Alternatives Considered but Eliminated from Detailed Study

Rosemont Copper Project

A Proposed Mining Operation in Southern Arizona

Coronado National Forest
Arizona
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# CONTENTS

INTRODUCTION........................................................................................................................................... 1

PROJECT OVERVIEW ..................................................................................................................................... 1
  Purpose and Need ...................................................................................................................................... 3
    Purpose of the Proposal ........................................................................................................................... 3
    Need for Action ....................................................................................................................................... 3
  Proposed Action ....................................................................................................................................... 4
  Facilities and Designs ............................................................................................................................... 9
  Mining Activities ................................................................................................................................... 14

REGULATORY REQUIREMENTS ................................................................................................................ 15

NATIONAL ENVIRONMENTAL POLICY ACT .......................................................................................... 16

CLEAN WATER ACT .................................................................................................................................. 16

ARIZONA CORPORATION COMMISSION LINE SITING PROCESS (ARIZONA REVISED STATUTES 40-360)... 16

ALTERNATIVES DEVELOPMENT PROCESS ......................................................................................... 17

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY ....................................... 19
  Alternatives that Do Not Meet the Purpose and Need ............................................................................ 19
  Alternatives Considered but Eliminated Because They Are Unlikely to Resolve an Environmental Conflict.................................................................................................................. 19
  Alternatives or Alternative Elements Considered but Determined to Be Technically or Financially Infeasible ....................................................................................................................................... 21

LITERATURE CITED ............................................................................................................................... 25

Appendix A ............................................................................................................................................. 26
Appendix B ............................................................................................................................................. 27
Appendix C ............................................................................................................................................. 28
Appendix D ............................................................................................................................................. 29
Appendix E ............................................................................................................................................. 30

Alternative Water Sources Considered .................................................................................................. 30
Figures

Figure 1. Project location map ..................................................................................................................... 2
Figure 2. Proposed action footprint .............................................................................................................. 6
Figure 3. Sulfide ore processing ................................................................................................................... 7
Figure 4. Oxide ore processing .................................................................................................................... 8
Figure 5. Water supply well area and pipeline ........................................................................................... 12

Tables

Table 1. Production schedule* ..................................................................................................................... 8
Table 2. Large truck trip data ...................................................................................................................... 15
Table 3. Alternatives that do not meet purpose and need ........................................................................... 19
Table 4. Alternatives unlikely to resolve an environmental conflict .......................................................... 20
Table 4. Alternatives unlikely to resolve an environmental conflict (Continued) .................................... 21
Table 5 Alternatives determined to be technically or financially infeasible (Continued) ......................... 23
Table 5 Alternatives determined to be technically or financially infeasible (Continued) ......................... 24
INTRODUCTION

The following describes the Coronado National Forest’s (the Coronado’s) alternatives development process for the proposed Rosemont Copper Project (the project), in particular, those alternatives considered but eliminated from detailed study. Alternatives retained for detailed analysis will be fully described and analyzed in the draft Environmental Impact Statement (DEIS), to be published at a later date. The alternatives development process was conducted in accordance with the Council on Environmental Quality (CEQ) and U.S. Department of Agriculture (USDA) Forest Service (Forest Service) regulations (40 Code of Federal Regulations (CFR) 1502.14 and 36 CFR 220.5, respectively) and Forest Service Region 3 guidance.

Alternatives are developed after careful consideration and evaluation of comments received during scoping (see Scoping Summary Reports 1 and 2). The Coronado’s interdisciplinary (ID) team reviewed all comments submitted during scoping, identified issues significant to the analysis, identified possible alternatives, and reviewed suggested mitigation.

PROJECT OVERVIEW

The proposed project is located approximately 30 miles southeast of Tucson, Arizona, in Pima County (figure 1). The project is located just west of State Route 83, on the northern edge of the Santa Rita Mountains in the Helvetia-Rosemont Mining Districts. The area covered by Rosemont Copper Company’s (Rosemont Copper’s) patented claims, unpatented claims, and fee lands totals approximately 14,880 acres, which include the Rosemont, Peach-Elgin, Broad Top Butte, and Copper World deposits. Rosemont Copper’s proposal is to mine the Rosemont deposit, which would disturb approximately 4,415 acres (including utility corridors) that encompass 3,670 acres administered by the Coronado, 995 acres of private land, 75 acres of Arizona State Land Department State Trust land, and 15 acres of Bureau of Land Management (BLM) administered land.

In July 2007, Rosemont Copper submitted a preliminary mine plan of operations (MPO), including a reclamation plan, to the Coronado, requesting approval to construct and operate a mine and related ore processing facilities on and adjacent to National Forest System land. Ore deposits that would be mined as part of the project are, for the most part, on private property owned by Rosemont Copper.

The proposed mine is expected to annually produce 234 million pounds of copper, 4.5 million pounds of molybdenum,

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1. Lode claims include a deposit of valuable ore occurring within definite boundaries that separate it from surrounding rock. A patented mining claim is one for which the Federal government has passed its title to the mining claimant, making it private land. A person may mine and remove minerals from a mining claim without a mineral patent. It also gives the owner title to the surface and other resources.

An unpatented mining claim gives the claimant the right to explore for, extract, and process locatable minerals in an area known as a mining claim.

For the purposes of this document, fee land is private land, including all surface and subsurface mineral rights, that is owned by Rosemont Copper.
and 2.7 million ounces of silver over the anticipated 20-year life of the mine. The MPO was accepted in February 2008 after Rosemont Copper submitted supplemental information, as requested by the Coronado. Decisions regarding approval and the content of the final MPO will not be made until a thorough environmental review has been completed. In accordance with 40 CFR 1501.4, the Coronado has reviewed the proposal and determined that preparation of an EIS is necessary.

An EIS is being prepared to analyze and disclose to the public the environmental, social, and economic impacts of the proposed project. The EIS will be prepared in compliance with the National Environmental Policy Act of 1969, as amended (NEPA); CEQ regulations for implementing NEPA; and other associated regulations. The Forest Service’s decision will be based on the results of this NEPA process (i.e., the findings of the impacts analyses reported in the EIS) and further, on the National Forest Management Act determination of the consistency of the proposed use with the parameters specified in the “Coronado National Forest Land and Resource Management Plan,” as amended (forest plan) (U.S. Forest Service 1986).

Purpose and Need

Purpose of the Proposal

Pursuant to Federal mining laws, the Forest Service and BLM are required to respond to a preliminary MPO for conducting mining operations. Under 36 CFR 228.5, the Forest Service must determine whether to approve the preliminary MPO submitted by Rosemont Copper or require changes or additions deemed necessary to meet the requirements of the regulations for environmental protection set forth in 36 CFR 228.8. Under 43 CFR 3809, the BLM must determine whether to approve the preliminary MPO submitted by Rosemont Copper, to approve the preliminary MPO subject to changes or conditions that are necessary to meet the performance standards of 43 CFR 3809.420 and to prevent unnecessary or undue degradation, or to disapprove or withhold approval of the preliminary MPO for reasons specified at 43 CFR 3809.411(d)(3). In addition, the BLM must determine whether any occupancy of BLM administered lands proposed in the preliminary MPO is in conformance with the regulations of 43 CFR 3715.

Under USDA regulations, Rosemont Copper must conduct mining operations in accordance with the regulations at 36 CFR 228A under a plan of operations approved by the Forest Service. Under Secretary of the Interior regulations, Rosemont Copper must conduct mining operations in accordance with the regulations at 43 CFR 3809 and 3715 under a plan of operations approved by the BLM.

Need for Action

The Coronado is addressing this project at this time in order to comply with its statutory obligation to respond to Rosemont Copper’s preliminary MPO in a timely manner. The actions proposed in this DEIS are for the development of the Rosemont ore deposit, owned by Rosemont Copper, in a manner that does the following: (1) complies with Federal, State, and local laws and regulations, (2) reduces adverse environmental impacts on National Forest System lands, (3) is without undue or unnecessary degradation of BLM administered lands, and (4) takes into consideration impacts to waters of the United States (WUS). Rosemont Copper is entitled to conduct operations that are reasonably incidental to exploration and development of mineral deposits on its mining claims pursuant to U.S. mining laws.

2 Unnecessary or undue degradation of the environment is defined as “surface disturbance greater than what would normally result when an activity is being accomplished by a prudent operator in usual, customary, and proficient operations of similar character and taking into consideration the effects of operations on other resources and land uses, including those resources and uses outside the area of operations” (43 CFR 3809.5).
The purpose of and need for action is based on statutes, regulations, and policies that govern mining on National Forest System land and BLM administered land, as follows:

- The General Mining Act of 1872 conferred a statutory right for claimants to enter upon public lands open to location, stake mining claims in pursuit of locatable minerals, and conduct mining activities in compliance with Federal and State statutes and regulations.

- The 1897 Organic Administration Act grants the Secretary of Agriculture the authority to regulate the occupancy and use of National Forest System lands. It provides the public with continuing rights to conduct mining activities under general mining laws and in compliance with rules and regulations applicable to National Forest System lands. It also recognizes the rights of miners and prospectors to access National Forest System lands for prospecting, locating, and developing mineral resources.

- The Multiple-Use Mining Act of 1955 confirms the ability to conduct mining activities on public lands, locate necessary facilities, and conduct reasonable and incidental uses to mining on public lands, including National Forest System lands.

- The Multiple-Use Sustained-Yield Act of 1960 requires that National Forest System lands be administered in a manner that includes consideration of relative values of various resources as part of management decisions. Furthermore, it specifies that nothing in the act be construed to affect the use of mineral resources on National Forest System lands.

- The 1970 Mining and Minerals Policy Act established the Federal government’s policy for mineral development “to foster and encourage private enterprise in the development of economically sound and stable industries and in the orderly development of domestic resources to help assure satisfaction of industrial, security, and environmental needs.”

- Forest Service mining regulations at 36 CFR 228A provide direction on the administration of locatable mineral operations on National Forest System lands.

- BLM mining regulations at 43 CFR 3809 and 3715 provide direction on the administration of locatable minerals and supporting facilities on BLM administered land.

With regard to mining, one goal of the Coronado forest plan is to “support environmentally sound energy and minerals development and reclamation” (U.S. Forest Service 1986: 11). However, an initial assessment indicates that the preliminary MPO is inconsistent with various aspects of the forest plan. Programmatic amendment(s) to the forest plan would be needed to ensure forest plan consistency should the preliminary MPO be selected.

The proposed electrical transmission line, water pipeline, and access road on BLM administered land are in an area that provides for mineral exploration and development under the regulations at 43 CFR 3809 (Bureau of Land Management 1988: 14). The BLM has determined that the proposed action and action alternatives are consistent with the “Proposed Phoenix Resource Management Plan and Final Environmental Impact Statement” which directs land use planning for BLM administered lands within the project area.

Proposed Action

A complete description of the proposed action is found in the preliminary MPO (WestLand Resources Inc. 2007) and in numerous technical documents, plans, and memoranda prepared by Rosemont Copper and its consultants in support of the preliminary MPO. The proposed mine is located about 30 miles southeast of Tucson, Arizona. Primary highway access would be from State Route 83, which is a north-south 2-lane paved road that connects to Interstate 10 approximately 12 miles north of the mine site. A new 2-lane gravel road, referred to as the “primary access road,” would be constructed to provide
primary access between State Route 83 and the mine (figure 2). The primary access road would leave State Route 83 between mileposts 46 and 47 along a straight section of the state highway. At the intersection, State Route 83 would be widened and provided with additional lanes. The primary access road would be open for the public from State Route 83 to the mine entrance. Approximately 1 mile of newly constructed road would connect the processing facilities to an existing road over Lopez Pass. The existing road over Lopez Pass would be improved to accommodate 2-wheel-drive vehicles. Existing forest roads, both official and unofficial, that enter the project site would be blocked, but public access to the area outside the mine site would be afforded by several new roads that would be constructed to reconnect the prior forest road system.

Mine construction, including removing the overlying rock to expose the ore in preparation for mining, is proposed to occur over an 18-month period.

The mine contains two types of ore, sulfide and oxide, each requiring a different process to recover the metals. Sulfide ore would be crushed and sent to a concentrator facility for grinding and flotation recovery of copper and molybdenum concentrates. Tailings from the sulfide ore processing would be dewatered and placed in the dry-stack tailings disposal facility (figure 3).

Oxide ore would be sent to a lined heap leach pad, where a dilute solution of sulfuric acid would be applied using a system similar to drip irrigation. The leach solution would seep through the oxide ore heap, separating copper ions from the ore, which would be routed to the solvent extraction and electrowinning facility for recovery of high purity “cathode” copper plates. The solvent extraction and electrowinning facility would recover copper from the leach solution using an extraction and stripping process that culminates in an electroplating process and would continually recirculate the process solutions (figure 4).

The metal concentrate and copper cathodes are the products to be sold by the proposed operation; further refining and metal recovery would be done offsite by other companies. Ore would be produced over a 20-year period at an approximate rate of 75,000 tons per day, and waste rock would be produced at a rate of 195,000 to 267,000 tons per day. Oxide ore would be mined out in the first 6 to 7 years of the project, while sulfide ore would be produced throughout the mine operation. Table 1 summarizes the mine production schedule.
Figure 2. Proposed action footprint
Figure 3. Sulfide ore processing

1. Sulfide-ore is first crushed then ground into a slurry.
2. Flotation process produces copper, moly, gold, and silver concentrates.
3. Concentrates are de-watered, the water is recycled back to crushing, and the copper goes to market for further processing.
4. Tailings are de-watered and sent to dry stack.
5. Water is recycled back to flotation.
Figure 4. Oxide ore processing

Table 1. Production schedule*

<table>
<thead>
<tr>
<th>Timeline</th>
<th>Sulfide Ore 1,000 tons</th>
<th>Oxide Ore 1,000 tons</th>
<th>Waste Rock 1,000 tons</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preproduction: 18 months</td>
<td>3,328</td>
<td>14,979</td>
<td>101,293</td>
</tr>
<tr>
<td>Year 1</td>
<td>19,444</td>
<td>18,244</td>
<td>84,286</td>
</tr>
<tr>
<td>Year 2</td>
<td>27,375</td>
<td>5,320</td>
<td>92,305</td>
</tr>
<tr>
<td>Year 3</td>
<td>27,375</td>
<td>937</td>
<td>89,088</td>
</tr>
<tr>
<td>Year 4</td>
<td>27,375</td>
<td>2,602</td>
<td>87,423</td>
</tr>
<tr>
<td>Year 5</td>
<td>27,375</td>
<td>5,002</td>
<td>85,023</td>
</tr>
<tr>
<td>Year 6</td>
<td>27,375</td>
<td>2,195</td>
<td>87,830</td>
</tr>
<tr>
<td>Year 7</td>
<td>27,375</td>
<td>–</td>
<td>90,025</td>
</tr>
<tr>
<td>Years 8 to 10</td>
<td>82,125</td>
<td>166</td>
<td>269,909</td>
</tr>
<tr>
<td>Years 11 to 15</td>
<td>136,875</td>
<td>–</td>
<td>287,195</td>
</tr>
<tr>
<td>Years 16 to 19</td>
<td>86,705</td>
<td>–</td>
<td>14,050</td>
</tr>
<tr>
<td>Total</td>
<td>492,727</td>
<td>49,445</td>
<td>1,288,427</td>
</tr>
</tbody>
</table>

Notes:
Excludes 3,026 kilotons of stockpiled sulfide ore rehandled in year 1 and 302 kilotons in year 9.
In years 8 to 10, 166 kilotons of oxide ore would be waste, as the leach pad would not be available.
* This does not include time for construction or closure.
FACILITIES AND DESIGNS

A list of operation facilities and activities is presented below. These items were considered by the Forest Service ID team with respect to their potential significant impacts.

Facilities

Pit

Open-pit mining would be used to excavate ore to recover copper, molybdenum, silver, and gold. The roughly circular open-pit mine would measure, at end of mine life, between 6,000 and 6,500 feet in diameter, with a final depth of 1,800 to 2,900 feet, depending on the elevation of the pit rim. Pit slope angles between in-pit roads are controlled by rock strength and would range between 28 and 48 degrees. The mine would produce a total of approximately 550 million tons of ore and 1,228 million tons of waste rock. The pit would disturb 955 acres, of which 590 acres would be on private land and 365 acres would be on National Forest System lands.

Heap Leach Pad and Ponds

The heap leach facility used to process the oxide ore during the first 6 to 7 years of the project would be located in the waste rock disposal area behind the perimeter buttress. The heap leach pad and ponds would ultimately be encapsulated within the waste rock storage area.

Diversion Channels

Diversion channels would be constructed to intercept stormwater runoff and route the runoff around the mine facilities. The main diversions are the process water temporary storage pond, diversions around the heap leach, waste, and tailings, and open-pit diversions. The diversions are designed to accommodate the peak flow from a 100-year, 24-hour storm event.

Compliance Point Dam

A compliance point dam would be located in Barrel Canyon to provide the final stormwater discharge sampling location for the project. It would be the final sediment pond and would be a porous, rock-fill check dam located in Barrel Canyon Wash, downstream of its confluence with McCleary Canyon Wash. The dam would be approximately 6 feet tall, with a storage capacity of approximately 2 acre-feet. It would be constructed in year 0 using inert waste rock as an Arizona Department of Water Resources nonjurisdictional, unlined embankment. The compliance point dam would serve as the final compliance point where stormwater can be monitored. Normally, the area behind the embankment would be empty. During storm events, water would be temporarily impounded and slowly released through the porous rock-fill dam. Stormwater from large storm events would be routed around the heap leach or tailings that had been contacted by process waters via diversion channels. The rerouted stormwater and water that flowed over waste rock would overtop the dam and proceed downstream, as permitted under Section 401 of the Clean Water Act (CWA). The compliance point dam would be evaluated after closure of the project facilities. The dam would be removed if it did not exceed CWA standards at that time.

Primary Access Road

The primary access road would be constructed to exit State Route 83 between mileposts 46 and 47 and would run approximately 3.7 miles to the mine entrance. The road would be located in the lower reach.
of Scholefield Canyon and would cross the ridgeline between Scholefield and McAlary Canyons to reach the mine entrance gate.

**Secondary Access Road**

Approximately 1 mile of gravel road would be constructed from the processing facilities to the existing road over Lopez Pass. The road over Lopez Pass would be improved for use of 2-wheel-drive vehicles.

**Perimeter Fence**

A perimeter fence would be constructed for each of the action alternatives, and a varying amount of National Forest System lands would not be available for public use during the 25-year mine life. The configuration varies by alternative and is depicted on the relevant maps in the resource sections of chapter 3 of the DEIS. A closure order would be issued by the Coronado, and notices would be posted along the fencing. Fencing would consist of a standard 5-strand barbed wire fence (with the bottom wire bare in accordance with BLM and Arizona Game and Fish Department fencing standards).

**Water Supply and Control**

Most of the water used at the proposed operation would be allocated to ore processing, with much smaller amounts employed for activities such as dust control, fire protection, drinking water, and sanitary uses. The majority of the water supply would come from ground water wells in the Santa Cruz Valley, with a much lesser amount obtained from stormwater and pit dewatering on the mine site. Water used to process ore (referred to as process water) and other water impacted by the project would be controlled as specified in the description of the action alternatives. Where feasible, water would be reclaimed from a variety of uses on the mine and returned for use in processing. Stormwater from above the mine pit would be diverted around disturbed areas. Stormwater that falls within the mine pit and associated disturbed areas, especially stormwater that comes into contact with ore, would be contained onsite and used for mining and processing purposes.

**WATER SUPPLY**

The project would use approximately 5,000 acre-feet per year of fresh water, for a total use over the mine life of approximately 100,000 acre-feet. The water would be pumped from four to six wells located on land owned by Rosemont Copper near the community of Sahuarita in the Santa Cruz Valley at a maximum rate of 5,000 gallons per minute (total pumpage). The well locations and proposed pipeline route and an alternative are shown in figure 5.

**WATER CONTROL**

The primary water control objective would be to reduce the risk of discharging contaminated water into the environment. Three major areas of water contamination control would be as follows:

- process water
- stormwater
- ground water

Control of process water would consist of containing the process water in engineered structures, such as tanks, pipes, sumps, lined ponds, lined ditches, and a lined heap leach pad, and maintaining the water content of the dry-stack tailings at a level that reduces seepage from the tailings disposal facility. The engineering design and performance of the various process water control facilities, including seepage and leakage monitoring and recovery, would meet or exceed the best available demonstrated
control technology criteria used by the Arizona Department of Environmental Quality (ADEQ) and would be regulated under the ADEQ Aquifer Protection Permit program.

The general design concept for managing stormwater from the dry-stack tailings facility is to minimize infiltration of water in the tailings. This would be accomplished by constructing uniform lifts of dry tailings that are buttressed by waste rock. The buttresses would be built around the tailings surface for containment and erosion control. The top of the tailings area is relatively impervious and would slope inward (away from the buttresses) so that all precipitation that falls on top of the active tailings area would remain on top and evaporate. Ponded water may be pumped to the process water temporary storage pond as needed to limit infiltration into the tailings mass. Minor diversion channels would be constructed to direct surface runoff from the outer waste rock shell slopes into sediment ponds. The sediment ponds associated with the tailings facilities are designed to store and release up to the 10-year, 24-hour storm event so that suspended sediment concentrations of discharged water are no greater than premining conditions.

Stormwater management at the waste rock facilities would be similar to that for the dry-stack tailings facility; however, minimizing infiltration of water could be beneficial or acceptable. For the construction of the initial perimeter buttresses, concurrent reclamation and appropriate best management practices would progress up the outer slopes as the buttresses are constructed. This would limit erosion potential, while minor diversion channels would be used to direct runoff to downdgradient sediment ponds. The exterior toe of the perimeter buttress would be set back from the Barrel Canyon divide by approximately 100 feet so that runoff from the outer slopes would infiltrate the waste rock facilities rather than discharge downdgradient. Where feasible, the top of the waste rock facilities would be sloped downward to facilitate stormwater draining toward the open pit. The sediment ponds at the toe of the outer slopes are designed to store and release up to the 10-year, 24-hour storm event so that suspended sediment concentrations of discharged water are no greater than background conditions.

Stormwater diversion channels would be constructed to route surface water runoff around the project area and from undisturbed areas within the project to natural drainages downhill from the mine site. Stormwater from the mine pit, ore processing facilities, and mine maintenance plant areas would be prohibited from surface discharge by the stormwater permit. Stormwater from the waste rock facilities, including the waste rock buttresses, would be routed to sediment control ponds, where any pond overflow discharging offsite would be monitored for chemical and sediment content in accordance with the stormwater permit.
Rosemont Copper Project

Figure 5. Water supply well area and pipeline
Active stormwater control would continue after the mine closes, as required by the stormwater discharge permit and the erosion control provisions of the mine land reclamation plan, administered by the Arizona State Mine Inspector.

Ground water control would include those activities and facilities intended to protect and monitor the quality of the ground water in the area, as well as the investigation and modeling used to predict the response of the ground water systems to both the withdrawal of ground water and the influence of seepage and leakage from the project facilities. It also includes various regulatory programs that have jurisdiction over ground water, primarily the Aquifer Protection Permit program administered by ADEQ.

Protection of ground water quality at the mine site during operations would primarily be achieved through the process water controls discussed above. This would include monitoring of the seepage and leakage detection facilities required to be designed into processing facilities by the applicable permits.

Of particular importance to the long-term ground water protection would be the acid rock drainage protection and monitoring program. Monitoring to ensure that offsite ground water quality is not impacted beyond the level allowed by the aquifer protection permit would be accomplished through the installation and scheduled sampling and testing of specific ground water monitoring wells in accordance with the requirements of the aquifer protection permit.

Protection of ground water quality following mine closure would be achieved by the closure and reclamation of the process facilities, elimination or reduction of acid rock drainage generation in the tailings and waste rock from the design and operation of the waste disposal facilities, monitoring and testing required by the aquifer protection permit following mine closure, and capture of possible impacted mine site ground water by localized ground water flowing into the pit.

**Electrical Power Supply**

The total power requirement for the project would be 133 megawatts and would require a minimum transmission voltage of 138 kilovolts. Tucson Electric Power (TEP) has entered into an agreement with Rosemont Copper to construct a transmission line to the proposed mine site. All costs of the line would be borne by Rosemont Copper. Construction of this line would require a Certificate of Environmental Compatibility from the Arizona Corporation Commission. The certificate of environmental compatibility process is currently being conducted; alternatives are being evaluated and are discussed in greater detail in chapter 2 of the DEIS. Under all alternatives, the proposed 138-kilovolt main power line would be supported on single 90- to 100-foot-tall single steel poles with a minimum of 75 feet of ground clearance. Pole spacing would be about 800 feet on level ground or less where required to maintain ground clearance going over the mountains. In addition, a power line supported on wooden poles would be constructed to supply electricity to the water supply wells and booster stations. All transmission lines and poles would be removed as part of the closure of the mine.

**Plant Site and Support Facilities**

Facilities necessary to support the Rosemont Copper mining and ore processing operations include buildings and structures, such as administration buildings, change house, warehouse with laydown yards, analytical laboratory, light vehicle and process maintenance building, mine truck shop, mine truck wash and lube facility, powder magazines and ammonium nitrate storage, main guard shack with truck scale, and fuel and lubricant storage and dispensing facilities.

In addition to traditional electrical service from TEP, the project would also generate energy onsite using solar technologies, such as passive solar installations for appropriate applications (e.g., water heaters and fans), photovoltaic cell, and wind technology for supplemental electricity generation.
Waste Rock and Tailings

Waste rock, which consists largely of chemically basic limestone and other largely nonacid-generating rocks, would be disposed of in areas located outside the proposed open pit. Tailings would be disposed of using the “dry-stack” method. In dry-stack disposal, the tailings slurry would be processed to remove most of the remaining water, resulting in a material that has the consistency of moist, fine grained sand. The preliminary MPO states that 92 percent of the water would be removed from the tailings slurry and recycled to the process circuit. The dewatered tailings would be sent via conveyor belt to the unlined dry-stack tailings disposal area, where the tailings would be deposited, stacked, and compacted as needed.

Solid, Hazardous, and Sanitary Waste

Solid waste would be recycled as appropriate and feasible. Nonrecyclable inert waste would be disposed of at a state licensed onsite landfill located on Rosemont Copper’s private property.

The landfill would cover approximately 2.6 acres and would be permitted and regulated by the ADEQ. All garbage, including food and waste subject to decay, would be disposed of offsite by a commercial disposal service. Large (greater than 3 feet in diameter) equipment tires, such as those on the haul trucks, would be disposed of onsite in specific tire burial cells located on Rosemont Copper’s private property and regulated by the ADEQ.

Hazardous waste would be handled and disposed of in accordance with applicable regulations. The project would produce less than 220 pounds of hazardous waste each month and would qualify as a conditionally exempt small quantity generator. No hazardous waste would be disposed of onsite.

All hazardous waste would be transported by licensed haulers and disposed of at regulated facilities.

Sanitary waste at the project site would be handled by septic systems, with leach fields located in the vicinity of each building. During the construction phase and where necessary during operations, portable toilets would be used in various locations throughout the plant and mine sites. The portable toilets would be serviced by a commercial sanitation company and the waste removed for disposal offsite.

MINING ACTIVITIES

Blasting and Drilling

Blasting would be required prior to excavation of the ore and waste rock. Blasting operations would be conducted daily and would be limited to daylight hours, typically between 9 a.m. and 4 p.m. Blasting would typically occur once a day with an ammonium nitrate and fuel oil explosive. All explosives management would be done in accordance with applicable rules, regulations, and safety standards.

Ore, Waste Rock, and Tailings Transport

Transportation of ore, waste rock, and tailings would occur only in the mine area, which is off limits to the public for safety reasons. Ore and waste rock would be moved in large, off-highway haul trucks.

Sulfide ore would be transported from the pit to a crusher in mine haul trucks; following crushing, the sulfide ore would be transported via conveyors to the flotation unit. Dewatered tailings would be transported using a conveyor system from the dewatering plant to the tailings facility for final placement.
The tailings facility would consist of perimeter buttresses constructed from waste rock that would be placed using haul trucks traveling on haul roads.

Oxide ore would be transported in mine haul trucks from the pit and placed directly on the lined heap leach pad for processing. Processing would include the placement of a system similar to drip irrigation for the delivery of a weak acid to leach the metals out of the ore.

Roads for the haul trucks would be constructed both within the open pit and between the pit and the plant, heap leach, and waste rock disposal sites. Haul roads would be approximately 125 feet wide, including safety berms and drainage ditches, and no steeper than 10 to 12 percent. Maximum truck speed would be 35 miles per hour. Haul roads are temporary and would not be paved but would be routinely watered for dust suppression.

**Transportation on State Route 83**

Mine related traffic on State Route 83 during operations would primarily consist of trucks carrying supplies to the project, trucks carrying concentrate and copper cathodes from the project, and employee traffic. Table 2 shows Rosemont Copper’s estimate of the truck shipments during the life of the mine.

Copper concentrate shipments would form the largest number of routine truck shipments, with approximately 56 round trips per day, 7 days a week. The largest concentrated volume of mine traffic during a 24-hour period would occur during workforce shift change. Shift changes vary between 6 a.m. to 8 a.m. and 4 p.m. to 6 p.m.

<table>
<thead>
<tr>
<th>Materials</th>
<th>Round Trips per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>Copper, molybdenum, and silver concentrate</td>
<td>56</td>
</tr>
<tr>
<td>Copper cathode</td>
<td>4</td>
</tr>
<tr>
<td>Materials (e.g., sulfuric acid, lime, fuels, etc.)</td>
<td>27</td>
</tr>
</tbody>
</table>

Equipment and construction material deliveries are estimated to total approximately 1,000 truck shipments to the site. Major equipment arriving by rail would be received at the Port of Tucson, which is located near Vail, Arizona.

**REGULATORY REQUIREMENTS**

Three federal laws and one state law (NEPA, CWA, Organic Administration Act, and Arizona Revised Statutes 40-360, regulating the placement of electrical transmission lines) provide the direction regarding alternatives development. The guidance provided by these laws and associated regulations is described briefly below.
NATIONAL ENVIRONMENTAL POLICY ACT

NEPA and Forest Service regulations governing mineral development on National Forest System lands provide guidance for alternative development. Under NEPA, the Forest Service and BLM are required to consider reasonable alternatives to a proposed project. Reasonable alternatives are those “that are practicable or feasible from a technological and economic standpoints and using common sense, rather than simply desirable from the standpoint of the applicant” (Council on Environmental Quality 1986, NEPA 40 Most Asked Questions, Answer to Question #2). All reasonable alternatives must fulfill the project’s purpose and need, as well as address significant environmental issues.

CLEAN WATER ACT

The U.S. Army Corps of Engineers (USACE) administers Section 404 of the CWA, which addresses activities related to the dredge and fill of WUS. The proposed action would require Rosemont Copper to obtain an Individual Permit under Section 404 of the CWA; therefore, the USACE’s procedures for implementing NEPA (33 CFR) have been considered. These regulations direct the USACE to consider only reasonable alternatives in detail. These regulations further state that reasonable alternatives are those that are feasible and focus on the underlying purpose and need, which would be satisfied by the issuance of the permit. The alternatives analysis should be thorough enough to use in completing the public interest review and Section 404(b)(1) guidelines.

The USACE has completed this analysis, and it is included in appendix A. According to this analysis, alternatives are influenced by the distribution, function, and value of the jurisdictional waters found at the site, the nature of the project purpose, and other environmental factors. Specific criteria are described that are used to identify the least environmentally damaging practicable alternative that fulfills the project’s overall purpose. The USACE criteria include the following:

- whether an alternative is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall project purpose,
- whether an alternative has the potential to reduce impacts to the aquatic ecosystem without causing other significant adverse environmental consequences, and
- the fact that an “alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes” (40 CFR 230.10).

ARIZONA CORPORATION COMMISSION LINE SITING PROCESS (ARIZONA REVISED STATUTES 40-360)

The development and identification of alternative routes for the 138-kilovolt transmission line project was based on electrical system requirements and an environmental and public planning process conducted by TEP from the summer of 2008 through the spring of 2010. This process included the following:

1. completion of environmental and engineering analyses,
2. public participation and agency comment during the routing identification and selection process, and
3. an application of line siting criteria to consider and evaluate the compatibility of each alternative route.
Environmental studies included a review of land use issues, as well as studies of visual, biological, and cultural resources. Engineering studies included an evaluation of technical data to ensure continued reliability on the TEP transmission system while meeting the power needs of the proposed project, as well as a review of potential links for constructability. Consideration was given to each route’s compatibility with established criteria for a certificate of environmental compatibility and consideration in the final route selection process by the Arizona Power Plant and Line Siting Committee and the Arizona Corporation Commission. Records pertaining to these planning efforts will be filed with the Arizona Corporation Commission. Ultimately, TEP identified a preferred route and three alternatives for consideration.

**ALTERNATIVES DEVELOPMENT PROCESS**

The alternatives development process was designed to identify a reasonable range of practicable alternatives for detailed analysis in the EIS. Alternatives were developed in accordance with NEPA and Section 404 of the CWA requirements. Through the scoping process, interested parties were provided with the opportunity to identify conflicts or issues related to the proposed action. Comments were received from members of Congress and tribal governments; Federal, State, and local agencies; organized interest groups; businesses; and individuals. The Coronado received 11,082 comment submittals during the scoping comment period, consisting of approximately 70 percent postcards, petitions, and duplicate submittals. Approximately 16,000 discrete comments were identified in the scoping submittals. Scoping submittals received from March 13, 2008, through August 1, 2008, were documented and analyzed. A systematic process referred to as content analysis was used to sort the contents of the submittals. Detailed records about this process are on file at http://www.rosemonteis.us/node/339.

Content analysis resulted in the identification of 11 significant issues that drove development of action alternatives and are the focus of this DEIS. Some public concerns were determined to be outside the scope of this DEIS because of one or more of the following: they did not reflect a legitimate cause and effect relationship supported by scientific evidence; they were not relevant to the decision to be made; they were outside Forest Service, BLM, or USACE authority; or they were already decided by law, regulation, or policy.

To develop a reasonable range of alternatives, the Coronado evaluated the proposed project by separating the proposed action into key elements that resulted in significant issues. These key elements were based on the cause and effect relationships of those portions of the preliminary MPO deemed to result in significant issues. Key elements could cause significant issues to one or more resources. For example, the placement of the waste rock would result in the disruption of natural stormwater flow in several drainages. It would also impact biological resources, cultural resources, and recreation resources, for example.

Key elements of the preliminary MPO (e.g., excavation of the pit, placement of waste rock or tailings, technology proposed for dry-stack tailings, etc.) were combined with other elements to form an alternative. Different alternatives were ultimately generated by modifying key elements of the proposed action and grouping them in different ways.

As discussed previously above, an alternative is practicable under the USACE 404(b)(1) guidelines if “it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes” (40 CFR 230.3(q), 230.10(a)(2)). Therefore, an alternative can be eliminated if it has one or more of the following characteristics:

1. Does not meet the project purpose and need;
2. Does not resolve environmental conflicts;
3. Is not available;
4. Is not capable of being done because of cost;
5. Is not capable of being done because of existing technology; and/or
6. Is not capable of being done because of logistics.

The six categories of screening criteria listed above were used to narrow the list of potential alternatives for consideration in the EIS. Additionally, alternatives were eliminated if they did not address a resource conflict.

On March 30, 2009, the ID team presented the significant issues to the forest supervisor and cooperating agencies. The forest supervisor concurred that the significant issues were developed sufficiently to begin the alternatives analysis. The ID team met formally 12 times between April 8, 2009, and May 10, 2010, to work on alternatives development. During this period, the ID team occasionally met with cooperating agencies to understand their concerns and solicit ideas, with Rosemont Copper and their consultants to confirm technological feasibility, and with the Coronado’s consultants to confirm the information provided.

The ID team and their contractors began the alternatives development process by reviewing the following:

- significant issues,
- comments received during scoping (appendix B), and
- “Rosemont Tailings Siting Study” (appendix C).

The ID team then used their professional knowledge of the area and existing geographic information system (GIS) data to map sensitive resources on the Coronado National Forest. The ID team also reviewed maps of the region to determine whether additional areas off National Forest System lands could be used for the siting of any of the major facilities or provide alternate transportation routes. Cooperating agencies also were invited to map resources of concern. From this point, the ID team’s approach was twofold: (1) they developed a list of alternative elements (e.g., roads, conveyance systems, etc.) that could be modified to address resource conflicts; and (2) they directed their contractors to determine practicable alternatives for siting the major tailings, waste rock, and milling facilities. Based on ID team direction, the contractors mapped numerous locations for the facilities and roughly calculated whether the indicated areas would contain the facilities. Once the ID team settled on acceptable alternate locations, Rosemont Copper was asked to verify that the locations were technologically feasible. With minor modifications, Rosemont Copper agreed that the ID team’s alternate locations for tailings and waste rock are technologically feasible. Rosemont Copper’s role was limited to providing technical expertise regarding contemporary mining practices and overall feasibility of construction. All of Rosemont Copper’s input was reviewed by the Coronado and their consultants.

A preliminary set of alternatives was presented to the cooperating agencies in November 2009. The cooperating agencies were invited to develop their own alternative, without the input of the Coronado. Over the course of two meetings, the cooperating agencies reviewed the significant issues and the cause and effect relationship of elements of the proposed action on potential impacts. The cooperating agencies ultimately developed an alternative that was presented to the line officer in January 2010.

On May 10, 2010, the Forest Supervisor for the Coronado National Forest issued a letter to the ID team directing which alternatives to analyze in detail. These are described in the DEIS.
ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED STUDY

Alternatives considered but dismissed from detailed consideration ranged from relatively simple elements, such as the realignment of the access road, to alternatives described at the level contained in the DEIS. A list of elements was initially considered by the ID team and is included in appendix D. Following is a summary of more thematic alternatives considered but eliminated from detailed consideration.

Alternatives that Do Not Meet the Purpose and Need

Interested parties suggested five general alternative themes regarding mining elsewhere. The following table describes the general concepts conveyed to the Forest Service and the rationale for eliminating from detailed study. Several of these themes were also described in the USACE 404(b)(1) alternatives analysis (see appendix A), which more fully explains the lack of available options to Rosemont Copper for mining other locations.

<table>
<thead>
<tr>
<th>Alternative or Alternative Element</th>
<th>Source of Alternative Idea</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reopen closed copper mines</td>
<td>PS</td>
<td>Rosemont Copper does not own any of these other operations (Rosemont Copper response table dated 4-22-09).</td>
</tr>
<tr>
<td>Develop alternative uses of public lands</td>
<td>PS</td>
<td>Rosemont Copper possesses legal mining claims where the project is proposed. Therefore, the Forest Service lacks the authority to deny a mine that can be legally permitted with reasonable mitigation.</td>
</tr>
<tr>
<td>Mine in other locations</td>
<td>PS, CA</td>
<td>Rosemont Copper has a legal right to access the minerals associated with their claims. Furthermore, the Forest Service is required to consider all proposals for mining that meet the requirements under CFR 36.222.</td>
</tr>
<tr>
<td>U.S. Government/Forest Service purchases the mine property for future U.S. consumption</td>
<td>IDT</td>
<td>Does not meet the purpose and need and is outside forest supervisor authority. This would likely require an act of Congress.</td>
</tr>
<tr>
<td>Land exchange</td>
<td>PS, CA</td>
<td>Does not meet the project purpose and need and does not decrease impacts. May also be outside forest supervisor signing authority.</td>
</tr>
</tbody>
</table>

Notes: CA = Cooperating agencies; IDT = Interdisciplinary team; and PS = Project scoping.

Alternatives Considered but Eliminated Because They Are Unlikely to Resolve an Environmental Conflict

The ID team reviewed numerous alternatives themes and elements that were deemed likely to result in greater impacts or to not resolve any environmental conflicts. The impacts of these alternatives or alternative elements would likely be the same as or greater than the proposed action. The following table summarizes these.
### Table 4. Alternatives unlikely to resolve an environmental conflict.

<table>
<thead>
<tr>
<th>Alternative or Alternative Element</th>
<th>Source of Alternative Idea</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Alternatives Involving the Placement of Waste Rock or Tailings</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Place tailings and waste rock in a horseshoe configuration around Barrel Drainage</td>
<td>IDT</td>
<td>In order for there to be sufficient volume, the piles would need to extend to State Route (SR) 83. If all of the high land is eliminated as a water source, the riparian area in Barrel Canyon would become starved and die.</td>
</tr>
<tr>
<td>Transfer waste and tails to Mission Mine</td>
<td>PS, CA</td>
<td>Impractical because of distance, increased impact to Santa Rita Experimental Range, energy costs, and lack of existing conveyor technology. Furthermore, Mission Mine is controlled by a competing mining company.</td>
</tr>
<tr>
<td>Keep all waste rock and tailings out of canyon bottoms</td>
<td>IDT, CA</td>
<td>Would result in placing waste rock and tailings high on ridges on slopes that may not be possible to reclaim because of steepness. Water resources would still be impacted by runoff from waste rock and tailings; riparian vegetation would be largely isolated from uplands and would lose functions and values.</td>
</tr>
<tr>
<td><strong>Alternatives Involving Reconfiguration of the Pit</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mining through the ridge</td>
<td>IDT</td>
<td>Would likely result in greater impacts to all issues of concern because of the additional blasting and hauling requirements and would result in substantially more waste rock.</td>
</tr>
<tr>
<td>Remove ridge behind the pit</td>
<td>IDT</td>
<td>Would result in greater waste rock requiring disposal and a larger footprint and would be visible from Sahuarita and Green Valley (IDT meeting notes. Furthermore, this is not economically feasible because the mineralization does not extend west of the pit.</td>
</tr>
<tr>
<td><strong>Alternatives Involving Transportation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Use Old Sonoita Highway</td>
<td>IDT</td>
<td>Would not alleviate use of the SR 83 and Interstate 10 (I-10) interchange and much of SR 83 from the proposed mine to I-10. Furthermore, the character of Old Sonoita Highway is a rural arterial that serves rural homes.</td>
</tr>
<tr>
<td>Create completely separate road access</td>
<td>PS</td>
<td>Suggestion unclear. However, an entirely separate road from the mine to the Tucson Port of Entry or other point in the Tucson area would result in greater impacts than what is currently being proposed. Rosemont Copper is proposing to construct a separate access road from SR 83.</td>
</tr>
<tr>
<td>Use Box Canyon road</td>
<td>PS, IDT</td>
<td>Construction of a road in Box Canyon, suitable for large trucks, would likely disproportionately increase impacts to popular recreation areas, sensitive riparian areas and animal species, and population centers such as Green Valley.</td>
</tr>
<tr>
<td>Use Helvetia Mine road</td>
<td></td>
<td>Impacts resulting from the combination of the construction of a road over Gun Site Pass sufficient to support primary access and impacts resulting from additional traffic through the town of Sahuarita would likely create additional impacts beyond what is already being proposed.</td>
</tr>
</tbody>
</table>
Table 4. Alternatives unlikely to resolve an environmental conflict (Continued)

<table>
<thead>
<tr>
<th>Alternative or Alternative Element</th>
<th>Source of Alternative Idea</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch proposed primary and secondary access roads/loop road circulation system/in from SR 83/out through Santa Rita Road/expand and use as secondary access</td>
<td>PS, IDT, CA</td>
<td>Impacts resulting from the combination of the construction of a road over Gun Site Pass sufficient to support primary access and impacts resulting from additional traffic through the town of Sahuarita would likely create additional impacts on top of what is already being proposed. The west access road would have to be completely upgraded to handle loaded traffic in either direction. The overall impact of this would be greater than the proposal.</td>
</tr>
</tbody>
</table>

Other Alternative Elements

<table>
<thead>
<tr>
<th>Alternative Element</th>
<th>Source of Idea</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Place transmission lines underground</td>
<td>PS, IDT</td>
<td>This would result in greater impacts as a result of increased ground disturbance. Furthermore, the line would need to be cooled by oil and would pose a greater potential for environmental damage.</td>
</tr>
<tr>
<td>Create a lake with Central Arizona Project (CAP) water on west side of Santa Rita Mountains for recreation and process water</td>
<td>PS</td>
<td>Excess CAP allocations have already been purchased for ground water recharge, and lakes would not create recharge—they would create a surface area for evaporation.</td>
</tr>
</tbody>
</table>

Notes: CA = Cooperating agencies; IDT = Interdisciplinary team; and PS = Project scoping.

Alternatives or Alternative Elements Considered but Determined to Be Technically or Financially Infeasible

The ID team reviewed numerous alternatives regarding the preliminary MPO that involved alternate technologies or configurations of the mine. Several elements were deemed to be outside the range of expertise. Therefore, the Coronado had their contractor, SRK Consulting, review 11 specific alternative elements in greater detail. The complete report is provided in appendix D. These alternatives included the following:

- Disposal of tailings and waste rock on the western slope of the Santa Rita Mountains;
- Mechanical conveyance of ore to a rail head;
- Use of in situ leaching;
- Use of high-temperature/high-pressure leaching;
- Modification of the mine life;
- Suspension of mining during certain environmental conditions;
- Use of sea water for mining and ore processing;
- Use of reclaimed water for mining and ore processing;
- Microbial leaching for ore processing;
- Replacement of internal combustion engines with electric motors; and
- Reconstruction of the McCleary Canyon drainage at closure.
During the alternatives development process, forest specialists requested that further review be completed on additional water sources for the mine; therefore, SRK Consulting was enlisted to review 22 alternative water sources (appendix E).

The following table summarizes alternative themes and elements considered but dismissed from detailed analysis.

### Table 5 Alternatives determined to be technically or financially infeasible

<table>
<thead>
<tr>
<th>Alternative or Alternative Element</th>
<th>Source of Alternative Idea</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alternatives Involving the Placement of Waste Rock or Tailings</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Transfer waste and tails to Mission Mine</td>
<td>PS, CA</td>
<td>Impractical because of distance, increased impact to Santa Rita Experimental Range, energy costs, and lack of existing conveyor technology. Furthermore, Mission Mine is controlled by a competing mining company (IDT meeting notes).</td>
</tr>
<tr>
<td>Relocate tails and waste to west side of ridge</td>
<td>PS, IDT</td>
<td>Not financially feasible to haul waste rock over the ridge (Rosemont Copper, Doc. X). Furthermore, Rosemont Copper does not control enough claim area on the western slope of the Santa Rita Mountains to accommodate the volume of both waste rock and tailings (IDT meeting, Doc X).</td>
</tr>
<tr>
<td>Transfer waste and tails to Mission Mine</td>
<td>PS, CA</td>
<td>Impractical because of distance, increased impact to Santa Rita Experimental Range, energy costs, and lack of existing conveyor technology. Furthermore, Mission Mine is controlled by a competing mining company (IDT meeting notes, Doc. X; Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Relocate tails, overburden, and/or ore via rail line or other mechanism to other Green Valley mines and Twin Buttes Mine</td>
<td>PS, CA</td>
<td>Impractical because of distance, increased impact to Santa Rita Experimental Range, energy costs, and lack of existing conveyor technology. Furthermore, these mines are controlled by competing mining companies (Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Remove all tails from public land</td>
<td>PS</td>
<td>Not financially feasible because of the volume of tailings (Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Ship tailings to Canada</td>
<td>PS</td>
<td>Not financially feasible (IDT meeting notes, Doc. X; Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Limited project—limit to fee simple and patented mining claims</td>
<td>PS</td>
<td>The largest contiguous parcel of land consists of a combination of both patented land and BLM administered land and is located north and west of the pit area. After evaluating storage volume of this area, it would fit, at the most, 852 million cubic yards. This is insufficient for this operation (Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Tunnel through the Santa Rita Mountains</td>
<td>PS, IDT</td>
<td>Although some utilities could be located in a tunnel through the upper portion of the Santa Rita Mountains, it would be cost prohibitive to mine the ore body via a tunnel (IDT meeting notes, Doc. X; Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Mechanical conveyance of ore to rail head/rail or trolley transport of ore, spoils, and tailings out of area</td>
<td>PS</td>
<td>Technically infeasible because no existing conveyor technology exists for the size of the conveyor that would be needed. Furthermore, Rosemont Copper does not control right-of-way or land from the proposed project site to the nearest rail head in southern Tucson. Financially infeasible; may not be possible to get approval for pipeline to connect at current port; cost prohibitive to acquire the right-of-way (IDT meeting notes, Doc. X).</td>
</tr>
</tbody>
</table>
Table 5 Alternatives determined to be technically or financially infeasible (Continued)

<table>
<thead>
<tr>
<th>Alternatives Involving Alternative Mining Techniques or Technologies</th>
<th>PS</th>
<th>Too vague to address in detail. However, Rosemont Copper has proposed using contemporary mining technologies such as dry-stack tailings (IDT meeting notes, Doc. X; Rosemont Copper, Doc. X).</th>
</tr>
</thead>
<tbody>
<tr>
<td>In situ mining</td>
<td>PS</td>
<td>Technically infeasible because it will not work on a sulfide ore body. Furthermore, this technique has never been commercially proven (Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Use onsite high-pressure/high-temperature leaching</td>
<td>PS</td>
<td>Technically infeasible because it will not work on a sulfide ore body. Furthermore, this technique has never been commercially proven (Rosemont Copper, Doc. X). Because of low acid generation (pyrite) of the ore, it is not amenable to the high-pressure concentrate leach method (Rosemont Copper response table dated 4-22-09).</td>
</tr>
<tr>
<td>Underground mine</td>
<td>PS</td>
<td>Ore grades are not high enough to sustain economic viable underground operation. This would also not significantly reduce the amount of tails or waste (Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Sublevel caving mining/vertical crater retreat or construction of shafts to subterranean levels</td>
<td>PS</td>
<td>The type of ore body owned by Rosemont Copper is not conducive to this type of mining because the ore is disseminated, rather than in veins or isolated zones (Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Backfill, continuous backfill, or partial backfill</td>
<td>PS, IDT, CA</td>
<td>This would take 20 years to excavate the pit, approximately 15 to refill; effects on most resources would increase in duration, result in questionable stability, and increase resource use (fuel); concurrent reclamation would not occur. Furthermore, the configuration of the ore body does not allow for a continuous backfill like a coal bed (IDT meeting notes, Doc. X; Rosemont Copper, Doc. X).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Alternatives that Adjust Timing of the Operations or Duration of the Mine Life</th>
<th>PS, CA</th>
<th>Not financially feasible because of the financing of large mine equipment. Would not result in reducing impacts identified in issues. May result in the need for an increased footprint for the plant facilities (IDT meeting notes, Doc. X; Rosemont Copper, Doc. X).</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lengthen or shorten the duration of the mine life</td>
<td>PS, CA</td>
<td>Technically infeasible because machines cannot be turned off easily/daily. Processes are continuous-flow processes that are not amenable to being shut down daily. Furthermore, because of large capital costs, it is financially infeasible not to operate the mine 24 hours a day. This is the standard practice for large, open-pit mines (Rosemont Copper, Doc. X).</td>
</tr>
</tbody>
</table>
### Table 5 Alternatives determined to be technically or financially infeasible (Continued)

<table>
<thead>
<tr>
<th>Alternative or Other Alternative Element</th>
<th>Source of Alternative Idea</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Use ocean water for operations</td>
<td>PS</td>
<td>This would require infrastructure that would make the project financially infeasible (Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Use reclaimed or “gray water”</td>
<td>PS</td>
<td>Not able to gain legal access to this water; Sahuarita uses theirs, and Green Valley leased all of theirs to private party for foreseeable future (Rosemont Copper, Doc. X).</td>
</tr>
<tr>
<td>Use waste rock for industrial uses</td>
<td>PS</td>
<td>Unlikely to have a measurable reduction in impacts. This has been tried at Sacaton, and there has not been enough demand to reduce any impacts (IDT Meeting).</td>
</tr>
<tr>
<td>Reclamation—create a lake out of pit</td>
<td>PS</td>
<td>A lake created in the pit during reclamation would not be safe for recreational boaters. Therefore, it would serve no purpose (Rosemont Copper, Doc. X).</td>
</tr>
</tbody>
</table>

Notes: CA = Cooperating agencies; IDT = Interdisciplinary team; and PS = Project scoping.
LITERATURE CITED


APPENDIX A

Clean Water Act 404(b)(1) Alternatives Analysis
APPENDIX B

Alternatives Suggested during Public Scoping
ALTERNATIVES
This section of the scoping document identifies twelve (12) alternatives in addition to the proposed project. These alternatives reflect a range of strategies to significantly reduce adverse environmental impacts: no action, alternative uses of public lands reduction of project scale, alternative types of mining, alternative locations for selected elements to the proposed project; transportation types and routes, timetable; and alternative processing technologies. This list is not intended to be exhaustive, and during the preparation of the Draft EIR other alternatives will surely be generated and evaluated accordingly. The following alternatives are generally listed in order of preference as regards reducing or eliminating adverse environmental impacts. Those alternatives with the least impact are listed first, with the successive alternatives listed in terms of likely increases in the type, magnitude, extent, and significance of adverse impacts. Note also that some alternatives could be used in combination, particularly with respect to placement of spoils, transportation types and routes, and processing technologies, particularly with respect to water use and recycling. This discussion does not address these possible combinations, however during the preparation of the Draft EIS such combinations should be fully explored in order to identify alternatives (and sub-alternative combinations) which result in significant reductions in adverse environmental impacts.

Alternative 1: No Action. NEPA requires the consideration of the "No Action" alternative. Assessment of this "no action" alternative should not simply state that there will be no impacts, but should list the impacts avoided as a result of the alternative as well as the public benefits of "no action." In the case of a large, open-pit copper mine and processing facility, the "No Action" alternative will obviously eliminate the many adverse and potentially significant environmental impacts associated with the project as proposed, including, but not limited to surface and groundwater resources; toxic materials, emissions and airborne toxic dust; noise; vehicular traffic; night lighting; visual quality; recreation; wildlife and wildlife habitat; regional rural economy, property values, and lifestyle; energy use; historic and cultural resources; and effects on local emergency services. In all likelihood, the "No Action" alternative will be determined to be the "environmentally superior" alternative as well.
### Alternatives

<table>
<thead>
<tr>
<th>Record ID</th>
<th>Comment Number</th>
<th>Commenter Type</th>
<th>Comment Text</th>
</tr>
</thead>
<tbody>
<tr>
<td>160</td>
<td>107</td>
<td></td>
<td>Alternative 1A: Alternative Uses of Public Lands. This alternative is a variation of the NEPA requirement to assess the &quot;No Action&quot; alternative (see above), and, in fact, could be incorporated into that alternative. Under this alternative, alternative uses of public lands would be considered in contrast to those set forth in the description of the &quot;Proposed Action&quot; in the Notice of Intent (NOI). According to the NOI, &quot;Project-related activities to be addressed in the EIS include, but are not limited to, the following: …… Construction, operation and reclamation of an ore-processing plant, tailings, waste rock and leach facilities on NFS land adjacent to the mine. …&quot; Inasmuch as these uses are not appropriate uses of public lands, this alternative explores the public benefits of alternative uses of NFS lands to those listed above rather than simply the passive alternative of &quot;no action&quot;. Such uses could include, but not be limited to the following (individually, and, as applicable, in combination): Public acquisition of privately held property within the northern range of the Santa Rita Mountains to provide in-perpetuity conservation of important open space lands within the greater Tucson region. Such public acquisition could also involve a land exchange with Augusta. Incorporation of the northern range of the Santa Rita Mountains, particularly that portion of the range within the Cienega creek watershed, into Las Cienegas National Conservation Area (LCNCA). The LCNCA provides an ideal model for utilizing land exchange and intergovernmental cooperation as a means of achieving long-term conservation of open space lands. Coronado National Forest lands are contiguous to LCNCA and BLM and the State of Arizona are already partners in LCNCA. Enhanced grazing lands in conjunction with the Ranch Conservation element of the Pima County Sonoran Desert Conservation Plan. These and similar alternatives would eliminate or significantly reduce the many adverse and environmental impacts associated with the uses proposed for NFS lands in the MPO. Conceivably, one of these alternatives could be determined to be the &quot;environmentally superior&quot; alternative as well.</td>
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<td></td>
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<td>Alternative 2: Limited Project. Under this alternative, mining excavation and placement of all spoils would be limited wholly to fee simple lands and patented mining claims, and thus provide maximum protection of all public trust lands - National Forest, Bureau of Land Management, and State of Arizona. This alternative would prohibit placement of all spoils and overburden on public lands thus protecting the five square miles of public land designated for permanent mine tailings, facilities, waste rock storage, and open pit excavation proposed in the current Mine Plan of Operation. Due to the reduced area of disturbance as well as the reduced scale and level of mining and processing activity, as well as eliminating the deposition of overburden and spoils on public land, this alternative would likely result in substantial reductions in a variety of impact categories, including, but not limited to surface and groundwater resources; toxic materials; emissions and airborne toxic dust; noise; vehicular traffic; night lighting; visual quality; recreation; wildlife and wildlife habitat; regional rural economy, property values, and lifestyle; energy use; historic and cultural resources; and effects on local emergency services (Relevant Comment numbers: 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 3A, 3B, 4A, 4B, 5, 6, 7, and 10).</td>
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### Alternatives

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<tr>
<td>160</td>
<td>109</td>
<td>General</td>
<td>Alternative 3: In-Situ Mine. In-situ means &quot;in the natural or original position.&quot; This alternative involves obtaining the desired material with only minimum physical disturbance of the mine site, as the ore is leached in its existing underground location. The alternative consists of a series of injection wells and recovery wells. These wells, constructed with acid-resistant casings, penetrate the copper-bearing ore, and are sealed from the surface through the ore zones. A weak, acid leach solution is pumped through the cracks in the ore, dissolving the copper into a concentrated solution, which in turn is pumped up through the injection well for processing. A continuous ring of recovery wells surround the injection wells to prevent leach solution from escaping. This alternative thus avoids the excavation of ore rock and the disposal of overburden and tailings. Processing can take place off-site thus minimizing adverse impacts at the mine site. When the copper ore body is depleted any hazardous materials remaining in the ore zone are flushed out through pumping and rinsing with fresh water. Once the wells are cleaned, they are filled with cement and the land returned to its former use. Due to the reduced area of disturbance as well as the absence of overburden and spoils on public land, this alternative would likely result in substantial reductions in a variety of impact categories, including, but not limited to surface and groundwater resources; toxic materials, emissions and airborne toxic dust; noise; vehicular traffic; night lighting; visual quality; recreation; wildlife and wildlife habitat; regional rural economy, property values, and lifestyle; energy use; historic and cultural resources; and effects on local emergency services. (Relevant Comment numbers: 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 3A, 3B, 4A, 4B, 5, 6, 7, and 10).</td>
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<tr>
<td>160</td>
<td>110</td>
<td>General</td>
<td>Alternative 4: Underground Mine. This alternative would involve sinking mine shafts to subterranean levels containing ore and then constructing horizontal tunnels, called adits, to reach the underground ore deposits. Through the use of this alternative, the large, highly visible open-pit excavation would be avoided, along with the surface deposition of a large volume of overburden waste rock. Modern underground mining technologies utilize blasting with explosives and typically utilize heavy-duty mechanical cutting equipment. Use of robotic technologies may be feasible. Ore is extracted via mechanical rail conveyances, thus the ore can be removed from the immediate mine site to off-site locations for processing. Reclamation of this underground mining alternative would involve closure of the shafts and tunnels, as well as reclamation of mine tailings. Due to the reduced area of disturbance as well as the reduced magnitude and extent of overburden and spoils on public land, this alternative would likely result in reductions in a variety of impact categories, including, but not limited to surface and groundwater resources; toxic materials, emissions and airborne toxic dust; noise; vehicular traffic; night lighting; visual quality; recreation; wildlife and wildlife habitat; regional rural economy, property values, and lifestyle; energy use; historic and cultural resources; and effects on local emergency services (Relevant Comment numbers: 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 3A, 3B, 4A, 4B, 5, 6, 7, and 10).</td>
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<td>160</td>
<td>111</td>
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<td>Alternative 5: Continuous Pit Backfill. Under this alternative the project would utilize a continuous backfill technology, whereby the open pit would be progressively filled with the waste rock, spoils, and overburden generated as the excavation proceeds. This alternative would thus eliminate the waste material placed on public lands, although at the project outset might warrant temporary and very limited storage of such materials on adjoining public lands. This alternative would also eliminate the open pit at the completion of extraction. Due to the reduced area of disturbance as well as eliminating the long-term effects of overburden and spoils on public land, this alternative would likely result in reductions in a variety of impact categories, including, but not limited to surface and groundwater resources; toxic materials, emissions and airborne toxic dust; noise; vehicular traffic; night lighting; visual quality; recreation; wildlife and wildlife habitat; regional rural economy, property values, and lifestyle; energy use; historic and cultural resources; and effects on local emergency services. (Relevant Comment numbers: 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 3A, 3B, 4A, 4B, 5, 6, 7, and 10).</td>
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<tr>
<td>160</td>
<td>112</td>
<td></td>
<td>Alternatives 6 through 10 are concerned with alternatives modes and routes for transporting materials - including ore, waste rock and tailings - equipment, and personnel to and from the mine site. These alternatives include the use of rail transportation, mechanical conveyances, and hydraulic conveyances as well as alternative vehicular routing in order to reduce the potential adverse impacts of the proposed project. Alternative 6: Rail Transport of Ore, Spoils and Tailings from the Mine Site. Under this alternative, all material - ore, spoils, tailings, and waste rock would be transported from the site via a new rail line constructed to the mine site. Overburden would be stockpiled on site for use during the reclamation phase. The ore would be transported to a processing site, and the so-called waste material could then be utilized off-site in other industrial processes, including but not limited to crushed rock for construction use, construction land fill, road bed construction, and similar industrial uses. Due to the long-term effects of eliminating overburden and spoils on public land, this alternative would likely result in reductions in a variety of impact categories, including, but not limited to surface and groundwater resources; toxic materials, emissions and airborne toxic dust; noise; vehicular traffic and public safety; night lighting; visual quality; recreation; wildlife and wildlife habitat; regional rural economy, property values, and lifestyle; energy use; historic and cultural resources; and effects on local emergency services. (Relevant Comment numbers: 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 3A, 3B, 4A, 4B, 5, 6, 7, and 10).</td>
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<td>160</td>
<td>113</td>
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<td><strong>Alternative 7:</strong> Rail Transport of All Ore from the Mine Site. Under this alternative, all ore would be transported to an off-site processing location, preferably adjacent or near an existing smelter. Transport from the mine site would be via a new rail line constructed between the mine site and a main rail line. Two routing options exist - one connecting to the north, the other to the west. Due to the relocation of the processing facility to a more appropriate off-site location, this alternative would likely result in reductions in a variety of impact categories, including, but not limited to surface and groundwater resources; toxic materials, emissions and airborne toxic dust; noise; vehicular traffic and public safety; night lighting/visual quality; recreation; wildlife and wildlife habitat; regional rural economy, property values, and lifestyle; energy use; historic and cultural resources; and effects on local emergency services. (Relevant Comment numbers: 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 3A, 3B, 4A, 4B, 5, 6, 7, and 10).</td>
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<tr>
<td>160</td>
<td>114</td>
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<td><strong>Alternative 8:</strong> Mechanical Conveyance of Ore to Rail Head. This alternative is similar to Alternative 7 but would utilize some form of mechanical conveyance, such as a mine cart conveyor system, down the west side of the Santa Rita Mountains to a rail head for shipment on the existing rail line connecting Nogales and Tucson. This alternative could be undertaken in conjunction with all other alternatives (see above), and could be used for shipment of both the ore product and the so-called waste materials. Due to the conveyance of ore to a rail head for shipping to an off-site processing facility, and the removal of processing from the on-site operations, this alternative would likely result in reductions in a variety of impact categories, including, but not limited to surface and groundwater resources; toxic materials, emissions and airborne toxic dust; noise; vehicular traffic and public safety; night lighting/visual quality; recreation; wildlife and wildlife habitat; regional rural economy, property values, and lifestyles; energy uses; historic and cultural resources; and effects on local emergency services. (Relevant Comment numbers: 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 3A, 3B, 4A, 4B, 5, 6, 7, and 10).</td>
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<tr>
<td>160</td>
<td>115</td>
<td></td>
<td><strong>Alternative 9:</strong> Hydrological Conveyance of Wet Ore Concentrate to Processing Site West of the Santa Rita Mountains. This alternative is similar to Alternative 8, but would utilize some form of hydrologic/pipeline conveyance down the west side of the Santa Rita Mountains to a processing/drying site near Santa Rita Road. According to the Applicant, 89% of the water could be returned to the mine area for reuse. The ore product could then be trucked to the Port of Tucson railhead at Kolb &amp; I-10 or to a railhead on the existing rail line connecting Nogales and Tucson. This alternative could be undertaken in conjunction with other mine-type and processing alternatives (see above). Due to the hydrologic conveyance of ore to a rail head for shipping to an off-site processing facility, and the removal of processing from the on-site operations, this alternative would likely result in reductions in a variety of impact categories, including, but not limited to surface and groundwater resources; toxic materials, emissions and airborne toxic dust; noise; vehicular traffic and public safety; night lighting/visual quality; recreation; wildlife and wildlife habitat; regional rural economy, property values, and lifestyle; energy use; historic and cultural resources; and effects on local emergency services. (Relevant Comment numbers: 1A, 1B, 1C, 2A, 2B, 2C, 2D, 2E, 3A, 3B, 4A, 4B, 5, 6, 7, and 10).</td>
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<tr>
<td>160</td>
<td>116</td>
<td>General</td>
<td>Alternative 10: Loop Road Circulation System. This alternative would utilize either a tunnel through or a summit road over the Santa Rita Mountains so that full ore trucks would road through a tunnel or over the top so that full trucks would go west to I-19, north to I-10, and then to the Port of Tucson railhead at Kolb and I-10; empty trucks would return on the East side of the Santa Rita Mountains via SR83. This alternative would likely result in reductions in a variety of impact categories, including, but not limited to emissions; noise; vehicular traffic and public safety; recreation; and effects on local emergency services. (Relevant Comment numbers: 2B, 2D, 3B, and 10).</td>
</tr>
<tr>
<td>160</td>
<td>117</td>
<td>General</td>
<td>Alternative 11: Modified Time-Table. The following alternatives address extensions or other changes in the timetable for mine operations which could result in reduced impacts: a. Extend Mine lifetime to 40 or 50 years b. Suspend mining operations during high winds c. Suspend mining operations during extreme drought conditions d. Suspend mining operations during periods of excellent &quot;seeing conditions&quot; at the surrounding dark-sky observatories.</td>
</tr>
<tr>
<td>160</td>
<td>118</td>
<td>General</td>
<td>Alternative 12: Alternative Processing Technologies. In addition to the alternatives listed above, the Draft EIS should expand the range of technical alternatives within the various processes and techniques proposed in the MPO and alternatives to the MPO as augmented in this scoping document and in subsequent alternatives generated through scoping and the formal environmental assessment phase. Such technical alternatives must be generated by an independent set of consultants with demonstrable expertise in mining technology and a proven record for successfully utilizing alternative mining methods and technologies which significantly reduce adverse environmental impacts.</td>
</tr>
<tr>
<td>1544</td>
<td>1</td>
<td>Individual</td>
<td>Why does the mine need to use clean/fresh/virgin water? Why can't they use gray water? Wouldn't everyone win if they piped gray water from the cities, used it, recharged it, and added to the fresh water supply.</td>
</tr>
<tr>
<td>1545</td>
<td>1</td>
<td>Individual</td>
<td>The tailings from the mine are going to be mixed with polyers to keep them from blowing around. Polyers are plastics that are made from oil and they do not degrade. So 30-50- years from now we will have this huge pile of dust and plastic? How about mixing the tailings with something else? Something that will bio-degrade and still perform the dust retention function.</td>
</tr>
<tr>
<td>1610</td>
<td>2</td>
<td>Individual</td>
<td>This TEP proposal provides another option to provide power to Rosemont Copper. This project provides for double-circuit 138 kV transmission lines to go southwest from the Vail substation to a new Cienega substaion in Phase 1 and a new Mountain View substation in Phase 2 to the south of Interstae 10, next to State Route 83 that goes directly to the Rosemont Copper mine (see enclosure 4). Q-51. Will the proposed Mountain View substation be considered as a power source for Rosemont Copper? Q-52. How much power will be available at the Mountain View substation, if Phase 2 is ever build, after servicing its distribution demands? Q-53. When is the Mountain View substation to be operational?</td>
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<td>1649</td>
<td>4</td>
<td>Individual</td>
<td>Also, if Rosemont is not processing any ore at the site (per the Rosemont Copper web-site) and other mining companies discuss removing the tailings (Freeport-McMoRan Copper &amp; Gold Inc from the area to use for other purposes ...</td>
</tr>
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<td></td>
<td></td>
<td><a href="http://www.fcx.com/envir/environmental.htm">http://www.fcx.com/envir/environmental.htm</a></td>
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<td>&quot;Freeport's environmental experts have demonstrated for years that the tailings material can be readily revegetated or reclaimed with native forestry and agricultural plants. When mining is complete, the deposition area will be valuable high ground suitable for many applications. One emerging project, however, can put the material to positive economic use in the short term. During the past several years, Freeport Indonesia has been collaborating with scientists from Indonesia's leading technological research university, Institute Teknologi Bandung (ITB) - the Bandung Institute of Technology's Research and Industrial Affiliation Institute - on tailings' use as raw material for the construction and manufacturing of concrete, bricks, pipes and other infrastructure products. The results so far have been promising. According to the researchers, the properties of the material are conductive to construction applications and the crushed rock offers cost advantages over other basic material.&quot;</td>
</tr>
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<td></td>
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<td></td>
<td>Has Rosemont Mine - looked for alternatives / other options to completely remove the tailings that would be dumped on Public lands - not leaving any &quot;dangerous&quot; refuse on the property at all ---- removing the need to use any Forest Service Lands - and limiting the mine to private property.</td>
</tr>
<tr>
<td>1649</td>
<td>5</td>
<td>Individual</td>
<td>Is Rosemont Mining Corp going to use the ISO 14001 Standards for Environment Management? International Standards to make sure that employees, customers, and nearby communities feel that the company is following the fulfilling their commitment.</td>
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<td></td>
<td></td>
<td></td>
<td><a href="http://www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000/iso_14000_essentials.htm">http://www.iso.org/iso/iso_catalogue/management_standards/iso_9000_iso_14000/iso_14000_essentials.htm</a></td>
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|           |                |                | "ISO 14001:2004 gives the generic requirements for an environmental management system. The underlying philosophy is that whatever the organization's activity, the requirements of an effective EMS are the same. This has the effect of establishing a common reference for communicating about environmental management issues between organizations and their customers, regulators, the public and other stakeholders. ...

ISO 14001:2004 can also be used to meet external objectives:

provide assurance on environmental issues to external stakeholders - such as customers, the community and regulatory agencies comply with environmental regulations support the organization's claims and communication about its own environmental policies, plans and actions provides a framework for demonstrating conformity via suppliers' declarations of conformity, assessment of conformity by an external stakeholder - such as a business client - and for certification of conformity by an independent certification body."
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<td>1700</td>
<td>5</td>
<td>Individual</td>
<td>Can the tailings be shipped to Rosemont or the Augusta Resources country?</td>
</tr>
<tr>
<td>1713</td>
<td>1</td>
<td>Individual</td>
<td>Why is CAP water not good enough for the &quot;mine&quot;</td>
</tr>
<tr>
<td>1715</td>
<td>2</td>
<td>Individual</td>
<td>Why doesn't Rosemont use CAP water?</td>
</tr>
<tr>
<td>1773</td>
<td>2</td>
<td>Individual</td>
<td>Given the mine is as long term as projected, can't there be a requirement of them to create/pave their own road?</td>
</tr>
<tr>
<td>1837</td>
<td>1</td>
<td>Individual</td>
<td>Rosemont will not put a lining under the tailings. A non porous lining should be placed under the Rosemont Mine tailings.</td>
</tr>
<tr>
<td>1840</td>
<td>2</td>
<td>Individual</td>
<td>I have heard that the mining company will not be putting a lining under the tailings pile. What impact will that have on the environment?</td>
</tr>
<tr>
<td>1842</td>
<td>2</td>
<td>Individual</td>
<td>I would hope that the Forest Service will require that any mines on their land, including the Rosemont Copper Project, will be required to return the material that is left after processing to the pit.</td>
</tr>
<tr>
<td>1957</td>
<td>21</td>
<td>Individual</td>
<td>it seems much more reasonable, safe, and certainly less intrusive on valuable Forest land, for the Forest Service to require Rosemont to simply switch the primary and secondary access routes in its Plan. The new access road coming from Route 83 would not need to be nearly as wide if it were only a secondary access route, thus saving Forest land, and the very heavy and hazardous mine traffic flows could be routed south and northbound along I-19, instead of Route 83. The existing road from the west would need improvement, but, again, I emphasize, Rosemont already recovers all its investment in less than three years, and a little additional roadgrading expense is nothing compared to the terrible suffering engendered by a school bus-acid truck collision along Route 83 (and please don't make the mistake of thinking that's not going to happen.).</td>
</tr>
<tr>
<td>1960</td>
<td>8</td>
<td>Individual</td>
<td>IF YOU APPROVE FOR THE ROSEMONT MINE TO GO INTO PRODUCTION, THEY SHOULD ONLY BE ALLOWED TO USE CAP WATER (NO GROUNDWATER). REMEMBER, THIS IS A FOREIGN COMPANY THAT WILL BE REMOVING OUR PRECIOUS METAL TO BE SHIPPED OVERSEAS. WHY IN THE WORLD WOULD WE ALLOW THEM (FOREIGN ENTITY) TO DESTROY OUR GROUNDWATER BASIN.</td>
</tr>
<tr>
<td>2106</td>
<td>7</td>
<td>Individual</td>
<td>Mines of this proposed magnitude have historically required rail service to transport the resulting ore to the smelter. I cannot conceive of the amounts of ore all being transported via truck. Where would such a rail line originate from and what additional environmental damage would result from its construction and use?</td>
</tr>
<tr>
<td>2126</td>
<td>8</td>
<td>Individual</td>
<td>IF YOU APPROVE FOR THE ROSEMONT MINE TO GO INTO PRODUCTION, THEY SHOULD ONLY BE ALLOWED TO USE CAP WATER (NO GROUNDWATER). REMEMBER, THIS IS A FOREIGN COMPANY THAT WILL BE REMOVING OUR PRECIOUS METAL TO BE SHIPPED OVERSEAS. WHY IN THE WORLD WOULD WE ALLOW THEM (FOREIGN ENTITY) TO DESTROY OUR GROUNDWATER BASIN.</td>
</tr>
<tr>
<td>2216</td>
<td>7</td>
<td>Individual</td>
<td>I would also like to know why the Rosemont Mine is not going to build a railroad to move the ore? I believe there were several in the area that could be redeveloped.</td>
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<tr>
<td>2244</td>
<td>4</td>
<td>Individual</td>
<td>Does the mine use solar? What is their energy conservation plan?</td>
</tr>
<tr>
<td>2255</td>
<td>7</td>
<td>Individual</td>
<td>All mines have a rail spur to deliver and transport its goods and products, in order to substan the mining operation. The only reason why they haven't included it, is because its their first mining venture. This spur would add to the motoring public SAFETY. by removing the ore trucks from the highway! The state govt would then main obstacle and the state(gov.) is notoriously easier to deal than the federal govt. Paving the orad and adding a Spur running parallel to the Helvatia road after leaving the turcks in Sahuarita. This spur would remove ore shipments from SR83, not to mention ACID and REAGENTS which are Extremely HAZARDOUS.</td>
</tr>
<tr>
<td>2263</td>
<td>1</td>
<td>Individual</td>
<td>Water is precious in the Tucson area. Currently many golf courses are required to use effluent for their water source. I would like to propose that Rosemont mine use effluent (refined sewer water) as an alternative to groundwter, or in combination with groundwater. Pima County is already studying the use of effluent by the public to meet future water needs, it would make more sense to use it for mining operations than our limited groundwater supplies.</td>
</tr>
<tr>
<td>2265</td>
<td>11</td>
<td>Individual</td>
<td>As the proposal includes the construction of a CAP water line from Avra Valley to Sahuarita as well pipe lines from the new wells to the Rosemont property why would Augusta not propose to connect these two projects and use the CAP water for their operation?</td>
</tr>
<tr>
<td>2284</td>
<td>17</td>
<td>Individual</td>
<td>Wouldn't it be better and less intrusive on the current SR83 travelers to improve it before opening the mine so it can handle the additional volume of heavy trucks, perhaps make it a concrete highway in the section supporting heavy trucks?</td>
</tr>
<tr>
<td>2289</td>
<td>2</td>
<td>Individual</td>
<td>The mine should put in a railroad spur from the line along I-19 traveling over to as close to the mine as possible and then truck the supplies over the mountain via the secondary road. This way all the traffic will be off the roads and only a few trains a day will handle all the traffic at a much lower fuel cost. Every 4 trucks will fill one hopper and so a train of 60 cars will take 240 trucks to fill. This is 12 hours of peration for the mine. So there would be two trains a day or so. This would not add the traffic load to Highway 83 nor to I10 or I19. The mine could get either the UP to run the line or have the Port of Tucson run it. Trains are 10 times more efficient for moving this high volume of material, saving a large amount of diesel fuel, and they would not clog up the Highway with the trucks. This would also eliminater the noise impact of the mine traffic on the highway.</td>
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<tr>
<td>2305</td>
<td>18</td>
<td>Individual</td>
<td>In their report Rosemont notes that open pit mining is being investigated to determine if passive contamination will be achieved. If the land must be raped of its resources why not use situ mining instead of open pit? The Copper Development Association wrote about In Situ Leaching: &quot;In situ&quot; literally means &quot;in place.&quot; With in situ mining, a diluted sulfuric acid and ferric sulfate solution is injected down holes drilled into the ore body. The solution flows through cracks in the rock under pressure, leaching the copper from the rock into the solution. The solution is then pumped to the surface to recover the copper, using solvent extraction techniques. Tests show that recovery rates normally achieved with heap and dump leaching could also be approached in situ mining. There are significant cost advantages of this operation which include: the surface need not be disturbed with anything other than pump and piping installations, no waste piles are created, start-up is relatively fast, equipment needs are reduced significantly, fluid control is more easily automated than solid batch processes, and we can mine deep, relatively low grade and complex ore bodies.</td>
</tr>
<tr>
<td>2366</td>
<td>4</td>
<td>Individual</td>
<td>Unless they bring in water from the ocean, and desalinate it if necessary for mining operations. The oceans are supposed to rise with global warming, not fall. So that supply wouldn't be exhausted, and after the mine closes after 20 years, the desalination plant and or transport pipe or canal could be used for homeowners, who surely will not be able to afford such a thing on their own. Not Pima county, not Tucson, not Green Valley, not Sahuarita, not even Arizona could afford such an expense now. Whether the mine could, they would have to decide.</td>
</tr>
<tr>
<td>2371</td>
<td>8</td>
<td>Individual</td>
<td>IF YOU APPROVE FOR THE ROSEMONT MINE TO GO INTO PRODUCTION, THEY SHOULD ONLY BE ALLOWED TO USE CAP WATER (NO GROUNDWATER). REMEMBER, THIS IS A FOREIGN COMPANY THAT WILL BE REMOVING OUR PRECIOUS METAL TO BE SHIPPED OVERSEAS. WHY IN THE WORLD WOULD WE ALLOW THEM (FOREIGN ENTITY) TO DESTROY OUR GROUNDWATER BASIN.</td>
</tr>
<tr>
<td>2381</td>
<td>17</td>
<td>Individual</td>
<td>I would suggest that Augusta's planners have not thoroughly researched the project. I propose that they examine Sycamore Canyon to the North of their project. This large canyon could accept all or nearly all of the waste, including tailings that would come out of the proposed pit. It would also not be visible from either Highway 83 to the East or from the Santa Cruz Valley to the West. The canyon for the most part is rather barren of plant growth, has no water, and is poor terrain for both wild life and cattle. A perfect dump space.</td>
</tr>
<tr>
<td>2381</td>
<td>19</td>
<td>Individual</td>
<td>The Rosemont ore body is ideally suited to an underground method of mining called sublevel caving. The technique is called VCR or Vertical Crater Retreat. This method is being used by Vale/Inco at the Stobic Mine in Canada. An underground approach to the Rosemont project eliminates the need for thousands of acres of public land for dump space, as the method produces very little waste rock. The caved area at the surface would be relatively small compared to an open pit and would be confined to Augusta's private land, not the publics. The caved area would not be as offensive to the line of sight from Highway 83, as a large open pit would be. Tailings could be deposited in Sycamore Canyon as discussed above.</td>
</tr>
<tr>
<td>2396</td>
<td>5</td>
<td>Individual</td>
<td>To alleviate traffic on public roads, a system of private roads on forestry land, maintained by Augusta may be a better alternative than allowing the mine's equipment to damage the public roads.</td>
</tr>
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</tr>
<tr>
<td>2400</td>
<td>11</td>
<td>Individual</td>
<td>Use existing Helvetia Mine road from the west side of the Santa Ritas for egress for mine employees and mine haul trucks.</td>
</tr>
<tr>
<td>2400</td>
<td>12</td>
<td>Individual</td>
<td>Establish rail spur for transportation of ore. This would eliminate mine traffic from our public roads, going thru housing, school sites...</td>
</tr>
<tr>
<td>2400</td>
<td>13</td>
<td>Individual</td>
<td>A conveyor belt or slurry pipe could be used to transport to the trucks over the mountain or directly to rail spur.</td>
</tr>
<tr>
<td>2405</td>
<td>5</td>
<td>Individual</td>
<td>I propose that Highway 83 should not be used for the Rosemont Mines primary access. The better and safer alternative is to use Santa Rita Road...</td>
</tr>
<tr>
<td>2423</td>
<td>5</td>
<td>Individual</td>
<td>I recommend that no current road/highway systems in existence be usable for that enterprise.</td>
</tr>
<tr>
<td>2453</td>
<td>19</td>
<td>Individual</td>
<td>I note the great interest in alternative energy - solar, wind, geothermal, etc. Perhaps some of these could be used at the mine? At any rate...</td>
</tr>
<tr>
<td>2470</td>
<td>29</td>
<td>Individual</td>
<td>Where is the railroad spur?</td>
</tr>
<tr>
<td>2480</td>
<td>4</td>
<td>Individual</td>
<td>Solar panels on tailings/crater: As a gesture of good will, why don't the planners install solar collectors on the mine crater and tailings...</td>
</tr>
<tr>
<td>2591</td>
<td>20</td>
<td>Individual</td>
<td>Has any consideration been given to the possibility of using processed waste water as a major source of water for mine use? If it is good...</td>
</tr>
<tr>
<td>2617</td>
<td>51</td>
<td>Individual</td>
<td>We understand that there are numerous copper mines that were closed down when the value of copper dropped. Further we are dismayed that a new mine...</td>
</tr>
<tr>
<td>2634</td>
<td>23</td>
<td>Business</td>
<td>The proposed Rosemont ore body is in an environmentally sensitive area and would be better left in the ground.</td>
</tr>
<tr>
<td>Record ID</td>
<td>Comment Number</td>
<td>Commenter Type</td>
<td>Comment Text</td>
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</tr>
<tr>
<td>2644</td>
<td>20</td>
<td>Individual</td>
<td>If the mining operation does come to fruition it would seem to us that the company should build and pay for their own paved road from the mine site to the Box Canyon Road, and pay to improve the Box Canyon road with a paved surface, and straightened curves, to Continental and the railroad to Mexico at that point. This would seem to have the least amount of impact and be the most direct route to ship the concentrated ore out of the country completely avoiding using Route 83, and avoiding possible hazardous materials loads on Route 82. The same Box Canyon route would be available to receive those hazardous materials required by the mining operation. Water from the extended C.A.P. canal could parallel the new Box Canyon/Continental road and be piped along the bottom of the Box Canyon Wash, then up and along the new road leading to the mine site. This entire route is in remote, mostly undeveloped country, until reaching Continental.</td>
</tr>
<tr>
<td>2666</td>
<td>12</td>
<td>Organization</td>
<td>The simplest solution suggested so far is to limit the mine to daytime operation only.</td>
</tr>
<tr>
<td>2673</td>
<td>21</td>
<td>Individual</td>
<td>An underground mine could be used as an alternative to extract the copper bearing ore. To reduce the impact of the tailings the underground mine could start with the primary shaft at the maximum surveyed depth of the ore deposit. The initial extraction (mining) would begin at the maximum depth and then work upwards to the top of the copper bearing ore. The project would be continuously refilling after the extraction of the ore from the bottom up with excess material and waste. The project would be continuously refilling after the extraction of the ore from the bottom up with excess material and waste. Rosemont Project representatives have indicated that a new mechanical process was going to be used to reduce the tailings debris to a moisture content of 15%. The reuse of the damp tailings should stop or reduce any in-hole dust and conceivably provide a good material for compaction to be used for the rising floor for the ever elevating mining process. The need for pumping invasive ground water out of the underground mine would lessen as the mine developed and work progress onto higher portions of the ore which would be the reverse of an open pit mine. An underground mine that utilized the tailings as part of the ongoing process would alleviate some of the concerns for major unsightliness, excessive overburden striping, a pit catching storm and ground water with the associated pumping and subsequent discharge. The on going concern with all large projects is the set aside for final cleanup and remediation as required. The underground mining alternative suggested above would greatly remove some of the concerns since most of the remediation is concurrent with the continuing extraction.</td>
</tr>
<tr>
<td>2673</td>
<td>33</td>
<td>Individual</td>
<td>We request a no action decision on the proposed Rosemont Copper Mining Projects.</td>
</tr>
<tr>
<td>2721</td>
<td>12</td>
<td>Individual</td>
<td>Mine closure – An effective use of the plus 3,000 acres of mine tailings and waste rock would be to level tem and use them for solar arrays. The Forest Service could lease these areas for a fee to private companies for power generation.</td>
</tr>
<tr>
<td>2736</td>
<td>26</td>
<td>Government</td>
<td>Could Rosemont use CAP water directly instead groundwater? What would be the effect?</td>
</tr>
</tbody>
</table>
# Alternatives

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<tr>
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<tbody>
<tr>
<td>2736</td>
<td>32</td>
<td>Government</td>
<td>If Rosemont directly used CAP water, where would the pipeline be located? What if Rosemont used CAP water directly and pumped groundwater when CAP water is not available.</td>
</tr>
<tr>
<td>2745</td>
<td>1</td>
<td>Individual</td>
<td>Alternative One is to require commercially-available Central Arizona Project (CAP) water and no groundwater to be used by Rosemont Copper for this action.</td>
</tr>
<tr>
<td>2745</td>
<td>2</td>
<td>Individual</td>
<td>Alternative Two is an alternative electricity plan to supersede those in the Mining Plan of Operations (MPO) in section 2.7 that does fails to meet the operational needs for Rosemont Copper.</td>
</tr>
<tr>
<td>2745</td>
<td>15</td>
<td>Individual</td>
<td>Alternative One is a solution that avoids almost all these impacts will still permitting the Rosemont Copper Mine. The only way to avoid impacting the groundwater is for Rosemont Copper NOT to used ground water as required by Alternative One.</td>
</tr>
<tr>
<td>2745</td>
<td>16</td>
<td>Individual</td>
<td>Alternative Two provides a new way to provide adequate and continuous electrical power to the Rosemont Copper mine without impacting the local electricity &quot;sink&quot; in Tucson due to inadequate electricity available for this mine and other large consumers in southern Arizona. Alternative two is to build an electrical generation plant on site, using natural gas from large El Paso natural Gasline that runs parallel to Interstate Highway 10 (I-10) with less air pollution, less water demands, and removable ease project reclamation upon completion of the mining operations.</td>
</tr>
<tr>
<td>2745</td>
<td>17</td>
<td>Individual</td>
<td>Overview of Alternative One: Rosemont Copper can commercially purchase adequate amounts of CAP water to meet all its needs. CAP water can be used by this mine in the same manner as ground water. Rosemont will need to purchase CAP water to meet its expected requirements and provide the necessary infrastructure to deliver CAP water to the mine. This will result in an underground pipe that will, after burial, have little resultant cumulative environmental impact. This pipeline will need environmental surveys; will probably impact a large number of Native American cultural resources, some animal and plant habitats, and usual construction mitigations including dust and noise control actions. In general, pipeline mitigations are significantly less onerous than water depletion impacts on the future of these communities. If Rosemont Copper demand is less than the quantity of CAP water purchased, then it can &quot;sell&quot; that CAP water to local water utility companies for recharge or to satisfy other needs, thus recouping some capital pipeline expenses.</td>
</tr>
<tr>
<td>2745</td>
<td>18</td>
<td>Individual</td>
<td>Please see attachment 1 for a detailed discussion of this alternative and elements that are required to be included in the draft EIS. Alternative One is recommended.</td>
</tr>
<tr>
<td>2745</td>
<td>20</td>
<td>Individual</td>
<td>Overview of Alternative Two. Rosemont Copper did not have a viable electricity plan in the MPO, section 2.7. This alternative provides a new electricity plan that results in less air pollution, less water resources consumed for electricity generation and results in almost no footprint after reclamation. This alternative is a local, air-cooled, natural gas turbine generation plant on site of the mining operation. An underground natural gas line to connect with the El Paso Natural Gas line to the north, parallel to Interstate 10, has a smaller footprint than any of the options proposed in the MPO.</td>
</tr>
<tr>
<td>2745</td>
<td>21</td>
<td>Individual</td>
<td>Please see Attachment (2) for discussion of this alternative and elements that are required to be included in the Draft EIS. Alternative Two is recommended.</td>
</tr>
<tr>
<td>Record ID</td>
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<tr>
<td>2760</td>
<td>7</td>
<td>Government</td>
<td>Reasonable alternatives could include, but are not necessarily limited to, alternative sites or alternative designs for major mining facilities (e.g. waste rock piles or tailings impoundments), smaller project, other viable ore bodies, different pit geometries, and pit backfilling; as well as any alternatives evaluated for purposes of obtaining a Clean Water Act Section 404 permit, pursuant to 40 CFR Part 230.</td>
</tr>
<tr>
<td>5286</td>
<td>22</td>
<td>Individual</td>
<td>In view of the already poor condition of Route 83, and the very high potential for disastrous conflict between school buses, sulfuric acid trucks, and wide loads on a narrow, twisting, mountain road, it seems far more reasonable and safe for the Forest Service to require Rosemont to simply switch its proposed primary and secondary access routes. An access road coming west from Route 83 would need neither to be as wide, nor as improved, it it were only to be a secondary access route, thus saving some of our CNF land, and much of the very heavy and hazardous mine traffic flows could be routed north- and southbound along I-19, instead of along Route 83. The existing road from the west would need improvement, but, again, I emphasize, Rosemont already recovers its investment in less than three years, and a little additional road-improvement expense is nothing compared to the terrible suffering which would be engendered by a school bus-acid truck collision along Route 83. This alternative would also save Rosemont the expense of constructing a very complex intersection at Route 83, which will be hazardous no matter how carefully planned, because it would be on a Route 83 downgrade. If this were only a secondary access road, a much less complex intersection would be required.</td>
</tr>
<tr>
<td>5286</td>
<td>23</td>
<td>Individual</td>
<td>An even better alternative would be to oblige Rosemont to use the existing Rosemont Junction road for this access road, instead of constructing an entirely new road through our pristine Forest land, as their MPO proposes. If there's already an existing road which goes almost directly to the mine, why ruin even more of our Forest to build a new one?</td>
</tr>
<tr>
<td>6720</td>
<td>2</td>
<td>Individual</td>
<td>Alternative one, limit mining excavation and placement of all spoils to fee simple lands under the ownership of Rosemont. Under this alternative the applicant could demonstrate their commitment to land stewardship through providing maximum protection of all public land surrounding their path in a few simple area. In effect, this alternative would prohibit placement of all spoils and overburden on public lands, thus protecting five square miles of public land designated for permanent mine tailings, facilities, waste rock storage, and open-pit excavation proposed in the current Mining Plan of Operation.</td>
</tr>
<tr>
<td>6720</td>
<td>3</td>
<td>Individual</td>
<td>Alternative 2, utilize a continuous backfill technology, whereby the open-pit is progressively filled with waste rock and spoils, and overburden generated as the excavation proceeds. This alternative might warrant some interim and very limited storage of waste material on adjoining public land, but would essentially protect all public lands. This alternative would not result in an open-pit completion of extration, surely a preferable outcome with the current proposal.</td>
</tr>
</tbody>
</table>
### Alternatives

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<thead>
<tr>
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<tbody>
<tr>
<td>6720</td>
<td>4</td>
<td>Individual</td>
<td>Alternative 3, this is my favorite. Remove all spoils, tailing, and waste rock, from the site via a new rail line constructed to the mine sites. This so called waste material could then be utilized as a resource, a positive resource offsite in other industrial processes, including but not limited to crushed rock for construction use, construction landfill, road met construction, similar industrial uses, some may be even requiring radioactivity material. This alternative can clearly promote conservation through minimizing waste materials, while the rail transportation would avoid the significant public safety impacts resulting from the proposed truck traffic on highway 82.</td>
</tr>
<tr>
<td>6842</td>
<td>1</td>
<td>Individual</td>
<td>Water is the most important issue in this entire process. Our water is our life. Without water -- it's more important than copper. And we need to protect the groundwater that is now being depleted at one inch a week. 48 -- four feet a year, approximately one inch a week the water table is lowering in the Tucson Active Management Area. That is required for sustaining life. Copper is not required for sustaining life. Therefore, a business should be able to set up a plan to buy -- plan to put in the pipes to import CAP water because mines, it doesn't matter whether it's CAP water or groundwater to operate the mine. So the water could be procured by the company to operate the mine, and, therefore, that alternative should be one considered by the Forest Service that I'm now recommending to be looked at seriously because it does seem to be extremely reasonable.</td>
</tr>
<tr>
<td>6842</td>
<td>2</td>
<td>Individual</td>
<td>The second alternative involved Section 2.7 of their plan which discusses the electrical supply for the mine. It states that adequate electricity is not available. The preferred TEP approach calls for turbines to be running in Nogales so that Rosemont Copper can operate its mine. I don't want to go through the electrical problems to get power in Santa Cruz County, because I've been working on that for the last nine years, but that is another alternative. And my alternative would be to put in a natural gas line to the mine from I-10 and then put in trailers which could hold the power plant. They have their own power plan operating the mine, and when it's over in 19 years, the trucks drive away and the power plant disappears. 95 percent of the power they buy from TEP comes from coal-fired power and, therefore, the CO2 and other options need to be considered, and it's clearer if you use natural gas.</td>
</tr>
<tr>
<td>6863</td>
<td>2</td>
<td>Individual</td>
<td>A pricing model that would be considered probably beneficial to them would be something that did underground mining with reusing the tailings back in the mine to keep it from collapsing like the West Virginia mine did. Something different would go along with the fact that, in their study, they only used $1.50 copper, which I gather now copper's worth three, four dollars. That would benefit us all by they would get their minerals when they wanted them and they would protect our visual impact on the Sonoita Highway. They would probably reduce everything else that's going on it. Without that kind of consideration, I would have to say no-action would be my favorite.</td>
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<td>Record ID</td>
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<tr>
<td>6885</td>
<td>1</td>
<td>Individual</td>
<td>Instead of storing cap water and using groundwater, I think a better alternative would be to pump the CAP water directly to the east side of the Santa Rita's into a man made lake. Rosemont can then pump directly from the lake for their processes. The lake can also be used for public recreation and wildlife water source. As as added benefit it may help prevent the groundwater levels from lowering north of the mine. It would also eliminate concerns from over pumping in Sahuarita and the planned use of community water storage areas. I propose a study be completed with this option as the primary source for the Rosemont Mine water source. It seems like a good alternative to pumping groundwater directly from a few close wells in Sahuarita, and would benefit the mine and the public.</td>
</tr>
<tr>
<td>6975</td>
<td>11</td>
<td>Individual</td>
<td>PROPOSAL : SATELLITE OPERATION The shut down Twin Buttes Mine could make an EXCELLENT choice of a satellite milling / processing facilities with the ore and over burden transported to the Twin Buttes site. Via covered conveyor belt. THIS PLAN WAS UNDER SERIOUS CONSIDERATION BY ANACONDA FOR THIS VERY PROPERTY, USING THE TWIN BUTTES FACILITIES AND THEN PRICE OF COPPER FELL! SOUND FAMILIAR?? This would mitigate damage done to US FOREST SERVICE PROPERTY THAT AUGUSTA WANTS TO TURN INTO TAILINGS AND WASTE DISPOSAL SITE. I WOULD REQUEST THAT YOU CONSIDER EACH PROPOSAL AND ANSWER THE SPECIFIC PROPOSALS. Please contact me if I could be of any assistance and I would make my well available to assist in monitoring.</td>
</tr>
</tbody>
</table>
3. The "alternatives" analysis, specifically the "no action" alternative, which is one of the keystones of the NEPA process, must be thoroughly explored. Alternatives are "the heart of the environmental impact statement." 40 C.F.R. ss1502.14. We want to reiterate that nothing in and no interpretation of the Mining Law of 1872 excuses the Forest Service from robustly evaluating a range of reasonable alternatives. Indeed, as the Court of Appeals for the Ninth Circuit has stated:

NEPA requires that the federal agencies include a detailed statement of "alternatives to the proposed action" in any recommendation or report on actions significantly affecting the quality of human environment. 42 U.S.C. ss 4332(2)(C)(iii). Additionally, the statute mandates that the agencies "study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources." Id. Ss 4332(2)(E). The "alternatives" section is "the heart of the environmental impact statement." 40 C.F.R. ss 1502.14. "The consideration of alternatives requirement… guarantee[s] that agency decisionmakers have before them and take into proper account all possible approaches to a particular project (including total abandonment of the project) which would alter the environmental impact and the cost benefit balance." Bob Marshall Alliance, 852 F.2d at 1228 (internal quotation marks, punctuation, and citation omitted) (emphasis in original). Pit River Tribe v. United States Forest Service, 469 F.3d 768 (9th Cir. 2006).

Such alternatives should include both site alternatives and technological alternatives. For example, Rosemont Copper Company had proposed using a dry tailings method that has never been used in the United States. Particularly given that this would be a first time use in the United States and in this climate, the DEIS should analyze other alternatives to that technology, along with their probable environmental effects, including the additional water alternative technologies would require.

We ask the Forest Service to ensure a comprehensive analysis of the "no action" alternative; the one automatically required alternative in all environmental impact statements. 40 C.F.R. ss1502.14(d). Agencies, at times, tend to give short shrift to the actual analysis on the "no action" alternative, to the detriment of both their own decisionmaking and the public's understanding of the potential impacts of the proposed action. See, for example, inadequate treatment of the "no action" alternative in NEPA documents prepared by the Forest Service in Pit River Tribe v. United States Forest Service, Id., and City of Tenaklee Springs v. Clough, 915 F.2d 1223 (9th Cir. 1990) The analysis in the DEIS should comprehensively evaluate the future of the affected geographic area in light of such plans as the detailed and comprehensive Sonoran Desert Conservation Plan adopted by Pima County, Pima and Santa Cruz County economic projections and other local, state, tribal and federal planning processes that affect the area. This evaluation must be compared to equally detailed analyses of the same areas should the proposed mine be approved and commence operations.

We also remind the Forest Service that it has an obligation to analyze reasonable alternatives that might, in whole or in part, lay outside of the agency's own authority.
### Alternatives

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<tr>
<td>01</td>
<td>General</td>
<td>&quot;An agency's refusal to consider an alternative that would require some action beyond that of its Congressional authorization is counter to NEPA's intent to provide options for both agencies and Congress.&quot; National Wildlife Federation v. National Marine Fisheries Service, 325 F. Supp. 2d, 1143 (W.D. Wa. 2002).</td>
<td></td>
</tr>
<tr>
<td>7151</td>
<td>27 Organization</td>
<td>Lining all mine facilities, including waste rock piles and berms, should be included as an alternative in the EIS.</td>
<td></td>
</tr>
<tr>
<td>7151</td>
<td>31 Organization</td>
<td>The alternatives in the EIS must include complete or partial back-filling of the open pit. The EIS should determine how much additional expense it would be to backfill the pit: How much additional time would be required in the overall life of the mine to include complete or partial backfilling? How would backfilling of the pit help protect or harm water quality in the watershed? How deep would this reduce the likelihood of aquifer contamination post-mining?</td>
<td></td>
</tr>
<tr>
<td>7184</td>
<td>11 Individual</td>
<td>Insulate the bottom of the tailings heap and dam in Barrel Canyon with an impermeable liner. Run perforated piping above the liner and below the tailings at each layer of limestone so that any and all run-off from the heap can be captured and disposed of properly. This would be a responsible and innovative approach to mitigating the majority of pollution problems associated with hard-rock mining. It would also be an exact method for measuring of and recording time tables for the speed of leaching and ypes of pollutants generated over the next 100 years or more. Rosemont would have to be responsible for monitoring the site and disposing of contaminants for that period of time.</td>
<td></td>
</tr>
<tr>
<td>7200</td>
<td>2 Organization</td>
<td>The EIS must identify and evaluate all reasonable alternatives to the Rosemont Project. Development of alternatives for the proposed action is the heart of the EIS. 40 C.F.R. SS 1502.14. Council on Environmental Quality (CEQ) regulations call on the Forest Service to &quot;[r]igorously explore and objectively evaluate all reasonable alternatives, and for alternatives which were eliminated from detailed study, briefly discuss the reasons for their having been eliminated,&quot; &quot;[d]evote substantial treatment to each alternative considered in detail including the proposed action so that reviewers may evaluate their comparative merits,&quot; &quot;[i]nclude the alternative of no action,&quot; and &quot;[i]nclude appropriate mitigation measures not already included in the proposed action or alternatives.&quot; Id. SS 1502.14 (emphasis added). For the Rosemont Copper Project EIS, the Forest Service must include the no-action alternative in their discussion and evaluation of reasonable alternatives. Considering the vast environmental impacts that are likely to occur should it move forward, the Sierra Club firmly believes this is the only appropriate alternative for this project. However, should the Forest Service reject this alternative, they must include a justification for the rejection as well as a discussion of mitigation measures that will adequately offset the impacts of the proposed action.</td>
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<tr>
<td>7277</td>
<td>2</td>
<td>Government</td>
<td>The Department believes that presentation of alternatives analyzed in the Environmental Impact Statement should include a description of water use by all elements of each alternative, including ancillary facilities, and should include best water conservation strategies for the technology used, by alternative. Analysis of alternatives should include direct, indirect, and cumulative effects to water supplies and rights to water.</td>
</tr>
<tr>
<td>7429</td>
<td>6</td>
<td>Individual</td>
<td>Extrapolating from the information in the Mine Plan of Operations, a truck would be entering or leaving the highway at the access road about every three minutes around the clock. Many of these would be very heavy trucks. Furthermore, this does not include employees entering or leaving the plant during shift change. (Note that “trip” as counted in the Plan is a round trip, in other words a truck entering and a truck leaving.) The plan also states that traffic would be staggered to reduce the numbers in the early morning and when school buses are operating, meaning that it would be even heavier at other times. The highway would become virtually unusable for regular traffic at certain times. Over half of these trucks (65%) will be tractor trailers taking copper concentrates to the railhead at Benson for shipment to a smelter. Because of the quantity of weight of concentrates, the usual means of transportation from Arizona mines is by rail. Most copper mines in Arizona have constructed rail spurs for this purpose. Arizona smelters are designed to accept concentrates delivered by rail. The plan to transport concentrates by truck is both unusual and unnecessary, as well as being expensive.</td>
</tr>
<tr>
<td>7429</td>
<td>9</td>
<td>Individual</td>
<td>Augusta must be required to review other possibilities, such construction of a rail spur, as other mines have done, or an alternative roadway to I-10, or both. A rail spur would be an economical and safe way or bringing many other bulk materials (fuel, acid and explosives) to the site as well as transporting both copper and moly concentrates to smelters.</td>
</tr>
</tbody>
</table>
Given the problems arising from transportation of concentrates, Augusta must be required to evaluate new methods of processing concentrates from sulfide ores. Specifically, Augusta must be required to consider use of on site high pressure/high temperature leaching of copper concentrates. This process is a new method of extracting copper from sulfide ores. It offers a low cost alternative to conventional smelting and refining. It is currently being used on a commercial scale at several locations around the world and in Arizona at the Morenci Mine and at the Bagdad Mine, both owned by Freeport-McMoRan.

The process in use at Freeport’s mines was refined and tested over a four year period at the Bagdad Mine before construction of the commercial scale plant at Morenci. Traditionally, copper concentrates from copper sulfide ores have been processed at smelters and refineries. The concentrate pressure leach process bypasses both of these steps and parallels the oxide process, producing cathode copper on site.

In pressure leaching of sulfide ores, the ore is milled and processed on site to produce concentrates in the same way it would if it were to be sent to the smelter. Instead of being sent to a smelter and refinery, the concentrate is mixed into a slurry and processed at high pressure and temperature in a leach vessel. This produces copper bearing solution that can be combined with the solution from the oxide circuit and sent to the SX/EW facility.

The pressure leaching step also produces sulfuric acid, which can be used in the oxide heap leach circuit, reducing or eliminating the need to purchase and transport acid to the site. The entire process takes place on site.

This new process appears well suited to a greenfield operation, particularly one with no convenient access to a smelter and refinery.

An internet search reveals additional information on this new technology.

The advantages of this system for the operator are:
Cost savings by eliminating the fees paid to a smelter and then to a refinery for processing and for the purchase of sulfuric acid for oxide ore processing, also purchased from a smelter. This seems particularly relevant for a company that does not own a smelter or refinery.

Cost savings from transportation of concentrates to smelter and transportation of acid from smelter to mine site.

Acid production can be managed to match consumption in the heap leach by control of temperature in the leach vessel.

Full use of SX and EW capacity through management of parallel systems. And increased ability to manage production levels.

Environmental Impacts:
A primary impact would be reduction of traffic. Trucking the concentrates accounts for about 65% of all traffic. Importing acid account for an additional 10%. A
### Alternatives

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<tr>
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<tbody>
<tr>
<td>7430</td>
<td>2</td>
<td>Organization</td>
<td>Some suggested steps to mitigate the potential harm from light pollution from the mine's all night operation include: 1. Use fully shielded or full cutoff lighting fixtures, aimed directly downward. 2. For all road, dirt road, and parking lot lighting, both inside and outside the pit, use 55 watt induction lamps with motion sensor controls to reduce energy consumption and light pollution at the same time. 3. Exterior lighting on any buildings or trailers should be fully shielded and limited to egress lighting, using the lowest level of light sufficient for the purpose.</td>
</tr>
<tr>
<td>7562</td>
<td>8</td>
<td>Individual</td>
<td>An underground mine could be used as an alternative to extract the copper bearing ore. To reduce the impact of the tailings the underground mine could start with the primary shaft at the maximum surveyed depth of the ore deposit. The initial extraction (mining) would begin at the maximum depth and then work upwards to the top of the copper bearing ore. The project would be continuously refilling after the extraction of the ore from the bottom up with excess material and waste. Rosemont Project representatives have indicated that a new mechanical process was going to be used to reduce the tailings debris to a moisture content of 15%. The reuse of the damp tailings should stop or reduce any in-hole dust and conceivably provide a good material for compaction to be used for the rising floor for the ever elevating mining process. The need for pumping invasive ground water out of the underground mine would lessen as the mine developed and work progress onto higher portions of the ore which would be the reverse of an open pit mine. An underground mine that utilized the tailings as part of the ongoing process would alleviate some of the concerns for major unsightliness, excessive overburden striping, a pit catching storm and ground water with the associated pumping and subsequent discharge. The on going concern with all large projects is the set aside for final cleanup and remediation as required. The underground mining alternative suggested above would greatly remove some of the concerns since most of the remediation is concurrent with the continuing extraction.</td>
</tr>
<tr>
<td>7649</td>
<td>1</td>
<td>Individual</td>
<td>What are the options, Alternative to this site? Why not: Ajo, Kingman, Ruby, San Manuel, Bisbee</td>
</tr>
<tr>
<td>7650</td>
<td>1</td>
<td>Individual</td>
<td>ALTERNATIVE 1 - Only Use CAP Water Resources.</td>
</tr>
<tr>
<td>7650</td>
<td>3</td>
<td>Individual</td>
<td>Alternative 1 uses water resources only from the Central Arizona Project (CAP). Ground water is neither required for mining nor for Rosemont Copper.</td>
</tr>
<tr>
<td>Record ID</td>
<td>Comment Number</td>
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<tr>
<td>7650</td>
<td>6</td>
<td>Individual</td>
<td>The Forest Service analysis must show which Alternative, the only CAP-water or the proposed and deficient water resource plan; best mitigates all direct and cumulative indirect and cumulative indirect water withdrawal impacts on ground water. This &quot;CAP water only&quot; Alternative needs to be fully evaluated so all decision makers have real options to consider before making their Record of Decision in this matter.</td>
</tr>
<tr>
<td>7650</td>
<td>7</td>
<td>Individual</td>
<td>ALTERNATIVE 2 - A New Electrical Plan.</td>
</tr>
<tr>
<td>7650</td>
<td>10</td>
<td>Individual</td>
<td>This ALTERNATIVE uses natural gas from an El Paso Gasline parallel to I-10 to fuel air-cooled gas turbines at the mine to also eliminate transmission losses from distant power plants. This is a reasonable ALTERNATIVE to provide power for Rosemont Copper with less air and water pollution by an underground gasline instead of transmission along Scenic Highway SR 83 or across Green Valley.</td>
</tr>
<tr>
<td>7650</td>
<td>23</td>
<td>Individual</td>
<td>Under ALTERNATIVE 1, Rosemont would be required to obtain allocations and permits, develop and build pipeline, and pump CAP water directly to the mine so that TAMA ground water will NOT be significantly impacted. Under ALTERNATIVE 1, less direct and cumulative indirect electricity will used as ground water is not be pumped out of the ground and CAP water is pumped into the ground for recharge. Many MW-hrs of 24/7 electrical power will be saved. Under ALTERNATIVE 1, subsidence and ground water impacts due to Rosemont Copper operations are avoided. There will be no impacts on local wells in the vicinity of Sahuarita, other than local wells closer to the mine where the mine pit will lower the water table by its large and half-mile deep cone of depression. Under ALTERNATIVE 2, the resultant electrical load will be decreased based on using ALTERNATIVE 1 for direct delivery of CAP water, thus reducing the overall cumulative negative impacts by using CAP water only. There are presently inadequate electrical resources in Pima and Cochise Counties to meet the continuous electrical demands of Rosemont Copper. To meet Rosemont Copper's electrical demand, ALTERNATIVE 2, uses local generated power dedicated to this mine to relieve other in Pima County demand. Constructing a natural gasline from the I-10 El Paso Natural Gasline corridor directly to Rosemont, under ALTERNATIVE 2, avoids new transmission lines, has a smaller carbon imprint, and pollutes less air to generate the mine's electricity. Less visual impacts result with no impacts on Scenic Highway SR 83. Natural gas turbines are small, fairly inexpensive, and can be mobile, so Rosemont Copper can remove its power plant after it closes. When assessing ALTERNATIVES 1 and 2, the synergistic effect needs to be considered as both are better together; however, each can be standalone.</td>
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</tr>
<tr>
<td>7650</td>
<td>24</td>
<td>Individual</td>
<td>Rosemont Copper proposes a &quot;system&quot; of an infrastructure, buildings, earth transportation, processing buildings, and other component elements. The most important interfaces to this system are water and electricity; otherwise, most operations are within the Rosemont Copper system. Every interface requires careful analysis, as each impacts all other elements withing. These two Alternatives provide a way for isolation of each (water and electricity) so that a sensitivity analysis for each ALTERNATIVE (and other impacts) can be performed. The Operations Research process provides ways with linear algebra, models and validated operations research tools to make accurate assessments of interacting elements, including transportation elements within and external to the system boundaries. Such analysis requires OR specialists, usually mathematicians experienced in this field of analysis. Allocation of measurable objective resources for each element determined by such analysis is commonly performed in the mining industry using standard Operations Research processes and computer models. This usual Systems Engineering task makes a series of objective trade and sensitivity studies, also called cost/benefit, trade-off, optimization or objective assessments.</td>
</tr>
<tr>
<td>8607</td>
<td>2</td>
<td>Individual</td>
<td>There is a passable road from Rosemont through the Santa Ritas to a railroad spur at Sahuarita.</td>
</tr>
<tr>
<td>8884</td>
<td>1</td>
<td>Individual</td>
<td>I would like the review committee to consider instead of doing an open pit mine at the proposed Rosemont project, to do a deep underground copper mine, similar, a, to what the Resolution Copper Mining Company is doing in Superior, Arizona, so that we could eliminate tailings and, um, then we could maybe fill -- use some of the other materials to fill other open pits, as they propose to do. Anyway, if you would please consider that as an alternative, um and give us pros and cons of that, I would really appreciate it.</td>
</tr>
<tr>
<td>11047</td>
<td>23</td>
<td>Individual</td>
<td>I propose a dome which can be opened and closed and used in conjunction with solar still desalination distilling to produce more fresh water. This should prevent more flying animal deaths as well as saving on ground water pumping. It will also save on electricity for water production as the water would be produced on site for the employees to drink and shower in and gravity feed could be used from the tanks.</td>
</tr>
<tr>
<td>11082</td>
<td>13</td>
<td>Individual</td>
<td>I think a fish habitat would be nice for reclamation. How about a nice lake that is safe in the pit for boating, fishing and so forth? I have no idea what the reclamation would be to make that happen safely though, but it would be nice to have a lake and recreation such as the Catalinas have. If the safe thing doesn't work out, I like the idea of a Solar Farm because no one would see it and the land would have already been raped so why not use it for some good?</td>
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CLIMATE CHANGE
### Climate Change

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<td>2760</td>
<td>75</td>
<td>Government</td>
<td>EPA recommends that the EIS identify the cumulative contributions to greenhouse gas emissions that will result from implementation of the project. In addition, we recommend the EIS discuss the potential impacts of climate change on the project. The EIS should also identify any specific mitigation measures needed to 1) protect the project from the effects of climate change (e.g., changes to storm magnitude or frequency), 2) reduce the project's adverse air quality effects, and/or 3) promote pollution prevention and environmental stewardship. Any sustainable design and operation measures that can be identified as reducing greenhouse gases should be identified in the EIS with an estimate of the greenhouse gas emissions reductions that would result if measures were implemented.</td>
</tr>
<tr>
<td>7812</td>
<td>20</td>
<td>Individual</td>
<td>On May 27, 2008, the US Climate Change Science Program (CCSP) released a major report on the effects of climate change. According to the USDA News Release of the same date, &quot;USDA is the lead agency for this report and coordinated it production as part of its commitment to CCSP.&quot; The report -- &quot;Synthesis and Assessment Product 4.3: The Effects of Climate Change on Agriculture, Land Resources, Water Resources, and Biodiversity in the United States&quot; -- integrates the research efforts of 13 federal agencies. According to Agriculture chief Economist Joe Glauber, the purpose of the report is to provide information to assist land owners and resource managers in making better decisions to address the risks of climate change. The report concludes that climate change is already affecting water resources, agriculture, land resources and biodiversity; all topics integral to the proposed Rosemont Copper Project. As such, the cumulative effects of climate change should also be incorporated into the Draft EIS on the proposed project.</td>
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### General

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<tr>
<td>33</td>
<td>6</td>
<td>Individual</td>
<td>The ecological degradation from this project will spread far and wide and persist for centuries if not millennia. As an atmospheric scientist and ecologist who has been tracking climate change for almost 3 decades, I know that a crucial underpinning to climate stability on a local, regional, and global scale is ecosystem health, integrity, and connectivity. In the interests of both surviving and mitigating anthropogenic climate change, there is absolutely no sane reason to be punching any more holes in the few remaining viable ecosystems left in this country.</td>
</tr>
<tr>
<td>1886</td>
<td>3</td>
<td>Individual</td>
<td>We are going into a long term drought. This drought will be made worse by climate changes due to global warming. Thwy have done numerous computer simulations on the most advanced super computers and have come up with the same climate projection for the arid southwest. The climate here will get a lot hotter and drier. The snow pack that supplies the Colorado River will dwindle, Rain toll will decline. This will result in a sharp decline in the Colorado River that supplies the Southwest with most of its water.</td>
</tr>
<tr>
<td>2271</td>
<td>4</td>
<td>Individual</td>
<td>The issue of Global Warming is becoming a great concern. Which would be better for Global Warming? A copper mine or the current forest?</td>
</tr>
<tr>
<td>2339</td>
<td>10</td>
<td>Individual</td>
<td>How much will the overall operation of this mine- the drilling, processing, lighting, traffic, fuels used -- increase green house gases?</td>
</tr>
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</table>
| 2593      | 57             | Organization   | - What is the carbon footprint of this mine projected to be?  
- What are the greenhouse gas emissions expected to be annually and over the life of the mine?  
- What are the major sources of greenhouse gas emissions associate with the mine expected to be including all mine facilities as well as vehicles at the mine and traveling to and from the mine?                                                                                                                                                                                                                   |
| 2599      | 22             | Individual     | According to the Sonoran Institute economic impact study previously mentioned, operation of the Rosemont Mine will require a staggering amount of electricity---enough to power 68,000 average households. The Rosemont MPO suggests that this power be supplied by TEP, which generates most of its electricity by burning coal. The resulting additional carbon dioxide burden to earth's atmosphere caused by this power demand, along with the burning of 9 million gallons of diesel fuel annually and other carbon dioxide producing activities, is estimated at 2.16 billion pounds per year. As the U.S. and other major greenhouse gas producers continue to fail to address this nascent worldwide calamity, the cumulative effect of Rosemont's carbon footprint, already predicted to account for 1% of total greenhouse gas emissions for the entire state of Arizona, will increase. |
| 2639      | 1              | Individual     | How will climate change in next 100 years impact this venture?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2646      | 9              | Individual     | Bad planning for the health of our temperatures                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 2647      | 10             | Individual     | Especially with the horrors of global warming we do not need to add more poison to the mix.                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| 2676      | 29             | Business       | If this mine is okayed, it sends an inescapable visual message to our children that we are not particularly interested in global warming, or the welfare of the planetary and human ecology                                                                                                                                                                                                                                                                                                                                                             |
| 2676      | 32             | Business       | Weand quality of life to degrade, let alone the global warming.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 2713      | 18             | Organization   | The EIS for the proposed Rosemont Copper Mine must consider both the immediate and cumulative impacts fo the proposed action, as required by the National Environmental Policy Act. Specifically, the following types of resources analyses must be included:  
An analysis of historic fire regimes in the project area and an analysis fo how the proposed activites may affect current fire regimes, in the context of predicted climatoloical changes.                                                                                                                                                                                                                                 |
<p>| 2727      | 3              | Individual     | Tucson is in a seemingly perpetual state of drought at a time of global warming which almost certainly will lead to more drought.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 2738      | 4              | Individual     | Tucson is in a seemingly perpetual state of drought at a time of global warming which almost certainly will lead to more drought.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 6873      | 8              | Organization   | And, lastly, as was just highlighted, how will prolonged drought and climate change factor into this water equation?                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 6874      | 2              | Individual     | Has consideration been given to the mining design for the climate changes?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 6939      | 10             | Individual     | Please also consider not just projections of current climate but also possible water supply scenarios as a result of global climate change.                                                                                                                                                                                                                                                                                                                                                                                                                  |</p>
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<tbody>
<tr>
<td>6962</td>
<td>8</td>
<td>Individual</td>
<td>5. Will the removal of all that vegetation and the excavation activity cause the area to undergo a temperature or micro climate change?</td>
</tr>
<tr>
<td>7021</td>
<td>4</td>
<td>Individual</td>
<td>Decades of reports about damages to the environment affecting our weather in general make me wonder why this project could have even been proposed.</td>
</tr>
<tr>
<td>7110</td>
<td>20</td>
<td>Individual</td>
<td>Carbon Foot Print: Doesn't this need to be considered with all the talk of &quot;Global Warming&quot; and &quot;Carbon Credits&quot;? Lots of kilowatts are needed at Rosemont, plus nine million gallons of diesel fuel each year - what about that carbon footprint?</td>
</tr>
<tr>
<td>7134</td>
<td>51</td>
<td>Business</td>
<td>14. Consistent with the trends in the courts and with other federal agencies' NEPA evaluations, the Forest Service must fully evaluate the Mine Project's effect on the &quot;affected environment&quot; in the context of climate change and greenhouse gases used. A recent petition to the President's Council on Environmental Quality (&quot;CEQ&quot;) has requested specific amendment to the CEQ regulations regarding the NEPA process to include evaluation of the proposed federal decision's impact on climate change and greenhouse gases, as well as how such impacts translate to the &quot;affected environment.&quot; This petition reflects a growing trend of court decisions to recognize the validity of this concern in the context of NEPA evaluations by federal agencies. Indeed, the California Environmental Quality Act, a state-level NEPA, has been read to require such evaluations. The Mine Project is likely to have measureable impacts on climate-change concerns because of, among other activities, the significant increase in greenhouse gases emissions in the area by reason of operation of mining equipment and transportation equipment. Further, the ultimate use of the mined copper in industrial processes and new GHG-emitting equipment, particularly in China (already a significant contributor to adverse climate change effects), which reports indicate will be primary market for copper taken from the Rosemont mine, must be assessed.</td>
</tr>
<tr>
<td>7143</td>
<td>15</td>
<td>Organization</td>
<td>The projected mining time frame of 20 years and amount of water usage proposed by Rosemont is unrealistic, since other local mines have been operating over 55 years and have stated plans to continue, due to increasing prices for copper. Therefore all the impacts of the mine, beginning with water usage, have been vastly underestimated. Air quality impacts resulting in health costs and issues are another prime example of underestimated impacts. Also, climate changes will be much more severe if the mine operates 75 or 100 years instead of the claimed 20 years.</td>
</tr>
<tr>
<td>7163</td>
<td>46</td>
<td>Organization</td>
<td>Climate change Questions to be answered in the EIS: Given the significant projected greenhouse emissions over the course of the mine's expected lifetime, how will such emissions contribute to climate change globally, nationally and regionally? How will these climactic changes impact the Coronado National Forest and its ability to manage these lands in public trust? How will greenhouse gas-induced global warming, accelerated by novel fossil-fuel intensive projects such as this, impact the National Forest and surrounding communities?</td>
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### Climate Change

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<tbody>
<tr>
<td>7211</td>
<td>2</td>
<td>Individual</td>
<td>Projections involving climate change predict that this region will become even more arid than it already is - and historical/prehistorical records show that the region has been already undergoing a very long desertification process. Snowpack that feeds the Colorado River is projected to decrease significantly - meaning that the CAP will be impacted.</td>
</tr>
<tr>
<td>7212</td>
<td>2</td>
<td>Individual</td>
<td>Projections involving climate change predict that this region will become even more arid than it already is - and historical/prehistorical records show that the region has been already undergoing a very long desertification process. Snowpack that feeds the Colorado River is projected to decrease significantly - meaning that the CAP will be impacted.</td>
</tr>
</tbody>
</table>
| 7253      | 57             | Organization   | - What is the carbon footprint of this mine projected to be?  
- What are the greenhouse gas emissions expected to be annually and over the life of the mine?  
- What are the major sources of greenhouse gas emissions associate with the mine expected to be including all mine facilities as well as vehicles at the mine and traveling to and from the mine? |
| 7336      | 32             | Individual     | Environment- The Rosemont Mine's proposed plan will completely destroy over 4,000 acres of land. Identify all flora and fauna that live here full time, part-time, and migrate through this wild corridor connecting Northern Mexico to the Rincon's, the Catalina's, and central Arizona... Specifically look at the risk to Tarahumara frogs, recently reintroduced in the Santa Rita's. Copper mine runoff is considered to be the most likely reason for their extirpation from Arizona in 1983, according to the Fish and Wildlife website. How many other threatened or endangered species exist here? How thorough can a handful of wildlife surveys be? How will all of the animal and plant species be affected by crushing, burying, heavy machinery, construction, chemical storage and ore processing facilities, blasting, lights, noise, dust, traffic, exposed contaminated surface water, rock and soil, exhaust, fumes, etc.? How will you determine if this level of destruction is acceptable? What happens if nothing grows in the waste pile and it becomes a permanent barren wasteland? Erosion and the downstream spread of toxins long buried, forgotten, and cashed out on, could be unleashed in the distant future? Are there seismic risks? How do climate change and Arizona's drought play into the proposal? A best case, average, and worst case scenario should be independently developed and published. |
| 7504      | 44             | 7508           | The Forest Service should also consider how the mine would get sufficient electrical power to it, and the cumulative impacts of 1) projected population and infrastructure growth; 2) power line siting and transmission lines; 3) the inability of Tucson Electric Power to provide Tucson area with sufficient power for its current and future needs; and 4) additional electrical power generation and the added impacts and effects on air pollution and global warming. |
| 7504      | 56             | 7508           | The proposed "recycling" of water by Rosemont must be examined and projected along with calculations of the potential for higher temperatures and drought projected by the effects of global warming on the desert Southwest. |
| 7609      | 1              | Individual     | In terms of global warming issues - Mining does not have a good record. In addition, mining practices scar the lands forever, ruin entire ecosystems and only benefit the investors for very short period of time. When they are done, the damage is irreparable and the effects to the local economies are devastating. |
### Climate Change

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<tbody>
<tr>
<td>8867</td>
<td>4</td>
<td>Individual</td>
<td>And my next opposition is in regards to the whole issue of global warming and the temperature changes that have occurred in the Green Valley area since we moved here 15 years ago, and the more the landscape that is destroyed, the warmer from our temperatures become and the less pleasant it becomes because of the atmospheric changes caused by the decrease in the natural vegetation.</td>
</tr>
<tr>
<td>8869</td>
<td>5</td>
<td>Individual</td>
<td>I don't think that the greenhouse gas emissions of the project have been considered enough. Recently in New Mexico, the BLM was sued by a western ecological law corporation in -- because they did not consider the effects of the drilling and oil projects that they leased to. So -- and they won, the eco law did.</td>
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CULTURAL RESOURCES
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<tr>
<td>2593</td>
<td>40</td>
<td>Organization</td>
<td>The cumulative impacts of the mine proposal must also be addressed. This would include impacts to the archaeological resources on and in the vicinity of the project as well as impacts to nearby communities.</td>
</tr>
<tr>
<td>7253</td>
<td>40</td>
<td>Organization</td>
<td>The cumulative impacts of the mine proposal must also be addressed. This would include impacts to the archaeological resources on and in the vicinity of the project as well as impacts to nearby communities.</td>
</tr>
<tr>
<td>7812</td>
<td>17</td>
<td>Individual</td>
<td>Increased degradation and loss of cultural resources;</td>
</tr>
</tbody>
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**Cultural Resources**

99  Cumulative Impact

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<td>81</td>
<td>Individual</td>
<td>COMMENT 7: MANY HISTORIC AND CULTURAL RESOURCE SITES HAVE BEEN IDENTIFIED WITHIN AND NEARBY THE MINE'S PROPOSED PERIMETER IN PREVIOUS ARCHAEOLOGICAL SURVEYS. MOST MAPPED SITE LOCATIONS ARE SUSPECT AND MUST BE INDEPENDENTLY RELOCATED USING GPS OR GIS TECHNOLOGIES, RE-DOCUMENTED, AND RE-EXAMINED BY PERTINENT TRIBAL AND OTHER AUTHORITIES. Coronado National Forest Land and Resource Management Plan states the following: &quot;Arizona and New Mexico have a wealth of historic and prehistoric cultural resources. Although all such resources are currently protected from disturbance by law, many people advocate a more aggressive approach to management of cultural values. The issue is: 1. The amount of time and investment to interpretation of cultural sites.&quot; In the 1970's and 1980's, the Arizona State Museum conducted an archaeological survey, testing, and data recovery in a large area around Rosemont and identified over 130 historic and cultural resource sites within and nearby the Mine's proposed perimeter. Because of occupation by the O'odham people and their ancestors, and because of current tribal use for plant gathering, there may also be sites important to Native Americans in the project area. Coronado National Forest Archaeologist Mary Farrell has concluded that the majority of the sites located in the Arizona State Museum survey were mapped prior to the availability of GPS technology and are, therefore, suspect. Mitigation: The proposed Mine site must be independently re-surveyed using current GPS or GIS technologies, re-documented, and examined by the Advisory Council on Historic Preservation, and pertinent tribal and other authorities. Sites of cultural and religious significance can be eligible for the National Register of Historic Places, even if there are no physical remains that would qualify as an archaeological site. Each historical or cultural site identified must receive the maximum protection permitted under the National Historical Preservation Act, the Native American Graves Protection and Repatriation Act, and other applicable laws even if doing so will require Augusta to modify its planned land use within or nearby the Mine's perimeter.</td>
</tr>
<tr>
<td>1641</td>
<td>6</td>
<td>Individual</td>
<td>The proposed Rosemont Copper mine will not only disturb archeological and historic sites</td>
</tr>
<tr>
<td>Record ID</td>
<td>Comment Number</td>
<td>Commenter Type</td>
<td>Comment Text</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>----------------</td>
<td>------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1664</td>
<td>1</td>
<td>Individual</td>
<td>I am very interested in the historic nature of the Sonoita Valley. I am a third generation local who has tales of the cowboys taking from the Indians, homesteaders taking from the cowboys (ranchers), small mining, movie sets, and much more. We have historic houses and historic neighborhoods, why not a historic valley that represents a great portion of what the American west is or has been through out history - a living history book of what represents the greatness of the American West. Don't put a blotch on the visual image of a great part of history.</td>
</tr>
<tr>
<td>1684</td>
<td>8</td>
<td>Individual</td>
<td>In the past nearly 50 archeological surveys have been performed on or near the area of interest. The adequacy of the past work will be checked and a Class III (100%) cultural resource survey will be conducted. The State Historic Preservation Office (SHPO) and interested tribal entities will be consulted during the proposed studies and the requirements of the National Environmental Policy Act (NEPA) will be met.</td>
</tr>
<tr>
<td>1790</td>
<td>2</td>
<td>Individual</td>
<td>In addition to the numerous economic benefits of mining, new jobs, in flux of money in local economy, taxes, etc. We also have a strong heritage of mining in the southwest that must continue.</td>
</tr>
<tr>
<td>1817</td>
<td>2</td>
<td>Individual</td>
<td>When Cochise would finish a raid on the Tubac Mines or Tumacacuri, he would lead his band over Lopel or Gunsite Pass toward the whetstones the proposed mine would deface, if not destroy, a rich cultural heritage.</td>
</tr>
<tr>
<td>1836</td>
<td>4</td>
<td>Individual</td>
<td>We are land owners, pay our taxes, and this will take away our history.</td>
</tr>
<tr>
<td>1885</td>
<td>3</td>
<td>Individual</td>
<td>As a granddaughter of a homesteader in Sonoita I believe it would be a crime to destroy the very thing the area is known + appreciated for (illegible).</td>
</tr>
<tr>
<td>1889</td>
<td>3</td>
<td>Individual</td>
<td>If a copper mine were to be open not only would it negatively affect wildlife in the area but it would destroy a part of America's natural heritage.</td>
</tr>
<tr>
<td>1957</td>
<td>5</td>
<td>Individual</td>
<td>I'm sure I need not remind you that area where this huge open pit mine is constructed is the very site where some of this country's first Westerns were filmed.</td>
</tr>
<tr>
<td>2079</td>
<td>4</td>
<td>Individual</td>
<td>There is also a real possibility of archeological interest and finds in that area since the Indians once lived there.</td>
</tr>
<tr>
<td>2194</td>
<td>1</td>
<td>Individual</td>
<td>Please observe your USDA Forest Service Proceedings RMRS-P-30.2003 (attached). This article details historical sites in the Santa Rita Mountains and the valley of the Santa Cruz. The author describes the history of Southern Arizona and site found so far; the potential for buried archaeological sites is stated as &quot;certain&quot;. It would seem to me that an open pit mine is certain to forever lose the history of Southern Arizona and its people. Several sites on the Rosemont property are mentioned.</td>
</tr>
<tr>
<td>2265</td>
<td>19</td>
<td>Individual</td>
<td>The Rosemont area is known to contain prehistoric sites will consideration be given to this as well?</td>
</tr>
<tr>
<td>2394</td>
<td>5</td>
<td>Individual</td>
<td>We need a new survey of the Rosemont area, because: There a number of Archaeological sites to protect.</td>
</tr>
<tr>
<td>2394</td>
<td>6</td>
<td>Individual</td>
<td>We need a new survey of the Rosemont area, because: There are several Indian Holy Sites to protect.</td>
</tr>
<tr>
<td>Record ID</td>
<td>Comment Number</td>
<td>Commenter Type</td>
<td>Comment Text</td>
</tr>
<tr>
<td>-----------</td>
<td>----------------</td>
<td>----------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>2394</td>
<td>7</td>
<td>Individual</td>
<td>We need a new survey of the Rosemont area, because: Native American Graves and Protection Act must be followed.</td>
</tr>
<tr>
<td>2407</td>
<td>1</td>
<td>Individual</td>
<td>I have been referred to you by the Director of the AZ State Museum; as experts in Arizona History and cultural preservation. I have concerns regarding a proposed copper mine which will cover about 1000 acres in the Santa Cruz Valley; an area inhabited by communities of man since 7500 BC.</td>
</tr>
<tr>
<td>2407</td>
<td>2</td>
<td>Individual</td>
<td>The area involved has played a pivotal part in AZ history and the history of the Cochise Culture, the Hohokam, the Tchoowaka, the Oodham, the Spanish Conquest, the Pima, the Catholic Mission movement, the mines, ranching history, and as an area of national parks, the CDC restoration/landmarks, and Madera Canyon.</td>
</tr>
<tr>
<td>2407</td>
<td>3</td>
<td>Individual</td>
<td>I'm afraid un-restored sites related to Arizona history will be lost to open pit mining in an area that has acknowledged historical and cultural importance. The modern history of the area goes back to 1680. The ancient history of the area dates back at least 10,000 years.</td>
</tr>
<tr>
<td>2407</td>
<td>4</td>
<td>Individual</td>
<td>I'd appreciate your taking a look at the area involved in the Rosemont Mine Plan (page 91, attached) and seeing if there are known native religious, archaeological, or historical sites that may be damaged or desecrated by the proposed Rosemont Mine.</td>
</tr>
<tr>
<td>2440</td>
<td>4</td>
<td>Individual</td>
<td>2) The historical value of the area has not yet been widely popularized or utilized for the benefit of the public. There are numerous archeological sites that document the history of ancestors back thousands of years. Remnants of Native American ball sites and domestic and public dwellings will someday be used to teach our children about these people and the lessons we can learn from them, as has been done with the cliff dwelling sites in northern New Mexico and southern Colorado. University of Arizona, Department of Archeology and Gordon Fritz, archeologist who researched this area.</td>
</tr>
<tr>
<td>2485</td>
<td>10</td>
<td>Individual</td>
<td>What about possible Native American archaeological sites?</td>
</tr>
<tr>
<td>2545</td>
<td>2</td>
<td>Individual</td>
<td>Yesterday I took my OHV through the Rosemont area and up and over the Santa Rita Mountains, Through Gun Site Pass. I stopped at the top to enjoy the views, There use to be a memorial for an individual that was killed at the top. This was Bulldozed over and there was a Dozer sitting on the top. I paid my respect to the individual that passed on this spot. This company cannot respect the dead let alone the living. This cannot continue! Why has it gone so far.</td>
</tr>
<tr>
<td>2592</td>
<td>89</td>
<td>Individual</td>
<td>The EIS should consider alternatives to the proposed land use in order to preserve the archaeological and cultural resources of the area. Such alternatives could include selection of a land use based on preservation of the archaeological, cultural, biological, and community structure of the area. The subject area was previously evaluated by Pima County for acquisition as park land. Alternatives should be developed for developing funding to purchase the private land held by ARC and establishing a protected area excluded from mineral entry.</td>
</tr>
<tr>
<td>2592</td>
<td>91</td>
<td>Individual</td>
<td>Pima Count identified a number of cultural resource/sites in the proposed project area (Figure 5). The EIS should consider alternatives for preserving these cultural resources such as complete documentation, excavation, and preservation of sites prior to disruption by the proposed project.</td>
</tr>
</tbody>
</table>
APPENDIX C

Rosemont Tailings Siting Study
1.0 Introduction

In March 2005, Augusta Resource Corporation (Augusta) commissioned Vector Arizona LLC (Vector) to conduct an initial site selection study for a tailings impoundment at the proposed Rosemont Mine in Arizona. The evaluation consists of an analysis of alternative sites based on defined design and selection criteria as well as estimated development costs to identify the preferred tailings impoundment locations and disposal methods.

1.1 Background

The Rosemont project site lies in a high, sparsely populated intermountain area approximately 35 miles southeast of Tucson, Arizona (Figure 1) on the east slope of the Santa Rita Mountains. Access to the site is via Highway 83 which connects Interstate 10 with the town of Sonoita. Augusta controls a large portion of the site including the Hidden Valley Ranch and Rosemont Ranch. The Coronado National Forrest is custodian of much of the slopes of the Santa Rita Mountains.

1.2 Site Visit

Troy Meyer, P.E. of Vector visited the Rosemont property March 8 through 9, 2006 to perform site reconnaissance and familiarize Vector with the proposed facility locations, site features, surficial geology and soils. Photographs taken during this site visit are presented in Attachment A.

1.3 Previous Studies

A pre-planning study was conducted by the University of Arizona (The Mines Project Group 1980) for a previous owner of the property (Anamax Mining Company). The study involved an evaluation of potential waste rock and tailings sites for the proposed
Helvetia/Rosemont Mine and was focused on economic feasibility, socio-economic factors such as visual impact and possible closure methods and landforms. The study identified Sycamore Canyon as the preferred tailings impoundment site for conventional tailings disposal.

1.4 Objectives

This report is intended to provide a basis for decisions regarding future tailings impoundment facilities and disposal methods. The study considered both conventional (slurry) and dry stack tailings disposal methods and a comparative analysis was performed to the extent possible. The primary tasks performed for the study included:

- Regional Screening;
- Identification of Sites;
- Analysis of Fatal Flaws;
- Investigation of Remaining Sites;
- Qualitative Evaluation and Ranking;
- Semi-quantitative Evaluation and Ranking;
- Cost Analysis; and
- Selection of Alternatives for Detailed Investigation.

This study attempts to provide a clear, transparent and communicable evaluation methodology and selection of the preferred tailings disposal site and method for the Rosemont project. Much of the site evaluations at this stage of the study are based on judgment and experience with similar projects rather than deterministic analysis due to the difficulty of quantifying the various potential impacts of a tailings impoundment, particularly environmental and socio-economic impacts. This report is based on information provided by Washington Group International (WGI) regarding the suitability of the tailings to the proposed filtering technology to produce “dry” tailings and the associated costs and does not attempt to verify WGI’s data or conclusions.

The next phase of the study will involve a detailed evaluation and investigation of the preferred sites and disposal methods including the following primary tasks:

- Detailed Site Investigation of Preferred Sites;
- Conceptual Designs for the Sites;
- Evaluation of Costs and Pollution Risks;
- Evaluation of Alternative Tailings Disposal Methods;
- Ranking of Sites/Methods and Selection of Prime Site/Method; and
- Preparation of Reports and Documentation.
2.0 Design Considerations

2.1 Design Objectives

Vector has developed a list of design objectives and design criteria to be followed in the evaluation of alternative tailings sites and disposal methods. The design criteria generally follow the Arizona BADCT Mining Guidance Manual (ADEQ, 2005). These criteria will be further refined during the design phase.

The overall general design objective is to provide safe, cost-effective, and environmentally responsible management of the tailings produced by the proposed Rosemont Mine. Detailed design criteria and objectives include:

- Provision of secure long-term storage of 440 million tons (mt) of tailings, which is sufficient for the ore to be mined and processed during about 16 years of project life at a projected rate of 75,000 tons per day (tpd) with potential expansion to 500 mt storage capacity.

- Location within the immediate general area of the mine (approximately 5 mile radius from the proposed mine pit).

- Design of the tailings impoundment so that tailings water seepage into the groundwater system will be reduced to the maximum extent reasonably achievable by basin sliming or geologic containment (for conventional deposition), provision of surface water runoff and seepage collection, and other measures as required.

- Prevention of airborne release of tailings solids to the environment by provision of dust suppression measures.

- Compliance with all applicable regulations including Arizona BADCT standards.

- Creation of a site-specific design that accounts for local factors including climate, geology, hydrogeology, seismicity, and vegetation.

- Establishment of an effective and efficient reclamation program, preferably concurrent reclamation.
2.2 Design Criteria

Table 2.1 presents a summary of the conceptual design criteria for the Rosemont tailings impoundment design.

Table 2.1: Summary of Conceptual Design Criteria

<table>
<thead>
<tr>
<th>1.0 Basic Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.1 Tailings design capacity requirement = 440 million tons</td>
</tr>
<tr>
<td>1.2 Ultimate tailings capacity requirement = 500 million tons</td>
</tr>
<tr>
<td>1.3 Tailings produced at 75,000 tons per day</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.0 Embankment Stability</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.1 Static</td>
</tr>
<tr>
<td>2.1.1 Minimum factor of safety (FOS) of 1.5 under normal operating conditions</td>
</tr>
<tr>
<td>2.1.2 Minimum FOS of 1.3 during construction (non-critical slopes)</td>
</tr>
<tr>
<td>2.2 Dynamic (earthquake)</td>
</tr>
<tr>
<td>2.2.1 Crest deformation &lt;3 ft under design basis earthquake loading</td>
</tr>
<tr>
<td>2.2.2 Minimum FOS of 1.1 for post-earthquake assessment</td>
</tr>
<tr>
<td>2.2.3 Assume tailings fully liquefy under earthquake conditions</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>3.0 Hydrology and Water Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.1 Assume 100 yr / 24 hour storm event for all hydraulic structures</td>
</tr>
<tr>
<td>3.2 Contain, without releasing to the environment, pond levels resulting from the Probable Maximum Flood (PMF), in addition to the maximum operating level under normal conditions</td>
</tr>
<tr>
<td>3.3 Use average monthly conditions to evaluate monthly fluid levels throughout the life of the tailings impoundment for alternatives analysis</td>
</tr>
<tr>
<td>3.4 Assume 100% water reclaim to mill</td>
</tr>
<tr>
<td>3.5 Design tailings facility and seepage control systems (e.g. liners, barriers, pumpback systems) such that the downstream flow immediately below the dam, in terms of quantity and quality (pH and metals) does not exceed applicable regulatory limits, over the active life of the facility</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4.0 Conventional Tailings Disposal Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1 Conventional subareal deposition technique</td>
</tr>
<tr>
<td>4.2 Assume tailings in-place density of 100pcf based upon published data</td>
</tr>
<tr>
<td>4.3 Assume 50% solids content by weight for tailings slurry</td>
</tr>
<tr>
<td>4.4 Tailings solids specific gravity = 2.70</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>5.0 Dry Tailings Disposal Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Dry stack within waste rock dump</td>
</tr>
<tr>
<td>5.2 Assume tailings in-place density of 110pcf</td>
</tr>
<tr>
<td>5.3 Assume 15% moisture content by weight for in-place dry tailings</td>
</tr>
<tr>
<td>5.4 Tailings solids specific gravity = 2.70</td>
</tr>
</tbody>
</table>
2.3 Tailings Production and Storage Requirements

Mine and milling estimates indicate a tailings stream of approximately 75,000 tons per day (tpd) to the tailings impoundment for 16 years for a total of 440 mt of tailings capacity required with an expansion capacity for up to 500 mt. Based on a tailings in-place dry density of 100 pounds per cubic foot (pcf) for conventional tailings and 110 pcf for dry tailings, the total volume of tailings requiring impoundment is approximately 370 million cubic yards (cy) and 337 million cy for conventional and dry tailings, respectively.

2.4 Water Management

Current engineering practice for conventional tailings facilities dictates that the probable maximum flood (PMF) is accommodated by providing excess tailings impoundment capacity during operations and by providing a permanent spillway at closure designed to discharge the peak flow during the PMF event. Water management for dry stack tailings would involve routing basin runoff away from the active stack area and providing armoured channels on the stack perimeter and downstream sediment controls.

2.5 Geologic and Geotechnical Considerations

Geotechnical considerations for design of conventional tailings facilities include engineering characteristics of the tailings with regard to permeability, consolidation, strength, liquefaction potential, seepage control, and methods of drainage; engineering characteristics of the near surface geology with regards to permeability, strength, bearing capacity, collapse potential, liquefaction potential, suitability to embankment and liner construction and seepage control; and engineering characteristics of deeper geology with regard to permeability, seepage flow paths, groundwater depth and recharge, and attenuation potential. Considerations for dry stack tailings facilities include many of the above mentioned factors as well as waste rock characterization. These data have not yet been collected; therefore these evaluations rely on assumptions based on published “typical” parameters and previous experience.

The evaluations presented in this report do not consider quantified geologic or geotechnical site characteristics or factors. This study assumes natural geologic containment can be achieved at the considered tailing impoundment sites by “sliming” the basin with fine tailings prior to normal deposition and by providing seepage control measures (cutoff trench, slurry wall, grout curtain, etc). Due to the large impoundment areas and difficult terrain, use of geomembrane impoundment liners is not considered the preferred containment method for conventional tailings disposal. Current
experience with geomembrane liners is that they can be very effective used under certain field and installation conditions for smaller impoundments, but their application to large impoundments and for long-term effectiveness is questionable. Geotechnical site investigations are necessary to provide data for future design evaluations. Section 5.0 of this report discusses recommended additional work related to detailed geotechnical investigation of preferred sites for conceptual and pre-feasibility level designs.

2.6 Dry Tailings

The dry stack concept developed for this study involves dewatering the tailings using filtering technology and delivering the “dry” tailings to a disposal site using conveyors. The tailings will have a moisture content of approximately 15%. The tailings will be placed within the proposed waste rock dump to provide erosion protection and allow for covering with waste rock for dust control and progressive reclamation similar to landfill operations. This study does not consider mixing or “co-mingling” of tailings and waste rock however future evaluations may find this method suitable.

2.7 Reclamation

Upon the end of the tailings facility operational life, the conventional tailings impoundment must be closed and reclaimed so as to retain physical and chemical stability, and to protect human health and environment. The reclamation concept assumed for this study involves dewatering the final surface of the impoundment and constructing a graded cover to provide positive drainage to a final closure spillway. The cover surface would then be vegetated to limit wind and water erosion and water infiltration through the tailings mass.

Dry tailings provide an opportunity for a more straight-forward closure design due the lack of a free water pool, more consolidated and dryer tailings mass, low seepage potential, and high degree of structural integrity. The dry stack can be constructed to provide a suitable final closure configuration. A reclamation cover similar to that described above would then be placed over the final surface and permanent armored drainage channels would be constructed.
3.0 Site Selection Evaluation for Conventional Facilities

3.1 General

Four potential impoundment sites were identified for conventional tailings disposal utilizing 10ft contour interval topographic mapping provided by Augusta. Figure 2 presents the general locations of each potential impoundment site.

Embankment and impoundment volumetrics were performed for each site to identify embankment alignments and sizes that will provide up to 500 mt of tailings storage. Embankment sideslopes of 2:1 (horizontal: vertical) and downstream construction methods were assumed for the study based on use of mine waste for embankment construction. Multiple embankment locations were considered in the larger drainages in order to evaluate the most efficient alignment.

Embankment fill volume, impoundment storage capacity, drainage basin area, and impounded tailings area was estimated for each site. The facility life was calculated based on a tailings disposal rate of 75,000 tpd and an average in-place tailings density of 100 pcf.

3.2 Fatal Flaw Screening Criteria

The potential tailings sites identified were initially screened based on two fatal flaw criteria. Sites providing less than the required 500 mt of ultimate storage capacity were eliminated. Sites not considered viable due to costs associated with displacement of waste rock were also eliminated. The sites located in the Barrel drainage were eliminated based on these criteria. The “Barrel A” site (embankment alignment A in upper Barrel drainage) was eliminated due to lack of capacity and the “Barrel B” site (embankment alignment B in lower Barrel drainage) was eliminated due its location in the designated waste rock disposal area. Figures 3 and 4 present the evaluated tailings impoundment layouts. Table 3.1 presents the site volumetrics for the remaining sites as well as storage capacity versus embankment fill volume ratios. This ratio is an indication of the cost per ton for tailings storage.
### Table 3.1 – Summary of Tailings Site Volumetrics

<table>
<thead>
<tr>
<th>Site</th>
<th>Crest Elev. (ft)</th>
<th>Emb. Height (ft)</th>
<th>Emb. Fill Volume (cy)</th>
<th>Storage Capacity * (cy)</th>
<th>Storage vs. Fill Volume Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schofield A</td>
<td>4760</td>
<td>285</td>
<td>12,236,691</td>
<td>38,367,840</td>
<td>3.1</td>
</tr>
<tr>
<td></td>
<td>5,080</td>
<td>605</td>
<td>143,512,669</td>
<td>383,667,035</td>
<td>2.7</td>
</tr>
<tr>
<td>Schofield B</td>
<td>4,650</td>
<td>250</td>
<td>9,402,720</td>
<td>41,792,797</td>
<td>4.4</td>
</tr>
<tr>
<td></td>
<td>4,940</td>
<td>540</td>
<td>136,862,802</td>
<td>379,013,604</td>
<td>2.8</td>
</tr>
<tr>
<td>Sycamore A</td>
<td>4,680</td>
<td>410</td>
<td>13,039,807</td>
<td>38,931,708</td>
<td>3.0</td>
</tr>
<tr>
<td></td>
<td>5,030</td>
<td>760</td>
<td>135,269,587</td>
<td>374,624,861</td>
<td>2.8</td>
</tr>
<tr>
<td>Sycamore B</td>
<td>4,520</td>
<td>350</td>
<td>7,170,599</td>
<td>39,743,046</td>
<td>5.5</td>
</tr>
<tr>
<td></td>
<td>4,800</td>
<td>630</td>
<td>64,877,056</td>
<td>383,227,357</td>
<td>5.9</td>
</tr>
<tr>
<td>Empire</td>
<td>4,450</td>
<td>185</td>
<td>3,506,908</td>
<td>57,478,054</td>
<td>16.4</td>
</tr>
<tr>
<td></td>
<td>4,600</td>
<td>335</td>
<td>21,604,721</td>
<td>412,803,391</td>
<td>19.1</td>
</tr>
</tbody>
</table>

* Based on 100pcf in-place dry density for tailings.

### 3.3 Evaluation Parameters

The siting studies were divided into four major categories (primary evaluation parameters), with overall weighting factors as shown in Table 3.2. In selecting a tailings impoundment site, it was important to Augusta that all sites analyzed were reviewed in a manner that accounts for all substantive impacts of concern by stakeholders. Using the techniques described in “A Multiple Accounts Analysis for Tailings Site Selection” (Robertson & Shaw) and other published papers (Caldwell 1983, Robertson 1982), Vector was able to analyze the potential sites through a series of these fundamental parameters.
Table 3.2 – Primary Evaluation Parameters and Weighting Factors

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Weighting Factor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Review</td>
<td>4</td>
</tr>
<tr>
<td>Socio-Economic Review</td>
<td>3</td>
</tr>
<tr>
<td>Technical Requirements</td>
<td>2</td>
</tr>
<tr>
<td>Project Economics</td>
<td>1</td>
</tr>
</tbody>
</table>

Under each primary evaluation parameter, a number of sub-parameters were defined. This list was then scrutinized to identify the sub-parameters which are either similar for all alternatives or not materially influential in the selection process. The remaining sub-parameters are considered the fundamental parameters for the Rosemont tailings impoundment siting study. The fundamental parameters were then weighted and each site was ranked on the fundamental parameters from one to nine, nine being the most appropriate and all other locations ranking equal or less. The weights and rankings were then multiplied together, resulting in a normalized sum (merit rating score) for each primary parameter. In this way, the most appropriate site based on a ranking is determined when ranked against another site for that particular parameter. The merit scores for each site were then compiled and multiplied by the weighing factors in Table 3.2 to provide a final score. Table 3.3 presents list of fundamental parameters and weightings for the Rosemont tailings impoundment siting study.

3.4 Environmental Review

The environmental fundamental parameters included eleven different factors. If the fundamental parameter did not distinguish one site from another, that particular parameter was dropped from the ranking system. All environmental fundamental parameters are listed below and the rational for inclusion or exclusion are included.

3.4.1 Climate

Climate was a parameter determined to have no impact on the siting study. All potential sites are located within one general area and the climate does not vary enough from site to site to make this a determining fundamental parameter.
3.4.2 Air Quality

In order to evaluate air quality, indicators were chosen. Those indicators included visible emissions from stacks (which will not be an indicator for tailings facilities), visible fugitives, noxious odors (not an indicator for tailings facilities), and total exposed area and elevation (which gives an indication of wind exposure).

When ranked against the other fundamental parameters in this section, air quality was ranked as high importance and was set at seven (7). Comparable rankings among each of the sites were then completed using elevation and location as affected by the prevailing winds. In this case, the higher locations on the southern side of the slope received the most unfavorable, i.e. lowest, ranking. The dry tailings option was considered the most favorable due to the opportunity for concurrent covering of the dry stack with waste rock limiting the exposed tailings surface.

Measures were also reviewed to determine if mitigation could change the ranking. In this case, dust control measures, emissions controls from processes, and maintaining road conditions did not affect the overall ranking.

3.4.3 Hydrology and Water Management

In order to evaluate hydrology and water management, the fundamental parameter of maximizing water conservation was used. Indicators for this fundamental parameter were water reuse based on tailings rate of rise, sufficient storage to capitalize on stormwater capture from upstream catchment areas, and potential pond sizes and their effect on evaporation.

When ranked against the other fundamental parameters in this section, hydrology and water management was ranked fairly high and was set at eight (8). Comparative rankings among each of the sites were then completed using rate of rise, natural containment, and potential evaporation. In this case, the larger tailings impoundments ranked lowest, i.e. most unfavorable conditions for this parameter. The dry tailings option was considered the most favorable since this method allows a higher fraction of the water to be removed from the tailings.

Measures were also reviewed to determine if mitigation could change the ranking analysis. In this case, process controls would affect each tailings impoundment equally. Therefore, mitigation did not affect the overall ranking.
3.4.4 Water Quality

Indicators were selected in order to evaluate water quality, specifically groundwater quality. Those indicators included preservation of ambient conditions at point of compliance (POC) wells. POC wells are installed and monitored to verify that geologic containment of the various sites are maintained.

When ranked against the other fundamental parameters in this section, water quality was ranked the highest and was set at nine (9). Comparative rankings among each of the sites were then completed using potential geologic containment. In this case, the smaller impoundments with better geologic containment ranked highest, or most favorable. The dry tailings option was considered the most favorable since this method limits potential seepage to a very low level.

Mitigating factors such as liners were discussed. However because the terrain in all locations at the property is either steep or hilly, placement of liner system would be difficult and long-term integrity hard to predict. If liners were used for the tailings facility, water quality issues may be mitigated but the overall site ranking would be offset by technical issues.

3.4.5 Aquatic Ecology

In order to evaluate aquatic ecology, it was determined that the fundamental parameter would be to minimize or eliminate downstream impacts. The indicators chosen for this evaluation included sedimentation and erosion potential in downstream watersheds which could cause an impact to Cienega Creek.

When ranked against the other fundamental parameters in this section, aquatic ecology was ranked in the mid-range and was set at five (5). This determination was made because there is no aquatic ecology located at the site so there is the potential for mitigation. Comparative rankings among each of the sites were then completed using the sedimentation and erosion potential from stormwater diversions. In this case, the channel outfall locations that were most isolated from natural drainages were ranked the highest, or most favorable to this parameter.

Measures were also reviewed to determine is mitigation could change the ranking analysis. Mitigation would be equally available at all sites and no change was made to the overall ranking.
3.4.6 Acid Rock Drainage (ARD) Control

In order to evaluate ARD control, indicators were chosen. Those indicators included water quality in stormwater runoff and POC wells. Both of these indicators are directly related to the rock types being mined and the controls which are put in place. Further investigation of the ARD potential of the final tailings material may change or eliminate this ranking.

When ranked against the other fundamental parameters in this section, ARD control was ranked in the mid-range and was set at five (5). Comparative rankings among each of the sites were then completed using geologic containment and runoff potential. In this case, the more compact locations ranked highest, or most favorable for this parameter.

Measures were also reviewed to determine if mitigation could change the analysis. Once the actual ARD potential is known for the tailings, ranking among the various sites could change.

3.4.7 Fish Habitat

In order to evaluate fish habitat, indicators were chosen. Those indicators included downstream water quality effects based on potential impacts to the Cienaga Creek drainage and local riparian habitats. Mapping and reports from the Sonoran Desert Conservation Plan (SDCP) were used to help make this determination.

When ranked against the other fundamental parameters in this section, fish habitat was ranked fairly low and was set at four (4). Comparative rankings among each of the sites were then completed using the potential for downstream effects based on size and location of the drainage.

Mitigating factors were also reviewed to determine if they would change the analysis. For this category, controls did not affect the overall ranking.

3.4.8 Terrain and Soils

In order to evaluate terrain and soils, indicators were chosen related to minimizing off-site impacts. The indicators chosen for this parameter included the potential for blowing dust and unnecessary roadways. Decision criteria were based primarily on exposed tailings, wind exposure, and haul and access road lengths.

When ranked against the other fundamental parameters in this section, terrain and soils was ranked fairly low and was set at four (4). Comparative rankings among each of the
sites were then completed using elevation and location as affected by the prevailing winds. In this case, the higher locations on the southern side of the slope received the lowest, or most unfavorable, ranking. The dry tailings option was considered the most favorable due to the opportunity for concurrent covering of the dry stack with waste rock limiting the exposed tailings surface and due to limitation of roadways.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, dust control measures, emissions controls from processes, and maintaining road conditions did not affect the overall ranking.

3.4.9 Vegetation

In order to evaluate vegetation, indicator parameters were chosen. These indicators included the vegetation conservation and invasive weed restriction. The Sonoran Desert Conservation Plan (SDCP) was used to map vegetative species in the area.

When ranked against the other fundamental parameters in this section, vegetation was ranked in the mid-range and set at six (6). Comparative rankings among each of the sites were then completed using the SDCP species mapping and the area impacted by the facility. Facilities with a larger footprint or with more species were ranked lower, or more unfavorable. The dry tailings option was considered the most favorable due limiting the disturbed footprint to that similar to the required area for waste rock disposal. This area would be disturbed regardless of tailings considerations.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, removing vegetation prior to disturbance, including monitoring invasive species, did not affect the overall ranking.

3.4.10 Wildlife

In order to evaluate wildlife, indicators were chosen related to minimizing disturbance or displacement of wildlife habitat. The indicators chosen for this parameter included the actual site usage by species and facility footprints mapped over the habitat from the SDCP.

When ranked against the other fundamental parameters in this section, wildlife ranked mid-range and was set at six (6). Comparative rankings among each of the sites were then completed using the number of species mapped in an area versus the facility footprint. The dry tailings option was considered the most favorable due limiting the disturbed footprint to that similar to the required area for waste rock disposal. This area would be disturbed regardless of tailings considerations.
Measures were also reviewed to determine if mitigation would change the analysis. In this case, exclusion of species from an area did not affect the overall ranking.

3.4.11 Special Status Species

In order to evaluate endangered species, indicators were chosen related to minimizing disturbance to critical habitat or to known populations of special status species. The indicators chosen for this parameter included the actual site usage by species and facility footprints mapped over the habitat from the US Fish and Wildlife Service, the Forest Service, and the SDCP.

When ranked against the other fundamental parameters in this section, special status species ranked mid-range and was set at six (6). Comparative rankings among each of the sites were then completed using the number of species mapped in an area versus the facility footprint.

Measures were also reviewed to determine if mitigation would change the analysis. Because the areas that would be mitigated are closely situated and the measures would be similar, the existence of a particular species from an area did not affect the overall ranking.

3.5 Socio-Economic Review

The socio-economic fundamental parameters included seventeen different factors. If the fundamental parameter did not distinguish one site from another, that particular parameter was dropped from the ranking study. All fundamental parameters are listed below and the rational for inclusion or exclusion are included.

3.5.1 Income

Income generation was a parameter determined to have no impact on the siting study. Because all potential sites are located within one general area, income generation is not directly affected by location. Therefore, this factor is not a determining fundamental parameter. Income generation would only be a factor if the selected site limited production capacity or the overall mine life.

3.5.2 Taxes

Tax generation was a parameter determined to have no impact on the siting study. Because all potential sites are located within one general area, tax generation is not directly affected by location. Therefore, this factor is not a determining fundamental
parameter. Tax generation would only be a factor if the selected site limited production capacity or the overall mine life.

3.5.3 Regional Government Development
Since the regional governments are already established, it was determined that this parameter had no impact on the siting study.

3.5.4 Labor Market Analysis
An analysis of the labor market was determined to have no impact on the siting study. Because all of the sites are located within one general area, labor requirements are not directly affected by location. Therefore, this factor is not a determining fundamental parameter. The labor market would only be a factor if the selected site limited production, and therefore manpower needs in a tight labor market.

3.5.5 Population
Population was a parameter determined to have no impact on the siting study. Because all of the sites are located within one general area, equally remote from habitated areas, population issues are not directly affected by location. Therefore, this factor is not a determining fundamental parameter.

3.5.6 Housing
The housing review was a parameter determined to have no impact on the siting study. Because the site is located within one general area, the actual housing situation is not directly affected by location. Therefore it will not vary enough from site to site to make this a determining fundamental parameter.

3.5.7 Transportation and Traffic
Housing was a parameter determined to have no impact on the siting study. Because all of the sites are located within one general area, equidistant from urban or rural areas, housing issues are not directly affected by location. Therefore, this factor is not a determining fundamental parameter.

3.5.8 Navigable Waters (Recreational)
There are no delineated navigable waters at the facility that are used for recreation. Therefore, this parameter was determined to have no impact on the siting study.
3.5.9  Health and Safety

In order to evaluate health and safety, indicators were chosen. Those indicators included worker safety based on injury and accident rates.

When ranked against the other fundamental parameters in this section, health and safety was ranked high and set at eight (8). Comparative rankings of each of the sites were then completed using the proximity of tailings facilities to the rest of the operation and the terrain between the tailings facilities and the plant. In this case, tailings impoundments further away or over tougher terrain ranked lowest, or more unfavorable. In the case of dry stack tailings, the additional operational equipment (filters, conveyors, stackers, compactors) were considered an opportunity for worker accidents.

Mitigating factors were also reviewed to determine if mitigation would change the analysis. In this case, hazard communications and training were determined not to affect the overall ranking.

3.5.10  Land Tenure

The sites considered are within land controlled by Augusta. Therefore, this parameter was determined to have no impact on the siting study.

3.5.11  Fishing

There is no historic fishing at any of the sites being evaluated. Therefore, this parameter was determined to have no impact on the siting study.

3.5.12  Outdoor Recreation and Tourism

In order to evaluate outdoor recreation and tourism, indicators were chosen related to minimizing impacts to current uses. The indicators chosen for this parameter included current recreational uses on the site, hiking trails intersecting the property, visibility of the operations from recreational areas, and the perceived “remoteness” of the current recreational area.

When ranked against the other fundamental parameters in this section, outdoor recreation and tourism was ranked high and set at nine (9). Comparative rankings among each of the sites were then completed using the size of the facilities, current uses, and existing impacts such as roadways and developed recreation. In this case, the largest area of impact ranked lowest, or most unfavorable. The dry tailings option was considered the most favorable due limiting the disturbed footprint to that similar to
the required area for waste rock disposal. This area would be disturbed regardless of tailings considerations.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation did not affect the overall ranking.

3.5.13 Visual Quality

In order to evaluate visual quality, indicators were chosen. Those indicators included determining which operating facilities would be visible from roadways and trails, and determining which views would be obstructed by those facilities. In addition, a viewshed analysis was completed to determine the long-range visual impact of the facilities. Figures 12 through 14 present the results of the viewshed analyses.

When ranked against the other fundamental parameters in this section, visual quality was ranked high and set at eight (8). Comparative rankings among each of the sites were then completed using the viewshed analysis. In this case, tailings impoundments with the lowest ultimate elevations that were furthest from existing roadways had the highest, or most favorable, score.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation did not affect the overall ranking.

3.5.14 Archaeological Resources

In order to evaluate archaeological resources, indicators were chosen. Those indicators included a review of potential archaeological resources in the area and the overall impact of each facility on those resources.

When ranked against the other fundamental parameters in this section, archaeological resources were ranked mid-range and was set at six (6). Comparative rankings among each of the sites were then completed using information available in the SDCP, studies performed by the University of Arizona for a previous land exchange, and other studies. In this case, it was determined sites in canyons or valleys not associated with steep terrain have more of a potential to have archaeological resources and are therefore ranked lower than those with steeper terrain or that are located outside of the canyons or valleys. The dry tailings option was considered the most favorable due limiting the disturbed footprint to that similar to the required area for waste rock disposal. This area would be disturbed regardless of tailings considerations.
Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation did not affect the overall ranking.

3.5.15 Historical Sites

In order to evaluate historical sites, indicators were chosen. Those indicators included a review of potential historical sites in the area and the overall impact of each facility on those sites.

When ranked against the other fundamental parameters in this section, historical sites were ranked mid-range and set at six (6). Comparative rankings of each site were then completed using information available in the SDCP and other studies. In this case, it was determined that sites located in areas of high archaeological concern would be the most impacted and receive the lowest, or most unfavorable, ranking. The dry tailings option was considered the most favorable due limiting the disturbed footprint to that similar to the required area for waste rock disposal. This area would be disturbed regardless of tailings considerations.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation did not affect the overall ranking.

3.5.16 Post-Mining Land Use

In order to evaluate post-mining land use, fundamental parameters of self-sustaining reclamation and appropriate uses were considered. The indicators associated with this fundamental parameter included restoration to historical use based on landscape surveys in the SDCP.

When ranked against the other fundamental parameters in this section, post-mining land use was ranked mid-range and set at six (6). Comparative rankings among each of the sites were then completed using the overall historic land use and the potential to restore the area to that use. In this case, tailings impoundments with a higher potential to be restored to historical use such as grazing scored higher, or more favorable. The dry tailings option was considered the most favorable due limiting the disturbed footprint to that similar to the required area for waste rock disposal. This area would be disturbed regardless of tailings considerations.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation did not affect the overall ranking.
3.5.17 Infrastructure Improvement

Infrastructure improvement was a parameter determined to have no impact on the siting study. Because all of the sites are located within one general area, infrastructure improvements are not directly affected by location. Therefore this factor is not a determining fundamental parameter. Site access and utility corridors would be required regardless of site selection.

3.6 Project Economics

The project economics fundamental parameter included five different factors. Because four of the five different fundamental parameters are included in a net present value analysis, they were grouped together as one category.

3.6.1 Net Present Value Analysis

Table 3.4 presents the net present value (NPV) analysis for the evaluated tailings sites. The analysis used a discount rate of six percent and evaluated capital and operating costs for 16 years of tailings production at 75,000 tpd which represents the Phase 6 mine pit plan. Capital and operating costs were estimated for the following items:

Embankment earthwork – a unit cost of $1.50/cy was used for construction of the starter embankment which assumes the use of a contractor. Costs were based on earthwork volumes estimated for a starter embankment providing approximately 2.5 years of tailings storage. A haulage unit cost of $0.10 per ton-mile was used for construction of the embankment downstream raises plus a placement cost of $0.75 per cy assuming a dozer working at the embankment and compaction of waste rock by haul traffic. This costs also assumes engineered “transition zones” will be constructed on the upstream portions of the embankments to provide filtering and bedding for a geomembrane liner. Depending on embankment design, transition zone materials may be derived from crushed or screened local materials.

The dry tailings options assumes placement of waste rock buttress at 20% of the tailings placement volume and assumes an incremental 2 mile haul over the “normal” waste rock haul to route haul traffic to the waste rock buttress with a waste rock placement cost of $0.05 per cy (assumed no compaction required). A cost of $0.05 per cy was also assumed for tailings placement and assumes a dozer will provide the necessary compaction for a trafficable surface and acceptable settlement.

Tailings slurry and water reclaim pipelines – costs were estimated for construction of the slurry line from the proposed mill location to each evaluated tailings dam location. Each
pipeline routing was evaluated to include length of pipe under gravity flow versus pressure flow. It was assumed that high density polyethylene (HDPE) pipe would be utilized for gravity flow portions of the pipeline and steel pipe would be required for the pressure flow portions. Unit costs of $100 per lineal foot (lf) and $150 per lf were assumed for gravity and high pressure HDPE pipe, respectively. Nominal pipe diameters of 30 inches and 22 inches were estimated for gravity and pressure pipelines, respectively.

Tailings pumping requirements – capital costs for required slurry and water reclaim pumps were estimated for each pipeline by calculating the bank horsepower (BHP) requirements. A unit cost of $300 per installed BHP was assumed for pump capital costs. Pump operating costs were estimated by converting BHP into kilowatt-hour requirements. A unit cost of $0.055 per kilowatt-hour was assumed.

Containment system costs – a unit cost of $3,000 per lf of embankment was assumed for installation of a containment system for conventional tailings impoundments. The conceptual containment system assumes geologic containment can be adequately achieved by “sliming” the basin with fine-grained tailings to form a seepage barrier to achieve groundwater protection goals. This approach would also involve some type of seepage cutoff and collection system at the embankment (e.g. cutoff trench, slurry wall, grout curtain, etc.) and a geomembrane liner on the upstream face of the dam.

Water costs – a unit cost of $500 per acre-ft of water was used based on input from Augusta. Makeup water requirements were estimated for each site based on water balance calculations. A separate Vector memo titled “Preliminary Rosemont Water Balance” and dated May 4, 2006 presents the detailed water balance calculations for the conventional tailings sites considered. Dry tailings makeup water assumed 15% water loss by weight.

Reclamation costs – a unit cost of $15,000 per acre was assumed for reclamation of the tailings impoundment surface at closure based on experience with similar projects. Reclamation costs for dry tailings stack was assumed to be covered by waste rock reclamation program.

Dry tailings equipment – capital and operating costs for the dry tailings equipment (filtration system, conveyors, stackers, etc) were provided by WGI. Vector did not attempt to verify these data.
The cost screening identified the most cost effective sites based on net present value (NPV) at a discount rate of 6 percent. The estimated costs for each facility were applied to the facility life cycle as follows: (1) starter embankment and liner system construction costs, slurry and reclaim water pipeline and pump capital costs, and dry tailings equipment costs were applied to the Year 0 (pre-mining construction), (2) the remaining embankment and liner system construction costs were spread evenly across Years 1 through end of facility life (Year 16), (3) slurry and reclaim water pumping costs and dry tailing operational costs were spread evenly across the facility life, and (4) closure costs were applied to Year 17. Table 3.4 presents the NPV analysis and Table 3.5 presents a summary of NPV values and tailings disposal costs expressed in $/ton of tailings. The technical viability of the proposed facilities and construction methods must be verified in the design phase to substantiate these costs; however the results of the analysis provide some guidance for tailings related decision making.

Table 3.5 – Summary of NPV Analysis Results

<table>
<thead>
<tr>
<th>Site</th>
<th>Starter Capital (Million $)</th>
<th>Operating Cost (Million $)</th>
<th>Operating Costs ($/ton)</th>
<th>6.0% NPV (Million $)</th>
<th>Disposal Costs ($/ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sycamore A</td>
<td>42</td>
<td>224</td>
<td>0.44</td>
<td>153</td>
<td>0.31</td>
</tr>
<tr>
<td>Sycamore B</td>
<td>30</td>
<td>192</td>
<td>0.37</td>
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<td>0.25</td>
</tr>
<tr>
<td>Schofield A</td>
<td>41</td>
<td>269</td>
<td>0.52</td>
<td>175</td>
<td>0.35</td>
</tr>
<tr>
<td>Schofield B</td>
<td>46</td>
<td>300</td>
<td>0.59</td>
<td>196</td>
<td>0.39</td>
</tr>
<tr>
<td>Empire</td>
<td>38</td>
<td>205</td>
<td>0.40</td>
<td>134</td>
<td>0.27</td>
</tr>
<tr>
<td>Dry Tailings</td>
<td>39</td>
<td>202</td>
<td>0.40</td>
<td>141</td>
<td>0.28</td>
</tr>
</tbody>
</table>

* Operating costs for life of mine after startup; disposal costs based on NPV.

From a project economics perspective, the Empire site provides the most efficient storage capacity resulting in relatively low capital and ongoing dam construction costs. However due to the large tailings surface area and resulting high evaporation rate and makeup water costs estimated for the Empire site, the NPV is relatively high. The dry tailings option compares favorably to the conventional disposal costs based on the costs provided by WGI and the assumptions presented herein and is primarily due to the cost savings related to water conservation. However it should be noted that comparison of costs between conventional and dry stack tailings is somewhat difficult at this stage of study due to the lack of design data and difficulty in estimating construction and closure costs, as well as potential overlap of dry stack work force with other duties.

3.6.2 Economic Risk

In order to evaluate economic risk, indicators were chosen including the relative ease of permitting and receiving a plan of operations.
When ranked against the other fundamental parameters in this section, economic risk was ranked high and set at seven (7). Comparative rankings of each of the sites were then completed using perceived impacts to the environment and the potential economic impact, such as the risk of permit delays or forced cessation of activities. In this case, sites potentially impacting major drainages or groundwater regimes ranked the lowest, i.e. most unfavorable. The dry tailings option was considered the most favorable due limiting the total disturbed footprint for tailings and waste rock to a single drainage.

In addition, areas seen as having a potential economic risk of losing investment or delayed investment elsewhere would also be ranked lower. The sites would have similar economic risk associated with investment so this criterion was not used in the ranking.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation factors did not affect the overall ranking.

3.7 Technical Issues

The technical issues fundamental parameters included six different factors. If the fundamental parameter did not distinguish one site from another, that particular parameter was dropped for this siting study. In this review, all fundamental parameters are listed below and the rationale for inclusion or exclusion is included.

3.7.1 Impoundments

In order to evaluate impoundments, a fundamental parameter of constructability was considered. The indicators for this parameter included the geology and site topography as well as embankment height.

When ranked against the other fundamental parameters in this section, impoundments were ranked high and set at eight (8). Comparative rankings of each of the sites were then completed using geologic containment and topography. In this case, areas that resulted in high tailings impoundment structures ranked the lowest, or most unfavorable. The dry tailings option was considered the most favorable due to the lack of engineered embankment and co-disposal with waste rock.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation factors would not affect the overall ranking.
3.7.2 Containment

In order to evaluate containment, a fundamental parameter of minimizing containment seepage and ensuring process containment were considered. The indicators for this parameter included using the best available demonstrated control technology (BADCT) standards, and providing allowances for emergency structures in sensitive areas.

When ranked against the other fundamental parameters in this section, containment was ranked fairly high and set at seven (7). Comparative rankings among each of the sites were then completed evaluating the actual physical location of the facility and distance from the operating facilities. In this case, sites with shorter dam lengths in more confined valley sites ranked the highest due to an implied relative ease of achieving geologic containment. Also, areas furthest from the plant site ranked the lowest, or most unfavorable, because these locations provide a larger overall facility footprint. The dry tailings option was considered the most favorable due to the very low anticipated seepage and lack of engineered containment system.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation factors did not affect the overall ranking.

3.7.3 Diversions

The diversions review was a parameter determined to have no impact on the siting study. Because all of the sites have similar containment or diversion requirements, this is not directly affected by location. Therefore, diversions are not a determining fundamental parameter.

3.7.4 Covers

In order to evaluate covers, a fundamental parameter of a self sustaining cover system was reviewed. The indicators for this parameter included the surface area, the ability to regrade or place materials and higher slope angles, and the ultimate elevation of tailings at closure.

When ranked against the other fundamental parameters in this section, covers was ranked high and set at seven (7). Comparative rankings among each of the sites were then completed using final elevations and impoundment size. The areas with the lower elevations and flatter slopes were ranked the highest, or most favorable. The dry tailings option was considered the most favorable due to the opportunity for concurrent reclamation and ability to construct the dry stack to facilitate final reclamation.
Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation factors did not affect the comparative ranking.

3.7.5 Access Road

In order to evaluate access roadways, a fundamental parameter of minimizing dust and the number of required roadways was considered. The indicator for this parameter included distance from the operating facilities.

When ranked against the other fundamental parameters in this section, access roads was ranked mid-range and set at five (5). Comparative rankings among each of the sites were then completed using an actual location and distance from the operating facilities. In this case, areas furthest from the plant site ranked the lowest, or most unfavorable. The dry tailings option was considered the most favorable due the dry stack location in proximity to the pit and plant site.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation factors would not affect the overall ranking.

3.7.6 Pipeline

In order to evaluate pipelines, fundamental parameters of ease of inspection and maintenance, and allowances for cleanout and spill control were used. The prime indicator for this parameter included the distance from operating facilities.

When ranked against the other fundamental parameters in this section, pipelines was ranked mid-range and set at five (5). Comparative rankings among each of the sites were then completed using actual location and distance from the operating facilities. In this case, areas furthest from the plant site ranked the lowest, or most unfavorable. The dry tailings option was considered the most favorable due the dry stack location in proximity to the pit and plant site.

Measures were also reviewed to determine if mitigation would change the analysis. In this case, mitigation factors did not affect the ranking.

3.8 Summary of Evaluation Results

In general, this study developed information that is fairly intuitive. The more compact the site footprint, the less impact they will have on the surrounding area. Grouping tailings facilities with the rest of the operating facilities and impacting a fewer number of drainage areas or watershed boundaries will be more favorable than those facilities that are more spread out. From a project economics perspective, several less economic
sites scored favorably overall due to environmental and socio-economic considerations. Table 3.3 presents the merit ratings for each fundamental parameter and Table 3.6 presents the final merit scoring results.

### Table 3.6 – Merit Scoring Results

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Schofield A</th>
<th>Schofield B</th>
<th>Sycamore A</th>
<th>Sycamore B</th>
<th>Empire</th>
<th>Dry Tailings</th>
<th>Weight (W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental</td>
<td>5.4</td>
<td>5.5</td>
<td>6.2</td>
<td>6.3</td>
<td>4.5</td>
<td>8.5</td>
<td>4</td>
</tr>
<tr>
<td>Socio-Economic</td>
<td>6.5</td>
<td>6.2</td>
<td>5.5</td>
<td>5.5</td>
<td>3.8</td>
<td>7.2</td>
<td>3</td>
</tr>
<tr>
<td>Project Economics</td>
<td>6.2</td>
<td>5.8</td>
<td>5.9</td>
<td>6.8</td>
<td>5.1</td>
<td>9.0</td>
<td>1</td>
</tr>
<tr>
<td>Technical</td>
<td>5.0</td>
<td>5.2</td>
<td>4.6</td>
<td>4.7</td>
<td>3.4</td>
<td>9.0</td>
<td>2</td>
</tr>
</tbody>
</table>

| Merit Score (RxW)/ΣW | 5.7 | 5.7 | 5.6 | 5.8 | 4.1 | 8.2 |

The dry tailings option scored the most favorable in all categories due to a number of factors including:

- Eliminates need for engineered embankment and seepage containment system
- Maximizes water conservation and minimizes water makeup requirements
- Results in a very compact site limiting disturbance to a single drainage
- Allows opportunities for concurrent reclamation and covering for dust control

Section 4 provides a more detailed description of the dry tailings concept.
4.0 Site Descriptions

4.1 General

This section provides a brief description of each of the preferred sites identified in the evaluation. Refer to Figures 5 through 9 for depictions of each embankment footprint, impounded tailings area, drainage basin area, and possible pipeline and haul road routings.

4.2 Physiography

The proposed Rosemont mine site is contained within the southwestern portion of the Mexican Highlands section of the Basin and Range physiographic province within the Santa Rita mountain range. The Mexican Highlands is a transitional terrain with varied topographic relief separating the Sonoran Desert to the southwest and the Colorado Plateau to the north. The Santa Rita mountain range, locally, defines the contact between the Sonoran Desert and the Mexican Highlands sections. A significant portion of the site is characterized by rolling grasslands interrupted by densely vegetated washes. Other portions of the site are characterized by relatively steep mountain valleys.

The proposed Rosemont mine can be further located within the Mexican Highlands, specifically, to the northern portion of the Santa Rita Mountain range, bounded on the west by the subdued topography of the Sonoran Desert and the Santa Cruz River drainage basin. This western boundary is coincident with the Quaternary-active Santa Rita fault zone. The Santa Rita Mountain range extends from the Pantano Wash, in the north, approximately 40 km southwest to the Sonoita Creek about 20 km north of the Mexican border.

4.3 Geology

The proposed Rosemont mine site lies in the southwestern region of North America, specifically, in the Basin and Range physiographic province. The Basin and Range is characterized by relatively evenly spaced, subparallel mountain ranges separated by broad, thick alluviated basins the boundaries of which are defined by high-angle extensional faults. This irregularly shaped region encompasses an area greater than 1,500 km in length and up to 1,000 km in width extending from the southern portions of Idaho and Oregon through the majority of Nevada, parts of western Utah, eastern California, western and southern Arizona, southwestern Arizona and northern Mexico.
The Santa Rita Mountains comprise a relatively small horst consisting of primarily Mesozoic-age rocks (deposited between 248 and 65 mybp) bounded on the east by the Davidson Canyon graben and a small uplifted range known as the Empire Mountains.

A detailed discussion of regional and site geology and seismicity is presented in a separate Vector memo titled “Geology and Seismotectonic Review for the Rosemont Mine Siting Study” and dated April 20, 2006.

4.4 Rosemont Open Pit

The open pit mining activity will be located along the eastern slope of the Santa Rita Mountain range at the upper reaches of Wasp Canyon. The identified ore-body is contained within a Paleozoic sedimentary sequence of quartzites, siltstones and carbonate rocks, namely the: Devonian Martin Formation; Mississippian Escabrosa Limestone; Pennsylvanian Horquilla Limestone; Pennsylvanian-Permian Earp Formation; and Permian Epitaph Formation, from oldest to youngest.

From a geotechnical standpoint, waste rock materials and those materials stripped as overburden will consist primarily of hard carbonate rocks, fine- to coarse-grained sandstones and conglomerates. Although no geotechnical site investigations have been completed, Vector believes these materials will provide sound construction materials. Some of the materials produced as waste from the open pit may be rich in chert. Chert is a poor aggregate material for concrete.

4.5 Schofield Site

The Schofield site is underlain by the Late Cretaceous Salero Formation and unconsolidated alluvium of Quaternary age. The upper Salero Formation consists of interbedded conglomerate, coarse sedimentary breccia, coarse-grained arkosic sandstone and lesser rhyolite flows. The Quaternary age alluvium is composed of gravel and sand common to washes and stream beds in the arid southwest with accumulations of material from sand size to boulders. These materials should be capable of supporting a large earthfill/rockfill embankment and may provide suitable construction materials using large excavation equipment. Based on review of available geologic mapping, there are no clay borrow sources available within the Scholefield Canyon area.

There are several high-angle normal faults underlying the Scholefield Canyon embankment site and impoundment that displace Late Cretaceous-age deposits. However, there is no indication that these faults are active in the current geologic setting.
and, therefore, pose a low risk of surface rupture and attendant hazards to a tailings storage facility.

Figure 10 presents a conception section of the proposed convention tailings dam for the Rosemont project.

### 4.6 Sycamore Site

The Sycamore site is underlain by rocks of the: Permian Epitaph and Scherer formations; Early Cretaceous Willow Canyon and Apache Canyon formations; and Larmide-age Helvetia Intrusions, in ascending stratigraphic order. These formations consist of limestones, siltstones, mudstones, marls, quartzites, sandstones, and conglomerates. Although, no geotechnical investigations were completed as a part of these siting studies, the foundation materials should be capable of supporting a large earthfill/rockfill embankment and may prove to be suitable construction materials using large excavation equipment. Based on review of available geologic mapping, there are no clay borrow sources available within the Sycamore Canyon area.

There are several high-angle normal faults underlying the Sycamore Canyon – B-Option embankment site and impoundment that juxtapose Permian and Cretaceous bedrock units. Additionally, the northern side of Sycamore Canyon at the Option B site is underlain by a series of southeast plunging anticlines and synclines. However, there is no indication that these faults or folds are associated with active tectonics in the current geologic setting and, therefore, pose a low risk of surface rupture and attendant hazards to a tailings storage facility.

### 4.7 Dry Tailings Stack

The concept developed for this study involves dewatering the tailings and placing the “dry” tailings within the proposed waste rock dump. The concept developed for this study involves placement of waste rock in the lower portion of the waste rock dump area to provide a dry tailings buttress. Dry tailings would be delivered by conveyor and placed with a radial stacker similar to that used for heap leach operations. This evaluation assumes a dozer would be used to spread the dry tailings and provide sufficient compaction for trafficability of the conveyor and stacker and to limit settlement to that similar to the waste rock buttress. The active stacking area would be limited to allow dust and erosion control. Contact water would be captured in a sediment pond located downstream of the waste rock dump. Figure 11 presents a conceptual dry stack for the Rosemont project. A separate memo presents the surface water hydrology and pond sizing calculations.
5.0 Summary and Recommendations

This report presents an evaluation of site alternatives for tailings facilities for the proposed Rosemont Mine. This evaluation provides a basis for decisions regarding future tailings impoundment facilities utilizing both conventional and dry stack tailings disposal methods.

This evaluation does not consider quantified geologic or geotechnical site characteristics or factors. Geotechnical and geological site investigations are necessary to provide data for additional studies and would consist of geologic mapping and test pit investigations to characterize the near surface geology and identify possible borrow materials for embankment construction, and geotechnical drilling to characterize deep geology and embankment foundation conditions to determine whether or not these potential sites are fatally flawed.

The evaluation consisted of an analysis of alternative sites based on defined design criteria and evaluation parameters including estimated development costs to identify the preferred tailings impoundment location and disposal method. Initially 4 sites were identified as possible impoundment locations for conventional disposal. Several embankment alignments were developed for 3 of these sites for a total of 7 impoundments for consideration. The initial fatal-flaw screening consisted of eliminating the sites with insufficient storage capacity to contain 500 mt of tailings and site that displaced efficient waste rock storage areas resulting in elimination of 2 impoundment sites. The remaining sites along with the dry tailings option were further evaluated using a multiple accounts analysis. The evaluation considered 4 primary evaluation parameters: environmental impacts, socio-economic impacts, technical review, and project economics. Fundamental sub-parameters in each category were developed and weighted to allow evaluation of relative site merit.

In general, this study developed information that is fairly intuitive, the more compact sites, closer to the operating facilities that impact a fewer number of drainage areas or watershed boundaries will be more favorable than those facilities that are more spread out. The results indicate the dry tailings option as the most favorable disposal method based on the assumptions presented in this report. Dry tailings stack eliminates the need for engineered embankments and seepage containment systems, maximizes water conservation and minimizes water makeup requirements, results in a very compact site limiting disturbance to a single drainage, and allows opportunities for concurrent reclamation and covering for dust control.
The evaluation indicates Shoffield (Embankment Alignment A) and Sycamore (Embankment Alignment B) as the preferred sites for conventional tailings disposal. Project economic ratings for Sycamore (Embankment Alignment B) and the dry tailings option are essentially equal when economic risk is considered.

Based on the evaluations presented in this report, we recommend that detailed site investigations and laboratory testing be initiated for the dry tailings option to support additional evaluations and conceptual design of dry tailings stack. These investigations should consist of the following:

- Geologic mapping of the proposed dry stack area;
- Geotechnical drilling and seismic surveys along the proposed waste rock buttress alignment to characterize foundation conditions;
- Laboratory testing on tailings and waste rock to provide engineering parameters for design.
6.0 References


Caldwell, Jack A. and Robertson, Andrew MacG., Selection of Tailings Impoundment Sites, Die Siviele Ingenieur in Sud-Afrika, October 1983.


Robertson, Andrew MacG. and Shaw, S.C. , A Multiple Accounts Analysis for Tailings Site Selection, Robertson GeoConsultants, Inc., Vancouver, BC, V6C 3B6, Canada.


APPENDIX A

SITE PHOTOS
Sycamore Canyon – Top of basin looking north

Sycamore Canyon – Top of basin looking north
Schofield Canyon – Just west of Hwy 83 looking west

Schofield Canyon – Top of upper south reach looking east
Schofield Canyon – North reach basin area looking south (buildings are Hidden Valley Ranch)

Barrel Canyon Basin– near top of basin looking north
Arcosic near surface soils in Barrel basin

Typical rocky ground surface at Rosemont site
APPENDIX D

Alternatives Considered but Dismissed
APPENDIX E

Alternative Water Sources Considered
Review of Alternative Water Sources—Revised

Report Prepared for
SWCA Environmental Consultants

Report Prepared by
SRK Consulting (U.S.), Inc.
SRK Project Number 183101/2200
May 2011
Review of Alternative Water Sources—Revised

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# Table of Contents

1 Introduction .......................................................................................................................... 1

2 Proposed Alternatives: Potable Water Sources ................................................................. 3
   2.1 Davidson Canyon Groundwater ..................................................................................... 4
       2.1.1 Description ............................................................................................................ 4
       2.1.2 Advantages .......................................................................................................... 4
       2.1.3 Limitations ......................................................................................................... 4
       2.1.4 Feasibility .......................................................................................................... 5
       2.1.5 Summary ........................................................................................................... 5
   2.2 Ciénega Creek Groundwater ......................................................................................... 5
       2.2.1 Description ........................................................................................................... 6
       2.2.2 Advantages .......................................................................................................... 6
       2.2.3 Limitations ......................................................................................................... 6
       2.2.4 Feasibility .......................................................................................................... 6
       2.2.5 Summary ........................................................................................................... 7
   2.3 Sonoita Creek Groundwater .......................................................................................... 7
       2.3.1 Description ........................................................................................................... 7
       2.3.2 Advantages .......................................................................................................... 7
       2.3.3 Limitations ......................................................................................................... 7
       2.3.4 Feasibility .......................................................................................................... 8
       2.3.5 Summary ........................................................................................................... 8
   2.4 San Pedro River Groundwater ....................................................................................... 8
       2.4.1 Description ........................................................................................................... 8
       2.4.2 Advantages .......................................................................................................... 9
       2.4.3 Limitations ......................................................................................................... 9
       2.4.4 Feasibility .......................................................................................................... 9
       2.4.5 Summary ........................................................................................................... 10
   2.5 Santa Cruz River Basin Groundwater .......................................................................... 10
       2.5.1 Description .......................................................................................................... 10
       2.5.2 Advantages .......................................................................................................... 11
       2.5.3 Limitations ......................................................................................................... 11
       2.5.4 Feasibility .......................................................................................................... 12
       2.5.5 Summary ........................................................................................................... 12
   2.6 Santa Rita Experimental Range Groundwater ............................................................. 13
       2.6.1 Description .......................................................................................................... 13
       2.6.2 Advantages .......................................................................................................... 13
       2.6.3 Limitations ......................................................................................................... 13
       2.6.4 Feasibility .......................................................................................................... 14
       2.6.5 Summary ........................................................................................................... 14
   2.7 CAP Direct Delivery Water .......................................................................................... 14
       2.7.1 Description .......................................................................................................... 14
       2.7.2 Advantages .......................................................................................................... 14
       2.7.3 Limitations ......................................................................................................... 15
       2.7.4 Feasibility .......................................................................................................... 15
       2.7.5 Summary ........................................................................................................... 15
   2.8 Tohono O’odham Nation Groundwater Direct Delivery ............................................ 16
       2.8.1 Description .......................................................................................................... 16
       2.8.2 Advantages .......................................................................................................... 16
       2.8.3 Limitations ......................................................................................................... 16
       2.8.4 Feasibility .......................................................................................................... 17
       2.8.5 Summary ........................................................................................................... 17
   2.9 RO Water from the Yuma Desalting Plant ................................................................. 17
4.4.2 Advantages ........................................................................................................................... 39
4.4.3 Limitations .......................................................................................................................... 40
4.4.4 Feasibility .............................................................................................................................. 40
4.4.5 Summary .............................................................................................................................. 40
4.5 Community Water Company, Future Recharge Project ..................................................... 40
  4.5.1 Description ........................................................................................................................... 40
  4.5.2 Advantages ........................................................................................................................... 41
  4.5.3 Limitations .............................................................................................................................. 41
  4.5.4 Feasibility .............................................................................................................................. 42
  4.5.5 Summary .............................................................................................................................. 42

5 Summary and Conclusions ........................................................................................ 43
  5.1 Summary ........................................................................................................................................ 43
  5.2 Conclusions ..................................................................................................................................... 43

6 References ...................................................................................................................................... 47

7 Acronyms ......................................................................................................................................... 1

8 Qualifications of Key Technical Authors ................................................................................ 2

List of Tables

<table>
<thead>
<tr>
<th>Table</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Table 2-1</td>
<td>Production Range of the Yuma Desalting Plant</td>
</tr>
<tr>
<td>Table 3-1</td>
<td>Metropolitan Effluent Entitlement</td>
</tr>
<tr>
<td>Table 4-1</td>
<td>Permitted recharge capacity of localized CAP facilities (ac-ft/yr)</td>
</tr>
<tr>
<td>Table 4-2</td>
<td>Types of Underground Storage Facilities</td>
</tr>
<tr>
<td>Table 5-1</td>
<td>Summary of Alternative Water Sources</td>
</tr>
</tbody>
</table>
1 Introduction

The proposed Rosemont Copper Company (Rosemont) operation will require approximately 3,800 gallons per minute (gpm) (6,132 acre-feet per year (ac-ft/yr)) of process water for mining and processing operations (Stantec Consulting, 2009) and approximately 4 gpm of potable water for showers, drinking, and toilets. For the life of the facilities, the total requirement is estimated to be 105,000 ac-ft. The Arizona Department of Water Resources (ADWR) has granted Rosemont a Mineral Extraction and Metallurgical Processing Groundwater Withdrawal Permit (ME Permit) to withdraw 6,000 ac-ft/yr from the Santa Cruz River basin, which is located west of the Santa Rita Mountains and west of the proposed mine site. The aquifer is within the Upper Santa Cruz River sub-basin of the Tucson Active Management Area (AMA) groundwater basin (WestLand Resources, 2007).

To offset groundwater pumping from the Upper Santa Cruz River sub-basin, Rosemont is purchasing water from the Central Arizona Project (CAP) and recharging it to the Santa Cruz groundwater basin. The difference in volume between pumped and recharged water will be a positive net gain that enables Rosemont to offset total project pumping by 105 percent (WestLand Resources, 2007).

With a view to reducing or eliminating potential impacts related to groundwater withdrawals from the Upper Santa Cruz sub-basin near the communities of Green Valley and Sahuarita, Arizona, the Coronado National Forest (CNF) identified 19 alternative water sources that alone or jointly might provide sufficient water quantity and quality for the proposed Rosemont operation. The alternative sources identified by the CNF can be divided into three water types on the basis of use:

- Potable Water, 9 potential alternative sources,
- Non-potable Water, 5 potential alternative sources, and

This purpose of this report is to provide a brief review of each alternative water source that describes each alternative and summarizes its advantages and limitations, and the feasibility of acquiring and using that potential water. The availability and use of many of the alternatives require a legal opinion, which is not part of the present scope of work. Sections 2, 3, and 4 discuss the 19 alternative water sources. A Summary and Conclusions are provided in Section 5. References are provided in Section 6 and a list of acronyms is provided in Section 7. The qualifications of key authors are summarized in Section 8. All alternatives were evaluated by SRK technical staff under the direct supervision of Corolla K Hoag, R.G., unless stated otherwise.

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1 One acre-foot (ac-ft) equals approximately 325,851 gallons (gals). One acre-feet per year (ac-ft/yr) equals approximately 0.625 gallon per minute (gpm).
All of the areas reviewed in this report have limitations related to potential impacts to the environment, archaeological and historical sites, sensitive areas, viewscape, and so on—owing to the construction of a water delivery system: pipelines and purpose-built pumps for conveying water to the mine site and related infrastructure. All alternatives that include conveying groundwater to the Rosemont mine site will require construction of a reservoir or cistern for storage of the water.

For clarity, the terms alluvium and basin fill are used interchangeably in this report in their most generic form to include all unconsolidated to semi-consolidated material that will yield water to wells: stream and fan terrace deposits, floodplain alluvium, basin fill deposits, river alluvium, and lake-bed deposits. The term well field is used to describe at least one primary well, with at least one backup well in the same general location to provide water to an end user. There may be more than one well field associated with any alternative.

Bedrock underlying the alluvial deposits is not considered in this assessment owing to its low permeability and the unlikely event of locating a source of water with a sufficient yield and volume. Surface water flows (stream flow) also are not considered because surface water in Arizona generally is ephemeral and seasonal, even though there are perennial reaches in some streams.
2 Proposed Alternatives: Potable Water Sources

Rosemont personnel will require potable water for drinking, toilets, and showers. In addition, potable water can be used for industrial processes such as milling. The first five discussions in this section focus on using potable groundwater extracted from river channels. The remaining four discussions in this section consider other sources of groundwater.

Streams in Arizona are mainly ephemeral, severely limiting the use of surface water as a source of water. Nonetheless, owing to how surface water is defined in Arizona\(^2\) groundwater withdrawn from a river channel may be regulated by the Arizona surface water code enacted by the state legislature on June 12, 1919, now known as the Public Water Code (ADWR, 2010a).

A further consideration is that the areas considered in this section are within the Gila Adjudication—one of the two general Arizona stream adjudications. The purpose of these judicial proceedings is to determine the nature, extent, and priority of water rights across the entire river system. In addition to confirming existing state-based surface water rights, the adjudications will quantify and prioritize reserved water rights for Indian and non-Indian federal lands. The latter classification includes military bases, national parks and monuments, and national forests. The adjudications will also determine which wells are pumping appropriable underground water (subflow) and, therefore, are subject to the jurisdiction of the court. The Gila Adjudication is being conducted in the Superior Court of Arizona in Maricopa County (ADWR, 2010a). The legal standing of taking water from the stream channels discussed below is not considered in this report. The water is considered groundwater for purposes of these discussions, although a legal opinion would be required to ensure that determination.

This section evaluates the areas listed below as potential sources of potable water:

- Davidson Canyon,
- Ciénega Creek,
- Sonoita Creek,
- San Pedro River,
- Santa Cruz River,
- Arizona State Land Department lands adjacent to the Santa Cruz River,
- Other private property adjacent to the Santa Cruz River,
- Santa Rita Experimental Range groundwater,
- Central Arizona Project direct delivery,
- Tohono O’odham Nation groundwater direct delivery, and
- Reverse Osmosis treated water from the Yuma Desalting Plant.

\(^2\) “Waters of all sources, flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, whether perennial or intermittent, floodwaters, wastewaters, or surplus water, and of lakes, ponds and springs on the surface” (A.R.S. § 45-101) (ADWR, 2010b).
2.1 Davidson Canyon Groundwater

Groundwater in alluvial channel deposits in Davidson Canyon is considered in this section as a source of potable water.

2.1.1 Description

The proposed Rosemont open pit and waste disposal facilities will be located in the upper Davidson Canyon watershed. The distance between a well field in the Davidson Canyon drainage and the Rosemont mine site varies because the canyon is not a point source; rather, it is an elongated feature that trends nearly north from its heading on the eastern slope of the Santa Rita Mountains to its confluence with Ciénega Creek north of U.S. Interstate 10. The distance between source and use areas, therefore, would depend upon the location in the canyon selected to extract groundwater. This analysis assumes an average distance of 6 miles.

Although there are perennial reaches, stream flow in Davidson Canyon is generally ephemeral and seasonal. The Tetra Tech (2010) hydrogeologic study of Davidson Canyon indicates that groundwater recharge is seasonal and varies in the upper and lower portions of the watershed. Groundwater recharge in the Davidson Canyon watershed primarily occurs through recharge of precipitation along the base of the mountain front and within the surface-water drainages (Tetra Tech, 2010). Storm events create runoff that infiltrates to the unconsolidated sediments in the drainage bottoms; this water can saturate the alluvial sediments to recharge the regional groundwater system and can flow laterally and downgradient through the stream channel system. Springs occur in Davidson Canyon where groundwater from deep regional sources or shallow, perched sources discharge at the ground surface. All of the observed seeps and springs in Davidson Canyon had measured flows of less than one gallon per minute (Tetra Tech, 2010).

2.1.2 Advantages

The alluvial aquifers in Davidson Canyon are expected to be unconfined at most locations. The estimated hydraulic conductivities of the alluvium are very high. Storativity is considerably higher than that of the bedrock and is approximately equivalent to specific yield. The quality of water would be suitable for industrial purposes and likely would be suitable for use as potable water, although it would require testing. The treatment options are commonly used technology if treatment is required. The possibility of a relatively short distance between well field and the proposed mine site is an additional advantage to securing water from this location.

2.1.3 Limitations

The groundwater in local, shallow perched alluvial aquifers in Davidson Canyon may not be available on a year-around, sustainable basis owing to natural fluctuations on an annual and seasonal time scale. Two perennial, free-flowing reaches of Davidson Canyon were designated in 2008 by the Arizona Department of Environmental Quality (ADEQ) as an Outstanding Arizona Water under
Arizona Administrative Code (A.A.C.) R18-11-112 (Tetra Tech, 2010). The U.S. Geological Survey operated a stream gage in Davidson Canyon Wash 0.2 miles upstream of the Interstate 10 crossing near Vail, Arizona (and about 1,000 feet north of the perennial stretch) between 1968 and 1981. During that period, the channel conveyed stream flow approximately 84 days per year and the flow exceeded one cubic foot per second less than 5 percent of the time (Tetra Tech, 2010); this intermittently flowing section of Davidson Canyon would not provide an adequate water supply on an annual basis. Furthermore, a certificate of in-stream flow rights was granted by ADWR to Pima County Flood Control District in December 1993 (No. 89090.0000). Therefore, the extraction of groundwater from Davidson Canyon is unlikely to be permitted.

Were it permitted and a sustainable supply identified, the use of groundwater from Davidson Canyon would require a water delivery system consisting of well field(s), pumping station(s), a pipeline, and accessory infrastructure. A pipeline could not be buried along its entire length because of the occurrence of crystalline bedrock near the surface. A surface pipeline plus pumping station(s) to raise water to the elevation of the mine site would be a visual impact to visitors to the canyon and would be subject to vandalism. For drinking water supplies, the water quality would require testing to ensure that the U.S. EPA National Primary Drinking Water Standards are met; if it did not, the water would require treatment. Water rights would need to be acquired, as would multiple permits for a well field, pumping stations, and a pipeline. The wells could be impacted during periods of drought with the result that the supply might not be sustainable.

### 2.1.4 Feasibility

The primary limit on the feasibility for Davidson Canyon alluvium as a source of potable water is obtaining the necessary permits because reaches of the canyon have been designated *Outstanding Arizona Waters*. In addition, Davidson Canyon alluvium is unlikely to be feasible as a continuous, sustainable water supply owing to natural fluctuation on both an annual and seasonal basis.

### 2.1.5 Summary

The alternative of obtaining water from Davidson Canyon alluvial aquifer is attractive because of the relatively short distance required to transport the water. It is not likely a feasible alternative, however, because portions of Davidson Canyon have been designated an *Outstanding Arizona Water* by ADEQ, which may pose difficulties obtaining water rights, permits from ADWR, and building a water delivery system. Drought could impact the wells and the sustainability of the supply. A pipeline would impact the viewscape.

### 2.2 Ciénega Creek Groundwater

Groundwater in perched channel deposits in Ciénega Creek is considered in this section as a source of potable water. The recharge mechanisms in Ciénega Creek are similar to those described in Section 2.1.1 for Davidson Canyon.
2.2.1 Description

The distance between the Ciénega Creek drainage and the Rosemont mine site varies because the drainage is not a point source; rather, it is an elongated feature that flows in a northerly direction, principally on the east side of the Empire Mountains. The distance between source and use areas, therefore, would depend upon the location in the drainage selected to extract groundwater. This analysis assumes an average distance of 10 miles. Although some reaches of Ciénega Creek are perennial, the stream flow is generally ephemeral. A large stretch of Ciénega Creek flows through the Las Ciénegas National Conservation Area, which is administered by the U.S. Bureau of Land Management (BLM).

2.2.2 Advantages

Installing well field(s) in a sandy stream bottom of Ciénega Creek likely would produce a limited quantity of potable water. The quality of water, although it would require testing, likely would be suitable for use as potable water. If treatment was required, treatment options would be commonly used technology, such as sparging, filtration, and chlorination.

2.2.3 Limitations

Natural and seasonal variations may limit the availability of sustained well yields except possibly within perennial reaches of Ciénega Creek. If a sustainable supply could be identified and the rights to the water could be purchased, Rosemont would need to install a well field and water conveyance system. A pipeline to transport the water from a well field in the Ciénega Creek drainage would cross private and state lands, and it could not be buried along its entire length because of the occurrence of crystalline bedrock near the surface. A surface pipeline plus pumping stations to raise the water to the elevation of the mine site, would be a visual impact to visitors to the area and would be subject to vandalism. The water quality would require testing to ensure that the U.S. EPA National Primary Drinking Water Standards are met; otherwise, the water would require treatment. Water rights would need to be acquired, as would multiple permits for a well field, pumping stations, and a pipeline. It is likely that the reach of the stream that traverses the Las Ciénegas National Conservation Area would be excluded from access. A further limitation is that in 1997 the Bureau of Land Management (BLM) applied for an in-stream flow right under state of Arizona water laws. The removal of groundwater from Cienega Creek basin could negatively impact this pending water right (BLM, 2010).

2.2.4 Feasibility

The primary limit on the feasibility for Ciénega Creek alluvium as a source of potable water is obtaining the necessary permits. Ciénega Creek alluvium is unlikely to be feasible as a continuous sustainable water supply owing to natural fluctuation on an annual and seasonal basis. Further limiting the feasibility is the impacts due to the required well field and the water delivery system.
2.2.5 Summary

Perennial reaches of the Ciénega Creek drainage could provide a source for potable water for the proposed Rosemont. The volume of water withdrawn from the alluvial aquifer would require acquisition of water rights and permits, and a water delivery system with a pipeline length of at least 10 miles. Drought could impact the wells and the sustainability of the supply. A pipeline would impact the viewscape.

2.3 Sonoita Creek Groundwater

Groundwater from Sonoita Creek is considered in this section as a source of potable water. The occurrence and recharge mechanisms in Sonoita Creek are similar to those described in Section 2.1.1 for Davidson Canyon.

2.3.1 Description

The distance between Sonoita Creek and the Rosemont mine site varies because the drainage is not a point source; rather, it is an elongated feature. The distance between source and use areas, therefore, would depend upon the location along the creek selected to extract groundwater. An average distance can be considered 14 miles south of the proposed Rosemont mine site. Sonoita Creek flows southwest through a narrow valley surrounded by mountains, passing through large sections of Nature Conservancy, state, and private lands. Sonoita Creek is located in the southwestern part of the Ciénega Creek groundwater basin, and is a tributary to the upper Santa Cruz River. Some reaches of Sonoita Creek are perennial, while other reaches are intermittent. The streambed alluvium, composed of unconsolidated silt, sand, and gravel deposits, may be up to 90-feet thick. The creek was dammed in 1968 to form a 265-acre reservoir that is surrounded by Patagonia Lake State Park.

2.3.2 Advantages

Some reaches of Sonoita Creek are perennial, while other reaches are intermittent. Installing a well field in a sandy stream bottom along Sonoita Creek would likely produce the required quantity of potable water if a sustainable source could be located, sufficient yield could be maintained, and the water rights could be acquired. The quality of water, although it would require testing, likely would be suitable for use as potable water. If treatment were required, the treatment options are commonly used technology.

2.3.3 Limitations

A pipeline to transport the potable water from a well field along Sonoita Creek may cross private, state and federal land, and it could not be buried along its entire length because of the occurrence of crystalline bedrock near the surface. A surface pipeline plus pumping station(s) to raise the water to the elevation of the mine site would be a visual impact to visitors to the area and would be subject to vandalism. The water quality would require testing to ensure that the U.S. EPA water quality
standards are met; otherwise, the water will require treatment. Water rights would need to be acquired, as would multiple permits for a well field, pumping station(s), and a pipeline. The wells could be impacted during periods of drought with the result that the supply may not be sustainable.

2.3.4 Feasibility

The primary limit on the feasibility on the use of Sonoita Creek alluvium as a source of potable water is obtaining the necessary permits. Sonoita Creek alluvium is unlikely to be feasible as a continuous sustainable water supply owing to natural fluctuation on an annual and seasonal basis. Further limiting the feasibility is the required well field and the surface conveyance pipeline.

2.3.5 Summary

Selected reaches of Sonoita Creek could provide a source for potable water for the proposed Rosemont. The volume of water withdrawn from Sonoita Creek alluvium would require acquisition of water rights and permits and a water delivery system with a pipeline an estimated length of 14 miles. Drought could impact the wells and the sustainability of the supply. A pipeline would impact the viewscape.

2.4 San Pedro River Groundwater

Groundwater from basin-fill formations along the San Pedro River is considered in this section as a source of potable water.

2.4.1 Description

The San Pedro River flows north for nearly 175 miles, from near Cananea, Mexico to its confluence with the Gila River in Maricopa County, Arizona. It has been divided into two hydrologic units: the Upper San Pedro Basin (nearly 100 mile of river from Cananea, Mexico north to The Narrows) and the Lower San Pedro Basin (about 76 mile of river from The Narrows north to the Gila River). Nearly half of the river is perennial. Data from June 2009 revealed that 45 percent of the 150 river miles mapped that year had flowing surface water (The Nature Conservancy, Center for Science and Public Policy, 2011).

Most of the upper San Pedro River, from the international border to the town of St. David (a 40-mile reach encompassing nearly 57,000 acres of public land in Cochise County), is within land designated as the San Pedro Riparian National Conservation Area (SPRNCA), which is administered by the BLM. The primary purpose for the special designation is to protect and enhance the desert riparian ecosystem, one of the most important, intact riparian areas in the United States. This process resulted in the prohibition of groundwater pumping, off-road vehicle use, and mineral development, and a moratorium on cattle grazing within the SPRNCA, as well as the retirement of thousands of acres of agricultural land that were formerly used for irrigation.
The proposed Rosemont mine site is west of the Upper San Pedro River Basin although it is outside the boundaries of the San Pedro River watershed. The distance between the Upper San Pedro River and Rosemont varies because the river is not a point source, rather it is an elongated feature that flows generally south to north. The distance between source and use areas, therefore, would depend upon the location along the river selected to extract groundwater. This analysis uses a conservative straight-line distance of 30 miles. Routing around intervening mountains and basins would likely double the distance.

Groundwater would be derived by installing a well field in unconsolidated or loosely consolidated basin-fill formations. Purchasing water from existing groundwater wells would be subject to any pre-existing legal requirements by ADWR based on quantity and intended use of the water.

### 2.4.2 Advantages

Installing a well field in basin-fill formations along the San Pedro River would likely produce the required volume of potable water and yield, if yields are similar to those measured in the Lower San Pedro River Basin. The quality of water likely would be suitable for use as potable water, although it would require testing. If treatment were required, treatment options are a commonly used technology.

### 2.4.3 Limitations

The principal limitation is that “The BLM asserts a Federal Reserve In-Stream Flow Water Right to the flows of the San Pedro River under Public Law 100-696, November 18, 1988 [Riparian National Conservation Area designation]. Removing groundwater from the Upper San Pedro Basin would likely negatively impact this water right.” (BLM, 2010).

Additional limitations are that pipeline to transport potable water from a well field along the San Pedro River would cross private, state, and CNF lands, and it could not be buried its entire length because of crystalline bedrock near the surface along much of the route. A surface pipeline plus pumping stations to raise the water to the elevation of the mine site would be a visual impact to visitors to the area and would be subject to vandalism. The water quality would require testing to ensure that the U.S. EPA water quality standards are met; otherwise, the water would require treatment. Water rights would need to be acquired, as would permits for a well field, pumping stations, and a pipeline. The wells could be impacted during periods of drought with the result that the supply may not be sustainable.

### 2.4.4 Feasibility

Assertions by the BLM to a Federal Reserve In-Stream Flow Water Right to the flows of the San Pedro River would make this alternative infeasible. Further limits on the feasibility for extracting groundwater from basin fill of the Upper San Pedro River, for use as a source of potable water, are existing water rights associated with the SPRNCA designation of the river corridor; the requirement
to sustain the local desert riparian ecosystem, which might be impacted by groundwater withdrawal; and the inferred difficulty in obtaining the necessary permits. In addition, without substantial testing it may not be possible to maintain a continuous, sustainable water supply owing to natural fluctuation on an annual and seasonal basis.

2.4.5 Summary

The San Pedro River could provide a source for potable water for the proposed Rosemont mine; however, use of the water would require acquisition of water rights and groundwater withdrawal permits, and a water distribution system with a pipeline conservatively estimated to be 32 miles in length. Drought could impact the wells and the sustainability of the supply. A water-delivery system would impact the viewscape.

2.5 Santa Cruz River Basin Groundwater

Rosemont has acquired a 53-acre parcel along Santa Rita Road northwest of the Santa Rita Experimental Range within the Upper Santa Cruz sub-basin of the Tucson AMA groundwater basin. Rosemont also has secured a Mineral Extraction and Metallurgical Processing groundwater withdrawal permit (ME permit) to withdraw 6,000 ac-ft/yr from the Tucson AMA. The permit was issued by ADWR pursuant to A.R.S. Section 45-514. Groundwater extracted pursuant to an ME permit may be transported away from an active management area, such as the Tucson AMA, to another basin such as the Ciénega Basin, in accordance with A.R.S. Section 45-543.

In view of perceived impacts from extracting groundwater in the area near Sahuarita for use at the Rosemont mine site, this section of the report considers the general availability of groundwater from alternative areas of the Santa Cruz River groundwater basin, for use as an alternative source by Rosemont. Both private and Arizona State Land Department lands are included in this section.

2.5.1 Description

The Santa Cruz River Basin consists of approximately 21,250 km² in southern Arizona and 1,035 km² in Mexico (USACE, 2005). The Santa Cruz River basin is characterized by a wide valley broken by several broad, low hills and mountains. The basin area has a maximum length of approximately 175 miles and is about 80 miles wide at its widest point.

The Santa Cruz River is a tributary to the Gila River, which in turn is a tributary to the Colorado River. Groundwater enters the basin along the Santa Cruz River west of Nogales, flowing generally from south to north. Stream gradients in the basin range from about 29 feet per mile near Lochiel, to 18.5 feet per mile at Tucson, to 8 feet per mile at the Gila River confluence (USACE, 2005). Natural groundwater recharge occurs from infiltration of Santa Cruz River channel flow and mountain front recharge. The depth to bedrock in the center of the Upper Santa Cruz sub-basin exceeds 11,000 feet. The basin sediments make up multiple hydrologic units (typically three to five) with differing hydraulic properties.
The Santa Cruz River and principle tributaries are mostly ephemeral, being dry for long periods of time. Flows in the river are a result of direct or upstream precipitation or poor-quality irrigation drainage water in the basin. For a short distance downstream of Tucson, the river conveys a perennial flow of sewage effluent from a sewage treatment plant.

From the headwaters to the confluence with Los Robles Wash, the Santa Cruz River is a gaining river, meaning discharge generally increases with drainage area. Downstream from the confluence with the Gila River, the flood plain flattens and broadens out and becomes a losing river. In this reach flood flows are dramatically attenuated such that discharge decreases with an increase in drainage area. Flows originating in the upper reaches of the Santa Cruz River rarely reach the Gila River; when they do reach the Gila River, they are usually augmented by tributary flows originating in the lower part of the basin.

The distance between the Santa Cruz River Basin and Rosemont varies because the basin is a broad elongated feature, and therefore, would depend upon the location within the basin selected to extract groundwater. A straight-line distance between the center of the basin due west of Rosemont, across the Santa Rita Mountains to the proposed Rosemont mine site is approximately 7 miles. Going around the Santa Rita Mountains and developing a well field at other locations within the basin would be at a substantially greater distances. Groundwater would be derived by installing a well field or purchasing water from an existing user with groundwater rights. The use of groundwater would be subject to any pre-existing legal requirements by ADWR that would be based on quantity and intended use of the water.

The Arizona State Land Department (ASLD) holds 37.8 percent of the land in the Tucson Active Management Area in trust for public schools and other beneficiaries under the State Trust Land system. The department is required by the Arizona constitution to manage those lands to maximize benefits to state land trust beneficiaries. Within the Tucson AMA, the primary use is grazing (ADWR, 2010b). ASLD works with entities when developing land-use plans for the land it controls, evaluates proposals for the use of the land on the basis of those plans, and depends on local entities to implement them.

2.5.2 Advantages

Installing a well field in private or ASLD lands along the Santa Cruz River or purchasing water from an owner with existing water rights would likely provide the required volume and a sustainable yield of potable water. The quality of water would require testing because of effluent disposal in the river channel; if water treatment were required, treatment options are a commonly used technology.

2.5.3 Limitations

Rosemont would need to acquire land and possibly water rights either from others or the ASLD, apply for an ME Permit, and apply for the required permits for a well field and the water delivery
system. Rosemont would be required to prepare a plan for developing groundwater beneath ASLD land and secure ASLD plan approval.

Aquifer testing would be required to demonstrate a sustainable yield, although prolonged drought could impact the wells. Also, the water quality would require testing and likely would require treatment to ensure that the U.S. EPA National Primary Drinking Water Standards are met. Twenty-six groundwater contamination sites have been identified in the Tucson AMA. Volatile organic compounds associated with industrial and transportation activities are common at the contamination sites. In addition, elevated concentrations of certain naturally occurring constituents, including arsenic, fluoride and metals have been measured in wells. Elevated nitrate, sulfate and total dissolved solid concentrations have been detected in wells near mining and agricultural operations (ADWR, 2010b). Irrigation drainage to the river also contributes pollutants. The towns of Nogales and Tucson, Arizona and Sonora, Mexico discharge wastewater effluent to the river. This effluent recharges to the regional groundwater sources and locally affects water quality. Further, in 2009 the Tucson Water Department Water detected the trace organic contaminant, perfluorooctane sulfonate (PFOS) in several groundwater production wells. The origin of PFOS contamination in Tucson Basin groundwater is unknown although evidence suggests that municipal wastewater effluent that recharges the local aquifer via the Santa Cruz River is an important source. PFOS, the key ingredient in Scotchgard™ until 2003, is a anthropogenic perfluorinated chemical that is very persistent and a suspected human carcinogen.

A water delivery system with a pipeline of indeterminate length would be required to move the water from a site within the Santa Cruz River basin to the mine site. The pipeline could not be buried along its entire length because of the occurrence of crystalline bedrock near the surface in many areas. Above-ground reaches of the pipeline plus pumping stations to move and lift the water to the elevation of the mine site would be a visual impact and would be subject to vandalism. The waterline would cross private, state, and federal lands.

2.5.4 Feasibility

The primary limits on the feasibility of extracting groundwater from the Santa Cruz River basin fill are demonstrating a sustainable yield and obtaining the necessary water rights and permits. In addition, significant water treatment would be required to provide potable water. Further limiting the feasibility would be the required well field and a water-delivery system that would impact the viewscape.

2.5.5 Summary

Obtaining potable water from the Santa Cruz River basin is possible because it is likely that wells can be installed within the floodplain to provide a source of water. The cities of Nogales, Sonora and Tucson, Arizona discharge wastewater effluent to the Santa Cruz River. Therefore, treatment would be necessary to ensure that the quality meets acceptable standards. It would be necessary to obtain
water rights and permits from ADWR, and to build a water delivery system. Drought could impact the wells and the sustainability of the supply. A water delivery system with aboveground pipeline and pumping stations would impact the viewscape.

2.6 Santa Rita Experimental Range Groundwater

Groundwater from basin-fill formations and alluvial fan deposits beneath the Santa Rita Experimental Range facility is considered in this section as a source of potable water. Locations to the north and south of the facility are the main focus of this evaluation because of the reduced concentrations of groundwater users.

2.6.1 Description

The Santa Rita Experimental Range (SRER) consists of 53,159 acres approximately 35 miles south of Tucson and 13 miles east of Green Valley by road, at the foot of the northwest edge of the Santa Rita Mountains. SRER was established to protect the native rangeland from grazing, to conduct research on problems associated with livestock production and rangeland management, and to research ways to improve and manage the semiarid grasslands in the Southwest. SRER is the oldest research area, maintained by the U.S. Forest Service from 1903 until 1987, when administration of the site was taken over by the University of Arizona, College of Agriculture. Today it is regarded as a “laboratory to study southwestern agricultural sustainability for 100 scientists” (UANews, 2010).

2.6.2 Advantages

The SRER is a very large research facility that is likely to be underlain by adequate reserves and quality of groundwater to provide potable water to the mine site. By dead reckoning, an approximate center point of SRER is 7 miles west of the proposed Rosemont mine site, although the two sites are on opposite sides of the Santa Rita Mountains. The distance between a source of groundwater and mine site would depend upon the location of a well field. Sites at the north and south ends of the facility would be farther from the Rosemont mine site.

2.6.3 Limitations

Extracting groundwater does not appear to be a typical goal of SRER, which promotes itself as an outdoor laboratory to study rangeland and related disciplines. Given these goals, it seems unlikely that the University of Arizona would permit groundwater extracting at SRER. Provided an agreement could be negotiated with the University of Arizona to extract groundwater, aquifer testing would be required to demonstrate that well yields are sufficient to maintain a continuous sustainable water supply that would not be impacted by natural annual and seasonal fluctuations or by prolonged drought.

Although SRER and the mine site are approximately 7 miles apart by dead reckoning, a water delivery system of at least 25–30 miles would be required to move water from the SRER source to
the mine site because of the intervening Santa Rita Mountains. The waterline would cross private, state, and CNF lands. The exact length of a pipeline would depend upon the location of a well field. The pipeline could not be buried along its entire length because of the occurrence of crystalline bedrock near the surface in many areas. Above-ground reaches of the pipeline plus pumping stations to move and lift the water to the elevation of the mine site would be a visual impact and the pipeline would be subject to vandalism.

Water rights would need to be secured from the University of Arizona, and permits would be required from ADWR. Drought could impact the wells and the sustainability of the supply.

2.6.4 Feasibility

Using the Santa Rita Experimental Range for a source of potable water is not feasible owing to the purpose and goals of the SRER facility. Negotiating an agreement with the University of Arizona for extracting groundwater would be the principal limitation, as would obtaining the necessary permits from ADWR. Water treatment likely would not be required to provide potable water, were it possible to secure a contract with the university. Further limiting the feasibility of this alternative source of water is the required well field and the surface conveyance pipeline that would impact the viewscape.

2.6.5 Summary

The SRER covers a very large area, with a center-point distance of 7 miles from the proposed mine site, by dead reckoning. An adequate volume and quantity of water likely exists beneath SRER, but the use of this groundwater may not be in line with the purpose and goals of the SRER facility. A water delivery system would be required, and water rights and permits would be required. An aboveground pipeline would impact the viewscape.

2.7 CAP Direct Delivery Water

CAP direct delivery water is considered in this section as a source of potable water.

2.7.1 Description

CAP direct delivery, as the name implies, is the direct delivery of CAP water to an end user. Direct delivery is in contradistinction to recharge/recovery or replenishment uses of CAP water. The Water Consumer Protection Act, a local voter initiative passed in 1995, prohibits the direct delivery of CAP water to homes in Tucson, requiring instead that it be recharged to an aquifer. Other CAP customers, however, are able to deliver CAP water directly to their end users.

2.7.2 Advantages

Long-term CAP contract entitlements in 2008 totalled 1.415 million ac-ft, although the CAP system was capable of delivering 1.8 million ac-ft annually at that time. Thus, in 2008 CAP had excess
capacity that could have been available to Rosemont. Direct delivery of CAP water to the Rosemont mine site would offset the withdrawal of the groundwater.

2.7.3 Limitations

Rosemont is not an operational mine so it cannot use direct delivery CAP water at this time. Limitations to the future use of direct delivery CAP water to offset withdrawal of groundwater are: drought and/or declining flows in the Colorado River that could impact Rosemont’s contract for year-to-year CAP excess water in order to accommodate higher priority CAP water users; problems created by short-term, planned CAP delivery system outages; and the possibility of a system failure.

Direct delivery of CAP water would require construction of a treatment plant and a water delivery system. The pipeline would cross private, state, and CNF lands. The exact length of a pipeline would depend upon the pipeline route. The pipeline could not be buried along its entire length because of the occurrence of crystalline bedrock near the surface in many areas. Above-ground reaches of the pipeline plus pumping stations to move and lift the water to the elevation of the mine site would be a visual impact and the pipeline would be subject to vandalism. Direct delivery would require a cistern or reservoir for above-ground water storage and a backup water supply in the event of a system failure, short-term outages, and changes in CAP delivery priorities.

Another limitation is that mines in Arizona are not required to use CAP water. Instead, they are subject to strict water conservation requirements (Tucson Water, 2011).

2.7.4 Feasibility

There was excess capacity of CAP direct delivery water in 2008, which could have provided to Rosemont for a potable water supply. However, the following possible circumstances make it infeasible to rely on this source: drought and reduced flows in the Colorado River, future demands on CAP water that could limit the availability of water to downstream users, and the possibility of CAWCD changing delivery priorities. Further limiting the feasibility is the required surface conveyance pipeline with attendant infrastructure, and damage to the viewscape created by the pipeline and pumping stations.

2.7.5 Summary

The alternative of obtaining CAP direct delivery water to offset groundwater pumping is not feasible unless Rosemont could acquire a guaranteed CAP allocation of M&I water for the life of the mine. In addition, direct delivery of CAP water would require a cistern or construction of a reservoir for water storage, a treatment plant, and a pipeline and water delivery system.

2.8 Tohono O’odham Nation Groundwater Direct Delivery

The Tohono O’odham Nation has groundwater resources, in addition to CAP allocations. This alternative evaluates the use of Nation groundwater at the Rosemont mine site.

2.8.1 Description

The Tohono O’odham Nation (Nation) is situated west of the proposed Rosemont mine site, with the Buenos Aires National Wildlife Refuge, Santa Cruz River sub-basin, and Santa Rita Mountains intervening. Its four non-contiguous segments of the reservation total more than 2.8 million acres, comparable in size to the state of Connecticut. Because of its size, the distance between Nation lands and the Rosemont mine site varies considerably. The straight-line distance between the Nation’s capital, Sells, Arizona, and the mine site is 67 miles. This analysis reviews the potential for obtaining potable water from the San Xavier District, which is an average distance of 25 miles from the mine site. This alternative would extract groundwater from basin-fill formations using an existing groundwater well field or developing a new well field.

2.8.2 Advantages

With testing, a source of groundwater with adequate volume and yield might be located within the San Xavier District and a well field installed. It is not likely that the groundwater would require treatment, but common technologies are available if treatment is required.

2.8.3 Limitations

As a hedge against drought the San Xavier District uses or will begin to use CAP water for in-channel, groundwater recharge. The District and the BLM believe that replenishment of the aquifer with CAP water will ensure the reliability of the water supply available to the San Xavier Cooperative Farm during short-term, planned CAP delivery system outages. From that plan it might be inferred that an adequate supply of groundwater for District use is questionable. There is not a major drainage in the San Xavier District and, therefore, it may be problematic to locate a continuous sustainable water supply.

Another limitation would be the unlikely possibility of securing a sustainable source of water in times of drought. Water would need to be available in excess of that required by the District for residential, stock and agricultural uses, and water rights would need to be acquired from the Nation to secure that water on a long-term basis. It is possible other governmental entities may be involved in such negotiations.

Water treatment may be required to provide potable water and a well field would be needed to once a suitable source was identified. A water delivery system (pumping stations to move the water and raise it to the elevation of the mine site, a pipeline, and other infrastructure) would need to be built. A pipeline to transport the water from the San Xavier District to the Rosemont mine site could not be
buried along its entire length in areas where crystalline bedrock is near the surface. The waterline would cross private, state, Nation, and CNF lands. The above-ground segments of a pipeline and pumping stations would be a visual impact and subject to vandalism. The water quality would require testing to ensure that it meets the U.S. EPA National Primary Drinking Water standards; otherwise, the water would require treatment. The wells could be impacted during periods of drought.

2.8.4 Feasibility

The feasibility of acquiring a source of potable water from the San Xavier District of the Tohono O’odham Nation appears unlikely given the possibility that there is an insufficient volume of groundwater for the Nation’s own use.

2.8.5 Summary

The alternative of obtaining potable water from a Tohono O’odham Nation groundwater source likely would require purchasing groundwater from the Nation from an existing well field. It is probable that a potable water source could be identified and wells could be installed to provide potable water; it is further likely that the water quality would be acceptable or the water could be treated to acceptable standards. The wells would require a Tohono O’odham Nation contract, and the location would be subject to approval by the Nation. The transport distance could be on the order of 25 miles and would involve a water delivery system.

2.9 RO Water from the Yuma Desalting Plant

Reverse osmosis (RO) water from the Yuma Desalting Plant is evaluated in this section as a source of potable water.

2.9.1 Description

Yuma is approximately 235 miles southwest of the proposed Rosemont. The Yuma Desalting Plant (YDP) was constructed by the Bureau of Reclamation (USBR) under authority of the Colorado River Basin Salinity Control Act of 1974. Construction of the plant was completed in December 1991. As constructed, the plant has a capacity of 72.4 million gallons per day (mgd) (Yuma Desalting Plant/Ciénega de Santa Clara Workgroup, 2005). Prior to May 2010, the YDP had been operated on two only occasions: for 6 months in 1992–1993 at one-third capacity and for a 90-day Demonstration Run in 2007 at 10 percent capacity.4

The plant was built to treat agricultural drainage from the Wellton-Mohawk Irrigation & Drainage District (WMIDD), which averages more than 100,000 ac-ft/yr, because the saline drainage water would have raised the salinity of the Colorado River to an unacceptable level for delivery to

4 The YDP was constructed as three units and therefore can be run at 1/3, 2/3, or full capacity.
Mexico.\textsuperscript{5} Due to surplus, and then normal water-supply conditions in the Colorado River basin over the years, however, the untreated drainage water was bypassed around the Mexican diversion at Morelos Dam and allowed to flow into and create the Ciénega de Santa Clara, a wetlands in Mexico.

In 2009, as a result of recent drought and 50 percent depletion of storage in the two primary reservoirs, Lake Mead and Lake Powell, the USBR developed a plan for a pilot run of the plant to gather cost and performance data. The pilot program started on May 3, 2010 and in March 2011 USBR officials said the desalting plant operated continuously for the year without any substantial problems or down time, demonstrating the potential to augment Lower Colorado River supplies. The purpose of the pilot run was to operate the plant at one-third capacity for a period of one year to collect performance and cost data needed to consider potential future operation of the plant. The program was funded by the USBR, in collaboration with The Metropolitan Water District of Southern California, Central Arizona Water Conservation District and Southern Nevada Water Authority. At the conclusion of the pilot test the Yuma Sun (2011) reported, “Now the Yuma Desalting Plant will be mothballed once again while the results of the test are evaluated and options are considered for its use.”

The USBR (2011) reported, “The YDP recycled about 30,000 acre-feet of irrigation return flow water which was included in Colorado River water deliveries to Mexico. This resulted in the same amount of water conserved in Lake Mead and available to the sponsoring water agencies when needed in the future.” Before the pilot run started, an international agreement was reached with Mexico that provided additional water to the Ciénega de Santa Clara wetlands during the year-long program\textsuperscript{6}.

### 2.9.2 Advantages

Treating water by RO is well-known and readily available technology. It is one of the most effective methods of not only removing salt ions, but bacteria and viruses as well. The plant capacity is sufficient to provide potable-water for the proposed Rosemont mine. The YDP recently underwent a pilot run. It produced more desalinated water from agricultural runoff than the 70 percent expected, and it concluded ahead of schedule and under budget.

Since the YDP is a process plant, the quantity and salinity of the product water and reject stream can be made to vary over a broad range. Table 2-1 illustrates some of the production ranges of the YDP.

\textsuperscript{5} Per treaty obligation, the United States is to ensure delivery of 1,500,000 ac-ft of water each year.

\textsuperscript{6} In what was to have been a temporary solution to the water-surplus problem, the 100,000 ac-ft/yr of water that flowed into the Ciénega de Santa Clara did not figure into the Mexican Colorado River allocation during those years (AWR, 2003).
Table 2-1  Production Range of the Yuma Desalting Plant

<table>
<thead>
<tr>
<th></th>
<th>YDP not operating</th>
<th>One third capacity operation</th>
<th>Two thirds capacity operation</th>
<th>Full capacity operation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Product water exiting the YDP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity (ac-ft)</td>
<td>23,438</td>
<td>42,392</td>
<td>64,598</td>
<td></td>
</tr>
<tr>
<td>Salinity (ppm)</td>
<td>122</td>
<td>148</td>
<td>160</td>
<td></td>
</tr>
<tr>
<td><strong>Reject stream from the YDP</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity (ac-ft)</td>
<td>8,669</td>
<td>15,679</td>
<td>23,892</td>
<td></td>
</tr>
<tr>
<td>Salinity (ppm)</td>
<td>7,818</td>
<td>7,747</td>
<td>7,715</td>
<td></td>
</tr>
<tr>
<td><strong>Water sent to the Colorado River</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity (ac-ft)</td>
<td>26,868</td>
<td>48,408</td>
<td>74,557</td>
<td></td>
</tr>
<tr>
<td>Salinity (ppm)</td>
<td>451</td>
<td>465</td>
<td>499</td>
<td></td>
</tr>
<tr>
<td><strong>Flow to the Cienega at the International border</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Quantity (ac-ft)</td>
<td>109,100</td>
<td>82,232</td>
<td>60,692</td>
<td>35,543</td>
</tr>
<tr>
<td>Salinity (ppm)</td>
<td>2,820</td>
<td>3,347</td>
<td>4,093</td>
<td>6,206</td>
</tr>
</tbody>
</table>

Source: Annual flows from 2004 (Yuma Desalting Plant/Ciénega de Santa Clara Workgroup, 2005)

2.9.3 Limitations

Traditionally RO plants are used to produce potable water. The YDP is not authorized or equipped for this use. Instead the YDP is authorized and equipped to desalinate a portion of the bypass flow from the WMIDD to meet treaty obligations for delivery of Colorado River water to Mexico.

The YDP has been operated two times since its completion in 1991, for testing purposes only. Although maintained during the intervening years, the cost and operability of the YDP were tested in a year-long pilot program and the test results are now being evaluated. If the plant is made operational on a continuous basis, there appear to be multiple options for disposition of the treated water. The most obvious ones are:

- Discharged into the Colorado River for inclusion in treaty deliveries to Mexico;
- Combined with untreated irrigation drainage water and the total amount discharged into the Colorado River for inclusion in treaty deliveries to Mexico; and
- Purchased by the Arizona, California, and Nevada water authorities that cooperated in the USBR pilot test (and others), through contracts secured with the USBR.

As a source of potable water for the proposed Rosemont mine, the purpose of the desalting plant would need to be revised and the plant would need to become operational on a routine and continuous basis. Transport of treated, potable water to the proposed Rosemont mine site would require a 235-mile waterline (or utilizing an existing pipeline where present). The waterline would cross private, state, and CNF lands. Above-ground sections of the pipeline would be a visual impact
and subject to vandalism. Rosemont would be required to negotiate a water contract with the USBR, which manages the plant, as well as to secure multiple permits and rights-of-way for construction of pumping stations, a pipeline, and accessory infrastructure.

### 2.9.4 Feasibility

Utilizing the Yuma Desalting Plant is not a feasible alternative. The principal limitation is that the YPD is approximately 235 miles from the proposed Rosemont mine site. Other limitations that render the alternative infeasible are that larger state and municipal water authorities might have superior entitlement to available water supplies, and draught and reduced flows in the Colorado River might cause reallocation of water supplies.

### 2.9.5 Summary

RO is a readily available technology for desalting water. However, treated water from the YDP is not yet readily available because the plant is not fully operational. Should the plant be operated at full capacity, and should the purpose of treating saline water be redefined, the water required by the Rosemont mine would need to be purchased from the USBR and transported from Yuma to the mine site, an approximate distance of 235 miles.
3 Proposed Alternatives: Non-potable Water Sources

This section of this report evaluates proposed alternative sources of non-potable water. Rosemont will require approximately 5,000 ac-ft/yr of process water (WestLand Resources, 2007). The non-potable alternatives considered in this section are local community wastewater effluent and Tucson reclaimed water; Sierrita Mine sulfate plume water; Department of Interior effluent and managed recharge credit recovery; deep aquifer brackish water; and sea water.

3.1 Wastewater Effluent or Reclaimed Water

This section evaluates the alternative of using wastewater effluent from the municipalities of Green Valley, Nogales, and Tucson or reclaimed water from the City of Tucson in lieu of pumping groundwater for use at the proposed Rosemont mine. Tucson and Green Valley are in the Tucson AMA and Nogales is in Santa Cruz AMA. The Rosemont mine is situated only partly within the Tucson AMA (WestLand Resources, 2007).

The alternatives in this section are described separately. The advantages and limitations are described jointly because the advantages and limitations are similar for each. The information used to prepare this section was compiled from public documents and data, a telephone conversation and email with Ms. Karen Dotson⁷ and the observations of SRK technical staff at various domestic and foreign mining operations.

3.1.1 Description of Wastewater Effluent

Two types of water may be discharged by a wastewater treatment plant: effluent and reclaimed water. Both are non-potable. Effluent is wastewater that has been treated to minimum standards that enable discharge to the environment, per the Arizona Pollutant Discharge Elimination System.

Pima County owns and operates the wastewater system for most of Pima County. A total of 72,588 ac-ft of effluent was produced in eastern Pima County in 2007, of which 68,299 ac-ft (94 percent) were produced in the metropolitan area (City of Tucson and Pima County, 2009a). Table 4.1 shows how 2007 effluent was distributed among the metropolitan entities having effluent entitlements.

The community currently has the following three major methods of effluent utilization/disposal (City of Tucson and Pima County, 2009a):

- Use in the City of Tucson reclaimed water system,

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⁷ Ms. Dotson is the Tucson Water Backflow Prevention/Reclaimed Water Program Coordinator. The conversation and email exchange occurred with C. Stone, R.G. (SRK) on October 14, 2010.
• Discharge to the Santa Cruz River, and
• Recharge in constructed facilities, the Santa Cruz River, and at the various outlying wastewater facilities.

### Table 3-1 Metropolitan Effluent Entitlement

<table>
<thead>
<tr>
<th>Metropolitan Effluent Entitlement</th>
<th>Based on 2007 Effluent Production – 68,299 ac-ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>SAWRSA:</td>
<td>28,200</td>
</tr>
<tr>
<td></td>
<td>40,099</td>
</tr>
<tr>
<td>CEP:</td>
<td>10,000</td>
</tr>
<tr>
<td></td>
<td>(Currently 0)</td>
</tr>
<tr>
<td></td>
<td>30,099</td>
</tr>
<tr>
<td></td>
<td>(40,099)</td>
</tr>
<tr>
<td>10%</td>
<td>90%</td>
</tr>
<tr>
<td>County</td>
<td>Providers</td>
</tr>
<tr>
<td>3,010 (4,010)</td>
<td>27,089 (36,089)</td>
</tr>
<tr>
<td>Oro Valley</td>
<td>Tucson</td>
</tr>
<tr>
<td>1,697 (2,348)</td>
<td>23,450 (31,055)</td>
</tr>
<tr>
<td>Metro</td>
<td>1,942 (2,686)</td>
</tr>
</tbody>
</table>

Source: City of Tucson and Pima County, 2009a. The values shown in parentheses are the entitlements in 2007.

Values are in ac-ft

SAWRSA = Southern Arizona Water Rights Settlement Act

CEP=Conservation Effluent Pool

### Green Valley Wastewater Effluent

The Green Valley Wastewater Treatment Plant (WWTP) is located south of Tucson, on the east side of the Santa Cruz River, within the Tucson AMA. It is owned and operated by Pima County. The Green Valley WWTP service area extends along both sides of Interstate 19. The facility primarily serves the retirement community of Green Valley and a small southern part of the Town of Sahuarita, both on the west of the Santa Cruz River, but it also serves some properties east of the river. Land use in the service area is primarily residential and commercial. The estimated service-area population in 2005 was 17,469 (PAG, 2006).

The Green Valley WWTP has a design capacity of 4.1 million gallon per day (mgd) (4,600 ac-ft/yr), with two treatment trains. The older, aerated lagoon system is a 2.1 mgd (2,350 ac-ft/yr) treatment process that produces Class B effluent. The newer, Biological Nutrient Removal Oxidation Ditch is a 2.0 mgd (2,250 ac-ft/yr) treatment process that produces Class A+ effluent. Effluent is delivered to
the Robson Quail Creek recharge basins, disposed of via percolation, and reused on site (PAG, 2006).

**Nogales Wastewater Effluent**

The Nogales International Wastewater Treatment Plant (NIWWTP) is located on the east side of Highway 19, south of Green Valley and north of the community of Rio Rico. It is the primary treatment facility in the Santa Cruz AMA. The facility has an average monthly flow of 17 mgd (19,100 ac-ft/yr) (ADEQ, 2009), which comes from Rio Rico, Arizona; Nogales, Arizona; and Nogales, Sonora, Mexico. Several smaller package treatment plants provide treatment to developments within the Santa Cruz AMA, but with the exception of the Tubac Golf Resort, do not provide reused effluent (reclaimed water).

The USBR (2010) reported that treated effluent generated by the NIWWTP is a major source of water in the watershed. Effluent is discharged to the Santa Cruz River, however, because the shallow depth to bedrock and too few surface reservoirs make water storage in the watershed problematic. The Nogales Area Water Storage study is being conducted by the USBR, ADWR, and the City of Nogales to address these issues.

**Tucson Wastewater Effluent**

Tucson Water has three sources of water physically available for their use, one of which is effluent. The situation was described as follows (Tucson Water, 2008):

“In 2006, 69,067 ac-ft of effluent were produced from the metropolitan wastewater treatment plants in the Tucson area. …the City of Tucson had entitlement to a total of 31,536 ac-ft (46 percent) of this effluent. Of this total, 11,983 ac-ft were reused as reclaimed water within the Tucson Water service area while the remainder (19,553 ac-ft) was discharged to the Santa Cruz River. In contrast, all of the effluent annually entitled to the Secretary of the Interior (28,200 ac-ft/yr) was discharged to the river and constitutes the majority of the perennial effluent flow observed in the Santa Cruz River.”

A fact sheet prepared by Tucson Water (2010) provides the following information on ownership of 2009 effluent in the Tucson Water service area, which totalled 66,411 ac-ft.

- City of Tucson 29,570 ac-ft
- Pima County 3,821 ac-ft
- Secretary of Interior (USBR) 28,200 ac-ft
- Oro Valley 2,242 ac-ft
- Metro Water 2,578 ac-ft
Updated projections of wastewater generation through 2030 indicate that annual effluent availability within the Long-Range Planning Area could approach 118,900 ac-ft/yr by 2030, and that the City of Tucson would have annual entitlement to approximately 61,000 ac-ft/yr by 2030 (Tucson Water, 2008).

3.1.2 Description of Reclaimed Water

Reclaimed water is effluent that has undergone additional treatment that makes it suitable for use in prescribed manners. In Arizona there are five classes of reclaimed water, depending upon the level of treatment. Class A and Class A+ reclaimed water have undergone the highest level of treatment: secondary treatment, filtration, nitrogen removal treatment, and disinfection. In addition, Class A+ reclaimed water requires a total nitrogen concentration of less than 10 milligram per litre. This level of treatment is required for reuse applications where there is a relatively high risk of human exposure to potential pathogens in the reclaimed water.

Tucson Reclaimed Water

Rosemont requires approximately 3,800 gallons per minute (6,132 ac-ft/yr) of fresh water for mining and processing operations (Stantec Consulting, 2009, p. 1). The reclaimed water produced by the City of Tucson is Class A, and soon it will be treated to the cleanest level, Class A+ (K. Dotson, personal communication, 14 October 2010).

Regarding long-term availability, Tucson Water (2008) stated:

“A key long-term planning assumption is that the reclaimed water system will supply at least 9 percent of Tucson Water’s projected total demand through 2050. Accordingly, reclaimed water demand in the Tucson Water service area is projected to increase from 11,983 ac-ft per year in 2006 to approximately 24,000 ac-ft per year in 2050.”

The Tucson Water reclaimed system currently utilizes 42 percent of Tucson Water’s effluent allocation and 27 percent of Pima County’s allocation (City of Tucson and Pima County, 2009a). In calendar year 2009, 17,249 ac-ft of reclaimed water was delivered to Tucson Water customers (Tucson Water, 2010).

3.1.3 Advantages

The use of effluent or reclaimed water is well suited for mining and processing operations—especially for the milling and concentrating facilities. Many mines in Arizona use water from their wastewater treatment facilities, although this component of water typically comprises a small percentage of their water needs. The majority of reclaimed water used at a mine site is pumped back from reclaimed-water ponds on conventional tailings facilities. The major advantage to using effluent or reclaimed water is that it limits the need to pump groundwater.
3.1.4 Limitation

The use of effluent or reclaimed water for mining and processing at Rosemont assumes that a sufficient volume of effluent or reclaimed water could be purchased and further, that it would be available on a guaranteed, continuing basis from one or more wastewater treatment plants during Rosemont’s LOM. Existing long-term contracts with private parties typically secure the reclaimed water for reuse within the community that generates the water. As of 2007, the Green Valley wastewater treatment plant did not have a reclaimed delivery system for Green Valley effluent (Huckelberry, 2007). The NIWWTP system does not have a reclaimed water delivery system, and the Tucson Water reclaimed water delivery system does not extend to the area of the mine site.

Another limitation is that climate change and drought could potentially affect local rainfall and future flows of the Colorado River. Reduced flows in the river could make the supply of effluent to the mine site vulnerable if local municipalities increased their demand for available effluent.

The use of effluent or reclaimed water also is limited by the lack of infrastructure to deliver it to the mine site. If sufficient water could be purchased, transporting the required volume of water would require construction of a pipeline from a WWTP or pumping station in Tucson, Green Valley, or Rio Rico. The length of pipeline, by dead reckoning, would approach 40 miles from Tucson, 15 miles from Green Valley, and nearly 30 miles from the NIWWTP in Rio Rico. These distances are conservative because the pipeline would need to skirt or cross the intervening mountains, adding substantially to the pipeline length and attendant environmental damage. Additionally, the pipeline would cross private, state, and federal land, and potential archaeological sites; could not be buried along stretches where the depth to bedrock is shallow and, therefore, it would be subject to vandalism; and would require extensive permitting to construct and operate. In addition, a filtration plant would have to be built at the mine site or somewhere along the pipeline, and sludge disposal would be required. Should it be possible to purchase both effluent and reclaimed water, two separate conveyance systems might be required.

3.1.5 Feasibility

Utilizing wastewater effluent or reclaimed water for Rosemont process water is feasible for a portion of the required 5,000 ac-ft/yr. Rosemont would need to secure a long-term guaranteed source.

3.1.6 Summary

The use of reclaimed water for mining and processing operations at the Rosemont mine is unlikely to cause any difficulties in those operations, and its use would limit or preclude withdrawal of potable water from the groundwater aquifer in the Upper Santa Cruz Basin. A water delivery system would be required to transport water from the source(s) to the proposed mine (an approximate pipeline distance of up to 50 miles). While technically feasible, the use of reclaimed water would depend upon available excess capacity and the ability to obtain guaranteed water rights and permits.
3.2 Sierrita Mine Sulfate Plume Water

This section discusses using sulfate-impacted groundwater from the Sierrita mine as an alternative water source.

3.2.1 Description

Operation of tailings impoundments at the Freeport-McMoRan Copper & Gold Sierrita Operations (Sierrita) has resulted in a plume of sulfate-impacted groundwater that contains between 1,000 mg/L and 2,000 mg/L sulfate (ADEQ, 2006) and has impacted down-gradient wells owned by the CWC. In June 2006, Sierrita signed a Mitigation Order on Consent with the ADEQ by which Sierrita voluntarily committed to practically and cost effectively provide the owner/operator of an existing drinking water supply, that was impacted by the sulfate plume, with a drinking water supply with sulfate concentrations less than 250 parts per million (Sierrita, 2010). The 250 mg/L limit is based upon an EPA Secondary Maximum Contaminant Limit of 250 mg/L that is a taste consideration and is not federally enforceable (ADEQ, 2006).

This alternative proposes to convey impacted tailings water from pumpback wells at the toe of the tailings facility to a newly constructed large water cistern or tank and from there convey it in a pipeline to the Rosemont mine site.

3.2.2 Advantages

Tailings reclaim water is routinely recycled back to mill operations at similar operations in Arizona and elsewhere. The water is pumped back to the mill facilities from collection ponds downgradient of the tailings storage facilities, pumpback wells along the toe of the tailings storage facilities, or from pump barges on the impoundment. There are well-known treatment technologies for the removal of elevated sulfate from water. For use as process water, the sulfate-impacted groundwater likely would not require treatment unless other constituents were problematic.

3.2.3 Limitations

Sierrita is currently recycling all of the impacted tailings water for reuse in their processing circuit. Therefore, impacted water is not available from Sierrita for use at Rosemont. If excess tailings water were available, it would require transporting the water to the Rosemont mine site. The pipeline would require an approximately 16-mile corridor that would cross Interstate I-19, as well as private, state, and CNF land, through potentially sensitive areas such as archaeological sites. Moving the water to the Rosemont mine site would require the use of additional electric power and the construction of purpose-built pumping station(s) to overcome elevation changes, expansion of the line, and line loss due to friction. Permits would be required for construction of pumping stations, a pipeline, and accessory infrastructure.
3.2.4 Feasibility

Sierrita sulfate impacted groundwater is not feasible because Sierrita recycles all of the water for reuse in their processing circuit.

3.2.5 Summary

Excess sulfate-impacted groundwater is not available from Sierrita for use as process water at the Rosemont mine. Were excess water available it would require construction of a water delivery system that would cross I-19, private, state, and CNF land and permits for the construction.

3.3 Secretary of Interior Effluent and Managed Recharge Credit Recovery

The following section discusses the use of Southern Arizona Water Rights Settlement Act (SAWRSA) effluent entitled to the Secretary of the Interior and the managed recharge credits received as an alternative water source for use at the Rosemont mine.

3.3.1 Description

The Southern Arizona Water Rights Settlement Act of 1982 (Public Law 97-293) (SAWRSA), a water rights settlement with the Nation, and the Arizona Water Settlements Act of 2004 (Public Law 108-451), obligate up to 28,200 ac-ft/yr of secondary treated effluent produced at Tucson area wastewater treatment facilities to the U.S. Secretary of the Interior, through the USBR, for the Nation. The purpose of obligating the effluent is to assist in implementation of the settlement.

All of the effluent annually entitled to the Secretary of the Interior (28,200 ac-ft) is discharged to the Santa Cruz River and constitutes the majority of the perennial effluent flow observed in the river (Tucson Water, 2008). The USBR receives Managed Recharge Credit for 50 percent of the water recharged. The USBR has determined that current recharge projects do not fully utilize the SAWRSA effluent. Consequently the agency has implemented the SAWRSA—Effluent Utilization program to fully utilize the 28,200 ac-ft/yr of treated effluent in other Tucson projects (USBR, 2010).

3.3.2 Advantages

Excess effluent appears to be available for use in other projects. Secondary treated effluent can be used successfully at the proposed mine site.

3.3.3 Limitations

The USBR seeks to fully utilize the 28,200 ac-ft/yr of effluent in other Tucson projects. If it is incumbent upon the agency to use the effluent in the Tucson area, it likely would not be made available for use at the proposed Rosemont mine site. In addition, legal impediments may exist to
obtaining a contract for a secure source of SAWRSA effluent or to purchasing Recharge Credits for later use.

If a guaranteed source of water could be secured, a pipeline would be required to transport the water from the municipal treatment plants to the mine site, a straight-line distance of 40 miles. The pipeline would cross Interstate I-19 and possible I-10, as well as private, state, and CNF land, through potentially sensitive areas such as archaeological sites. Moving the water to the mine site would require the use of additional electric power and the construction of purpose-built pumping station(s) to overcome elevation changes, expansion of the line, and line loss due to friction. Permits would be required for construction of pumping stations, a pipeline, and accessory infrastructure.

### 3.3.4 Feasibility

Use of SAWRSA effluent is not feasible, principally because of the likely legal impediments to purchasing the effluent for use at Rosemont.

### 3.3.5 Summary

SAWRSA effluent obligated to the Secretary of the Interior for implementation by the Southern Arizona Water Rights Settlement Act, for the Tohono O’odham Nation, may be available, but the use of this effluent would require securing a long-term contract, constructing a pipeline to transport the water a minimum distance of 40 miles, and overcoming potential legal impediments to a contract.

### 3.4 Deep Aquifer Brackish Water

This alternative describes the advantages and limitations of using deep aquifer brackish groundwater as an alternative source of water for process water at the Rosemont mine. Brackish water typically has a dissolved solids concentration between 1,000 and 10,000 milligrams per liter (mg/L, or parts per million (ppm)).

#### 3.4.1 Description

Deep brackish groundwater aquifers have been identified in many parts of Arizona, although not in the Santa Cruz or San Pedro river basins. Working with the Central Arizona Water Conservation District, Montgomery & Associates (2008) identified five areas with the potential for developing more than 10,000 ac-ft/yr from each, in a sustainable manner. Using that definition, they estimated more than 600,000,000 ac-ft of groundwater is stored in Arizona aquifers, generally at depth of less than 1,200 feet. Evaporite deposits, they concluded, are responsible for most salinity in northern Arizona aquifers, and agricultural irrigation is primarily responsible for brackish groundwater in southern Arizona. However, evaporites are also a factor in southern Arizona basins, such as Safford, Picacho, and the West Salt River. While there are dozens of brackish groundwater areas in Arizona, the M&A (2008) investigation suggests that only five or six areas have sufficient volume of brackish
water in storage to be of near-term interest for development of desalination projects. The area closest to the Rosemont mine site is located in Cochise County, straddling I-10. Nonetheless, this is a generalized discussion of water quality and water transport from a well field near this site to the proposed Rosemont because closer sources of brackish water might exist.

This alternative would require identifying a deep aquifer with brackish water, obtaining the needed water rights and permits, developing a well field to extract the water, treating the water, disposing of sludge from the treatment plant, and conveying it to the Rosemont mine site. Water treatment requirements and sludge disposal methods would depend upon the quality of the water (dissolved solids concentration) extracted from the deep aquifer and on the ore and the process used. There is usually some tolerance for lower quality process water, although there is no specific standard. The water would need to be tested against the process requirements to verify there is no interference with the process, and metallurgical testing would be required. Pumping requirements would depend upon distance and terrains crossed, such as those involving ecologically sensitive areas and elevation changes.

### 3.4.2 Advantages

The use of brackish water from a deep aquifer for mining and process water at the proposed Rosemont mine site is possible because such sources of water are known to exist beneath certain basins in southern Arizona, and in selected instances, brackish water can be used without treatment or with limited treatment. There are an estimated 60 to 75 million ac-ft of brackish groundwater in storage in the Gila River basin south of Phoenix, extending into Pinal County, with dissolved solids between 1,000 and 5,000 mg/L (M&A, 2008). The Willcox basin area in Cochise County contains an estimated 45 million ac-ft of brackish groundwater in storage, with similar concentrations of dissolved solids. Treatment technologies are commonly available. Pumping technologies and infrastructure are common and long distance pipelines are a common method of transporting fluids.

### 3.4.3 Limitations

Water rights would be required to extract brackish groundwater from a deep aquifer, and a permit would be required from ADWR/CDWR to pump approximately 5,000 ac-ft/yr. Pumping the required volume of water at a rate of 3,800 gpm from a deep aquifer would require considerable power consumption and specialized wells and pumps because the brine would be corrosive. Water treatment requirements and the volume of sludge to be disposed of would be unknown until a suitable deep aquifer is identified, and the water tested.

M&A (2008) pointed out the following major limitation:

“...in Arizona is the state’s classification of all aquifers as “Drinking Water Aquifers,” including those where salinity substantially exceeds that of sea water, or where yield rates to wells are less than one gallon per minute. Because brine injection into deep, saline aquifers is often the best, or only, feasible method of brine disposal, the ability to utilize Arizona’s abundant brackish
groundwater resources may depend on a reappraisal of the aquifer classification system in the state.”

A pipeline of approximately 75 miles would be required to convey brackish water from the Gila River and Picacho basins near Eloy to the mine site; a pipeline of approximately 55 miles would be required to convey water from the Willcox basin to the mine site. Moving the water to the mine site would require the use of additional electric power and the construction of purpose-built pumping station(s) to overcome elevation changes, expansion of the line, and line loss due to friction.

### 3.4.4 Feasibility

Use of deep aquifer brackish groundwater for Rosemont process is feasible. A permit from ADWR would be required and a pipeline of approximately 55 miles and pumping stations would be required. Segments of the pipeline might be routed along the I-10 right of way.

### 3.4.5 Summary

The production and treatment of brackish water from a deep aquifer are feasible because they involve common technologies. Water rights must be secured and permits will be necessary to use the deep aquifer groundwater. Pumping from a deep aquifer will have considerable power requirements and will require specialized equipment due to the corrosive nature of the brine. Water treatment and sludge disposal will be required, as will the construction and permitting of a pipeline and pumping stations.

### 3.5 Sea Water

The following section discusses the use of sea water as an alternative source of water for the Rosemont mine. The section was prepared by John T. Kline, B.S., M.A.O.M.

#### 3.5.1 Description

Sea water in its native state contains about 35,000 mg/L (parts per million (ppm)) of salt. In comparison, groundwater contains generally less than 1,000 ppm of total dissolved salts.

Water at the mine site is needed for dust control, processing, and for potable-water uses (drinking, etc.). Untreated sea water is corrosive to steel and could not be used for processing. Further, the salts would interfere in the processing. Untreated sea water could not be used for dust control on roads because of possible groundwater contamination. Finally, untreated sea water is not suitable for drinking and other potable uses. This review, therefore, assumes that sea water is taken from its sources and treated at the coastline prior to pumping to the site.

There are two main processes used to remove salt from sea water, namely, distillation and RO (Ashley, 2009). RO is the more efficient process. This well-known and readily available technology
uses filtration of sea water followed by passing the sea water past high-pressure membranes. The salt is separated as highly concentrated brine and typically it is returned to the sea.

The nearest source of sea water to the Rosemont mine site is the Gulf of California (Sea of Cortez) at Puerto Peñasco, Mexico, which is the closest town on the Gulf. The approximate distance from the mine site to Puerto Peñasco is 250 miles via road. By dead reckoning, the distance is approximately 165 miles. The second source option is in the United States at a location near San Diego, California. The approximate pipeline distance between Tucson and San Diego is over 430 miles by dead reckoning.

3.5.2 Advantages

The use of treated sea water for industrial and drinking purposes is a well-known technology and has been used for many years. According to the U.S. Geological Survey (2009), “In 2002, there were about 12,500 desalination plants around the world in 120 countries. Among industrialized countries, the United States is one of the most important users of desalinated waters (6.5%), especially (sic) in California and parts of Florida.”

“In November 2009, Connecticut-based Poseidon Resources Corporation won a key regulatory approval to build a $300 million water desalination plant at Carlsbad, north of San Diego California” (Energy Recovery, Inc., 2008). The plant is designed to produce 50 million gallons of drinking water per day (34,700 gpm) for southern California users. This plant alone will produce approximately 10 times the daily needs of Rosemont.

Pumping long distances is also a well-known and commonly used technology. It is done in the oil and gas industry, and water is commonly pumped from its source to its end users through steel, concrete, and high-density polyethylene pipelines.

3.5.3 Limitations

Environmental, right-of-way, access, permitting, and other similar issues are associated with treating sea water and transporting it from the source area to the Rosemont mine site. Environmental issues include the impacts the brine may have on the local environment where the salt is discharged (California Coastal Commission, 2004), and impacts associated with construction of a pipeline and pumping stations along the pipeline corridor. The pipeline path in the U.S. is across mountain ranges, private fee lands, Indian Nation lands, federal lands, and an interstate boundary. The pathway in Mexico traverses Mexican federal land and private land, and would cross an international boundary.

Pipelines installed on the surface are subject to weathering due to movement and changes in temperature. They also provide a barrier to the movement of hunters, off-road vehicles and other transportation, and migratory animals. The inherent movement of the lines causes wear and stress that can cause line failure. Theft of water and vandalism can also occur to the pipeline and pumping.
stations. Therefore, the water line would have to be buried along most or all of its route, some of which would be along rights-of-way for existing roads. The pipeline would also cross through potentially sensitive areas such as archaeological sites, rivers and streams, mountains, town sites, and highways.

Moving the water from the coast to the mine site would require construction of purpose-built pumping stations to overcome elevation changes, expansion of the line, and line loss due to friction.

Finally, numerous permits would be required to secure sea water, dispose of brine, construct a pipeline and pumping stations, and there may be a need to have an international agreement with Mexico if the water source is from the Gulf of California.

3.5.4 Summary

The production of water for mining and processing from seawater is possible because it is a commonly used technology. The water would require treatment, with attendant disposal of large quantities of salt brine. The long distances required to pump the treated water are substantial but not uncommon for pumping oil and natural gas. Limitations include the following issues:

- The water line would cross through potentially sensitive areas such as archaeological sites, rivers and streams, town sites, and highways;
- The water line would have to be buried;
- Numerous permits would be required;
- Brine disposal would be necessary at the treatment plant in Mexico or California;
- A determination would need to be made regarding legal ownership of the water rights; and
- International agreements may be required.
4 Proposed Alternatives: Localized CAP Recharge and Recovery Water

The purpose of the Central Arizona Project (CAP) recharge and recovery program is to allow renewable surface water supplies, such as Colorado River water, to be stored underground now for recovery later during periods of reduced water supply (CAP, 2010). To encourage the direct use of renewable water supplies, the recharge program restricts the type of water that may be stored long-term to renewable water supplies that cannot be used directly.

The Central Arizona Water Conservation District (CAWCD) has developed and currently operates six recharge projects, with one additional project under development that has an expected completion date in 2011. The localized, Tucson Active Management Area (AMA), recharge facilities have a cumulative permitted capacity of 91,000 ac-ft/yr and include the Avra Valley, Pima Mine Road and Lower Santa Cruz Recharge Projects. The other three existing facilities and the project under development are in the Phoenix AMA. The permitted and cumulative recharge capacities of the localized facilities are shown in Table 3.1.

Table 4-1 Permitted recharge capacity of localized CAP facilities (ac-ft/yr)

<table>
<thead>
<tr>
<th>Project Name</th>
<th>Year Complete</th>
<th>Permitted Capacity</th>
<th>Cumulative Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Avra Valley</td>
<td>1996-97</td>
<td>11,000</td>
<td>11,000</td>
</tr>
<tr>
<td>Pima Mine Road</td>
<td>1998-99</td>
<td>30,000</td>
<td>41,000</td>
</tr>
<tr>
<td>Lower Santa Cruz</td>
<td>2000</td>
<td>50,000</td>
<td>91,000</td>
</tr>
</tbody>
</table>

Source: CAP (2010)

The three main CAP contract categories are Non-Indian municipal and industrial (M&I), Non-Indian agricultural (NIA), and Indian. Almost all NIA subcontracts have been declined or terminated, and CAP water is used pursuant to the Department’s recharge program. As of October 2009, CAP annual subcontract totals were:

- M&I Subcontracts 620,678 ac-ft/yr
- Indian Contracts 555,806 ac-ft/yr
- Non-Indian Agricultural Subcontracts 9,026 ac-ft/yr
- Currently Uncontracted Water 155,787 ac-ft/yr
- Other Project Water Under Contract 73,703 ac-ft/yr

There are two types of CAP storage facilities: the Underground Storage Facility (USF) and the Groundwater Savings Facility (GSF). The USF physically stores water in the aquifer through direct recharge. A GSF uses surface water (CAP water) instead of groundwater.
The type of recharge water stored in a USF varies; it may be CAP water, precipitation, effluent, or other. The most common type of USF is a constructed storage facility that uses infiltration (spreading) basins in which the water is spread out over a large surface area that allows the water to infiltrate or seep into the alluvial material and eventually reach the aquifer. Infiltration basins are typically located adjacent to stream channels where infiltration rates are high due to the porous nature of the soils. Another type of constructed USF involves the use of injection (recharge) wells where water is forced directly into the aquifer through a borehole. This recharge method is less common than infiltration basins because of its higher operational expense.

The Managed USF is one where water is discharged into a streambed and allowed to flow naturally down the channel without the assistance of any construction. Water infiltrates (percolates) into the aquifer below the stream channel (Arizona Water Banking Authority (AWBA), 2010). The types of USFs are given in Table 3.2

<table>
<thead>
<tr>
<th>Underground Storage Facilities</th>
<th>Managed USF</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constructed USF</td>
<td></td>
</tr>
<tr>
<td>Spreading Basin</td>
<td>Injection Well</td>
</tr>
</tbody>
</table>

Source: CAP (2010)

A GSF, on the other hand, is established when the AWBA partners with an entity (farmer or irrigation district) that would have pumped groundwater to grow a crop, and provides CAP water in-lieu of pumping groundwater. The AWBA gets a long-term storage credit for groundwater that is not pumped (AWBA, 2010). The AWBA has a lower priority to CAP water than entities with municipal and industrial (M&I) subcontracts (AWBA, 2011).

Rosemont has committed to acquire sufficient Colorado River renewable surface water supplies to be delivered through the CAP canal to the Tucson Active Management Area (TAMA) to offset 105 percent of the total projected mine usage, or approximately 105,000 ac-ft. To implement this plan, Rosemont obtained an excess-water contract from the CAWCD to purchase CAP water on a year-to-year basis (the only timeframe for which excess water can be purchased), and is investigating and contracting other CAP sources to ensure their total commitment.

A major limitation to using CAP excess water is pointed out on the CAP website (CAP, 2011):

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8 “Excess water is a specifically defined category of CAP water that can only be made available for delivery one year at a time. It is the most junior priority within the CAP water priority hierarchy and, as such, it will be the first supply to be reduced if a shortage is declared. Having a CAP Excess Water contract and an approved delivery schedule does not constitute an assured water supply” (www.cap-az.com/operations/excess-contracts, accessed October 21, 2010).
“Having a CAP Excess Water contract and an approved delivery schedule does not constitute an assured water supply. It is important to note that the CAP excess water supply is expected to decline significantly in upcoming years, and should not be relied upon in planning future demands.”

For the excess-water contract, Rosemont entered into three water-storage agreements with the CAWCD to store the purchased CAP water at CAWCD-operated USFs: the Pima Mine Road Recharge Project facility, the Avra Valley Recharge Project facility, and the Lower Santa Cruz Recharge Project facility.

This section evaluates localized recharge and recovery facilities for Rosemont to bank their CAP water.

- Pima Mine Road Recharge Project facility,
- Lower Santa Cruz Recharge Project facility,
- Avra Valley Recharge Project facility
- FICO groundwater savings facility,
- 841 Facility (Tohono O’odham Nation recharge), and
- Future Community Water Recharge Project facility.

### 4.1 Pima Mine Road Recharge Project

The section describes the Pima Mine Road Recharge facility as a recharge and recovery facility for use by Rosemont.

#### 4.1.1 Description

The Pima Mine Road Recharge Project (PMRRP) is one of the three localized CAP recharge projects in Pima County. The facility is situated approximately 15 mile south of Tucson on the Santa Cruz River flood plain. Developed by the CAWCD in cooperation with the City of Tucson, the project has two operational components: the original, pilot-scale facility and a newer, full-scale facility. Full-scale operation of the pilot basins began in September 2000, and full-scale operation of the expansion basins began in December 2001. Combined, the two facilities encompass 37 acres of spreading basins and have a maximum permitted annual recharge capacity of 30,000 ac-ft.

The Reach 6 portion of the CAP aqueduct provides water to the PMRRP facility. It is at the terminus of the CAP pipeline. Infiltration rates at the PMRRP pilot facility typically range from 1.9 to 5.8 feet/day, but are much higher following surface maintenance. The expansion basins were not excavated as deep as the pilot basin and, therefore, infiltration rates are substantially lower; they range from 0.7 to 4.2 feet/day. Maintenance typically consists of scraping and ripping the basin surfaces to break up the crust and increase infiltration into the underlying basin-fill formations.
4.1.2 Advantages

The PMRRP is one of the three CAWCD-operated facilities currently used to store the excess CAP water purchased by Rosemont. The PMRRP is the storage facility closest to Sahuarita where Rosemont’s proposed groundwater production wells will be located. Recharge of CAP water allows Rosemont to replenish a greater volume of groundwater than it proposes to pump for use at the proposed mine site. Use of this particular facility to recharge CAP water allows Rosemont to replenish the aquifer in the area of their groundwater wells. Recharge also offsets subsidence caused by groundwater pumping.

4.1.3 Limitations

Although Rosemont entered into three water storage agreements with CAWCD to store its purchased CAP water at CAWCD operated USFs (the Pima Mine Road Facility, the Avra Valley Facility, and the Lower Santa Cruz facility) and specifically requested that as much of this water as possible be stored in the southernmost facility, Pima Mine Road, CAWCD was, for the most part, unable to accommodate this request because existing customers (City of Tucson and Tohono O’odhamNation) were using all of the existing capacity. Therefore, most of the water for 2007, 2008, and 2009 was stored at the Lower Santa Cruz facility. The Lower Santa Cruz facility is farther from Sahuarita than is the Pima Mine Road facility, and consequently is less able to offset groundwater pumping from Rosemont’s Sahuarita well field.

4.1.4 Feasibility

Although the Pima Mine Road facility is the optimum recharge facility, utilizing this facility at present is not feasible because the facility currently does not have surplus recharge capacity.

4.1.5 Summary

Rosemont has entered into an agreement to purchase excess CAP water from the CAWCD on a year-to-year basis and has three water storage agreements that include storing water at the PMRRP. The PMRRP facility is closest to Sahuarita where Rosemont’s proposed production wells will be located. Use of this facility would allow Rosemont to replenish the aquifer in the area of their groundwater wells, but Rosemont cannot store additional water there because the facility lacks surplus recharge capacity. The water must be stored at facilities farther north.

4.2 Lower Santa Cruz and Avra Valley Recharge Projects

The section describes the Lower Santa Cruz and Avra Valley Recharge facilities and their advantages and limitations as recharge and recovery facilities for use by Rosemont. These recharge facilities are similar; therefore, the discussions have been combined.
4.2.1 Description

The Lower Santa Cruz Recharge Project (LSCR) and the Avra Valley Recharge Project (AVRP) are two of three CAP recharge and recovery projects in Pima County. The facilities were developed using state demonstration funds. The projects are both located in the northwest portion of the Tucson AMA, north of Tucson near the Marana Airport, and west of the Tangerine Road exit off I-10.

The LSCR consists of three spreading basins with an approximate total area of 30 acres. Full-scale operation began in June 2000. The LSCR was developed also in partnership with the Pima County Department of Transportation and Flood Control District (Pima County), and was constructed in conjunction with a flood control levee along the Santa Cruz River. Water is delivered to the LSCR site via an open channel irrigation canal. The project has a permitted capacity of 50,000 ac-ft/yr and a total storage capacity of 600,000 ac-ft. Delivery capacity is 65 cubic feet per second (cfs). The infiltration rate at LSCR is exceptional, exceeding 7 feet per day. Only two of the basins are needed at one time to store deliveries of over 60 cfs, allowing the third basin to be in a drying cycle.

The AVRP was the CAP’s first recharge project. It was conceived as part of the Northwest Tucson AMA Replenishment Program, a cooperative effort of the local water entities that began in 1994. CAP constructed the facility and began operating a 2-year pilot program in 1996. The AVRP began full-scale operation in March 1998. The project consists of approximately 11 acres of recharge basins. It has a permitted capacity of 11,000 ac-ft/yr and a delivery capacity of 12 cfs.

Spreading basins become clogged over time, slowing infiltration. Maintenance is required when infiltration rates decrease; harrows may be used to break up the clogging layers. Eventually the surfaces require scraping to improve surface infiltration into the underlying basin-fill formations.

4.2.2 Advantages

The LSCR and the AVRP are two of the three CAWCD-operated facilities currently used by Rosemont to store CAP water. The recharge of CAP water allows Rosemont to replenish a greater volume of groundwater than it proposes to pump for use at the proposed mine site. Recharge also offsets subsidence caused by groundwater pumping.

4.2.3 Disadvantages

The LSCR and AVRP locations are north of the Sahuarita area where Rosemont will be extracting groundwater for use at the proposed mine site.

4.2.4 Feasibility

It is feasible to utilizing the Lower Santa Cruz and Avra Valley Recharge Projects to store Rosemont CAP water because they have the capacity. However, the two recharge basins are 40 miles north of the proposed Rosemont well field, while the Pima Mine Road facility is much closer.
4.2.5 Summary

Rosemont has entered into an agreement to purchase excess water from the CAP on a year-to-year basis, and has an existing agreement to store water at both the LSCRP and AVRP. The recharged water replenishes groundwater in the area of recharge, but these two facilities are not adjacent to the Sahuarita area of proposed Rosemont well field.

4.3 FICO Groundwater Savings Facility

A Groundwater Savings Facility (GSF) is not a recharge facility. Its benefit lies in using CAP water instead of pumped groundwater. The FICO GSF would use CAP water to offset part of their almost 35,000 ac-ft/yr groundwater allotment, most of which (just over 29,000 ac-ft in 2008) is required to irrigate its pecan orchards in the Sahuarita-Green Valley area (FICO, 2010). However, the facility is not yet in operation (Inside Tucson Business, 2010) and a proposed date to construct the CAP pipeline southward to the facility does not appear to be eminent. This does not appear to be an alternative source of water or an alternative recharge facility for Rosemont.

4.4 841 Facility

This section describes the water rights of 841 Facilities specified by the Arizona Indian Water Rights Settlement Agreement in the Tucson Active Management Area (AMA) and the Stipulation of Parties to the Tohono O’odham Settlement Agreement and Request for Entry of Judgment and Decree (Superior Court of Arizona, Maricopa County, 2006) with respect to Rosemont Copper Company securing a water rights contract for CAP water from the Tohono O’odham Nation. Only the Tohono O’odham Nation is considered in this discussion due to the remoteness of the proposed Rosemont mine site from other Indian Nations.

4.4.1 Description

An 841 Facility is a federally recognized Indian community within Arizona that qualifies to accrue long-term storage credits, as stipulated in Arizona Revised Statute (A.R.S.) §45-841.01, Accrual of long-term storage credits; Indian water rights settlements, for storage of the unused portion of its Colorado River water entitlement. The statute is intended “to further the implementation of Indian water rights settlements in this state” (A.R.S §45-841.01 (B)). The statute codifies the conditions under which an Indian community may participate in the accrual of long-term storage credits for the delivery of its CAP water to the holder of grandfathered groundwater rights in an AMA or for off-reservation storage of its CAP water.

The Arizona Indian Water Rights Settlement Agreement specifies that the Tohono O’odham Nation shall have the following rights to CAP water in the Tucson AMA:

- 37,800 ac-ft/yr: total CAP Indian priority water currently under contract
- 28,200 ac-ft/yr: total new CAP NIA\(^9\) priority water

The Indian Water Rights Settlement Agreement specifies three agreements with the Tohono O’odham Nation in the Tucson AMA: Tucson Agreement, FICO Agreement, and ASARCO Agreement.

Among its many provisions, the 2006 ASARCO Agreement with the Nation provides for (1) the Nation to deliver up to 10,000 ac-ft/yr of CAP water to ASARCO to replace groundwater pumping by ASARCO on or near the San Xavier Indian Reservation, (2) ASARCO to construct and maintain the infrastructure for delivery of CAP water, and (3) the Nation to earn long-term storage credits for ASARCO’s use of CAP water in substitution for groundwater.

Pursuant to A.R.S. §45-841 (C)(2), the holder of grandfathered groundwater rights who accepts delivery of CAP water from an 841 Facility must “use the water delivered off of Indian community lands on a gallon-for-gallon substitute basis instead of [using] groundwater that otherwise would have been pumped pursuant to the grandfathered groundwater rights from within an active management area.”

Section 9 The Nation’s Right to Lease CAP Water of the *Stipulation of Parties to the Tohono O'odham Settlement Agreement and Request for Entry of Judgment and Decree* (Superior Court of Arizona, Maricopa County, 2006) states:

9.1 The Nation may lease CAP water to other water users outside of the Nation's Reservation for a term not to exceed 100 years in accordance with section 309(c) of the Settlement Act.

9.2 For leases with terms in excess of 25 years, the Nation shall offer the lease to users within the Tucson Management Area. If the Nation receives no proposals from users within the Tucson Management Area, the Nation may offer the lease to users outside the Tucson Management Area but within the CAP service area, subject to a right by Qualified Entities within the Tucson Management Area of making counteroffers. A counteroffer matches or is superior to a proposal from an entity outside the Tucson Management Area if it matches the price and other substantive terms of the proposed transaction.

**4.4.2 Advantages**

The principal advantages inherent in A.R.S. §45-841 are that the holders of grandfathered groundwater rights (such as ASARCO) agree to use CAP water in lieu of pumping grandfathered groundwater, or the CAP water is stored for future use; and the 841 Facility accrues long-term storage credits from the AWBA for CAP water they are not presently able to use.

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\(^9\) As explained in Section 3, almost all non-Indian agricultural (NIA) subcontracts have been declined or terminated and CAP water is used pursuant to the Department’s recharge program.
4.4.3 Limitations

The principal limitations to Rosemont securing a CAP water contract from an 841 Facility are that Rosemont does not hold grandfathered groundwater rights, and under these terms of the Southern Arizona Indian Water Rights Settlement is not eligible to secure a water supply contract with an 841 Facility. Another limitation is that Rosemont is outside the Tucson AMA service area; should they secure 841 CAP water, their contract could be superseded by a superior counteroffer from a water user in the Tucson AMA.

4.4.4 Feasibility

Securing a CAP water contract from an 841 Facility (e.g., Tohono O’odham Nation) is not feasible because Rosemont does not hold grandfathered water rights, which is a major requirement.

4.4.5 Summary

The Tohono O’odham Nation may have excess CAP water that it can lease or store. However, requirements of the Arizona Indian Water Rights Settlement Agreement and the Stipulation of Parties to the Tohono O’odham Settlement Agreement and Request for Entry of Judgment and Decree place severe limitations on potential water users who do not have grandfathered groundwater rights or are outside the Tucson AMA.

4.5 Community Water Company, Future Recharge Project

This section describes the proposed CAP water delivery system of the Community Water Company of Green Valley (CWC), which would enable the CWC to take and use its allotment of CAP water. This evaluation is based upon the following sources of information: the USBR website, the Community Water Company website, and a Revised Draft Environmental Assessment and its appendices (ERO Resources Corporation, 2009).

4.5.1 Description

The CWC is a non-profit, member-owned co-op, incorporated in 1975 by the water users of Green Valley. It began operations in 1977. The CWC has a contract for delivery of 2,858 ac-ft/yr of CAP M&I water to its service area, but it has not been able to use its allocation because the CAP pipeline extends only to the Pima Mine Road recharge basin. The pipeline would need to be extended to the CWC service area in Green Valley, an approximate added length of 8 miles. Consequently, the CWC’s annual CAP allocation has been available for purchase as excess CAP water. With construction of a water delivery system and recharge facility (pipelines, a recharge basin, a booster station, and other related infrastructure), CWC’s allocated CAP water would be delivered to the CWC service area for direct use or recharge.
Rosemont has proposed to fund the water delivery system, and in return, the CWC plans to give Rosemont priority for use of CWC’s CAP water and available recharge storage capacity for the first 15 to 20 years of the system’s operation, unless it is needed by CWC. Additional water supplies that Rosemont may obtain also would be recharged to utilize the maximum recharge capacity. The maximum capacity for the 36-inch mainstem pipeline was established at 30,000 ac-ft/yr. The full recharge capacity of the CWC recharge basin would be 5,000 ac-ft/yr.

The proposed water delivery system required preparation of an Environmental Assessment (EROResources Corporation, 2010) under National Environmental Policy Act rules and regulations. On July 18, 2010 the company posted a letter on its website informing members and customers of the USBR’s finding regarding the water delivery project (CWC, 2010). The letter states, in part,

“After almost two years of environmental evaluations and studies … the Bureau of Reclamation has issued a "Finding of No Significant Impact" for the Community Water Company of Green Valley Central Arizona Project Water Distribution System and Recharge Facility.”

The finding enables the CWC to move forward with construction of the water delivery system. Following the first 15 to 20 years, it is expected that CWC would continue to recharge its CAP water at the site, along with other CAP water supplies from potential participants, such as the Green Valley Domestic Water Improvement District and other participants in the Upper Santa Cruz Providers and Users Group (USC/PUG).

4.5.2 Advantages

Use of CWC’s proposed water delivery system to convey and store CAP water has multiple advantages. It would enable Rosemont to replenish groundwater at the CWC recharge storage facility in the vicinity of Well 11 and eventually in the vicinity of Rosemont’s proposed well field, a 53-acre parcel of land located on Davis Road, Sahuarita. The water delivery system would secure future supplies of water for the CWC service area and for other members of the USC/PUG. Based on nearly a year of monitoring, from February 27, 2009 to January 8, 2010, parts of the Green Valley/Sahuarita area have had up to 1.4 inches of subsidence (ADWR, 2010c). Recharging groundwater would help maintain the local aquifer and reduce subsidence that has been occurring over the past 50 years in the area due to over pumping by local farms and mines.

4.5.3 Limitations

Construction of the water delivery system will require several years to complete. Construction will include securing permits from state and local entities, acquiring pipeline rights of way, and a commitment of substantial funds. The total cost for the Pima Mine Road Recharge Project in 2001 was $11 million. The Avra Valley Recharge Project, about a third of size of the Pima facility, cost $790,000 in 1998 (CAP, 2010).
4.5.4 Feasibility

Utilizing the proposed future Community Water Project’s CAP pipeline extension and recharge facility is feasible; however, the system is at least several years in the future and the construction costs will require a substantial commitment of funds.

4.5.5 Summary

Rosemont has signed an expression of interest with the CWC to construct a water delivery system that will extend the CAP pipeline to the CWC service area in the Green Valley/Sahuarita area. The project would deliver CWC’s CAP allocation to their service area and, by enabling Rosemont to recharge groundwater at the CWC recharge storage facility, help sustain the aquifer and reduce land subsidence in that area.
5 Summary and Conclusions

5.1 Summary

This report provides a review of 19 alternative water sources identified by the Coronado National Forest. The review is intended to evaluate the potential of the different sources to provide an adequate volume and yield of groundwater that might offset groundwater pumping at the site near Sahuarita, Arizona that is presently intended for development by Augusta Resources Corporation for the proposed Rosemont mine site.

The alternatives were grouped into three classes on the basis of water type:

- Potable Water, 9 potential alternative sources,
- Non-potable Water, 5 potential alternative sources, and

Many of these alternative water sources may have associated jurisdictional and/or legal issues, which are beyond the scope of this report, and consequently are generally not discussed herein. Additional considerations include identifying a groundwater source within a given area having an adequate volume and sustainable yields; securing long-term, guaranteed water rights; potential drought and reduced flows in streams and the Colorado River, which could cause water authorities to reprioritize water allocations.

Table 5-1 summarizes the findings of this review.

5.2 Conclusions

Of the 19 alternative water sources reviewed herein, nine are not feasible alternatives to replace groundwater withdrawals from Rosemont Copper Company’s planned well field near the town of Sahuarita, Arizona. Of the 19 reviewed, six alternatives may be feasible although water rights and jurisdictional and legal implications may change that assessment. The remaining four alternatives are of uncertain feasibility; inquiries made to appropriate owners and agencies may clarify this uncertainty.
Table 5-1  Summary of Alternative Water Sources

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Principal Advantage</th>
<th>Principal Limitation</th>
<th>Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Potable Water Sources</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Davidson Canyon Groundwater</td>
<td>Closest source of water to Rosemont mine site</td>
<td>Two reaches designated <em>Outstanding Arizona Water</em> in 2008.</td>
<td>NO—unlikely to be permitted due to <em>Outstanding</em> designation; unlikely to have sufficient volume and yield</td>
</tr>
<tr>
<td>Ciénega Creek Groundwater</td>
<td>Reasonable distance to Rosemont mine site</td>
<td>BLM 1997 application for in-stream flow water right; volume and yield along stream unlikely to be sufficient.</td>
<td>NO—unlikely to be permitted due to BLM application for in-stream flow rights</td>
</tr>
<tr>
<td>Sonoita Creek Groundwater</td>
<td>Reasonable distance to Rosemont mine site</td>
<td>Difficulty obtaining necessary permits due to local opposition</td>
<td>UNCERTAIN—may be difficult to obtain permits</td>
</tr>
<tr>
<td>San Pedro River Groundwater</td>
<td>Likely to have sufficient volume and well yield</td>
<td>BLM asserts a Federal Reserve In-Stream Flow Water Right to the San Pedro River; further asserts groundwater removal might negatively impact stream flow and BLM water right.</td>
<td>NO—unlikely to be permitted due to BLM assertion of water rights</td>
</tr>
<tr>
<td>Santa Cruz River Basin Groundwater</td>
<td>Likely to have sufficient volume and well yield</td>
<td>Multiple contamination areas due to effluent, mine and agricultural discharges</td>
<td>YES—volume and yield, permits, and identifying an uncontaminated zone (or water treatment) are likely.</td>
</tr>
<tr>
<td>Santa Rita Experimental Range Groundwater</td>
<td>Likely to have sufficient volume and well yield</td>
<td>Extraction of groundwater may not be in line with purpose and goals of SRER; perceived to impact rangeland, subject of SRER study.</td>
<td>UNCERTAIN—inquiries could be made of SRER and UA.</td>
</tr>
<tr>
<td>CAP Direct Delivery</td>
<td>CAP had excess capacity in 2008</td>
<td>Rosemont is not operational so cannot accept direct delivery of</td>
<td>UNCERTAIN—inquiries could be made of CAP for future deliveries</td>
</tr>
<tr>
<td>Alternative</td>
<td>Principal Advantage</td>
<td>Principal Limitation</td>
<td>Feasibility</td>
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</tr>
<tr>
<td>Tohono O’odham Nation Groundwater Direct Delivery</td>
<td>Likely to have sufficient volume and well yield</td>
<td>An adequate volume of groundwater for District use is questionable.</td>
<td>NO—an adequate supply is not confirmed.</td>
</tr>
<tr>
<td>RO Water from Yuma Desalting Plant</td>
<td>At full operating capacity, the RO plant could supply the needs of the proposed Rosemont mine.</td>
<td>The plant is not operational; large state and municipal water authorities might acquire superior entitlements when the commercial operation commences; the timing is uncertain; the distance to the proposed mine site is over 200 miles.</td>
<td>NO—the plant is not operational; other water authorities might have superior water entitlements; the distance is too great.</td>
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</tbody>
</table>

### Non-potable Water Sources

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Principal Advantage</th>
<th>Principal Limitation</th>
<th>Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wastewater Effluent or Reclaimed Water</td>
<td>Use of effluent and wastewater are well suited for mining and processing.</td>
<td>Long-term contracts typically secure reclaimed water for reuse within the community that generates it.</td>
<td>YES—provided a long-term guaranteed source could be secured.</td>
</tr>
<tr>
<td>Sierrita Mine Sulfate Plume Water</td>
<td>Tailings reclaim water is routinely recycled back to mill operations.</td>
<td>Sierrita recycles all of the impacted water for reuse in their process circuit.</td>
<td>NO—none is available.</td>
</tr>
<tr>
<td>Secretary of Interior Effluent and Managed Recharge Credit Recovery</td>
<td>Excess effluent appears to be available.</td>
<td>Legal impediments may exist to obtaining a contract; USBR seeks to utilize the effluent in other Tucson projects, so it may not be available outside Tucson area.</td>
<td>UNCERTAIN—inquiries could be made of DOI and USBR.</td>
</tr>
<tr>
<td>Deep Aquifer Brackish Water</td>
<td>Nearby basins contain an estimated 45 to 75 million ac-ft of brackish water.</td>
<td>Power consumption to pump from a deep aquifer and possibly treat the water would be enormous; disposal of brine sludge could be</td>
<td>YES—provided a long-term guaranteed source could be secured and environmental issues resolved.</td>
</tr>
</tbody>
</table>
## Alternative Water Sources

<table>
<thead>
<tr>
<th>Alternative</th>
<th>Principal Advantage</th>
<th>Principal Limitation</th>
<th>Feasibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sea Water</td>
<td>Treating sea water for industrial and drinking purposes is a well-known technology.</td>
<td>The distance from California and transboundary issues conveying water from Mexico; disposal of brine sludge could be problematic.</td>
<td>NO—distances and transboundary issues would make conveying water from the source areas unfeasible.</td>
</tr>
<tr>
<td><strong>Localized CAP Recharge and Recovery Water</strong></td>
<td></td>
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<tr>
<td>Pima Mine Road Recharge Project</td>
<td>Rosemont has an existing agreement with CAWCD to store water at the PMRRP.</td>
<td>The PMRRP does not have adequate capacity to store Rosemont water.</td>
<td>YES—provided CAWCD makes storage capacity available to Rosemont.</td>
</tr>
<tr>
<td>Lower Santa Cruz and Avra Valley Recharge Projects</td>
<td>Rosemont has an existing agreement with CAWCD to store water at the LSC and AV recharge projects.</td>
<td>The facilities are too far from Rosemont’s planned production well field in Sahuarita.</td>
<td>YES—Rosemont presently recharges its CAP excess water at the LSC facility.</td>
</tr>
<tr>
<td>FICO Groundwater Savings Facility</td>
<td>Using CAP water instead of pumping groundwater.</td>
<td>CAP delivery to FICO has not been constructed; the timing is unknown for FICO becoming a GSF.</td>
<td>NO—the GSF facility does not exist.</td>
</tr>
<tr>
<td>841 Facility</td>
<td>Holders of grandfathered groundwater rights agree to use CAP water in lieu of pumping groundwater.</td>
<td>Rosemont does not hold grandfathered groundwater rights.</td>
<td>NO—Rosemont does not quality.</td>
</tr>
<tr>
<td>Community Water Company, Future Recharge Project</td>
<td>Local recharge would reduce subsidence in the area; Rosemont could eventually replenish groundwater in the vicinity of its proposed well field.</td>
<td>Construction of the water delivery system will require several years to complete.</td>
<td>YES—Rosemont is working with the CWC to construct the CAP pipeline extension.</td>
</tr>
</tbody>
</table>
6 References


City of Tucson and Pima County, 2009a, Reclaimed water technical paper: report prepared for City/County Water and Wastewater Study Oversight Committee, April 2009, 27 p.


Huckelberry, C.H., 2007, Long-term Green Valley water supply: Memorandum to the Pima County Board of Supervisors, October 2, 2007, 5 p., 2 appendices.)


Rosemont Copper Company, 2007: Briefing notes on use of Central Arizona Project water: unpublished summary provided by Rosemont Copper to the Coronado National Forest, 2 p.


## 7 Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>A.R.S.</td>
<td>Arizona Revised Statute</td>
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<tr>
<td>ac-ft</td>
<td>acre-feet</td>
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<tr>
<td>ac-ft/yr</td>
<td>acre-feet per year</td>
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<tr>
<td>ADEQ</td>
<td>Arizona Department of Environmental Quality</td>
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<tr>
<td>ADWR</td>
<td>Arizona Department of Water Resources</td>
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<tr>
<td>AMA</td>
<td>Active Management Area</td>
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<td>ASLD</td>
<td>Arizona State Land Department</td>
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<tr>
<td>AVRP</td>
<td>Avra Valley Recharge Project</td>
</tr>
<tr>
<td>AWBA</td>
<td>Arizona Water Banking Authority</td>
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<tr>
<td>BLM</td>
<td>U.S. Bureau of Land Management</td>
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<tr>
<td>CAP</td>
<td>Central Arizona Project</td>
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<tr>
<td>CAWCD</td>
<td>Central Arizona Water Conservation District</td>
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<tr>
<td>CEP</td>
<td>Conservation Effluent Pool</td>
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<tr>
<td>cfs</td>
<td>cubic feet per second</td>
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<td>CNF</td>
<td>Coronado National Forest</td>
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<tr>
<td>CWC</td>
<td>Community Water Company (of Green Valley)</td>
</tr>
<tr>
<td>Sierrita</td>
<td>Freeport-McMoRan Copper &amp; Gold, Inc.</td>
</tr>
<tr>
<td>gal/per/day</td>
<td>gallons per person per day</td>
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<tr>
<td>gpd</td>
<td>gallons per day</td>
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<td>gpm</td>
<td>gallons per minute</td>
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<tr>
<td>GSF</td>
<td>Groundwater Savings Facility</td>
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<tr>
<td>HCP</td>
<td>Habitat Conservation Plan</td>
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<tr>
<td>LSCRCP</td>
<td>Lower Santa Cruz Recharge Project</td>
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<tr>
<td>M&amp;I</td>
<td>Municipal &amp; Industrial</td>
</tr>
<tr>
<td>mgd</td>
<td>million gallon per day</td>
</tr>
<tr>
<td>Nation</td>
<td>Tohono O’odham Nation</td>
</tr>
<tr>
<td>NIA</td>
<td>Non-Indian agricultural water</td>
</tr>
<tr>
<td>NIWWTP</td>
<td>Nogales International Wastewater Treatment Plant</td>
</tr>
<tr>
<td>PFOS</td>
<td>perfluorooctane sulfonate</td>
</tr>
<tr>
<td>PMRRP</td>
<td>Pima Mine Road Recharge Project</td>
</tr>
<tr>
<td>ppm</td>
<td>parts per million</td>
</tr>
<tr>
<td>RO</td>
<td>reverse osmosis</td>
</tr>
<tr>
<td>SAWRSA</td>
<td>Southern Arizona Water Rights Settlement Act</td>
</tr>
<tr>
<td>SRER</td>
<td>Santa Rita Experimental Range</td>
</tr>
<tr>
<td>USBR</td>
<td>U.S. Bureau of Reclamation</td>
</tr>
<tr>
<td>USF</td>
<td>Underground Storage Facility</td>
</tr>
<tr>
<td>WMIDD</td>
<td>Wellton-Mohawk Irrigation &amp; Drainage District</td>
</tr>
<tr>
<td>WWTP</td>
<td>Wastewater Treatment Plant</td>
</tr>
<tr>
<td>YDP</td>
<td>Yuma Desalting Plant</td>
</tr>
</tbody>
</table>
8 Qualifications of Key Technical Authors

John Kline B.S., M.A.O.M., has a degree in chemistry and has worked for 35 years in the copper mining industry as technical manager, environmental permitting, operations managers, and Project manager. His specific work in the field of water management and treatment includes:

Manager of Plant Operations, where he was responsible for operation and maintenance of a 14,000 gpm water production system;
Manager of an Environmental Water Testing Laboratory;
Technical Manager where he conducted test on mine solutions treatment by ion exchange and reverse osmosis; and
Manger of an in-situ copper mining leach project in which a membrane filtration system was designed to treat mine water effluents.

Ms. Hoag is a Principal Geologist at SRK’s Tucson office and is licensed as a registered geologist in Arizona and Texas. She has conducted geological and hydrogeological investigations for various mining operations and remedial or environmental permitting activities on behalf of clients subject to state and/or federal regulations. Her expertise included permit negotiations and Aquifer Protection Permit applications, water quality monitoring and assessment; compliance monitoring and reporting on new and existing APP and Underground Injection Control permits; geologic drilling and sampling to support geochemical assessment of waste rock, tailings, and heap leach dumps acid rock drainage and metal leaching. Mining geology experience includes gold/copper exploration sampling/drilling, preparation of geological models and resource estimates for porphyry copper and molybdenum deposits in Arizona and New Mexico. Database auditing and QA/QC sampling verification, feasibility studies for new mine and expansion developments.