Storage Area Soil Salvage Estimates
Rosemont Copper

June 2007
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1.0 INTRODUCTION

Reclamation of mined land is required under Arizona and Federal laws. Revegetation of the mined and disturbed areas is a primary focus of reclamation. Vegetation requires suitable growth media to become established.

Definition of the available site soil resource that overlaps with the mined or disturbed areas is needed to confirm soil cover volumes. For the waste rock and dry tailings storage areas approximately 2,700 acres will be disturbed. To cover the waste rock and dry tailings storage areas with a minimum of 12 inches of soil, approximately 4,312,000 cubic yards of salvaged soil will be required.

This report estimates the soil salvage extents and volumes associated with the Rosemont waste rock and dry tailings storage areas. The estimates are based on Tetra Tech’s Survey of Salvage Topsoil Resources Report dated June 2007. The Survey of Salvage Topsoil Resources Report defines salvage soil thicknesses throughout the storage areas and identifies their varying suitability as growth media. Suitable soil thicknesses ranging from less than 6 inches to more than 36 inches were identified.

The life cycle of the mine will result in the continuing growth in size of the waste rock and dry tailings storage areas. A close association of the salvage soil and facility expansion allows the reclamation operations to be managed without the use of intermediary soil salvage stockpiles.

In this report, Table 3.1 lists the disturbed areas and salvaged soil volumes for years 0, 5, 10, 15, and Ultimate from these areas. Figure 1 describes the potential salvage soil within the anticipated Project boundaries while Figures 2 through 6 present the location of the cumulative disturbed waste rock and tailings storage areas superimposed on the salvage soil maps. A summary of the areas is presented below along with the total estimated volume of salvaged material per area. The estimated total volume of salvage soil from all areas is 4,582,594 cubic yards.
2.0 **SUITABLE SOIL AREAS**

In March 2007, Tetra Tech completed a detailed map of the onsite soil borrow depths within the proposed limits of the Rosemont Project Area. Since the map was completed, the limits of the project have changed slightly but the extent of the soil information remains largely inside the project limits. This map was based on a site soil resource evaluation and inventory field study completed by Tetra Tech. Detailed information from the study, including laboratory test results, soil profile logs and suitability criteria are provided in the Survey of Salvage Topsoil Resources Report (June 2007).

The six soil types within the project limits are described below. These six soil types are further delineated into eight different borrow depths as presented on Figure 1. The availability of soil which can be salvaged in a particular area will be determined by the machinery used and the topographic disposition of the salvage area. Maximum salvage is achieved on flat ground where machinery function can be optimized.

### 2.1 Northern Aspect – 12 inches

North aspect soils located in the southern portion of the survey area are formed from colluvium and slope wash-alluvium. The geologic parent material of this area is the Gila Conglomerate which consists of quartz sandstone, carbonates, argillite, hornfels, granitic rock, and quartz–feldspar. The average depth of suitable borrow soil is approximately twelve inches. The soils available for salvage are sandy loams with 15 to 20% gravel, 0 to 5% cobbles, and between 45 and 65% surface coarse fragments. Slopes range from 20 to 45 degrees. Generally these soils have moderate vegetative cover including trees, shrubs, and grasses.

### 2.2 Southern Aspect – 6-12 inches

South aspect soils located in the southern portion of the survey area are formed from colluvium and slope wash-alluvium. The geology of this area is also the Gila Conglomerate. These soils have approximately 6 inches of suitable soil for salvage with occasional deeper deposits in concave physiographic positions. The texture of these soils are sandy loam to coarse sandy loam with a coarse fragment content on the surface ranging from 50 to 75% and coarse fragment content in the soil ranges 20 to 40% gravel and 0 to 5% cobbles. Slopes occurring in these areas range from 20 to 45 degrees. Vegetation cover is primarily forbes, cactus, and grasses.

### 2.3 Alluvial Wash/Fans – 24-45 inches

Alluvial washes are located in drainage bottoms throughout the Project area. These soils are deep with borrow depths ranging from 24 to 45 inches and with textures of loamy sand to sandy loams. The coarse fragment content ranges from 15 to 45% consisting primarily of small gravels. Care will be needed within the active flood plain portions of the wash which generally have insufficient fines within the profile to support vegetation. Vegetation cover varies widely depending on the orientation/position of the site.

The alluvial fans were limited in extent and were therefore included with the alluvial wash map unit. These fans are located at the mouths of side drainages and have the deepest soil salvage potential. The alluvial fan soil profile is very similar to the alluvial wash soils except that they are generally deeper with finer texture soils, generally loams rather than sandy loams. Vegetative cover in the fans also varies greatly depending on aspect and grazing pressure but is generally in a good class.
2.4 Alluvial Terraces – 18 inches
This soil unit is fairly limited and located in the western portion of the study area. These soils are derived from Late Pleistocene alluvial terrace material at the toe of the upper slopes of the Santa Rita Mountains. They are deep gravelly to very gravelly loams over weakly cemented reactive (high pH) extremely gravelly alluvium. The salvageable borrow ranges from 12 to 18 inches with gravel and cobbles generally being the restrictive feature. Vegetative production is good and is primarily comprised of grasses.

2.5 Residual Benches – 12 inches
These soil units are located in the northwestern portion of the Project area. The majority of these soils are derived from very weathered residuum of the Willow Canyon Formation. These soils are moderately deep; however, borrow depths are generally limited to 1 foot due to coarse fragment content and heavy clay soils. Surface coarse fragment content ranges from 30 to 50%. Near surface texture are generally clay loams grading to clays with slopes varying greatly from 5 to 40% dependent on position. Vegetative cover varies from moderate to good.

2.6 Shallow to Bedrock – <6 inches
The shallow bedrock unit is located in the center and northern portions of the project area. The major geologic formations include the Willow Canyon, an arkosic to tuffaceous siltstone, sandstone, and conglomerate; the Apache Canyon, a shale and laminated siltstone and the Mt. Fağan Rhyolite, an ash flow tuff. Soil depths range from very shallow to 5 inches on slopes, to deep 24 inches in drainages. The soils in this area range form coarse sandy loams to clay loams. Coarse fragments within the soil are between 25% and 45% gravels and surface fragments of 40 to 60% and higher. Some additional isolated pockets of borrow soil may be available on site specific basis. The limiting factor for suitable borrow soil in this area is the bedrock outcrops and shallow depth to bedrock throughout the majority of these areas. This material is the initial pedogenesis zone and generally not considered during soil salvage determination. However since the current vegetation cover primarily includes forbes, cactus and grasses, this indicates that the shallow bedrock unit is actively serving as a growth media. Soil suitability is being validated by growth media studies under way at the University of Arizona in Tucson. Revegetation success has been observed within the proposed pit area where weathered bedrock material has been used for reclamation at exploration locations.
3.0 ROSEMONT STORAGE AREAS

As planned, there are two dry stack tailings areas, separated by a natural channel. The sites are known as the north and south dry stack tailings facilities. Waste rock mined from the open pit will be used as a waste rock buttress for both dry stack sites. All other waste rock will be placed within ultimate waste rock storage areas.

The location of the above areas is indicated on Figure 2. The area of north dry stack tailings area will cover about 820 acres. The south dry stack tailings area will cover about 400 acres. The waste rock storage area will cover about 1,500 acres.

3.1 Estimated Soil Salvage Volumes

The soil map units and the corresponding mining facility for Year 5 areas are combined into the intersecting areas presented on Figure 3. In addition, Figures 4, 5, and 6 present Years 10, 15, and Ultimate. Table 3.1 presents an itemized total of each soil type and on-going facility area. Appendix A presents the Storage Area and Map Unit Intersection. The total estimated volume of salvageable soil in the prospective mine facility is approximately 4,583,000 cubic yards.

Table 3.1: Storage Area and Salvageable Soil Volumes

<table>
<thead>
<tr>
<th>Operational Year</th>
<th>Area in Acres (Rounded)</th>
<th>Estimated Soil Volume in (Cubic Yards)</th>
</tr>
</thead>
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<td>410</td>
<td>693,000</td>
</tr>
<tr>
<td>Year 5</td>
<td>1,850</td>
<td>3,134,000</td>
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<tr>
<td>Year 10</td>
<td>2,340</td>
<td>4,027,000</td>
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<tr>
<td>Year 15</td>
<td>2,570</td>
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<tr>
<td>Ultimate</td>
<td>2,670</td>
<td>4,583,000</td>
</tr>
</tbody>
</table>

Underlying the salvageable soil throughout the site, and specifically underlying the above operational areas, is a substantial layer of unconsolidated and weathered bedrock. The volume of potentially salvageable material in these areas was estimated using a minimum depth of 4 feet as defined in the Survey of Salvage Topsoil Resources Report (June 2007). The estimated volume of unconsolidated and weathered bedrock is 17,230,000 cubic yards.
4.0 CONSIDERATIONS

When implementing the soil salvage activities, the following items are offered for consideration:

- Waste rock and stack piles will be developed step-by-step with mine operations; in this way, as the waste rock and dry stack areas are concurrently reclaimed, salvaged soil can be used as these areas develop.

- The typical salvage soil can likely make a viable growing media. Considering the desert nature of the area, a high coarse soil percentage will help to keep the soil in place during occasional extreme erosion events;

- Observed native plant growth on the site is on the Northern aspects. This is attributable to the locally high aridity index, which is more severe on southern exposures. When practicable, sloping reclaimed areas to the north will aide the re-vegetation effort.

- Salvage of some of the underlying fractured bedrock will effectively increase the salvage volume without degrading the salvage soil quality.
5.0 REFERENCES


FIGURES
FIGURE 1
Soil Map Unit Delineation

Legend
- Soil Sampling Sites
- Project Area Boundary
- Township Range
- Sections

Rosemont Topsoil Unit Delineation
Depth
- <6"
- 6"
- 6-12"
- 12"
- 18"
- 18-24"
- 24"
- 36"

Source:
Cooper Aerial Photo, Pima County GIS, Arizona ArcIMS server, and the Coronado National Forest
NAD83 UTM 12 Meters

1:24,000
1 inch equals 2,000 feet

Rosemont Soil Survey

6/29/2007 N:\PROJECTS\Rosemont Soil Survey\GIS\Fig 1 Rosemont Soil Survey.mxd T: Kevin Hively
Pre-Production Storage Area - Disturbed Area Map

Legend
- Buttress and Storage Year Zero
- Project Area Boundary
- Township Range
- Sections

Rosemont Topsoil Unit Delineation

Depth
- <6"
- 6"
- 6-12"
- 12"
- 18"
- 18-24"
- 24"
- 36"

Source: Cooper Aerial Photo, Pima County GIS, Arizona ArcIMS server, and the Coronado National Forest

NAD83 UTM 12 Meters
1 inch equals 2,000 feet

FIGURE 2
Pre-Production Storage Area - Disturbed Area Map
FIGURE 4

Year Ten Storage Area - Disturbed Area Map

Legend
- Buttress and Storage Year 10
- Project Area Boundary
- Township Range
- Sections

Rosemont Topsoil Unit Delineation
Depth
- <6"
- 6"
- 6-12"
- 12"
- 18"
- 18-24"
- 24"
- 36"

Source:
Cooper Aerial Photo, Pima County GIS, Arizona ArcIMS server, and the Coronado National Forest

NAD83 UTM 12 Meters

1 inch equals 2,000 feet

PROJECT:
Rosemont Soil Survey

SOURCE:
Cooper Aerial Photo, Pima County GIS, Arizona ArcIMS server, and the Coronado National Forest

SCALE:
1:24,000

FIGURE 4

1 inch equals 2,000 feet

Page 11
Dry Stack Tailings Storage Area

Waste Rock Storage
T 18 S, R 15 E
T 19 S, R 15 E T 19 S, R 16 E

Dry Stack Tailings Storage Area

Source: Cooper Aerial Photo, Pima County GIS, Arizona ArcIMS server, and the Coronado National Forest

FIGURE 6
Ultimate Storage Area - Disturbed Area Map

Legend
Buttress and Storage Ultimate
Project Area BDY
Township Range
Sections
Rosemont Topsoil Unit Delineation

Depth
<6" 6"
6-12" 12"
12-18" 18"
18-24" 24"
24-36" 36"

1:24,000
1 inch equals 2,000 feet

Project:
County:
PRJ:
State: Location:
Date: Revision:
Pima
Rosemont Soil Survey
Arizona T 18-19 S, R 15-16 E
6/29/2007 1
I
0 1,000 2,000 3,000 4,000
Feet

Page 13
APPENDIX A

STORAGE AREA AND MAP UNIT INTERSECTION
Table A - 1 - Storage Areas and Map Unit Intersection

<table>
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<th>Map Unit Depth Range (inches)</th>
<th>Salvageable Depth by Machine</th>
<th>Area (Acres)</th>
<th>Estimated Volume (Cubic Yards)</th>
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