

## 2.1 Mine Plan

### 2.1.1 Open Pit Plans

The ultimate extent of the pit is based on long-range price forecasts for copper, molybdenum and silver, as well as engineering estimates of operating costs, concentrator recoveries, anticipated smelting charges, and payment terms. The design of the open pit and internal mining phases incorporates geotechnical recommendations for safe slope angles, internal ramp development for access to all working areas, and pit wall smoothing to enhance stability and operator safety.

Pit slope angles between ramps will vary according to rock strength, lithology and structural controls, but are expected to range between 28° and 48° between ramps. Where possible, catch benches will be spaced on 100-ft vertical intervals to maximize the effective widths for containing scree.

Floating cone analyses of the economic pit limits were conducted using copper prices of US\$1.20/lb to US\$1.50/lb (below three-year trailing averages), with corresponding molybdenum prices of US\$10.00/lb to US\$15.00/lb. The basis for mine planning was the US\$1.50/lb copper pit shell, which contains an estimated 600 MT of ore and 1,288 MT of waste rock. Oxide (heap leach ore) is presently estimated at 50 MT of mineralized material, which is contained within the above ore figures.

At the rim, the ultimate open pit will be about 6,500 ft across north to south, 6,000 ft across east to west, and will be about 1,800 to 2,900 ft deep. The pit bottom elevation is projected at 3,150 ft above msl. The pit area totals about 700 ac, and an additional 300 ac will be disturbed for access/haul roads, ore stockpiles, the primary crusher and overland conveyor, power lines, water pipelines, truck shop, and storage of fuel and lubricants.

Seven conceptual mining phases, or pushbacks, have been developed for a feasibility study of the Rosemont Project and used to generate a mine production schedule. The first phase, or starter pit, will be located toward the southwest corner of the ultimate pit, leaving about a 300-ft-wide subsequent pushback in Phase 5 that will extend to the final limits along the west side. Phase 2 expands the starter pit to the east and north. Phase 3 further extends the pit to the east, and Phase 4 expands the open pit to the north and east. Phase 5 will enlarge the pit on the west and southwest sides to their ultimate limits. Phases 6 and 7 progressively expand the pit to the east and southeast, following the orebody down its easterly slope. Each phase will develop about two to four years of sulfide ore reserves.

The current ultimate pit plan is presented in Figure 2-1. Pit contours are shown at mid-bench elevations on vertical intervals of 50 ft.

### 2.1.2 Mine Haul Roads

Mine haul roads will be constructed around the north, east and south edges of the planned ultimate pit limits (Figure 2-1). Temporary haul roads will be constructed internal to the ultimate pit limits as

necessary to provide access to all working faces in the open pit and connecting with the primary crusher, oxide leach pad and waste rock storage areas located to the southeast, east and northeast of the pit.

Mine haul roads will be constructed using material excavated within the open pit, typically consisting of limestone, skarn, arkose, andesite and quartz monzonite porphyry rock types. Road surface material may be crushed and screened as needed to produce a smooth running surface.

Pit haul roads will generally be 125-ft wide, inclusive of safety berms and ditches, and will support the traffic of 260-T off-highway mine haulage trucks. The gradient for the mine haul roads will be 10%, although short intervals may be constructed as steep as 12%. The minimum inside lane radius for switchbacks within the pit will be 40 ft. Roads will be slightly crowned to promote drainage of surface runoff to side ditches or berms. Safety berms will be constructed to a minimum height of about 6 to 8 ft, the height at the center of the largest truck wheel.

Haul truck speeds will not exceed 35 mph and will usually be less than 25 mph on ramp gradients of 10% or more. Haul truck traffic will follow the convention of left-hand drive in the pit, leach pad, and waste rock areas. Dust will be suppressed by wetting the road surfaces using a fleet of appropriately-sized water trucks with up to 30,000-gallon tank capacities.

An access road will also be constructed between the open pit and the truck shop located near the plant site. This road will have the same design parameters and speed limits as the mine haul roads.

### 2.1.3 Pit Production Schedule

Sulfide milling is scheduled for 24 hours per day, 7 days per week, 365 days per year at an ore processing rate of 75,000 tpd, or 27 MT per annum. The open pit mine will operate using the same schedule. The Project will use four rotating crews, each working 12-hour shifts, to provide continuous operator coverage.

The Project's production schedule is presented in Table 2. Preproduction stripping will require 18 months to prepare for full-scale mine operations, training work crews, constructing access and haul roads, and clearing and grubbing the pit and waste rock storage areas that will be disturbed during the initial years of operation. Peak material handling rates will occur in Years 1 to 2, averaging about 342,000 tpd of total material before falling off to nearly 322,000 tpd for Years 3 to 12.

Sulfide ore will be directed to the primary crusher and concentrator, while oxide ore will be placed on a leach pad. Treatment of pit-run waste rock and dewatered mill tailings is discussed in Section 2.3.

Figure 2-2 shows the extent of mining and the waste rock disposal areas at the end of the preproduction period. The pit bottom will reach the 5,050 elevation in Phase 1, and waste stripping in Phase 2 will advance to the 5,250 bench. A 3.3-MT sulfide ore stockpile will be constructed near the primary crusher, mostly within the ultimate pit limits, to facilitate subsequent recovery in Year 1 of mill operations. A

run-of-mine stockpile, located near the primary crusher, will be used throughout the mine's life to provide flexibility in handling short-term operating disruptions in the sulfide ore crushing and conveying system.

**Table 2. Rosemont Copper Project Production Schedule**

Time Period	Sulfide Mill Ore				Oxide Leach Ore		Waste Ktons	Total Ktons	Strip Ratio
	Ktons	% Cu	% Mo	Ag oz/t	Ktons	% Cu			
Preprod	3,328	0.27	0.012	0.10	14,979	0.17	101,293	119,600	5.53
Yr 1	19,444	0.42	0.015	0.14	18,244	0.20	84,286	121,974	2.07
Yr 2	27,375	0.54	0.015	0.12	5,320	0.17	92,305	125,000	2.82
Yr 3	27,375	0.45	0.013	0.10	937	0.17	89,088	117,400	3.15
Yr 4	27,375	0.53	0.015	0.17	2,602	0.14	87,423	117,400	2.92
Yr 5	27,375	0.45	0.013	0.11	5,002	0.15	85,023	117,400	2.63
Yr 6	27,375	0.49	0.013	0.14	2,195	0.17	87,830	117,400	2.97
Yr 7	27,375	0.50	0.014	0.12			90,025	117,400	3.29
Yr 8-10	82,125	0.49	0.012	0.12	166	0.16	269,909	352,200	3.28
Yr 11-15	136,875	0.49	0.015	0.12			287,195	424,070	2.10
Yr 16-19	86,705	0.41	0.019	0.13			14,050	100,755	0.16
<b>Total</b>	<b>492,727</b>	<b>0.47</b>	<b>0.015</b>	<b>0.12</b>	<b>49,445</b>	<b>0.18</b>	<b>1,288,427</b>	<b>1,830,599</b>	<b>2.38</b>

Note: Excludes 3,026 ktons of stockpiled sulfide ore rehandled in Year 1 and 302 ktons in Year 19.

Mining progress through the end of Year 5 is projected in Figure 2-3. The pit bottom will be at the 4,250 bench, and the upper benches on the west side of the pit will reach their ultimate limits as Phase 5 stripping commences from 6,100 ft down through the 5,850 ft elevation.

Figures 2-4, 2-5 and 2-6 illustrate the extent of open pit mining and waste rock disposal by the end of Years 10, 15 and the ultimate configuration, respectively. Each plan shows the projected active ore and waste rock areas, as well as all internal haulage ramps. Nearly all of the oxide ore reserves will be placed onto the leach pads by the end of Year 6. The ultimate pit and completed waste rock disposal facility are shown in Figure 2-6.

#### 2.1.4 Blasting

The primary drilling pattern for 12.25-in diameter blastholes will have an approximate spacing and burden of 33 ft, with about 10 ft of subgrade. Ammonium nitrate and fuel oil (ANFO) blasting agents will be used for nearly all rock breakage in dry ground, comprising an estimated 80% to 90% of the total explosive use. Ammonium nitrate emulsions will be employed in wet conditions. Based on a powder factor of about 0.31 lbs per T of rock broken, blasting agent use will average about 36 to 53 tpd, or 13,000-19,000 tpy.

Non-electric caps, delays and cords will be used to initiate blasts in conjunction with TNT boosters, as is typical practice in large-scale, open-pit mines. All blastholes will be stemmed with drill cuttings and/or crushed rock to confine the blasting agent for maximum effectiveness, minimizing fly rock and

over-pressure, and therefore surface noise. Best blasting practices and timing procedures will be employed to minimize off-site ground vibrations, as measured by peak particle velocity, to prevent damage to structures.

Blasting operations will be conducted daily and will be limited to daylight hours, typically between 9:00 a.m. and 4:00 p.m. local time, under the supervision of certified blasters who are either employed directly by the company or by licensed contractors. Access to blasting areas will be restricted to authorized personnel only, who will follow strict safety and communication procedures. Blasting caps and boosters will be stored in secure magazines located south of the open pit and west of the waste rock storage area. The magazines will be constructed to meet all applicable fire code, Bureau of Alcohol Tobacco and Firearms security standards, and industry safety standards, and will be accessible only to authorized personnel. Bulk ammonium nitrate will be stored in silos located northwest of the truck shop area and south of the mill site (Figure 2-1). An on-site emulsion plant may be located nearby, depending on the extent of wet blasting conditions and emulsion usage.

Blasting agents will be transported to the blast site in ANFO emulsion product delivery trucks or prill trucks designed to carry ANFO as each hole is loaded. Caps, delays, cords and boosters will be transported from the magazines to the blast site in a separate vehicle.

### **2.1.5 Ore Transport**

Sulfide ore will be transported via large (260-T) off-highway haul trucks from the open pit to the primary crusher, which will be located near the east pit rim. After crushing, the sulfide ore will travel by overland conveyor to a covered crushed ore stockpile. The material will then pass through feeders and onto another conveyor that will discharge into the semi-autogenous grinding (SAG) mill at a daily rate of 75,000 tpd.

A run-of-mine (ROM) coarse ore stockpile will be located near the primary crusher to temporarily hold sulfide ore mined before mill startup. The stockpile will also provide equipment utilization flexibility and short-term ore storage in case of interruptions in crusher operation. The ROM stockpile will hold 100,000 to 200,000 T of sulfide ore, but will reach a projected maximum size of about 3.3 MT at the end of preproduction stripping.

Oxide ore will be transported from the open pit to the leach pad by haul trucks. The oxide ore will not be crushed, but will be dumped in 30-ft-high lifts atop the lined pad for subsequent leaching. Crawler dozers will be used to spread the oxide ore and cross rip the material to a depth of 5 to 6 ft to promote the infiltration of barren leach solution. Oxide ore mining and placement on the leach pad will be concentrated in the early years of operation, peaking at about 51,000 tpd in Year 1. Nearly all of the oxide ore will be placed onto the leach pad by the end of Year 6.

Leach ore placement rates will be dictated by how much oxide ore is encountered when supplying 75,000 tpd of sulfide ore to the mill. These placement rates will vary considerably over the long and short term. Initially, oxide ore will be delivered to the leach pad at rates in excess of what can be leached and

processed by the solvent extraction (SX) plant. Consequently, not all of the material will be placed under leach at once; different sections will be leached according to copper recovery, solution balances, and other metallurgical considerations.

Figure 2-1 shows the general site arrangement, including the locations of the ROM ore stockpile, primary crusher and overland conveyor, crushed sulfide ore storage, and oxide leach pad areas.

### **2.1.6 Waste Rock**

The waste rock storage areas will be located to the southeast, east and northeast of the proposed open pit, as shown in Figure 2-1. The waste rock storage areas will receive pit-run waste rock consisting largely of limestone and skarn rock types, with some andesite, quartz monzonite porphyry and arkose. The presence of substantial quantities of limestone and skarn will provide a large buffering capacity within the waste-rock storage areas to minimize the generation of acid rock drainage (ARD). Waste rock production from the pit will range from about 195,000 tpd to a maximum of nearly 267,000 tpd.

Portions of the waste rock storage areas will also receive dry (filtered) tailings from the sulfide ore processing plant at a nominal rate of 73,600 dry tpd. This material will be stacked behind large containment berms constructed from pit-run waste rock. The construction of the dry tailings and pit waste rock storage facilities is described in more detail in Section 2.3.

### **2.1.7 Mine Equipment**

The major pieces of mining equipment required to fulfill the production schedule are summarized in Table 3. The final equipment selection and fleet sizes may vary slightly with vendor selection and future mine optimization studies.

Production blasthole drilling will be performed by diesel- and electrically powered rotary rigs capable of 120,000 to 130,000 lbs of bit loading (pulldown) pressure using 12.25-in -diameter tri-cone bits. A diesel-powered percussion drill (3.5- to 4-in. diameter holes) will be used for road and bench pioneering work and secondary rock breakage.

Electrically-powered mining shovels with 60 cy dippers will perform the bulk of the ore and waste rock loading. Two 33-cy front-end loaders will augment the shovel fleet and be used for safety berm maintenance, bench pioneering, road construction, bench toe cleanup, and constructing pit-bottom sumps.

Off-highway trucks will be used for the production haulage of all ore and waste rock. These will be diesel-powered units with either mechanical or electrical drive systems. The final truck selection will be based on manufacturers' supply capabilities, tire availability, and economic considerations. Rosemont is investigating the use of an electric trolley-assist system to reduce diesel fuel consumption. A computer-based truck dispatch system will be employed to direct haul trucks to available loading units, maximize unit truck productivities, and maintain production and performance records of the mine operations. This

will require the use of a high-bandwidth radio communication system for data transfer between mobile units and the computer base station.

**Table 3. Major Mining Equipment**

Equipment	Fleet Size
<b>Drills:</b>	
12.25-in.-diameter rotary blasthole drill	4
Percussion drill for secondary breakage and pioneering	1
<b>Loading Units:</b>	
60-cy electric mining shovel	3
33-cy front-end loader	2
<b>Trucks:</b>	
260-T off-highway haul trucks	31
30,000-gallon water truck (150-T)	2
20,000-gallon water truck (100-T)	1
<b>Support Units:</b>	
850-hp crawler dozer/ripper (D11-class)	3
580-hp crawler dozer/ripper (D10-class)	2
630-hp rubber-tired dozer (844-class)	3
500-hp motor grader, 24-ft (24H-class)	2
270-hp motor grader, 16-ft (16H-class)	1

An electric power line will be constructed around the perimeter of the pit to supply energy to the shovels, pit dewatering systems and, potentially, to a trolley-assist system for the haul trucks. Radial power lines will extend down into the pit to substations located near the working faces. The Project's power grid will be constructed and maintained by company electricians and specially-trained technicians.

Large (580- to 850-hp) crawler dozers will be used for road and sump construction, clearing benches, trimming pit wall faces, maintaining the waste rock storage area, spreading and cross-ripping heap leach ore on the leach pad, regrading waste rock storage area slopes for reclamation, and other tasks in and around the mine. Rubber-tired dozers (630-hp) will be used primarily for cleaning up the shovel area, patrolling the road, and clearing of blasthole sites. Motor graders (270- to 500-hp) will be used for constructing and maintaining roads throughout the Project area. The 270-hp grader will also be used for maintaining the project access road from SR 83 to the plant site.

Water trucks, with tank capacities of up to 30,000 gallons each, will be used to control dust emissions from the mine haul roads. Road water for pit haul roads will be taken from the pit dewatering system or the process water temporary storage (PWTS) pond located near the plant site. Temporary holding tanks will be used for some limited storage and to fill water trucks close to the main haul roads. Roads external

to the pit will be watered using fresh water. Separate water stands and holding tanks will be maintained for this purpose.

In addition to the major mining equipment described above, the Rosemont mine operations and maintenance crews will require other support equipment, including, but not limited to, explosive/blasting agent delivery trucks, an 8-cy front-end loader, 25-T haul trucks (for stemming deliveries and spreading aggregate), backhoe/loaders, a portable aggregate crushing and screening plant (brought in periodically by a contractor to produce stemming and road surfacing material), an all-terrain crane, fuel/lube trucks, mechanic field service trucks, a 200-T transporter/trailer, a tire handling truck, integrated tool carriers, forklifts, light plants, pickup trucks and crew vans.

### **2.1.8 Mine Staffing**

The number of mine operations employees (excludes plant, administration, etc.) will vary with the waste rock stripping rates and the increasing depth of the pit over time, both of which affect haulage profiles and the number of truck drivers. Generally, the number of pit operations employees per shift will range from 148 to 181 people. With four rotating crews working 12-hour shifts, mining crews will average about 37 to 45 people for each shift. Operating personnel will consist of drillers, blasters, shovel and loader operators, truck drivers, dozer and motor grader operators, and a pool of laborers and trainees.

Mine maintenance personnel required to support the Project's operations will be about half the size of the operating crews. The Project's maintenance crews will consist of heavy equipment and diesel mechanics, welders, electricians, instrument technicians, lubrication and tire service personnel, laborers, and trainees. Precision machining and component rebuilds will be generally performed off site by qualified vendors. Total mine maintenance personnel will range between 57 and 99 people, and will be distributed over four rotating crews working 12-hour shifts.

Mine supervision, technical and support personnel will consist of about 45 people during most of the project's life. These will include mine and maintenance superintendents, supervisors, maintenance planners, mining engineers, environmental and safety professionals, geologists, surveyors, engineering/ore control technicians, and administrative support personnel.

The mine operations total personnel requirements are projected at 250 to 325 people. The vast majority of the skilled mining personnel needed for the Rosemont Project are available in the greater Tucson area.