MT. TAYLOR MINE

CLOSEOUT/ CLOSURE PLAN

EXISTING MINE PERMIT #C1002RE
DISCHARGE PERMIT DP-61

RIO GRANDE RESOURCES CORPORATION

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1 INTRODUCTION

1.1 Background

In January 2012 the Mining and Minerals Division (MMD) of the New Mexico Department of Energy, Minerals and Natural Resources issued Permit Revision 10-1 to the existing-mine permit #C1002RE for the Mt. Taylor Mine. In addition to renewing the Standby status for the mine, Permit Revision 10-1 required the owner, Rio Grande Resources (RGR), to update the Closeout Plan to reflect current regulatory standards and site conditions while the Mine Permit is in Standby status and before the mine returns to Active status through a subsequent permit revision if required under 19.10.5.505 NMAC. In addition, the New Mexico Water Quality Control Commission, through 20.6.2.3107 A (11) NMAC as enforced by the Mining Act Compliance Section (MACS) of the New Mexico Environment Department's Ground Water Quality Bureau (NMED-GWQB), requires a closure plan under Discharge Permit DP-61. Both the mine permit and the discharge plan require reclamation of some of the mine facilities as well as financial assurance (FA) to cover the cost of such reclamation. Because the mine closeout plan and the discharge permit closure plan have common elements and similar FA requirements, the MMD and MACS have agreed that RGR can submit one document, this Closeout/ Closure Plan, including one cost estimate, that satisfies the requirements of both agencies, with MMD taking the lead in coordinating the regulatory review and approval process.

This submittal has been prepared to update the mine closeout plan and incorporate discharge permit closure requirements relevant to the actual conditions as they exist at the time of this submittal. The closeout plan was originally submitted in 1998 by RGR as a revision to its existing-mine permit #C1002RE in accordance with the New Mexico Mining Act, NMSA 1978, Section 69-36-1 Section 69-36-11B(3) and (4), and the New Mexico Mining Act Rules subparts 506.A and 506.B of 19.10.5 NMAC . DP-61 was originally approved in 1979 and was subsequently modified and renewed in 1984 and 1989, and amended to include a closure plan in 1995. The mine permit #C1002RE closeout plan and DP-61 closure plan, both submitted in 1998, anticipated that the primary post-mining land use of the mine site and most facilities would be a water supply project and that substantially more waste rock would be disposed of on the mine site. Neither of those conditions is applicable to the existing conditions at the mine and, therefore, they are not included in this update.

This Closeout/ Closure Plan describes the existing disturbances caused by mining and the measures that will be taken to reclaim the disturbed land for post-mining land uses and to satisfy the requirements of relevant environmental standards.

The following sections contain a description of the mine site and mining-related disturbances (section 2), proposed post-mining land uses and related ecosystems (section 3), waiver of a self-sustaining ecosystem (section 4), closeout measures to achieve the post-mining land uses (section 5), and environmental monitoring and reporting requirements (section 6). Other environmental standards and permits required for closeout are addressed in section 7. Section 8 addresses the closeout schedule. The cost estimate for closeout is discussed in section 9.

1.2 Project Description

Rio Grande Resources Corporation (RGR) is owner and operator of the Mt. Taylor Uranium Mine located in Cibola County, New Mexico in Section 24, T13N, R8W, NMPM (Figure 1-1). The mine site is 1/2 mile northeast of the Village of San Mateo and is accessible from New Mexico State Route 605. At the time of this submittal, the mine remains on standby after mining operations were suspended in 1990 due to the depressed uranium market. The mine extracts uranium ore from depths of over 3,000 feet below ground surface using room-and-pillar and stope mining methods. There are no mill facilities present within the proposed permit area. The underground mine is a room-and-pillar mine consisting of drifts, stopes and stations that connect to two 3300-foot deep shafts from the mine surface. Potential mine subsidence was evaluated as part of the mine permit application in 1994 (Rio Grande Resources, 1994) and would be limited to 300 feet above the mine workings, leaving overlying aquifers and ground surface unaffected.

The Mt. Taylor Mine units described in the Mine Permit Application of December 1994 remain unchanged. Of the 4006.7 acres included in the permit area, the mine surface facilities are located on 285.6 acres, of which approximately 148 acres are disturbed land and the remaining 137.9 acres are undisturbed. The Mine Unit, consisting of the underground workings, shafts, and conduits, has no surface disturbance other than that included in the Service and Support Facilities Unit (shaft collars, vent raises). The disturbed land consists of:

- Support (Service and Support) Facilities – 93.0 acres
- Mine Water Treatment Area - 28 acres

- Ore Stockpile - 6.8 acres
- Waste Pile - 11.5 acres
- Storm Water Retention Ponds (2) - 3.7 acres
- Access Road - 4.7 acres

These facilities are shown on Figure 1-2 and described in more detail in the mine permit and the closeout drawings (Appendix A).

The Treated Mine Water Discharge Pipeline extends 4.3 miles from the Mine Water Treatment Unit (MWTU) area to the outfall point north of the mine. Up to 15 acres, most beyond the mine surface area, could be disturbed when the pipeline is removed.

A maintained gravel access road, NM 334, bisects the mine site. This is a state road and right-of-way, maintained by Cibola County, that provides public access to the west edge of the Cibola National Forest; it is not part of the mine permit area, and not subject to closeout. However, surface disturbance will be required to remove soil with elevated levels of radium and uranium.

1.3 Project History

Prior to 1971, when Gulf Mineral Resources Corporation acquired the property, there was no mining within the permit area of the Mt. Taylor Mine. However, some disturbance for exploratory drilling and access roads was created before 1971.

The Mt. Taylor Mine was developed in the 1970's by Gulf Mineral Resources Company. After excavation of the two 3,300 foot shafts during a five-year period, Gulf started production in 1980. Production continued until September 30, 1982, when the market price of uranium fell dramatically, resulting in the temporary cessation of production by Gulf. Mine pumps continued pumping mine water during this shut-down period. Ownership was transferred to Chevron Resources Company in 1985 when the two companies merged. Chevron suspended production of uranium ore in 1990 due to low market price for uranium. RGR acquired the mine and other Chevron property in 1991. The mine has not produced since RGR purchased the property because of the continued low market price for uranium, and facility descriptions remain unchanged from those provided in previous renewals of this plan. Mine

operation will resume after the mine permit (# CI002RE), issued by the Mining and Minerals Division, is revised to Active status about year 2014.

To gain access to the ore zones, the mine had to be dewatered, and the mine water was treated before discharge. Large-scale pumping of water from wells at depths of down to about 3,300 feet began in the mid-1970's.

The mine historically produced uranium using conventional underground mining methods from ore zones of the Morrison Formation at depths of more than 3000 feet below ground surface. Approximately 675,085 tons of ore and approximately 698,000 tons of waste rock have been mined. The ore was shipped off site for milling. Waste rock from shaft sinking (shaft muck) and from mine development was placed in an on-site waste rock pile.

1.4 Existing and Required Permits

RGR maintains several permits that are relevant to the closeout/ closure of the Mt. Taylor Mine. In addition to the mine permit #C1002RE and DP-61, the other permits related to the mine are listed in Table 1.1.

There are no stationary sources with potential emissions of regulated contaminants associated with closeout activities, so there are no air quality permit requirements for closeout.

A Clean Water Act Section 404 permit may be required from the U.S. Army Corps of Engineers for placement of riprap along the arroyo banks. A 404 permit will be required only if the amount of riprap placed will be more than one cubic yard per running foot or more than 500 feet long. The closeout design volumes will stay below these limits, but if they are exceeded, the work could be done under the Nationwide Permit #13 (Jean Manger, Albuquerque COE office, telcon 4/23/98), which requires a Joint Application for Department of the Army Permit and NM Water Quality Certification.

No other permits are required for closeout of the Mt. Taylor Mine.

2 SITE CHARACTERISTICS

2.1 Site Climate

The climate and air quality of the permit area are described in the Permit Application (RGR, 1994a) and the Environmental Site Assessment (RGR, 1994b). The climate is semi-arid, like most of the state, but the elevation (about 7300 feet above MSL) and orographic effects of Mt. Taylor cause low winter temperatures and frequent high winds that impose some limitations on post-mining land uses and ecosystems. In particular, the climate of the site is not well suited to crop production other than hay, but it has historically allowed livestock grazing. Rainfall is not sufficient to support forest within the area of the surface facilities, where most disturbance has occurred.

2.2 Site Geologic Setting Summary

The geologic setting of the mine has been described in detail in the Baseline Study prepared by NMEI in 1974 and the Site Assessment submitted in 1994. The following summary is derived from those reports. The geologic section is illustrated in Figure 2-1.

The mine level is approximately 3200-3300 feet deep in the Recapture Creek Sandstone member of the Morrison Formation. This member grades laterally into the Westwater Canyon member above. The Westwater Canyon member is quite variable in thickness owing to lensing and vertical gradations into both the Brushy Basin and Recapture Creek members. The lower sandstone unit is about 64 feet thick, while the upper sandstone unit is approximately 123 feet thick in the mine shaft area. These two sandstone units, which carry the uranium ore reserves of the mine, are most often separated by a green shale. The Brushy Basin member conformably overlies and interfingers with the Westwater Canyon member. It measures 80 feet thick and contains uranium ore deposits at several locations in New Mexico.

Between the ore-bearing formations and ground surface is a sequence of sedimentary units approximately 2900 feet thick, starting with the Dakota Sandstone, which unconformably overlies the Brushy Basin member of the Morrison Formation. The Dakota is approximately 58 feet thick and is only slightly mineralized and not mined at the Mt. Taylor Mine. The overlying Mancos Shale, nearly 900 feet thick, is composed chiefly of dark-gray, calcareous, marine clay shale. The Gallup Sandstone interfingers with and conformably overlies the Mancos Shale and is the lowermost member of the Mesaverde group.

The Gallup Sandstone consists of two separate sandstone units separated by 130 feet of dark gray shale. The Crevasse Canyon Formation contains three major members, in ascending order the Dilco Coal, Dalton Sandstone, and Gibson Coal. The Hosta Tongue Sandstone of the Crevasse Canyon Formation, 115 feet thick, is overlaid by another Mancos Shale wedge called the Satan Tongue, consisting of dark gray, sandy shale. The Point Lookout Sandstone, the shallowest aquifer at the mine, is 767 feet deep and approximately 115 feet thick. The Point Lookout aquifer provides the domestic water supply for both the mine and the Village of San Mateo.

The Menefee Formation is the uppermost geologic unit present at the mine. It forms uneven slopes around the mine and near the Village of San Mateo. The formation is composed of interbedded pale yellowish-brown silt stone, fine to medium grained sandstone, gray shale, carbonaceous shale, and thin coal beds. Its thickness at the mine is approximately 767 feet (NMEI, 1974). Mine water treatment pond basins were excavated into the Menefee, and both the manway/vent and production shafts are collared in this formation.

Deposits of Quaternary age exposed in the area consist of unconsolidated talus, alluvial and eolian sediments. Talus, landslides, and black lava blocks cover extensive areas on the slopes adjacent to the high basalt-covered mesas to the south, southwest and east of the mine. Clay, silt, sand, and gravel alluvial lenses underlie the valleys, as well as the lower topographic slopes (NMEI,1974).

2.3 Site Hydrology Summary

The hydrologic conditions of the mine and impacts from mining have been described in detail in the Baseline Study prepared by NMEI in 1974 and the Site Assessment submitted in 1994. The following summary of the surface and ground water hydrology from those reports and updates from more recent observations and studies are provided here as the basis for proposed closeout/closure measures.

2.3.1 Surface Water

Two main surface drainage systems collect both spring water and storm water run-off in the vicinity of the mine. The primary surface water course is San Mateo Creek, located one-half mile south of the mine. The perennial stream is fed with numerous springs in the San Mateo Canyon area, but disappears into the stream bed approximately two miles beyond the Village of San Mateo. During spring peak run-off

and after heavy rain storms, the surface flow may occasionally extend for a brief period farther down San Mateo Creek. Surface water runoff within the permit area occurs only after heavy precipitation on or upstream from the site. The second main drainage system is the Marquez Canyon ephemeral steam, located immediately north of the mine. This deeply incised arroyo collects water during the infrequent heavy rain storms, but otherwise is dry throughout the year. Low-flow springs are located at higher elevations feeding this drainage, but their total flow has never been large enough to be measureable at the mine's elevation. Marquez arroyo flattens out and dissipates into the alluvium about one-half mile west of the mine.

Constructed during mine development in the 1970's, diversion ditches and below-grade collection systems intercept and channel runoff originating on the site to unlined storm water retention ponds where water is evaporated or treated before release. These ditches replace three shallow ephemeral drainage courses that existed prior to mine development (Figure 2-2). Storm water originating directly on the mine site area was channeled into a below-ground storm water collection system (culverts) and passed into either the mine water treatment system before being discharged and pumped off-site or was retained in storm water retention ponds and evaporated. After closure, those diversion ditches that support post-mining land use will remain; otherwise, runoff will be re-directed to existing drainage courses that naturally would receive runoff from the site.

2.3.2 Ground Water

Several aquifers are intersected by the mine shafts and were affected by mine dewatering. These aquifers and the ground water conditions in general are described by NMEI (1974) in the Baseline Study and by a report by Geohydrology Associates, Inc., 1994.

Ground water occurs in some Cretaceous formations and in the sandstones of the Morrison Formation, where the ore bodies are found. These water-bearing strata produce a large amount of water that was removed by pumping during mine operations through 1990 to dewater the ore bodies. This mine water has concentrations of uranium and radium that slightly exceed drinking water standards (Table 2.1), requiring it to be treated for these constituents before release. After the mine water was treated in the Mine Water Treatment Unit, it was transported through a 24-inch, 4.3 mile pipeline across private land, except for approximately a three-quarter mile portion leased from the Federal Forest Lands, to the outfall in San Lucas Canyon north of the mine. The water discharged under NPDES Permit #NM 0028100

into the San Lucas Canyon, normally an ephemeral stream, where it was a source of water for both domestic animals and wildlife. When the mine is operating, the discharge water flows northward from the San Lucas Canyon and disappears approximately 22 miles from the point of discharge after commingling with the San Miguel Creek drainage system; however, no mine water has been discharged since June 25, 1990.

The Village of San Mateo and the mine both have wells reaching approximately 650-900 feet into the Point Lookout Sandstone, the shallowest potable water aquifer at the mine site. . The water chemistry of many of these wells was included in the 1974 Baseline Study. The quality of the Point Lookout water remains very good (Table 2.2), and the aquifer has a large flow potential. The mine began using this water in 1972, whereas the village's water well was drilled in 1976 by Gulf and serves approximately 200 residents.

The NMEI Baseline Study (1974) includes a list of other water wells, most of which are clustered in and around San Mateo. Six wells (three hand-dug) are in the alluvium less than 100 feet deep and nine wells produce from the Upper Menefee Formation from 120 feet to 336 feet deep. Some of these wells are currently being used for watering livestock, but a number of them were plugged off when the Point Lookout water well was drilled for village use by Gulf.

Perched ground water occurs in some locations in the mine area at the alluvium/bedrock contact at 30-60 feet and in shallow, low-volume aquifers elsewhere in the Upper Menefee. On the mine site one perched zone has been investigated for contamination and is currently being addressed in an NMED-approved abatement plan. The shallowest aquifer capable of sustaining a water potable supply in the mine area, the Point Lookout sandstone in the Lower Menefee, has a potentiometric surface at a depth of approximately 500-600 feet below the surface. This sandstone unit is separated vertically from the surface and alluvium by several hundred feet of shale and sandy shale sequences (Figure 2-1) in the Upper Menefee, minimizing the possibility of any seepage water reaching the Lower Menefee aquifer.

2.4 Existing Mine Units

Mt. Taylor Mine is an underground mine, with the ore bodies over 3000 feet below surface, supported by a surface facility. Refer to the Permit Application for details of mine facilities. Ore is mined by drill-and- blast and mechanical methods, raised to the surface in ore skips via shafts, and transported offsite for milling. Due to the extreme depth of the ore, no surface mining has been conducted and no subsidence will reach ground surface (see the 1994 Permit Application for subsidence analysis). Therefore, upon closeout, underground workings will be abandoned and shafts will be plugged.

Surface operations consist of all activities needed for support of underground mining including:

- hoisting of men, materials, and ore
- ventilation and cooling of air for the underground
- removal and treatment of mine water
- disposal of waste rock
- administrative, health and safety, and maintenance services
- stockpiling and loading of ore for offsite milling

The location and identification of existing mine units are shown on Figure 1-2.

2.4.1 Mine

The units in this category consist of all subsurface units of the Mt. Taylor Mine, including shafts and underground workings. The underground mine workings, including all drifts, stopes, and haulageways and other openings for ore extraction are shown on Figure II of the Site Assessment. These underground workings follow the ore body at depths of 3100-3200 feet below ground surface.

The Mt. Taylor Mine has two shafts, the main production or haulage shaft (24-foot shaft) and a manway/ ventilation shaft (14-foot shaft). In addition, two 10 ¾ -inch diameter utility conduits extend from ground surface to mine level. The shafts and conduits penetrate all the geologic units and aquifers described in sections 2.2 and 2.3.

The conduits have steel casings, grouted in place. The annulus between the steel casing and the bored

hole is cement-grouted. The grout isolates the conduit from all aquifers except the Westwater at mine level.

Both shafts have cast-in-place reinforced concrete liners from collar level to mine level. The liner thickness increases with depth, from 1.0 feet at subcollar level to 3.0 feet at mine level. The rock/ concrete contact is pressure-grouted through the saturated section from the Point Lookout aquifer to the shaft stations at mine level, isolating the shafts from the aquifers above mine level and the aquifers from each other. The hydrologic isolation of the shafts and the mine water from the Point Lookout aquifer is demonstrated by the difference in static water levels between the shafts and the Phase I dewatering wells in the Point Lookout aquifer; the shaft water levels are 820 feet below ground surface, or about elevation 6520, versus the water elevation of about 6780 in the Phase I wells in the Point Lookout aquifer. After 22 years without dewatering, this water level difference of 260 feet over a distance of 200-400 feet shows that there is no measurable hydrologic connection between the mine water (Morrison/ Recapture/Westwater) and the Point Lookout. Any connection would have equalized the water levels in the mine shafts to those in the Point Lookout by flow from the Point Lookout to the shafts during the time since pumping stopped. The isolation of mine water from the Point Lookout is also evident from the contrast in water quality between the mine water (Table 2.1) sampled in the 24-foot shaft and the Point Lookout water (Table 2.2) sampled in well 2A.

2.4.2 Mine Dewatering and Mine Water Treatment

These mine facilities include deep wells for removing water from the mine, a Mine Water Treatment Unit (MWTU), and a treated water discharge pipeline. When the mine is operating, these facilities are used to pump, treat, and discharge up to 7,200,000 gallons per day. However, during mine standby, no mine water is being discharged, and these facilities are not in operation.

During initial mine operations, water was pumped from up to 22 deep wells to dewater the mine. These wells are located concentrically around the shafts, as shown on Figure 1-2 and listed in Table 2.3. In addition, two deep monitoring wells (SM in Table 2.3) near the production shaft were installed to measure water levels in and below the mine horizon.

The mine water requires treatment to remove low concentrations of uranium and radium so that the treated water meets drinking water standards. Treatment consists of sediment settlement,

precipitation of radium by flocculation with barium chloride, and an ion exchange circuit for removal of uranium. Treated water is then pumped through a 4.3 mile long, 24-inch pipeline and discharged to San Lucas Canyon (Figure 2-3) under authority of NPDESpermit (# NM0028100). The pipe consists of 1/4-3/8 inch thickness steel sections welded in the field.

The MWTU is regulated under Discharge Plan 61 (DP-61), which was originally approved on July 20, 1979 and subsequently renewed on July 12, 1984, March 30, 1989, and January 24, 1995. DP-61 is currently in the process of timely renewal based on RGR's application dated September 6, 1999.

The MWTU covers 28 acres of land surface within the Mine Permit boundary. The MWTU includes eight hypalon or clay-lined treatment ponds with a total storage capacity of 62.3 acre-feet (20.3 million gallons), the sediment dewatering area just east of Pond #1 referred to as Area A, and water treatment equipment and buildings within these 28 acres. Table 2.4 lists the physical dimensions and radium concentrations of the MWTU ponds. The ponds are below-grade basins excavated into native soil and rock. Pond #2 currently serves as a retention pond for runoff from the mine service and support area and holds a few inches to a few feet of water for evaporation; otherwise, the ponds are not in use and contain no standing water. Three ponds, #1, #2 and #3, function as settling basins for suspended solids that are pumped out of the mine with the mine water, which is treated with flocculant before being released into Pond #1. Mine water is then treated with barium chloride (barium-radium-sulfate co-precipitation) to remove radium from solution as precipitate in Ponds #4, 5 and 8. The treated water is held in ponds #6 and 7 before release to the 24-inch pipeline, which conveys the water to the outfall in San Lucas Canyon.

The ion exchange Plant, flocculant treatment facility, and barium chloride treatment facility contain the active treatment components of the MWTU. At the time of this submittal, during Standby status of the Mine Permit, each of these facilities is idle.

Area A, northeast of Pond #1, is used during the pond cleaning process to dewater the sands and silt prior to storage on the ore pad for shipment off site.

2.4.3 Service and Support Facilities

Service and support facilities include all surface functions other than mine water treatment and mine waste rock disposal. The location and identification of these facilities are shown on Figure 1-2.

Service facilities are those units at ground surface that support the overall mine operation but do not provide direct support of underground operations, and that will be either removed from the site or converted to post-mining use after closeout. These facilities include the guard house, fire equipment building, service building, electrical substation, car shop, carpenter shop, electrical building, waste treatment building, storage building, core storage building, water tanks, fuel storage tanks, fan shop, septic tank, leach field, and water wells for water supply to the mine.

Support facilities consist of those facilities at ground surface that have a direct function in underground mining operations and that will be either removed from the site or converted to post-mining use after closeout. These units supply air for ventilation; pumping of water from the underground space; cooling and heating of underground air; and hoisting of personnel, materials and ore to and from the underground mining levels. The present mine support facilities include the compressor buildings, York chiller, cooling tower, pump building, shaft heating building, hoist house, headframes, and exhaust fans.

An electrical substation is located at the north side of the service and support facilities area. This substation is owned by the Continental Divide Electrical Cooperative and Public Service of New Mexico, is not part of the mine permit, and is not subject to closeout.

2.4.4 Ore Stockpile

The ore stockpile presently covers 6.8 acres and contains approximately 60,000 tons of low-grade ore. The entire surface of the ore is covered with approximately two feet of native soil that is supporting well-established vegetation consisting mostly of grasses.

The chemistry of the high-grade ore, which exceeds the uranium content of ore in the stockpile, is represented by the tests results in Appendix D.3.

2.4.5 Waste Pile

The waste pile occupies 11.5 acres in the southwest corner of the surface facility area. Upon resumption of mining operations, waste rock will be placed on this pile until it reaches the maximum build-out configuration. The waste pile contains waste rock, mined during mine development and production, from non-ore bearing formations or below-ore-grade rock in the mine. The mound of material at the southwest corner is primarily shaft muck excavated from strata above mine level, making its

radionuclide content essentially background level.

The waste pile also contains a variety of non-rock waste from the mine such as rock bolts, timbers, and other hardware. These materials occur randomly throughout the pile.

Analyses were performed previously to determine the structural stability (resistance to mass movement) of the pile upon ultimate buildout, the largest size that the pile could have. This condition would include slopes that are higher than those that exist now. The results of these analyses, documented in Appendix B, show that the minimum factors of safety are 2.42 under static load conditions and 1.61 under pseudostatic (earthquake) load conditions. These values are well above the minimums necessary (1.00) to ensure stability.

2.4.6 Storm Water Retention Ponds (2)

Two storm water retention ponds capture and retain runoff from areas of the mine surface that contain ore or waste rock. The north pond, 0.9 acres and located between the ore stockpile and the mine water treatment area, retains runoff from the ore stockpile and holds it until it evaporates. The south storm water retention pond, 1.45 acres, retains storm water from the waste pile and a portion of the service and support facilities area. The sediments in both ponds have radium levels exceeding the 6.8 pCi/g limit and will require clean-up.

Presently, Pond #2 in the mine water treatment unit receives most of the runoff from the service and support unit area through a system of subgrade drainage pipes. Upon closeout, this runoff will be diverted to the south storm water retention pond and to arroyos north and south of the mine site, similar to the natural, pre-mining drainage patterns.

2.4.7 Access Road

The maintained gravel road, NM 334, is a public road and right-of-way, totaling approximately 4.7 acres, maintained for the State of New Mexico by Cibola County, that provides access to the west edge of the Cibola National Forest; it is not part of the mine permit area, and not subject to closeout.

3 POST-CLOSURE LAND USE

3.1 Factors in Selection of Post-mining Lands Uses

In selecting post-mining land uses (PMLUs) for the permit area, RGR took into account many factors. These included:

- Technical feasibility
- Economics
- Land ownership
- Current and possible future surrounding land uses
- Public interests
- Site resources and ecosystems
- Environmental impacts and standards

Technical feasibility - No uses were considered for which the necessary technology does not presently exist.

Economics - This factor consists of two parts, economic feasibility and economic compatibility. A PMLU should have net positive economic returns (returns at least equal to costs). The net returns can be in the form of revenues, cost savings, or any combination of these. The PMLU should work positively within the local economy, either by improving it or helping to sustain it. *Land Ownership* - RGR leased or purchased its permit-area surface from the owners listed in the Permit Application. RGR anticipates that after termination of the mine, control of the surface will return to those owners. Most of the surface will be returned to the previous owners; however, 10 acres of surface centered on each of the two shafts, or a total of 16.6 acres, will remain under RGR ownership.

Current and possible future surrounding land uses - The surrounding lands have been used for livestock grazing and small-scale logging for several generations, and these uses are expected to continue in the foreseeable future. The Cibola National Forest to the east provides a number of recreational, commercial, and cultural uses available to the public. The selected PMLUs should be consistent and compatible with surrounding land uses but need not be the same uses.

Public interests - The San Mateo community has a strong cultural heritage and places great value on its

rural, independent lifestyle. PMLUs that would require substantial new infrastructure or impose demographic changes were avoided to reduce the chance for negative impacts to the community.

Site resources and ecosystems - RGR examined the resources of the site other than the uranium ore, especially those already disturbed by mining, to identify which ones have potential for productive use after mining. Site resources include both natural and man-made attributes of the site. Water removed from the mine and some mine surface facilities are considered to be resources that have potential use after mining operations. Reclamation should restore the pre-mining ecosystem to the extent consistent with the PMLU(s).

Environmental impacts and standards - Potential PMLUs should limit land disturbance or, preferably, contribute to mitigation of mining disturbances. Each PMLU must be able to meet standards for air and water protection established by the New Mexico Environment Department (NMED) and federal agencies as applicable.

3.2 Potential Post-Mining Land Uses

Using the factors described above, RGR identified the following potential PMLUs:

- livestock grazing
- wildlife habitat
- commercial or government facilities
- water supply facilities

Livestock grazing as a PMLU is consistent with surrounding and historical land uses and local public interest. It is also consistent with the wishes of those land surface owners who have expressed a preference. This use will be facilitated through covering of the waste rock pile and mine water treatment ponds, final grading of disturbed surfaces, and revegetation. This PMLU could coexist with or next to the other potential PMLUs and would restore the pre-mining ecosystem.

Wildlife habitat is consistent with surrounding lands uses and community values. It is readily implemented with the same measures used for establishing livestock grazing. *Commercial or government facilities* would make use of some existing mine buildings and infrastructure, all in excellent condition, for services, manufacturing, or wholesale/ retail sales, providing a center for employment in

the San Mateo area. This use is consistent with a municipal water supply or livestock grazing PMLU but is not compatible with wildlife habitat. The mine surface facilities include office, warehouse, and maintenance facilities that could be used by other mining operations in the area or by land management agencies such as the Bureau of Land Management and the US Forest Service. Although located away from main transportation routes and in a thinly populated area, the mine facilities could attract light industrial business.

Water supply facilities already exist on site in the form of the mine water treatment unit, the wells, and the shafts. During operations these facilities remove water from the mine and treat it to the required standards before release. Continued operation of these facilities after mining would provide a long-term source of water for municipal and industrial users. Such users might be within the local area but might also be located at much greater distance from the mine.

Selected Post-Mining Land Uses

For the purposes of this closeout/ closure plan, RGR has selected grazing as the PMLU as the basis of the cost estimate for financial assurance. However, this use can be used in combination with one or more of the other PMLUs. Specifically, the electrical substation will remain unchanged or otherwise disposed, as determined by Continental Divide Electrical Cooperative and Public Service of New Mexico . Existing NM 334 and its right-of-way through section 24 will remain unchanged. The right-of-way is not under RGR control either during or after mining. This surface is dedicated to public use and is not subject to reclamation or PMLU considerations under the Mining Act.

3.2.1 Grazing

Prior to the development of the mine, the site was used for grazing by generations of the same families to whom ownership or control will be returned after mining. See the Mine Permit Application (RGR, 1994) for delineation of post-mining surface ownership. Specifically, the following present and future surface owners have grazed livestock on, or expressed this preference for, the following areas:

- Portion of NE 1/4, section 24 - This is the northerly portion of the mine surface area, containing the Mine Water Treatment Unit as well as the county road right-of-way. Presently, RGR is the surface owner of this tract. After mining RGR plans to return the surface to Arturo S. and Mary Lou Candelaria *et ux* (Candelaria) except for areas described in the relevant agreement. This land has been grazed historically so the non-excluded parts of this surface will be returned to grazing as the

PMLU.

- Portion of SE 1/4, section 24 - This is the southerly portion of the mine surface area as well as undisturbed land south of the mine facilities. It contains most of the surface support and mine support facilities and the waste rock pile. Presently, RGR owns the surface of this tract. After mining RGR expects the surface ownership will be turned over to the Trusts of Sifredo Sandoval Ethel Sandoval *et ux* (Sandoval). Sandoval has expressed its preference that most existing buildings are left in place for Sandoval's use after mining. Sandoval has also stated its preference for grazing as the PMLU on this surface.
- Fernandez portion of SE 1/4, section 24 - This triangle of land, about six acres owned by the Fernandez Company Ltd., is the surface presently occupied by part of the waste rock pile and the adjacent storm water retention pond. RGR is negotiating a land swap agreement with the Fernandez Company to transfer title of this land to RGR in exchange for RGR land outside the permit area. This triangle of land would be included subsequently with the rest of the SE 1/4 of section 24 and turned over to Sandoval. The storm water pond will be retained as a stock tank, and the remainder of the area will be converted to grazing with the exception of the waste pile, which will be fenced to exclude grazing.

3.2.2 Commercial or Government Facilities

The existing service and support facilities, located within the Sandoval portion of the site, are multiple-use buildings that support offices, warehouse, and maintenance/ repair activities. At the landowner’s request these building and facilities will be left in place for PMLU for logistical support of agricultural, commercial/ mining or government activities. The agreement with Sandoval specifies that the following facilities will remain in place for PMLU:

- Compressor Building,
- York Chiller (Chill Water) Building
- Pump Building (Chill Water Pump House)
- Hoist House
- Guard House (Security Building)
- Fire Equipment Building (Fire House)
- Service Building (Office & Warehouse)

- Car (Maintenance) Shop
- Carpenter Shop
- Electrical Building
- Water Treatment & Boiler Building
- Core Storage Building
- Water Tank
- Fuel Storage Tanks
- Fan Shop
- Septic System – Treatment Unit, Septic Tank and Leach Field
- Water Wells # 1, 2A, 3, 4, 5, 6, 7, 8, and 10
- Storage Building

These facilities are listed on Table 5.1 and shown on Figure 1-2 and Drawing MT12-CL-04 (Appendix A).

Radiation levels in these facilities do not exceed the NRC Regulatory Guide 1.86 criteria for unrestricted release and use. Therefore, no decontamination will be required.

4 WAIVER FROM SELF-SUSTAINING ECOSYSTEM OR POST-MINING LAND USE

RGR is not seeking a waiver from a self-sustaining ecosystem or post-mining land use. RGR is proposing livestock grazing as the primary PMLU, with wildlife habitat as a natural and compatible use inevitably associated with livestock grazing. Once vegetation is re-established on the portions of the site not used for other purposes, grazing should be sustainable as it has been in this area for many generations. The mine water treatment pond and waste pile areas will be fenced and restricted from grazing so that a self-sustaining ecosystem can regenerate on fill slopes without interference from livestock.

Agricultural/ commercial or government use of the service and support structures to be left in place, as requested by the landowner, as additional PMLUs that will provide valuable infrastructure for sustainable economic opportunities for the San Mateo community. No comparable facilities exist in this area to support mining, land management, agriculture or commerce.

5 DESCRIPTION OF CLOSEOUT ACTIVITIES

Closeout/ closure of the Mt. Taylor Mine will include a number of activities that are organized into several categories:

1) Shaft closures
2) Well and Conduit Plugging
3) Surface Facilities Demolition
4) Earthwork
5) Revegetation

Technical specifications for these measures, as appropriate, are contained in Appendix C. Closeout measures are illustrated in Drawings MT12-CL-04 through -10, and the anticipated surface configuration of the site after closeout is shown on Drawing MT12-CL-11.

Small quantities of solvents and lubricants from the maintenance shops may remain on site at the time of closeout. Presently, in standby status, the inventory of potential contaminants is limited to those listed in Table 5.2. These potential contaminants will be removed and disposed of offsite by a licensed contractor at a permitted facility.

5.1 Shaft Closures

Both the 24 ft diameter production or haulage shaft and the 14 ft diameter manway/ ventilation shaft will be closed in the same way, illustrated on Drawings MT12-CL-05 and -06 and described in Appendix C, in the following sequence:

- Equipment and fittings within the shaft collar will be removed to the subcollar level. Softer, less rigid materials such as wood and rope guides, pipes, electrical cable, and duct work will be dropped down the shaft. Structural steel, sheet metal and other rigid materials will be removed from the shaft for salvage.
- The headframe will be toppled to the ground with explosives and/or heavy equipment and cut into pieces by excavator-mounted hydraulic shears.

- Selected pieces of the headframe structural steel and steel plate will be set aside to use in the shaft plug, but the remaining pieces will be cut to 40-foot maximum lengths, sorted and separately stacked for salvage and sale off-site.
- Selected structural steel I-beams and scrap metal plate from headframe demolition will be welded in sections to fit into the shafts at subcollar level (See Drawings MT12-CL-05 and -06).
- Each section will be lowered from ground surface and set onto the shaft subcollar to form the first layer of the support platform for the shaft plug and backfill.
- A second layer of I-beams will be placed on top of, and perpendicular to, the lower layer to form an orthogonal support system for the shaft plug and backfill.
- A plug of light-weight concrete will be poured to encapsulate the platform steel.
- The remainder of the shaft, as well as connecting tunnels and raises, will be backfilled with a cementitious slurry of ore (from the ore stockpile) or soil, Portland cement, fly ash, and water. The proportions will be determined using test batches of the available materials.
- Remaining space at the top of the shaft will be capped with concrete, including a marker monument.

The hydrologic isolation of the shaft from the surrounding aquifers was established by the initial design and construction of each shaft, which included a continuous concrete liner and pressure grouting of the rock around the liner through the water-bearing formations. The effectiveness of these features, described in section 2.4.1, has not diminished over time and will not be compromised by shaft closure measures. The space within each shaft is isolated from the surrounding aquifers and is hydrologically connected only to the ore zone in the Recapture/Westwater. Except for some oxidation occurring while sitting in the ore stockpile, the ore has not been processed or otherwise chemically altered from the ore in the mine. The mine water quality (Table 2.1) naturally bears the chemical effects of the ore, so placement of stockpiled ore into the shaft as backfill should not lead to significant changes in mine water chemistry.

Infiltration or inflow of water from surface runoff will be prevented by the shaft plug and backfill in each shaft as well as by the existing shaft liner and annular grout, the combination of which provides a barrier to infiltration that is equivalent to the natural bedrock surrounding the shafts. Therefore, the proposed shaft closure measures will be protective of ground water quality from both mine-level and surface sources of potential contamination.

5.2 Well and Conduit Plugging

5.2.1 Conduits

Two vertical utility conduits, 11.5-inch diameter casings extending from ground surface to mine level, will be plugged. A concrete plug will be placed from 18 feet depth to two feet below ground surface. The top two feet of casing will be removed and the remaining hole will be backfilled with soil. Although the conduits are not shafts, the closure measures are similar to the shaft closures and will be equally protective of ground water.

5.2.2 Depressurizing and Deep Monitor Wells

Of the 22 wells used to depressurize and dewater the mine, 14 extend to depths greater than 2000 feet. In addition, two deep (>3500 feet) monitor wells were used to observe drawdown in the mine area. These wells are too deep to be economically maintained and operated for PMLU and will be plugged. Each of these will be grouted from bottom of casing to ground surface using tremie methods as required by 19.27.4.NMAC. The grout mix will be 4:1 cement to bentonite. Details are described in the technical specifications in Appendix C.

5.3 Surface Facilities Demolition

Surface facilities not listed in Section 3.2, to be retained for the land owner for PMLU, will be demolished. Table 5.1 lists all surface buildings, their sizes and their disposition at closeout. Facilities to be demolished include:

- Shaft Headframes
- Glycol Heat Exchanger
- Chlorine Building
- Flocculant Treatment Building
- Barium Chloride Treatment Building
- Ion Exchange Building
- Mine Water Treatment Pond Hydraulic Structures
- Mine Car Rails and Concrete Base for Rail
- Shaft Exhaust Fans and Vents

- Cooling Towers
- York Chiller Refrigeration Equipment
- Mine Water Discharge Pipes
- Treated Water Pipeline

Radiological contamination levels in these facilities do not exceed the NRC Regulatory Guide 1.86 criteria for unrestricted release and use. These facilities will not require decontamination prior to demolition.

Structural steel and sheet metal roofing and siding will be salvaged for sale and off-site use. Other scraps materials will be either buried in the waste pile or disposed of in the shafts prior to plugging. Materials dropped in the shafts will be limited to non-contaminated, flexible or soft materials that will not damage the shaft liners when dropped. Demolition of these facilities will include the concrete slabs or other foundations. The concrete will be broken up, separated from reinforcement, and recycled as riprap in closure of the waste pile.

The treated water discharge pipeline is 1/4 to 3/8 inch thick steel pipe. The in-place and spare lengths total approximately 23,000 feet. This pipe will be removed from the site and sold for re-use or salvage, but no cost credit for this is taken in the cost estimate (Section 9).

The vent shaft hoist will be sold and removed from the site. Hoists of this size are hard to find and have long lead times for manufacturing, so this hoist has high re-sale value on the world market. However, no cost credit against the closeout cost estimate has been taken for any sale of the hoist.

5.4 Earthwork

Earthwork for mine closeout will begin after most of the demolition work has been completed. In general, earthwork will involve short hauls by dozer to redistribute berm fills or mine waste rock and by scraper or grader for contaminated soil removal. Some loader excavation and short truck hauling will be required, as well. Except for short pushes of up to 300 feet on pond berms and waste pile slopes, the working grades are less than 5%. All borrow sources and haulage routes for excavated material are within the existing disturbed area of the mine.

Steep cut slopes (steeper than 1H: 1V) in weak sedimentary rock or soil will be flattened by cut-and-fill to final gradients of not greater than 1H:1V. However, cut slopes capped by basalt, or sedimentary

slopes that have naturally revegetated to basal coverage and canopy equivalent to similar natural slopes, will not be flattened. Slopes reduced to 1H:1V will be left uncovered and will not be revegetated, providing an artificial talus habitat for wildlife.

The earthwork for mine site closure has been designed to use available soils from areas already disturbed, and sufficient fill volumes should be available from the design cut quantities. However, if additional borrow soil is needed, it can be obtained from the area east of the ore stockpile or immediately north of Marquez Canyon arroyo within the permit area. The soil consists of sandy clay, clayey sand and clay with Unified Soil Classification of SC and CL as determined by test pits and laboratory testing (Appendix D).

5.4.1 Ore Stockpile Removal

The ore stockpile, including the existing soil cover, will be excavated by loader and hauled by truck to the shafts, where the ore will be dumped as shaft backfill up to the subcollar level. Ore, and other soil if needed, will be mixed with other materials, as described in section 5.1, to form the cementitious backfill above the shaft plugs.

After the ore stockpile is removed, the remaining contaminated soil in the ore pad area will be excavated as described in section 5.4.3 to achieve the required soil cleanup standards.

5.4.2 Mine Water Treatment Ponds Backfill and Cover

Mine water treatment ponds will be closed by backfilling with contaminated soil from soil clean-up (section 5.4.3), then covering with clean soil presently contained in the surrounding pond berms, essentially placing this soil back where it originated. The pond sediments contain low levels of uranium, radium, barium sulfate and other constituents from the mine sediments and mine water treatment circuit described in section 2.4.2 and Appendix D.

Several alternatives were considered for closure of these pond basins:

1) Excavate sediments and dispose in the mine shafts.
2) Excavate sediments and dispose in the waste pile.
3) Excavate sediments from seven basins and consolidate them in one pond basin.

4) Leave sediments in place and backfill/ cover with berm soils.

The primary factors considered in selecting alternative #4 were:

- Relatively thin deposits and low levels of radionuclides and other contaminants in the sediments,
- Potential for spillage and airborne releases of pond sediments if they are excavated and transported,
- Absence of saturated or permeable alluvium in the ponds area,
- Shallow depth of bedrock in the ponds area, and
- Availability of suitable soil for cover and growth medium.

The excavation alternatives (#1-3) all present the risk of release of contaminants to the environment that the selected alternative avoids. Alternative 3 involves this risk without reducing any fill earthwork volumes. Alternatives 1-3 could either bring the pond sediments in direct contact with ground water (#1) or leave contaminants closer to ground surface (#2,3) than alternative #4. Recent sampling and testing performed on the waste pile (Kleinfelder, 2012; Appendix D) indicates that there is insufficient net infiltration of precipitation in the mine area to leach contaminants, so positive drainage of runoff (addressed in section 5.4.5) will minimize the potential for mobilization and leaching of contaminants from the covered pond sediments, and alternative #4 maximizes the pond cover thickness that would limit infiltration.

After the hydraulic control structures of the ponds are demolished, the berms around each of the ponds will be excavated by dozer. Approximately 49,000 cubic yards of contaminated soil from the mine water treatment and ore pad areas will be placed in the ponds, distributed to limit the radium source terms in each pond. After contaminated soil is placed in each pond basin, the clean berm soils will be pushed into the pond basins, spread and tracked in lifts appropriate to the size of the contractor's equipment. This earthwork will involve balanced cut and fill of approximately 168,000 cubic yards of soil. Technical specifications for this earthwork are included in Appendix C.

The RADON code was used to model each of the eight ponds to evaluate whether the radon attenuation achieved with 2.0 feet of cover soil, derived from clean soil in the pond berms and elsewhere, would be sufficient to meet the radon flux standard of 20 pCi/m^2s from the cover surface. The input and output files for each pond are included in Appendix B. The RADON analysis shows that 2.0 feet of cover limits radon flux to less than the flux standard for all eight ponds.

The buried drainage culvert from the storm drain along the county road to pond #2 will not be removed, but it will be plugged with concrete at its south end to prevent runoff from entering the mine water treatment pond area after the ponds are backfilled.

5.4.3 Excavation and Disposal of Contaminated Soil

As is typical for a uranium mining operation, materials bearing uranium and uranium progeny are found at locations within the mine permit boundary including the waste pile, mine water treatment ponds, and the immediate vicinity of the 24-foot main shaft, the ore pile area, the storm water retention ponds, and approximately seven acres north of Marquez Canyon arroyo. This radiological contamination is limited to the mine permit area. Figure 5-1 shows the results of radiological measurements and sampling , and recent radiological investigations are documented in Appendix D.

Investigative radiation surveys and soil sampling were performed in Spring 2012 in the mine area to establish background levels of radium and to evaluate whether radioactive materials have been dispersed by wind, rain and snow runoff. This investigation included the Marquez Canyon arroyo and the other San Mateo Creek tributaries situated north and east of the Village of San Mateo. All the surveys and soil sampling found uranium and uranium progeny (e.g., radium) at background concentrations along these drainages. This finding indicates: 1) operations at the mine have used administrative and engineered controls that prevent the spread of uranium mining contaminants; and 2) the controls implemented under the NPDES storm water permit (i.e., storm water ponds, berms, diversion channels) have prevented the discharge of radioactive materials from the mine property.

The highest external radiation exposure rates are inside Ponds 3, 4, and 8 (2.5, 2.1, and 1.5 millirem/hour respectively). This is due to the settling of radium and radium-bearing residues during mine water treatment. Exposure rates elsewhere around the site vary from background (+/- 0.015 millirem/hour) to 0.4 millirem/hour around the main shaft and 0.17 millirem/hour on the waste pile.

Access to the mine is controlled by fences, locked gates, and surveillance to prevent exposure to the general public. Occupational exposure controls and monitoring are implemented during entry into the ponds and excavation of the ponds, piles, and mine compound. These controls will be continued during closeout activities.

After demolition is complete and debris has been transported to the locations of staging or disposal on site, the site soils will be excavated to remove radiological contamination above the cleanup standard as derived from 40 CFR 192, 5 pCi/g Ra-226 above background in the top 15 cm (~6 inches) of soil. The technical specifications for contaminated soil earthwork are included in Appendix C.

Historical and recent site radiological surveys (Trinitek, 2012) indicate an average background Ra-226 concentration of 1.8 pCi/g, so soils exceeding 6.8 pCi/g radium will be excavated and placed on the mine water treatment pond basins from areas north of the county road and on the waste pile from the county road and areas to the south. The 6.8 pCi/g Ra corresponds to a gamma reading of 0.026 millirem/hour. Gamma readings will be made while soil cleanup excavation is being performed, and readings below 0.026 millirem/hour will indicate that the soil radium concentrations are below 6.8 pCi/g and the soil cleanup standard has been achieved.

Existing and recent radiological survey results are shown on Figure 5-1. The area limits and estimated volumes of soil cleanup are approximately 133 acres and 93,000 cubic yards for entire mine site (Drawing MT12-CL-02). Cleanup of contaminated soil from the county road right-of-way is included in these quantities.

Contaminated soil in large, unobstructed areas will be excavated, loaded and hauled to the waste pile by scraper. Smaller or obstructed areas of soil will be excavated by loader or grader and either windrowed for scraper pickup or loaded onto trucks for disposal in the waste pile.

5.4.4 Waste Pile Stabilization

At closeout the waste pile will be reshaped and covered to enhance long-term stability. The technical specifications for this earthwork are included in Appendix C. As part of the original closeout plan, analyses were performed to determine the structural stability (resistance to mass movement) of the pile after maximum buildout and stabilization. The results of these analyses, documented in Appendix B, show that the minimum factors of safety are 2.42 under static load conditions and 1.61 under pseudostatic (earthquake) load conditions for slope gradients that are steeper than those proposed for the reconfiguration of the existing waste pile. These values are well above the minimums necessary (1.00) to ensure stability. The configuration of the pile reshaped from its present (2012) form will have even higher factors of safety, given the lower height and flattened slopes compared to those of the

model.

The waste rock pile, as shown in Drawings MT12-CL-08, -09, -10 and -11 will be consolidated into a smaller area and stabilized in place. The thin wedge of waste rock on the east side of the pile (Drawing MT12-CL-08 and -09) will be excavated and pushed west over the area of thicker waste rock. Although there is no concern about structural stability of the existing west and south pile slopes, these slopes will be flattened to not more than 5H:1V to facilitate cover placement, erosion protection, and revegetation for better erosional stability. This earthwork will be performed by dozer.

A recent waste pile characterization study (Kleinfelder, 2012) was performed in support of the Stage II abatement plan for the perched water contaminant excursion from the pre-mining waste lagoon buried under the waste pile. This study showed that infiltration of precipitation into the waste pile is offset by evaporation and that contaminants in the waste rock (low levels of radionuclides, no acid rock drainage) are not being leached from the waste rock. Therefore, a soil cover is not needed to protect the waste rock from infiltration or leaching, and the function of a cover will be to provide radon attenuation, a suitable growth medium for vegetation, and erosion protection of the waste rock.

The mound of shaft muck that occupies the southwest corner of the waste pile has background levels of radiation and presently supports healthy volunteer vegetation, so it will be used as cover soil over the reshaped waste pile surface. Results of soil tests (Appendix D) show that the shaft muck has weathered to soil consistency and classifies as low to moderate plasticity clay and clayey sand, similar to the soil presently covering the ore stockpile, on which two feet of cover is supporting healthy volunteer vegetation. Therefore, 2.0 feet of this soil cover over the waste pile will support a vegetative cover consistent with the local ecosystem and with the PMLU. RADON modeling (Appendix B) shows that 2.0 feet of soil cover also limits radon flux at the cover surface to less than the standard of 20 pCi/m^2s.

To protect the soil cover from erosion after finish grading and until vegetation is established, the side slopes will be covered with tobacco netting, Curlex®, or similar biodegradable mat through which water can pass and plants can grow. In addition, crushed concrete will be used to create water bars and riprap blankets on the lower portions of side slopes and other locations where runoff may concentrate. Exact locations will be determined when modeling using the Revised Universal Soil Loss Equation (RUSLE2) available at (http://fargo.nserl.purdue.edu/rusle2_dataweb/RUSLE2_Index.htm) and Water Erosion Prediction Project erosion model (WEPP), available at

(http://forest.moscowfsl.wsu.edu/cgi-bin/fswepp/wd/weppdist.pl) can be applied after as-built slopes are measured. For purposes of closeout planning and estimating, RGR assumes that all broken concrete generated by demolition (approximately 1600 cubic yards) will be crushed, screened, and applied on the waste pile and adjacent diversion channel for erosion protection.

5.4.5 Finish grading

After demolition, soil cleanup, shaft and well plugging, and waste pile reshaping are complete, the land surface disturbed by these and related mine site activities will be regraded to approximately the line and grades shown on Drawings MT12-CL-07, -08, and -11 to provide controlled drainage and to prepare those areas for revegetation. Grading along the treated water pipeline corridor will be performed as needed to prepare the ground for revegetation. Grading will be adjusted as needed to remove obstacles or depressions in the ground surface that might obstruct or divert runoff from the intended flow directions. The technical specifications for grading are included in Appendix C. Finish grading will be accomplished by motor grader over approximately 148 acres on the mine permit area and pipeline corridor.

5.5 Revegetation

All areas that have been disturbed by Mt. Taylor mining operations and soil cleanup, approximately 133 acres, will be revegetated except the storm water ponds and those areas where mining-related features, such as buildings and roads, are retained at the request of the surface owner. Up to 15 acres could also require revegetation along the treated water pipeline corridor when the pipe is removed. Regraded areas, the waste rock pile, the ore stockpile area, mine water treatment pond area and locations of demolished facilities will be revegetated.

Preparations for revegetation and the selected seed mix will be directed toward establishing a vegetation community that can thrive at this site and that can support grazing of livestock. Plants native to the general area will be used as much as possible to provide for long-term stability of the soils and vegetation communities. Plant species that provide rapid initial cover will be used in the seed mix to achieve initial soil stabilization. Species selected will not necessarily be found in the surrounding undisturbed area, but will have been approved for use in reclamation by the Natural Resources Conservation Service (NRCS, 1980) and other appropriate government agencies.

Revegetation of the recontoured areas will employ a variety of methods, depending principally on the steepness of the slope. A large percentage of the total disturbed area will be revegetated using standard mine reclamation equipment; i.e., tracked and wheeled tractors, rangeland seed drill, and mulch applicator. In areas with slopes of 3H:1V or steeper (natural or cut slopes east of the shafts), a mixture of manual and mechanical application techniques will be used, including hand broadcasting and heavy chains dragged by a tracked dozer to incorporate the seed with the soil. Mulching in most cases will be accomplished by a mulch blower and crimped by a tracked dozer. If hand application of mulch is required, crimping will be accomplished by hand as well. Seeding with a seed drill will be conducted as much as possible along the contour in order to minimize the development of rills. During the revegetation period temporary runoff controls will be used as necessary to impede or divert rainfall and snowmelt runoff from revegetated areas.

Runoff control during regrading and revegetation will use the most appropriate technology available at that time, including methods recognized by the NRCS or the International Association for Erosion Control. Measures that use present technology include check dams constructed of hay bales, geotextile silt fences secured in shallow trenches, and water bars across the disturbed area and perpendicular to the slope. Tobacco net, Curlex or similar net-and-fiber mats might be used as required for protection of surfaces susceptible to rilling or wind erosion. The specific measures applied to revegetated surfaces will be based on the method most appropriate for the seeding method, erodibility and depth of the soils, degree of slope, proportion of large rocks at the surface, roughness of the surface, and anticipated rainfall.

Locations of temporary runoff controls will be selected to retard or divert runoff, trap sediment, and provide improved conditions for germination and plant establishment and will be changed over time to keep pace with revegetation. Once revegetation has been achieved, temporary erosion control measures that have not disintegrated will be removed.

5.5.1 Revegetation Species

The predominant native grass species in the area is blue grama (NMEI, 1974). Therefore, this species will be the primary species in the revegetation seed mix if it is readily and economically available at the time of closeout. Other species in the mix have been selected on the basis of their suitability for the terrain and climate, compatibility with native species and nutrient value to livestock. Additional factors in the

selection of species are (1) likelihood of becoming a "pest" species in the area, (2) ability to achieve quick cover with a minimum of care and moisture, (3) strength of their root system for stabilizing the soil, and (4) ability to act as a nurse crop for the later establishment of local grasses, shrubs and forbs. Several cool-season and warm-season grass and shrub species are proposed in this plan to reestablish species that have been severely impacted by grazing and to optimize the chances for successful germination and establishment, regardless of the particular microclimate. The list of proposed species is shown on Table 5.3.

The seed mixture proposed in this plan is intended to introduce both cool-season grasses and permanent warm-season species to the recontoured areas. This approach incorporates a full range of seed species into the seedbed in one application, allowing one or more among them to exploit conditions favorable to their establishment. Vegetation establishment over the long term will be augmented by natural invasion by plant species already established in the adjoining undisturbed areas. Depending on the growing conditions of any particular year, the adjacent established vegetation will have the potential to enhance natural succession in the revegetated areas.

5.5.2 Other Revegetation Materials

Hay bales and mulch. These materials will be used to slow runoff and provide temporary protection to newly emergent vegetation. To reduce the likelihood of introducing small grain species to the area, native grass hay will be used. Blue grama or similar hay may be available locally and would be preferable since its use would likely provide additional seed source to the revegetated areas. Alfalfa *(Medicago sativa)* will be used if native grass hay is unavailable or impractical. Hay mulch will be spread by means of a blower or by hand on steep slopes. It will be applied at a rate of approximately 1-2.5 ton per acre, sufficient to provide adequate cover for the seeds yet not so much to prevent moisture from percolating into the soil or smother emerging seedlings. The use of hydro-mulch is not anticipated since, in the dry climate normal for this area, the fairly dense surface that forms on the mulch layer tends to impede percolation of the limited rainfall.

Stabilization Netting. A number of materials are commercially available for this purpose. Tobacco netting, Curlex, jute or other biodegradable material will be used if netting is chosen as a means to stabilize the soil. However, the additional stabilization achieved with its use may not be sufficient to justify its cost. In the areas where jute or other suitable netting is used, it will be rolled by hand onto the surfaces to be

treated, then anchored in place to prevent the net from being dislodged by the wind or surface water runoff.

5.5.3 Seed-Bed Preparation and Seeding

The regraded surfaces will be prepared for seeding by scarifying the surface and creating minor depressions to provide a proper seed bed. Seed will then be applied by either rangeland drill or broadcast. Broadcast seed will be incorporated into the growth medium by hand raking or some mechanical means such as heavy chains dragged behind tracked dozers.

5.5.4 Seed Origin and Quality

Seed should be harvested from native stands within 200 miles north, 300 miles south, 200 miles west, and 100 miles east of Mt. Taylor. If seed from native stands is not available, seed of suitable quality grown under appropriate conditions, or seed of released cultivars known to be adapted to the San Mateo area, may be used. All seed must be certified, and each seed bag must have attached to it a complete label with certification information.

5.5.5 Revegetation Success

Interim Standard - Because of the history of intensive grazing in the area of the Mt. Taylor Mine, the use of reference area or baseline data for establishing technical standards for revegetation success was considered to be inappropriate. Therefore, an interim technical standard based on range site descriptions has been proposed and is described in Table 5.4. Range site descriptions were obtained from the Natural Resource Conservation Service (NRCS, 1980) for soil mapping units existing on the mine site. This standard will remain in effect until either the volunteer revegetation success is determined to support a higher standard or a test plot program has produced acceptable results that support a more site-specific standard.

Volunteer Revegetation Success – In approximately two decades since mining operations were suspended and the last significant disturbances were made to the mine site, volunteer vegetation has taken hold in areas of the site that were not subjected to routine maintenance traffic. Specifically, vegetation has developed on the slopes of the waste pile and on the cover of the ore stockpile. No survey of these surfaces has been performed, but the success of the volunteer vegetation will be

measured against the criteria listed in Table 5.4 to evaluate if the vegetation success meets or exceeds the interim standard.

Monitoring - Monitoring of revegetated areas will be conducted on a periodic basis. Success of both germination and establishment will be dependent in large part on the moisture received in the summer and winter months and variations from year to year. Monitoring activities will be designed and scheduled to recognize this. An annual survey of the revegetated areas will be conducted to determine species composition and vegetation cover, frequency and density. Since establishment of vegetation is a function of its ability to reproduce, vegetation will also be assessed for its reproductive status, as well as its overall vigor. The annual survey will be conducted toward the end of the growing season, no later than October or early November. The survey will be conducted by a botanist or other qualified vegetation specialist. Survey results will be analyzed and summarized to aid in determining the need for any changes in management practices or the need for reseeding or other supplementary practices. Less formal monitoring will be conducted through the year by RGR personnel to identify conditions in the revegetated areas that may require attention.

Evaluation - Evaluation of success will be based on a combination of criteria categories that include (1) site-specific conditions, (2) vegetation cover and species composition in the undisturbed adjacent areas, and (3) the potential vegetation cover and composition per NRCS range descriptions for particular soil types in the area (SCS, 1993). A combination of these criteria is used since any one of them by itself may be inadequate to provide an acceptable standard. Specific criteria and numeric values for evaluation will be developed in consultation with the Mining and Minerals Division. The success criteria are expected to take into account:

- Range site descriptions, developed by the SCS (1993) for the area are based on a combination of factors including types of soils (depth, parent material, etc.) and climate. The descriptions provide a range of expected vegetation types and annual productivity for various uses.
- Site-specific conditions, used to modify the range-site derived criteria by increasing or decreasing required production. These will be used primarily to adjust productivity as a function of soil depth.
- Life-form diversity in surrounding undisturbed areas, i.e. the ratio of grasses:forbs:woody plant species, used to provide an additional measure by which to evaluate revegetation success. The criteria will be developed with the understanding that the entire region has been extensively grazed for many generations. Therefore, there are no truly undisturbed areas from which a baseline or

natural background standard can be developed (NMEI, 1974).

5.5.6 Management and Contingency Plans

After revegetation efforts have been completed, management of the revegetated areas will include:

- instruction of staff in measures to protect revegetated areas
- posting of signs to warn against disturbance
- placement, and replacement as necessary, of erosion controls
- supplementary seeding of areas as necessary
- periodic inspections and monitoring

Revegetation efforts will be repeated until successful. If results of annual monitoring indicate failure in all or part of a revegetated area, RGR will either supplement work already accomplished or revegetate the affected area, as appropriate. Efforts will be modified as necessary depending on what the cause of the failure is determined to have been.

5.6 Erosion Protection

5.6.1 Protection of the Waste Rock Pile Surface

Erosion protection will be provided for surfaces on the waste pile that are susceptible to erosion due to high runoff velocities or concentrated flows, such as some steep slopes or drainage swales. In most cases, crushed concrete screened for minus six inches will be applied as riprap in the bottom 1/3 of steeper slopes and water bars in swales.. Larger rock (12 inches plus) will be used as riprap along the south arroyo bank. Crushed fines, 0.38 inches and smaller, will be mixed with the top lift of cover soil to form rock mulch on side slopes prior to application of the soil stabilization netting or mat. .

Riprap will be placed on the lower 1/3 of the west slope of the waste pile will be at least 0.5 feet thick, consisting of crushed concrete or basalt or equivalent rock with average particle diameter (d_{50}) of not less 2.7 inches. If the quantity of crushed concrete is not sufficient, basalt boulders can be harvested from the mesa slope east and south of the mine and crushed into the necessary sizes. The initial erosion protection for the other waste pile slopes will provided by rock mulch (minus 0.38 inches mixed with the top 6 inches of cover soil) and tobacco netting or similar erosion control blanket material.

Information on drainage structure and erosion protection design for the waste rock pile is provided in Appendix B and Drawings MT12-CL-08, -09, and -10. Design runoff and shear calculations were prepared as part of the original closeout plan in 1998 and address the issue of erosion protection for the ultimate build-out size and shape of the waste pile surfaces. Those calculations determined that the peak shear stress during design storm runoff would not exceed the allowable shear stress for the cover soil or riprap protection. The as-is waste pile in 2012 is smaller, and the closeout design for this pile has flatter slopes; therefore, the runoff parameters and results in the 1998 calculations modeled a more extreme (conservative) condition than would develop for the as-is waste pile closure slopes. Consequently, the 1998 calculations have been retained and applied to this update for conservatism.

Top surfaces, and side slopes other than the west slope, will not require riprap. These surfaces have been designed so that the allowable shear from runoff on clay soil surfaces will not be exceeded by peak runoff of the 100-year, 24-hour storm.

Water bars of crushed concrete or basalt will be placed in swales or on slopes as necessary, based on final actual slope grades and lengths, using calculation methods in Appendix B. The need for, or location of, water bars cannot be determined until the actual amount of contaminated soil placed on the waste pile and the final grades of the cover are known. However, for cost estimating purposes 1850 cubic yards of riprap on the pile outslopes has been assumed.

5.6.2 Arroyos

Hydrologic analyses using the HEC-1 and HEC-2 models (Appendix B) show that Marquez Canyon arroyo will conduct the 24-hour, 100-year flood without need for erosion protection or channel improvements. These analyses show that the design flood water and energy surfaces are well within the arroyo banks in both cases, indicating that there should be no out-of-bank flow during the design flood and that the arroyo morphology appears to be in equilibrium with much larger runoff events.

The middle arroyo was largely filled in during site construction, but its remnants lead to the south storm water retention pond (ultimately the stock tank) north of the waste rock pile. The middle arroyo has a very small watershed; therefore, it receives little runoff that can be accommodated with site grading and channel shaping.

The southern arroyo was diverted at the time of mine development to run along the south side of the

waste rock pile. HEC-1 and HEC-2 analyses show that its hydraulic parameters are also sufficient to convey the 24- hour, 100-year flood but its north bank adjacent to the waste pile will require protection by large (12 inch or larger) riprap. For this purpose, broken concrete from demolition or basalt cobbles and boulders will be used. The riprap will be placed from toe of the north bank to the elevation of the peak water surface of the 100-year design flood, less than 10 vertical feet above the arroyo thalweg. The riprap thickness will be not less than two times the average particle diameter and will extend from the southwest corner of the waste pile eastward for at least 400 feet or to the southeast corner of the waste pile at approximately where the arroyo crosses E 559450 (Drawing MT12-CL-10). Riprap will be placed also at other locations of concentrated flow in this arroyo, especially areas where flow has bypassed some of the existing concrete liners and at the western end of the entire channel. Approximately 600 cubic yards of channel protection riprap has been estimated for this application.

A surface water diversion channel, located east of the 14-foot shaft and ore stockpile areas, intercepts and diverts runoff northward to Marquez Arroyo. The channel is very stable, with substantial amount of rock and vegetation in place, and will be preserved in closeout in this condition.

5.7 Fencing

Recently RGR has been replacing and increasing the height of existing fences on the mine site to provide better exclusion of cattle and wildlife from the mine site. One chain link fence will be eight feet high and enclose the MWTU, approximately 5000 feet in length. The other eight-foot chain link fence will be up to 3000 feet surrounding the waste pile, depending of its final footprint. An additional 2000 feet of this fence will prevent entry to the shaft areas.

6 ENVIRONMENTAL MONITORING AND REPORTING

6.1 Ground Water

An abatement plan is in effect for remediation of ground water contamination in perched water at the soil/ bedrock contact below and west of the waste rock pile. The waste pile characterization report (Kleinfelder, 2012) found that the perched water and contamination originated in the re-mining waste lagoon that was covered by the waste pile and that contaminants are not leaching from the waste pile to the perched water. Through Stage I and Stage II (currently in progress), shallow monitor wells have

been installed, water levels measured, and water samples obtained for testing. A line of salt cedars has been planted across the plume, along a north-south line at the west edge of the mine area, to intercept the plume, consume the nitrates, and dry up the perched water zone. The plume and the effects of the abatement plan are being assessed through this monitoring program. When the abatement plan objectives have been achieved, this monitoring program will be discontinued and a completion report will be submitted to NMED.

Two deep monitoring wells, SM-24-38 and SM-24-43, extend to depths below the mine workings, or about 3500 feet, next to the 24-foot shaft. These wells were used to measure water levels in the mine. They will be decommissioned and plugged at mine closure.

Stage I depressurizing wells (section 5.2.2) to depths of up to 2000 feet will be retained by the land owner for PMLU. Well 2A currently provides potable water from the Point Lookout aquifer for use at the mine. This well will continue to be sampled annually for the sample water quality parameters listed in Table 2.2 until closure is complete per DP61. The sampling and test results will be reported to NMED annually during the closure period.

6.2 Surface Water

The surface water courses across the site are ephemeral, and no monitoring of flows has been conducted during operation or standby periods. The storm water retention ponds have collected runoff during larger storm or snowmelt events but are usually dry. Sediments with elevated levels of radium will be removed from these ponds during closeout, and this cleanup will be verified by radiological surveys and sample testing. No post- closure monitoring will be conducted after the pond basins are determined to be free of contamination.

6.3 Radiological Monitoring

Radiation safety controls will be implemented to protect workers and the public, and to ensure compliance with the ALARA requirement in subsection B of section 404 of Part 4 of the New Mexico Radiation Protection Regulations (20.3.4.404.B NMAC). The performance standards will be the pertinent monitoring requirements and radiation dose limits specified elsewhere in 20.3.4 NMAC. The controls will be implemented pursuant to the Mt. Taylor Mine Radiation Safety Program Manual (RSPM) and its subordinate standard procedures. Radiation work permits (RWP) will be written and implemented for those phases of work for which no applicable standard procedures are in place.

7 ENVIRONMENTAL STANDARDS COMPLIANCE

Through the closeout measures described in section 5 and the requirements of other permits described in section 1.4, the Mt. Taylor Mine site is expected to stay within environmental standards for air and water quality. The mine involves extraction of ore for processing elsewhere; there are no milling facilities on the site to concentrate or release potential contaminants.

RGR provided information to the NMED that showed elevated concentrations of chloride, nitrate, sulfate, and TDS in monitor well MW-5 located down gradient from the waste pile. In response to NMED concerns about the origin and extent of this contamination, a two-stage abatement plan was undertaken and a waste rock characterization study was performed. As briefly summarized in Section 5.4, the latter study (Kleinfelder, 2012) determined that the contamination is a relic of an old waste lagoon that was buried under the waste rock and was not caused by infiltration or leaching of the waste rock. Stage II of the approved abatement plan is in progress and is expected to remediate the contamination. No additional remedial measure will be needed, so none is included in this closeout/closure plan.

Surface water releases will continue to conform to NPDES requirements until closeout is completed and the NPDES permits have been terminated. The proposed revegetation and erosion protection measures have been designed to limit runoff and erosion rates to normal levels, with special emphasis placed on preventing erosion of waste rock material or exposure and release of the buried sediments in the mine water treatment ponds. All other potential sources of sediment are naturally occurring at ground surface, and the erosion rates of these materials should return to normal when revegetation has been

completed.

Erosion modeling using the Revised Universal Soil Loss Equation (RUSLE) shows that the maximum soil loss rate, currently estimated at 1.1 T/acre/year, should be reduced to a maximum of 0.2 T/acre/year after closeout. Because of short slope lengths, the maximum annual soil loss rate on the unreclaimed waste rock pile is only 0.02 T/acre/yr, according to RUSLE modeling, and this will be reduced to less than 0.005 T/acre/yr after revegetation of the soil cover. Therefore, sediment releases should be very low.

Air quality impacts from Mt. Taylor Mine are minimal, resulting primarily from fugitive dust generated by truck traffic. Completion of closeout measures will reduce truck traffic to occasional trips by the landowner if grazing is the PMLU. Traffic related to other continued use of mine facilities retained by the surface owners cannot be predicted at this time. Revegetation of disturbed ground and riprap covers on steep slopes will reduce other fugitive dust to background levels. There are no other sources of dust or gaseous emissions left after closeout. For additional information on air quality, see page 14 of the Mt. Taylor Mine Site Assessment.

8 CLOSEOUT SCHEDULE

The schedule for mine closeout is shown in the Gantt chart in Figure 8-1. The schedule time line is based on an assumed start date of 8/1/2012. From initiation of the closeout contracting process to completion of the closeout activities on site is estimated to take one year. Of that year the first four months would be taken up by project management and contractor procurement, followed by eight months of actual construction activities on site from mobilization through demobilization.

9 COST ESTIMATE

The estimated costs of closeout/ closure of the Mt. Taylor Mine were developed to satisfy the requirements of both MMD's *CLOSEOUT PLAN GUIDELINES FOR EXISTING MINES, Attachment #4 (FINANCIAL ASSURANCE CALCULATION HAND BOOK)* and its *Guidance To Mine Operators for Calculating Reclamation Costs in Net Present Value, December 29, 2004* as well as NMED-GWQB's *Discharge Plan Closure Guidance for Mines, May 30, 1996.*

Several references were used for unit costs, the primary being R.S. Means Heavy Construction Cost Data 2012 and the Caterpillar Performance Handbook. The basis for each unit cost is identified on the cost estimate spreadsheet.

Quantities of work and materials were based on field measurements or counts of materials, construction or design record drawings, and area/ volume calculation functions within AutoDesk AutoCAD Civil 3D® design software. The 1990 topographic base map of the mine site, with 5-foot contour intervals, was digitized into AutoCAD and used for most area and earthwork volume calculations. A new base map was completed in June 2012 at 2.0-foot contour intervals and was used to refine some of the earthwork estimates; however, it was not available in time to be used as the topographic base for this update.

The cost estimate does not include any deductions or offsets for re-sale or salvage value of mine components and scrap. However, the value of these materials, especially the structural steel and the treated water pipeline, could be one quarter to one third the estimated direct cost of closeout.

The detailed estimate is presented in Appendix E. Rounded to the nearest $1000, the costs by category are:

Direct Cost = $3,133,626

Indirect Cost = $1,284,787

Location Cost Adjustment= 1.005

Total Adjusted Direct+Indirect = $4,440,505, net present value (NPV) in 2012

The cost estimate also includes cost projections over three additional years with annual escalation of 3% and NPV for those same years using a discount date of 3.75%.

LIST OF REFERENCES

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