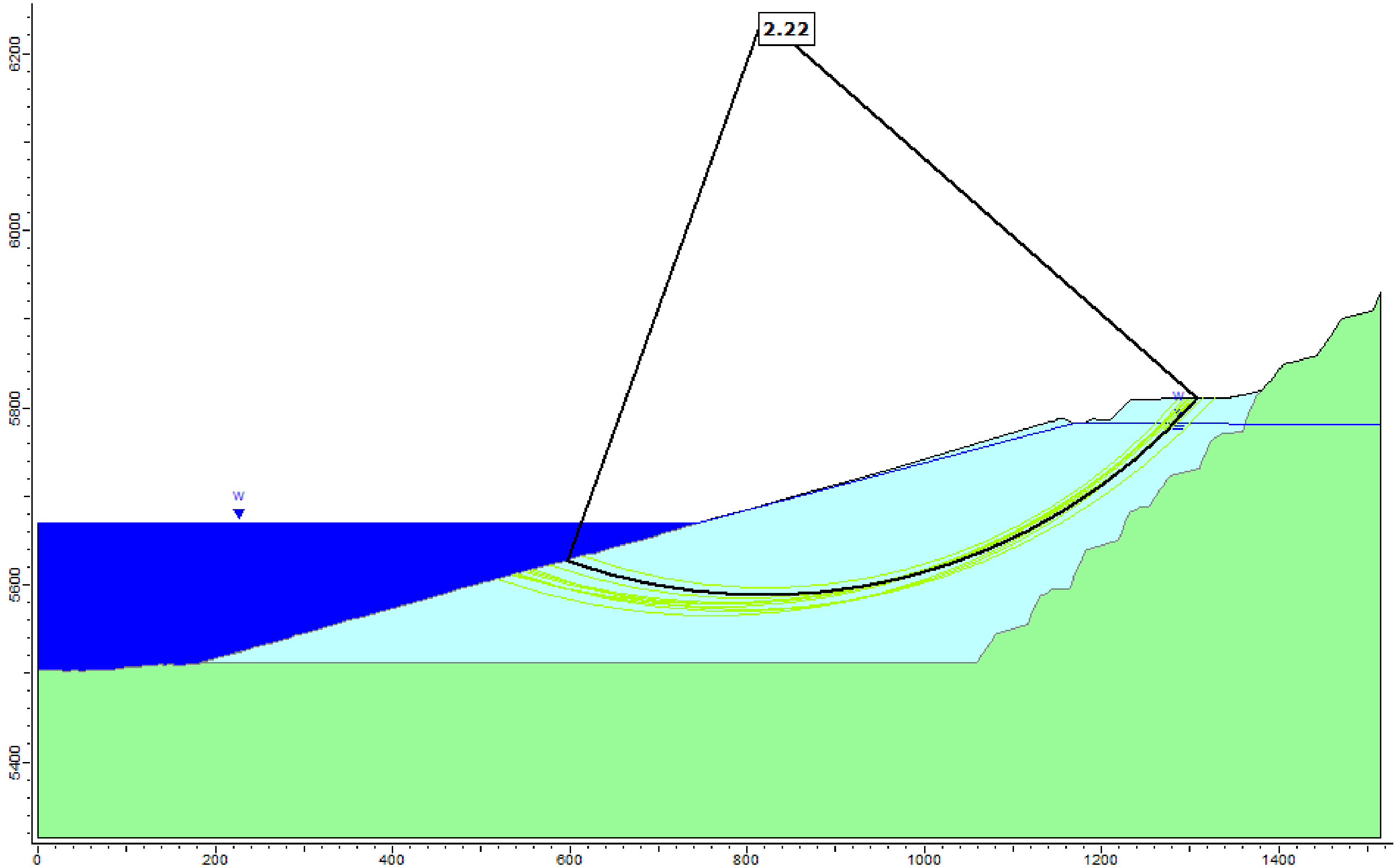
SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *NO PIT LAKE – DEWATERED PIT*
FAILURE /CONDITONS: *CIRCULAR, STATIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update REV 2		
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A14		*Company* FMI - Tyrone
SLIDEINTERPRET 8.014	*Date* 2-25-2022		*File Name*



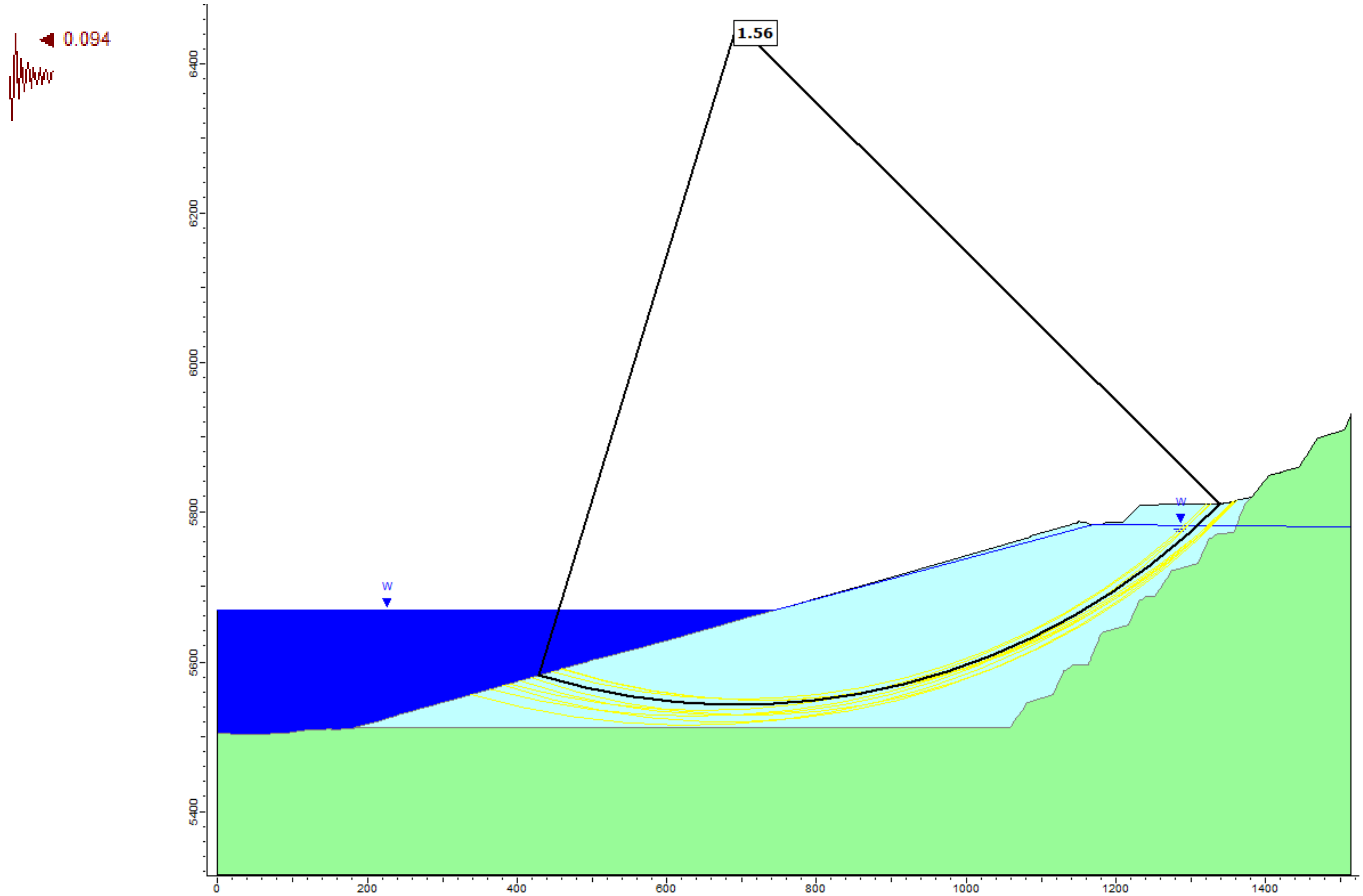
SECTION: *EAST IN-PIT WASTE: LR-E1*
MINE YEAR: *CLOSURE*
WATER CONDITIONS: *NO PIT LAKE – DEWATERED PIT*
FAILURE /CONDITONS: *CIRCULAR, SEISMIC*

GOLDER	*Project* FMI – Tyrone: Little Rock Closure Close-out Plan Update		REV 2
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A15	*Company* FMI - Tyrone	
SLIDEINTERPRET 8.014	*Date* 2-25-2022	*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		REV 2
	Analysis Description SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
	Figure A16	*Company* FMI - Tyrone	
SLIDEINTERPRET 8.014	*Date* 2-25-2022	*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		REV 2
Analysis Description	SLIDE 2D LIMIT EQUILIBRIUM – (GLE/Morgenstern-Price)		
Figure	A17	Company	FMI - Tyrone
Date	2-25-2022	File Name	

SLIDEINTERPRET 8.014

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