Chapter 2. Alternatives, Including the Proposed Action

Introduction

This chapter describes and compares the alternatives considered in detail for the project; it also discusses how these alternatives respond to the purpose of and need for action and address the significant issues presented in chapter 1. The alternatives considered in detail represent a range of possible actions that respond to the significant issues, purpose and need, and Federal and State laws and regulations. The Bureau of Land Management and U.S. Army Corps of Engineers have concurred on the final range of alternatives, including those considered in detail in this draft environmental impact statement (DEIS).

For the purposes of this DEIS, the term "project area" refers to those areas that would be excluded from public access to accommodate mine activities and includes the open pit, waste rock storage area, tailings area, heap leach facility, plant site and ancillary facilities, fenced area around the mine, and mine primary and secondary access roads. Unless specifically noted, the term "project area" does not include the linear water and electricity utility corridors.

The term "analysis area" is specific to each resource and is explicitly defined in each resource section of chapter 3. The analysis area includes all areas necessary to adequately assess impacts to resources and often includes areas beyond the project area, including utility corridors.

General Overview of Mining Operations

The discussion of mine operations in this section applies to the proposed action and all action alternatives (alternatives 2 through 6). A complete description of the proposed action is found in the Rosemont Copper Company (Rosemont Copper) preliminary mine plan of operations (MPO) (WestLand Resources Inc. 2007a) and in numerous technical documents, plans, and memoranda prepared by Rosemont Copper and its consultants in support of the preliminary MPO. A compact disc (CD) with the complete preliminary MPO can be found in a pocket at the back of this document.[1]

A list of operation facilities and activities common to all the action alternatives (which excludes the no action alternative) is presented below. The project facilities listed below would be constructed for all action alternatives; however, the location and detailed design may vary by alternative.
The exception is the mine pit, plant site, and heap leach pads, which would have the same location, shape, and depth for all action alternatives. Maps depicting key elements for each alternative are provided as part of the alternative descriptions.

Main Facilities and Activities Common to All Alternatives

The facilities and activities described in this section are typical of open-pit mine sites.
The descriptions below, however, are specific to the components for this project. The mine pit is where blasting and drilling activities would occur. The waste rock and tailings would be transported and processed within the corresponding facilities. Lighting and waste disposal would take place at the plant site and support facilities. The perimeter fence would encompass the main mining and processing operations, excluding portions of the access roads.

[1] Printed versions can be reviewed at the Coronado National Forest Supervisor's Office, 300 West Congress, Tucson, Arizona.

Pit

Preproduction stripping of overlying rock would require 18 months to prepare for full-scale mining operations, train work crews, construct access and haul roads, and clear and grub the pit and waste rock storage areas that would be disturbed during the initial years of operation. Open-pit mining would be used to excavate ore to recover copper, molybdenum, and silver. 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 would be 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 1,288 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.

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. Dry bulk ammonium nitrate would be stored in silos located at the plant site. Wet hole blasting requires the use of emulsion and/or slurry, which would be stored in tanks onsite. Mixed ammonium nitrate and fuel oil would be transported and loaded using special trucks designed for that purpose. Blasting detonators (caps, delays, cord, and boosters) would be stored in special magazines and transported in separate vehicles. All explosives management would be done in accordance with applicable rules, regulations, and safety standards.

Ore Processing

The mine contains two types of ore, sulfide and oxide, each requiring a different process to recover the metals. 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 mined 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.

Table 1. Production schedule

Timeline	Sulfide Ore 1,000 tons	Oxide Ore 1,000 tons	Waste Rock 1,000 tons
Preproduction: 18 months	3,328	14,979	101,293
Year 1	19,444	18,244	84,286
Year 2	27,375	5,320	92,305
Year 3	27,375	937	89,088
Year 4	27,375	2,602	87,423
Year 5	27,375	5,002	85,023
Year 6	27,375	2,195	87,830
Year 7	27,375	–	90,025
Years 8 to 10	82,125	166	269,909
Years 11 to 15	136,875	–	287,195

Timeline	Sulfide Ore 1,000 tons	Oxide Ore 1,000 tons	Waste Rock 1,000 tons
Years 16 to 19	86,705	–	14,050
Total	**492,727**	**49,445**	**1,288,427**

Notes:

This does not include time for construction or closure. The table is correct for the preliminary MPO; however, there may be minor adjustments for various alternatives or during operations.

Excludes 3,026,000 tons of stockpiled sulfide ore rehandled in year 1 and 302,000 tons in year 19.

In years 8 to 10, 166,000 tons of oxide ore would be waste, as the leach pad would not be available.

Sulfide Ore Process

Sulfide ore would be sent through a circuit of crushers, grinding mills, and ball mills to reduce the rock size to the consistency of sand. A flotation circuit would separate the copper and molybdenum concentrates from the waste material. The concentrates would then be dewatered, thickened, filtered, and loaded for shipment. The waste or tailings from the sulfide ore processing would be dewatered using large-capacity pressure filters, which would essentially squeeze the water out of the tailings to create a dry cake with a moisture content of 12 to 15 percent (AMEC Earth and Environmental Inc. 2009a). These dry-stack tailings would then be conveyed to the storage facility and placed in the dry-stack tailings disposal facility, while the water returns to the process for recycled use (figure 2).

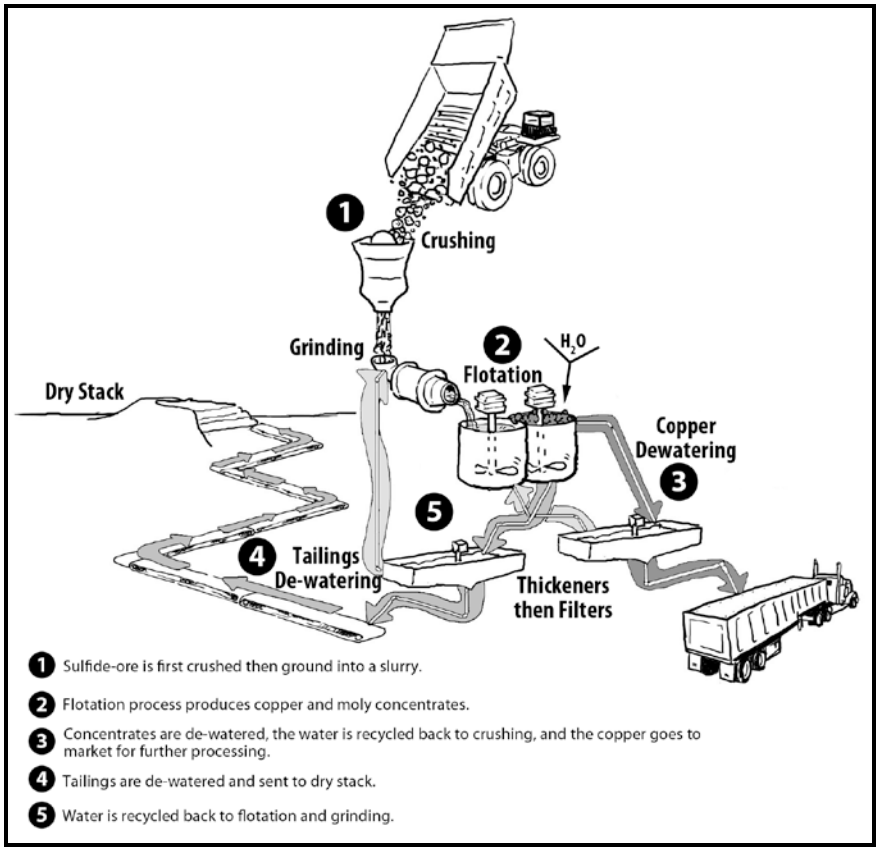

Figure 2. Sulfide ore processing

Oxide Ore Process

Oxide ore is located within the top portions of the excavated pit and is expected to be processed only within the first 6 to 7 years of the project. Oxide ore would be sent to a lined heap leach pad, where the ore would undergo a leaching process. 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. 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 the production 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 3). The heap leach pad and ponds would ultimately be encapsulated within the waste rock storage area.

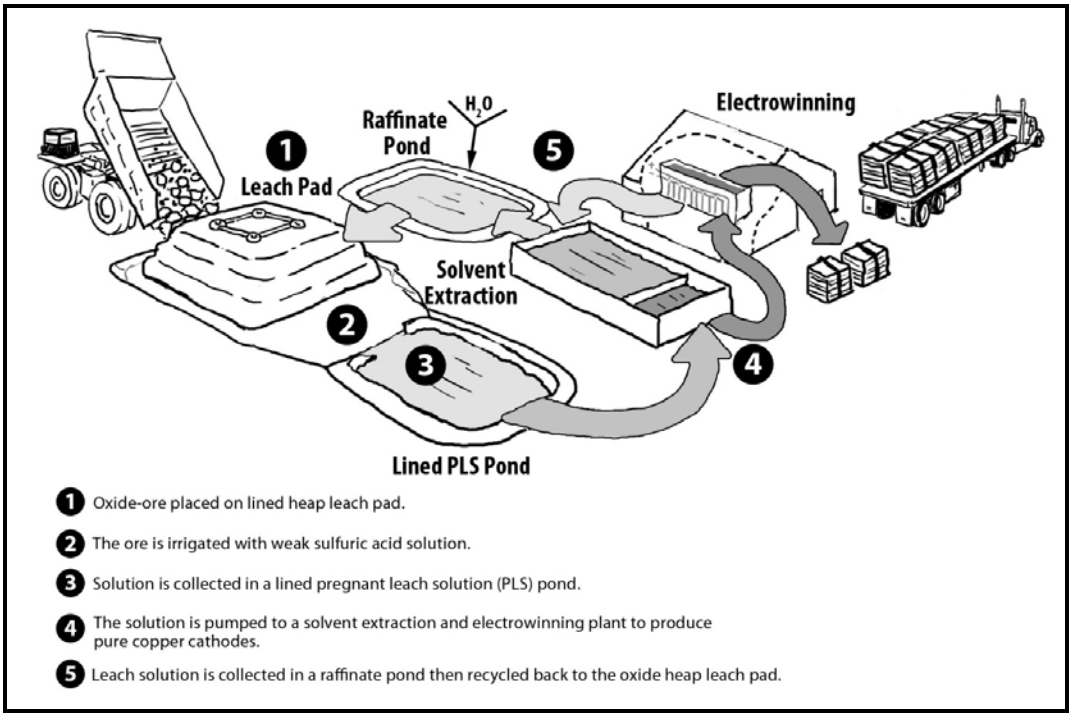

Figure 3. Oxide ore processing

Waste Rock and Tailings Placement

Waste rock, which consists largely of chemically basic limestone and other largely nonacid-generating rocks, would be placed in areas located outside the proposed open pit. 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. Ultimately, the tailings would be encapsulated, or covered, completely by a thick layer of waste rock. Other than "Alternative 1 – no action alternative," all the alternatives represent differing waste rock and tailings placement that allow Rosemont Copper to mine and process their identified mineral resource.

Ore, Waste Rock, and Tailings Transport

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

Roads for the haul trucks would be constructed both within the open pit and between the pit and the plant, heap leach, tailings facility, and waste rock storage area. 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 regularly move based on the locations of material placement.

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 grinding and 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.

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.

Lighting

The most current outdoor lighting plan proposed by Rosemont Copper (M3 Engineering and Technology Corporation 2011) describes lighting elements, including the amount of lumens expected from these sources and how that compares with the current Pima County Lighting Code. This plan has been designed with the intent of meeting this code except where safety may be compromised. According to this report, low pressure sodium lighting masks all colors, making them appear gray. This could present safety risks in occasions of injury with blood recognition and hazardous oils that are color coded. While some particular areas might not use the code's prescribed lighting fixtures for this reason, the lumens emitted per acre of the project area should meet the code, according to the report.

All roadway and parking lot areas would use low pressure sodium fixtures set 123 feet apart on 2-lane haul roads and 225 feet apart on light truck roads. While the primary access road was not addressed in the initial design, the amount of lumens was projected using only full cut-off low pressure sodium fixtures.

Elevated hazard areas, such as the mine process area and pit, would mostly require high pressure sodium lighting fixtures. The high pressure sodium lamps would be around the buildings in the process areas and concentrated around the large shovel working areas in the pit. With a total of three shovels, three drills, and two loaders with various sized lamps, there would numerous high pressure sodium fixtures ranging from 35 to 1,000 watts. The only low pressure sodium lighting fixtures in this area would be used at a refueling site and explosives storage facility. Lighting on the leach pads would be portable, may be dependent on ore processing schedules, and would be specified as high pressure sodium with shields.

According to the detailed site general electrical design, there would be a total of 12 200-watt and 475 90-watt low pressure sodium fixtures, and there would be 19 200-watt, 86 90-watt, 11 70-watt, 21 50-watt, and 334 35-watt high pressure sodium fixtures.

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. According to the Town of Sahuarita, this landfill would not be consistent with aspects of their general plan.

The landfill would cover approximately 2.6 acres on Rosemont Copper private property and would be permitted and regulated by the Arizona Department of Environmental Quality. All putrescent materials or other items that cannot be appropriately disposed of in the solid waste facility 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 within waste rock facility.

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.

Perimeter Fence

A perimeter fence would be constructed for each of the action alternatives, and a varying amount of National Forest System lands would be unavailable for public use during the 25-year mine life. The configuration varies by alternative and is depicted on the footprint maps for each alternative displayed later in this chapter. A legal closure order would be issued by the Coronado National Forest (the Coronado), and notices would be posted along the fencing. Perimeter fencing would consist of a standard 4-strand barbed wire fence (with the bottom wire bare in accordance with Bureau of Land Management and Arizona Game and Fish Department fencing standards). Sections of the perimeter fence would be removed following closure after considering grazing and safety needs. Portions of the site, including the mine pit, would remain fenced off and closed to the public indefinitely for safety reasons.

Ancillary Facilities and Activities Common to All Alternatives

The discussion of facilities and activities in this section apply to all action alternatives, including the proposed action. They are common to all action alternatives, although placement may vary by alternative. Detailed maps of these components are available in the alternatives descriptions sections later in this chapter.

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 currently being evaluated by the Arizona Corporation Commission and are discussed in greater detail later in this chapter under "Utility Lines (Electrical and Water Supply) Alignment Alternatives."

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).

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 or leased 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, proposed pipeline route, and alternative pipeline route are shown in figure 4. Either pipeline route would require booster stations to maintain water flow in the line. According to the Town of Sahuarita, these booster stations would not be consistent with aspects of their general plan. Location alternatives are discussed in greater detail later in this chapter under "Utility Lines (Electrical and Water Supply) Alignment Alternatives."

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 groundwater wells in the Santa Cruz Valley, with a much smaller 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 below.

Where feasible, water would be reclaimed from a variety of uses on the mine and returned for use in processing (Figure 5). Water acquired through pit dewatering would either be used in processing or for dust control purposes. Because the quality of this water is expected to approach potable standards, it would not require any additional processing to be used in the various mining processes.

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,
- groundwater, and
- stormwater.

Figure 5 is a schematic diagram of the process water control system that shows the basic water circuits for the processing of sulfide and oxide ore. Control of process water would consist of

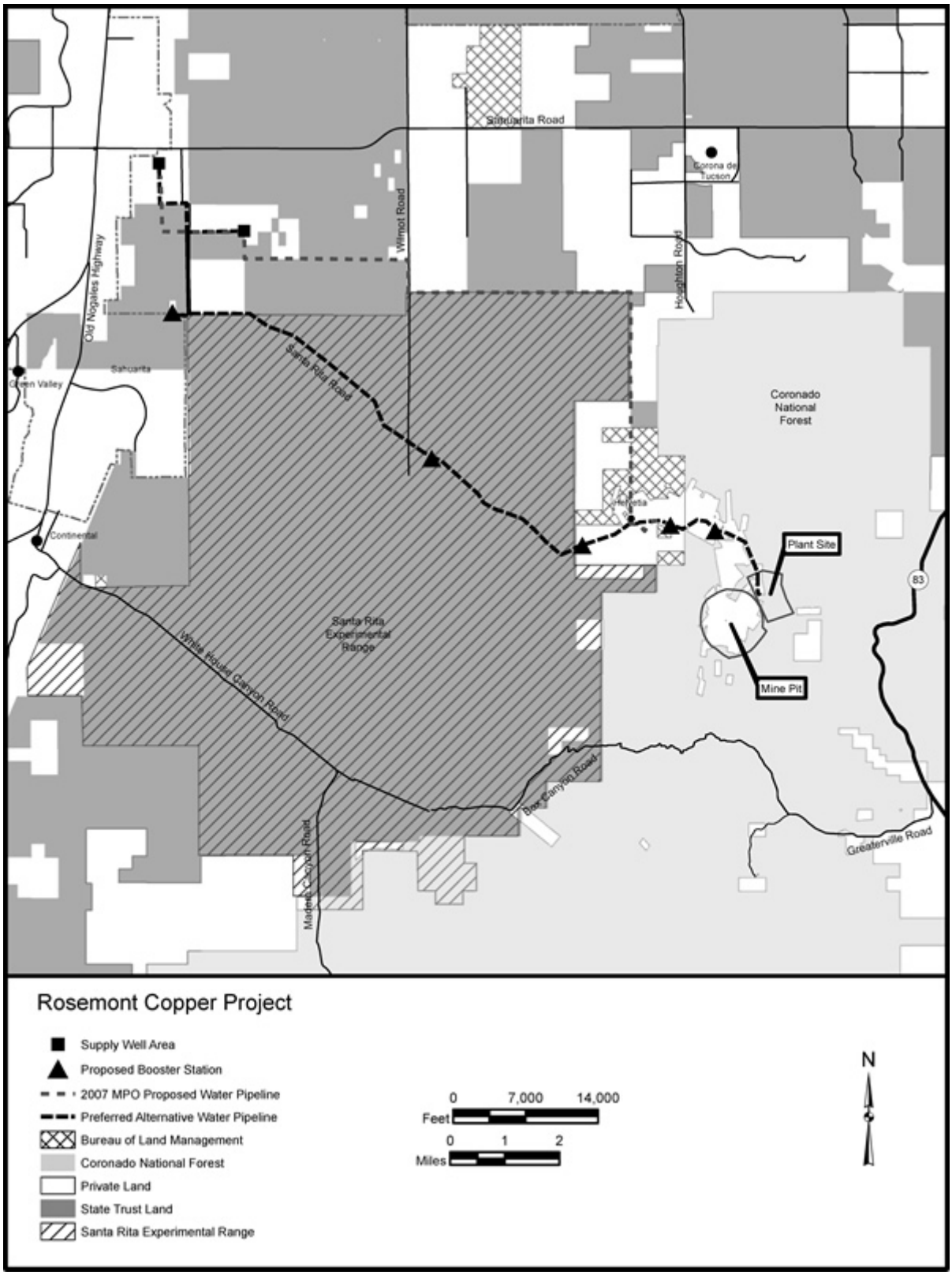

Figure 4. Water supply well area and pipeline

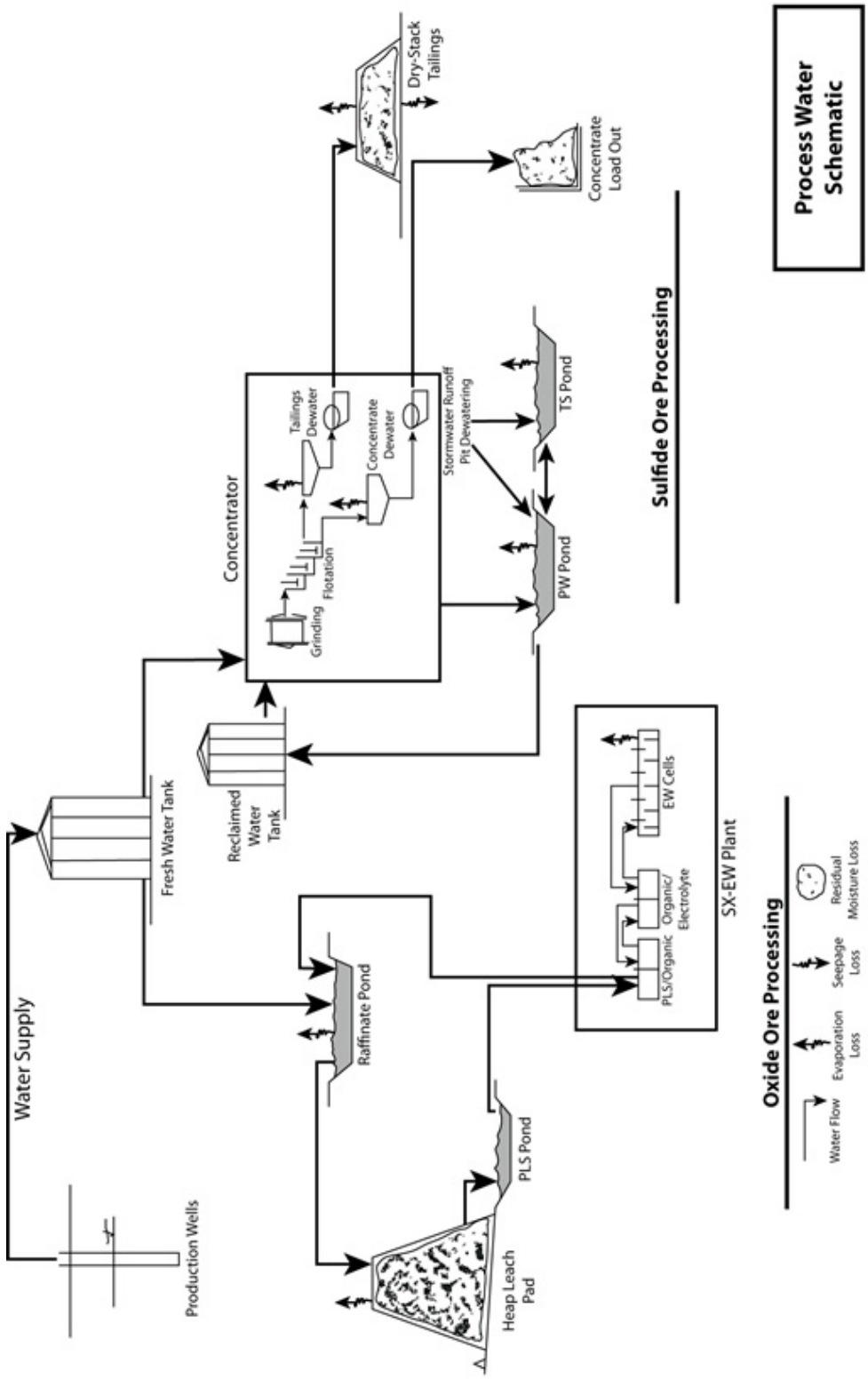

Figure 5. Process water schematic

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 dry stack tailings 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 and would be regulated under the Arizona Department of Environmental Quality Aquifer Protection Permit program.

Groundwater

Groundwater control would include those activities and facilities intended to protect and monitor the quality of the groundwater in the area, as well as the investigation and modeling used to predict the response of the groundwater systems to both the withdrawal of groundwater and the influence of seepage and leakage from the project facilities. Implementation of groundwater control requirements would also be monitored by various regulatory programs that have jurisdiction over groundwater, primarily the Aquifer Protection Permit program administered by Arizona Department of Environmental Quality.

Protection of groundwater 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 systems required to be designed into processing facilities by the applicable permits. Of particular importance to the long-term groundwater protection would be the acid rock drainage protection and monitoring program. Monitoring to ensure that offsite groundwater 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 groundwater monitoring wells, in accordance with the requirements of the aquifer protection permit. There are two equally important demonstrations mine permittees must make to receive an aquifer protection permit: (1) demonstration of compliance with Arizona aquifer water quality standards at a point of compliance (i.e., demonstrated via monitoring); and (2) demonstration that the facility has been designed and will be operated to achieve the greatest degree of discharge reduction achievable through the application of best available demonstrated control technology (i.e., engineering controls and practices).

Protection of groundwater quality following mine closure would be achieved by the following: 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 facilities, monitoring and testing required by the aquifer protection permit following mine closure, and capture of possible impacted mine site groundwater by localized groundwater flowing into the pit.

Stormwater

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 that has not contacted tailings 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 from above the mine pit would be diverted around disturbed areas to the extent practical. 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.

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 non-contact runoff to downgradient sediment ponds. Where feasible, the top of the facilities would be designed to slope toward the open pit. The sediment ponds at the toe of the outer slopes would be 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 noncontact surface water runoff around the project area and from undisturbed areas within the project to natural drainages downgradient of the mine site. Stormwater (contact water) 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 and tailings facilities, including the waste rock buttresses that are not reclaimed or stabilized, would be routed to sediment control structures, where any overflow discharging offsite would be monitored for chemical and sediment content in accordance with Arizona Department of Environmental Quality's mining stormwater general permit.

General structures were designed using a precipitation-runoff simulation computer program developed by the U.S. Army Corps of Engineers. Results from 1,000-year, 24-hour; 500-year, 24-hour; 100-year, 24-hour; 100-year, 6-hour; and 100-year, 1-hour local probable maximum precipitation and 72-hour general probable maximum precipitation events were evaluated. Two calculations were evaluated (the peak flow and the runoff volumes) for Rosemont Copper's selection of the most practical and protective methodology and criteria for use (Tetra Tech 2010h). According to this report, the highest peak flow was produced by the 6-hour local probable maximum precipitation, and the highest amount of runoff was produced by the 72-hour general probable maximum precipitation.

The following list describes the general structures and the storm event they were designed to accommodate (Tetra Tech 2010h):

- General and local probable maximum precipitation event (runoff and storage): pit diversion channel, permanent diversion channels, detention basins, and waste rock storage areas
- 1,000-year, 24-hour event (storage): top reclaimed surface of tailings facility
- 500-year, 24-hour event (runoff): drainage benches, drop structures, pregnant leach solution and stormwater ponds' diversion channels, pond access road diversion channel
- 100-year, 1-hour event (runoff): heap leach pad perimeter road V ditch
- 100-year, 24-hour event (storage): raffinate/pregnant leach solution pond/stormwater ponds, process water temporary storage ponds, settling basin, evaporation ponds
- 25-year, 24-hour event (runoff): temporary perimeter ditches

Active stormwater control would continue after the mine closes, as required by the Arizona Department of Environmental Quality's mining stormwater general permit and the erosion control provisions of the mine land reclamation plan, administered by the Arizona State Mine Inspector. The Arizona State Mine Inspector has jurisdiction of reclamation under Arizona Revised Statutes Title 27, Chapter 5; this is the Reclamation Act statute for reclamation of hardrock mining, which pertains to private lands with more than 5 acres of mining disturbance.

Compliance Point Dam

The compliance point dam would serve as the final compliance point where stormwater can be monitored. While this dam is common to all action alternatives, its location varies by alternative; locations are shown on the footprint figures for each alternative later in this chapter. The dam would be approximately 6 feet tall and approximately 100 to 200 feet wide, 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. 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. Large storm events would overtop the dam and proceed downstream, as permitted under Section 401 of the Clean Water Act. Section 401 requires that an applicant for a federal license or permit provide certification that any discharge from the facility will comply with the Clean Water Act, including water quality standards. The compliance point dam would be evaluated after closure of the project facilities. The dam would be removed if it complies with the Section 404 permit at that time and if it is determined that subsequent discharges would meet Arizona Surface Water Quality Standards.

Primary Access Road

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. The primary access road would leave State Route 83 along a straight section of the state highway. At the intersection, State Route 83 would be widened and provided with additional lanes. Locations and length vary by alternative and are shown on the footprint figures for each alternative later in this chapter. Public use would be restricted on portions of the primary access road during construction and operation of the mine because of safety considerations but would be reopened to the public after closure. Segments of the primary access road would be added to the national forest road system.

Secondary Access Road

Approximately 1 mile of gravel road would be constructed from the processing facilities to the existing road over Lopez Pass, to function as the "secondary access road." The road over Lopez Pass would be improved for use of 2-wheel-drive vehicles. The secondary access road would be used only to access the utility lines and water pipeline. Workers would not use the secondary access road to commute to the mine and no haul trucks or deliveries would use the secondary access road.
The secondary access road would be closed to the public during construction and operation of the mine and would be reopened to the public after closure. Segments of the secondary access road would be added to the national forest road system.

Other Area Roads

Existing forest roads, both official and unofficial, that enter the project site would be blocked. Public access would be restricted on portions of the primary and secondary access roads during construction and operation of the mine because of safety concerns.

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 and molybdenum 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 would vary between 6 a.m. to 8 a.m. and 4 p.m. to 6 p.m.

Table 2. Large-truck trip data

Materials	Round Trips per Week
Copper and molybdenum concentrate	392
Copper cathode	17
Materials (e.g., sulfuric acid, lime, fuels, etc.)	173

Equipment and construction material deliveries to the site would be in addition to the large-truck trip data provided. Major equipment arriving by rail may be received at the Port of Tucson, which is located near Vail, Arizona. Construction traffic would use State Route 83 and existing Forest Road 231 to access the site until the new primary access road is constructed. This may require an upgrade of that road within the current roadway configuration.

Reclamation and Closure

Reclamation of the project would be administered and regulated by the Coronado (36 Code of Federal Regulations 228) on National Forest System lands; administered and regulated by the Arizona State Mine Inspector (Arizona Revised Statutes 27-901 et seq., as amended) on private land; and regulated by the Arizona Department of Environmental Quality (Arizona Revised Statutes 49-241 through 49-252; and Arizona Administrative Code 18-9-101 through 403). The final reclamation concept plan, which would be completed prior to publication of the final EIS (FEIS), would focus on design of the facilities with closure goals in mind. The plan would accomplish the following:

- Manage operations to minimize environmental impacts,
- Implement concurrent reclamation practices (36 Code of Federal Regulations 228 Subpart A),
- Constrain disturbances to a minimum number of drainages and minimize downstream hydrologic disturbances,
- Prepare a comprehensive drainage plan,
- Use appropriate technology to minimize the generation of impacted water,

- Reclaim the facilities and roads to blend in with surrounding topography,
- Salvage soil resources,
- Perform selective vegetation removal,
- Revegetate reclaimed surfaces, and
- Prepare an estimated closure cost for a variety of closure scenarios.

It is anticipated that by year 10, leaching of the heap leach facility would be completed. At that time, the ponds would be decommissioned and residual leach solutions would have evaporated or been processed. Once the ponds are decommissioned and have been deemed closed or are under active management and in compliance with the aquifer protection permit issued by the Arizona Department of Environmental Quality, the facility would be completely covered by waste rock.

At closure, fence construction for the mine pit would be a minimum of 3-strand barbed wire with warning signs. Arizona Administrative Code R11-2-401 specifies measures that include fencing and signage. Additionally, Rosemont Copper has contemplated berms around the pit, possible “tank traps” as necessary to restrict road access, and upgraded fencing (i.e., chain link) if necessary on steeper slope areas above the pit or other areas to provide additional safety protections. Operating facilities at the project site would be demolished and removed, and building foundations would also be removed. All areas would be investigated for contaminants, and any contaminated soils, reagents, or fuels would be disposed of offsite at licensed facilities.

Postmine land use on National Forest System lands would follow the forest plan that is in place at that time. Postmining/closure reclamation objectives for Rosemont Copper’s private property could include dispersed recreation, wildlife habitat, and ranching.

Utility Lines (Electrical and Water Supply) Alignment Alternatives

Introduction – Overview

The discussion of electrical and water supply lines in this section apply to all action alternatives, including the proposed action. The development and identification of alternative routes for the Rosemont 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 Rosemont Copper 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 four alternatives for consideration. Figure 6 shows all of the proposed utility alignments.

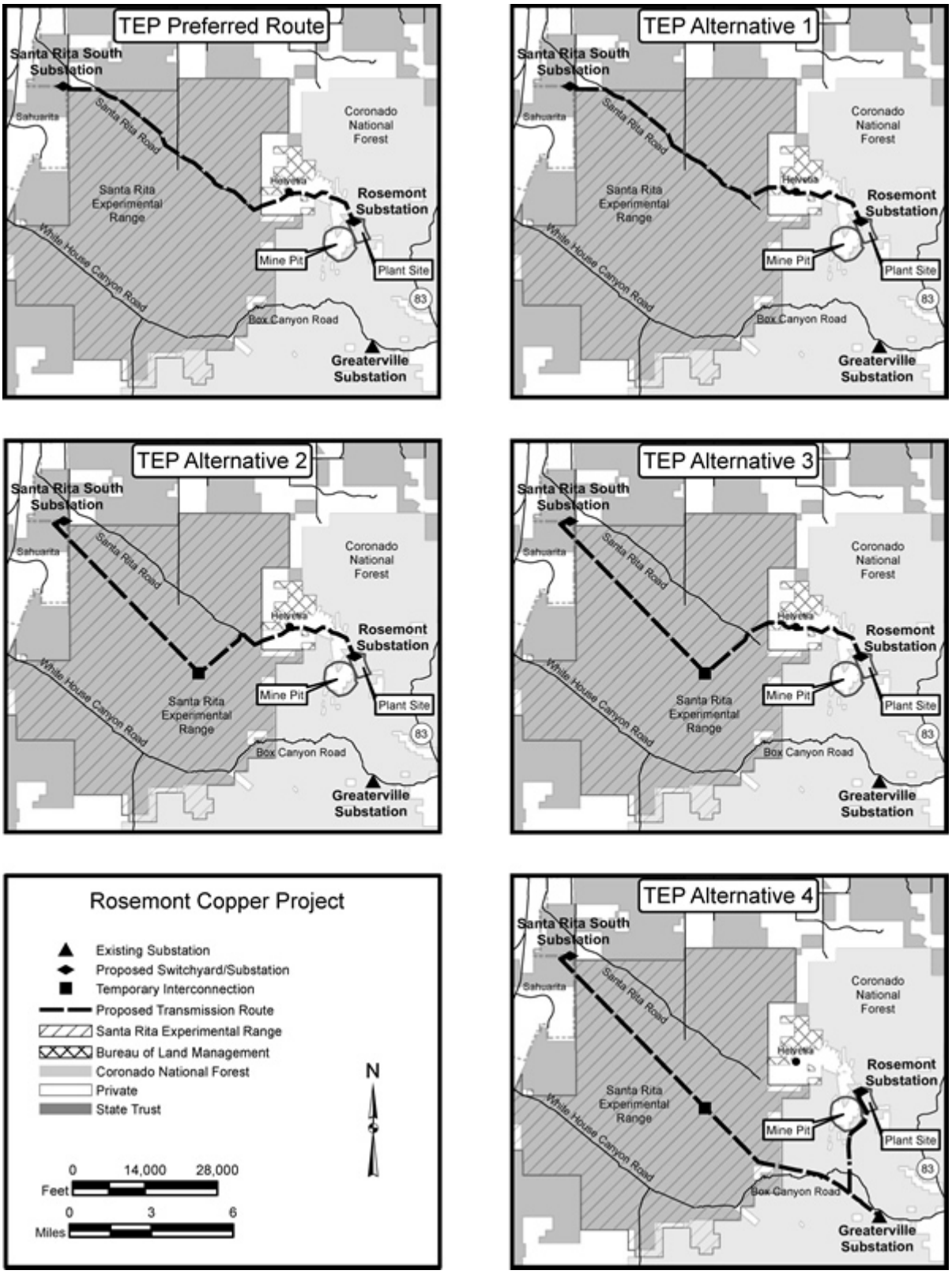

Figure 6. Proposed utility alignment alternatives (Tucson Electric Power 2011)

Summary Comparison of Alternative Routes

Electrical power and water would be brought to the project site from the west for all action alternatives. This section describes alternative alignments for the utilities. It is currently proposed that the water and electrical lines would be co-located in places in which they have parallel routes.

Power

Power for all alternatives would be provided from a link attached to existing transmission lines on the South Substation loop. All of the transmission lines alternatives include aboveground 138-kilovolt transmission lines and an associated 14-foot-wide unpaved maintenance road. This set of routing alternatives recommended to be carried forward will be presented to the Arizona Corporation Commission Line Siting Committee. As mentioned in chapter 1, the decision whether to permit one of these alternatives resides with the Arizona Corporation Commission.

Northern Route (eliminated from further consideration)

This alignment generally parallels the northern and eastern boundary of the Santa Rita Experimental Range and includes a relatively small portion of Bureau of Land Management administered lands before entering the Rosemont claim block and crossing over the ridgeline near Lopez Pass. This route is included in the preliminary MPO; however, the Arizona State Land Department expressed concern with this route, and it has been eliminated from further consideration.

TEP Preferred Route

West of the Santa Rita Mountains ridgeline, the preferred route generally parallels the existing South Santa Rita Road before entering private property held by Rosemont Copper. The alignment then enters the Rosemont claim block and crosses the ridgeline at Lopez Pass.

TEP Alternative 1

Alternative 1 is very similar to the preferred route, but it includes a divergence from the private property alignment across Bureau of Land Management administered lands.

TEP Alternative 2

This alternative would parallel an existing 46-kilovolt power line until the junction of Helvetia Road, where it would head northeast to Santa Rita Road to follow the same path as the preferred route, terminating at the Rosemont Substation. Although an access road for the 46-kilovolt line currently exists, it would need to be improved in order to construct the new power line. This alternative would then require that a new power line alignment be developed from the existing 46-kilovolt line north to the Rosemont Copper Project through private property held by Rosemont Copper and over Lopez Pass.

TEP Alternative 3

TEP Alternative 3 is very similar to TEP Alternative 2, but it includes a divergence from the private property alignment across Bureau of Land Management administered lands.

TEP Alternative 4

This alternative would be a double-circuit line and would also parallel the existing 46-kilovolt power line south of Santa Rita Road through the Santa Rita Experimental Range. However, unlike TEP Alternatives 2 and 3, this alternative would continue through Box Canyon until the line is able to head north through the Coronado National Forest to connect to the Rosemont Substation.

The Rosemont Substation would connect to the line by a north-south line through the Coronado National Forest. This route would result in demolition of the existing 46-kilovolt power poles and reconstruction of the 138-kilovolt power line with an improved access road on State land.

Water

The identification and development of alternative routes for the Rosemont Copper water pipeline were based on the requirements set forth by the landowner, the Arizona State Land Department, and the current land management agency for the Santa Rita Experimental Range—the University of Arizona. The initial proposed location on the northern boundary of the range was reviewed and determined not to be suitable based on the potential to open up the area to additional traffic once a road was established. Because there is a major roadway through the middle of the experimental range, it was determined that facilities paralleling this roadway would provide the best location for the pipeline and would minimize impacts to areas within the range that currently have no access. This route was also determined to be the least disruptive to the photo-point locations that exist within the range.

Two water line alignments have been proposed: one is provided in the preliminary MPO (WestLand Resources Inc. 2007a):figure 2.10), and the second largely parallels Santa Rita Road through the Santa Rita Experimental Range. These alignments generally correspond to the northern and preferred routes, respectively, for the power line, described above. In discussions with the Arizona State Land Department and University of Arizona (which are responsible for the Santa Rita Experimental Range), the preferred alignment for all parties is the one that parallels Santa Rita Road.

With either alignment, the pipeline would be constructed with a minimum soil cover of 36 inches within Arizona State Land Department easements and up to 24 inches on Rosemont Copper property, where available and practical, depending on slope, topography, and the availability of material. The pipe bedding requirements would follow the manufacturer's recommendations. Isolation valves would be installed in the pipeline at intervals of approximately 3,000 feet and at elevation changes of 250 feet. At wash crossings the pipeline would be constructed below the calculated scour depth of the wash, and grade control structures would be provided at the largest washes to provide additional protection. Construction of the pipeline would include an unpaved permanent maintenance road and up to five reservoirs and pump stations. The reservoirs and pump stations would be built outside potential waters of the United States.

Permits and Permitting Processes

The permitting and authorization requirements discussed in this section apply to all action alternatives, including the proposed action. Federal mining laws provide for mineral exploration and development on Federal lands, and State and Federal environmental laws are intended to ensure that adverse impacts are reduced and that long-term productivity of the surface resources is preserved to the extent practicable.

The Coronado, as the lead Federal agency for the Rosemont Copper Project EIS, has a primary role in approving and administering the project. The Bureau of Land Management and U.S. Army Corps of Engineers are Federal cooperating agencies and also have a role in approving the project and administering aspects of the project. The Coronado accepts certification and other approvals issued by State, local, or other Federal agencies as compliance with similar or parallel requirements of its mining regulations. Besides the Coronado, other agencies that require or have a role in issuance of

permits or authorizations for the project are the Bureau of Land Management, U.S. Army Corps of Engineers, U.S. Department of Transportation, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, Arizona Corporation Commission, Arizona Department of Agriculture, Arizona Department of Environmental Quality, Arizona Department of Water Resources, Arizona State Mine Inspector, State Historic Preservation Office, and Pima County Department of Environmental Quality. These Federal and non-Federal agencies with authorization or permitting authority may also have continuing responsibility for administering those respective aspects of the project.

The permits or authorizations that have been obtained or may need to be are summarized in table 3. This list is not intended to be exhaustive.

Table 3. Major permits or authorizations applicable to the proposed Rosemont Copper Mine

Agency	Permit or Authorization	Purpose
Federal		
U.S. Forest Service	Drilling Plan of Operations	Allows drilling to be done on National Forest System lands.
U.S. Forest Service	Revised MPO (after publication of the FEIS and approval of the record of decision (ROD)	A revised MPO would be required to reflect ROD requirements.
Bureau of Land Management	Revised MPO (after publication of the FEIS and ROD)	A revised MPO would be required to reflect ROD requirements.
U.S. Army Corps of Engineers	Individual Section 404 Permit (Clean Water Act (CWA))	Required for the discharge of dredged or fill material into waters of the United States (WUS).
U.S. Department of Transportation	Hazardous Materials Transportation Permit	Governs the transport of hazardous materials as defined by the U.S. Department of Transportation. Requires specific employee training and security and contingency planning.
U.S. Environmental Protection Agency	Hazardous Waste Identification Number	Allows facilities to generate and transport off site hazardous waste in quantities in excess of 100 kilograms per month (or that generate acute hazardous waste in quantities exceeding 1 kilogram per month). Requires specific employee training, inspections, and contingency planning.
U.S. Fish and Wildlife Service	Biological Opinion	Ensures that the Coronado's approval of the revised MPO would not jeopardize the continued existence of a threatened or endangered species or adversely modify designated critical habitat.
State of Arizona		
Arizona Corporation Commission	Certificate of Environmental Compatibility	Ensures compliance with Arizona Revised Statutes 40-360 and regulates the placement of electrical transmission lines.
Arizona Department of Agriculture	Agriculture Land Clearing Permit	Allows disturbance and clearing of state protected native plants, as required under the Arizona Native Plant Law.
Arizona Department of Environmental Quality (ADEQ)	Aquifer Protection Permit	Regulates the direct or indirect addition of pollutants to groundwater. Specifies best available demonstrated control technology (design criteria and/or operation practices) to control discharge of pollutants to groundwater and establishes aquifer water quality limits enforced at points of compliance specified for the facility. Requires monitoring, reporting, contingency planning, and financial assurance.
ADEQ	Section 401 Certification	State must certify, waive, or deny an application for a U.S. Army Corps of Engineers' permit for discharge of dredged or fill material to WUS. To certify, the State must find that the activities proposed under the 404 permit will not result in a violation of state surface water quality standards. The 401 certification may specify conditions, including reporting requirements.

Agency	Permit or Authorization	Purpose
ADEQ	Arizona Pollutant Discharge Elimination System (AZPDES) General Permit for Discharges from Construction Activities (State primacy over Section 402 of the CWA)	Authorization under this permit is required for discharges of stormwater to WUS resulting from construction activities disturbing 1 acre or more. Requires implementation of site-specific BMPs to control pollutants in stormwater runoff from construction activities. Regular inspections required.
ADEQ	AZPDES Permit for Stormwater Discharges from Industrial Activities (State primacy over Section 402 of the CWA)	Required for discharges of stormwater to WUS resulting from industrial activities. Two general permits that together authorize stormwater discharges associated with industrial activity from 29 industrial sectors (25 nonmining and four mining) for industrial stormwater discharges are available for coverage from ADEQ. The mining general permit includes applicable construction stormwater general permit language to accommodate a mine's nearly continual phase of construction throughout the life of its operations. Requires inspection, sampling/analysis, planning, reporting, and compliance evaluations, with permit renewals every 5 years.
ADEQ	AZPDES	Allows discharges from well development activities into drainages. Requires inspection, sampling/analysis, reporting, and planning with permit renewals every 5 years.
ADEQ	Solid Waste Plan Approval	Will be required once ADEQ adopts rules for nonmunicipal solid waste landfills. In the interim, requirements of 40 Code of Federal Regulations 257 must be met, along with other requirements set forth in state statutes (e.g., compliance with location restrictions, recordation of a restrictive covenant).
ADEQ	Hazardous Waste Management Program	Governs the management of hazardous waste (including transport and disposal). Requirements differ somewhat, depending on the volume and nature of hazardous waste generated; however, in general requires inspection, training, and contingency/emergency planning.
ADEQ	Drinking Water Registration and Regulations	Systems (including nontransient, noncommunity systems) must register with ADEQ and meet substantive requirements. Requires inspection, sampling/analysis, contingency/emergency planning, reporting, and notification.
Arizona Department of Transportation	Right-of-Way Encroachment Permit	Authorizes the construction of the intersection of the primary access road in the right-of-way for State Route 83.
Arizona Department of Water Resources (ADWR)	Groundwater Withdrawal Permits	Groundwater withdrawal rights.
ADWR	Well Drilling Permit	Issued any time drilling may intercept the water table. Requires paperwork to be filed by a licensed well driller.
ADWR	Dam Safety Permit	Regulates the construction and operation of large containment structures.
Arizona State Land Department	Right-of-Way Permit	Allows placement of water and electrical supply lines to be placed on a right-of-way. This is done after the Arizona Corporation Commission approves the alignment.
Arizona State Mine Inspector	Arizona Mined Land Reclamation Plan Approval	Applies to reclamation activities at the site. Requires certification, plan updates, annual reporting, and financial assurance.
State Historic Preservation Office	Section 106 of the National Historic Preservation Act	The State Historic Preservation Office consults on various permit actions to ensure conditions are included that minimize impacts on properties of archaeological and historical significance.

Agency	Permit or Authorization	Purpose
ADWR	Water Storage Permits	Augusta Resource Corporation currently has three water storage permits with ADWR. Note that Rosemont Copper/Augusta Resource Corporation is not required by ADWR to store water, but they have elected to store water in the Tucson Active Management Area. As of December 31, 2009, their long-term storage balance was 42,593.02 acre-feet of Central Arizona Project credits.
Pima County		
Pima County Department of Environmental Quality (PCDEQ)	Air Activity Permit	Applies to activities (such as earth moving, trenching, road building, blasting, etc.) leading up to mining and well development.
PCDEQ	Air Operating Permit	Applies to emissions from activities during operations. Requires inspection, sampling, monitoring, contingency/emergency planning, notification, reporting, and compliance certification.
PCDEQ	Hazardous Waste Management	Registers all U.S. Environmental Protection Agency ID numbers.
PCDEQ	Drinking Water System Registration	Registers all noncommunity, nontransient drinking water systems. Requires sampling and emergency planning.
Pima County Development Services	Grading Permit	Allows for lot development for well sites, grading, and fencing on county and private lands.
Pima County Regional Flood Control District	Floodplain Use Permit	Required for activities that might obstruct, retard, or divert the flow of water in a watercourse. Required for private lands in unincorporated areas of Pima County.
Pima County Cultural Resources and Historic Preservation Office	Pima County Right-of-Way Use Permit; may include Cultural Resources Process	To ensure that all projects on County land or rights-of-way with the potential to impact cultural resources comply with the applicable laws or regulations.

The Coronado, Bureau of Land Management, and U.S. Army Corps of Engineers will each sign a record of decision (ROD) that identifies the selected alternative and specifies activities that are authorized on lands or resources administered by these agencies. However, these activities cannot commence until all appropriate permits and authorizations are in place. The MPO would be revised as needed to reflect the requirements contained in the permits and the ROD and would be submitted to the Federal agencies for review and approval. Once the revised MPO is approved and applicable permits issues (such as the Section 404 permit from the U.S. Army Corps of Engineers), activities on federally administered lands could commence. It should be noted that some activities on private lands may commence without the Coronado's, Bureau of Land Management's, or U.S. Army Corps of Engineers' approval. The following events illustrate the relationship:

> Following issuance of the ROD, Rosemont Copper would submit a revised MPO and provide the necessary reclamation bond, which complies with the selected alternative described in the ROD and other local, State, and Federal permits in effect at that time. If the revised MPO proves acceptable, the Coronado and Bureau of Land Management could approve the MPO, contingent upon receiving the required local, State, and Federal permits. At this point, activities that do not require approval by other local, State, and Federal agencies could proceed.
>
> Prior to beginning any surface-disturbing activities on lands administered by the U.S. Forest Service (Forest Service) or Bureau of Land Management, Rosemont Copper would submit

supplemental information as described in its approved MPO as required by the ROD. In the first year of operation, Rosemont Copper would provide additional details on the location, schedule, and surface resources that would be affected by the planned activities.
A construction schedule would be submitted to the Coronado that indicates the order of activities and which activities and mitigation measures are required prior to initiation of construction. The Coronado would review these supplements to ensure that they are within the scope of the Rosemont Copper Project EIS and approve any required changes to the approved MPO. If the effects of the proposal are within the scope of the EIS, approval to proceed would be granted following submittal of a bond to reclaim the surface resources affected.

The U.S. Army Corps of Engineers would determine whether to issue or deny an individual permit for the discharge of dredged or fill material into waters of the United States.

The Arizona Department of Environmental Quality would determine whether to issue the 401 Certification and the Arizona Pollutant Discharge Elimination System permit or authorization prior to discharge of any pollutants to waters of the United States. Any stipulations, conditions, and monitoring required by the Arizona Pollutant Discharge Elimination System permit would be in place as required by the permit. Rosemont Copper would obtain the necessary stormwater permits prior to initiation of any activity that would result in a discharge of pollutants to waters of the United States.

Pima County would determine whether to issue an air quality permit pursuant to state law and delegated authority by the U.S. Environmental Protection Agency.

After the first year of operation, additional details on the following year's operation would be submitted as annual work plans. These annual work plans would include a summary of the previous year's activities, would describe the schedule of operations for the following year, and would include a statement verifying that all proposed operations are as approved in the MPO. The Coronado would annually review project status and proposed activities to ensure that the project is covered by a sufficient reclamation bond. If after review of these annual supplements, the Coronado determines that proposed activities are outside the scope of the selected alternative and approved MPO, a modified MPO would be required and the appropriate analysis conducted as required under National Environmental Policy Act and Forest Service mining regulations.

As other State and Federal permits are approved, Rosemont Copper would submit them to the Forest Service as supplements to their approved MPO if National Forest System land would be affected by the approved operations. The Coronado would review the conditions of the approved permit(s) to ensure that they are consistent with the terms of the ROD and approved MPO and that they would not result in any adverse environmental impacts that have not been considered in the National Environmental Policy Act analysis and documented in the FEIS, ROD, or administrative record. After this review, the Coronado would either accept the permit as a supplement to the approved MPO or notify Rosemont Copper that the permits constitute a modification of its approved MPO and that additional National Environmental Policy Act analysis and documentation are required. The above procedures would also be used to address changes in local, State, or Federal permits that would result in adverse environmental impacts not considered in the FEIS, ROD, and administrative record. Modifications to the approved MPO would be required if environmental impacts occur that

are outside the scope of the ROD for the Rosemont Copper Project. Compliance with the approved MPO is conditional and requires compliance with the terms of the local, State, and Federal permits, which govern actions that could affect the surface resources on National Forest System lands. The Coronado and other local, State, and Federal agencies would coordinate with one another to the extent possible. In addition, Rosemont Copper has a legal obligation and financial interest in seeing that the project is implemented as described in its approved plans and permits. The continuation and ultimate success of the mining venture depends on implementing and coordinating all of the facilities, activities, and personnel in an economically viable and environmentally sound way. To accomplish the objective of documenting compliance with permit requirements, a system of self-monitoring and quality assurance/quality control techniques is proposed. To achieve this objective, Rosemont Copper would provide the Coronado with a description of how environmental protection standards contained in approved plans and permits would be implemented. This plan would specify company and contractor personnel who are responsible for performance, inspection, and approval of all work that affects the surface resources. Rosemont Copper would designate an environmental coordinator as the primary contact with the Coronado on permit compliance, monitoring, and mitigation. An interagency task force would be formed to administer the approved MPO. The Coronado, Arizona Department of Environmental Quality, and other agencies (as appropriate) would be members of the task force. This group would oversee regulatory compliance and quality assurance/quality control issues related to Rosemont Copper.

Alternatives Considered in Detail

The Forest Service has developed alternatives (including “no action”) that have been considered in detail in response to Rosemont Copper’s preliminary MPO using issues raised by the public, Forest Service interdisciplinary team (ID team), tribal governments, participating State and Federal agencies, and organizations. “Reasonable alternatives include those that are practical or feasible from technical and economic standpoint and using common sense, rather than simply desirable from the standpoint of the applicant” (Council on Environmental Quality 2007:16). All reasonable alternatives must fulfill the project’s purpose and need, as well as address significant issues.

Therefore, reasonable alternatives were developed that respond to the significant issues, reduce potential environmental impacts, and respond to the purpose and need for action. Alternatives to the proposed action primarily involve different locations and shapes for the tailings and waste rock facilities, different locations for the access roads, and modification to process facility locations as required by the different tailings facility sites. In addition, the alternatives also include modification of other elements of the plan such as timing of the tailings placement, storm events used to design stormwater control facilities, and layout of stormwater diversion channels.

A description of the six alternatives considered in detail in this DEIS is provided in this chapter. Only the no action alternative (alternative 1) is consistent with the management direction contained in the “Coronado National Forest Land and Resource Management Plan,” as amended (forest plan) (U.S. Forest Service 1986). The action alternatives (alternatives 2 through 6) would require a programmatic amendment that would permanently alter the Coronado’s forest plan for the area covering the proposed project area, along with the associated plan components for that area. Refer to the Forest Plan Consistency section of this chapter, which follows the description of alternatives.

The Forest Service ID team began the development of alternatives by reviewing the following:

1. The proposed action and the purpose of and need for action.
2. Significant issues (see chapter 1), as developed from comments received during the 120-day scoping period.
3. All alternatives proposed by the public and other agencies during the scoping period.

Alternatives that did not meet the purpose of and need for action, alternatives that did not resolve environmental conflicts, and alternatives that were not available or feasible were eliminated from detailed consideration (see the "Alternatives Considered but Eliminated from Detailed study" section later in this chapter).

The ID team met on several occasions to review potentially affected resources and identify preliminary alternatives. These alternatives were submitted to Rosemont Copper to verify that they could be constructed. Rosemont Copper confirmed that all alternatives could technically be constructed; however, minor modifications were made for safety and stability considerations and to ensure that the waste rock and tailings facilities had sufficient capacity.

The Coronado invited the cooperating agencies to review the preliminary alternatives during several regularly scheduled monthly meetings. Several of the cooperators submitted comments and proposed additional alternatives for consideration. As a result of these comments, the Coronado invited the cooperators to develop an alternative as a collaborative effort. This involved a review similar to the ID team's efforts detailed above.

On May 10, 2010, the forest supervisor identified three action alternatives in addition to the proposed action for detailed analysis in this DEIS (Derby 2010). The forest supervisor subsequently directed that a fifth action alternative be analyzed in detail.

The alternatives selected for detailed analysis are as follows:

1. No action
2. Proposed action
3. Phased Tailings
4. Barrel
5. Barrel Trail
6. Scholefield-McCleary

The U.S. Army Corps of Engineers developed alternatives in accordance with the Clean Water Act Section 404(b)(1) guidelines found at 40 Code of Federal Regulations 230. The Section 404(b)(1) guidelines require the U.S. Army Corps of Engineers to permit the least environmentally damaging practicable alternative in light of cost, logistics, and technology while giving due deference to the applicant's stated purpose and need. The U.S. Army Corps of Engineers' alternative development process is summarized in appendix B, which provides the "U.S. Army Corps of Engineers' Section 404(b)(1) Alternatives Analysis" (WestLand Resources Inc. 2010a). The alternatives analysis is intended to ensure that no discharge be permitted "if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences (40 C.F.R. §230.10(a))." See appendix B for further details.

Descriptions of all alternatives considered in detail are provided below, including the proposed action and no action alternatives. With the exception of the no action alternative, the alternative components that are described are in addition to the descriptions of mining facilities and processes that were described previously in this chapter. All permits, operations, facilities, designs, activities and mitigation measures previously identified as applying to all action alternatives should be considered to be a component of the proposed action (alternative 2) and the action alternatives (alternatives 3 through 6).

Alternative 1 – No Action Alternative in Detail

The National Environmental Policy Act requires consideration of a "no action" alternative (figure 7). Under this alternative, Rosemont Copper would not develop the Rosemont mineral deposit at this time. The environmental, social, and economic conditions described as the affected environment in chapter 3 would not be affected by the construction, operation, reclamation, or closure of the mine. Any existing exploration related or baseline collection disturbances on National Forest System lands by Rosemont Copper would be reclaimed in accordance with existing laws and permits. Existing uses such as grazing and recreation use would continue at current levels.

Specific information pertaining to the effects of "Alternative 1 – No Action Alternative" is summarized at the end of this chapter.

Alternative 2 – Proposed Action in Detail

The proposed action reflects the preliminary MPO which has been accepted as sufficient to be analyzed under the National Environmental Policy Act by the Coronado and Bureau of Land Management. The proposed action, which is shown in figure 8, contains all the elements listed previously in this chapter as being common to all action alternatives.

Waste Rock Storage Area

The waste rock storage area would be constructed south of the tailings facility (see figure 8). It is designed to accommodate approximately 720 million tons of material, with an additional 569 million tons of waste rock dedicated to construction of the perimeter buttress and other facilities. It would cover approximately 2,000 acres. Starting in the first year, waste rock would be placed as perimeter buttresses to partially block the view of the mining area project for travelers on State Route 83 and for viewers in the surrounding area. Throughout the life of the mine, waste rock would be disposed of to the west and/or north of (behind) these buttresses. Waste rock would also be placed to support and armor the outer slopes of the dry-stack tailings disposal areas during the processing of sulfide ore through approximately year 20. Construction of the perimeter buttresses would be complete approximately 5 years after plant startup. The final elevations of the perimeter buttresses would be about 5,475 feet but would step down on the northeast side to elevations that are between 5,150 and 5,050 feet to tie in with the dry-stack tailings and oxide heap leach facilities. The height of the waste rock buttresses would vary, ranging from 100 to 400 feet, depending on existing topography.

Prior to disposal of waste rock, undisturbed areas would be cleared and grubbed, and soil usable for growth media would be salvaged for active or future reclamation. The outer slopes of the waste rock disposal area would have an overall slope of 4:1 (horizontal: vertical). Growth media would then be spread across the surface, seeded, fertilized, and managed as necessary to promote revegetation of the waste rock storage area. Reclamation of these areas would be conducted concurrently.

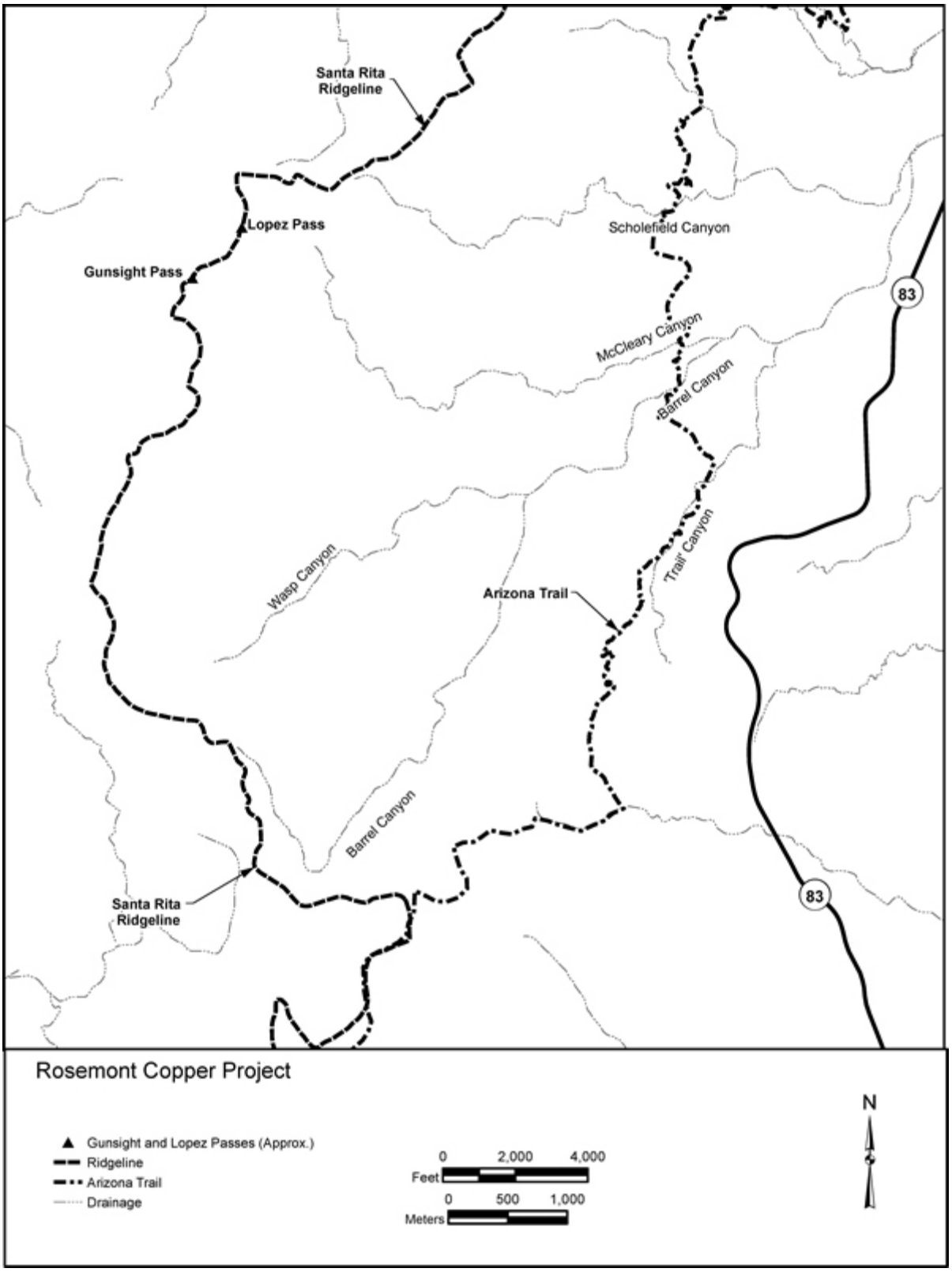

Figure 7. No action alternative

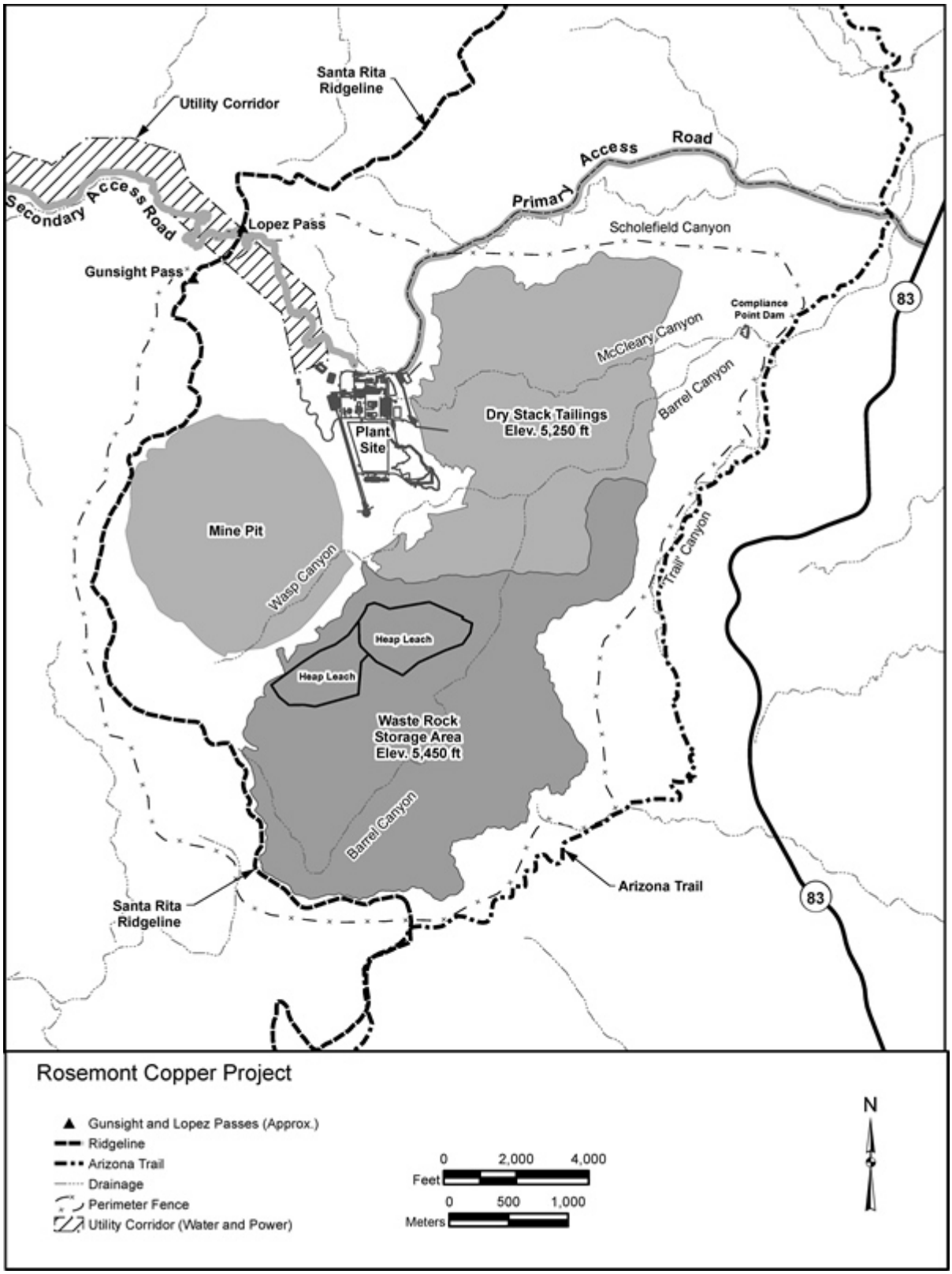

Figure 8. Proposed action footprint

Waste rock disposal would be restricted to a single surface water drainage basin, the Barrel Canyon area, including the tributaries of Wasp and McCleary drainages. The tops of the disposal facilities would be sloped to direct stormwater away from the crest of the perimeter buttresses. Stormwater and seepage from the waste rock disposal area would be collected at the toe of slopes and ultimately directed to a sediment pond to the northeast of the tailings storage area. This pond would be the final testing and control point for stormwater discharge to the Barrel Canyon drainage.

Dry-Stack Tailings Facility

The proposed action incorporates a waste rock perimeter buttress that would completely surround the dry-stack tailings and the heap leach facility. The dry-stack tailings disposal area would be divided into two separate units, north and south, that would be separated by a stormwater control facility (the central drain). The north stack would be constructed in years 1 through 14 and the south stack in years 15 through 20. The dewatered tailings would be deposited by a mechanical stacker and moved and compacted as needed by a bulldozer. The outer slopes of the dry stack would be contained and armored with benched waste rock buttresses that would be no less than 150 feet wide and that would have an overall crest-to-toe slope of 3:1 (horizontal: vertical). The central drain would be constructed of waste rock selected for size and chemical inertness and would function to collect and route stormwater from both on top and upstream of the tailings facility.

Plant Site

The plant site would be located between the pit and the north end of the tailings facility. The specific layout of plant site facilities in this alternative differs from the other alternatives (figure 9).

Process Water Temporary Storage Pond

The process water temporary storage pond would be located southeast of the plant site (see figure 9). The process water temporary storage pond would be divided into two sections (ponds), identified as the process water and the temporary storage portions. In general, the reservoir in the process water pond would be managed to optimize containment of recirculated water, and the temporary storage pond would be kept at low fill levels to optimize room for stormwater runoff. Incline-mounted or barge pumps in each pond would pump captured recirculated process water and stormwater to the reclaimed water tanks for distribution as needed into the process circuit. The pumps would also allow each pond to be emptied for inspection.

The process water portion would be a single-lined surface impoundment that would provide storage for 3 days of water reclaimed from the tailings filters mixed with fresh water from wells near Sahuarita. The 3-day period would allow for some flexibility and emergency storage in case of a service interruption at the plant facilities. Additionally, ponded stormwater on the surface of the dry-stack tailings facilities may be pumped to the process water portion to limit infiltration into the tailings material.

The temporary storage portion would be a single-lined surface impoundment that would receive stormwater runoff from the plant site area, including a small drainage basin located west of the pond. As currently designed, the temporary storage portion would provide containment of a 100-year, 24-hour storm event.

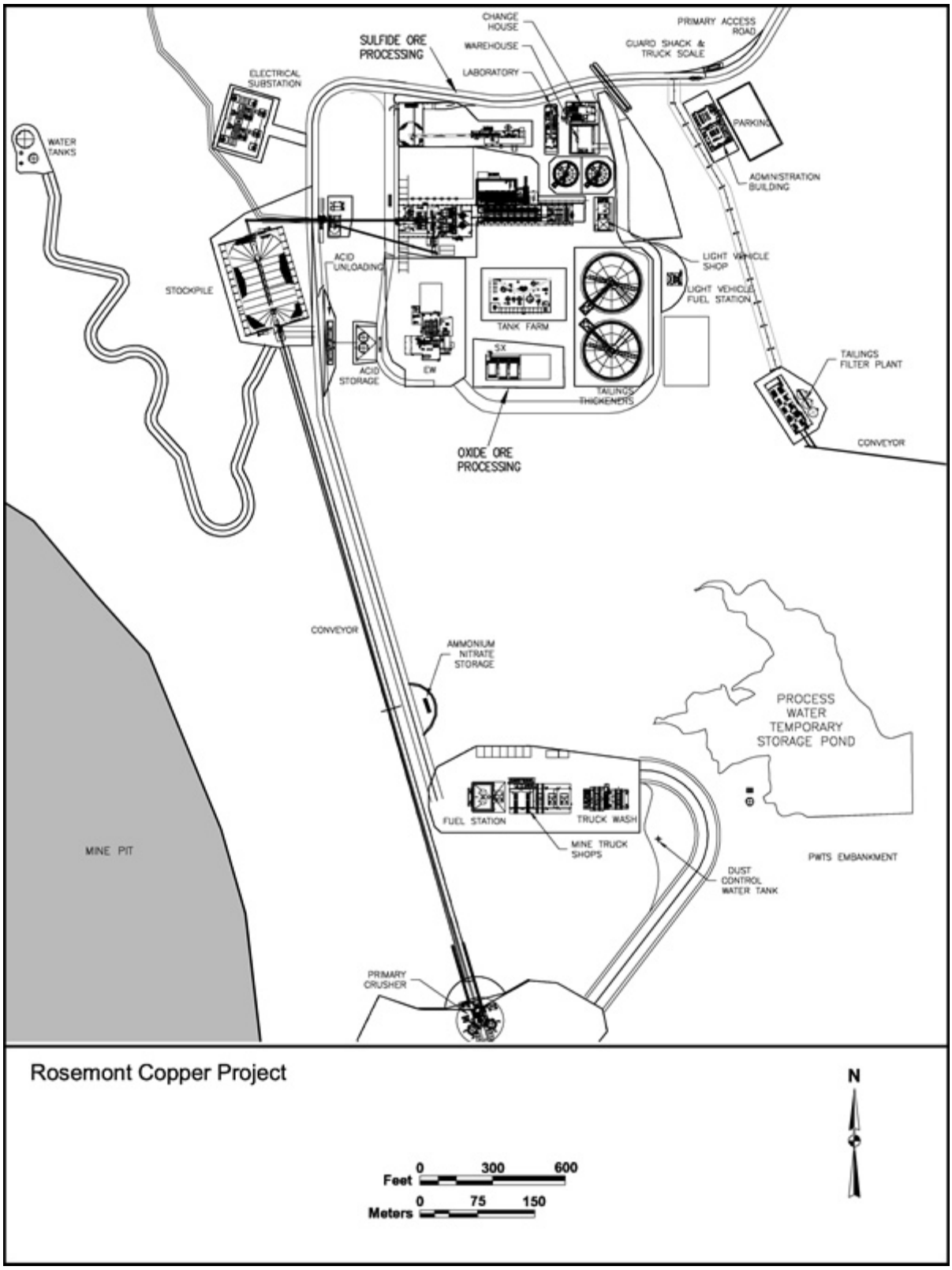

Figure 9. Proposed action plant facilities

Central Drain

The central drain would be a rock chimney drain located between the north and south tailings. It is designed to route excess stormwater through the tailings disposal area from both upstream and on top of the dry-stack tailings facility and ultimately to the compliance pond in Barrel Canyon. Stormwater from the waste rock buttresses of the dry-stack tailings disposal area would be combined with stormwater from the waste rock disposal for reuse or discharge downstream after passing through the final compliance pond (figure 10).

Over time, the northern tailings facility would expand to the south and east and would cover a portion of the Barrel Canyon drainage. The north diversion would then be extended in the natural drainage as a porous rock drain, known as the central drain, and waste rock would be stacked over the top of the rock drain material. An upstream impoundment, the attenuation pond, would collect surface runoff and slowly feed stormwater into the central drain. The central drain design was based on placement of clean, competent rock to allow conveyance of the 100-year, 24-hour storm event volume from the contributing basin through the drain within 30 days. The estimated volume of 436 acre-feet that could be temporarily stored in the upstream attenuation pond (to a maximum water level elevation of 4,895 feet, which would pass through the drain in 30 days) assumes a rock permeability of approximately 0.5 inch per second and a drain cross-sectional area of 9,000 square feet. The drain was sized to provide a 30-foot-high drain across the streambed, which is approximately 300 feet wide. Select waste rock would be placed above the 30-foot-high portion of the drain to extend the drain upward as the tailings stack is advanced.

Phasing of Activities

Mining activities exclusively for copper production would begin after 18 months of initial construction. Activities would include the sequential construction of the tailings facility with the northern dry stack, in operation for years 1 through 14, and the southern dry stack, in operation for years 15 through 20. Reclamation would be phased during the mine life, with concurrent reclamation occurring on the outer slopes of the perimeter buttress and waste rock facility as those surfaces are completed. During years 21 through 25, closure and reclamation would take place.

Specific information pertaining to the effects of “Alternative 2 – Proposed Action Alternative” is summarized at the end of this chapter.

Alternative 3 – Phased Tailings Alternative in Detail

Specific Elements of the Phased Tailings Alternative

The Phased Tailings Alternative was developed to respond to the significant issues regarding the potential impacts on water resources and visual resources. Alternative 3 (figure 11) contains a number of features in common with the proposed action. However, several features were modified and designed to better respond to the issues mentioned. These include the following:

- Reversing the phased placement of the dry-stack tailings to leave the McCleary Canyon drainage open for approximately an additional 10 years. This would reduce the short-term impact on surface water flow by allowing the McCleary Canyon drainage to remain open approximately 10 years longer than it would under the proposed action.

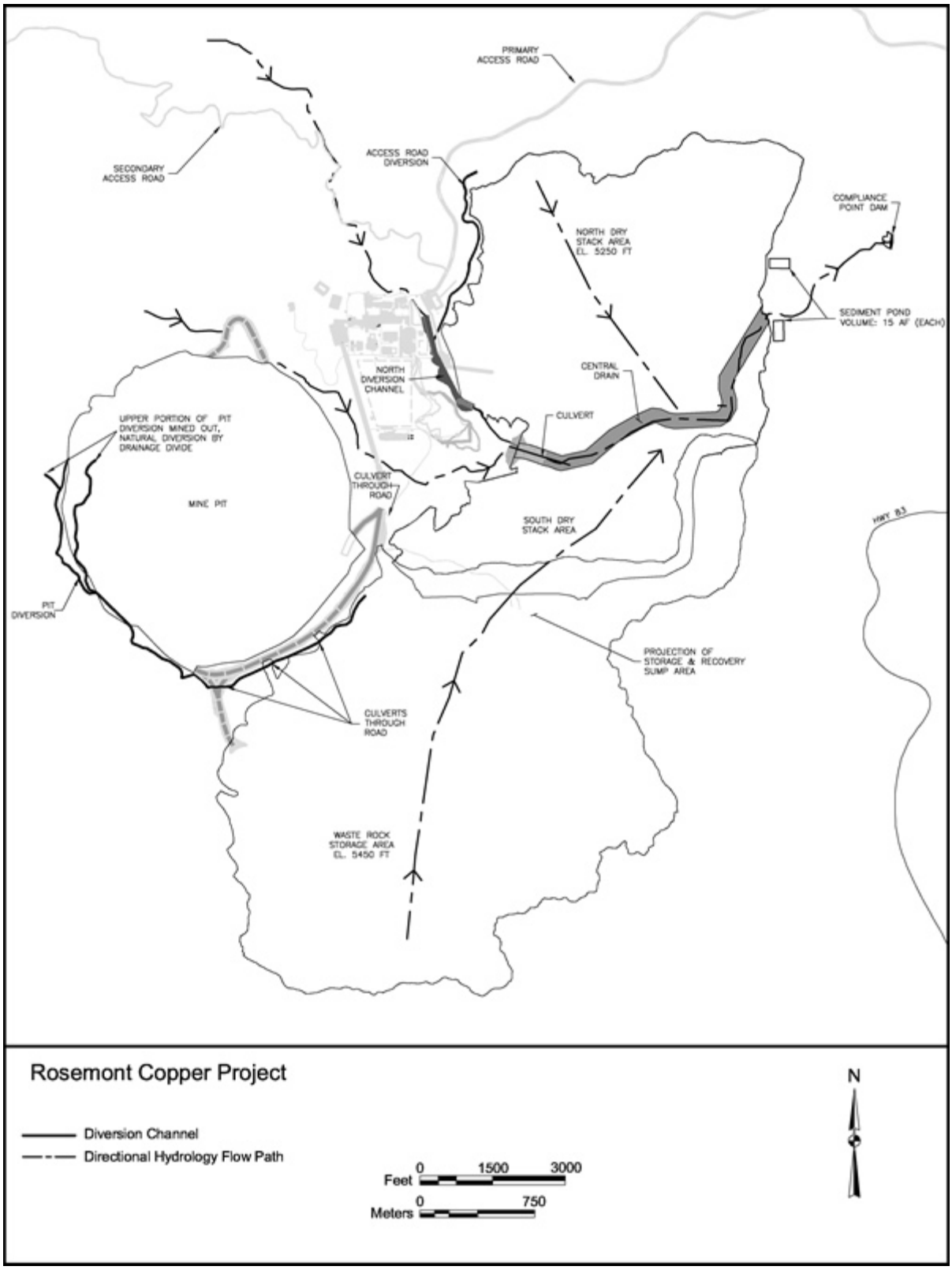

Figure 10. Proposed action stormwater control concept

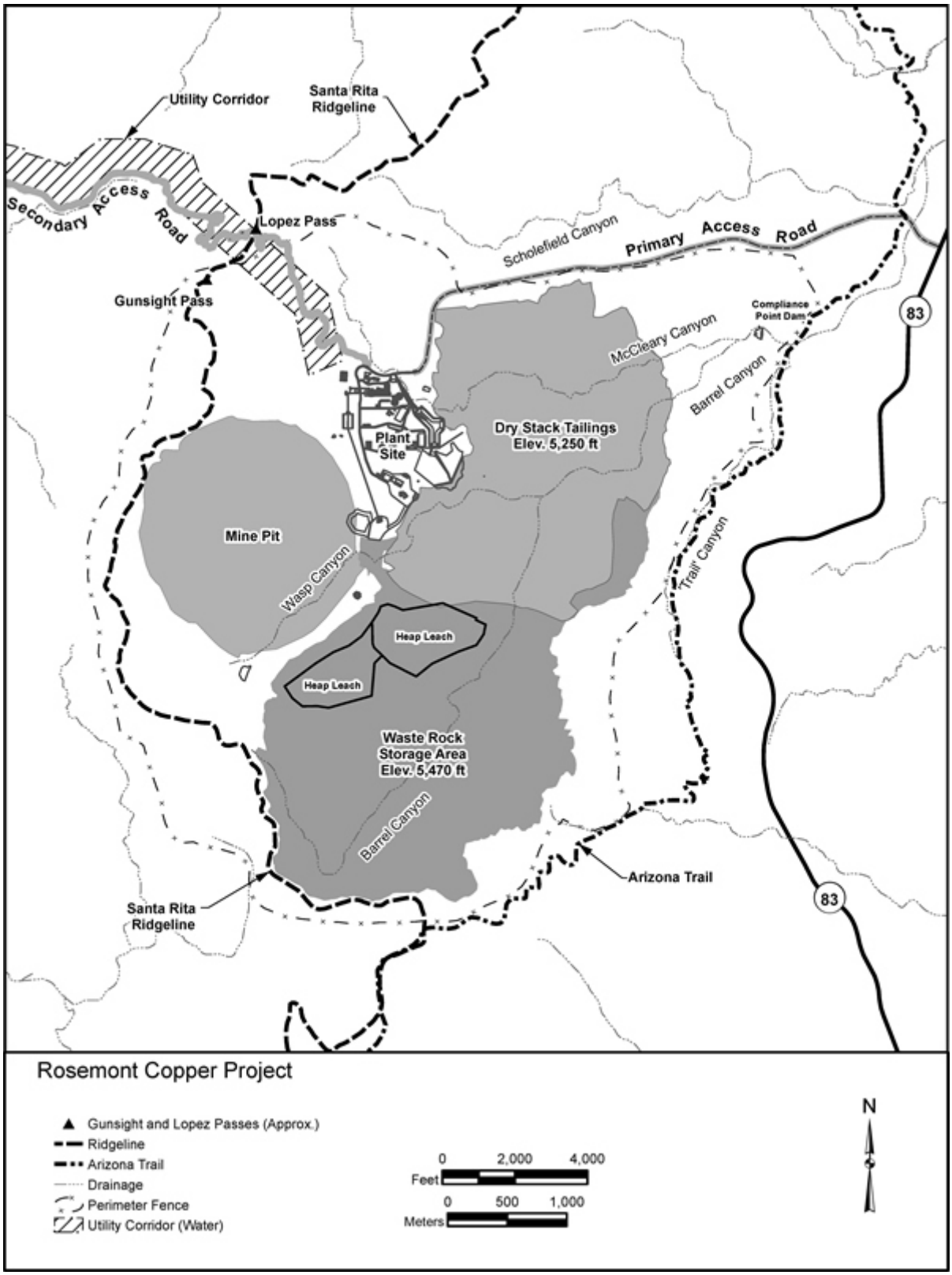

Figure 11. Phased Tailings Alternative footprint

- Replacing the central drain with a series of flow-through drains and drainage basins located beneath or adjacent to the dry-stack tailings facility to improve overall stormwater drainage capacity and reduce the possibility that stormwater that has contacted tailings could comingle with stormwater discharged offsite.
- Redesigning the diversion and stormwater management plan and including more conservative storm design criteria for surface water control structures to increase the capacity of stormwater control structures.
- Modifying the process water temporary storage pond and adding a double liner with a leak collection and removal system to the process water containment to improve the containment of process water and separate stormwater from process water.
- Realigning the primary access road to avoid Scholefield Canyon, reduce its visibility, decrease stormwater runoff into the Barrel Canyon drainage system, and reduce impacts to riparian vegetation.
- Modifying the locations of facilities at the plant site to reduce geotechnical concerns regarding differential settlement (figure 12).
- Providing secondary containment opportunities where possible for process solutions, process interruptions, or ponds by changing facility locations; and adding catchments where necessary.

Like the proposed action, the Phased Tailings Alternative incorporates a waste rock perimeter buttress that would completely surround the dry-stack tailings, and the heap leach facility would be located in the same place as for the other alternatives. The construction of the tailings phases is reversed from that of the proposed action, with phase I to be constructed between McCleary Canyon and the waste rock storage area and operated in years 1 through 12. Phase II would be an extension of the phase I facility constructed north of phase I within McCleary Canyon. Phase II would operate from years 12 through 20. However, at the end of mine life, the final waste rock and tailings facility would functionally occupy the same location as in the proposed action.

A series of flow-through drains beneath the tailings and waste rock facilities would replace the central drain and attenuation pond of the proposed action. The flow-through drains, which are rock drain structures placed in the natural drainage channels, are designed to pass stormwater beneath the tailings and waste rock facilities. They are part of the overall diversion system. The diversion and stormwater management system was completely redesigned from that of the proposed action and incorporates more conservative design criteria to reduce the potential for failure during unusually high precipitation events.

Figure 13 shows the layout, which incorporates diversion channels and detention basins on the mine site; channels, detention basins, and drop structures on the waste rock and perimeter buttress of the tailings facility; and flow-through drains, including the design storm event used in the design of each facility.

The process water temporary storage pond is divided into two containments, one for process water and one for temporary storage of plant site runoff and any overflow from the process water containment. The redesigned process water pond has a double liner with leak collection and removal system over a geosynthetic clay liner, and the temporary storage pond has a single liner over a geosynthetic clay liner. A settling basin upstream of the process water containment has been included in the provide containment for tailings settlement, if necessary, and allow water to flow into the process water pond. Additionally, the leaching system barren solution pond was relocated upgradient of the process water pond to provide containment opportunities.

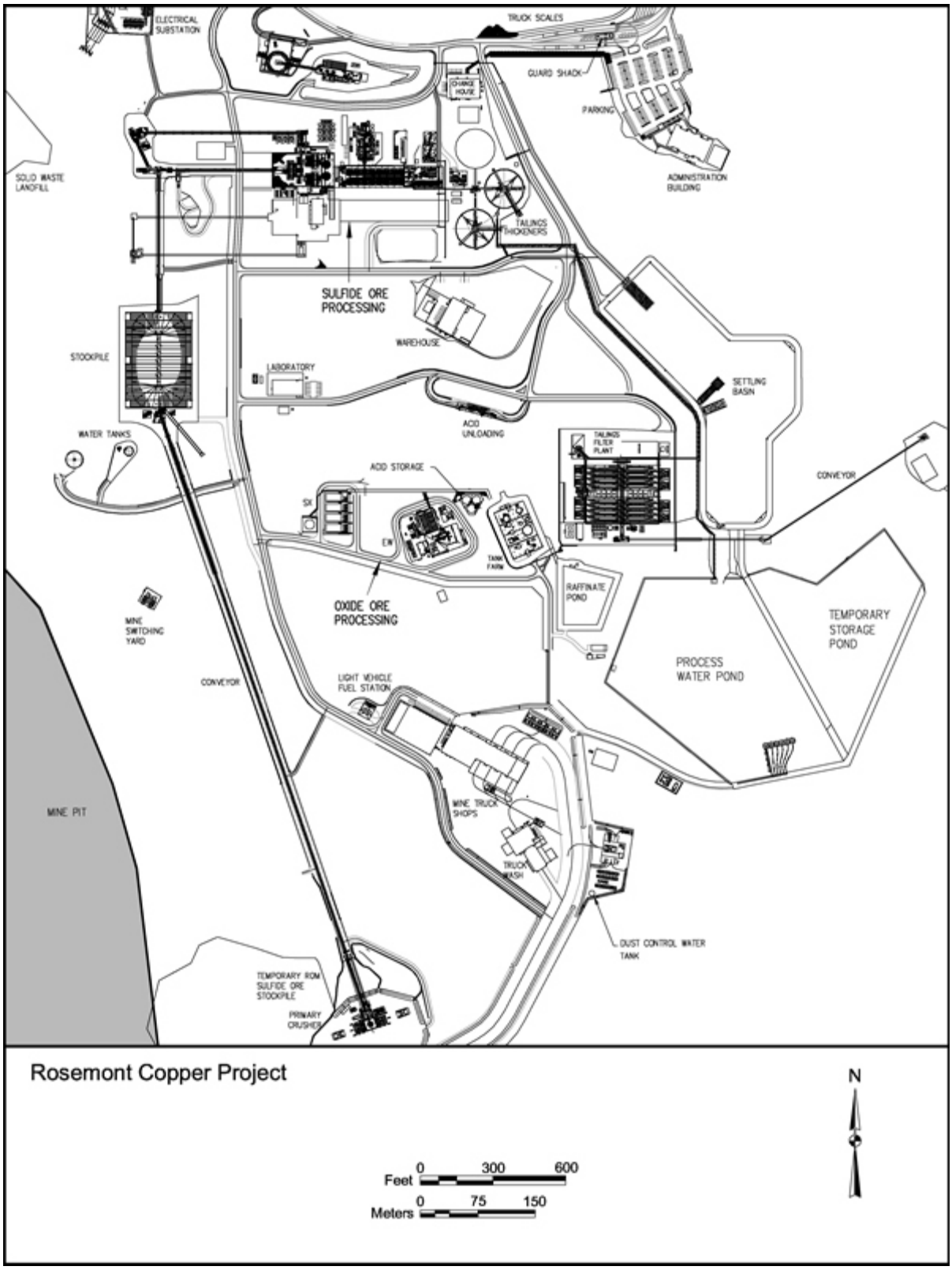

Figure 12. Phased Tailings Alternative plant site

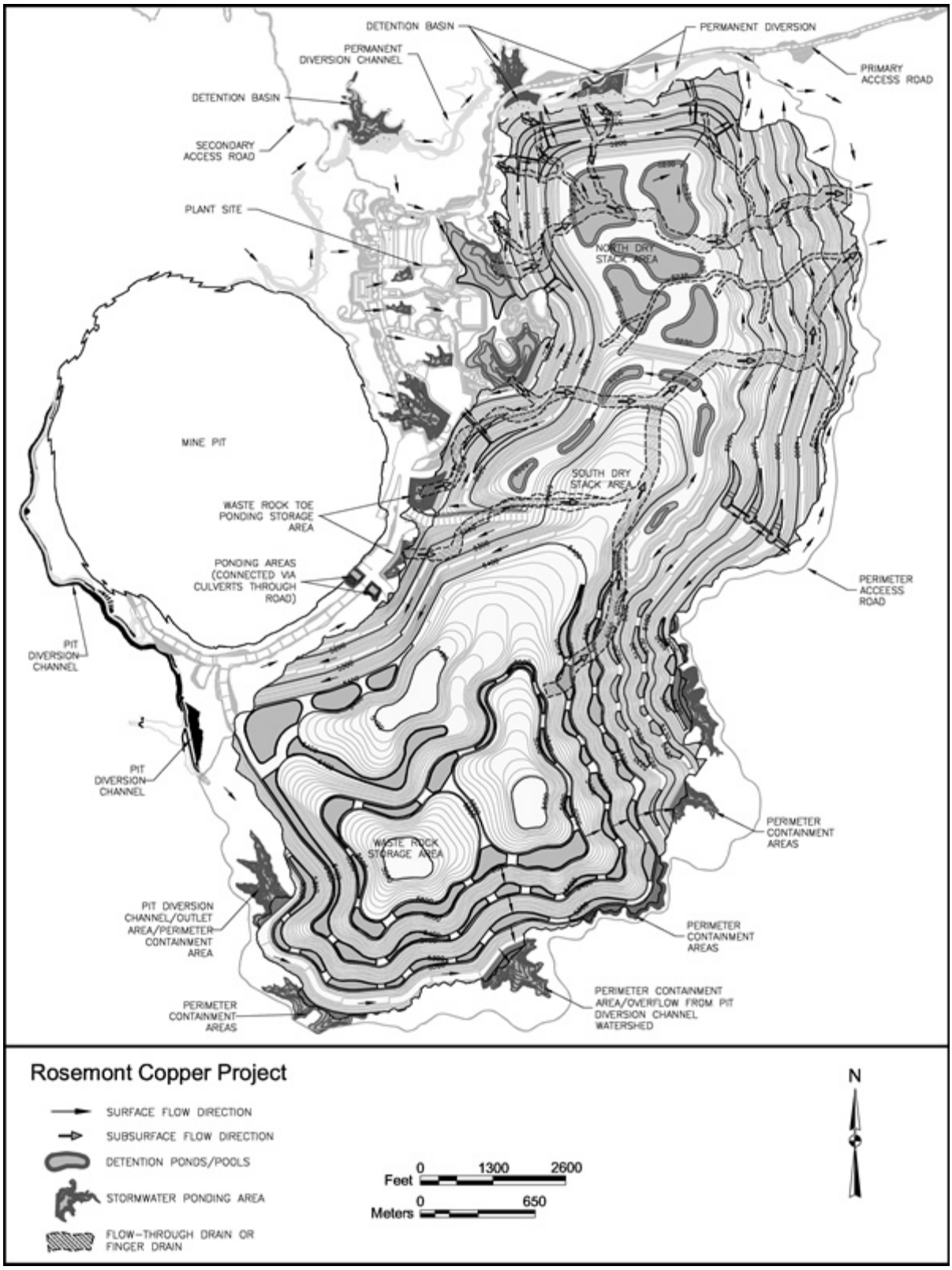

Figure 13. Phased Tailings Alternative stormwater control concept

The primary access road was redesigned to follow a revised alignment that both shortens the road and reduces its visibility from State Route 83. The new alignment intersects State Route 83 at the same location as in the proposed action but is 3.2 miles long, as shown in figure 11.

Other relatively minor differences between the Phased Tailings Alternative and the proposed action include relocating facilities within the plant site, although the overall location of the plant site would remain the same. In addition, the Phased Tailings Alternative includes a minimum 20-foot-thick final cap of waste rock atop the heap leach rather than the 50-foot minimum in the proposed action. The thickness of the waste rock cap over tailings is not considered to be the critical determining factor for seepage of stormwater through the tailings (which is controlled by the low permeability of the unsaturated tailings). A cap of 20 feet is considered sufficient as long as ponding is not occurring above the heap leach. This thickness should afford reasonable infiltration resistance (mostly by retaining the intermittent infiltration in the near surface soil, where it can wick back to the surface and evaporate following the rain). It should be noted that discharge from the heap both during operations and postclosure is regulated by the Arizona Department of Environmental Quality; therefore, precipitation recharge cannot lead to an environmental impact without a violation of the required aquifer protection permit.

Specific information pertaining to the effects of “Alternative 3 – Phased Tailings Alternative” is summarized at the end of this chapter.

Alternative 4 – Barrel Alternative in Detail (Preferred Alternative)

The Forest Supervisor has chosen the Barrel Alternative to be the preferred alternative. Factors influencing the decision include preservation of resource values in McCleary Canyon, including recreation, riparian areas, and wildlife species habitat and movement corridors, as well as avoidance of waters of the United States and cultural sites in McCleary Canyon and other areas.

Specific Elements of the Barrel Alternative

The Barrel Alternative (figure 14) was developed to respond to the significant issues regarding potential impacts on biological resources, cultural resources, recreation, and the surface water component of water resources. The Barrel Alternative places all of the tailings and waste rock in upper Barrel Canyon and the lower portion of Wasp Canyon. Prohibiting mine tailings or waste in McCleary Canyon permanently maintains its contribution of surface water flow to the Barrel Canyon drainage system, albeit in a somewhat decreased capacity during operations by requiring runoff from the plant site to be retained, and increases the drainage area that may be diverted through the McCleary Canyon channel, in contrast to that of the proposed action and the Phased Tailings Alternative.

The Barrel Alternative incorporates a waste rock perimeter buttress that would completely surround the dry-stack tailings, and the heap leach facility would be located in the same place as for the other alternatives. In order to maintain concurrent reclamation of final outer slopes, waste rock is initially placed in berms along the outside edge of the waste rock area, followed by waste rock and tailings placement behind the berms. As with all action alternatives, the heap leach facility would ultimately be encapsulated within the waste rock and tailings facilities.

The primary access road from State Route 83 and the secondary access road over Lopez Pass, as well as the general layout of facilities within the plant site, would be similar to the Phased Tailings

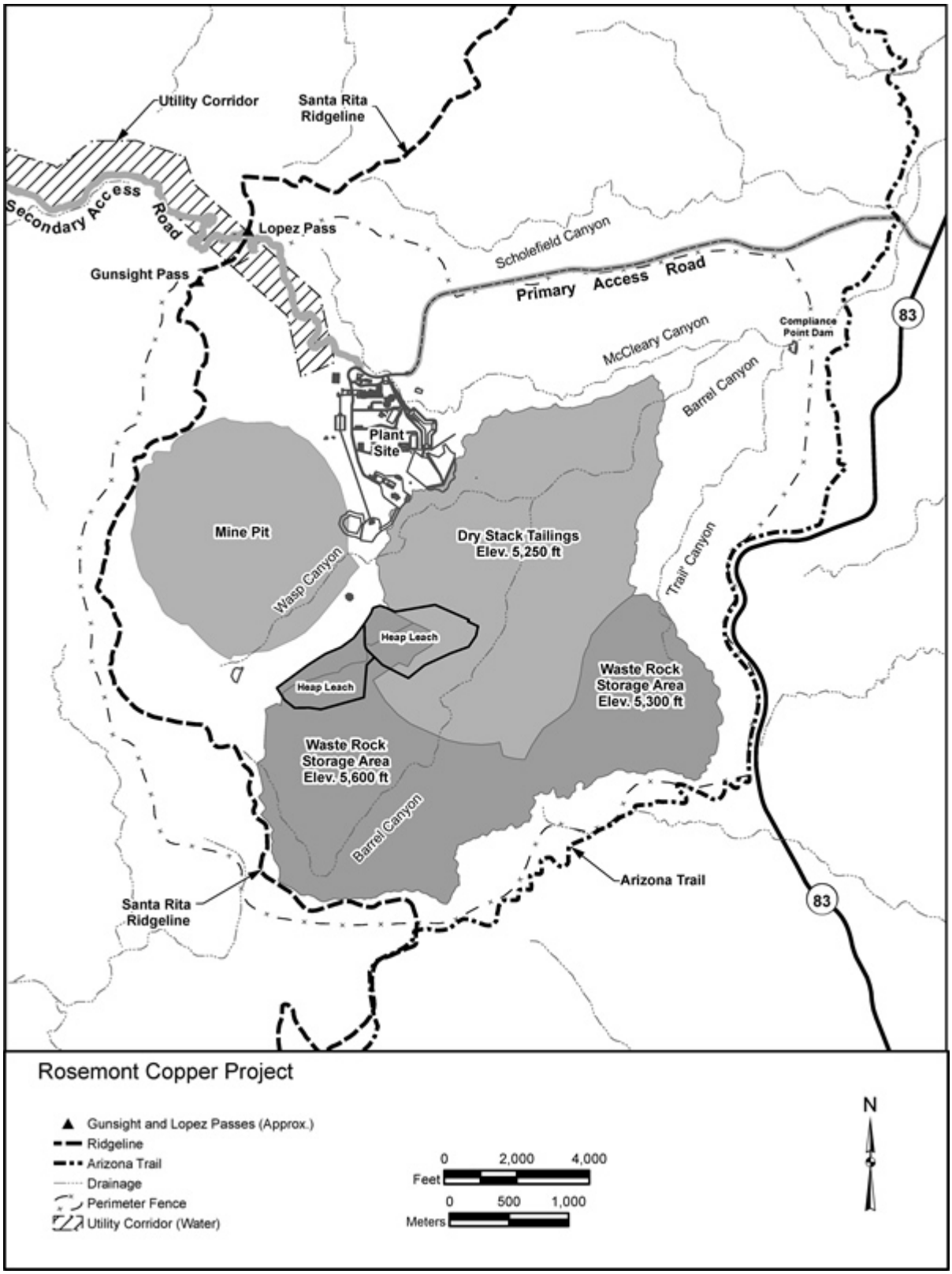

Figure 14. Barrel Alternative footprint

Alternative, except that the tailings conveyor system would require modification to accommodate the relocated tailings facility. Surface water management facilities include diversions around the facility to convey storm events upgradient of the pit, operating facilities, and waste rock and tailings storage areas and to place the water back into drains or other control structures. Diversion and stormwater control facilities would be designed to the same criteria used for the Phased Tailings Alternative.

Specific information pertaining to the effects of "Alternative 4 – Barrel Alternative" is summarized at the end of this chapter.

Alternative 5 – Barrel Trail Alternative in Detail

Specific Elements of the Barrel Trail Alternative

The Barrel Trail Alternative (figure 15) was developed to respond to the significant issues regarding potential impacts on visual resources and the surface water component of water resources. The Barrel Trail Alternative places all tailings and waste rock in upper Barrel, Trail, and Wasp Canyons. This alternative is similar to the Barrel Alternative in that it also permanently avoids placement of mine waste in McCleary Canyon to reduce impacts to surface water flows into Barrel Canyon. However, this alternative incorporates a more varied topography to more closely replicate a natural landform than the other alternatives. The incorporation of a more varied topography resulted in an expanded footprint of the tailings and waste rock facilities. The topography of the Barrel Alternative includes two ridges with varying elevations and an intervening valley that drains to Barrel Canyon.

Like the Barrel Alternative, the Barrel Trail Alternative incorporates a waste rock perimeter buttress that would completely surround the dry-stack tailings, and the heap leach facility would be located in the same place as for the other alternatives. However, in order to maintain concurrent reclamation of final outer slopes, waste rock would initially be placed in berms along the outside edge of the waste rock area, nearest State Route 83, followed by waste rock placement behind the berms. As with all alternatives, the heap leach facility would ultimately be encapsulated within the waste rock and tailings facilities.

The primary access road from State Route 83 and the secondary access road over Lopez Pass, as well as the general layout of facilities within the plant site, would be similar to the Phased Tailings Alternative, except that the tailings conveyor system would require modification to accommodate the relocated tailings facility. The general style for diversion and stormwater control structures, including the storm events for design, would also be similar, except that the valley incorporated in the ultimate mine waste landform would carry stormwater to Barrel Canyon in lieu of the rock drop structures used in the Phased Tailings Alternative. However, engineering concepts available thus far indicate that rock drop structures and hardened channels would be required to manage the facility without excess erosion. Figure 16 shows the layout, which incorporates diversion channels and ponding areas.

Specific information pertaining to the effects of "Alternative 5 – Barrel Trail Alternative" is summarized at the end of this chapter.

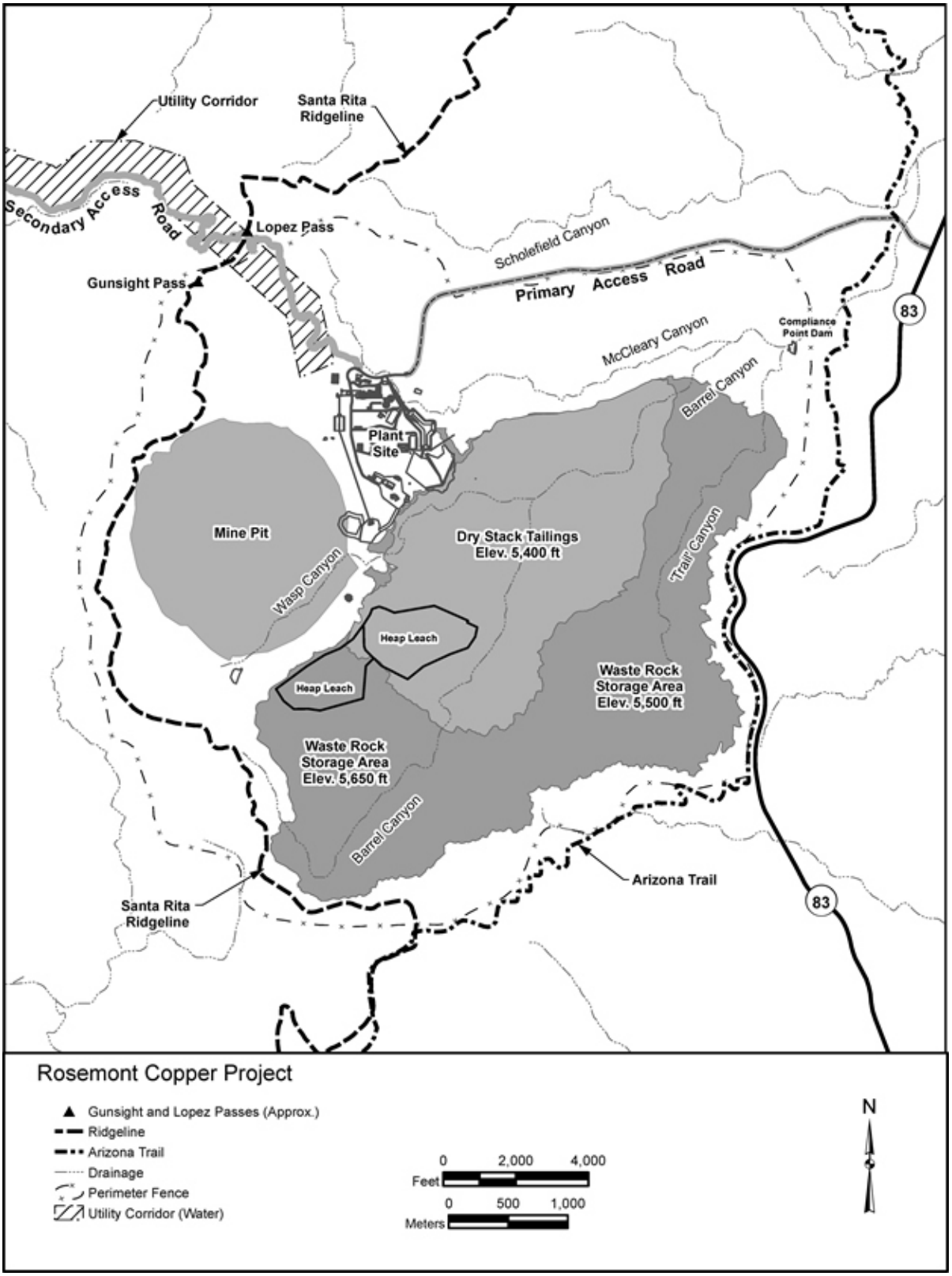

Figure 15. Barrel Trail Alternative footprint

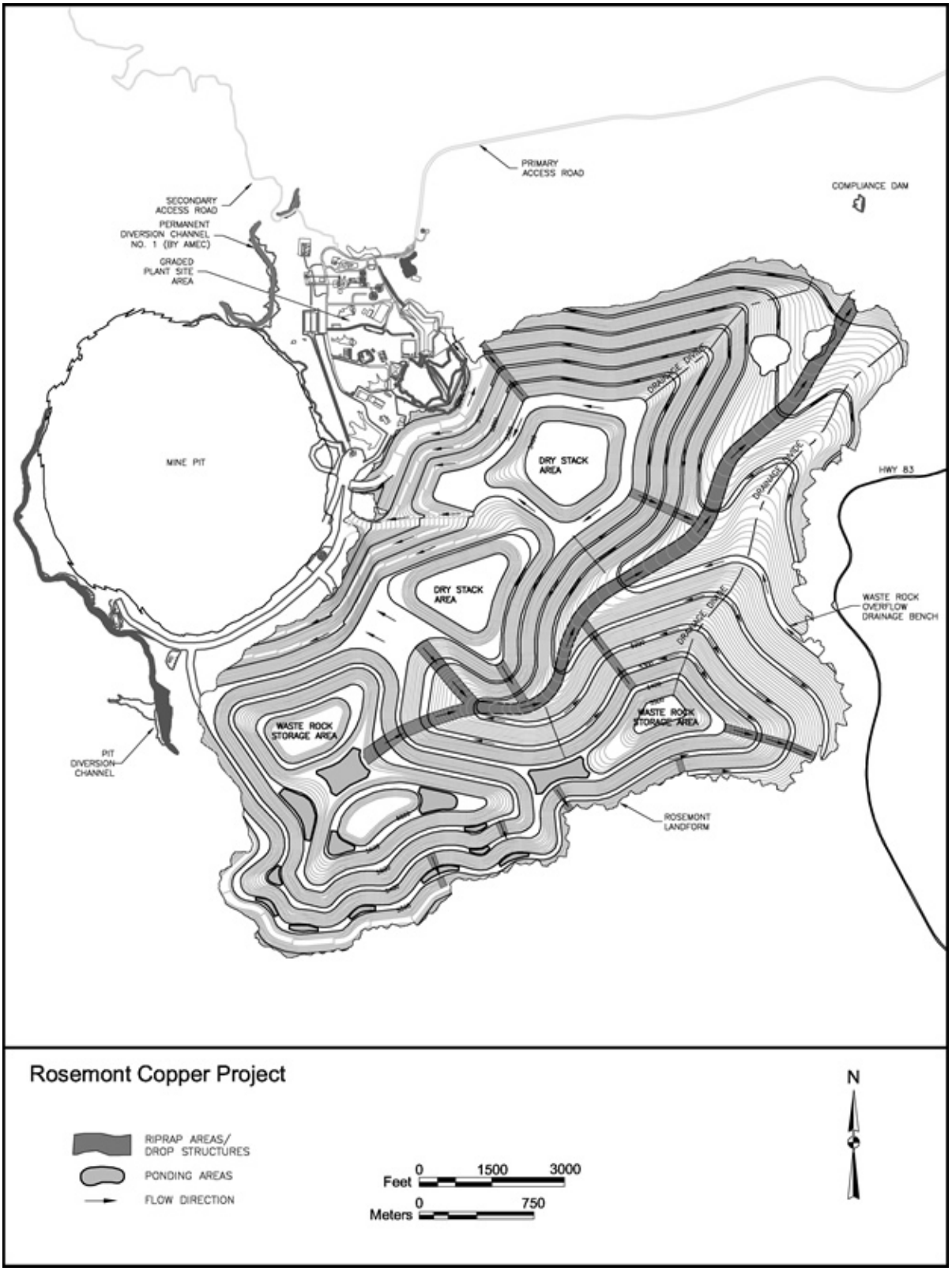

Figure 16. Barrel Trail Alternative stormwater control concept

Alternative 6 – Scholefield-McCleary Alternative in Detail

Specific Elements of the Scholefield-McCleary Alternative

The Scholefield-McCleary Alternative (figure 17) was developed to respond to the issues regarding potential impacts on cultural resources, riparian habitat resources, and the surface water component of water resources that would arise from placing the tailings and waste rock in the McCleary and/or Barrel Canyon drainages. The Scholefield-McCleary Alternative would place all tailings and the majority of waste rock north of the McCleary Canyon drainage channel. The dry-stack tailings would occupy Scholefield Canyon and an unnamed tributary drainage, and waste rock would be placed on the northern slope of McCleary Canyon above the drainage bottom and extend to the north atop the tailings. The general facility layout within the plant site would be similar to alternatives 3 and 4.

The heap leach facility would remain in Barrel Canyon, like for the proposed action and the other action alternatives. Reclamation of the heap leach pad would include encapsulating the heap with waste rock to a minimum thickness of 20 feet atop the pad and constructing the side slopes of the waste rock cover similar to and using the same stormwater control design criteria as the Phased Tailings Alternative.

Diversion and stormwater control facilities would be designed to the same criteria used for the Phased Tailings Alternative. Because of the relocation of mine waste to Scholefield Canyon, the site of the primary access road for the proposed action and other action alternatives, the road would be realigned, as shown in figure 17. The primary access road would be redesigned to follow the alignment shown in figure 17, intersecting State Route 83 between mileposts 41 and 42, and would be 2.8 miles long.

Specific information pertaining to the effects of “Alternative 6 – Scholefield-McCleary Alternative” is summarized at the end of this chapter.

Mitigation Measures Incorporated into the Project Design

The discussion of mitigation measures in this section applies to all action alternatives, including the proposed action. Council on Environmental Quality regulations (40 Code of Federal Regulations 1508.20) defines mitigation measures as follows:

- Avoiding an impact by not taking a certain action or parts of an action;
- Minimizing an impact by limiting the degree or magnitude of the action and its implementation;
- Rectifying an impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating an impact over time, through preservation and maintenance operations during the life of the action; and
- Compensating for an impact by replacing or providing substitute resources or environments.

Mitigation measures are often incorporated as integral components in the design of a project (Council on Environmental Quality 2011). The Rosemont Copper proposed action contains numerous measures that are designed to avoid, reduce, rectify, eliminate, or compensate for environmental impacts. These measures apply to alternatives 3 through 6, as well as the proposed action (alternative 2).

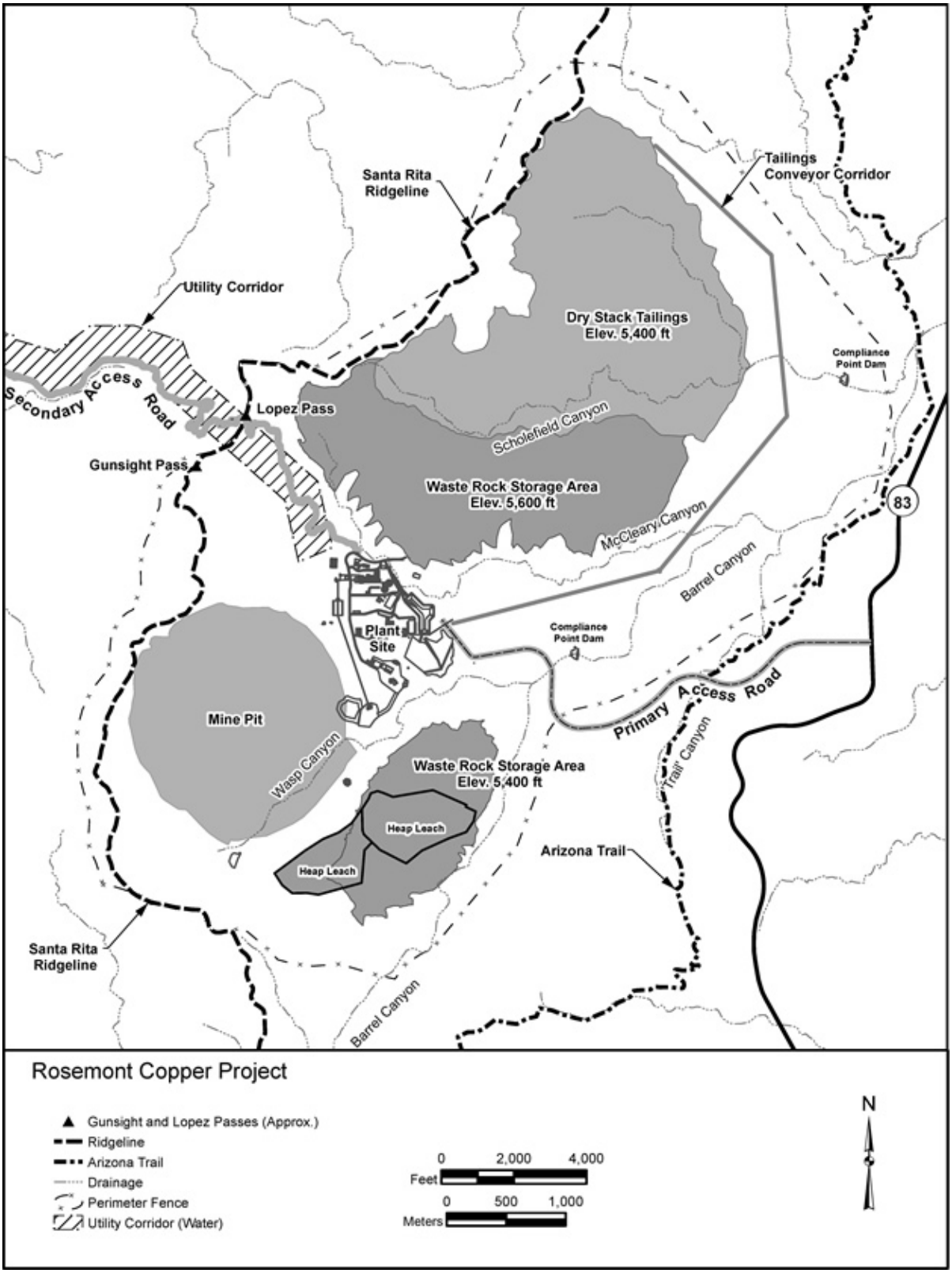

Figure 17. Scholefield-McCleary Alternative footprint

The mitigation measures described in this section are mandatory should one of these alternatives be selected for implementation. An interagency task force would be formed to administer the project once approved. The Coronado, Arizona Department of Environmental Quality, and other agencies (as appropriate) would be members of the task force. This group would oversee regulatory compliance and quality assurance/quality control issues related to the project, including implementation and monitoring of mitigation measures.

Mitigation measures that are common to the proposed action and action alternatives are listed here to avoid repeating them in each alternative description. While these measures are listed under specific resource area headings, it is important to understand that they typically have benefits for multiple resources. Additional mitigation measures specific to alternatives 3 through 6 are listed later in this chapter.

In addition to the mitigation measures that follow, the Forest Service is currently investigating the feasibility of incorporating geomorphic design concepts (sometimes called landforming) into construction of the Rosemont mine waste rock and tailings piles. Landforms of geomorphic design can create more stable, natural functioning and natural looking topography than conventionally designed landforms, which could mitigate some impacts to water quality and quantity, visual quality, recreation settings, and wildlife habitat. The Forest Service is currently exploring the status of geomorphic landform design in the mining industry. If these investigations show that geomorphic landform design is a reasonable approach and may be feasible for the project, the Forest Service will then apply geomorphic principles to at least one alternative. This may include partial backfill of the pit to reduce the footprint of waste rock and tailings facilities while maintaining a hydraulic sink. This investigation is currently taking place, and potential design work would occur between the DEIS and FEIS.

Air Resources

The finalized Air Quality Permit issued by Pima County would include final required mitigation measures. Because this permit has not yet been issued, the items below are based on information provided in the permit application.

The current dust control plan for the use on the unpaved road network includes three options available for use to provide flexibility to alternate between one option and another based on individual needs and ensures that at least a 90 percent control of particulate matter 10 (PM_{10}) emissions is achieved (Applied Environmental Consultants 2010a). The three options are as follows:

- Option A is the application of chemical dust suppressant, such as petroleum resins and acrylic cement, with a reapplication monthly.
- Option B is the periodic watering on days with precipitation of less than 0.01 inch. This option assumes hourly application calculations with application amount differences based on daytime and nighttime watering.
- Option C is the application of chemical dust suppressant with a monthly reapplication, plus watering to increase the efficiency of the suppressants.

The current dust control plan for open areas and storage piles in active use includes the application of water. Areas that are not actively used would be controlled with the application of sufficient chemical dust suppressant and/or water to develop and maintain a visible crust. Inactive areas would be periodically inspected, and other means of suppression may be applied if necessary.

Point source pollution control equipment would be used on all process equipment with significant emissions potential. Containment on processes with low emissions potential would be accomplished by water sprays or physical enclosures.

Point source emissions limits that are stricter than Federal and County requirements would be met. Newer engine designs would be used in mobile sources; these newer designs are subject to stricter Federal regulation and would result in lower emissions.

Tailings would be managed as they are placed within the tailings facilities. Tailings would be compacted using large equipment in the areas near the buttress. Compaction and other construction specifications would be dependent on their location within the tailings area and would be specified in the tailings operations and management plan. Rosemont Copper would follow specified procedures contained in material safety data sheets to reduce impacts of chemical releases into the atmosphere. Materials include chemical or physical dust control agents, organics, inorganic binders, and/or stabilizing polymers.

While dust control waste rock is not specifically indicated in the dust control plan, the U.S. Environmental Protection Agency states, “Waste Rock dumping can generate dust, but this generally consists of coarse particles that settle out rapidly with no other controls” (U.S. Environmental Protection Agency 1994).

Rosemont Copper would use low-sulfur diesel fuel onsite for all stationary equipment and “Tier 2” diesel engines for all haul trucks. Tier 2 engines meet the 2010 national standards for emissions. See the preliminary MPO in appendix A for further details.

Rosemont Copper would ensure that construction equipment is properly maintained at all times, that engines do not unnecessarily idle, and that equipment is tuned to manufacturers’ specifications.

To avoid aerosol losses to the wind, emitters (similar to drip irrigation) would be used to apply acid leaching solution to the oxide ore heap leach pad.

Air Quality Permit and Dust Control Plan

The Pima County Department of Environmental Quality has jurisdiction pursuant to state law, with the delegated authority to issue an air quality permit for the project. The air quality permit is a requirement under the Clean Air Act, whose regulatory authority has been delegated from the U.S. Environmental Protection Agency to the Pima County Department of Environmental Quality to implement and enforce applicable federal air quality standards. Development of a dust control plan is part of the permitting process. The Rosemont Copper Project Dust Control Plan includes measures to reduce dust and its potential effects on air quality through a variety of onsite dust control measures, many of which have been described above. Details can be found in the air quality permit application.

Community, Social and Cultural

Rosemont Copper intends to establish the Santa Rita Mountains Community Endowment Trust, for the purposes of funding priority community projects that include community recreation, cultural, and environmental conservation. The endowment would comprise assets, commitments, and funding from Rosemont Copper, including conservation easements and restrictive covenants donated in the first year of production ($6 million), $500,000 contributed from Rosemont Copper each year for 25 years ($12.5 million), and up to $25 million in variable contributions from Rosemont Copper, based on the price of copper (Rosemont Copper Company 2010). Because the Trust would be established as an independent charitable trust, with a Board of Trustees and Advisory Council, the projects that the Trust would fund would be decided at a later date, upon the board's specific decisions.

Production and Operation Blasting Plan

Rosemont Copper would prepare a production and operation blasting plan that would require that Rosemont Copper and any successors in interest or ownership of the mine be required to repair or otherwise pay for all damages to area residential, historical, or other structures resulting from blasting associated with mining activities. A blast monitoring program would be included in the blasting plan, with monitoring points located between the areas to be blasted and sensitive receptor sites. Results of blast monitoring would be available to agencies and local residents upon request.

Cultural Resources

As required by the National Historic Preservation Act of 1966 as amended, Class III cultural resources surveys have been completed on all areas potentially affected by the construction, operation, and reclamation of the mine and associated utilities, water, and roadways. If there are no further changes to the footprints of these features, no additional cultural field surveys would be required.

All cultural resources were evaluated for their eligibility for listing in the National Register of Historic Places. In accordance with the Forest Service regional Programmatic Agreement with the State Historic Preservation Office and the Advisory Council, all unevaluated historic properties are treated as if eligible until determined otherwise. The consulting tribes also requested that properties not determined ineligible be treated as eligible pending completion of the FEIS process and the final determination of the project impacts. The archaeological reports submitted by the Forest Service for all sites within the project area of potential effects were approved by the Arizona State Historic Preservation Office, who concurred with the Coronado's recommendations.

The next step mandated by the National Historic Preservation Act, when adverse effects are present, is to develop a historic properties treatment plan to specify the measures to be taken to mitigate the project's adverse effects on historic properties eligible for listing in the National Register of Historic Places. The historic properties treatment plan would be developed by the Coronado in consultation with the Arizona State Historic Preservation Office, cooperating agencies, cooperating tribes, and Rosemont Copper. It would be attached to a memorandum of agreement signed by these parties and approved by the State Historic Preservation Office and the Advisory Council on Historic Preservation.

Rosemont Copper has agreed to mitigate potential adverse effects on plants of critical traditional importance to tribes with interest in the area of potential effects. Rosemont Copper would work with the Coronado staff and consulting tribes to develop recommendations on the selection of plant species that would be used for reclamation purposes. In addition, Rosemont Copper would provide notification of access to tribal interests to facilitate harvesting of traditional food, medicinal, and basketry plants (e.g., agave, beargrass) and traditionally used clays and pigments (generally found in natural cutbanks and at springs) before project disturbance. Through consultations with tribal experts, the Coronado and Rosemont Copper would identify whether plants in the project area can be feasibly and practicably transplanted to tribal lands. Plants may include Palmer agave, yucca, beargrass, oak, mesquite, juniper, and medicinals. Mitigation to other adverse effects will be determined during the development of the historic properties treatment plan and memorandum of agreement with cooperating parties.

Energy Conservation

Rosemont would use energy conservation and alternative energy generation practices to reduce energy consumption. Examples of this include the use of solar energy power for onsite administrative facilities. The project administration building would be designed to showcase use of leadership in energy and environmental design and sustainable energy concepts to at least the silver level or equivalent of the leadership in energy and environmental design rating system. Testing of alternative energy systems by Rosemont Copper is currently underway, and the outcome of those results would determine specific implementation.

Construction of electric lines would be expedited in order to reduce the need for onsite electrical generation and associated emissions.

Hazardous Materials

In order to reduce potential human health and environmental risks, hazardous materials and substances would be managed and contained within facilities that are designed, constructed, and maintained to meet applicable laws and regulations. These facilities would include leak containment and recovery systems as required and adequate stormwater management and drainage systems to prevent contamination outside containment areas.

Mine Safety and Health Administration regulations require Rosemont Copper to maintain material safety data sheets available to workers and to provide notification to site visitors of potential hazards. Material safety data sheets would be provided to appropriate emergency response departments and hospitals and would be available for employees and visitors entering the site.

Land Impact

The design of the proposed action includes a mine footprint that is substantially smaller than conventional mines with similar production capacity. This is because of the use of dry-stack tailings technology; implementation of 3:1 side slopes (horizontal: vertical) on tailings and waste rock facilities; and a revegetation program on mine waste rock and mine tailings.

The use of dry-stack tailings facilities would also avoid some visual impacts and would enhance reclamation, compared with the use of traditional tailings settling ponds. Filtered tailings would be transported, spread, and compacted to form an unsaturated, dense, stable tailings stack that would include a surrounding rock and soil buttress seeded for revegetation.

Land Ownership and Boundary Management

The status and locations of corners and monuments would be determined during the course of a dependent resurvey performed by the Bureau of Land Management to protect and perpetuate the original corner positions that control property boundaries between National Forest System, Bureau of Land Management administered, and private lands as well as corners for current and future administrative or management purposes. During the dependent resurvey, the Bureau of Land Management would establish a well monumented control network set outside the disturbance area using survey-grade global positioning system units referenced to the property corner monuments or positions (mineral survey, section, and quarter corners).

The Bureau of Land Management dependent resurvey would be completed prior to any ground-disturbing activities occurring on National Forest System lands. All survey costs would be borne by Rosemont Copper. The approved field notes and plats for the dependent resurvey and control network would be filed in the Bureau of Land Management public room and would become official records in the public land and records system.

Rosemont Copper would reestablish, monument, and re-monument all corners that control the property boundaries between National Forest System lands, Bureau of Land Management administered, and private lands and other surveyed lines needed for administrative or management purposes and post the property boundaries to applicable Forest Service and/or Bureau of Land Management standards. This would occur as needed during operations.

At a minimum, the relocation or reestablishment of corner monuments and posting of the property boundaries between National Forest System lands, Bureau of Land Management administered, and private land would comply with the following:

- applicable land surveying principles, procedures, and standards as set forth in the appropriate General Land Office and Bureau of Land Management Manual of Surveying Instructions, publications, and circulars;
- current Forest Service and Bureau of Land Management Standards and Guidelines for Cadastral Surveys using GPS Methods and the Standards for the Positional Accuracy of Cadastral Surveys When Using Global Navigation Satellite Systems;
- current Arizona Boundary Survey Minimum Standards;
- appropriate local and State laws and regulations; and
- monument and posting specifications provided by the Forest Service.

Rosemont Copper and the Coronado would work together regarding surface ownership and nonmineral surface development rights of private lands owned by Rosemont Copper to be covered by waste rock and tailings. The intent is to reduce or eliminate future development of these lands that could compromise reclamation of waste rock and tailing areas over the long term.

The proposed action and action alternatives use private lands to the extent possible for the location of utility and access corridors. In addition, Rosemont Copper has acquired extensive private landholdings and grazing leases in an effort to preserve open space and provide a management buffer adjacent to the proposed project. A subsidiary of Rosemont Copper would operate a working cattle ranch throughout construction, operation, and reclamation of mine operations.

Noise

Rosemont Copper has proposed to use some noise management techniques and operational tools to minimize noise generated during mine operations. Blasting only during daylight hours and sequenced blasting using time-delay technology have already incorporated into the project design. Another tool to be used is attenuated back-up alarms that are electronically modulated alarms to meet Federal requirements. Procedures to be used are prohibiting jake-brake use on the primary access road and enforcing speed limit designations.

Dark Skies

To the extent allowed under the Mine Safety and Health Administration, all exterior and access route lighting would be designed and operated with the intent to reduce nighttime light pollution. Rosemont Copper has developed a lighting plan that identified steps that would be taken to achieve the goals of the 2006 City of Tucson and Pima County Outdoor Lighting Code while also protecting the safety of the workers and visitors to the project facilities. Where safety requirements allow, outdoor lighting design incorporated the following: appropriate shields; dimmers and/or full cutoff lighting fixtures; timers; motion detectors; directional lighting; limited spectrum technologies; and production of the minimum lumens practicable. In addition, structures are to be designed and painted to be nonreflective to reduce glare and incorporate strategic placement of lighting fixtures.

Plants and Animals

Rosemont Copper would revegetate disturbed areas with native vegetation, excluding the pit area. This includes linear features such as utilities and pipelines, which would be reclaimed to avoid fragmentation of native biological communities. Specifications would be included in the reclamation plan.

Process water ponds, such as raffinate ponds, pregnant leach solution collection ponds, or chemical or fuel storage areas, would be enclosed, covered, or otherwise managed to protect wildlife, livestock, and public safety. Location and construction criteria for project facilities would prevent deleterious exposure of livestock, wildlife, and birds to toxic chemicals or hazardous conditions created by, used in, or resulting from processing operations. Further details are contained in the preliminary MPO.

In order to protect wildlife breeding habitat, Rosemont Copper would fence selected exclusion areas of highest value riparian habitat to restrict livestock access from breeding areas for sensitive wildlife species within the Rosemont Ranch land system, including National Forest System lands within the Rosemont, Thurber, DeBaud, and Greaterville grazing allotment permits, which would be modified to reflect fence locations and livestock exclusion periods.

Rosemont Copper would monitor disturbed and revegetated areas associated with mine activities for noxious and invasive weeds and would take action to prevent, eliminate, or control weeds should they occur. Methods of control may include removal by hand, spray, mechanical, or other approved methods. Actions to control invasive or noxious plant species would comply with the Environmental Assessment for the Invasive Exotic Plant Management Program (U.S. Forest Service 2004a).This plan would also address invasive species such as bullfrogs.

In order to reduce or avoid impacts to habitat specific to rocky slopes on the east side of the Santa Rita Mountains, including talus slopes, the west side pit operations power loop would be located within the disturbance perimeter of the ultimate pit and diversion structures.

Invasive Species Control Plan

While invasive species must be addressed as directed by Executive Order 13112, “Invasive Species,” Rosemont Copper is going a step further and developing a comprehensive invasive species control plan. Chapter 3 of this DEIS contains an analysis of invasive species. The Rosemont Copper Project Invasive Species Control Plan would address the risk of noxious and invasive weed infestation of disturbed areas and would contain specific measures to prevent, control, and reduce noxious weed introduction throughout the project area. It would stress that noxious and invasive weed prevention is preferable to remedial action and would include provisions to this effect. If noxious and invasive weeds do invade disturbed areas, Rosemont Copper has committed to remove them by hand, spray, mechanical, or other approved methods. The effectiveness of the invasive species control plan would be reported on in the monitoring plan. Further information on invasive species can be found in the environmental assessment for the Invasive Exotic Plant Management Program (U.S. Forest Service 2004a).

Public Health and Safety

In order to mitigate the potential impacts to local emergency service providers, Rosemont Copper would work with organizations to maintain or increase the appropriate level of service.

Health and Safety Training Plan

A health and safety training plan is required under 30 Code of Federal Regulations 48.23 and must be approved by the Mine Safety and Health Administration. Rosemont Copper would maintain a site health and safety plan and complete the required site-specific training during operations. Refer to 30 Code of Federal Regulations 48.23 for further details regarding the requirements for this plan.

Reclamation Plan

A mine reclamation plan is required by Forest Service regulations and is subject to approval by the Arizona State Mine Inspector for reclamation on private lands. According to the Forest Service reclamation policy, “Reclamation shall be an integral part of Plans of Operations that propose surface disturbance” (U.S. Forest Service 1990). The policy requires that disturbed lands shall be reclaimed to a condition that is “consistent with forest land and resource management plans, including applicable State air and water quality permits” (U.S. Forest Service 1990).

In accordance with the Forest Service reclamation policy, the preliminary MPO includes a description of the design approach and goals of the proposed reclamation activities for the proposed action in the reclamation and closure plan (Tetra Tech 2007c).

According to the preliminary MPO, the three regulatory programs that form the framework of the reclamation and closure plan are the requirements of the Forest Service Reclamation Policy, Arizona Mined Land Reclamation Act, and Arizona Department of Environmental Quality Aquifer Protection Permit program. The Rosemont Copper Project Reclamation and Closure Plan's approach to reclamation is to exceed regulatory requirements by employing reclamation activities concurrent with mining operations.

Rosemont Copper also developed a reclamation concept update report that expanded on some of the ideas presented in the previous reclamation and closure plan (Tetra Tech 2010f). This concept update incorporated features in an effort to mitigate some public concerns. For example, the "Rosemont Ridge," as it is named in the original 2007 plan, would have variation in shape to incorporate landscaping and aesthetic considerations. Shaping would also to assist in stormwater and erosion control. The end result, according to this concept, would be a more contoured appearance, with variation of slopes and benches with enhanced vegetation growth.

While these specific actions and initiatives described in the 2007 reclamation and closure plan and the 2010 reclamation concept update apply to the proposed action, they would also apply to the action alternatives, as well. A more detailed reclamation and closure plan would be developed specifically for the final selected action alternative.

Revegetation

Rosemont Copper commenced revegetation studies in 2007 to ensure that any revegetation program it uses would be a success and avoids the spread of invasive plant species. As a result of cooperative studies with the University of Arizona, School of Natural Resources and the Environment, a site seed mix has been developed from tests with native plant species that can be used to reclaim the site.

Rosemont Copper has continued the revegetation studies and has recently extended these contracts to incorporate ranching impact assessments to determine appropriate livestock management on reclaimed areas and to determine how to best incorporate the possible beneficial uses and impacts associated with grazing.

Rosemont Copper would revegetate tailings and waste rock piles with the intent to reduce visual impacts, reduce potential erosion, and recover vegetation for wildlife habitat and livestock grazing. Revegetation plans would be consistent with Forest Service policy and would be approved by the Coronado. Slopes on waste rock and tailings piles would be designed to be flat enough to support successful revegetation where applicable. Revegetation of disturbed areas would include use of a Forest Service approved seed mix that includes native grasses, forbs, and wildflowers, as well as planting of native shrub and tree species in key areas such as highly visible slopes and where needed for stability. Rosemont Copper would consider inclusion of those species important to traditional Native American cultural uses in the area and traditional and heritage livestock and wildlife uses of local plant species; furthermore, plant species selection would strive to balance heritage use species with natural environment and stabilization criteria. Specific provisions to prepare seedbed and reseed any project related disturbances along Pima County right-of-way or roadway would be developed (i.e., Santa Rita Road). Rosemont Copper, in conjunction with the Forest Service, would also determine the feasibility of planting vegetation on broken ledges on visible parts of the pit wall.

Rosemont Copper would identify reference sites in the mine vicinity that would be used to calculate native species' occurrence, density, and cover. Aspect, elevation, and location (ridge versus canyon bottom) would be considered. Based on reference site data, Rosemont Copper would provide appropriate native seed mixes and plant lists for Coronado approval prior to any site revegetation. Rosemont Copper would select species capable of being self-sustaining and would include species with the ability to provide erosion control and stability.

Specifications and goals for the salvage, storage, and reuse of growth media (topsoil) from disturbed areas would be developed with the goal of providing sufficient cover on all disturbed areas to be reclaimed. Unless otherwise specified, Rosemont Copper would provide for a minimum of 1 foot of growth media cover over final waste rock slopes, waste rock surfaces, waste rock benches, completed tailings buttress; water diversion fill slopes, plant site fill slopes, construction laydown areas, facility plant site following final removal of equipment, and temporary roads. The areas to be revegetated would be contoured, graded, prepared, and seeded. Storage of growth media would require placement of growth media stockpiles in locations that are protected from mining operations and associated activities, stable, isolated from surface water, gently sloping, and well drained. Growth media stockpiles would be convex in shape and would have slopes no steeper than 3:1 (horizontal: vertical). Stockpiles would be revegetated with native species no later than the first growth season following construction to minimize erosion. No persistent nonnative species would be used in reclamation except as specifically allowed and approved by the Forest Service, where some locally important nonnative species may already be established. Sediment control structures would be installed or other best management practices implemented as needed to protect growth media from loss. Finally, growth media stockpiles would be used quickly during concurrent reclamation to minimize the length of storage time.

Rosemont Copper would take appropriate actions to ensure that plants are successfully established. Plantings would include species from a list approved by the Coronado and would generally match the native assemblages currently onsite.

At the end of mine operations, Rosemont Copper would reclaim sites that contain structural improvements by removing all unneeded ore processing facilities, ancillary facilities (including foundations), and utility lines. Growth media would be placed on reclaimed areas and revegetated with native grasses, trees, and/or shrubs to meet desired conditions, to be determined by the Forest Service.

Recreation

Rosemont Copper has already paid for the establishment and enhancement of a segment of the Arizona National Scenic Trail in the project area. In addition, Rosemont Copper would fund the relocation of remaining impacted segments of the trail prior to installation of the perimeter fence or ground-disturbing activities that would compromise the scenic and recreational values for which the trail was designed. Impacted parking areas, off-highway vehicle loading ramps, and other recreational facilities would be reviewed by the Forest Service and relocated or otherwise mitigated as needed to maintain recreational access. Post mine mitigation measures may not fully rectify or compensate for all impacts to recreational access.

Transportation

Wherever practicable and subject to public and employee safety concerns, Rosemont Copper would provide for public access to Rosemont Copper private lands not affected by mine related operations through the Arizona Game and Fish Cooperative Landowner Incentive Program. Costs for providing and maintaining public access provisions and/or easements would be the responsibility of Rosemont Copper during the 25-year mine life, from construction through closure. Rosemont Copper would work with the Coronado to create appropriate access to National Forest System lands. If feasible, portions of the primary access and secondary access roads shall be made available for this purpose.

Rosemont Copper would comply with the Coronado travel management goals where feasible, and where Mine Safety and Health Administration regulations allow, on roads under Forest Service control or jurisdiction that are used for mining or associated activities. Travel management details are subject to yearly modification by the Forest Service. When consistent with management goals, mine roads that are no longer needed for mine construction and operations or access would be reclaimed using appropriate methods, which may include restoring natural contours where appropriate, placing growth media, and revegetating with native plants.

Rosemont would comply with Arizona Department of Transportation Encroachment Permit requirements to address State Route 83 improvement issues related to mine operations, such as intersection improvements and development of turn lanes.

Additional items that Rosemont Copper has identified to improve traffic safety include the following:

- Design and construct four bus pullouts, locations to be determined by demographics, along State Route 83.
- Develop a carpool system to reduce the amount of worker commute trips on State Route 83 for all phases.
- Requiring truck traffic avoids times of high commuter or school bus traffic.

The Arizona Department of Transportation would review and approve the primary road intersection with State Route 83 as part of its encroachment permit process and may require additional mitigation measures to improve traffic flow and safety. The Arizona Department of Transportation has the legal authority to require reasonable highway improvements of a project proponent within 1 mile of a proposed intersection and can negotiate highway improvements with a project proponent beyond 1 mile of a proposed intersection. Mitigation measures under consideration include adding passing lanes and shoulders at the proposed primary access intersection and improving the roadway pavement to accommodate heavy truck use.

Transportation Plan

Rosemont Copper has agreed to develop a comprehensive Rosemont Copper Project Transportation Plan for all project related roads on National Forest System and Bureau of Land Management administered lands. The transportation plan would address maintenance standards; levels of appropriate use; methods to maintain the roadways sufficiently to prevent washboard, rutting, and drainage problems; commitment to replace surfacing lost to drainage; commitment to repair roads damaged by use; commitment to restore temporary roads to natural preoperation conditions during reclamation/closure; and installation and maintenance of wildlife crossing structures (e.g., corrugated metal pipes) under the primary access road at locations of known wildlife concentration.

To address potential vehicle emissions from increased vehicle trips to the project area, the transportation plan would identify carpooling opportunities for employees, establish a “park and ride program” for workers during all phases of the project to distribute peak travel operations during the morning and evening commute periods to minimize congestion, and manage trucking to reduce impacts to State Route 83 and overlap with school traffic to the extent possible. The transportation plan would also strive to minimize construction related trips of workers and equipment, including trucks and heavy equipment.

Visual Quality

Evaluation of using geomorphic design is ongoing and various concepts may be included, as feasible, depending on the alternative that is selected. Conceptual ideas include site-specific outer-berm mitigation and/or lower edge or basal lift along sides that are more visible to the public at levels that would be most visible to recreationists. Establishment of a work group to include mining, landscape, reclamation, ranching, hydrology, and operations team members would be used to develop functional surface management criteria for final design integration.

Rosemont Copper would construct a perimeter berm to provide a visual barrier to the mine operations, which would block the view of much of the final pit configuration from State Route 83. The project is designed so that it would be not be visible from Green Valley, Vail, Sahuarita, Tubac, or Tucson.

A perimeter buttress would be constructed with intermediate slopes of 3:1 (horizontal: vertical). Further contouring of slopes to facilitate early revegetation would result in revegetation earlier in the life of the project and would help control erosion and stabilize surface soils.

In order to reduce potential visual impacts, mine related buildings would be painted or stained in earth tones, or Rosemont Copper would use other materials that result in a nonreflective flat appearance (except where prohibited by Mine Safety and Health Administration or other specific requirements, i.e., water tanks) approved by the Coronado. Selection of specific earth tones would consider indigenous weathered hues of onsite surface rocks, local topsoil, and vegetation as approved by the Coronado prior to application.

Water Resources

In order to conserve water, Rosemont Copper has committed to filter the tailings and maximize water conservation. The filtered tailings would reduce Rosemont Copper’s consumption of water by 50 to 60 percent over traditional industry designs. In addition to filtering the tailings, Rosemont Copper has also included in their facility designs a number of ways in which they would maximize the reuse of process water and stormwater.

Rosemont Copper would mitigate the potential effects of mine related pumping on residential water supply wells in the Sahuarita Heights neighborhood by the agreement that they have entered into with the Rosemont United Sahuarita Well Owners. The agreement, which is currently in place, is a legally binding residential well protection plan that has been negotiated and implemented by the United Sahuarita Well Owners group and Rosemont Copper. This well protection program consists of basic well survey, analysis and preventative maintenance; well pump insurance; and well repair, deepening, and replacement to ensure that residential water wells in the Sahuarita area remain productive

throughout the mining operation (Rosemont Copper Company and United Sahuarita Well Owners LLC 2009).

Rosemont Copper has voluntarily committed to implementing regional groundwater mitigation measures within the Tucson Active Management Area. Rosemont Copper would do the following:

- Use available Central Arizona Project water as a source to conduct recharge within the Tucson Active Management Area. Note that this compensatory mitigation is dependent on Central Arizona Water Project water's being available to Rosemont Copper.
- Recharge as close as possible within the Tucson Active Management Area to the Rosemont Copper supply well field.
- Balance Central Arizona Project storage credits with water to be pumped from mine supply well field, with the intent to maintain a surplus inventory of storage credits prior to pumping groundwater for mineral extraction use.

Maintain water storage and use inventory records to show that Central Arizona Project recharge credits are balanced against groundwater removed from the Tucson Active Management Area until at least 5 years following completion of the extraction of the ore. Rosemont Copper would annually fund the U.S. Geological Survey to operate and maintain the existing surface water flow measurement gage at Barrel Canyon (09484580). After 5 years postmining, the U.S. Geological Survey may fund the gage or remove it at their discretion.

Small retention structures would be constructed on waste rock structures to facilitate infiltration of stormwater and contribute to local groundwater recharge. These retention/infiltration basins would be managed to optimize maintenance of surface water and groundwater quality. Rosemont Copper would manage water on the tailings storage and waste rock facilities to avoid or reduce erosion as described previously.

Where mine facilities remain over the long term, specific dam safety permit limits (see "Permits and Permitting Processes" section of this chapter) require Rosemont Copper to install permanent water control structures that may exist beyond the life of the mine. Specific permit conditions provide for periodic monitoring and maintenance of spillways, diversions, and other permanent facilities.

The design and location of the heap leach facility is also considered mitigation for these structures (U.S. Environmental Protection Agency 1994). This lined facility is designed to collect all possible drainage and solution, is on top of a stable rock location, and would be encapsulated by waste rock to protect from stormwater infiltration up to the maximum reasoned storm event.

Water Source Enhancement and Mitigation Plan

Rosemont Copper would replace or repair water guzzlers, stock tanks, and other human created water supply structures lost to wildlife or grazing use, whether through direct or indirect project related impacts. The result would be no net loss in the current preproject number of human created water sources for livestock and wildlife. This requirement would be stipulated in a water source enhancement and mitigation plan. The water source enhancement and mitigation plan would apply to private and public lands contained within Rosemont Copper's Forest Service grazing permits.

Aquifer Protection Permit

The aquifer protection plan is embodied within the Aquifer Protection Permit issued by the Arizona Department of Environmental Quality. Rosemont Copper must obtain an aquifer protection permit to comply with the Arizona Revised Statutes, and the Arizona Department of Environmental Quality has the regulatory authority to regulate groundwater quality. The aquifer protection permit addresses requirements to manage discharges so that they do not cause or contribute to a violation of aquifer water standards at the point of compliance or, if the standards are exceeded at the time of permit issuance, then the requirement is to manage the discharges so that they do not cause further degradation of the water quality.[2] Permit acquisition requires the preparation of necessary studies and technical reports as prescribed by the Arizona Department of Environmental Quality, which would be relied on to issue the authorizing or regulatory permit.

On May 16, 2011, Rosemont Copper submitted documents to the Coronado and Arizona Department of Environmental Quality that describe and commit to measures to identify and ensure isolation of potentially acid-generating waste rock, prevention of acid generation from mine waste, and any additional mitigation measures that may be necessary should prevention measures fail. These include the development of a plan to identify and manage materials using geochemical analysis and acid-base accounting methods.

A baseline monitoring program has been implemented as part of the monitoring plan proposed in the aquifer protection permit in order to establish ambient conditions prior to operations. This program is in place to determine the amount of chemical constituents, such as sulfate and chloride already in the aquifer. Ambient groundwater quality would be established prior to aquifer protection permit regulated facilities begin operation.

A tailings operation and management plan would be prepared to address requirements of the aquifer protection permit. Tailings would be managed as they are placed within the tailings facilities. Compaction and other construction specifications would be dependent on their location within the tailings area and would be specified in the tailings operations and management plan.

A contingency plan was created and proposed in the aquifer protection permit application submitted by Rosemont Copper. This plan outlines the contacts responsible for coordinating an emergency response. The plan (Tetra Tech 2009a) states that an emergency response is necessitated “if a discharge results in any of the following:

- A violation of an Aquifer Quality Limit;
- An exceeded Alert Level;
- A violation of any other permit condition, such as a Discharge Limit, where there is a potential impact or unauthorized discharge to groundwater; or
- An imminent and substantial endangerment to the public health or the environment.”

[2] Information on Arizona regulations pertaining to aquifer protection permits can be found at http://www.azsos.gov/public_services/title_18/18-09.htm; and at http://www.azleg.gov/FormatDocument.asp?inDoc=/ars/49/00241.htm&Title=49&DocType=ARS.

Stormwater Pollution Prevention Plan

This plan is required by the Arizona Department of Environmental Quality as part of the process for obtaining coverage under the multisector general permit, which is also required under Section 402 of the Clean Water Act. This permit requires the preparation of a stormwater pollution prevention plan and implementation of control measures, as outlined by the Arizona Department of Environmental Quality's Arizona Pollutant Discharge Elimination System Multi-sector General Permit program. The use of best management practices is an integral part of these plans and permits.

Mitigation Measures Specific to Alternatives 3 through 6

The following elements are an integral component of alternatives 3 through 6 and therefore are considered requirements should one of these alternatives be selected for implementation. To provide a meaningful comparison of the proposed action and other alternatives, these additional mitigation measures do not apply to the proposed action. The measures listed in this section are in addition to those discussed above in the section titled "Mitigation Measures Incorporated into the Project Design."

Paleontological Resources

In order to mitigate potential impacts to scientifically significant or rare paleontological resources, ground-disturbing activities in geological units with a moderate to high potential for these fossils would be monitored by a Forest Service approved paleontologist (U.S. Forest Service 2005c). Discovery of said resources would result in Rosemont Copper's suspending work at the site, and recovery or other mitigation would occur to protect the fossil resources before work resumes.

Transportation

A revised alignment for the primary access road is included in the action alternatives. The revised alignment would reduce the project area and reduce potential impacts by moving the road out of Scholefield Canyon and bringing it onto ridges to the extent feasible, as displayed on alternative maps.

Rosemont Copper would provide a multiplate (or equivalent) underpass to accommodate bicyclists, livestock, hikers, and pack stock under the secondary access road where the Arizona National Scenic Trail crosses the road. The location would be determined based on which alternative is selected in the ROD. The Coronado would work with the Arizona Trail Association in the design and location of this crossing. It is understood that equestrians and bicyclists may be required to dismount for passage.

Visual Quality

The applicability of procedures to darken or "weather" exposed rock faces where exposed rock is lighter than adjacent weathered rock would be determined by the Coronado. Treatment of exposed areas would be limited to those that are visible from concern level 1 travel ways. Treatment would be completed as soon as feasible.

Mitigation for Impacts to Waters of the United States

Rosemont Copper would comply with mitigation specifications identified in the Clean Water Act Section 404 individual permit. Rosemont Copper has committed to mitigate for loss of waters of the United States in accordance with the April 10, 2008, "Final Rule for Compensatory Mitigation for Losses of Aquatic Resources" (Federal Register 73:19594). This potentially includes the purchase and set aside of offsite mitigation areas, payment in lieu of mitigation to an established restoration program, and/or permittee responsible onsite mitigation.

According to Pima County, this would not be consistent with local planning guidelines of the Sonoran Desert Conservation Plan.

Appendix E provides the U.S. Army Corps of Engineers' Habitat Monitoring Plan.

Monitoring and Evaluation

Monitoring is fundamental for ensuring the implementation and effectiveness of mitigation commitments, meeting legal and permitting requirements, and identifying trends and possible means for improvement (Council on Environmental Quality 2011). Council on Environmental Quality regulations explicitly require that "a monitoring and enforcement program shall be adopted . . . where applicable for any mitigation" (40 Code of Federal Regulations 1505.2(c)).

Monitoring and evaluation apply at both the forest plan and project-specific levels. The National Forest Management Act requires that national forests monitor and evaluate their forest plans (36 Code of Federal Regulations 219.11) and addresses monitoring requirements contained in site-specific decisions. Chapter 6 of the "Coronado National Forest Land and Resource Management Plan" addresses monitoring and evaluation activities that are part of forest plan implementation. Title 36 Code of Federal Regulations 219.11(b) states,

> Monitoring of site-specific actions. The decision document authorizing a site-specific action should describe any required monitoring and evaluation for the site-specific action.
> The responsible official must determine that there is a reasonable expectation that anticipated funding is adequate to complete any required monitoring and evaluation prior to authorizing a site-specific action.

The Council on Environmental Quality (Council on Environmental Quality 2011) states, "Once an agency determines that it will provide for monitoring in a particular case, monitoring plans and programs should be described or incorporated by reference in the agency's decision documents. The mitigation plan and program should be described to the extent possible based on available and reasonably foreseeable information in cases where NEPA analysis and documentation are completed prior to final design of a proposed project."

Monitoring and evaluation activities would be prescribed, conducted, and/or reviewed by Rosemont Copper, the Coronado, the Bureau of Land Management, and other agencies with permitting responsibilities. Rosemont Copper would fund monitoring as set forth in the ROD, approved MPO, and final monitoring plan. Other monitoring activities may be associated with the regulatory authority of Federal and State agencies and would be funded by permit fees or the agencies themselves as part of their normal activities.

The Coronado is committed to developing a monitoring plan that meets the guidance and direction specified by the Council on Environmental Quality and in applicable laws and regulations. The framework for such a plan is contained in appendix C of this DEIS. It is important to note that the full suite of mitigation measures would not be known until many or most of the required permits have been issued, which often contain required measures intended to avoid or reduce environmental effects. It is fully expected that a more detailed and complete monitoring plan would be contained in the FEIS and ROD.

Evaluation and Reporting

Title 36 Code of Federal Regulations 219.11(d) states,

> Use of monitoring information. Where monitoring and evaluation is required by the plan monitoring strategy, the responsible official must ensure that monitoring information is used to determine one or more of the following:
>
> 1. If site-specific actions are completed as specified in applicable decision documents;
> 2. If the aggregated outcomes and effects of completed and ongoing actions are achieving or contributing to the desired conditions;
> 3. If key assumptions identified for monitoring in plan decisions remain valid; and/or
> 4. If plan or site-specific decisions need to be modified.

To evaluate the results of monitoring for the proposed project, the forest supervisor would convene a multiagency monitoring group representing applicable State and Federal agencies, organizations, and Rosemont Copper. The group would meet annually to review monitoring results and determine whether the following applies: (1) monitoring requirements have been completed; (2) monitoring results indicate that effects and results of mining and related activities are within the range of those predicted in the FEIS and ROD; (3) monitoring activities and methods remain valid and are warranted going forward; and (4) changed conditions, if any, dictate modification of the approved MPO and/or ROD.

Rosemont Copper would submit an annual report to the Coronado that contains a description of all activities conducted during the previous year and a summary of the amount of acreage disturbed, status of reclamation, spills or releases of chemicals or fuel, and results of all monitoring plans in a format approved by the Forest Service, including a complete data summary and any data trends, status of mining plan (tons of ore and waste mined and any changes to methods or equipment), and plans for the coming year. Significant changes would be required to be incorporated into the approved MPO and reflected in financial assurance. Past, ongoing, or projected impacts on the environment may also require amendment of the approved MPO, ROD, and/or financial assurance held for the project.

Postclosure Monitoring

All reclaimed sites would be monitored twice a year for a period to be determined, in order to evaluate the success of reclamation work. Any areas not meeting the reclamation goals would be analyzed to determine the underlying problems, which would be addressed with a modified plan.

In addition, there would be quarterly monitoring of groundwater for a term to be decided by the closure requirements specified in the aquifer protection permit and required by the Arizona Department of Environmental Quality. Locations of point of compliance monitoring wells would not be finalized until the aquifer protection permit is issued by Arizona Department of Environmental Quality. However, these wells are currently proposed to be located near the eastern, downgradient boundary of the proposed management area, within or near McCleary, Scholefield, and Barrel Canyons. These wells are proposed to be screened between 4,021and 4,540 feet above mean sea level.

Surface water would be monitored as required in the Arizona Pollutant Discharge Elimination System program following cessation of mining operations. Final monitoring details and locations would be decided when Arizona Department of Environmental Quality provides the corresponding permit. Results of this monitoring would be used to evaluate the success of the measures taken to protect the water resources. Any changes in water quality would be evaluated to determine whether the changes are related to the reclaimed mining features, and appropriate steps would be taken to address the problem.

Financial Assurance

As part of the approval of an MPO for the Rosemont Copper Mine, the Forest Service would require Rosemont Copper to post financial assurance, or reclamation bond, that would provide adequate funding to allow the Forest Service to complete reclamation and postclosure operation, maintenance activities, and necessary monitoring for as long as required to return the site to a stable and acceptable condition. The amount of financial assurance would be determined by the Forest Service and would "address all Forest Service costs that would be incurred in taking over operations because of operator default" (U.S. Forest Service 2004b). The financial assurance would be required in a readily available bond instrument payable to the Forest Service. In order to ensure the bond can be adjusted as needed to reflect actual costs and inflation, there would be provisions allowing for periodic adjustment on bonds in the final MPO prior to approval.

The reclamation bond amount is an estimate of both direct and indirect costs to reclaim the operation, based on contractors performing the work. This estimate is also to consider the time of operation in which reclamation costs would peak. This cost peak can be determined by looking subjectively at the mine schedule and timing of greatest areas and volumes of disturbance and materials or quantitatively calculating reclamation costs on an annual basis. As reclamation plans evolve from conceptual designs during permitting to as-built designs during construction, the bond estimates and requirements would be adjusted. Further, "Reclamation standards and bond estimates (with accompanying details) become legally binding when the operator changes the proposed Plan of Operation to include them, posts the required bond, and is notified by the authorized officer that the Plan of Operation is approved" (U.S. Forest Service 2004b).

It is important to note that mitigation under Section 404 of the Clean Water Act also requires financial assurance. The Arizona Department of Environmental Quality and Arizona State mine inspector also require bonds as part of their permitting authority. The aquifer protection permit requires bonding for closure and groundwater protection. Rosemont Copper has submitted calculations in section 13 of their aquifer protection permit application, which includes all reclamation costs, including bonds for the Forest Service, Arizona State mine inspector, and Arizona Department of Environmental Quality. These calculations have not yet been reviewed by the Forest Service. Since the components of the final decision are unknown at this time, it is premature for the Forest Service to calculate bond

amounts. Once a final decision has been determined, the Forest Service would calculate bond amounts and ensure that adequate bonding is provided.

Alternatives Considered but Eliminated from Detailed Study

The National Environmental Policy Act, Clean Water Act, and Organic Administration Act provide guidance regarding alternatives development. The National Environmental Policy Act and Forest Service regulations (36 Code of Federal Regulations 228) governing mineral development on National Forest System lands provide guidance on alternatives development. Reasonable alternatives include those "that are practical or feasible from technical and economic standpoints and using common sense, rather than simply desirable from the standpoint of the applicant" (Council on Environmental Quality 2007:16). All reasonable alternatives must fulfill the project's purpose and need, as well as address significant environmental issues. The selection of alternatives under National Environmental Policy Act criteria includes consideration of a reasonable range of alternatives that meet the project purpose and need and that are economically and technically feasible.

An analysis of alternatives is also required by the U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency to demonstrate compliance with guidelines established under Section 404(b)(1) of the Clean Water Act (40 Code of Federal Regulations 230) for avoidance and minimization of impacts to jurisdictional waters of the United States. The alternatives analysis is intended to ensure that no discharge be permitted "if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences" (40 Code of Federal Regulations 230.10(a)). See appendix B of this DEIS for further information on the Section 404(b)(1) analysis.

A number of alternatives suggested during scoping or otherwise developed have been eliminated from detailed study by the responsible official. Alternatives, themes, and elements were put through an iterative ID team process to develop alternatives that could be evaluated for inclusion in the DEIS. The resulting alternative evaluation considered the following criteria when determining which alternatives would be addressed in detail in the DEIS and which would be eliminated from detailed study.

1. Does the alternative meet the project purpose and need?
2. Does the alternative resolve environmental or resource conflicts?
3. Is the alternative available? and/or
4. Is the alternative feasible, in terms of cost, current technology, and logistical capability?

These criteria were used to narrow the list of potential alternatives for consideration in the DEIS.

More detailed rationale for elimination and supporting documentation is contained in the project record in "Alternatives Considered but Eliminated from Detailed Study" (U.S. Forest Service 2011a). These evaluations were conducted by the ID team, with support from their contractors and cooperating agencies. Rosemont Copper participated in the process, in accordance with the terms of the memorandum of understanding, as amended. Rosemont Copper's role was limited to providing technical expertise regarding contemporary mining practices and overall constructability. All of Rosemont Copper's input was reviewed by the Coronado and their consultants.

Alternatives eliminated from detailed study ranged from relatively simple elements to alternatives described at the level of detail contained in this DEIS.

A summary of alternatives considered but eliminated from detailed study follows. The descriptions capture the general rationale for eliminating from detailed study general groups of alternative themes that were raised during scoping or by the ID team. See “Alternatives Considered but Eliminated from Detailed Study” (U.S. Forest Service 2011a) for further information.

Mining Other Locations

Several variations of alternatives were recommended by the public during scoping that suggested an alternative to the proposed action that would mine in locations that did not include National Forest System lands, purchasing another copper mine, or reopening a closed copper mine. These alternatives were eliminated from detailed study. Rosemont Copper owns private mineral rights and has a possessory interest for mining purposes in unpatented mining claims where the project is proposed. Therefore, the company has a legal right to access minerals associated with their claims, and the Forest Service is required to consider all proposals that meet the requirements under 36 Code of Federal Regulations 228 Subpart A. Forest Service regulation and policy is to allow reasonably incident mineral operations on claims in a manner that minimizes adverse environmental impacts on National Forest System surface resources by imposition of reasonable conditions which do not materially interfere with mineral operations (see 36 Code of Federal Regulations Part 228 Subpart A and Forest Service Manual 2317). Mining at other locations would not meet the statutory and regulatory criteria or manual direction.

Additionally, one of the criteria in determining practicable alternatives is whether a site is “available.” The U.S. Army Corps of Engineers dismissed some alternative sites that were unavailable (WestLand Resources Inc. 2010h). See appendix B, “U.S. Army Corps of Engineers’ Section 404(b)(1) Alternatives Analysis” (WestLand Resources Inc. 2010a), for further details on the analysis. Available means the site could be reasonably obtained, used, expanded, or managed by Rosemont Copper in order to fulfill the basic project purpose (40 Code of Federal Regulations 230.10(a)(2)).

The lead agencies considered nine sites in southern Arizona. Of the nine, two alternative sites were available: the Carlota and Copper Creek Projects. These projects were purchased by other companies (Quadra and Redhawk Resources, respectively) and were therefore unavailable to Augusta Resource Corporation (Augusta Resource). There was no indication that the remaining seven sites were available to sell.

Mining Methods

A number of alternative mining methods have been considered during the evaluation of the proposed action (summaries follow). The preliminary MPO calls for extraction of the ore from a generally cone-shaped pit. This would allow for the extent of the oxide ore body and the known extent of the sulfide ore body to be removed for processing. As previously mentioned, Rosemont Copper has a legal right to access minerals associated with their claims, and the Forest Service is required to consider all proposals that meet the requirements under 36 Code of Federal Regulations 228 Subpart A. Refer to the “Need for Action” section in chapter 1 of this DEIS for further information regarding statutes, regulations, and policies that govern mining on National Forest System lands and lands administered by the Bureau of Land Management.

Mining the Ore Using Shafts and Adits

The nature of the Rosemont Copper Mine oxide and sulfide deposits is such that it is disseminated across a wide area underground, unlike minerals deposited along seams. Mining using shafts would not allow access to the full ore body. Furthermore, the ore is not of sufficient concentration that it would be economically feasible to recover the ore using this approach.

Reducing the Pit Size

The pit configuration proposed by Rosemont Copper was reviewed by the Coronado and their consultants. The proposed pit was deemed appropriately configured, in terms of size, to access the oxide and sulfide ore bodies. A reduced pit size would limit Rosemont Copper's ability to fully access all of the minerals to which they own or claim mineral rights. Forest Service regulation and policy is to allow reasonably incident mineral operations on claims in a manner that minimizes adverse environmental impacts on National Forest System surface resources by imposition of reasonable conditions which do not materially interfere with mineral operations (see 36 Code of Federal Regulations Part 228 Subpart A and Forest Service Manual 2317). A reduced pit size would not meet the statutory and regulatory criteria or manual direction.

In Situ Leaching

"In situ" is Latin for "in place" and refers to the recovery of the metals without any significant disturbance of the rock matrix. Leach solutions, generally a weak sulfuric acid solution, are pumped into the ground via an injection well and subsequently travel though the fractures in the rock and dissolve the minerals. Recovery wells are installed to recover the metal-bearing solutions. There are a number of Arizona mining operations using in-place copper mining, and pilot testing of in situ mining has occurred at several locations. The solubility of the minerals themselves also is a major consideration. The sulfide minerals are greatly insoluble in the presence of sulfuric acid solutions. A minimal amount of chalcopyrite may be made soluble. However, the mineral is disseminated in the ore along fractures typically sealed with quartz, and the solution cannot readily access the copper mineralization. Molybdenum and silver are essentially nonsoluble in weak sulfuric acid solutions.

It is not technically possible for the sulfide mineralization proposed for mining by Rosemont Copper to be leached effectively using in situ leach methods owing to the low permeability of the sulfide zone and the inability of the leach solutions to contact the sulfide mineralization. Furthermore, there is no record of any recovery of molybdenum or silver using these types of mining methods.

High-temperature/high-pressure Leaching

The proposed alternative is the use of high-temperature/high-pressure leaching for onsite processing of oxide and sulfide ores. The leaching would be followed by solubilization by a weak sulfuric acid solution and treatment of the copper-bearing solutions by solvent extraction and electrowinning methods. The recovered copper would be in the form of copper cathode as the final site product.

The oxide ores in the Rosemont deposit are already oxidized, and any treatment by oxidation (high temperatures) and pressure is unnecessary. The sulfide ore, however, is materially different in mineralization. The ore would have to be reduced to a size at which the surfaces could be oxidized and the treated ores leached. Crushing and milling, as required to make concentrates as proposed in the preliminary MPO, would be required; however, the physical size of the ore particles would have to be reduced to a dramatically smaller size than required for production of concentrate. There is no

record of bulk or milled copper ore being treated by high-temperature/high-pressure leaching. Furthermore, there is no process in this alternative that would allow for the recovery of silver and molybdenum.

Traditional Slurry Tailings

The preliminary MPO proposes that the tailings would be filtered to achieve an overall water recycle rate that exceeds 90 percent to approximately 92 percent (dry tailings). The filtered tailings would then be mechanically conveyed to the tailings facility for final disposition of the material. Although this technology is in use in other mines in Alaska and South America, it has not been applied to any of the large mines in Arizona. Public concerns about the use of mechanical filters for removal of the water from tailings were expressed. A regionally proven alternative would be to employ the use of slurry tailings.

This alternative was deemed to have greater overall impacts and greater environmental risks. A previous study (Arnold and Meyer 2006) determined that a dry tailings facility was preferred when environmental, socioeconomic, project economics, and technical parameters were evaluated. Compared with traditional slurry tailings, dry tailings would do the following:

- eliminate the need for an engineered embankment and seepage containment system,
- increase water conservation,
- reduce the footprint and associated impact to resources, and
- allow concurrent reclamation and covering for dust control.

Configuring the Pit to Allow “Continuous” Backfill

The geometry of the ore bodies is such that a conical pit would require the least amount of excavation to maximize the extraction of the ore. Other types of ore bodies and coal seams lend themselves to being extracted in a linear fashion such that the overburden can be used to backfill the pit as extraction advances. Extracting the ore from the proposed Rosemont Copper Mine using continuous backfill would require a substantially larger pit. A larger pit would likely result in greater impacts while reducing the economic feasibility of the project.

Completely Backfilling or Partially Backfilling the Pit

Several scenarios were evaluated in which the waste rock and tailings would be placed back in the pit after mining. These scenarios included changing the footprint of the facilities to reduce impacts and placing the waste rock and tailings near the pit and away from sensitive resources. The primary driving factor in whether to backfill the pit partially or completely is the predicted development of a pit lake.

Complete Pit Backfill

Complete backfill of the pit was considered. Under this scenario, waste rock that has not come into contact with process water would be placed back into the pit. The bottom of the pit that is excavated to remove copper ore is lower than the surrounding groundwater, and a pit lake would eventually form, causing groundwater to flow into the pit. Under the current modeling, more water would evaporate from the pit than would come in through rain or existing groundwater. This would create a

"hydrologic sink." The benefit of maintaining a hydrologic sink is that potential contaminants entering the surrounding groundwater would tend to flow into the pit and be contained.

Creation of a hydraulic sink is considered to be an acceptable and desirable condition, as it protects groundwater chemistry should pit water become contaminated. Protection of groundwater is required by the Clean Water Act. The Best Available Demonstrated Control Technology Manual published by the State of Arizona includes the permanent hydraulic sink as an acceptable method of ensuring groundwater chemistry and therefore complying with the Clean Water Act. Backfilling the pit with "clean" waste rock could create a flow-through situation where groundwater would flow through the pit lake, thereby eliminating the hydraulic sink and increasing the risk of detrimental impacts to groundwater chemistry from potential contaminants in pit lake water.

In addition, stockpiling clean waste rock during mining operations would likely increase the footprint of mine related facilities. Pit refill could not begin until mining operations were completed, would likely increase the number of years that activities at the mine site would occur, and would extend the time frame for accomplishing reclamation. Concurrent reclamation could not occur. Effects on most resources would increase in duration, and resource use (fuel, electricity) would increase. For these reasons, complete backfill of the pit was eliminated from further consideration.

Partial Pit Backfill

Partial backfill was also evaluated. An analysis of the pit lake indicated that an estimated 14 percent of the waste rock could be placed back in the pit and still maintain a hydrologic sink. While this may increase costs, it could be addressed through a mitigation measure. The Forest Service is currently investigating this option and may include it in one or more alternatives in the FEIS.

Reconfiguring or Relocating the Waste Rock and Tailings Facilities

Several alternatives were considered to reconfigure or relocate the waste rock and tailings facilities. The volume of waste rock and tailings is relatively fixed. This is because Rosemont Copper possesses the legal right to access their mineral deposits, and the size of the pit cannot feasibly be reduced. Four primary alternatives for relocation or reconfiguration were considered, as follows.

Relocating Waste Rock and Tailings to Existing Mines

Impacts to National Forest System lands could be reduced by removing the waste rock and tailings offsite. The Coronado contacted three existing mines (Sierrita, Twin Buttes, and Mission) west of the Santa Rita Mountains and inquired whether they would consider receiving this material. None of the mines were agreeable to accepting this material. Other off-forest options were constrained by lack of availability of enough available open land, transportation logistics, or the fact that placement of the materials would move them closer to populated areas.

Avoiding Placement in Drainages

A variety of alternatives evaluated the potential to avoid placing any waste rock or tailings in drainage bottoms. This alternative was constrained by the steep topography in the area and would require perching waste and tailings in numerous smaller locations along the northern slope of the Santa Rita Mountains. This would limit reclamation opportunities because the materials would have

to be placed at the angle of repose. Since the uplands consist primarily of steep slopes, they are not conducive to stable, long-term storage of large quantities of tailings and waste rock. Furthermore, this alternative would alter the uplands substantially and would impact the functions and services provided by these areas.

Depositing the Tailings on the Northwestern Slope of the Santa Rita Mountains

This alternative was developed to reduce the visual impact of the waste rock and tailings by placing the tailings in Sycamore Canyon. The placement of tailings would be conveyed over the ridge south of Lopez Pass and placed in a tailings facility. This facility would require rock to be quarried in Sycamore Canyon to provide a source for the containment structure. This alternative was dismissed for two reasons: (1) the tailings would have been visible from the Tucson area, and (2) this alternative created the potential to impact a second watershed and aquifer.

Using a Natural Backfill Configuration

The cooperating agencies met on three occasions to develop an alternative. Some cooperating agencies stated that it would be desirable to configure the waste rock and tailings such that, over geological time, natural erosion would carry all of the material back into the pit. This alternative would require the placement of materials above the pit and in areas considered a core biological area in Pima County's Sonoran Desert Conservation Plan.[3] This alternative was dismissed because there is insufficient space above the pit to be able to place the materials and avoid the core biological area.

Modifying the Life of the Mine

The proposed mine life is approximately 25 years (20 years of mine operation). This alternative evaluation considers doubling the mine life to 40 years or halving the mine life to 10 years. Both modifications would affect multiple aspects of mining and production: personnel, mining, processing, infrastructure, equipment, operations, onsite and offsite vehicular traffic, and the timing of reclamation and closure. Neither modification would affect the ultimate size of the open pit, waste rock dumps, or tailings piles, unless changes in operating or capital costs affect the mine life reserves,[4] nor would either modification affect the total volume of water used or the final viewshed.

According to Rosemont Copper, the plans to produce and process the minerals were developed to provide a stable operating cost in an economic environment in which copper prices fluctuate. The design for milling equipment was reviewed to determine an efficient combination of grinding equipment that is currently available. A mill capable of processing 75,000 tons per day was determined to be the optimum size with regard to capital investment and production rates (Huss 2009). From this determination, all other equipment and processing schedules were planned. Furthermore, contemporary processing facilities are not designed to be shut down on a daily basis. For example, once leaching begins, it is extremely complicated to shut down the solvent extraction and electrowinning process.

Shortening the mine life would reduce the length of time during which mining activities would be carried out but would increase the daily intensity of activities. Lengthening the mine life would

[3] See www.pima.gov/cmo/sdcp/index.html for further information on the Sonoran Desert Conservation Plan.

[4] This means that as long as the cost of pulling ore out of the ground remains the same as proposed, the feasibility/profitability of retrieving the ore would stay the same and the same amount of ore would be sought after.

reduce the intensity of daily mining activity by spreading it out over a longer period. Modifying the mine life in the manner proposed would not reduce the majority of landscape-level environmental impacts. These types of alternatives are not a standard practice in the mining industry. Rather than using an arbitrary production schedule, mine planning professionals use optimization programs to determine the most favorable mine life using inputs from all of the conditions associated with the mine, such as infrastructure requirements and considerations of ore type, grade, and occurrence. While the alternative is technically feasible, it is not practically feasible.

Water Supply

Rosemont Copper has secured the water rights to pump water in the Upper Santa Cruz Basin, as identified in the preliminary MPO. It is important to note that it is beyond the authority of the Forest Service to require that Rosemont Copper find an alternate source. However, the public, cooperating agencies, and members of the Forest Service ID team identified 22 alternate sources of water, as follows:

- Potable sources to the east:
  - Davidson Canyon
  - Cienega Creek
  - Sonoita Creek
  - San Pedro River
- Potable sources to the west:
  - Santa Cruz River basin (existing permit in Sahuarita)
  - Other private property adjacent to Santa Cruz River or Sahuarita (buffer distance from residences or businesses)
  - State land groundwater (buffer distance from residences or businesses)
  - Santa Rita Experimental Range groundwater (buffer distance from residences or businesses)
  - Central Arizona Project direct delivery
  - Tohono O’odham Nation groundwater direct delivery
  - Reverse osmosis water from Yuma treatment
- Localized Central Arizona Project recharge and recovery:
  - Lower Santa Cruz constructed facility (Augusta Resource has some existing credit)
  - Avra Valley constructed facility (Augusta Resource has some existing credit)
- Nonpotable sources to the west:
  - Green Valley waste water effluent
  - Nogales waste water effluent
  - Tucson waste water effluent
  - Tucson reclaimed water
  - Sierrita sulfate plume consent water from Freeport-McMoRan Copper and Gold
  - Secretary of the Interior Department effluent
  - Secretary of the Interior Department managed recharge credit recovery (not wet water)

- Deep aquifer brackish water
- Ocean water from Sea of Cortez, desalinized

The technical and practical aspects of these alternate sources were investigated on behalf of the Coronado by SRK Consulting Inc. (Stone et al. 2011).

A review found that the use of effluent or reclaimed water to offset a portion of groundwater pumping was feasible. However, this option was eliminated from detailed study because of the following: (1) a pipeline or other water delivery system from the source to the mine site, approximately 50 miles, would likely result in additional environmental and social impacts; (2) there is no guarantee that available excess effluent or reclaimed water would be available; and (3) there is no indication that Rosemont Copper could obtain a guaranteed water right or permit for use of effluent or reclaimed water.

A review found that the use of deep aquifer brackish water was feasible. However, this option was also eliminated from detailed study because of the following: (1) it would require location of an adequate supply of such water, the closest potential location being in Cochise County; (2) a pipeline of approximately 55 miles and pumping stations would be required, which would likely result in additional environmental and social impacts; (3) there is no indication that Rosemont Copper could obtain the necessary rights or permits to use such water; and (4) there is an indication that use of such water in Arizona may depend on reappraisal of the aquifer classification in the state.

Rosemont Copper currently has water rights to their supply wells, and the Forest Service does not have the authority to require that Rosemont Copper find an alternate source.

Transportation

Alternatives were considered to the proposed transportation of workers, supplies to the mine, shipments to the mine, and primary access road. Several comments received during scoping suggested that the transportation of materials to the mine could be accomplished by improving the road in Box Canyon. The impacts to Box Canyon that would result from constructing the road such that it could accommodate large trucks were deemed to be greater than the preliminary MPO. Similarly, routing supply trucks to approach the site from the south was also determined to have a greater impact on resources than the preliminary MPO.

Land Exchange or Purchase of the Rosemont Project Area by the Forest Service

Members of the public suggested during scoping that a land exchange would reduce the administrative impact of managing a mine on the Coronado National Forest and remove the permanent placement of a mine on public lands. This alternative would not result in a change in the preliminary MPO; therefore, it would not reduce the environmental impacts. Additionally, a land exchange is not within the scope of the purpose of and need for the project.

Forest Plan Consistency

The FEIS and ROD for the Coronado National Forest, dated August 4, 1986, and the associated "Coronado National Forest Land and Resource Management Plan," as amended (U.S. Forest Service 1986), were adopted pursuant to the National Forest Management Act (16 United States Code 1604) and its implementing regulations at 36 Code of Federal Regulations 219[5] to provide strategic direction (desired conditions, goals, and objectives) and to set parameters on land and resource use activities (standards and guidelines). As a forest plan is implemented through time, it periodically becomes necessary to adjust this strategic direction to provide for site-specific land and resource use or activities. Such adjustments, commonly called amendments, may be initiated and adopted by the forest supervisor as needed to adapt the forest plan to changing land and resource conditions or management needs.

Forest plans may "be amended in any manner whatsoever after final adoption and after public notice" (16 United States Code 1604(f)(4)). Federal regulations at 36 Code of Federal Regulations 219.14 allow forests to use the provisions of the planning regulations in effect before November 9, 2000, in order to amend forest plans. These regulations state that the responsible official shall do the following: (1) determine whether proposed changes to a land management plan are significant or not significant in accordance with the requirements of Section 1926.51; (2) document the determination of whether the change is significant or not significant in a decision document; and (3) provide appropriate public notification of the decision prior to implementing the changes. Disclosure of the need to amend the Coronado's forest plan in this DEIS and the FEIS is intended to provide public notification. Determination of the significance of the proposed amendment will be made by the responsible official prior to making a decision and will be documented in the ROD.

Findings of the responsible official regarding the consistency of projects or activities and actions with the land management plan and the determination of the significance of an amendment are an integral part of decisions. As such, they are subject to administrative review under 36 Code of Federal Regulations 219.14.

A review of the consistency of the Rosemont Copper Project resulted in a determination that certain aspects of implementing the proposed action (preliminary MPO) or any of the action alternatives would result in conditions that are inconsistent with management direction in the forest plan. Table 4 provides an overview of the types of inconsistencies identified. Figure 18 shows the forest plan management areas within the project area.

[5] Established pursuant to the National Forest Management Act of 1976 (16 United States Code 1600–1614, August 17, 1974, as amended 1976, 1978, 1980, 1981, 1983, 1985, 1988, and 1990, and its implementing regulations at 36 Code of Federal Regulations Part 219 (effective September 30, 1982)).

Table 4. Coronado forest plan consistency

Management Direction Category	Rosemont Copper Project Consistency with Forest Plan Management Direction – Alternatives 2 through 6
Forest-wide Standards and Guidelines	Inconsistent with standards and guidelines related to the following: Maintenance, rehabilitation, and enhancement of visual resources Protection of cultural resources Maintenance and improvement of wildlife habitat Maintenance and protection of existing riparian resources Maintenance of wildlife and plant diversity Maintaining buffers around watering and feeding areas Retention of riparian area Amount of riparian area Diversity of riparian species Maintenance of riparian area productivity Minimizing soil damage Maintenance of Recreation Opportunity Spectrum classes
Management Area 1 Standards and Guidelines	Inconsistent with standards and guidelines related to the following: Maintenance of visual resources Maintenance and improvement of wildlife habitat Maintenance of vegetative structure Loss of horizontal structure Loss of vertical structure Delisting threatened and endangered species and reoccupying historic habitat Recreation Opportunity Spectrum settings: semiprimitive motorized and nonmotorized
Management Area 4 Standards and Guidelines	Inconsistent with standards and guidelines related to the following: Maintenance of Recreation Opportunity Spectrum classes Maintenance of visual resources Maintenance and improvement of wildlife habitat
Management Area 7 Standards and Guidelines (Applies to Management Prescriptions A and B)	Inconsistent with standards and guidelines related to the following: Maintenance of Recreation Opportunity Spectrum classes Maintenance of visual resources Maintenance and improvement of wildlife habitat

The Coronado proposes to amend its forest plan in order to allow activities integral to the proposed project. The proposed forest plan amendment consists of a new management area that specifically addresses copper mining. A detailed description follows.

The proposed new management area is referred to as Management Area 16 – Rosemont Mining Area. It includes standards and guidelines specifically developed to allow copper mining to comply with the amended forest plan. Proposed Management Area 16 is common to the proposed action and all action alternatives. All mining and associated ground-disturbing activities associated with the Rosemont Copper project would be located within the boundaries of proposed Management Area 16, with the

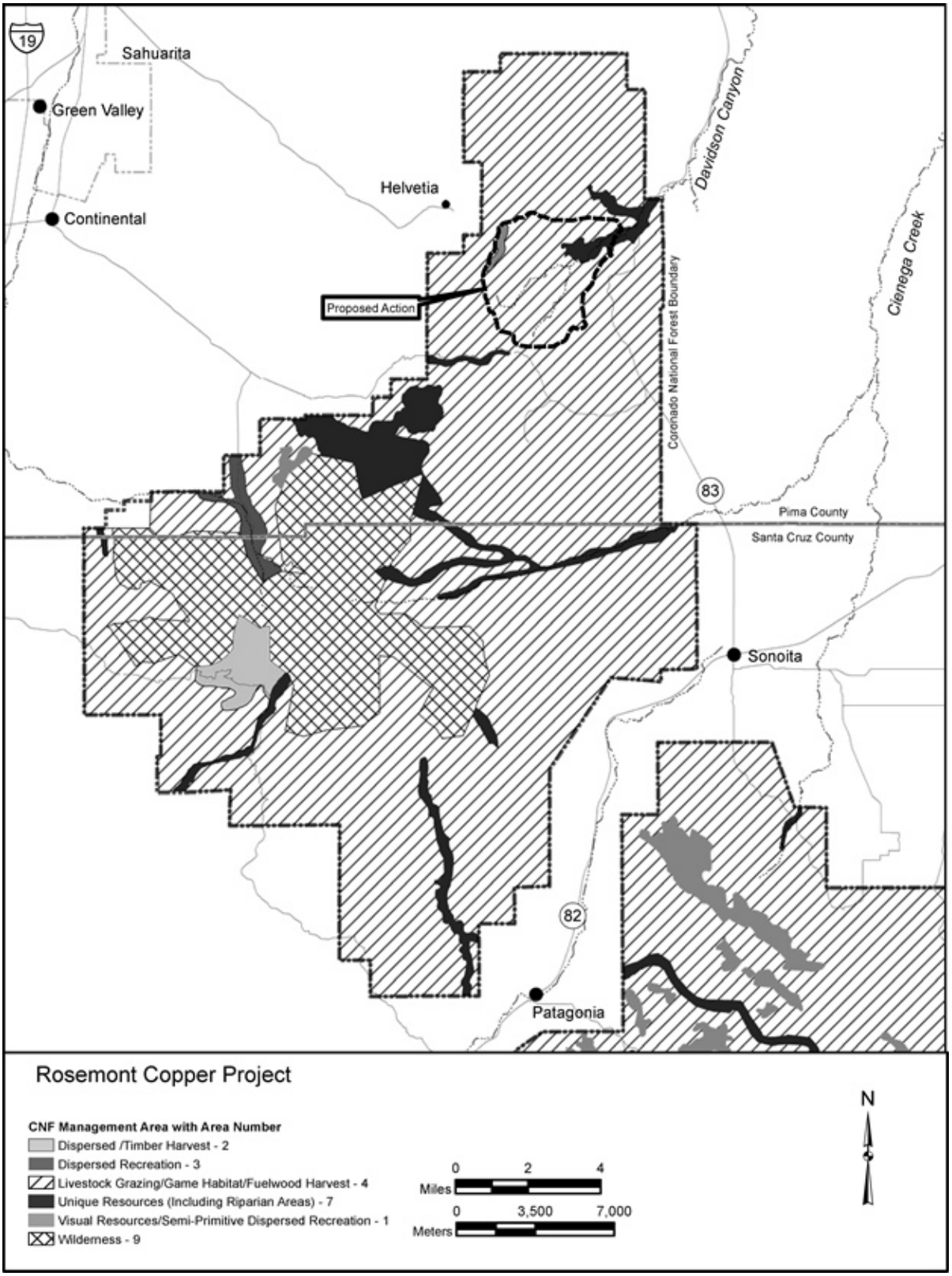

Figure 18. Coronado National Forest existing management areas

possible exception of some access road construction and the movement of employees, materials, and mine products. The final boundaries for this management area may be modified somewhat, depending on which alternative is ultimately selected for implementation. Any revisions will be described in the FEIS and ROD.

Proposed Forest Plan Amendment

Management Area 16 – Rosemont Mining Area

Management Emphasis and Intensity

This management area is an administrative delineation that provides for mining of privately held mineral resources while allowing other forest uses to the degree that they are safe, practical, and appropriate for an active or postmine environment.

Management Area Description

Land within the Sycamore Canyon and Davidson Canyon subwatersheds, located on the Nogales Ranger District, that is within or immediately adjacent to the area containing mining and related activities for the Rosemont Copper Project. This management area contains no suitable timber land; old-growth forest; or spotted owl or goshawk habitat; and contains 8,792 acres of land that is currently capable for grazing (premine conditions). The new management area was carved out of existing Management Areas 1, 4, and 7.

The management area standards and guidelines that follow (table 5) supersede any inconsistent forest-wide plan language identified in chapter 2, table 4 of the Rosemont Copper DEIS.

Capability Area Types

See Management Areas 1, 4, and 7 for this information. Total acres = 8,792.

Table 5. Specific management prescription

Management Practices	Standards and Guidelines
Dispersed Recreation	1. Access for exploration and development of locatable mineral resources will be analyzed in response to a proposed operating plan. Potential impacts will be considered in reviewing proposed MPOs. 2. The area within the perimeter fence that encloses active mining operations will be closed to public use until such a time that mining and reclamation activities are completed. 3. Trails will be evaluated to determine whether their continued use is warranted, given mining activities and postmine conditions. 4. Relocation of segments of the Arizona National Scenic Trail that are affected by mining operations will be evaluated to determine options for continued use in both the short and long term.
Visual Resource Management	1. Mine reclamation should consider using a geomorphic approach that results in landforms similar to adjacent natural terrain and hydrologic functions similar to natural systems in order to minimize long-term monitoring and maintenance requirements. 2. Mining activities should incorporate reclamation measures that reduce contrasts with the surrounding landscapes.

Management Practices	Standards and Guidelines
Wildlife and Fish	1. Mitigate impacts on wildlife and plant diversity by applying the following standards and guidelines to the appropriate management activities. a. Mineral entry and oil and gas exploration i. To the extent practical, leave buffers around watering and feeding areas for escape and hiding cover. Buffer widths vary with the site but must be wide enough to screen affected wildlife from the project site. ii. Rehabilitate site after using mixture of forage and cover plant species. iii. Within occupied habitat of threatened and endangered species. 2. a. Specific recommendations made on a site by site basis.
Range Management	1. Livestock will be excluded from the area enclosed by the perimeter fence, which surrounds mining activities and facilities. 2. Following completion of mining and reclamation activities, evaluate the area within the perimeter fence to determine capability for livestock grazing. 3. Consider future livestock grazing when selecting and approving seed and plants for revegetation.
Watershed and Soil Maintenance and Improvement	1. To the extent practicable, mining facilities and reclamation should strive to emulate natural hydrologic functions. 2. Mine reclamation treatments will be conducted using primarily native species. Species will be approved by the Forest Service prior to use.
Minerals Management	1. To the extent possible, avoid construction of permanent roads across Federal lands unless needed for future access. 2. Mining and leasing activities will be allowed within the framework of applicable laws and regulations, including environmental laws and regulations designed to mitigate the impacts of mining activities. Emphasis will be on gaining cooperation and control through the use of operating plans and bonds for rehabilitation to protect and restore surface resources. 3. With forest supervisor approval, mining and reclamation activities that meet Management Area 16 standards and guidelines supersede inconsistent forest-wide standards and guidelines.
Lands Administration	1. Approved occupancy on National Forest System lands for mining purposes is restricted to site security measures. Permanent structures and/or occupancy are limited to only those that are necessary and incidental to approved mining operations.
Road Maintenance	1. Roads located within the perimeter fence will be closed to public access pending mine closure and reclamation.

Adoption of proposed Management Area 16 would bring the mining and related activities contained in the proposed action and action alternatives into compliance with the Coronado forest plan, as amended. The environmental effects of those activities are described in the various sections of chapter 3 of this DEIS.

Implementation of the proposed forest plan amendment would not significantly alter the multiple-use goals and objectives of the current forest plan. The amendment proposes changes in management direction to allow mining and associated activities to occur only in the Rosemont area and adjacent lands. These activities are restricted in geographic extent and would not have wide-ranging effects across the Coronado National Forest.

Management Area 16 would replace those portions of existing Management Areas 1, 4, and 7 where they overlap (figure 19). Therefore, the total acreage of these existing management areas would be reduced on a forest-wide basis, as shown in table 6. Management prescriptions for these management areas would not change. Significant changes in the multiple-use goals and objectives for long-term land and resource management are not expected.

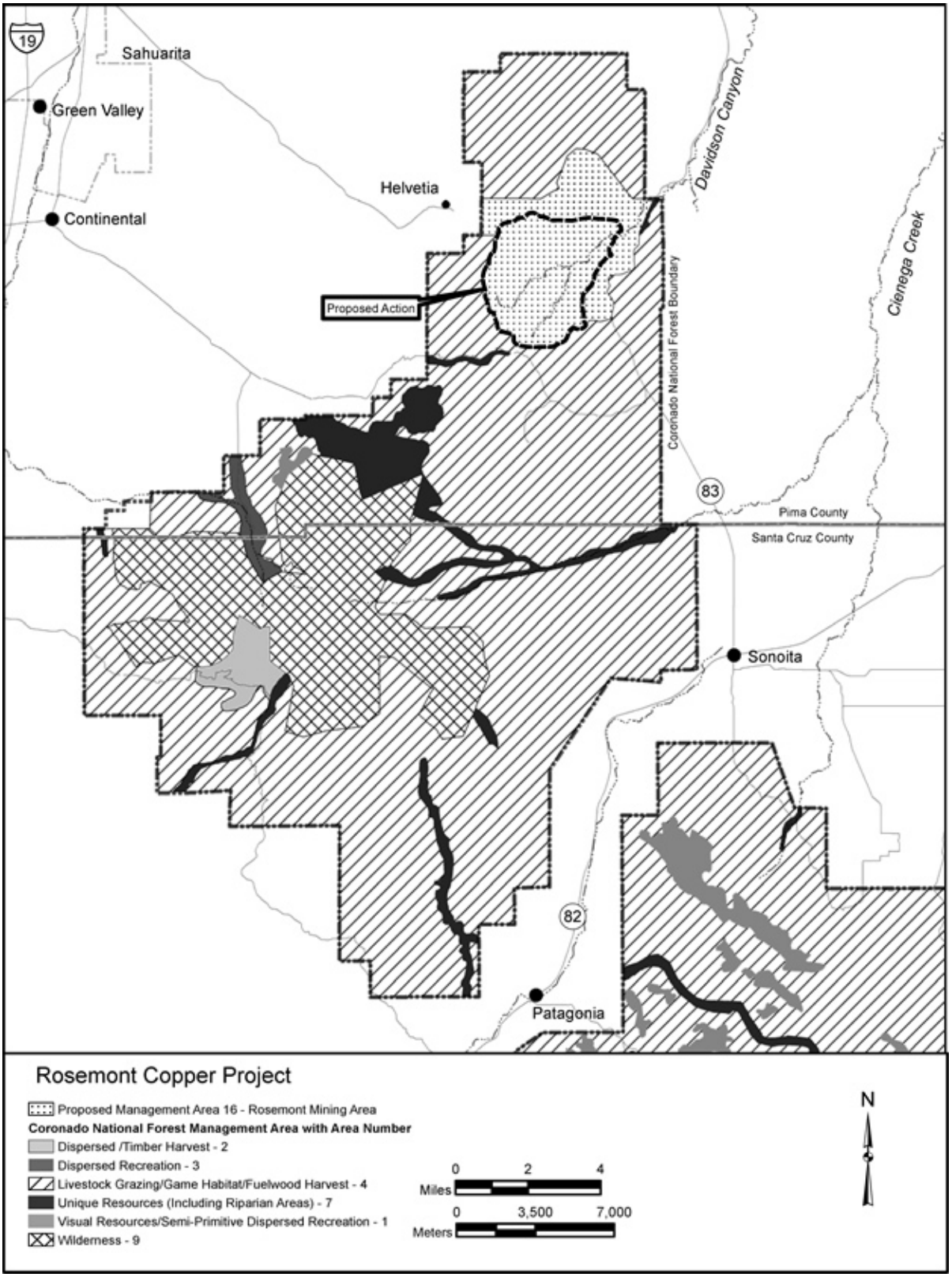

Figure 19. Management Area 16 – Rosemont Mining Area

Table 6. Reduction in existing management areas

Existing Management Area	Current Acreage Forest-wide (Forest Plan, Table 2A)	Acres Forest-wide with Adoption of Management Area 16	Net Reduction (acres and percent)
1	97,772 acres	97,661 acres	111 acres (0.11%)
4	1,126,289 acres	1,118,463 acres	7,826 acres (0.69%)
7	41,547 acres	40,692 acres	855 acres (2.06%)

The reduction in acres of Management Areas 1, 4, and 7 is expected to have minimal effects on the output of goods and services across the Coronado National Forest.

Preliminary Finding of Significance

A preliminary review of the proposed amendment indicates that it would likely not be a significant amendment to the Coronado forest plan. Further information regarding this preliminary finding of nonsignificant amendment is contained in the Project Record.

Forest Plan Revision

The current forest plan was originally developed in 1986, more than 25 years ago. The Coronado is in the process of revising the 1986 forest plan. This process began in 2006, and a number of needed changes were identified through collaboration with the public. A working draft of the revised forest plan was released in March 2010. Further public review will occur in 2012, with the release of a proposed draft forest plan and DEIS. A decision on the revised forest plan is anticipated in 2013.

At this time, the ROD for the Rosemont Copper Project is anticipated to be issued prior to completion of forest plan revision. Therefore, the Rosemont Copper Project must comply with the existing forest plan. As previously mentioned, the proposed Rosemont forest plan amendment is intended to bring the activities associated with the Rosemont Copper Project into compliance with the forest plan.

Once forest plan revision is complete, the revised plan will replace the current amended forest plan. Coordination between the forest plan revision effort and the Rosemont Copper project forest plan amendment is occurring to ensure that the project would comply with the revised forest plan when it takes effect.

Alternatives Impact Summary

Table 7 compares the design elements for the action alternatives. Table 8 summarizes the impacts of each alternative based on the issues, as stated in chapter 1, that drove the analysis. A more thorough and detailed discussion of impacts is provided in chapter 3 of the DEIS. Through this process, resource specialists determined some additional factors that should be considered in the overall analysis used to compare alternative effects.

Table 7. Alternatives comparison table: design elements

Option Element	Proposed Action (preliminary MPO)	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
Waste rock storage design capacity (tons)	719,827,000	+36,273,000	+30,612,000	+399,557,000	+424,861,000
Waste rock ultimate elevation (feet above mean sea level)	5,450	+20	−15/+250	−150/+150	+50
Waste rock area (acres)	2,000	−630	−540	−180	−702
Distance from pit center to waste rock center (approximate feet)	7,400	No change	+2,350	+1,760	+4,050
Infrastructure area (roads, plant site, pit)* (acres)	1,545	+173	+170	+168	+205
Tailings storage design capacity (tons)	543,200	+52,800	+66,800	+66,800	+87,800
Tailings storage ultimate elevation (feet above mean sea level)	5,250	No change	+50	−12	+137
Tailings area (acres)	870	+265	+117	+170	+344
Distance from pit center to tailings center (approximate feet)	8,800	−200	−1,445	+900	+6,000
Leach pad ultimate elevation – no cover (feet above mean sea level)	5,340	+40	+40	+40	+40
Leach pad ultimate elevation – covered (feet above mean sea level)	5,450	−25	−25	−25	−25
Leach pad area (acres)	230 300-foot ultimate height	−104 +30-foot ultimate height	−104 +30-foot ultimate height	−104 +30-foot ultimate height	−104 +30-foot ultimate height
Increase in haulage requirements	No change	No change	8.4%	5.4%	12.3%
Total diversion structures – length (feet)	23,175	+1,720	−6,715	−11,085	+18,390

* Common to all alternatives:

Pit – 950

Access roads, utility corridors, etc. – 473

Updated plant site – 292 (120 for preliminary MPO version)

Stormwater basins – 2

Diversion structures – 168 (excluded in preliminary MPO version) – estimate consistent at this point for all options; however, more analysis will be required

Table 8. Alternatives impact summary

Issue Category	No Action	Proposed Action	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
Geology, Minerals, and Paleontology						
Other Effects Considered						
Amount of rock and sediment removed (tons)	None	1.8 billion	1.8 billion	1.8 billion	1.8 billion	1.8 billion
Potential loss of paleontological resources (sensitive acres disturbed)	None	3,782	3,759	4,409	4,409	3,592
Potential for disturbance of cave resources	None	No cave resources have been identified in project area; however, potential may exist. If present, cave resources could be impacted.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Geotechnical and seismic stability of pit	Not applicable	Failure is unlikely because of the design criteria for expected seismic activity.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Soils						
1: Qualitative assessment of long-term stability of tailings and waste piles	None	Modeling indicates that waste rock and tailings will be more stable than required by regulations.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
1: Character of risks to stability through time, including expected results of reclamation; qualitative assessment of the potential for revegetation of tailings and waste rock piles	None	After 100 years, reclamation approaches historic climax conditions, with varying success by vegetation type and elevation.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
1: Area and quantitative level of disturbance leading to lost soil productivity (acres)	0	4,415	4,390	4,165	4,165	4,310
1: Sediment delivery to Davidson Canyon, Cienega Creek, or other streams and washes, compared with background sediment loading (tons per year)	32,600	16,000	16,500	Modeling not completed	20,300	24,200
Air Quality and Climate Change						
2: $PM_{2.5}$ versus background and threshold	No impact	2× increase versus background levels; maintenance of the National Ambient Air Quality Standards (NAAQS) threshold.	Same as proposed action	8.8× increase versus background levels; exceedance of the NAAQS threshold.	3.5× increase versus background levels; exceedance of the NAAQS threshold.	7.4× increase versus background levels; exceedance of the NAAQS threshold.
2: PM_{10} versus background and threshold	No impact	More than 3× increase versus background levels; near exceedance of NAAQS threshold.	Same as proposed action	4.6× increase versus background levels; exceedance of the NAAQS threshold.	5.2× increase versus background levels; exceedance of the NAAQS threshold.	14.1× increase versus background levels; exceedance of the NAAQS threshold.
2: Greenhouse gas emissions versus background	No impact	1% increase in Pima County CO_2 emissions.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
2: Volatile organic compound (VOC) emissions	No impact	Less than 1% increase in Pima County VOC emissions; emission rate of about 105 tons per year.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
2: Nitrogen oxide (NO_x) emissions	No impact	4% increase in Pima County NO_x emissions; emission rate of about 1,250 tons per year; risk of exceedance of ozone NAAQS threshold in Tucson area.	Same as proposed action	4% increase in Pima County NOx emissions; 6.7× increase versus background levels; near exceedance of the NAAQS threshold.	4% increase in Pima County NOx emissions; 7.1× increase versus background levels; exceedance of the NAAQS threshold.	4% increase in Pima County NOx emissions; 8.4× increase versus background levels; exceedance of the NAAQS threshold.
2: Effects on air quality in Class I airsheds	No impact	Causes and contributes to degradation of visibility in the Saguaro National Park East and Galiuro Wilderness Area Class I airsheds.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
2: Effects on air quality outside Class I airsheds	No impact	Risk of exceedance of ozone and PM_{10} NAAQS thresholds in the Tucson and Saguaro National Park East areas	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
2: Meeting of air quality standards	No impact	Risk of exceedance of PM_{10} NAAQS thresholds in the Tucson and Saguaro National Park East areas; risk of exceedance of NO_2 1-hour standards; causes and contributes to degradation of visibility in the Saguaro National Park East and Galiuro Wilderness Area Class I airsheds.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action

Issue Category	No Action	Proposed Action	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
Groundwater Quantity*						
Davidson Canyon/Cienega Basin						
3A: Direction and degree of change in water table level (feet)	None	More than 100-foot drawdown near mine pit; 10- to 100-foot drawdown near residential areas along Singing Rock Road and Hilton Ranch Road, with impacts beginning by end of active mining; no drawdown above threshold of 5 feet at Corona del Tucson residences, along Cienega Creek, or at Davidson Canyon/Cienega confluence; 1- to 10-foot drawdown at Upper Empire Gulch, with impacts beginning approximately 50 years after end of active mining.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
3A: Locations in which water resources may be impacted (geographic extent)	None	More than 100-foot drawdown near mine pit; 10- to 100-foot drawdown near residential areas along Singing Rock Road and Hilton Ranch Road, with impacts beginning by end of active mining; no drawdown above threshold of 5 feet at Corona del Tucson residences, along Cienega Creek, or at Davidson Canyon/Cienega confluence; 1- to 10-foot drawdown at Upper Empire Gulch, with impacts beginning approximately 50 years after end of active mining.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
3A: Duration of effect (in years)	None	Perpetuity	Perpetuity	Perpetuity	Perpetuity	Perpetuity
3A: Relative impairment of mountain-front groundwater recharge function	None	1%	1%	1%	1%	1%
3D: Potential lowering of the water table/reduced groundwater flow to Davidson Canyon and Cienega Creek that results in permanent changes in flow patterns may affect their designations as Outstanding Arizona Waters and current designated uses						
Subcomponent 1: Reduction in flow along Cienega Creek (percentage)	None	1 to 3% of average annual flow; critical low-flow periods (May through June) would see greater impacts; impacts modeled to potentially start 50 years after end of active mine life	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Subcomponent 2: Miles of perennial stream length lost along Cienega Creek	None	0.16 (based on average flow)	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Subcomponent 3: Reduction in flow along Davidson Canyon (percentage)†	None	10%; impacts expected to start immediately after construction of mine	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Subcomponent 4: Miles of perennial stream length lost along Davidson Canyon†	None	0.29	0.29	0.29	0.29	0.29
3A: Comparison of mine pit water loss with overall basin water balance	None	1.7 to 5.3% (at equilibrium; during active mine dewatering this percentage would be greater)	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
3D: Number of springs or seeps lost or impaired	None	64	64	63	64	69
3A: Potential reduction in groundwater outflow from Davidson Canyon	None	6.4%	6.4%	6.4%	6.4%	6.4%
3A: Approximate number of wells within geographic extent of impact	None	500 to 550	500 to 550	500 to 550	500 to 550	500 to 550
Upper Santa Cruz Sub-Basin						
3B: Water needed for operations from Santa Cruz Valley and comparison with other water uses and basin water balance, measured in acre-feet						
Subcomponent 1: Amount of groundwater pumped (acre-feet per year)	None	5,400	5,400	5,400	5,400	5,400
Subcomponent 2: Groundwater pumped as percent increase in current pumping	None	6.7%	6.7%	6.7%	6.7%	6.7%
3B: Change in water table level (feet)						
Subcomponent 1: Approximate total drawdown attributable to pumping (feet)	None	Up to 70	Up to 70 feet	Up to 70 feet	Up to 70 feet	Up to 70 feet

Issue Category	No Action	Proposed Action	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
Subcomponent 2: Annual rate of drawdown attributed to pumping (feet per year)	None	Up to 3.5	Up to 3.5	Up to 3.5	Up to 3.5	Up to 3.5
3B: Locations where water resources may be impacted (geographic extent), in miles from pumping center	None	3 to 4	3 to 4	3 to 4	3 to 4	3 to 4
3B: Duration of effect (in years)	None	100 to 140 years	100 to 140 years	100 to 140 years	100 to 140 years	100 to 140 years
3B: Approximate number of wells within geographic extent of impact	None	400 to 450	400 to 450	400 to 450	400 to 450	400 to 450
Groundwater Quality						
3C: Ability to meet Arizona Aquifer Water Quality Standards						
Subcomponent 1: Infiltration from tailings and waste rock	None	Modeled water quality for potential seepage from tailings and waste rock meets standards	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Subcomponent 2: Infiltration from heap leach	None	Modeled water quality for untreated seepage from heap leach exceeds standards for cadmium, fluoride, nickel, and selenium; treatment with an engineered biological system meets standards.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Subcomponent 3: Mine pit lake water quality	None	Modeled water quality in mine pit lake meets standards	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
3C: Ability to demonstrate best available demonstrated control technology						
Subcomponent 1: Effectiveness of tailings and waste rock control technology	None	Modeled water quality indicates that selected technology is acceptable for preventing groundwater contamination	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Subcomponent 2: Effectiveness of heap leach control technology	None	Modeled water quality indicates that selected technology for one type of passive treatment acceptable for treating heap leach seepage	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Other Effects Considered						
Impact to Sierrita Sulfate Plume	None	Minor changes in gradient or groundwater levels as a result of mine supply pumping would occur in the vicinity of the Sierrita sulfate plume, but mitigation pumping by Sierrita would control any migration of plume	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Surface Water Quantity						
3D: Quantitative assessment of water released and available for beneficial uses	No change	Beneficial uses of ephemeral stream flows primarily related to stock tanks; after mitigation, negligible effect on beneficial uses	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
3D: Stock watering tanks that will be unavailable (number)						
Subcomponent 1: Stock tanks directly disturbed (number)	0	15 stock tanks lost 15 mitigated; no net loss	15 stock tanks lost 15 mitigated; no net loss	18 stock tanks lost 18 mitigated; no net loss	19 stock tanks lost 19 mitigated; no net loss	8 stock tanks lost 8 mitigated; no net loss
Subcomponent 2: Downstream stock tanks indirectly impacted (number)	0	6	6	5	5	6
3D: Change in volume, frequency, and magnitude of runoff from the mine						
Subcomponent 1: Reduction in volume of stormwater flow from the project area (percent)	0	45.8%	44.3%	33.8%	42.0%	22.8%
Subcomponent 2: Reduction in 100-year, 24-hour peak flow from the project area (percent)	0	53.1%	49.9%	34.9%	40.0%	29.5%
Subcomponent 3: Reduction in flow along Davidson Canyon (percent)	0	9.7%	7.1%	5.4%	6.7%	3.6%
Subcomponent 4: Change in recharge to the aquifer by runoff	0	Reduction in recharge expected but not quantified	Reduction in recharge expected but not quantified	Reduction in recharge expected but not quantified	Reduction in recharge expected but not quantified	Reduction in recharge expected but not quantified
Surface Water Quality						
3E: Area (in acres) and locations that may be affected by surface water quality impacts	None	Impacts to 2.5 miles of Barrel Canyon (23 acres), and 14 miles of Davidson Canyon (234 acres)	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
3E: Duration of impacts	None	Full impacts during active mine life (25 years), gradually reducing but never to premine conditions	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
3E: Ability to meet Arizona Surface Water Quality Standards						

Issue Category	No Action	Proposed Action	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
Subcomponent 1: Sediment delivery to the U.S. Geological Survey Gaging Station (% change)	0	−51.3	−49.6	−38.2 (interpolated)	−38.2	−26.1
Subcomponent 2: Sediment delivery to the Barrel Canyon outlet (% change)	0	−18.0	−17.4	−13.4 (interpolated)	−13.4	−9.1
Subcomponent 3: Sediment delivery to Davidson Canyon outlet (% change)	0	−5.1	−5.0	−3.8 (interpolated)	−3.8	−2.6
Subcomponent 4: Potential for acid rock drainage	None	Acid-base accounting and kinetic testing indicate that all but one of the rock types to be excavated are nonacid generating. The waste rock management plan will ensure that waste rock and tailings with acid-generating potential are encapsulated and buffered by acid-neutralizing rock types. There is a low probability for generation of acid rock drainage.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Subcomponent 5: Potential for other contaminants	None	Leachate from tailings and waste rock facilities is expected to meet all water quality standards and will not impact surface waters. Untreated heap leachate is expected to exceed water quality standards; treatment with engineered biological system meets standards. There is no potential, however, for heap leachate to reach surface waters.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Other Effects Considered						
Loss of waters of the United States to mine footprint (acres)	0	47.8	44.9	39.9	53.3	31.5
Loss of important riparian areas to mine footprint (acres)	0	213.8	220.8	207.5	210.8	83.4
Biological Resources[‡]						
4. Riparian habitat disturbed (acres)[§]	None	Cienega Creek: 490.4 hydroriparian/mesoriparian; Davidson Canyon: 471.2 xeroriparian, 17.2 to 204.7 mesoriparian; Empire Gulch: 58.3 hydroriparian/mesoriparian; Gardner Canyon: 139.6 hydroriparian/mesoriparian	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
4. Qualitative assessment of ability to meet legal and regulatory requirements	None	Biological, hydrologic, and geomorphic impacts to Davidson Canyon; Biological and hydrologic impacts to Cienega Creek, Empire Gulch, and Gardner Canyon	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
5A: Vegetation – Loss of vegetation communities[¶]	None	6,380 to 6,461 acres lost or converted	6,278 to 6,359 acres lost or converted	7,014 to 7,095 acres lost or converted	7,014 to 7,095 acres lost or converted	7,363 to 7,444 acres lost or converted
5B: Habitat Loss – Acres of habitat[¶]	None	6,380 to 6,461 acres lost or converted	6,278 to 6,359 acres lost or converted	7,014 to 7,095 acres lost or converted	7,014 to 7,095 acres lost or converted	7,363 to 7,444 acres lost or converted
5B: Habitat Loss – Impacts to Aquatic Habitat	None	63 springs and seeps impacted; 15 stock tanks impacted; and 0.8 acre of wetland impacted	63 springs and seeps impacted; 15 stock tanks impacted; and 0.8 acre of wetland impacted	63 springs and seeps impacted; 19 stock tanks impacted; and 0.8 acre of wetland impacted	63 springs and seeps impacted; 19 stock tanks impacted; and 0.8 acre of wetland impacted	67 springs and seeps impacted; 8 stock tanks impacted; and 0.8 acre of wetland impacted
5C: Nonnative Species – Acres of Disturbance[¶]	None	6,380 to 6,461 acres disturbed	6,278 to 6,359 acres disturbed	7,014 to 7,095 acres disturbed	7,014 to 7,095 acres disturbed	7,363 to 7,444 acres disturbed
5D: Wildlife Movement – Change in Movement Corridors and Connectivity	None	Increased fragmentation and reduced connectivity	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
5D: Wildlife Movement – Traffic Related Mortality	No Change	Animal roadkills on State Route 83 will approximately double by year 20 of mine operations[#]	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
5E: Species of Concern – Habitat Lost or Converted[¶]	None	6,380 to 6,461 acres lost or converted	6,278 to 6,359 acres lost or converted	7,014 to 7,095 acres lost or converted	7,014 to 7,095 acres lost or converted	7,363 to 7,444 acres lost or converted
5E: Species of Concern – Effects on Population Viability	No Change	Could be reduced for at least 3 sensitive species	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
5F: Animal Behavior – Acres of Habitat Impacted	None	Up to 145,190 acres** impacted	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Landownership and Boundary Management						
Other Effects Considered						
Total acres	0	6,226	6,122	6,859	6,859	7,208
Private land (acres)	0	1,215	1,212	1,212	1,212	1,369
National Forest System land (acres)	0	5,008	4,906	5,644	5,644	5,837
Bureau of Land Management land (acres)	0	3	3	3	3	3

Issue Category	No Action	Proposed Action	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
Arizona State Land Department land (acres)	0	0	0	0	0	0
Effect on mineral survey fractions	None	Sale of currently federally owned mineral survey fractions to Rosemont Copper as permitted by the Small Tracts Act negates need for future management	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Effect on boundary management	None	Proposed activities include Bureau of Land Management administered resurvey and control network, resulting in no impacts to boundary management	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Livestock Grazing						
Other Effects Considered						
Issues Analyzed: Impact to Allotments						
Change from Fully to Partially Capable within Rosemont Allotment (acres)	0	4,684	4,590	5,316	5,316	4,445
Change from Fully to Partially Capable within Thurber Allotment (acres)	0	280	280	290	290	0
Change from Fully to Partially Capable within Greaterville Allotment (acres)	0	88	88	88	88	0
Change from Fully to Partially Capable within DeBaud Allotment (acres)	0	18	8	8	8	1,235
Change from Fully to Partially Capable within to Helvetia Allotment (acres)	0	155	155	155	155	155
Change from Fully to Partially Capable within Stone Springs Allotment (acres)	0	0	0	0	0	219
Change from Fully to Not Capable within Rosemont Allotment (acres)	0	950	950	950	950	950
Stock Ponds Lost	0	15	15	19	19	8
Springs Lost	0	63	63	63	63	67
Potential Reduction in Animal Unit Months Each Year over 25-Year Mine Life	0	1,146	1,129	1,075	1,075	1,409
Dark Skies						
8: Fractional increase in sky brightness from mine facility and vehicle lighting at Whipple Observatory	No impact, but subject to regional trends and conditions; night sky lighting intensity meets regional Outdoor Lighting Code	2,300% increase at horizon. Increase would be perceptible up to 50 degrees from horizon. Long-term, adverse impacts to astronomy research.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
8: Fractional increase in sky brightness from mine facility and vehicle lighting at Jarnac Observatory	Same as Whipple	540% increase at 5 degrees above the horizon. Increase would be perceptible throughout the sky. Long-term, adverse impacts to astronomy research.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
8: Fractional increase in sky brightness from mine facility and vehicle lighting at Sonoita	Same as Whipple	1,600% increase at horizon. Increase would be perceptible up to 50 degrees above horizon.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
8: Fractional increase in sky brightness from mine facility and vehicle lighting at Corona de Tucson	Same as Whipple	1,900% increase at 5 degrees above the horizon. Increase would be perceptible everywhere in the sky.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
8: Fractional increase in sky brightness from mine facility and vehicle lighting at State Route 83	Same as Whipple	4,000% increase at 5 degrees above the horizon. Increase would be dramatic up to the zenith (directly overhead).	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
8: Fractional increase in sky brightness from mine facility and vehicle lighting at Empire Ranch	Same as Whipple	11,000% increase at horizon. Increase would be perceptible up to the zenith.	Same as proposed action	Same as proposed action	Same as proposed action	Same as proposed action
Visual Resources						
7: Coronado National Forest scenic integrity impacts (acres of project area visibility within very high and high scenic integrity objectives)	No impact.	13,742	13,427	14,773	21,170	21,904

Issue Category	No Action	Proposed Action	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
7: Qualitative assessment/degree of change in landscape character from analysis viewpoints: Open-pit impacts	No impact.	Strong contrasts and adverse impacts from highly visible pit face and diversion channel.	Similar to proposed action, but more visible in early years and slightly less visible permanently.	Pit face and diversion channel permanently visible.	Same as Barrel Alternative.	More adverse impacts than proposed action because of open views of pit face and diversion channel.
7: Qualitative assessment/degree of change in landscape character from analysis viewpoints: Waste rock and tailings impacts	No impact.	Permanent, major, adverse impacts from highly visible piles; irreversible loss of scenic views.	Permanent, major, adverse impacts from highly visible piles; irreversible loss of scenic views; scree slopes and increased pile visibility would increase adverse contrasts.	Same as proposed action.	Same as proposed action.	Same as proposed action, but also visible from west side of Santa Rita Mountains.
7: Qualitative assessment/degree of change in landscape character from analysis viewpoints: Processing facility impacts	No impact.	Facility exposed to view for up to 7 years, then screened by waste rock and tailings.	Facility exposed to view for 12 years, then screened by waste rock and tailings.	Facility visible for approximately 10 years, then partially screened by waste rock and tailings.	Same as Barrel Alternative.	Visible for entire mine lifetime.
7: Qualitative assessment/degree of change in landscape character from analysis viewpoints: Power line impacts	No impact.	Adversely visible in Box Canyon, along ridgeline, and at Lopez/Gunsight Pass for life of the project.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
7: Miles of project area visibility along concern level 1 and 2 forest roads and trails within the Coronado National Forest (and outside the project area)	No impact.	40	40	42	59	52
7: Miles of State Route 83 with direct, line-of-sight views of the project area[††]	No impact.	3.4	3.5	3.9	4.9	3.5
Other Effects Considered						
Project area regional visibility (acres)	No impact.	187,893	245,038	264,795	260,589	763,295
Recreation and Wilderness						
9: Recreation Opportunity Spectrum Setting Impacted and Area No Longer Available for Recreational Use (total acres)	0.0	6,211.2	6,107.3	6,844.6	6,844.6	7,193.9
9a: Semiprimitive Nonmotorized (acres)	0.0	0	0	0	0	119.2
9b: Semiprimitive Motorized (acres)	0.0	5,973.0	5,868.4	6,054.0	6,054.0	6,874.0
9c: Roaded Modified (acres)	0.0	170.0	170.0	170.0	170.0	0
9d: Roaded Natural (acres)	0.0	68.2	68.9	620.6	620.6	200.7
9: Annual Hunter Days Lost (per year)[§§]	0	776	757	702	886	905
9: Percent of Hunt Unit 34A on Forest Lands Affected	0.0%	4%	4%	4%	5%	5%
9: Public Roads Lost (miles)	0.0	30.4	30.5	32.6	32.6	30.7
9: Arizona National Scenic Trail Relocated (miles)	0.0	3.79	3.68	5.30	5.30	3.79
Hazardous Materials						
Other Effects Considered						
Potential for release of ammonium nitrate and fuel oil during use	None	Materials used up during detonation; negligible risk to environment	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Potential for release of laboratory reagents during storage or use	None	Materials used in small quantities in controlled setting; negligible risk to environment	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Potential for release of cleaning fluids during storage or use	None	Materials used in small quantities in controlled setting; negligible risk to environment	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Potential for release of reagents during solvent extraction and electrowinning	None	Except for kerosene and sulfuric acid, all reagents used up in process or used in small amounts; negligible risk to environment	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Potential for release of ammonium nitrate from risk of explosion during storage	None	In dry form presents little risk for release or migration; by itself and properly stored does not present an unusual risk of fire or explosion; negligible risk to environment	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Potential for release of hazardous waste	None	When stored, transported, and disposed of properly does not pose risk of accidental release; petroleum products described separately; negligible risk to environment	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.

Issue Category	No Action	Proposed Action	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
Potential for catastrophic release of sulfuric acid or petroleum product during transportation	None	Direct impacts to plants, wildlife, and/or soil in immediate vicinity of spill; possible migration into surface waters with indirect downstream effects on vegetation, aquatic species, and/or wildlife; some risk of groundwater contamination	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Potential for catastrophic or major release of sulfuric acid or petroleum product within the mine	None	Direct impacts to soil and wildlife and if long-term release, high potential for groundwater contamination; unlikely to migrate beyond the boundaries of the mine as a result of hydrologic gradients; direct impacts to birds and wildlife from pit contamination	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Potential release of contaminants from failure of leach pad	None	Direct impacts to groundwater from sulfuric acid; unlikely to migrate beyond the boundaries of the mine as a result of hydrologic gradients; direct impacts to birds and wildlife from pit contamination	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Fuels and Fire Management						
Other Effects Considered						
Activities Increasing Risk of Ignition						
Blasting	None	None	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Increased Vehicle Traffic	None	Increased risk of accidental ignition along transportation routes	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Storage and Transportation of Flammable Materials	None	Increased risk of accidental ignition along transportation routes	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Construction	None	None	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Activities Increasing Fuel Loading						
Clearing of Vegetation	None	None	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Noxious Weeds	None	Minor additional fuel loading after mitigation	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Decrease in Groundwater Level	None	Minor	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Transportation/Access						
Other Effects Considered						
Changes in Traffic Volume/Level of Service	No change in traffic volume/level of service (therefore no effect)	Decrease in level of service, but will not decrease to an unacceptable level of service. Mitigation measures would reduce the impacts of mine-related traffic.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Changes in Transportation Routes	No change in transportation routes (therefore no effect)	Increase in number of roads to access the mine (primary and secondary access routes).	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Changes in Access	No change in access (therefore no effect)	Existing Forest Service routes within project footprint currently open to the public would be closed. New public access via primary and secondary access routes after closure of mine.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Changes in Public Transportation	No change in public transportation (therefore no effect)	Increase in mine related traffic may affect public transportation. Mitigation measures would reduce the affect of mine related traffic on public transportation.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Noise						
9: Potential for noise to reach recreation areas and expected noise level	None	Impacts to recreational users from blasting noise (construction and operational phases) and equipment operational noise (operational phase), resulting in likely decrease in recreational value in area.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
11B: Ability of alternatives to meet rural landscape expectations	Likely to meet expectations	No impacts to residents from construction, blasting, equipment operation, or traffic noise during any phases of mine life.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Public Health and Safety						
10: Change in type and pattern of traffic by road and vehicle type; qualitative assessment of transportation conflicts	None	Traffic volumes to increase up to 356% by year 20 as a result of mine related traffic and anticipated population growth; with carpool mitigation measure traffic volumes to increase by up to 201% by year 20 as a result of mine related traffic and anticipated population growth.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.

Issue Category	No Action	Proposed Action	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
10: Trip count per day for all hazardous materials and qualitative assessment of potential effects of accident	None	Direct impacts primarily from potential release of petroleum products, ammonium nitrate, or sulfuric acid. Onsite ammonium nitrate explosion would cause damage up to 2 miles away and release a plume of toxic gases. Onsite petroleum product fire or sulfuric acid release would cause a plume of smoke and/or toxic gases. Accident during transportation would affect a radius of up to 0.5 mile for sulfuric acid, fuels, and ammonium nitrate and a radius of up to 1 mile for explosives.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
10: Qualitative assessment of public health risk from mine operations and facilities	None	Hazards to recreation are unlikely.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
10: Qualitative assessment of public health risk from geological hazards	None	Geological hazards are unlikely, with the exception of land subsidence, which could be marginally increased by mine supply pumping.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
10: Qualitative assessment of public health risk from noise	None	Acute noise hazards from construction, traffic, equipment, or blasting are unlikely.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
10: Quantitative assessment of ability to meet air quality standards for human health	None	Two modeling scenarios indicate exceedance of hourly NAAQS for NO_x.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Cultural Resources						
6A: Prehistoric sites (number)	–	62	60	77	77	64
6A: Historic sites (number)	–	32	32	33	33	32
6A: Traditional Cultural Properties (number)	–	1	1	1	1	1
6A: Multicomponent (prehistoric/historic) sites (number)		2	1	1	1	2
6A: Qualitative assessment of mitigation[¶¶] required	–	–	–	–	–	–
6B: Prehistoric sites known or likely to have human remains (number)	–	28	25	29	29	20
6B: Historic sites known or likely to have human remains (number)	–	1	1	1	1	1
6C: Springs/seeps impacted (number)						
Major impacts within alternative		12	12	11	12	17
Major and possible impacts external to alternative		52	52	52	52	50
Total		64	64	63	64	67
6C: Qualitative assessment of impact to Native Americans[¶¶]	–	–	–	–	–	–
6C: Qualitative assessment of impact to other communities[¶¶]	–	–	–	–	–	–
6D: Traditional resource collection areas (acres)	–	6,419.4	6,330.0	7037	7037.4	7,359.6
Socioeconomics and Environmental Justice						
11A: Change in employment over time	No change (therefore no effect)	Small regional increase; 2,400 direct jobs for construction (3 to 4 years), 350 to 480 annual jobs for mining operations and closure.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
11A: Change in property values over time	No change (therefore no effect)	Potential decrease in area property value of up to 15% within 2 miles of the project area, with the potential for a rebound in values once operations begin. Rebounding property values unlikely in areas where domestic wells are adversely impacted.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
11A: Change in tax base per year over time	No change (therefore no effect)	Small regional increase. Generates $11 million in construction sales tax during construction. Total direct revenues over the life of the mine are estimated at $136.7 million.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
11A: Change in demand and cost for road maintenance over time	No change (therefore no effect)	Increase in funding needs during operation phase of mine.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
11A: Change in demand and costs for emergency services over time	No change (therefore no effect)	Potential change in population not expected to result in dramatic demands on public services and emergency services costs.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.

Issue Category	No Action	Proposed Action	Phased Tailings	Barrel	Barrel Trail	Scholefield-McCleary
11A: Qualitative assessment in change of tourism revenue over time	No change (therefore no effect)	Negligible changes in regional tourist spending. Adverse impacts on dark skies could result in an impairment of observatories near the project area, which could result in a decrease in State revenues generated from astronomy, space, and planetary research and tourism.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
11B: Qualitative assessment of the ability of alternatives to meet rural landscape expectations as expressed by Federal, State, and local regulations and ordinances	No change (therefore no effect)	Potential degradation of area quality of life in terms of community values	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.
Other Effects Considered						
Environmental justice	No change (therefore no effect)	Possible disproportionate effects on Tohono O'odham Nation with regard to disturbance to cultural resources.	Same as proposed action.	Same as proposed action.	Same as proposed action.	Same as proposed action.

* Any ranges shown reflect the range of impacts from multiple models.

† Impacts to Davidson Canyon vary, depending on whether the Reach 2 and Escondido Springs are supplied by regional groundwater or ephemeral stormwater stored in the shallow alluvial aquifer. Multiple lines of evidence indicate that the latter is most likely. The potential reduction in perennial stream length assumes the springs that are supplied by the regional groundwater but is provided as a potential scenario.

‡ The acreages listed in this table are the acreages within the perimeter fence for each action alternative.

§ Riparian area disturbance refers to acreage potentially affected indirectly by groundwater drawdown or reduction in surface flows. Direct impacts from surface disturbance are analyzed in the "Surface Water Quality" section.

¶ See table 101 for breakdown of impacts to vegetation type by landownership.

See the "Transportation/Access" section.

** See table 99 for acreages of vegetation community by landownership within the analysis area.

†† Miles of the realigned Arizona National Scenic Trail with direct line-of-sight views of the project area cannot be calculated until the Forest Service has reviewed and approved the final realignment routes.

§§ Only considers hunter days lost for white-tailed deer, javelina, and Mearn's quail (Heffelfinger n.d. (2011)).

¶¶ See the "Direct and Indirect Effects of Each Alternative" part of the "Cultural Resources" section.