This report further develops the Rosemont Ridge Landform and incorporates a variety of considerations such as controlling stormwater and erosion, addressing post-mining land uses, and incorporating landscaping or aesthetic considerations.
Memorandum

To: Beverly Everson
Cc: Tom Furgason
From: Kathy Arnold
Doc #: 012/10 – 15.3.2
Subject: Transmittal of Reclamation Concept Update Report
Date: March 26, 2010

Rosemont is pleased to transmit the Reclamation Concept Update by Tetra Tech and dated March 2010 to the Forest Service and SWCA. This report further develops the Rosemont Ridge Landform and incorporates a variety of considerations such as stormwater and erosion controls, addressing post-mining land uses, and incorporating landscaping and/or aesthetic considerations. It is intended to supplement the concepts presented with the Mine Plan of Operations Reclamation Plan in 2007. Again, we are providing three hardcopies and two disk copies to the Forest and two hardcopies and one disk copy to SWCA.
Reclamation Concept Update

Rosemont Copper Project

This report further develops the Rosemont Ridge Landform and incorporates a variety of considerations such as controlling stormwater and erosion, addressing post-mining land uses, and incorporating landscaping or aesthetic considerations.

Prepared for:

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Tetra Tech Project No. 114-320832

March 2010
ROSEMONT COPPER PROJECT

RECLAMATION CONCEPT UPDATE

The following document has been prepared by the staff of Tetra Tech under the direct supervision of the ENGINEER of Record, whose seal and signature appear below.

The INFORMATION presented herein, were prepared in accordance with generally accepted professional engineering principles and practices.

David Krizek, P.E.
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## ACRONYMS

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<thead>
<tr>
<th>Acronym</th>
<th>Definition</th>
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<tbody>
<tr>
<td>ADEQ</td>
<td>Arizona Department of Environmental Quality</td>
</tr>
<tr>
<td>APP</td>
<td>Aquifer Protection Permit</td>
</tr>
<tr>
<td>BADCT</td>
<td>Best Available Demonstrated Control Technology</td>
</tr>
<tr>
<td>BLM</td>
<td>Bureau of Land Management</td>
</tr>
<tr>
<td>CNF</td>
<td>Coronado National Forest</td>
</tr>
<tr>
<td>EIS</td>
<td>Environmental Impact Statement</td>
</tr>
<tr>
<td>gpm</td>
<td>gallons per minute</td>
</tr>
<tr>
<td>H:V</td>
<td>Slope Horizontal to Vertical ratio</td>
</tr>
<tr>
<td>kton</td>
<td>kilo ton [1,000 short tons, two (2) million pounds]</td>
</tr>
<tr>
<td>M&amp;A</td>
<td>Errol L. Montgomery &amp; Associates</td>
</tr>
<tr>
<td>MPO</td>
<td>Mine Plan of Operations</td>
</tr>
<tr>
<td>NE</td>
<td>Northeast</td>
</tr>
<tr>
<td>NEPA</td>
<td>National Environmental Policy Act</td>
</tr>
<tr>
<td>NRCS</td>
<td>National Resources Conservation Service</td>
</tr>
<tr>
<td>PMP</td>
<td>Probable Maximum Precipitation</td>
</tr>
<tr>
<td>RUSLE</td>
<td>Revised Universal Soil Loss Equation</td>
</tr>
<tr>
<td>SE</td>
<td>Southeast</td>
</tr>
<tr>
<td>SR</td>
<td>State Route</td>
</tr>
<tr>
<td>USDA</td>
<td>United States Department of Agriculture</td>
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EXECUTIVE SUMMARY

The Rosemont Copper Project (Project) involves developing an open pit mine over a 20-25 year period on the east side of the Santa Rita Mountains. During operations, the Project is committed to concurrent reclamation, which includes contouring and revegetation of the outer slopes of the facilities that make up the Rosemont Ridge Landform. At the end of the mine life, final reclamation of the site will include demolition and closure of the Plant Site facilities and final regrading and revegetation of the Rosemont Ridge Landform. At closure, the Rosemont Ridge Landform will remain along with the Open Pit, access roads, and the graded Plant Site area.

The Rosemont Ridge Landform (Landform) is the consolidated and contoured earthen structure consisting of waste rock from the Open Pit, a closed Heap Leach Facility encapsulated with waste rock, and a Dry Stack Tailings Facility, also encapsulated with waste rock. The base reclamation concept associated with the Rosemont Ridge Landform (shown on Illustration E1.0) can be described as a diverse habitat mosaic reclamation approach. In this approach, the final features of the Landform incorporate a variety of end uses and considerations such as controlling stormwater and erosion, allowing access to all areas, addressing the post-mining land use (ranching and wildlife habitat), and incorporating landscaping or aesthetic considerations. Depending on the location, shaping of the Rosemont Ridge Landform was varied to allow for landscape diversity and to adhere to design and/or physical constraints.

As indicated, the Rosemont Ridge Landform was developed by taking the following factors into account:

- Stormwater and erosion control (overriding);
- Access to all areas;
- Post-mining land use;
- Visual considerations; and
- Material placement costs.
A more contoured look was applied to the south end of the Rosemont Ridge Landform which is comprised of the Waste Rock Storage Area. Relief was provided by shaping the slopes with a modified Ridge and Valley Method using short slope runs. Slopes were pushed in and out by adding wide benches ranging in width from 100 to 300 feet. These benches provide access to all areas of the Landform. Water management features, such as shallow pools, are planned on these wide benches. These locations provide stormwater control, enhanced vegetative growth, and wildlife habitat. Several small hill features (hillocks) also comprise the top surface of the area. The slopes between the benches are generally about 300 to 325 feet long on a 3H:1V (horizontal:vertical) angle. This corresponds to a vertical rise of about 100 feet between benches.

Less contouring was achievable for the slopes in the central and northern portions of the Landform which are associated with the Dry Stack Tailings Facility. The dry stack tailings are encapsulated by thick waste rock buttresses on the outslopes. Drainage benches in the dry stack tailings area were placed on an approximate vertical spacing of 100 feet to provide stormwater runoff control and access to all areas of the outslopes. Drainage from these benches were directed to the Waste Rock Storage Area, to natural ground, or to stilling pools which transition storm flows from the channels to drop structures. These large stilling pool areas are also locations for enhanced vegetative growth and wildlife habitat.

The drainage benches are generally 50 feet wide and accommodate an access road, safety berm, and a stormwater channel. The stilling pool areas range from 100 to 200 feet wide. A contoured ridge is also planned for the top surface of the central portion of the Rosemont Ridge Landform, which is above the South Dry Stack Tailings Facility. This ridge is constructed of waste rock and provides a transition from the hillocks constructed in the Waste Rock Storage Area to the top of the North Dry Stack Tailings Facility, or the north end of the Rosemont Ridge Landform.

Contouring was also incorporated into the east facing slope of the Landform associated with the North Dry Stack Tailings Facility. The contouring applied generally follows a modified Ridge and Valley approach with short slope runs. Except for the lower section of the east face, the areas between the benches are generally about 300 to 325 feet long on 3H:1V (horizontal:vertical) slopes. The lower part of the slope, however, has a slope run of about 600 feet. Placing a rock cover over this lower section is envisioned, along with the contoured valleys of the upper slope area. Illustration E2.0 shows a view of the reclaimed slopes on the east side of the North Dry Stack Tailings Facility.

Illustration 2.0 Rendering of the Rosemont Ridge Landform Near Milepost 46.6 on State Route 83 looking at the east slope of the reclaimed North Dry Stack Tailings Facility

The top surface of the northern end of the Landform is flat with large, shallow depressions. Post-mining land use such as wildlife habitat and ranching are envisioned for this area. In
addition to controlling stormwater, these large, shallow depressions will help to enhance vegetative growth and wildlife habitat.

Besides the application of a seed mix and tree plantings on the benches and on the slopes, additional mitigation strategies envisioned for the Rosemont Ridge Landform include the placement of scree piles (rock slopes). Scree piles may be placed for visual purposes, for erosion protection, or for wildlife habitat.

Rosemont is currently performing work on two (2) revegetation test plots located at the Project site. These test plots represent different site elevations as well as the opportunity to test different soils and soil treatments. These test plots mimic the slope lengths and slope angles generally applied to the Rosemont Ridge Landform.

A plan view of the post mining land use for the Rosemont Ridge Landform is shown on Illustration E3.0
As shown on Illustration 3.0, the Rosemont Ridge Landform was designed with the following features:

- Water management features (areas of enhanced vegetation growth and wildlife habitat);
  - Water Management Features within the Landform footprint: 327 acres; and
  - Water Management Features outside the Landform footprint: 164 acres.
- Total Water Management Features associated with the Rosemont Ridge Landform design is 491 acres.
- Scree areas (areas of slope protection, wildlife habitat, and visual mitigation): 274 plan acres;
- Ranching areas within the Landform: 1,726 plan acres; and
- Hillocks (small hill features): 217 plan acres.
1.0 INTRODUCTION

This report presents an update to the planned reclamation approach associated with the Rosemont Copper Project (Project) located in Pima County, Arizona. In 2007, Tetra Tech, Inc. (Tetra Tech) prepared the Reclamation and Closure Plan (Tetra Tech, 2007) associated with feasibility level designs and the preparation of the Rosemont Project Mine Plan of Operations (MPO) [WestLand Resources, Inc. (WestLand), 2007]. In the 2007 report, concurrent reclamation was highlighted during operations, which included contouring and revegetation of the outer slopes of the facilities that make up the Rosemont Ridge Landform. The Rosemont Ridge Landform (Landform) is the consolidated and contoured earthen structure consisting of waste rock from the Open Pit, a closed Heap Leach Facility encapsulated with waste rock, and a Dry Stack Tailings Facility, also encapsulated with waste rock. The planned approach to stormwater control on the outer slopes of the final Landform was generalized. In summary, the following stormwater control options were listed in the 2007 report:

- Barber Pole Method;
- Dendritic Pattern;
- Retention Method;
- Continuous soil covered or rock covered slopes; and
- Continuous soil covered or rock covered slopes with natural landform features.

As a subset of the last option, the Ridge and Valley Method was contemplated for the final reclaimed surfaces. As described in the Reclamation and Closure Plan (Tetra Tech, 2007):

In the Ridge and Valley Method, channels are constructed generally perpendicular to the crest and toe of the outslope. The contributing slopes extend from the channel on either side, terminating at ridges (parallel to the channel) where the adjacent section then begins. These sections are then repeated across the face of the outslope, with rounded convex summits and concave bases.

Further analysis of stormwater control methods achievable on the outer slopes of the Landform, based on physically controlling factors, led to a combination approach. A base reclamation concept associated with the Rosemont Ridge Landform was developed taking the following factors into account:

- Stormwater and erosion control (overriding);
- Access to all areas;
- Post-mining land use;
- Visual considerations; and
- Material placement costs.

This Reclamation Concept Update provides details associated with the base concept of the Rosemont Ridge Landform.

In addition to the Reclamation and Closure Plan (Tetra Tech, 2007), other supporting design documents have been submitted to regulatory agencies that include reclamation and closure aspects associated with the Project:

- Mined Land Reclamation Plan (MLRP) submitted to the Arizona State Mine Inspector (ASMI) (Tetra Tech, 2008); and
Aquifer Protection Permit (APP) Application to the Arizona Department of Environmental Quality (ADEQ) (Tetra Tech, 2009a).

The MLRP associated with Project was approved by ASMI on July 10, 2009. The APP application is currently in the technical review phase with ADEQ. Additionally, the Project is going through the Environmental Impact Statement (EIS) development process under the National Environmental Policy Act (NEPA). Analyses performed as part of the EIS process will also guide the final facility design process. However, this Reclamation Concept Update, and any other future updates, is intended to supplement and refine information presented in previous submittals.

The reclamation concept presented herein is for informational purposes only and is not intended to be a final design package. Based upon the final preferred alternative or set of alternatives selected during the EIS process, reclamation and closure plans will be further developed and will include:

- Phasing;
- Updated reclamation and closure costs; and
- Refined disturbance areas.

Disturbed areas associated with this updated reclamation concept, however, are similar to those presented in the Reclamation and Closure Plan (Tetra Tech, 2007).

The remainder of this document includes the following sections:

- Section 2.0 – Property Location, Ownership, and Land Use;
- Section 3.0 – Rosemont Ridge Landform;
- Section 4.0 – Design Criteria;
- Section 5.0 – Oblique Aerials of the Rosemont Ridge Landform;
- Section 6.0 – Renderings and Viewshed Analysis;
- Section 7.0 – Rosemont Ridge Landform Features; and
- Section 8.0 – References.
2.0 PROPERTY LOCATION, OWNERSHIP, AND LAND USE

The Rosemont Property (Property) is located approximately 30 miles southeast of Tucson, Arizona west of State Route 83 (SR 83), as shown on Figure 01. Access to the site is from Interstate 10 to SR 83 south, then west on a proposed Primary Access Road that will be constructed at the start of the Project (Figure 02). Figure 02 also shows the main Project disturbance area located within the following drainages:

- Barrel Canyon drainage;
- Wasp Canyon drainage; and
- McCleary Canyon drainage.

Based on the planned facility layouts, all drainages within the footprint of the main disturbance area report to a proposed Compliance Point Dam (Compliance Point) as indicated on Figure 02. This Compliance Point is located within the Lower Barrel Canyon Wash. Placing the Project facilities within a single watershed drainage area was an early initiative developed for the Project.

The Property consists of a group of patented mining claims, unpatented mining claims, and fee land that cover most of the Rosemont and Helvetia Mining Districts (Figure 03). In geographical terms, the Rosemont Property is located at the approximate latitude and longitude coordinates of 31° 50'N and 110° 45'W.

The core of the Project consists of 132 patented lode claims that total an area of 1,969 acres. A contiguous group of 947 unpatented lode-mining claims, that total an area of about 14,000 acres, surrounds the patented load claims. Additionally, there are a total 911 acres of fee land on the East side of the Santa Rita mountains near the Project site. Most of the unpatented claims were staked on Federal Lands that are now administered by the United States Department of Agriculture (USDA), Forest Service, and the Coronado National Forest (CNF). A limited number of claims in the northwest portion of the Property are on Federal Land administered by the Bureau of Land Management (BLM). The area covered by the patented claims, unpatented claims, and fee lands total about 17,000 acres. All private land and unpatented mining claims described above are owned and/or controlled by Rosemont Copper Company (Rosemont), a subsidiary of Augusta Resource Corporation.

Current land use reflects a mixture of mining activities, ranching, wildlife habitat, and recreational use. A portion of the Arizona Trail is along the southern boundary of the Project site. In addition to on-going exploration activities, the area is used by hikers and other outdoor enthusiasts.

Post-mining recreational activities in the area are anticipated to include horseback riding, hunting, prospecting, all-terrain vehicle and motorcycle riding, hiking, and bird watching. Post-mining reclamation objectives for the Property include dispersed recreation (excluding motorized recreation), ranching, and wildlife habitat. Much of the top and side surfaces of the post-mining Rosemont Ridge Landform will be ideal for grazing once vegetation is established.

Because Rosemont is planning concurrent reclamation of the facility, it is anticipated that the establishment of wildlife habitat will start early in the life of the Project.
3.0 ROSEMONT RIDGE LANDFORM

As previously indicated, the Rosemont Ridge Landform is the consolidated and contoured earthen structure consisting of the Waste Rock Storage Area, a closed Heap Leach Facility encapsulated with waste rock, and a Dry Stack Tailings Facility, also encapsulated with waste rock. The Project will entail processing of both sulfide and oxide ores. Tailings from the sulfide ore processing circuit will be dewatered and placed behind thick waste rock buttresses in the Dry Stack Tailings Facility. Leaching of oxide ore will take place on a Heap Leach Pad located within the footprint of the Rosemont Ridge Landform. Details on the dry stack tailings are available in a report prepared by AMEC Earth & Environmental, Inc. (AMEC) titled *Dry Stack Tailings Storage Facility Final Design Report* (AMEC, 2009b). Details of the Heap Leach Facility are available in a report by Tetra Tech titled *Rosemont Heap Leach Facility Permit Design Report* (Tetra Tech, 2009).

As part of the facility characterization, Tetra Tech prepared the *Infiltration, Seepage, Fate and Transport Modeling Report* (Tetra Tech, 2010b) for the following facilities:

- Waste Rock Storage Area;
- Heap Leach Facility; and
- Dry Stack Tailings Facility.

A brief discussion of the closure aspects applied to the Rosemont Ridge Landform, based on the *Infiltration, Seepage, Fate and Transport Modeling Report* (Tetra Tech, 2010b), are presented in Section 4.2 (Heap Leach Facility Closure) of this report.

Figure 04 shows the Rosemont Ridge Landform with the operational Plant Site. Figure 05 shows the Landform with a post-closure graded Plant Site area.

The Pollutant Management Area (PMA) shown on Figures 04 and 05 is the limit projected in the horizontal plane of the area on which pollutants are or will be placed. The PMA consists of a line circumscribing the APP Regulated Facilities. This initial PMA was developed by delineating the drainage divides around the Project site.

During development of detailed phasing plans associated with the Rosemont Ridge Landform, operational issues arose with regard to material placement and access routes. Figure 06 shows a required haul road traversing the west and north sides of the Rosemont Ridge Landform. This haul road will likely remain at closure. Additionally, adjustments made to the Landform during shaping, etc., lead to a material imbalance. An expanded Rosemont Ridge Landform, shown on Figure 07, was developed to accommodate this imbalance. Accommodation of the following material tonnages was made within the expanded Rosemont Ridge Landform.

- 1,232,308 ktons of waste rock;
- 69,974 ktons of oxide ore; and
- 546,340 ktons of sulfide ore/dry stack tailings.

The expanded Rosemont Ridge Landform included raising the South Dry Stack Tailings Facility by 160 feet and the North Dry Stack Tailings Facility by 60 feet.

As indicated in Section 1.0, the Project is going through the EIS process and the selection of a final preferred alternative may require adjustments to the reclamation plan. Therefore, updated costs and phased reclamation sequencing, as applicable to the selected alternative, will be prepared at a later time along with updated reclamation drawings. The remaining descriptions...
and development of the Rosemont Ridge Landform within this report, however, were based on Figure 05.

3.1 General Reclamation Approach

At the end of the 20 to 25 year mine life, final reclamation of the site will include demolition and closure of the Plant Site facilities and final regrading and revegetation of the Rosemont Ridge Landform. The Rosemont Ridge Landform will remain along with the Open Pit, access roads, and the regraded Plant Site. The Plant Site may be developed into additional recreational areas. The Open Pit will remain as an excavation, subject to natural processes of wind and water erosion, and geochemical weathering processes. A lake is anticipated to develop in the Open Pit as determined by regional groundwater modeling performed by Montgomery & Associates (M&A) documented in the Groundwater Flow Modeling Conducted for Simulation of Proposed Rosemont Pit Dewatering and Post-Closure Rosemont Project Pima County, Arizona (M&A, 2009).

Based on pit recharge information provided by M&A, and geochemical testing performed by Tetra Tech, Tetra Tech prepared the Geochemical Pit Lake Predictive Model (Tetra Tech, 2010a). Following 200 years of model simulation, the results of the model suggest that water in the pit lake will closely resemble the quality of local groundwater.

As indicated, the Open Pit, the graded Plant Site, access roads, and the Rosemont Ridge Landform will remain after closure. Design of the outer shell of the Rosemont Ridge Landform followed the stormwater control features described in Section 3.2 and the overall design criteria described in Section 4.0. A general description follows:

The Rosemont Ridge Landform can be described as a diverse habitat mosaic reclamation approach where the final features of the Landform incorporate a variety of end uses and considerations such as controlling stormwater and erosion, allowing access to all areas, addressing the post-mining land use (ranching and wildlife habitat), and incorporating landscaping or aesthetic considerations. Depending on the location, shaping was varied to allow for landscape diversity and to adhere to design and/or physical constraints.

Following the cessation of mining, the Rosemont Ridge Landform will remain along with the Open Pit and appropriate access roads. Over the mine life, the dry stack tailings and heap leach facilities will be encapsulated within a thick waste rock shell. Waste rock will also be placed around the western perimeter of the Landform footprint early in the mine life to allow concurrent reclamation of the outer slopes. This will allow modification and enhancement of the reclamation approach during the life of the mine – should conditions warrant.

A more contoured look was applied to the south end of the Landform which is comprised of the Waste Rock Storage Area. Relief was provided by shaping the slopes with a modified Ridge and Valley Method using short slope runs. Slopes were pushed in and out by adding wide benches ranging in width from 100 to 300 feet. These benches provide access to all areas of the Landform. Water management features, such as shallow pools, are planned on these wide benches. These locations provide stormwater control, locations for enhanced vegetative growth, and wildlife habitat. Several small hill features (hillocks) also comprise the top surface of the area. The slopes between the benches are generally about 300 to 325 feet long on a 3H:1V (horizontal:vertical) angle. This corresponds to a vertical rise of about 100 feet between benches.

Less contouring was achievable for the slopes in the central and northern portions of the Landform which are associated with the Dry Stack Tailings Facility. The dry stack tailings are encapsulated by thick waste rock buttresses on the outslopes. Drainage benches in the dry
stack tailings area were placed on an approximate vertical spacing of 100 feet to provide stormwater runoff control and access to all areas of the outslopes. Drainage from these benches were directed to the Waste Rock Storage Area, to natural ground, or to stilling pools which transition storm flows from the channels to drop structures. These large stilling pool areas are also potential locations for enhanced vegetative growth and wildlife habitat.

The drainage benches are generally 50 feet wide and accommodate an access road, a safety berm, and a stormwater channel. The stilling pool areas range from 100 to 200 feet wide. A contoured ridge is also planned for the top surface of the central portion of the Landform, which is above the South Dry Stack Tailings Facility. This ridge is constructed of waste rock and provides a transition from the hillocks constructed in the Waste Rock Storage Area to the top of the North Dry Stack Tailings Facility, or the north end of the Rosemont Ridge Landform.

Contouring was also incorporated into the east facing slope of the Landform associated with the North Dry Stack Tailings Facility. The contouring applied generally follows a modified Ridge and Valley approach with short slope runs. Except for the lower section of the east face, the areas between the benches are generally about 300 to 325 feet long on a 3H:1V (horizontal:vertical) slopes. The lower part of the slope, however, has a slope run of over 600 feet. Placing a rock cover over this lower section is envisioned, along with adding rock to the contoured valleys of the upper slope area.

The top surface of the northern end of the Landform is flat with large, shallow depressions. Post-mining activities such as wildlife habitat and ranching are envisioned for this area. In addition to controlling stormwater, these large, shallow depressions will help to enhance vegetative growth and wildlife habitat.

Cross sections and expanded plan views were prepared for the Rosemont Ridge Landform as shown on Figure 08. Figures 09 through 11 show cross sections through the Landform as described below:

- **Figure 09:** Cross Section A-A’ – South to north cross section running through the entire Rosemont Ridge Landform. This section shows the location of the closed and encapsulated Heap Leach Facility and the Interim Buttress located between the South Dry Stack Tailings Facility and the North Dry Stack Tailings Facility;

- **Figure 10:** Cross Section B-B’ – West to east cross section running through the Waste Rock Storage Area. This section shows wide benches developed on the outer slopes of the Waste Rock Storage Area;

- **Figure 10:** Cross Section C-C’ – West to east cross section running through the Waste Rock Storage Area and the closed Heap Leach Facility. This section shows the steeper west facing slope adjacent to the closed Heap Leach Facility and the waste rock cover thickness placed over the spent leach ore;

- **Figure 11:** Cross Section D-D’ – West to east cross section through the South Dry Stack Tailings Facility. This section shows the large waste rock buttresses encapsulating the dry stack tailings. Also shown is a waste rock ridge placed above the south dry stack. As shown on this section, the waste rock varies from a minimum of five (5) feet to approximately 85 feet; and

- **Figure 11:** Cross Section E-E’ – West to east cross section through the North Dry Stack Tailings Facility. This section shows the large waste rock
3.2 Applied Stormwater Controls

Figure 12 provides an expanded view of the Waste Rock Storage Area. Shaping the outer surface of the Waste Rock Storage Area was based on application of the following stormwater control features:

- Stormwater control basins would be constructed on wide benches in the Waste Rock Storage Area to hold up to the 500-year, 24-hour storm event. Stormwater generated from flows over the 500-year, 24-hour storm event would be routed to containment areas located between the toe of the Waste Rock Storage Area and adjacent natural ridge areas. These areas are generally sized to hold the Probable Maximum Precipitation (PMP) event. Stormwater routing to these perimeter containment areas would be via rocked slopes connecting the benches to the perimeter areas. The benches are generally spaced 100 feet vertically with intervening 3:H:1V slopes. This results in slope lengths of about 315 feet between benches. This configuration assumes that the waste rock material is fairly coarse;

- No stormwater ponding is allowed above the encapsulated Heap Leach Facility; and

- A limited area on the west face of the Rosemont Ridge Landform, adjacent to the closed Heap Leach Facility, will have slopes steeper than 3H:1V due to conflicts with extending the Landform toe. These steeper slopes will have rock facing to control erosion over this entire steepened face. Additionally, drainage channels will be constructed in this area to control stormwater runoff. These drainage channels will be similar to those planned for the Dry Stack Tailings Facility (see descriptions below on stormwater controls associated with the dry stack tailings).

Cross sections were prepared for the Waste Rock Storage Area showing typical stormwater control basins and perimeter containment areas (see Figures 13 and 14).

- Figure 13: Cross Section F-F’ – Typical section showing the wide benches in the Waste Rock Storage Area and location of the stormwater control basins. These basins are typically four (4) feet to eight (8) feet deep;

- Figure 13: Section G-G’ shows the flow channel between the stormwater control basins. These connecting channels are approximately two (2) feet deep;

- Figure 14: Cross Section H-H’ – Section through a typical perimeter containment area between the toe of the Waste Rock Storage Area and an adjacent natural ridge. The Pit Diversion Channel shown on Figures 04 through 08 discharges to this perimeter containment area. The Pit Diversion Channel diverts unimpacted stormwater runoff from an area up-gradient of the Open Pit; and

- Figure 14: Cross section I-I’ provides an additional section through this perimeter containment area. Shown on the section is an overflow channel out of this containment area to another perimeter containment area.

An expanded view of the Dry Stack Tailings Facility is shown on Figure 15. Both the South Dry Stack Tailings Facility and the North Dry Stack Tailings Facility are shown. Shaping the outer surface of the Dry Stack Tailings Facility was based on application of the following stormwater control features:
The configuration of the slopes are generally 3H:1V with drainage control benches spaced about 100 feet vertically. This results in slope runs of approximately 315 feet long. Drainage control benches are generally 50 feet wide and accommodate a drainage channel, access road, and a safety berm. This configuration assumes that the waste rock material placed on outer slopes is fairly coarse. Thick waste rock buttresses will encapsulate the dry stack tailings material;

The drainage channels route storm flows to the Waste Rock Storage Area, natural ground, or to stilling pools/drop structures. At a minimum, the channels are sized to accommodate a 500-year, 24-hour event, even with a 30% loss in channel volume due to sedimentation as detailed in the Technical Memorandum titled *Rosemont Dry Stack Tailings Facility Drainage Bench Analysis* (Tetra Tech, 2010);

For reference, peak flows generated by a 500-year, 24-hour storm event using the National Resource Conservation Service (NRCS) curve number approach were deemed equivalent to the Pima County Method using PC-Hydro, which uses a 100-year storm event. This comparison is available in the Technical Memorandum titled *Rosemont Hydrology Method Justification* (Tetra Tech, 2010);

The drop structures, and associated stilling basins, transfer stormwater off the slopes of the Dry Stack Tailings Facility. At a minimum, these drop structures are designed to accommodate peak flows generated by a 500-year, 24-hour event;

Stormwater will pond on the top surface of the North Dry Stack Tailings Facility in large depressed areas. These areas are designed to hold runoff from up to the 1,000-year, 24-hour event before storm flows are discharged through decant structures to stilling pools/drop structures located on the face of the Dry Stack Tailings Facility. A containment berm located around the top perimeter of the North Dry Stack Tailings Facility, however, is designed to control storm volumes larger than the PMP event; and

Waste rock will be mounded over a majority of the top surface of the South Dry Stack Tailings Facility. Storm events up to the 10-year, 24-hour event will be contained in large depressed areas around the top perimeter of the South Dry Stack Tailings Facility. Storm events up to the 1,000-year, 24-hour event will pool on the top surface behind a two (2) foot high permeable rock weir on the west side of the Rosemont Ridge Landform leading to a flow-through drain. Flow-through drains are large rock drains intended to provide a hydraulic connection between the up-gradient side and the down-gradient side of the Landform. These large flow-through drain structures are located at the base of the Landform on natural ground. Except for the outlet on the west side, a large containment berm is located around the perimeter of the South Dry Stack Tailings Facility and is designed to route large storm events, such as the PMP, to the outlet on the west side.

Cross sections were prepared for the Dry Stack Tailings Facility as shown on Figures 16 through 22. These sections show typical details associated with construction of the waste rock buttresses encapsulating the dry stack tailings. Buttress dimensions are variable based on drop structure locations, haul road access requirements, etc. However, the minimum buttress width is generally 150 feet to accommodate two-way haul truck traffic required during buttress construction. Additionally, a minimum separation distance of 30 feet was maintained between the dry stack tailings and the final reclaimed side slope surface. A minimum cover thickness of five (5) feet of waste rock was applied to the top surface of the dry stack tailings.
The following cross sections are shown on Figures 16 through 22:

- **Figure 16**: Cross Section J-J’ – Typical buttress section showing spacing of stormwater drainage benches;
- **Figure 17**: Cross Section K-K’ – Buttress section through stilling pool/drop structure location;
- **Figure 18**: Cross Section L-L’ – Typical buttress section showing spacing of stormwater drainage benches;
- **Figure 19**: Cross Section M-M’ – Buttress section through contoured ridge showing spacing of stormwater drainage benches;
- **Figure 20**: Cross Section N-N’ – Buttress section through contoured ridge showing spacing of stormwater drainage benches;
- **Figure 21**: Cross Section O-O’ – Buttress section through contoured valley showing spacing of stormwater drainage benches; and
- **Figure 22**: Cross Section P-P’ – Buttress section through stilling pool location.

Figure 23 shows a typical drainage control bench design using either a V-channel design or a trapezoidal channel design. Use of the V-channel design is anticipated on the drainage benches.

Figures 24 through 28 show the development of typical stilling pool and drop channel design elements. Other stilling pool/drop channel locations are anticipated on the west side of the Rosemont Ridge Landform as shown on Figure 15.

- **Figure 24**: Plan view of the Southeast (SE) stilling pools/drop structures;
- **Figure 25**: Detailed plan view of a SE stilling pool;
- **Figure 26**: Plan view of the Northeast (NE) stilling pools/drop structures;
- **Figure 27**: Typical sections associated with the SE stilling pools/drop structures; and
- **Figure 28**: Typical sections associated with the NE stilling pools/drop structures.

Figure 29 shows a typical plan and section view for the decant structures located on top of the North Dry Stack Tailings Facility.
4.0 DESIGN CRITERIA

Both general and specific design criteria were applied to the design of the Rosemont Ridge Landform. Specific storm event criteria used to design stormwater control features were presented in Section 3.2. Section 4.1 below provides general design criteria applied to the Project. Section 4.2 provides closure guidance associated with the Heap Leach Facility.

4.1 General Reclamation Design Criteria

The following general design criteria were applied to the development of the Rosemont Ridge Landform. Select operational controls are also summarized that reduce the potential for long-term closure issues to occur.

- Placement of facilities to minimize or eliminate post-mining reclamation work, (i.e., Heap Leach Facility placed within the Waste Rock Storage Area and covered);
- Placement of waste rock/buttress material at final design slopes and plan configurations to minimize regrading costs;
- In general, maintain minimum 3H:1V post-mining slopes. Drainage control benches are generally placed on a vertical 100 foot vertical spacing. At an inner bench slope of 3H:1V, the inner slope is about 315 feet. This configuration assumed the slope is fairly course based on available material test results [see Appendix A for Technical Memorandum titled Rosemont Copper Company Waste Rock Material Characterization, (Tetra Tech, 2010f)]. A Revised Universal Soil Loss Equation (RUSLE) analysis was perform on general slope configurations. Appendix B provides the results of this analysis in a Technical Memorandum titled Soil Erosion Estimates (Tetra Tech, 2010j);
- Maintain minimum post-mining slope stability factors of safety per Best Available Demonstrated Control Technology (BADCT) recommendations, (i.e., 1.3 static, with material testing, and 1.1 dynamic) (ADEQ, 2004). A stability analysis was performed on a typical section in the Waste Rock Storage Area as well as a few sections in the Dry Stack Tailings Facility area. All analyses showed acceptable safety factors. Stability analyses for the Waste Rock Storage Area is documented in a Technical Memorandum titled Reclamation Plan Update – Waste Rock Stability Analysis (Tetra Tech, 2010e). Stability analyses for the Dry Stack Tailings Facility is documented in a Technical Memorandum titled Dry Stack Facility Stability Analyses (AMEC, 2009a). Both Technical Memoranda are provided in Appendix C;
- Placement of inert (non-acid generating) waste rock on outer slope areas and active management of limited quantities of potentially acid generating material. Implement a geochemical characterization program for the waste rock to verify preliminary geochemical characteristics and to provide updated placement information. Inertness is determined using the procedures in the Draft Policy for the Evaluation of Mining Rock Materials for the Determination of Inertness (ADEQ, 1998);
- Implementation of the dry stack tailings disposal method to reduce water consumption requirements and minimize the potential for seepage;
- Design to applicable BADCT guidelines for the Heap Leach Facilities to minimize the potential to impact groundwater and surface water resources;
- Construction of a perimeter berm/buttress around the Waste Rock Storage Area and Dry Stack Tailings Facility with concurrent reclamation of these areas as appropriate;
Soil salvage for reclaiming the outer surface of the Rosemont Ridge Landform, Plant Site, and Open Pit benches, as needed;  
Construction of flow-through drains to provide a hydraulic connection between the up-gradient and down-gradient sides of the Rosemont Ridge Landform; and  
Early decommissioning and reclamation of the Heap Leach Facilities to allow for monitoring of heap drain-down during active sulfide mining and milling operations.

4.2 Heap Leach Facility Closure

As indicated in Section 3.0, infiltration, seepage, fate and transport modeling was performed on the following facilities:

- Waste Rock Storage Area;  
- Heap Leach Facility; and  
- Dry Stack Tailings Facility.

Infiltration, seepage, fate and transport are defined as follows:

- Infiltration refers to the portion of rainfall runoff (or snowmelt) that enters a facility by downward flow through the surface;
- Seepage refers to the diffuse outward flow of water from a facility; and
- Fate and transport refers to the process of water passing through a facility and its resulting chemical composition as it migrates away from that facility.

Infiltration, Seepage, Fate and Transport modeling of the Heap Leach Facility was performed to determine the minimum thickness of waste rock cover necessary to prevent seepage (other than drain-down) from meteoric precipitation (i.e., rainfall and/or snowmelt) from occurring. A minimum waste rock cover of 20 feet was determined as detailed in the Technical Memorandum titled *Minimum Thickness Analysis for Waste Rock Placed Over Spent Leach Ore Material* (Tetra Tech, 2010c) as provided in Appendix D.

Additionally, a drain-down curve was developed for the spent ore pile associated with the Heap Leach Facility. It was estimated that the residual drain-down seepage from the spent ore would be less than ten (10) gallons per minute (gpm) about two (2) to three (3) years after the cessation of active leaching. Covering the spent ore pile with waste rock is envisioned no later than three (3) years after cessation of leaching. If residual seepage continues, the ponds located at the base of the Heap Leach Pad may be converted to treatment basins (Tetra Tech, 2010b).

Closure of the Heap Leach Facility ponds would follow BADCT guidelines (ADEQ, 2004). Appendix E presents a closure concept for the ponds that will be evaluated by ADEQ in the Technical Memorandum titled *Prescriptive BADCT Closure for the Heap Leach Facility Ponds* (Tetra Tech, 2010d).
5.0 OBLIQUE AERIALS OF THE ROSEMONT RIDGE LANDFORM

Figures 30 through 35 present oblique aerial views of the simulated reclaimed surface as applied to the base reclamation concept of the Rosemont Ridge Landform. The following figures are shown:

- **Figure 30:** Rosemont Ridge Landform – Oblique Aerial looking West – Immature Vegetation
- **Figure 31:** Rosemont Ridge Landform – Oblique Aerial looking West – Mature Vegetation
- **Figure 32:** Rosemont Ridge Landform – Oblique Aerial looking Southwest – Immature Vegetation
- **Figure 33:** Rosemont Ridge Landform – Oblique Aerial looking Southwest – Mature Vegetation
- **Figure 34:** Rosemont Ridge Landform – Oblique Aerial looking South – Immature Vegetation
- **Figure 35:** Rosemont Ridge Landform – Oblique Aerial looking South – Mature Vegetation

The Open Pit and the Rosemont Ridge Landform were placed on unreferenced aerial photos taken of the Project site. An inset of the original photos showing existing conditions is also provided on each of the oblique views. Only the two (2) major facilities remaining at closure were inserted into these oblique perspectives: the Open Pit and the Rosemont Ridge Landform.

From each perspective, west, southwest, and south, both immature and mature vegetation were applied to the Rosemont Ridge Landform and to the graded Plant Site area.

Mature vegetation is defined as:

“… what the site might look like twenty years after planting with native Prosopis velutina, Velvet Mesquites, local Juniperus deppeana pachyphlaea, Alligator Juniper trees, and seed mix understory. It depicts possible results if treated to achieve 100% revegetation. A typical Velvet Mesquite, under natural growing conditions, should achieve maturity after approximately 20 years, reaching a typical size of 30’ H x 30’ W. Alligator Juniper grows slowly up to 20-40’ H x 15-30’ W. Maturity may not be achieved until after 20 years. Results may be slower than anticipated, or with smaller resulting trees due to soil conditions and no irrigation,” [Sage Landscape Architecture & Environmental, Inc. (Sage), 2010].

Immature vegetation is defined as:

“… the same site if the 100% revegetation efforts have 25-30% plant survival after 20 years, or if 25-30% revegetation is initially implemented and achieves complete success. Vegetation remains Velvet Mesquites, Alligator Juniper, and seed mix,” (Sage, 2010)

Besides the application a seed mix and tree plantings, additional mitigation strategies applied to the Rosemont Ridge Landform included planting on the benches and on the slopes, and the placement of scree piles (areas of slope protection, wildlife habitat, and visual mitigation). Scree piles may be placed for visual purposes, for erosion protection, or for wildlife habitat. The current design concept of the Rosemont Ridge Landform also includes many water management features which will enhance vegetation growth and wildlife habitat. The Technical Memorandum titled *Rosemont Copper Company Waste Rock Material Characterization* (Tetra
Tech, 2010f) was used as a guide to apply coloration to the Landform. Materials comprising the final pit walls were summarized in another Technical Memorandum titled *Rosemont Copper Project Final Open Pit Wall Coloration* (Tetra Tech, 2010g). These two (2) technical memoranda are provided in Appendix A.

Rosemont is currently performing work on two (2) revegetation test plots located at the Project site. These test plots represent different site elevations as well as the application of different soils and soil treatments. Details of this test plot program and information on the seed mix being tested at the site are provided in Appendix F.

Example photographs of potential mitigation techniques using tree plantings and other strategies on side slopes are provided in Appendix G. As indicated above, tree planting on the benches and on the slopes is envisioned as a potential mitigation strategy for the outer slopes of the Rosemont Ridge Landform.
6.0 RENDERINGS AND VIEWSHED ANALYSIS

Renderings of the Rosemont Ridge Landform were prepared at select locations along SR 83 and in lower Barrel Canyon Wash. Additionally, viewshed analyses were performed at locations both close and distant to the Project site. Figure 36 shows the viewpoint locations associated with the renderings and the viewshed analyses. The following viewpoints were used:

- Viewpoint near Milepost 46.6 on SR 83 (M46 on Figure 36);
- Viewpoint in Lower Barrel Canyon Wash (LBC on Figure 36);
- Viewpoint near Milepost 44 on SR 83 (M44 on Figure 36);
- Viewpoint near Milepost 43 on SR 83 (M43 on Figure 36);
- Viewpoint from end of Singing Valley Ranch Road (SVR on Figure 36);
- Viewpoint from Arizona Trail (AZT on Figure 36);
- Viewpoint near Box Canyon Road/Arizona Trail Crossing (BCR on Figure 36);
- Viewpoint near Gunsight Pass (GSP on Figure 36);
- Viewpoint near Hilton Ranch Road Rural Residential Area (HRR on Figure 36);
- Viewpoint near Las Cienegas BLM Kiosk/Empire Ranch Entry (LCK on Figure 36);
- Viewpoint on Four Spring Tail – Mt. Wrightson (FST on Figure 36); and
- Viewpoint north of Sonoita Junction (NSJ on Figure 36).

Renderings were made of the Rosemont Ridge Landform from the following locations:

- Viewpoint near Milepost 46.6 on SR 83 (M46) (see Figure 37);
- Viewpoint in Lower Barrel Canyon Wash (LBC) (Figure 38); and
- Viewpoint near Milepost 44 on SR 83 (M44) (Figure 39).

The Rosemont Ridge Landform was placed in panoramic photos taken from the three (3) viewpoint locations. Renderings are assumed viewed from six (6) feet above the ground. Mature and immature vegetation, and other mitigation strategies described in Section 5.0, were applied to the Landform.

In addition to the renderings, viewshed analyses were performed for each of the viewpoint locations. Viewpoints were also assumed six (6) feet above the ground at these locations. Figures 40 through 51 show the results of targeted viewsheds. For clarity, only areas potentially disturbed by mining activities, or areas along the ridgeline of the Santa Rita Mountains, were shown as being visible from the viewpoint. These visible areas were “painted” yellow.

- Viewshed – Viewpoint near Milepost 46.6 on SR 83 (M46) (Figure 40);
- Viewshed – Viewpoint in Lower Barrel Canyon Wash (LBC) (Figure 41);
- Viewshed – Viewpoint near Milepost 44 on SR 83 (M44) (Figure 42);
- Viewshed – Viewpoint near Milepost 43 on SR 83 (M43) (Figure 43);
- Viewshed – Viewpoint from end of Singing Valley Ranch Road (SVR) (Figure 44);
- Viewshed – Viewpoint from Arizona Trail (AZT) (Figure 45);
- Viewshed – Viewpoint near Box Canyon Road/Arizona Trail Crossing (BCR) (Figure 46);
- Viewshed – Viewpoint near Gunsight Pass (GSP) (Figure 47);
- Viewshed – Viewpoint near Hilton Ranch Road Rural Residential Area (HRR) (Figure 48);
- Viewshed – Viewpoint near Las Cienegas BLM Kiosk/Empire Ranch Entry (LCK) (Figure 49);
- Viewshed – Viewpoint on Four Spring Tail – Mt. Wrightson (FST) (Figure 50); and
- Viewshed – Viewpoint north of Sonoita Junction (NSJ) (Figure 51).
7.0 ROSEMONT RIDGE LANDFORM FEATURES

As stated in the above sections, the design of the Rosemont Ridge Landform was developed with the following factors in mind:

- Stormwater and erosion control (overriding);
- Access to all areas;
- Post-mining land use; and
- Visual considerations.

Figure 52 provides an overall view of the Rosemont Ridge Landform with the following features highlighted:

- Water management features (areas of enhanced vegetation growth and wildlife habitat);
  - Water Management Features within the Landform footprint: 327 acres; and
  - Water Management Features outside the Landform footprint: 164 acres.
- Total Water Management Features associated with the Rosemont Ridge Landform design is 491 acres.
- Scree areas (areas of slope protection, wildlife habitat, and visual mitigation): 274 plan acres;
- Ranching areas within the Landform: 1,726 plan acres; and
- Hillocks (small hill features): 217 plan acres.

Based on this concept of the Rosemont Ridge Landform, the total disturbance areas anticipated for the Project are summarized below:

- The Open Pit (including associated access/haul roads): 915 plan acres;
- The Plant Site (including miscellaneous access roads and ancillary facilities): 450 plan acres;
- The Dry Stack Tailings Facility, Waste Rock Storage Area, and Heap Leach Facility: 2,675 plan acres (Rosemont Ridge Landform);
- Primary Access Road, West Access Road, and Offsite Power and Water Utilities: 425 plan acres; and

The total disturbance area of 4,465 plan acres includes undisturbed buffer areas that are within the main disturbance area and along road/utility corridors. These disturbed acreages are estimates only and may vary depending on final design of the facilities.
REFERENCES


ROSEMONT COPPER PROJECT
RECLAMATION CONCEPT UPDATE

STATE OF ARIZONA
N.T.S.

PROJECT LOCATION MAP

TETRA TECH
5051 West Van Buren Blvd
Phoenix, AZ 85041
(602) 397-0722
(800) 367-7749

TITLE SHEET AND GENERAL LOCATION MAP
Project: ROSEMONT COPPER PROJECT
County: PIMA COUNTY, ARIZONA
Figure: 01

Issued by: TETRA TECH
12000 Techpoint Blvd
602-397-0722
602-367-7749

Legend

- Roads
- Mile marker

Note:
The Main Disturbance Area is based on the updated base concept of the Rosemont Ridge Landform.
APPENDIX A
COLORATION
APPENDIX A1

TECHNICAL MEMORANDUM TITLED
ROSEMONT COPPER COMPANY
WASTE ROCK MATERIAL CHARACTERIZATION
(TETRA TECH, 2010F)
Rosemont Copper Project
Locator Sheet

Record # 012412

Document Date 2010 01 08

Document Title: Rosemont Copper Project Waste Rock Material Characterization

Document Author Tetra Tech

Document Description Summary of anticipated physical properties of waste rock materials that will be placed on outer surfaces of Rosemont Ridge Landform.

Other Notes Appendix A1 of 012308

This document is located in the following
[CIRCLE THE CATEGORY (from the list below) IN WHICH THIS ITEM IS FILED]

1. Project Management
   a. Formal recommendations & Directions
   b. Formal meeting minutes & memos
   c. General Correspondence
   d. Contracts, Agreements, & MOUs (Rosemont, Udall, SWCA)
   e. Other

2. Public Involvement
   a. Announcements & Public Meetings
   b. Mailing Lists
   c. Scoping Period Comments
   d. Udall Foundation Working Group
   e. Scoping Reports
   f. Comments after Scoping Period
   g. DEIS Public Comments

3. Agency Consultation & Permits
   a. Army Corps of Engineers (404 permit)
   b. US Fish & Wildlife Service (Sec. 7 T&E)
   c. State Historic Preservation Office (Sec. 106)
   d. Tribes (Sec. 106)
   e. Advisory Council on Historic Preservation (Sec. 106)
   f. Other

4. Communication
   a. Congressional
   b. Cooperating Agencies
   c. Organizations
   d. Individuals
   e. FOIA
   f. Internal
   g. Proponent

5. Proposed Action
   a. Mine Plan (including compilation)
   b. Supporting Documents
   c. Detailed Designs

6. Alternatives
   a. Cumulative Effects Catalog
   b. Connected Actions
   c. Dismissed from Detailed Analysis
   d. Analyzed in Detail

7. Resources
   a. Air Quality & Climate Change
   b. Biological
   c. Dark Skies
   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
   g. Land Use
   h. Livestock Grazing
   i. Noise & Vibration
   j. Public Health & Safety
   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. Reclamation

9. DEIS

10. FEIS

11. Geospatial Analysis (GIS Data)

12. FOIA Exempt Documents

13. ROD (including BLM & ACOE)
APPENDIX A2

TECHNICAL MEMORANDUM TITLED
ROSEMONT COPPER PROJECT
FINAL OPEN PIT WALL COLORATION
(TETRA TECH, 2010G)
Rosemont Copper Project
Locator Sheet

Record # 012411

Document Date 2010 01 08

Document Title: Rosemont Copper Project Final Open Pit Wall Coloration

Document Author Tetra Tech

Document Description Summary of the anticipated colors of the final Open Pit walls at the proposed Rosemont Copper Project

Other Notes Appendix A 2006 01 23 08

This document is located in the following:

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   e. Other

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   b. Mailing Lists
   c. Scoping Period Comments
   d. Udall Foundation Working Group
   e. Scoping Reports
   f. Comments after Scoping Period
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   b. US Fish & Wildlife Service (Sec. 7 T&E)
   c. State Historic Preservation Office (Sec. 106)
   d. Tribes (Sec. 106)
   e. Advisory Council on Historic Preservation (Sec. 106)
   f. Other

4. Communication
   a. Congressional
   b. Cooperating Agencies
   c. Organizations
   d. Individuals
   e. FOIA
   f. Internal
   g. Proponent

5. Proposed Action

6. Alternatives
   a. Cumulative Effects Catalog
   b. Connected Actions
   c. Dismissed from Detailed Analysis
   d. Analyzed in Detail

7. Resources
   a. Air Quality & Climate Change
   b. Biological
   c. Dark Skies
   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
   g. Land Use
   h. Livestock Grazing
   i. Noise & Vibration
   j. Public Health & Safety
   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. Reclamation

9. DEIS
10. FEIS
11. Geospatial Analysis (GIS Data)
12. FOIA Exempt Documents
13. ROD (Including BLM & ACOE)
APPENDIX B

TECHNICAL MEMORANDUM TITLED SOIL EROSION ESTIMATES (TETRA TECH, 2010J)
This document is located in the following
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1. Project Management
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   b. Formal meeting minutes & memos
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   e. Other

2. Public Involvement
   a. Announcements & Public Meetings
   b. Mailing Lists
   c. Scoping Period Comments
   d. Udall Foundation Working Group
   e. Scoping Reports
   f. Comments after Scoping Period
   g. DEIS Public Comments

3. Agency Consultation & Permits
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   b. US Fish & Wildlife Service (Sec. 7 T&E)
   c. State Historic Preservation Office (Sec. 106)
   d. Tribes (Sec. 106)
   e. Advisory Council on Historic Preservation (Sec. 106)
   f. Other

4. Communication
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   b. Cooperating Agencies
   c. Organizations
   d. Individuals
   e. FOIA
   f. Internal
   g. Proponent

5. Proposed Action

6. Alternatives
   a. Cumulative Effects Catalog
   b. Connected Actions
   c. Dismissed from Detailed Analysis
   d. Analyzed in Detail

7. Resources
   a. Air Quality & Climate Change
   b. Biological
   c. Dark Skies
   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
   g. Land Use
   h. Livestock Grazing
   i. Noise & Vibration
   j. Public Health & Safety
   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. Reclamation

9. DEIS

10. FEIS

11. Geospatial Analysis (GIS Data)

12. FOIA Exempt Documents

13. ROD (including BLM & ACOE)
APPENDIX C1

TECHNICAL MEMORANDUM TITLED RECLAMATION PLAN UPDATE – WASTE ROCK STABILITY ANALYSIS (TETRA TECH, 2010E)
Rosemont Copper Project
Locator Sheet

Record # 012421

Document Date 2010 03 12

Document Title: Waste Rock Storage Area - Stability Analysis

Document Author Tetra Tech

Document Description Summarizes Results of a slope stability analysis performed for the Waste Rock Storage Area associated w/ Rosemont Project.

Other Notes Appendix C1 of 012308

This document is located in the following
[CIRCLE THE CATEGORY (from the list below) IN WHICH THIS ITEM IS FILED]

1. Project Management
   a. Formal recommendations & Directions
   b. Formal meeting minutes & memos
   c. General Correspondence
   d. Contracts, Agreements, & MOUs (Rosemont, Udall, SWCA)
   e. Other

2. Public Involvement
   a. Announcements & Public Meetings
   b. Mailing Lists
   c. Scoping Period Comments
   d. Udall Foundation Working Group
   e. Scoping Reports
   f. Comments after Scoping Period
   g. DEIS Public Comments

3. Agency Consultation & Permits
   a. Army Corps of Engineers (404 permit)
   b. US Fish & Wildlife Service (Sec. 7 T&E)
   c. State Historic Preservation Office (Sec. 106)
   d. Tribes (Sec. 106)
   e. Advisory Council on Historic Preservation (Sec. 106)
   f. Other

4. Communication
   a. Congressional
   b. Cooperating Agencies
   c. Organizations
   d. Individuals
   e. FOIA
   f. Internal
   g. Proponent

5. Proposed Action

6. Alternatives
   a. Cumulative Effects Catalog
   b. Connected Actions
   c. Dismissed from Detailed Analysis
   d. Analyzed in Detail

7. Resources
   a. Air Quality & Climate Change
   b. Biological
   c. Dark Skies
   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
   g. Land Use
   h. Livestock Grazing
   i. Noise & Vibration
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   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. Reclamation
9. DEIS
10. FEIS
11. Geospatial Analysis (GIS Data)
12. FOIA Exempt Documents
13. ROD (including BLM & ACOE)
APPENDIX C2

TECHNICAL MEMORANDUM TITLED
DRY STACK FACILITY
STABILITY ANALYSES
(AMEC, 2009A)
Rosemont Copper Project
Locator Sheet

Record # 012402

Document Date 2009 12 15

Document Title: Dry Stack Facility Stability Analysis

Document Author AMEC Earth + Environmental

Document Description Slope stability analyses conducted in support of proposed alternate geometry for Dry Stack Tailings Facility

Other Notes Appendix C2 of 012308

This document is located in the following
[CIRCLE THE CATEGORY (from the list below) IN WHICH THIS ITEM IS FILED]

1. Project Management
   a. Formal recommendations & Directions
   b. Formal meeting minutes & memos
   c. General Correspondence
   d. Contracts, Agreements, & MOUs (Rosemont, Udall, SWCA)
   e. Other

2. Public Involvement
   a. Announcements & Public Meetings
   b. Mailing Lists
   c. Scoping Period Comments
   d. Udall Foundation Working Group
   e. Scoping Reports
   f. Comments after Scoping Period
   g. DEIS Public Comments

3. Agency Consultation & Permits
   a. Army Corps of Engineers (404 permit)
   b. US Fish & Wildlife Service (Sec. 7 T&E)
   c. State Historic Preservation Office (Sec. 106)
   d. Tribes (Sec. 106)
   e. Advisory Council on Historic Preservation (Sec. 106)
   f. Other

4. Communication
   a. Congressional
   b. Cooperating Agencies
   c. Organizations
   d. Individuals
   e. FOIA
   f. Internal
   g. Proponent

5. Proposed Action

6. Alternatives
   a. Cumulative Effects Catalog
   b. Connected Actions
   c. Dismissed from Detailed Analysis
   d. Analyzed in Detail

7. Resources
   a. Air Quality & Climate Change
   b. Biological
   c. Dark Skies
   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
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   j. Public Health & Safety
   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. Reclamation

9. DEIS

10. FEIS

11. Geospatial Analysis (GIS Data)

12. FOIA Exempt Documents

13. ROD (Including BLM & ACOE)
APPENDIX D

TECHNICAL MEMORANDUM TITLED
MINIMUM THICKNESS ANALYSIS
FOR WASTE ROCK PLACED OVER
SPENT LEACH ORE MATERIAL
(TETRA TECH, 2010C)
Rosemont Copper Project
Locator Sheet

Record # 012414

Document Date 2010 01 14

Document Title: **Minimum Thickness Analysis for Waste Rock Placed Over Spent Heap Leach Ore Material**

Document Author: Tetra Tech

Document Description: T.T.'s infiltration & seepage modeling associated with a waste rock cover over proposed Heap Leach Facility @ Rosemont Project.

Other Notes: Appendix D of 012308

This document is located in the following
[CIRCLE THE CATEGORY (from the list below) IN WHICH THIS ITEM IS FILED]

1. **Project Management**
   a. Formal recommendations & Directions
   b. Formal meeting minutes & memos
   c. General Correspondence
   d. Contracts, Agreements, & MOUs (Rosemont, Udall, SWCA)
   e. Other

2. **Public Involvement**
   a. Announcements & Public Meetings
   b. Mailing Lists
   c. Scoping Period Comments
   d. Udall Foundation Working Group
   e. Scoping Reports
   f. Comments after Scoping Period
   g. DEIS Public Comments

3. **Agency Consultation & Permits**
   a. Army Corps of Engineers (404 permit)
   b. US Fish & Wildlife Service (Sec. 7 T&E)
   c. State Historic Preservation Office (Sec. 106)
   d. Tribes (Sec. 106)
   e. Advisory Council on Historic Preservation (Sec. 106)
   f. Other

4. **Communication**
   a. Congressional
   b. Cooperating Agencies
   c. Organizations
   d. Individuals
   e. FOIA
   f. Internal
   g. Proponent

5. **Proposed Action**

6. **Alternatives**
   a. Cumulative Effects Catalog
   b. Connected Actions
   c. Dismissed from Detailed Analysis
   d. Analyzed in Detail

7. **Resources**
   a. Air Quality & Climate Change
   b. Biological
   c. Dark Skies
   d. Fuels & Fire Management
   e. Hazardous Materials
   f. Heritage
   g. Land Use
   h. Livestock Grazing
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   j. Public Health & Safety
   k. Recreation & Wilderness
   l. Riparian
   m. Socioeconomics & Environmental Justice
   n. Soils & Geology
   o. Transportation & Access
   p. Visual
   q. Water

8. **Reclamation**

9. **DEIS**

10. **FEIS**

11. **Geospatial Analysis (GIS Data)**

12. **FOIA Exempt Documents**

13. **ROD (including BLM & ACOE)**
APPENDIX E

TECHNICAL MEMORANDUM TITLED
PRESCRIPTIVE BADCT CLOSURE
FOR THE HEAP LEACH FACILITY PONDS
(TETRA TECH, 2010D)
University of Arizona Revegetation Study
Where is Rosemont Copper?
Rosemont Copper Reclamation

- Concurrent Reclamation
- Perimeter Buttress
  - Minimize Visual Impact
- Soil salvage
Rosemont Copper Reclamation

- Primarily east-facing slopes
- 18-degree slopes

Future Uses:
- Grazing
- Wildlife Habitat
- Recreation
University of Arizona Research Grant
  - $500,000 grant
  - 10 year revegetation study
  - School of Natural Resources, Dr. Jeff Fehmi

• 3-Phase Revegetation Study & Palmer Agave Study
• Food source

• Translocation Study

• Seed Study
Phase I: Seed Mix Development

- Site Assessment
- Seed Mix Development – 503 species considered
- Criteria for Mix:
  - Native Species
  - Common to the Area
  - Commercially Available
  - Represent current functional groups
Phase II: Greenhouse Testing

- 3 Mulch Treatments
  - No Mulch, Straw Mulch, Straw Mulch & Fertilizer

- 3 Soil Types
  - Gila, Glance, Arkose

Experimental Design
- 29 native species:
  - 4 seed mixes
- 3 Rainfall Scenarios
  - High, Average, Low
Phase II: Results

- Establishment on all soil types
- Best establishment with high precipitation
- Mulch aided establishment
Phase III: Field Testing

- 3 mulch treatments
- 2 soil surface treatments
- 10 native species seed mix

<table>
<thead>
<tr>
<th>Section Treatments</th>
<th>Soil Surface</th>
<th>Mulch Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Smooth Surface</td>
<td>No mulch</td>
</tr>
<tr>
<td>2</td>
<td>Smooth Surface</td>
<td>Mulch Incorporated</td>
</tr>
<tr>
<td>3</td>
<td>Smooth Surface</td>
<td>Mulch Surface</td>
</tr>
<tr>
<td>4</td>
<td>Rough Surface</td>
<td>No mulch</td>
</tr>
<tr>
<td>5</td>
<td>Rough Surface</td>
<td>Mulch Incorporated</td>
</tr>
<tr>
<td>6</td>
<td>Rough Surface</td>
<td>Mulch Surface</td>
</tr>
</tbody>
</table>
Replicating Future Reclamation

- East-facing slope
- 3-to-1 slopes
- 2 soil types

3 Areas:
- 2 elevations
- 7 acres
Long-Term Testing
Plant Salvage
Tucson Cactus & Succulent Society

- Non-Profit Organization
- Over 650 plants salvaged
- Over 400 crew hours
- Plant sales support Society, Education Grants
Where we are today

Area 1 – Lower Test Plot

Area 2 – Upper Test Plot

Area 3 – Upper Test Plot
Mulch Treatments

**Mulch Incorporated in the Soil:**
- Improves soil moisture during periods of drought
- Enhances surface roughness

**Mulch Placed on Soil Surface:**
- Adds a layer of protection from environment and predators
- Preserves moisture
- Tackifier to assist

**No Mulch:**
- Determines the site conditions and the effects of mulch
**Rough Surface:** Shown to reduce wind-erosion, reduce evaporation, retain soil moisture, create microniches.

**Smooth Surface:** Good soil-to-seed contact is necessary for germination.
**Broadcast Seeding**

- **10 native species seed mix**
- **Timing**
- **Rate**

<table>
<thead>
<tr>
<th>New Mix</th>
<th>Scientific Name</th>
<th>Group</th>
<th>Range (ft)</th>
<th>Composition</th>
<th>PLS Seed/ft²</th>
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</thead>
<tbody>
<tr>
<td>Arizona cottontop</td>
<td>Digitaria californica</td>
<td>WSPG</td>
<td>1000-6000</td>
<td>13.7%</td>
<td>6.8</td>
</tr>
<tr>
<td>Blue grama</td>
<td>Bouteloua gracilis</td>
<td>WSPG</td>
<td>4000-8000</td>
<td>13.7%</td>
<td>6.8</td>
</tr>
<tr>
<td>Curly mesquite</td>
<td>Hilaria belangeri</td>
<td>WSPG</td>
<td>3000-6000</td>
<td>13.7%</td>
<td>6.8</td>
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<tr>
<td>Green sprangletop</td>
<td>Leptochloa dubia</td>
<td>WSPG</td>
<td>2500-6000</td>
<td>13.7%</td>
<td>6.8</td>
</tr>
<tr>
<td>Plains Lovegrass</td>
<td>Eragrostis intermedia</td>
<td>WSPG</td>
<td>3000-6000</td>
<td>13.7%</td>
<td>6.8</td>
</tr>
<tr>
<td>Sideoats grama</td>
<td>Bouteloua curtipendula</td>
<td>WSPG</td>
<td>2500-7500</td>
<td>13.7%</td>
<td>6.8</td>
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<tr>
<td>Bottlebrush squirre tail</td>
<td>Elymus elymoides</td>
<td>CSPG</td>
<td>2500-10000</td>
<td>3.0%</td>
<td>1.5</td>
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<tr>
<td>Mexican gold poppy</td>
<td>Eschscholzia californica</td>
<td>AF</td>
<td>2000-4500</td>
<td>8.0%</td>
<td>4</td>
</tr>
<tr>
<td>Desert marigold</td>
<td>Balessa multiradiata</td>
<td>PF</td>
<td>2000-5000</td>
<td>4.0%</td>
<td>2</td>
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<tr>
<td>False mesquite</td>
<td>Calliandra eriophylla</td>
<td>SH</td>
<td>2000-5000</td>
<td>3.0%</td>
<td>* 0.03</td>
</tr>
</tbody>
</table>

Total PLS Seed/ft²: 48.5
Other Contributions to Seeding

Seed Bank Sampling

• Determine potential for revegetation, species not in the seed mix
• Viability Testing to determine if re-seeding is necessary before monsoon season
• Outside Plots
  - Seed contribution from outside source
  - Natural Plant Community species composition
Other Considerations

- Seed Predation
- Invasive Species
### Evaluation

<table>
<thead>
<tr>
<th>Vegetation</th>
<th>Erosion</th>
<th>Climate</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Density</td>
<td>- Silt Fences</td>
<td>- Precipitation</td>
</tr>
<tr>
<td>- Germination</td>
<td>- Topography</td>
<td>- Temperature</td>
</tr>
<tr>
<td>- Cover</td>
<td>- Infiltration</td>
<td>- Wind</td>
</tr>
<tr>
<td>- Species Composition</td>
<td>- Compaction</td>
<td></td>
</tr>
<tr>
<td>- Growth</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Soil Moisture</td>
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<td></td>
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<tr>
<td>- Mycorhizzae</td>
<td></td>
<td></td>
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<tr>
<td>- Biomass</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Predation</td>
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</tbody>
</table>
Success from the Start

Resulting research will be used with concurrent reclamation starting in year one, producing successful revegetation.
APPENDIX G

SLOPE MITIGATION EXAMPLES
# LIST OF PICTURES

<table>
<thead>
<tr>
<th>Photograph</th>
<th>Description</th>
<th>Page</th>
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<tbody>
<tr>
<td>01</td>
<td>Slope Mitigation Example 1</td>
<td>G-1</td>
</tr>
<tr>
<td>02</td>
<td>Slope Mitigation Example 2</td>
<td>G-2</td>
</tr>
<tr>
<td>03</td>
<td>Slope Mitigation Example 3</td>
<td>G-2</td>
</tr>
<tr>
<td>04</td>
<td>Slope Mitigation Example 4</td>
<td>G-3</td>
</tr>
</tbody>
</table>
Appendix G – Slope Mitigation Examples  Rosemont Copper Company

Photograph 02  Slope Mitigation Example 2

Photograph 03  Slope Mitigation Example 3
Photograph 04  Slope Mitigation Example 4