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7.1 *Introduction*

This section describes the major features of the proposed Yarnell Project. Major features include:

- Mine development including, drilling, blasting and ore/waste hauling
- Waste dump development
- Drainage and sediment control
- Ore crushing
- Heap leaching including the process solution, application and recovery system
- Solution processing and metal recovery system
- Access and haul roads
- Explosives, fuel and reagent storage
- Water supply and transport system
- Fencing and security
- Lighting
- Closure/Reclamation

The general layout of facilities is shown in Figure 7.1

7.2 *Mining*

The Yarnell Deposit will be mined using the conventional open-pit mining method involving drilling, blasting, loading and hauling. Benches are planned to be 20 feet high. The overall waste pit-slope will be 53°. The ore pit-slope follows the footwall of the ore zone and is generally 30 to 50°.

Planned mining equipment includes a blast-hole drill, one front-end loader, four haul trucks, one motor grader, one water truck, one track dozer and support equipment. An additional haul truck, a further dozer and front-end loader would support crushing and pad loading activities. The mining operation is planned to operate 24 hours per day, 5 days per week. Ore would be hauled directly to the crusher area, and either dumped directly into the primary feed, or stockpiled for later feeding by the loader or dozer.

The planned open pit includes 29 benches. Ore production has been scheduled from the top of the deposit downward. Waste production includes some pre-stripping in the southern end of some lower benches. Ore production is planned for 1.2 million tons per year to meet the ore processing schedule.

7.2.1 Mineable Reserves

The mineable reserve was generated manually with a rough approximation of the floating cone technique, using Datamine software to assist with pit extrapolation and to tabulate reserves from the geological block model. Three pits were initially developed; the procedure was to outline all economic ore blocks on a base bench level, then extrapolate the pit slopes upward to daylight and downward until the minimum mining width (50 feet) was encountered. The three base bench levels used were 4700, 4660, and 4620 feet.

Once the pits were generated, reserves were tabulated and the pits were checked manually against the geological cross sections to verify reasonable pit geometry. Where necessary, bench perimeters were adjusted manually and the reserves were re-tabulated. Once finalized, the three mineable reserves were then subjected to a comparative cash flow analysis to determine the reserves with the highest net present value. While the 4620 pit contained the most ore tons, and thus contained ounces, it was rejected due to a higher strip ratio. The 4660 pit and 4700 pit were nearly equal when compared on a cash flow basis, however the 4660 pit maximized the ounces recovered from the deposit, so it became the chosen pit outline. Table 7.1 summarizes the deposit's recoverable reserves.

TABLE 7.1. Mineable Reserves

Ore Tons (1000s)	Gold Grade (opt)	Gold Ounces (1000s)	Waste Tons (1000s)	Strip Ratio
Proven/Probable 5,412	0.036	196,440		
Possible 1,583	0.034	50,390		
Total 6,995	0.035	246,830	11,818	1.69

7.2.2 Open Pit Design

A 20 foot bench height and a maximum slope of 53° were used as the primary pit design criteria. The 20 foot bench height was chosen to maximize the efficiency of the mining fleet. Little benefit would be realized by lessening the bench height for greater selectivity, as discussed in Section 6.3.1.

The Yarnell deposit lies along the Yarnell Fault with mineralization extending into the hanging wall. The structure dips northwest 30 to 50°. The southeast pit-slope along the fault will generally follow the structure. The 53° pit-slope on the highwall (northwest) side of the pit and the pit ends will be in unaltered granite. The pit-slope configuration will consist of 5 foot catch benches every

20 feet, with slopes of 1/2 horizontal to 1 vertical between benches. Slope stability will be maintained using blasting techniques to minimize seismic shock to the highwall and maintain the integrity of each bench toe. Pre-digging survey control will prevent overdigging of the bench toes.

7.2.3 Mine Development Plan

Construction of the heap leach pad and crusher site will require placement of approximately 300,000 cubic yards of fill material. This material will be excavated from the pit in two areas. The first area will be a haul road extending from the uppermost benches to the crusher pad, and the second will be a pre-strip pit south of the haul road.

Total pre-strip requirements are 574,000 tons; most of this material will come from the pre-strip pit. Pre-stripping in the pit south of the haul road will continue during the first year in order to avoid higher stripping requirements in the third year. Ore production has been scheduled from the top of the deposit downward.

7.2.4 Mine Engineering and Production Planning

7.2.4.1 Grade Control

Ore grade control will be based on blast hole sample assays and relevant geological parameters. The grades of each blast hole sample, as provided by the on-site assay laboratory, will be plotted on the blast hole location map. Ore boundaries will be defined by the grade control geologist in consultation with the planning and production staff. The ore boundaries will be marked on the blasted ore by the survey department, taking into account the movement of ore due to blasting.

7.2.4.2 Survey

The mining operations will be supported by a surveying team consisting of one instrument man and one rodman. This team will provide all pit-bench excavation control, dump and heap monitoring, and direction for the production operators.

7.2.4.3 Mine Planning

All mine planning will be completed on-site by the engineering department. Planning cycles will include excavation plans for each active bench, along with quarterly short range plans and yearly life-of-mine plan updates.

7.2.5 Haul Roads

The majority of haul roads are contained within the pit perimeter. The gentle slope along the footwall provides excellent access to the lower benches without increasing stripping requirements. All haul roads will be 54 feet wide with a maximum 10% grade. Safety berms and diversion ditches will be constructed where required. The haul road locations are shown in Figure 7.1, with typical cross sections in Figure 7.2.

Access to the pit's upper benches will be via a 54 foot wide haul road which will be constructed in cut material in the pit area, and predominantly fill material outside of the pit. The road will be "mined-in" by the mine production crews from the bottom up at a constant 10% grade. Waste pre-stripping will commence at the pit's southern end below the main haul road and serve two purposes: 1) provide construction fill material for the leach pad and crusher site, and 2) reduce stripping ratios in years 2 and 3 to manageable levels. Most in-pit road segments are designed at 10% grade with the exception of the bottom two benches which are at 20% and 15%. Uphill waste haul speeds will be limited to 18 miles per hour (mph) maximum, and for safety, all other speeds will not exceed 30 mph.

Initial access to the north waste dump requires a short segment of in-pit haul road be constructed from the proposed maintenance facility area up to the 4900 foot bench, where it will connect with the haul road to the crusher. Access to the upper benches requires a sharp in-pit switchback at this intersection. Removing the initial haul road as benches are mined out will provide the remaining access to the north waste dump.

Haulage to the south waste dump shares the main haul road to the ore crusher. Waste rock from the upper benches will be hauled to the dump's top elevation of 4850 feet. Waste rock from the lower benches may be hauled to a lower lift to reduce uphill hauls.

7.2.6 Blasting

Blasting will be accomplished using standard industry practices and materials. Conventional ammonium nitrate and fuel oil (ANFO) explosives will be used. Blasting supplies will be stored in accordance with MSHA and Arizona State Mine Inspector regulations. Blasting will be conducted week days only during daylight hours and under strict safety procedures. Overall mine safety practices will conform to Article 2 of the Arizona Mine Safety Code and MSHA regulations. Explosives will be delivered by licensed haulers and stored on site in approved storage facilities.

This blasting plan outlines the general design elements and precautions that YMC will use to control rock movement, ground vibration, and airblast from proposed surface blasting operations. The following procedures are included:

drilling patterns, hole loading, initiation and hookup, controlled blasting, clearing and guarding, shot initiation, inspection, all clear signal, and blast reports. YMC will continually review the blast results of these initial designs and adjust future designs based on observed results.

7.2.6.1 Drilling

A 40,000 lb. blast-hole drill will be used for drilling. Initial blastholes will be 5 3/4 inches in diameter and they will be drilled to a depth of 23 feet. This hole depth includes 3 feet of subdrill below the 20 foot bench grade. Drillers will report any conditions such as mud seams and ground faults that they encounter to the blasting supervisor, so that special precautions can be taken when loading these areas. Typical drill patterns will be staggered with a 12 foot burden and spacing. Powder factors up to 1 lb/ton will be used.

7.2.6.2 Hole Loading Procedures

Before loading commences, all drill holes will be inspected and measured. Short holes will be re-drilled, if necessary, before loading any holes in the pattern. Dry blastholes will be loaded with ANFO. Wet holes or wet portions of holes will be loaded with a packaged emulsion blasting agent.

All blast holes will be primed with a 1 lb booster placed at the bottom of the hole. Millisecond delay, nonelectric detonators will be used to provide sequential in-hole delay timing. Boosters and detonator primer assemblies will be "made up" at the hole, just prior to loading. Unused primers will be disassembled before transporting the booster and detonator components to their respective and separate magazines.

All holes will be stemmed with 12 feet of drill cuttings.

7.2.6.3 Initiation System Hookup Procedures

Detonators in the hole, with detonating cord and detonators on the surface, will be used to create two path sequential timing. All shots will be initiated by a lead-in line, spliced to a detonator, attached to the first hole to fire.

7.2.6.4 Clearing And Guarding Procedures

The Blasting Supervisor will be responsible for all shot area clearing and guarding procedures, as follows:

- The Blasting Supervisor will coordinate blasts with all concerned parties, on an approved blasting schedule.

Blasting will be conducted during daylight hours approximately once per week.

- A safe area around the shot area will be cleared and guards will be placed to prevent entry.

- Traffic will be delayed for up to 30 minutes on U.S. Highway 89 by YMC personnel prior to entering the stretch of highway adjacent to the project's study boundary.

- When the area is secure, the lead-in line initiator will be connected to the shot and the shot will be fired when all traffic and persons, including the shot-initiator, are in a safe location.

- The Blasting Supervisor will inspect the shot area after a blast is fired and will relieve all guards and give the all clear signal, only when there are no existing hazards resulting from the blast.

If lightning is detected, these same procedures will be used to clear and secure the area until the hazard has passed. Permanent signs will be installed along U.S. Highway 89 to warn motorists that they are entering an area adjacent to blasting activities.

7.2.6.5 Shot Initiation

When the blast area is secure, a lead-in line initiator will be attached to the shot initiation point. The detonator will be fired from a safe location.

7.2.6.6 Blast Initiation and All-Clear Signal

After blasting, the Blasting Supervisor will inspect the shot area for any hazardous conditions before allowing traffic and work to resume in the area. Loose rock conditions or misfired explosives hazards will be corrected before any work is allowed in the immediate area.

When the blast area is free of hazards, the Blasting Supervisor will give the "All Clear Signal." Under no circumstances will any traffic or work proceed in the area until this signal is given by the Blasting Supervisor.

7.2.6.7 Vibration Monitoring Plan

Scaled distance formulas, (Dupont, 1969), will be used to determine maximum charge weights per delay for all blasts. All designs are planned to keep vibration levels well below the surface mining limits for the State of Arizona.

7.2.6.8 *Airblast and Flyrock Control*

YMC will use drill cuttings as stemming to prevent blowouts, high airblast, and excessive rock movement. Moreover, hole-by-hole sequential timing will be used to control shot movement and direction.

7.2.7 Pit Water Management

The majority of original exploration holes drilled in the open-pit mining area were dry below planned mining elevations. Consequently, no ground water of significant quantity is anticipated in the open pit. Any water encountered during mining will be diverted to an in-pit sump and utilized for dust suppression.

7.2.8 Outdoor Lighting

Outdoor lighting will be necessary at several of the project facilities in order to extend operating hours beyond daylight, as well as for reasons of security and safety. Portable light plants (metal halide) will be required to light the active ore and waste removal mining area and the active waste rock dump areas. Lighting will also be necessary at the crusher, ADR plant, and shop. All lights will be hooded and directional away from the highway and residences to avoid unnecessary glare.

7.3 Equipment Requirements

Equipment selection is based on a daily capacity of up to 15,600 tons of ore and waste. The mine will operate 24 hours per day, 5 days per week, 52 weeks a year in order to meet the required ore production of 1.2 million tons per year.

Equipment sizing and selection also took into account the requirement to haul ore from the crusher to the heap on a five-day per week, 24-hour per day schedule. All equipment was sized using 90% mechanical availability and 50 minutes operated per hour to account for operator efficiency.

Drill selection was based on a 12 feet x 12 feet pattern of 5 3/4 inch diameter holes. Hole depth will be 23 feet. The drill selected is a track-mounted blast hole drill, with 40,000 lbs. of pulldown pressure. Drilling will either be by air rotary or with a down-hole hammer.

Loading and haulage units were matched to meet the required production. Haul cycle times average 11 minutes round trip from the pit to the crusher and 12 minutes from the pit to the dumps. The average haul cycle time from the crusher to the heap is six minutes.

The selected loading unit is a 11 cubic yard front-end loader. An additional 7 cubic yard front-end loader will be used to feed the primary crusher from the Run-of-Mine (ROM) stockpile when ore haulage is not feeding the crusher or to load trucks from the fine ore stockpile, when required. Four 60 ton haul trucks are required for mine production with a 40 ton truck necessary to haul fine ore from the crusher to the heap.

Heavy equipment for mine support will include a motor grader, water truck and track dozer. A second track dozer will support the heap building operation. Miscellaneous light mobile equipment required to support the mining and processing operations is a lube and service truck, mechanic's truck, 2-1/2 ton flatbed, utility dozer, tool carrier, small backhoe, light plants and 11 pickup trucks. Table 7.2 summarizes the primary mining equipment required.

7.4 Waste Rock Dumps

The Yarnell Project is planned with two sites for disposal of overburden and uneconomical rock from mining operations. These two sites (the north and south dumps) are shown in Figure 7.1.

7.4.1 Site Selection

The two proposed sites were chosen as the best sites from both operational and environmental standpoints from a site selection study in the project area. This study identified three sites, as outlined below.

- The north dump site, in the valley north of the mine site, has capacity for approximately 3.7 million tons of waste rock. This site would have limited visibility from U.S. Highway 89. The capacity for waste rock at the site is limited by the elevation of the north end of the proposed pit, by the county road (without county road relocation), and by a reach of Yarnell Creek east of the dump described as a high-quality wetland.

- The south dump site, at the head of the valley southwest of the mine site, has capacity for the remaining waste rock (approximately eight million tons). This site would be visible from US Highway 89.

- A third site at the head of the gently-sloping valley southeast of the mine site could hold waste rock, but is the preferred site for the heap leach facility. Although this site has the capacity for most or all of the waste rock, the slope of the valley floor and containment features of this site makes it the preferred heap leach facility site.

TABLE 7.2 Mining Equipment Requirements

Equipment	Quantity
Front-end Loaders	
Caterpillar 990 Wheel Loader	1
Caterpillar 988F Wheel Loader	1
Haul Trucks	
Caterpillar 773B End Dump	4
Caterpillar 769C End Dump	1
Dozers	
Caterpillar D8N Track-Type Tractor	2
Motor Grader	
Caterpillar 16-G	1
Rotary Blasthole Drill	
Driltech D40K (5 3/4 inch to 6 3/4 inch Diameter)	1
Water Truck	
5,000 Gallons	1
Backhoe	
Caterpillar 426	1
Maintenance Vehicles	
Mechanic 2 1/2 Ton	1
Utility Flatbed	1
Steam Cleaner	1
Tool Carrier	
Caterpillar IT 28B	1
Pickup Trucks	11
Crusher	
Jaw and Cone	1
Light Plants	5

Note: Equivalent equipment makes and models may be utilized.

Other potential waste rock dump sites in the mine area were either within large drainage basins or farther from the mine, and were not evaluated further.

7.4.2 Site Development and Operation

The north waste rock dump will be developed by end dumping from the 4825 foot elevation, starting from the north side of the mine pit and advancing to the north and east. The initial portion of the north waste rock dump will be used for shop, storage, and laydown areas.

The south waste rock dump will be developed by end dumping from the 4850 foot elevation, starting from the southwest end of the mine pit and advancing to the south and west. Near the end of mining, dumping of waste rock may be required above the 4850 foot elevation. The area at the northeast corner of the south waste rock dump will be used for the crushing plant foundation and an area for ore stockpiles.

The general scenario of development of the north and south waste rock dumps is illustrated in Figures 7.3 through 7.5. Actual dump area advancement may differ from that shown in these figures. Due to the elevation of the pit above the elevation of the waste rock dump sites, downhill hauling of waste rock to the dumps is necessary. Due to the downhill waste rock haul, construction of the dumps in lifts is not necessary, since it would require additional elevation loss and gain. In addition, foundation conditions and slope stability analyses have shown that the dumps would be stable with end-dumped dump construction.

During development, the top of the waste rock dump will be at a slight grade (generally sloping upward to the edge of the dump face), and the advancing face of the dump will be at the angle of repose of the waste rock (as shown in Figure 7.5). Prior to covering an area with waste rock, the underlying ground will be stripped of vegetation and available soils for reclamation will be salvaged. Reclamation soil stockpile areas are shown in Figures 7.3 through 7.5. At the ultimate toe of the dump, a sediment catchment berm will be constructed to retain sediments that may be generated from the dump face and from nearby stripped and disturbed areas that have not been covered with waste rock.

Runoff control will be handled by sloping of the top surface of the waste rock dumps and by constructing diversion channels, as shown in Figures 7.3 through 7.5. The channels have been designed to keep runoff from undisturbed areas separate from waste rock and disturbed areas as much as possible. The waste rock dumps and associated diversion channels have been designed to withstand and convey peak runoff from the 100-year, 24-hour storm, as outlined in ADEQ BADCT guidelines (ADEQ, 1990). Runoff from disturbed areas will be contained in the sediment retention structures shown in Figures 7.3 through

7.5. The capacity of these structures has been sized to retain runoff from the 10-year, 24-hour storm.

7.4.3 Reclamation

Reclamation of the waste rock dumps will take place at the end of mining. Reclamation of the dumps concurrent with operation is not possible due to the method of dump advancement. Reclamation of the waste rock dumps will consist of the tasks outlined below.

- Regrading of the surface of the top of the dump to fill areas of differential settlement and promote the desired reclamation drainage.

- Regrading of the face of the dump to a 2:1 (horizontal:vertical) slope by dozing material downward from the top of the dump face. The toe of the 2:1 reclaimed slope would correspond with the location of the sediment control berm at the toe of the dump.

- Maintaining and enhancing the diversion channels (if necessary) to convey runoff after reclamation with minimal maintenance.

- Placing and spreading reclamation soil on the top surface and reclaimed face of the dump, using the soils that had been salvaged and stockpiled during waste rock dump development.

- Establishing vegetation on the surface of the dump.

The reclamation is discussed more fully in the Reclamation and Decommissioning Plan, Section 9.0.

7.5 Ore Crushing and Stockpiles

7.5.1 Primary Crushing

Run-of-mine ore at maximum 24 inch size will be dumped from 60 ton trucks into a hopper and fed with a vibrating grizzly feeder into a 30 inches x 42 inches jaw crusher. The primary crusher product will have an 80% passing 6 inch size with a maximum 9 inch size. The crushed product will be conveyed to the secondary crushing unit.

7.5.2 Secondary Crushing

The secondary crushing plant will consist of a vibrating screen, a 5 1/2 foot standard cone crusher, discharge conveyors and electrical panels to make a complete operating module.

The primary crusher product will have an 80% minus 1 1/2 inch size, and be conveyed to the secondary triple-deck vibrating screen for fines removal. The screen oversize will feed the secondary cone crusher; the product from the secondary will be combined with the primary product and grizzly undersize for re-screening. The crushing plant plan is illustrated in Figure 7.7. To control the dust generated during the crushing stages, dry dust scrubbers and/or water spray bars will be installed to service the primary and secondary crushing circuits.

7.5.3 Stockpiles

Run-of-mine and fine ore stockpiles will be located at the crusher site. Ore will be stockpiled, as necessary, when the crusher is down and/or ore cannot be hauled to the leach pad. The ROM ore stockpile will be constructed to allow ore trucks to end dump directly into the bin feeding the primary crusher.

7.5.4 Crushing Schedule and Rate

Ore will be crushed at a rate of approximately 300 tons per hour, 24 hours per day, 5 days per week. However, the crusher may be required to operate additional days for short periods of time to adjust for down time.

7.5.5 Crusher Reagents

Lime will be added by belt feeder to the ore after secondary crushing for thorough mixing prior to hauling to the leach pad. Five pounds of lime per ton of ore will be added to maintain protective alkalinity above pH 10.0 throughout the respective leaching cycles. Only fresh water will be used at the crusher site.

7.6 Heap Leaching

This section describes the heap leaching portion of the ore processing plan for the Yarnell Project. The ore processing flow sheet is shown in Figure 7.8. The layout and other details of the heap leach facility is illustrated in Figures 7.9 through 7.12. The ore processing flow sheet is shown in Figure 7.8.

As described in Section 7.4, the oxide ore will be crushed in a two-stage process to minus 1 1/2-inch size for leaching with a dilute cyanide solution. Initial test work on Yarnell ore has shown that crushing is required to achieve desired precious-metal recovery levels. The crushed ore is placed by controlled dumping and dozing on the leach pad in lifts. The ore is leached by percolation of cyanide solution through the crushed ore to dissolve precious metals in the ore. The resulting "pregnant" solution is collected and processed in the adsorption, desorption and refinery (ADR) plant to recover the precious metals from the solution (described in more detail in Section 7.6). The leach solution is chemically adjusted prior to re-application on the heap.

7.6.1 Site Selection

As discussed in Section 7.3, three sites in the mine site area were evaluated for their suitability for waste rock dumps or heap leaching. Although the site at the head of the gently-sloping valley southeast of the mine site has the capacity for most or all of the waste rock, the slope of the valley floor and containment features of this site make it the preferred heap leach facility site. The other two sites have steeper slopes and narrower valley cross sections, and are more amenable to waste rock disposal.

7.6.2 Leach System Selection

Due to the length of leaching time for acceptable gold recovery for the Yarnell ore (approximately 100 days), a fixed-pad heap leach system was selected (instead of a re-usable pad). Since the leach pad site is amenable to both valley and conventional heap leach systems, both fixed-pad alternatives were evaluated, as outlined below.

- Conventional leach pad system. For a conventional leach pad system, leach solutions are drained from the heap, conveyed by gravity, and collected in a lined pond below the leach pad. The heap drainage system is designed to minimize the zone of saturation or head above the leach pad liner. The leach pad is constructed with slopes steep enough to promote drainage but maintain acceptable heap slope stability.

- Valley leach system. For a valley system, leach solutions are contained within the heap rather than in an exterior pond. The leach pad consists of a lined basin inside of a perimeter or valley embankment. Due to the containment of solutions within the heap, the liner and monitoring system for a valley leach system are typically more extensive than for a conventional leach pad. This is due to the potential for leakage from the zone of saturation or head above the liner.

Valley leach systems are often used in sites where there is insufficient space for a conventional leach pad and exterior ponds. For the Yarnell Project, the leach pad site has sufficient space for the planned tonnage of crushed ore and exterior ponds. Due to its better heap drainage features, the conventional leach pad system was selected for the Yarnell Project.

7.6.3 Design Criteria

The heap leach system is designed as a closed system, such that the leach solutions are contained within the heap and collection ponds with no discharge or leakage. Outside additions of water are limited to precipitation directly onto the leach pad and collection ponds. Losses of water are limited to evaporation of solution.

The heap and underlying leach pad was sized for seven million tons or ore with contingency for more or lesser ore tonnages. Using a swell factor of 20% for crushed and stacked ore, the average waste rock density used for heap design was 1.83 tons per cubic yard (14.7 cubic feet per ton or 136 lb per cubic foot).

The leach pad was designed to be consistent with ADEQ BADCT guidelines for precious-metal heap leach facilities (ADEQ, 1990). The external slopes of the heap were evaluated to ensure acceptable factors of safety under both static and seismic conditions.

More detailed supporting information on the process design and the heap leach amenability evaluation is included in Appendix 6.0.

7.6.4 Leach Pad

The initial leach pad phase will have an area of approximately 570,000 square feet. Expansions of the pad beyond this will be completed in two additional phases until a total pad area of 1,350,000 square feet is developed.

The leach pad layout is shown in Figures 7.9 and 7.10. Leach pad details are shown in Figures 7.11 and 7.12. The leach pad would be formed by a combination of regrading on-site materials and placement of waste rock. The leach pad would have maximum internal slopes of 3:1 to facilitate subgrade construction and installation of a geomembrane liner. The minimum leach pad slopes would be at the south end of the pad, with an anticipated grade of four percent. The leach pad will be lined with a 60 mil high density polyethylene (HDPE) synthetic liner placed on a prepared sub-grade of appropriate liner bedding material.

On top of the HDPE liner, a network of slotted drain pipes will be placed to promote heap drainage and minimize the zone of saturation above the liner. The slotted pipes will connect to pipes which will convey solution into the pregnant solution pond.

The leach pad has been designed for phased construction over the life of the project. Construction of the leach pad in three phases is planned, as shown in Figure 7.10. The estimated leach pad areas are summarized below.

Phase	Area (sq. ft.)	Area (acres)
1	570,000	13.1
2	460,000	10.6
3	320,000	7.3
Total	1,350,000	31.0

7.6.5 Heap Construction

The heap will be constructed by end dumping ore in lifts up to 20 feet high. On the outside slopes of the heap, the lifts of ore would be set back on benches of sufficient width to form overall exterior slopes of 2:1. The ultimate heap height is expected to be approximately 200 feet.

7.6.6 Solution Containment

Three ponds are planned to collect and store process solutions from heap leaching. The total capacity of the three ponds is approximately 9.0 million gallons, based on the following criteria (based on ADEQ BADCT guidelines).

- Containment of precipitation on the leach pad from the 100-year, 24-hour storm (5.2 inches), totalling 4.4 million gallons (5.2 inches over a 31-acre area).

- Provision for operating volume, totalling 2.0 million gallons in the pregnant and barren solution ponds.

- Provision for heap draindown (24 hours at the anticipated 1200 gpm application rate), totalling 1.7 million gallons.

- 0.8 million gallons freshwater storage

In addition, the ponds will have two feet of freeboard above the 9.0 million gallon capacity.

The pregnant and barren solution ponds will be constructed with the first phase of the leach pad, with a total capacity of over 6 million gallons. The third pond will be operated as fresh water and stormwater storage pond, and will be constructed either initially or concurrently with the second phase of leach pad construction. The pond layouts and details are shown in Figures 7.13 through 7.15.

The pregnant and barren solution ponds will be connected by a lined spillway to convey excess water from the pregnant pond to the barren pond should it be filled. The overflow pond is constructed downstream of the barren pond, with a lined spillway between the barren pond and overflow pond.

The pregnant and barren solution ponds will have double synthetic liners with a leak detection system between the ponds (as outlined in ADEQ BADCT guidelines). The overflow pond will be constructed with a single liner. The liner system details are shown in Figure 7.15.

Monthly water balance calculations for the heap leach facility show that there will be a net makeup water requirement for heap leaching and rinsing. During active ore placement and leaching, makeup water rquirements range from approximately 30 gpm in winter to approximately 140 gpm in summer (under average climatic conditions). Following active ore placement, makeup water requirements decrease to 80 gpm in summer months and zero in winter months.

7.6.7 Solution Application and Collection

Solution application to the ore will be by a drip or emitter system piped from the barren solution pond. For avian protection, no open areas of ponded or flowing water will be exposed and open to access by wildlife. The leach pad and pond area will be completely fenced, and the barren and pregnant solution ponds will be covered with netting.

7.6.8 Reclamation

At the conclusion of active solution application, the heap will be rinsed by adding fresh water to the system to recover residual gold and remove residual cyanide. Rinsing of the heap with fresh water will continue until weak-acid dissociable (WAD) cyanide concentrations in the rinsate are below 0.2 mg/l. Hydrogen peroxide may be added to the rinse water to increase the rate of detoxification. Confirmation sample collection and analysis of the rinsate will be conducted to assure that WAD cyanide levels are at or below 0.2 mg/l and other constituents are below levels for ground water protection.

Following heap rinsing and detoxification, the heap slopes will be reclaimed by regrading to an overall slope of 2:1. The regraded heaps will be covered with stockpiled soil and revegetated. The Closure and Reclamation Plan is discussed more fully in Section 9.0.

7.7 Ore Processing

A comprehensive metallurgical testing program was completed on samples taken from the Yarnell Deposit. Results indicate that oxide ores from the deposit are amenable to heap leaching. Crushing is required to obtain economically acceptable gold extraction. In addition to crushing and heap leaching described above, the process circuit includes carbon adsorption and stripping. Cathodes will be smelted at the mine to produce dore bars for shipment. Figure 7.8 illustrates the complete processing circuit.

7.7.1 Heap Leach Processing and Gold Recovery

7.7.1.1 Ore Pre-treatment

Two stage crushing will reduce the oxide ore to a nominal 80% passing 1 1/2 inch size at a rate of 300 tons per hour. Lime will be added to the ore in the crusher circuit prior to hauling to the leach pad. Approximately five pounds of lime per ton of ore will be added to maintain protective alkalinity.

7.7.1.2 Leaching

The crushed ore will be hauled to the leach pad in a 40 ton haul truck. Lifts will be constructed by dumping with a nominal height of 20 feet. Cyanide-enriched barren solution will be distributed 24 hours per day over the heap by a drip irrigation system. The barren solution application rate will be approximately 0.005 gpm/ft^2. Leaching of a particular area of heap lift (cell) will be conducted for approximately 100 days.

7.7.1.3 Adsorption

The gold will be recovered from the pregnant solution by adsorbing the dissolved gold onto activated carbon contained in one row of six carbon columns. Each column will hold two tons of carbon. The bed of carbon in each column will be "fluidized" so that maximum gold loading is achieved.

7.7.1.4 Acid Washing

Carbon will be moved (educted) from the carbon adsorption columns to an acid wash tank. Dilute hydrochloric acid will be circulated through the acid wash tank until the pH of the return solution decreases to one. Fresh acid will be added to the pump box with a metering pump to maintain the necessary free acid concentration.

When the washing cycle is complete, a solution of caustic soda will be added to the acid wash pump box and pumped through the acid wash tank to neutralize the free acid. Once neutralization has occurred, as indicated by a final pH of 8, the washed carbon will be transferred to the stripping circuit. The neutralized solution will be pumped though a filter press to remove the metal hydroxides prior to recycling; the hydroxide sludge will be discarded to the waste dump.

7.7.1.5 Carbon Stripping

Twice a week, one carbon column will be stripped of its gold content. The stripping will take place in a desorption column. Strip solution containing caustic soda and cyanide will be pumped through the strip vessel at a temperature of 265°F and a pressure of 30 psi. The loaded eluate will be cooled to 150°F and stored in a tank prior to being pumped to the electrowinning cells. The barren eluate from the electrowinning cells will flow to a storage tank from which the solution will be pumped through an in-line propane-fired solution heater to the strip vessel. Fresh caustic and cyanide will be added to the barren eluate tank as required. The total stripping time will be approximately 16 hours.

7.7.1.6 Electrowinning

The cooled loaded eluate will be pumped through the electrowinning cell and the precious-metal will be plated onto stainless steel mesh cathodes. The loaded cathodes will be removed from the electrowinning cell and subjected to washing with water at 100 psi pressure. The precious-metal slurry will be pumped through a filter press to recover the metal particulates, which will be dried in an over prior to refining.

Periodically, the sludge that has accumulated on the bottom of the electrowinning cell will be removed and refined with the cathode metal.

7.7.1.7 Refining

The dried precious-metal sludge and cathodes will be mixed with the appropriate fluxes and melted in a propane-fired furnace. The molten bullion will be cast into dore bars for shipment to a refinery and the slag will be poured into a mould, crushed and stored in drums for periodic shipment to a smelter for precious-metal recovery.

7.7.1.8 Carbon Regeneration

Carbon will need to be regenerated after pollutants decrease its ability to remove gold efficiently from the solution. The frequency of carbon regeneration may be several months to several years, depending on the actual chemical make up of the pregnant solution and its interaction with the carbon. Carbon regeneration will take place in a kiln where the carbon is heated to 1,200°F. After cooling, the carbon can then be returned to the adsorption columns.

7.7.2 Reagent Handling

7.7.2.1 Lime

Lime will be added to the ore stream by a belt feeder following secondary crushing so that thorough mixing of the lime and ore can occur. Lime will be delivered approximately twice a week by truck to a 60-ton storage silo located at the crusher site.

7.7.2.2 Sodium Cyanide

Solid sodium cyanide will be delivered to the site in briquette form by tanker truck or in bulk sparger containers. Barren solution will be circulated through the tanker or sparger container to dissolve the briquettes. The solution will then be pumped into a solution storage tank located at the processing plant. The resulting liquid cyanide product will be used to maintain the cyanide concentration in the barren solution at 1 lb. per ton. Sodium cyanide will be delivered to the mine as needed, approximately two times per month.

7.7.2.3 Caustic Soda

Caustic soda will be added to the barren solution when required to maintain protective alkalinity in the system. Because the bulk of the alkalinity will be provided by lime, caustic soda consumption will be low. Trucks will deliver caustic soda approximately one time each month. Dry caustic soda will be stored in the process storage area. Liquid caustic soda will be stored at the processing plant.

7.7.2.4 Anti-scaling Agent

Antiscalant will be added to the pregnant solution ahead of the carbon columns and also to the barren feed pumps. Insulated bulk tanks and metering pumps for antiscalant will be provided by the supplier. Tanker trucks will deliver antiscalant to the mine approximately once a month.

Additional discussion of the reagents and their handling and storage is presented as part of Section 9.0.

7.7.3 Design Criteria and Equipment List

Details of the process design criteria and the major equipment list for the processing facilities are shown in Appendix 6.0.

7.8 Production Schedule

Mine production has been scheduled to meet the ore processing schedule of 1.2 millions tons per year as summarized in Table 7.3. The average strip ratio of the pit planned for the Yarnell Project is 1.69 tons waste to 1 ton of ore; however, due to the construction pre-stripping requirement of approximately 574,000 tons, the operating strip ratio is effectively reduced to 1.61 to 1. Ore and waste quantities for each bench are shown in Table 7.4.

TABLE 7.3 Production Summary

Year	Ore (Tons)	Waste (Tons)	Construction Waste (Tons)	Total (Tons)
1	1,200,000	2,389,000	574,000	4,163,000
2	1,200,000	2,519,000	0	3,719,000
3	1,200,000	2,695,000	0	3,895,000
4	1,200,000	2,074,000	0	3,274,000
5	1,200,000	1,290,000	0	2,490,000
6	995,000	277,000	0	1,272,000
Total	6,995,000	11,244,000	574,000	18,813,000

Ore production has been scheduled from the top down; i.e., ore mining will begin at the highest bench level in the pit and proceed down to each succeeding bench. Waste production will coincide with ore production on each bench. In order to reduce stripping "peaks" the pre-stripping effort continues on benches 4940, 4920 and 4900 of the main pit, in addition to benches 4840 and 4780 of the pre-strip pit during year ore. The yearly mine production schedule is shown by bench in Table 7.5.

All ore delivered by the mine to the crusher will be processed immediately. Ore will be crushed, hauled to the heap, and leaching will begin as soon as a suitably sized area is available for irrigation. Due to heap leaching kinetics, only a portion of the recoverable gold placed on the pad during a production year will be recovered that year.

It is estimated that 83.5% of the recoverable gold placed will actually be recovered in a given year. Gold production in doré will also lag behind gold recovered in the adsorption circuit. Gold production will lag gold recovery by one month. Average annual gold production during steady state operations will be 30,100 ounces.

7.9 *Ancillary Facilities*

7.9.1 Access Road

Access to the site from Wickenburg or Prescott will be via U.S. Highway 89 to Yarnell, then on an existing county road to the mine office.

7.9.2 Electrical Power Supply

Electricity will be delivered to the site by the Arizona Public Service Company (APS) via 12 kV overhead transmission lines. APS will install the line from their main power line to the project metering points, where the voltage will be stepped down to 480V. Main metering points will be the crushing plant, ADR

TABLE 7.4 Mineable Reserves by Bench

BENCH	LEVEL	Ore (tons)	Grade (opt)	Gold (ozt)	Waste (tons)	Total (tons)	Strip Ratio	Construction Prestrip (tons)	Road Waste (tons)	Remaining Waste (tons)
5100	5	6,900	0.021	146	3,800	10,700	0.55		0	3,800
5080	6	63,500	0.025	1,608	11,800	75,300	0.19		5,060	6,740
5060	7	122,700	0.030	3,726	53,000	175,700	0.43		2,860	50,140
5040	8	165,500	0.030	5,041	116,900	282,400	0.71		440	116,460
5020	9	202,300	0.029	5,790	176,800	379,100	0.87		8,800	168,000
5000	10	218,100	0.030	6,500	250,900	469,000	1.15		0	250,900
4980	11	225,200	0.030	6,733	329,700	554,900	1.46		1,100	328,600
4960	12	238,400	0.030	7,185	400,200	638,600	1.68		1,760	398,440
4940	13	249,700	0.031	7,667	477,800	727,500	1.91		2,640	475,160
4920	14	253,700	0.033	8,271	567,200	820,900	2.24	8,000	0	559,200
4900	15	265,100	0.034	8,959	671,100	936,200	2.53	11,000		660,100
4880	16	261,100	0.034	8,962	771,300	1,032,400	2.95	65,000		706,300
4860	17	270,000	0.036	9,749	926,500	1,196,500	3.43	193,000		733,500
4840	18	276,500	0.037	10,347	1,001,600	1,278,100	3.62	274,340		727,260
4820	19	326,700	0.039	12,796	1,016,400	1,343,100	3.11			1,016,400
4800	20	362,100	0.041	14,710	995,200	1,357,300	2.75			995,200
4780	21	433,800	0.038	16,453	925,600	1,359,400	2.13			925,600
4760	22	521,000	0.035	18,194	1,009,500	1,530,500	1.94			1,009,500
4740	23	477,000	0.039	18,641	770,700	1,247,700	1.62			770,700
4720	24	434,900	0.037	15,984	576,300	1,011,200	1.33			576,300
4700	25	441,000	0.035	15,622	400,600	841,600	0.91			400,600
4680	26	444,300	0.035	15,758	212,000	656,300	0.48			212,000
4660	27	415,900	0.037	15,322	78,900	494,800	0.19			78,900
4640	28	230,300	0.040	9,149	70,800	301,100	0.31			70,800
4620	29	89,400	0.039	3,520	3,000	92,400	0.03			3,000
TOTAL		6,995,100	0.035	246,834	11,817,600	18,812,700	1.69	551,340	22,660	11,243,600

TABLE 7.5 Annual Production Schedule

		YEAR 1			YEAR 2			YEAR 3			YEAR 4			YEAR 5			YEAR 6		
BENCH	LEVEL	Ore (tons)	Ore (ozt)	Waste (tons)	Ore (tons)	Ore (ozt)	Waste (tons)	Ore (tons)	Ore (ozt)	Waste (tons)	Ore (tons)	Ore (ozt)	Waste (tons)	Ore (tons)	Ore (ozt)	Waste (tons)	Ore (tons)	Ore (ozt)	Waste (tons)
5100	5	6,900	146	3,800	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5080	6	63,500	1,608	6,740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5060	7	122,700	3,726	50,140	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5040	8	165,500	5,041	116,460	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5020	9	202,300	5,790	168,000	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5000	10	218,100	6,500	250,900	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4980	11	225,200	6,733	328,600	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4960	12	195,800	5,901	327,242	42,600	1,284	71,198	0	0	0	0	0	0	0	0	0	0	0	0
4940	13	0	0	120,000	249,700	7,667	355,160	0	0	0	0	0	0	0	0	0	0	0	0
4920	14	0	0	100,000	253,700	8,271	459,200	0	0	0	0	0	0	0	0	0	0	0	0
4900	15	0	0	80,000	265,100	8,959	580,100	0	0	0	0	0	0	0	0	0	0	0	0
4880	16	0	0	0	261,100	8,962	706,300	0	0	0	0	0	0	0	0	0	0	0	0
4860	17	0	0	0	127,800	4,614	347,190	142,200	5,134	386,310	0	0	0	0	0	0	0	0	0
4840	18	0	0	7,660	0	0	0	276,500	10,347	719,600	0	0	0	0	0	0	0	0	0
4820	19	0	0	306,000	0	0	0	326,700	12,796	710,400	0	0	0	0	0	0	0	0	0
4800	20	0	0	257,000	0	0	0	362,100	14,710	738,200	0	0	0	0	0	0	0	0	0
4780	21	0	0	266,000	0	0	0	92,500	3,508	140,648	341,300	12,945	518,952	0	0	0	0	0	0
4760	22	0	0	0	0	0	0	0	0	0	521,000	18,194	1,009,500	0	0	0	0	0	0
4740	23	0	0	0	0	0	0	0	0	0	337,700	13,197	545,630	139,300	5,444	225,070	0	0	0
4720	24	0	0	0	0	0	0	0	0	0	0	0	0	434,900	15,984	576,300	0	0	0
4700	25	0	0	0	0	0	0	0	0	0	0	0	0	441,000	15,622	400,600	0	0	0
4680	26	0	0	0	0	0	0	0	0	0	0	0	0	184,800	6,554	88,178	259,500	9,204	123,822
4660	27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	415,900	15,322	78,900
4640	28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	230,300	9,149	70,800
4620	29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	89,400	3,520	3,000
TOTAL		1,200,000	35,445	2,388,542	1,200,000	39,757	2,519,148	1,200,000	46,496	2,695,158	1,200,000	44,337	2,074,082	1,200,000	43,604	1,290,149	995,100	37,195	276,522
Strip Ratio				1.99			2.10			2.25			1.73			1.08			0.28

plant and shop facilities. Step-down transformers will be provided as necessary. Low voltage power will also be supplied to the mine office by APS.

The maximum annual electrical power requirement for the project will be 6,596,000 kwH as shown in Table 7.6.

TABLE 7.6 Electrical Power Equipment

Facility	Power Draw (HP)	Power Draw (kW)	Operated Hrs/Day	Operated Days/Year	Power Required (kwH/Year)
Crusher	642	478	20	260	2,536,850
Leach/ADR Plant	398	297	24	365	2,597,428
Maintenance	21	16	15	208	48,812
Assay Lab	68	51	6	208	63,224
Water Supply Pumps	200	149	24	365	1,305,240
Administration Office	29	22	10	208	44,938
Total					6,596,492

7.9.3 Water Supply and Storage

The water supply required for dust suppression, ore processing and potable uses is approximately 100 gpm during months with hot temperatures and low precipitation. Water will be required for approximately 5 to 6 years during operations and 2 to 3 years during mine closure. The water supply requirement will be met by an existing ground water well located on patented ground (Edmond Claim) and two wells to be developed on land administered by the BLM. YMC proposes to transport water from the two new wells to the site in an aboveground steel pipe crossing state and federal lands.

7.9.3.1 Hydrogeologic Investigations

The water potential in this area has been reviewed by Errol L. Montgomery & Associates, and more recently by Groundwater Resources Consultants, Inc. (GRC), both of Tucson, Arizona. Montgomery based their report on a 500 gpm water supply requirement. GRC's evaluation is based on a 100 to 200 gpm requirement. Refer to Appendix 2.0 for copies of these reports. Both firms recommend the Antelope Valley basin as a potential water source to supply the mine's limited needs. Section 3.6 summarizes regional ground water hydrology.

Four areas were considered as potential water development locations including the Peeples Valley basin, Antelope Creek basin, Fools Gulch area, and the area near Parker Dairy Farms. These areas were evaluated using currently available data. The Peeples Valley basin is located approximately 5 miles north of the project site near the community of Peeples Valley. For other study area locations, refer to Figure 7.16.

7.9.3.2 Existing Ground Water Supply

An existing water supply well is located in the Southeast 1/4 of the Northwest 1/4 of Section 14, Township 10 North, Range 5 West (Figure 7.16). This well was previously used to supply water to the community of Glen Ilah. Based on conversations with the local water well driller and operator of the well, it was pumped continuously at a rate of 20 gpm for a number of years. The well was decommissioned when Glen Ilah was connected to Yarnell's water supply system. No written well records have been found.

YMC personnel recently test pumped the well to develop additional hydrogeologic data. Test results are summarized in Appendix 2.0. Based on the test results and previous pumping records, the well is expected to yield a long-term supply of approximately 20-30 gpm.

7.9.3.3 Proposed Additional Ground Water Supply

Based on proximity to the project site and the potential for ground water development, the Antelope Creek basin will be the target for two exploration wells. One well will be drilled near the confluence of Yarnell Creek and Antelope Creek and another approximately 1 mile northwest of this confluence. Both wells will be located on land administered by the BLM. Based on data currently available, each well is expected to produce approximately 35 gpm.

7.9.3.4 Transport and Storage

Water from the existing ground water well located in the Yarnell Creek basin, will be pumped to a 10,000 gallon storage tank via an above ground steel pipeline. The proposed pipeline corridor is shown on Figure 7.16. The storage tank will be a freestanding, steel tank, and will be located at the maintenance facility. As necessary, a 5,000 gallon water truck will transport water from this tank to another 10,000 gallon storage tank located at the crusher.

Water from the proposed development wells in the Antelope Creek basin will be transported to the barren solution pond located near the ADR Plant site via an aboveground steel pipeline. The pipeline will follow the county road with the Yarnell Creek drainage as closely as possible across state and federal lands before following an existing exploration road crossing federal land to the project site.

7.9.3.5 Further Hydrogeologic Investigations

YMC has contacted several well owners in the area, including the Yarnell Water Improvement Association (YWIA), to gain a better understanding of potential water supply sources and to solicit parties interested in leasing water to YMC from existing wells. YWIA is the local water company and supplier to Glen Ilah and Yarnell, and is supervised by an elected board of local residents. YWIA indicated that they cannot provide a viable supply to meet or supplement the mine's needs. No formal agreements have been reached with other well owners, but negotiations are ongoing. YMC is also attempting to gain permission to test pump existing wells in the Antelope Creek basin.

If appropriate, ground water monitoring wells required for the ADEQ Aquifer Protection Permit may be developed as potential water supply wells. A specific capacity test will be conducted in all monitoring wells. If a test indicates that a monitoring well can provide a sustained yield greater than approximately 10 gpm, it may be converted to a water supply well. A replacement monitoring well will then be drilled at a different location with concurrence from ADEQ.

7.9.4 ANFO/Explosive Storage

Ammonium nitrate will be delivered as bulk prill. The prill will be stored in an approved 30-ton silo located adjacent to the maintenance facility. Explosives will be delivered by licensed haulers and stored on-site in approved storage facilities (bullet-proof explosives magazines). These magazines will be located at an appropriate distance from the ammonium nitrate storage silo. All employees responsible for explosives will be trained and certified by government agencies as required.

7.9.5 Fuel Storage

Diesel and gasoline will be stored in aboveground steel tanks located adjacent to the maintenance facility (Figure 7.1). The tanks will be within a containment area, lined with an impervious synthetic liner covered with rock, to minimize any impacts from spills. The containment area will be designed to hold 100% of both tank capacities, plus a 25-year, 24-hour rainfall event. The diesel and gasoline storage tanks will have 10,000 and 5,000 gallon capacities, respectively. Liquid fuel will be delivered to the mining equipment via a service vehicle.

Propane will be used to heat the mine office during winter months and fire the carbon reactivation kiln and the smelting furnace. The propane vendor will supply and install tanks at the mine office and processing plant in accordance with current safety regulations (Figure 7.1).

7.9.6 Reclamation Soil Stockpiles

In areas of the site to be covered or disturbed, available soil will be stripped (where it is present) and salvaged for reclamation. Primary locations of reclamation soil stockpiles are shown in Figure 7.1. Smaller locations for stockpiles may also be utilized, which are not shown in the figure.

7.9.7 Sanitary and Solid Waste Disposal

Waste produced on-site will be handled and disposed according to county and state requirements. Trash will be temporarily stored in a receptacle at the mine site and hauled off-site to the local licensed municipal waste disposal facility. Items which may be classified as hazardous will be shipped to a Class I landfill for disposal.

The project will utilize both permanent and portable sewage facilities. The permanent facilities will consist of a system of engineered collection piping, a septic tank and accompanying leach field designed according to Yavapai County Health Department standards. The portable facilities will be chemical toilets which will be moved periodically as operations dictate. Waste from the chemical toilets will be hauled off-site by the licensed vendor supplying the toilets.

7.9.8 Potable Water

Wash water and drinking water will be pumped from wells developed on the project site, or purchased from the local water company, the Yarnell Water Improvement Association (YWIA). Bottled water may also be purchased for drinking water from a local vendor. If ground water is used, it will be treated, as necessary, to meet EPA primary and secondary drinking water standards.

7.9.9 Maintenance and Warehouse Facility

The maintenance shop (approximately 6,000 square feet) will be erected just west of the pit area. Heavy mobile equipment repair, maintenance and service will be completed in the shop. Shop area will also be set aside for light truck maintenance, welding and tool storage. The shop floor is designed to eliminate any contamination of the surrounding area by machine fluids. A floor sump will be constructed to contain any spills that may occur.

7.9.10 Mine Office

Administrative facilities (approximately 3,600 square feet) will be provided on site at the mine office for the operating management and staff. The mine manager, department heads and engineering support group will be assigned offices in these facilities (see Figure 7-17). Accounting, payroll and purchasing will also operate out of the mine office.

7.9.11 Assay Laboratory

The assay laboratory will be located in the ADR building. The lab will include a sample preparation area, analytical area, and offices for lab personnel. The sample preparation area includes equipment for drying, crushing, splitting and pulverizing samples. The analytical area includes provisions for weighing, wet chemical analyses and atomic absorption assays. Most of the samples assayed will be mine grade control samples.

Storage for pulps will be provided adjacent to the lab and will be added to as needed. These storage units will also provide space for samples brought from the pit.

7.9.12 Fencing and Security

The mine and process area will be fenced by barbed wire with several locked gates. The gate at the mine entrance will be manned by office staff. A 5 foot tall, chain-link fence will be installed around the process area, leach pad and all solution ponds.

7.9.13 Fire Protection, Emergency Response and Safety

Adequate fire protection is an important component of any mining operation, both for protecting the resources, facilities, and personnel of the mining company and for maintaining compliance with regulations imposed by the Mine Safety and Health Administration (MSHA) as well as by applicable state and county building codes. The location of the Yarnell Project is such that local fire/rescue facilities in Yarnell can assist with medical and/or fire emergencies, if needed. As specified by MSHA, YMC will conduct recurring first aid training for all employees. On-site water tanks discussed in Section 7.8.3. will be available for fire protection.

An "Emergency Notification Plan" (ENP) will be prepared to cover actions to be taken in the event of an on-site spill, fire, release of toxic gas or any other emergency. These actions will include notification procedures, as well as loading and unloading procedures, containment structures, surveillance, and inventory control procedures for these critical materials. The ENP will also include a list of safety and emergency response equipment on-site, as well as a personnel safety training program. The plan will be completed prior to beginning construction. As part of the plan, trained staff will be assigned to each shift, including weekends.

To provide for the safety and well-being of all individuals involved with the project, the general public, and local wildlife, the following precautions will be taken:

- The pad, pond and process areas will be surrounded by a five-foot high chain-link fence. Warnings signs will be placed on the fence at 200 foot intervals, and entrance gates will kept closed. Additional gates will be placed to block vehicular access to the entire mine site. The open pit and waste dump areas will be surrounded by a four-strand barbed wire fence.

- All chemicals will be stored within the fenced area. Sodium cyanide and acid will be stored separately.

- Sufficient calcium hypochlorite and/or hydrogen peroxide will be maintained on-site to neutralize any unforeseen spills.

- Empty cyanide containers (if applicable) will be triple rinsed, rendered unusable and removed to an approved disposal site or shipped back to the manufacturer.

- All employees will be indoctrinated in the safe use of chemicals.

- Hard hats, safety glasses and steel-toed boots will be worn by all personnel on site. Face shields or goggles, rubber aprons, gloves and respirators will be worn when handlng chemicals. This safety equipment, plus earplugs will be used at all appropriate times and will meet MSHA requirements.

- A cyanide antidote kit, oxygen bottle, first aid kit, fresh water shower and eye wash station will be located in the plant area. An additional cyanide antidote kit, oxygen bottle, first aid kit and trauma kit will be located in the mine office. All employees will be instructed in their use.

- At least two people will be present when sodium cyanide is added to the system.

- All applicable county, state and federal rules and regulations will be followed.

7.10 Drainage, Diversion and Sediment Control

The generation of sediment from surface water runoff events is minimal because of the limited amount of precipitation. Drainage ditch construction minimizes the extent of erosion and subsequent construction sedimentation by limiting channel slopes. In areas that show excessive sediment loading riprap will be installed, as appropriate.

Sediment will be a concern from runoff impacting the waste rock dumps, roads and parking areas. The heap leach pad and process areas will be zero discharge. As described in Section 2.4.1.10 a Stormwater Pollution Prevention Plan will be prepared that will control sediment and any accompanying pollutants.

7.10.1 Mine Pit

The mine pit will generally be a containment basin for runoff from the mine pit slopes. Near the end of mining, the mine pit runoff would exit at the southwest end of the pit. At that time, a sediment control basin will be constructed to detain runoff from the pit.

7.10.2 Waste Rock Dumps

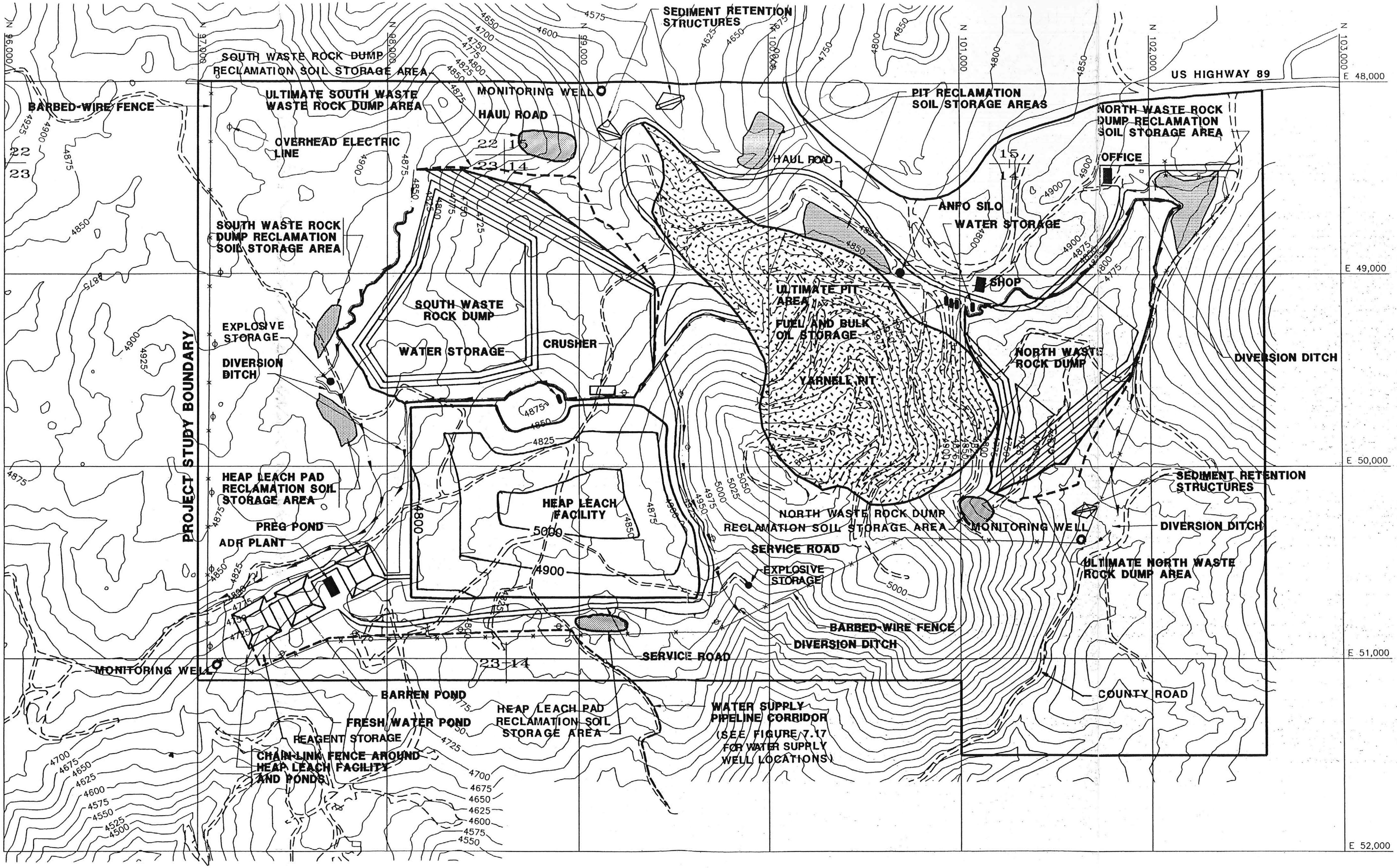
As mentioned in Section 7.3, diversion and drainage around the waste rock dumps has been designed to convey the 100-year, 24-hour storm. This drainage plan is shown in Figures 7.1 and 7.3 through 7.5. Upon reclamation, the waste rock dumps will be regraded, covered with soil, and revegetated. The drainage channels used during operation will be maintained at reclamation (as shown in Figure 9.1).

7.10.3 Heap Leach Facility

Due to the closed system design of the heap leach facility, all runoff and drainage from the heap is collected in the solution ponds. A diversion channel and access road is constructed on the upstream side of the leach pad for all three phases of heap construction.

7.10.4 Roads and Other Disturbed Areas

Runoff from the haul roads and other access roads on site will be collected and detained within the sediment control systems for the mine pit and waste rock dumps, or within separate sediment detention structures.



SCALE IN FEET

0 500 1000

YARNELL MINING COMPANY
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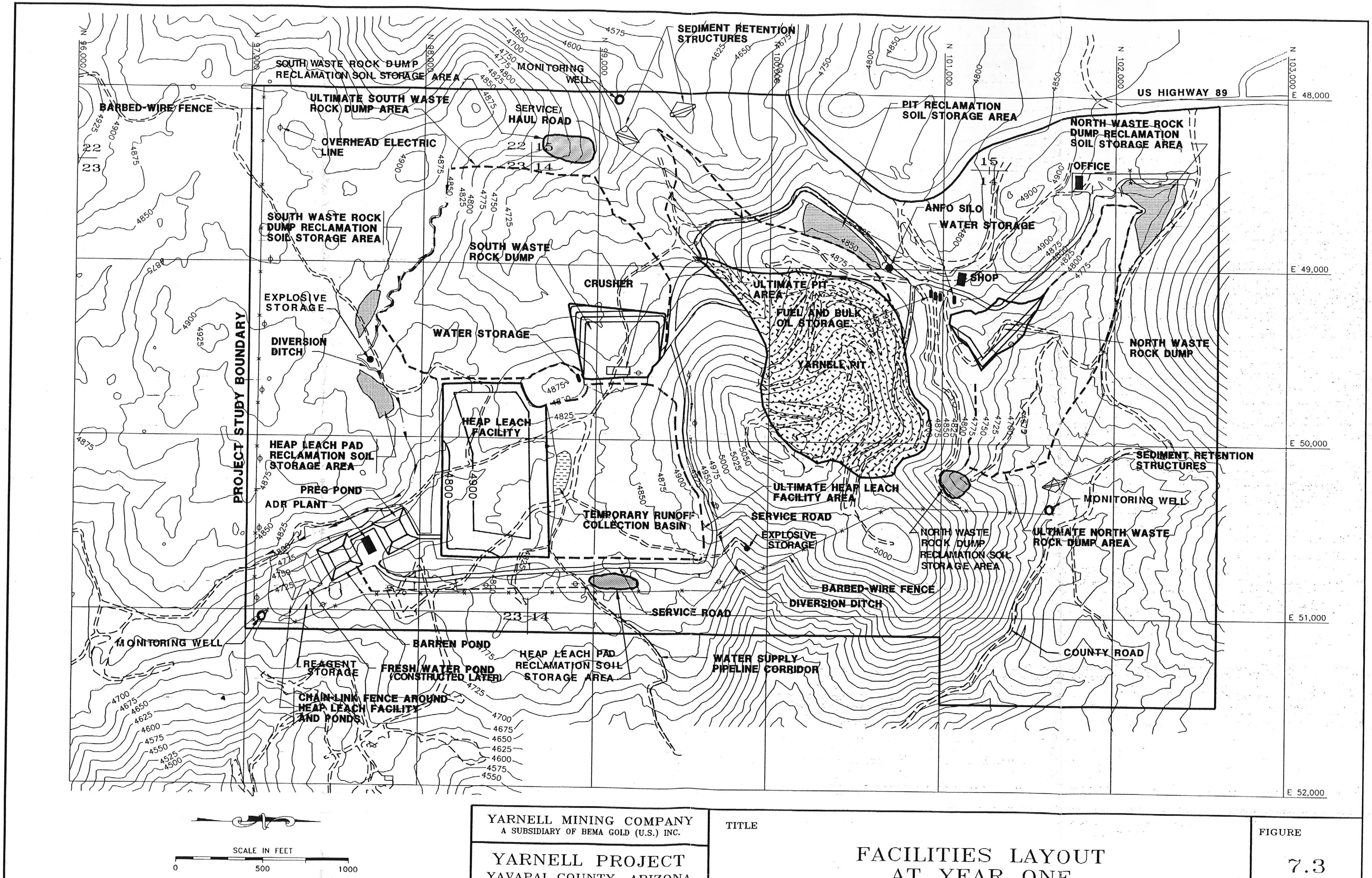
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

GENERAL FACILITIES LAYOUT

FIGURE

7.1



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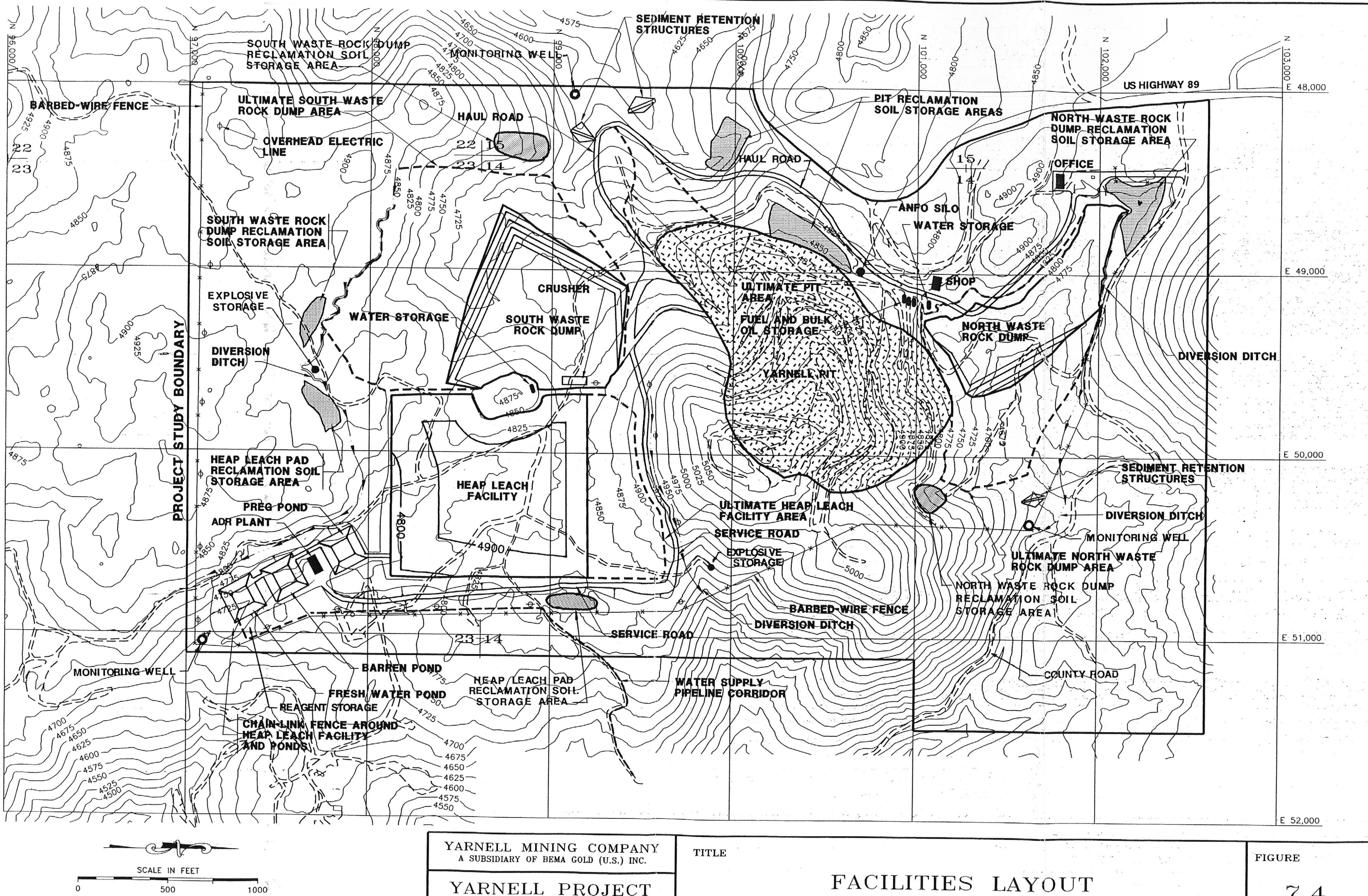
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

FACILITIES LAYOUT AT YEAR ONE

FIGURE 7.3



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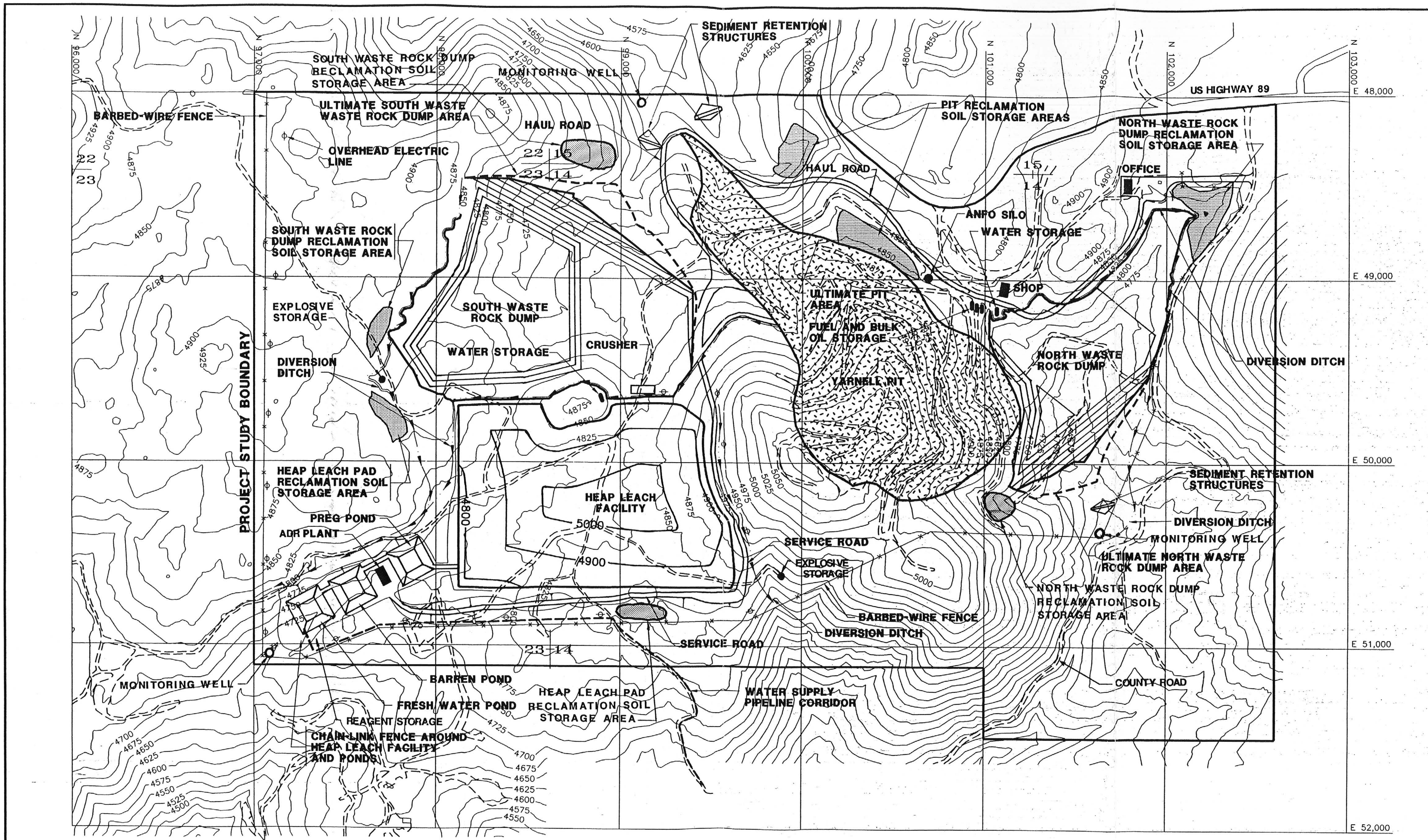
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

FACILITIES LAYOUT
AT YEAR THREE

FIGURE
7.4



SCALE IN FEET

0 500 1000

YARNELL MINING COMPANY
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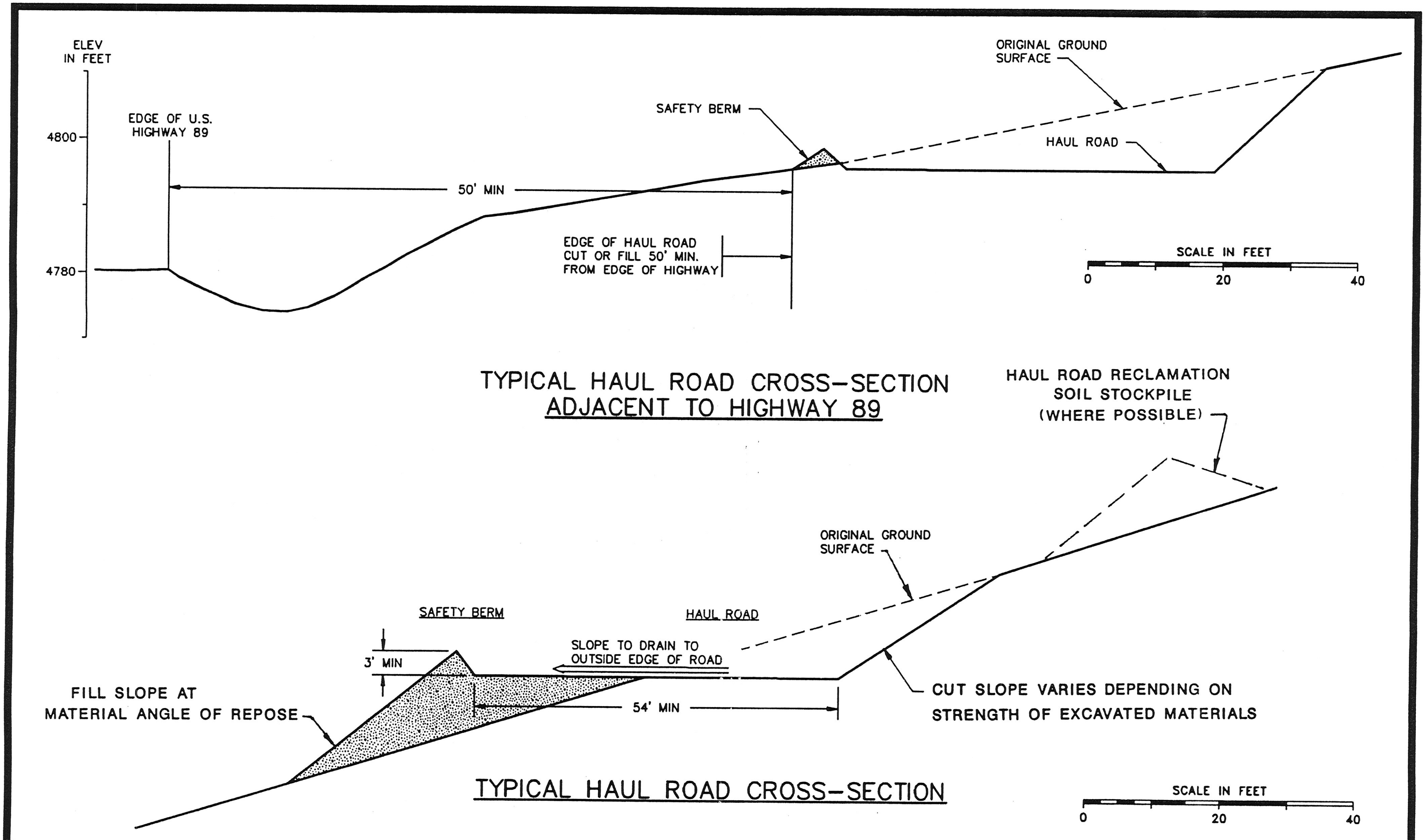
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

FACILITIES LAYOUT
AT YEAR FIVE

FIGURE

7.5



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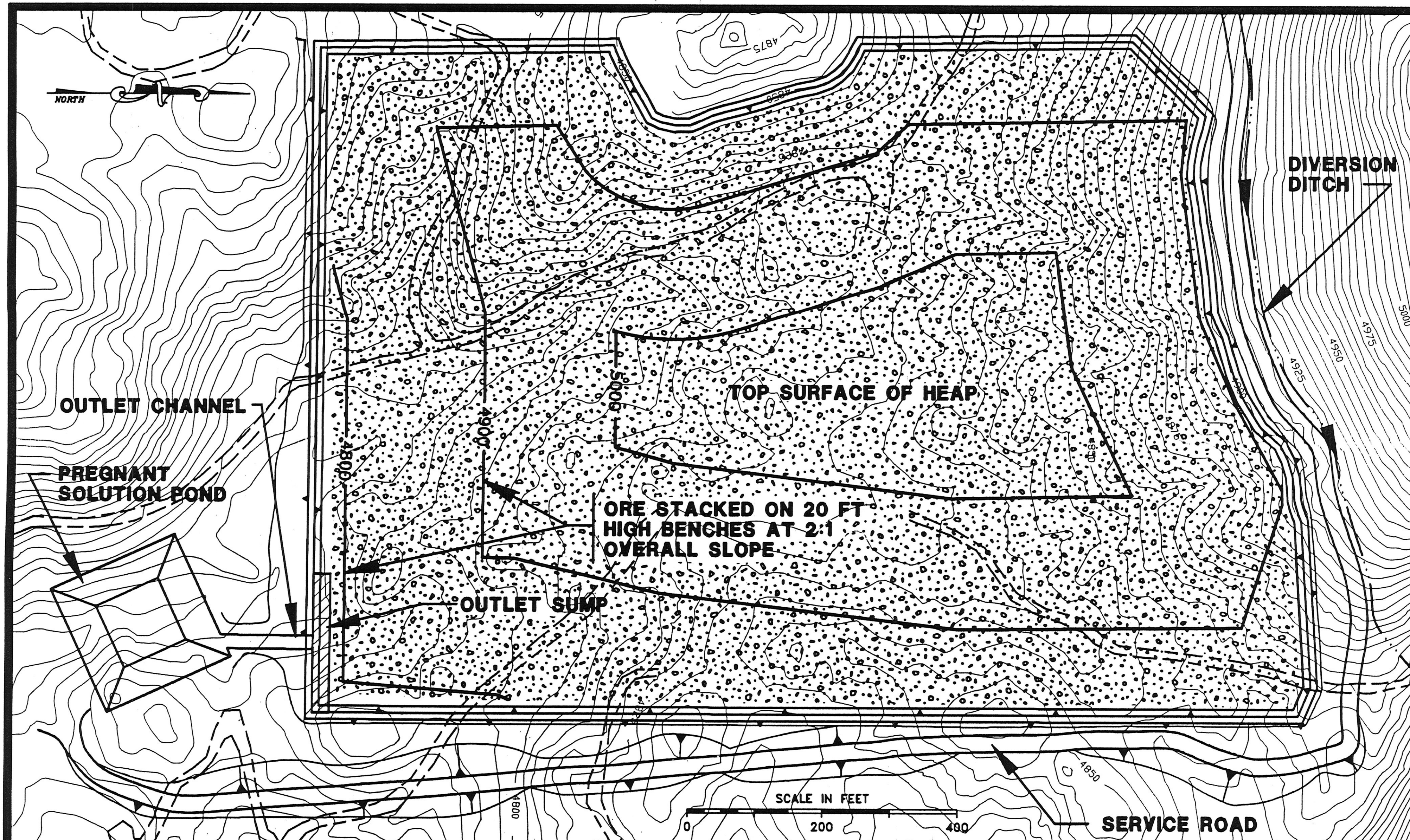
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

HAUL ROAD CROSS–SECTIONS

FIGURE

7.2



YARNELL MINING COMPANY
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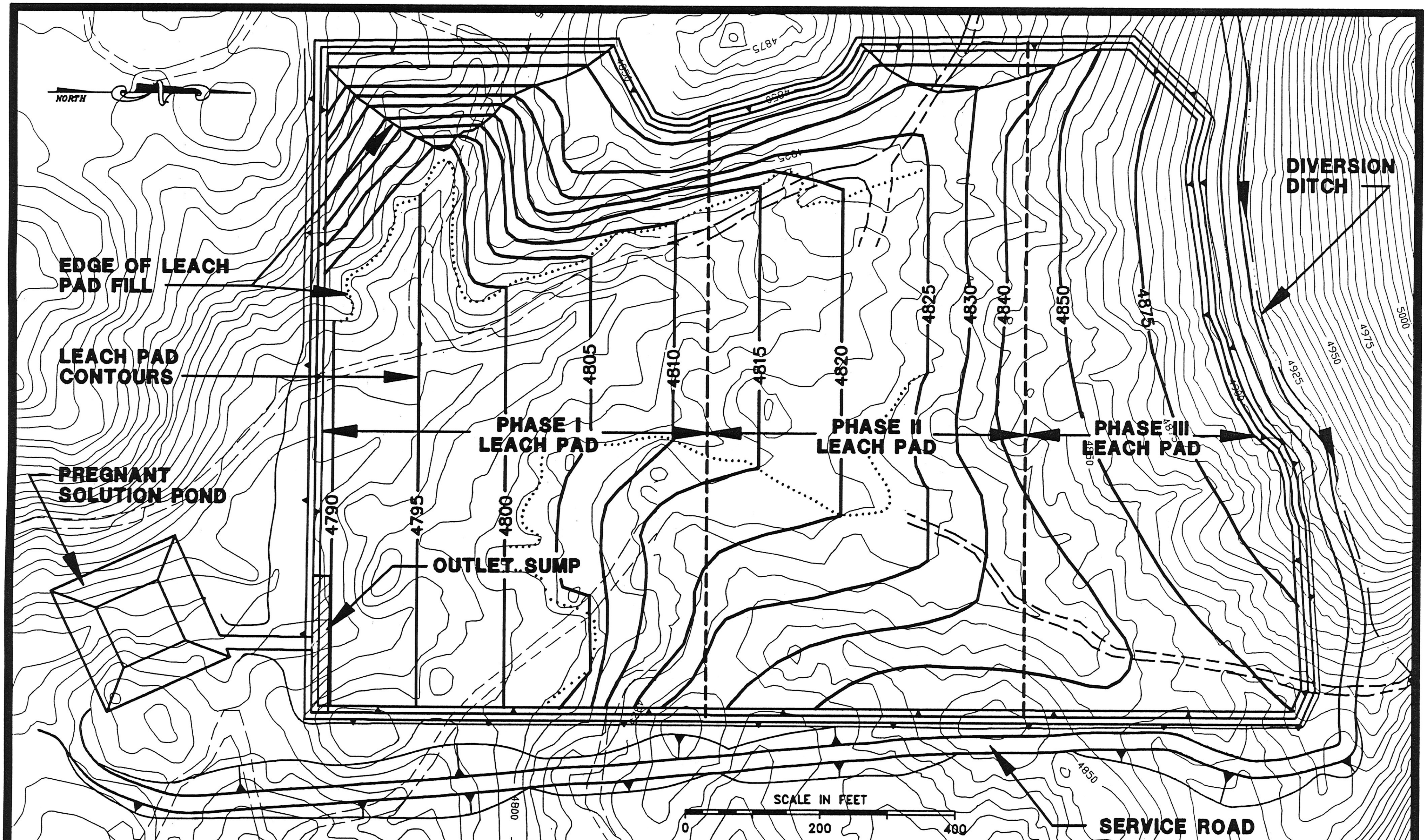
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

HEAP LAYOUT MAP

FIGURE

7.9



YARNELL MINING COMPANY
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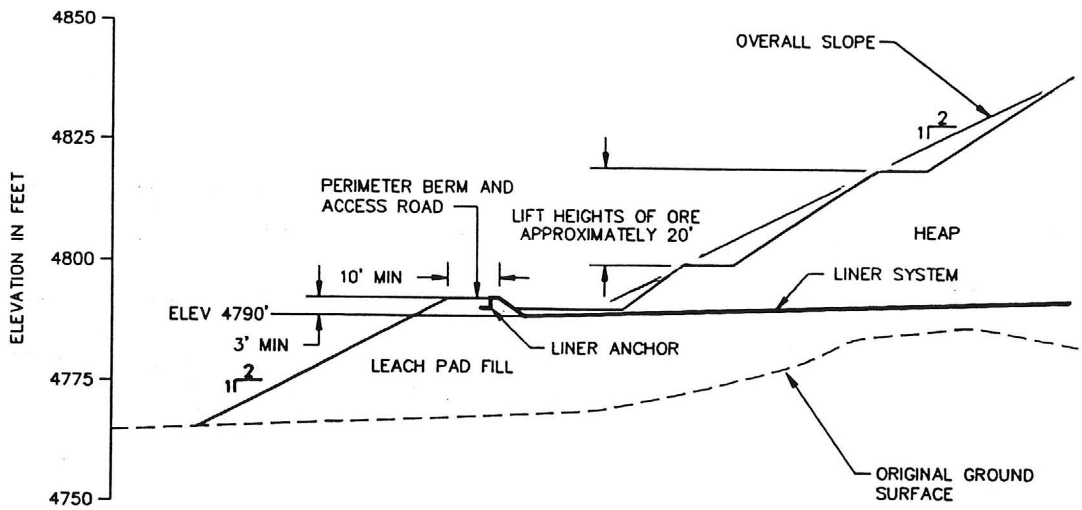
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

LEACH PAD LAYOUT MAP

FIGURE

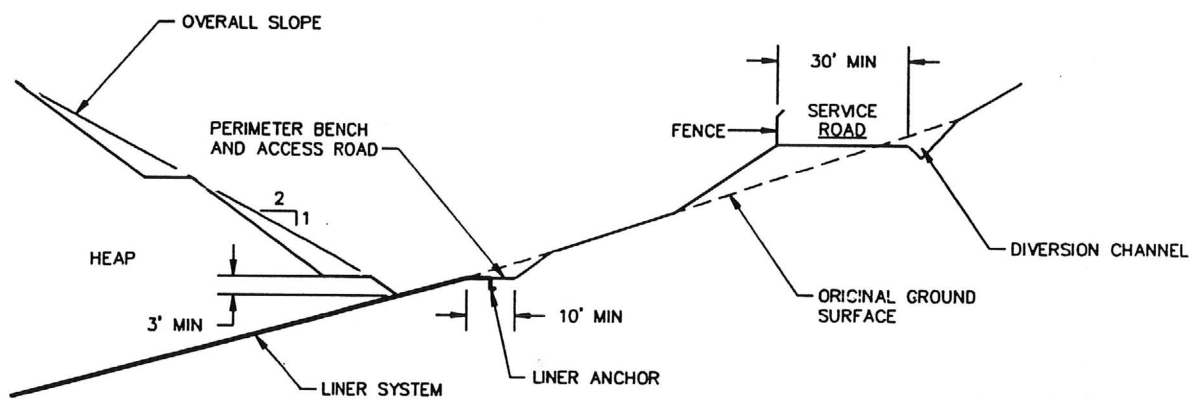
7.10



TYPICAL CROSS–SECTION THROUGH SOUTH END OF HEAP

SCALE: 1" = 40'

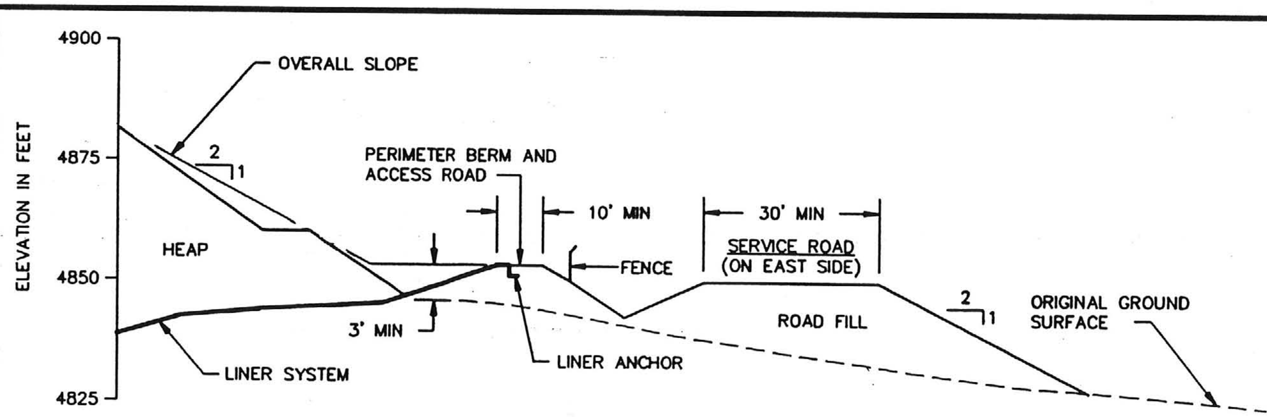
NO VERTICAL EXAGGERATION



TYPICAL CROSS–SECTION THROUGH NORTH END OF HEAP

SCALE: 1" = 40'

NO VERTICAL EXAGGERATION

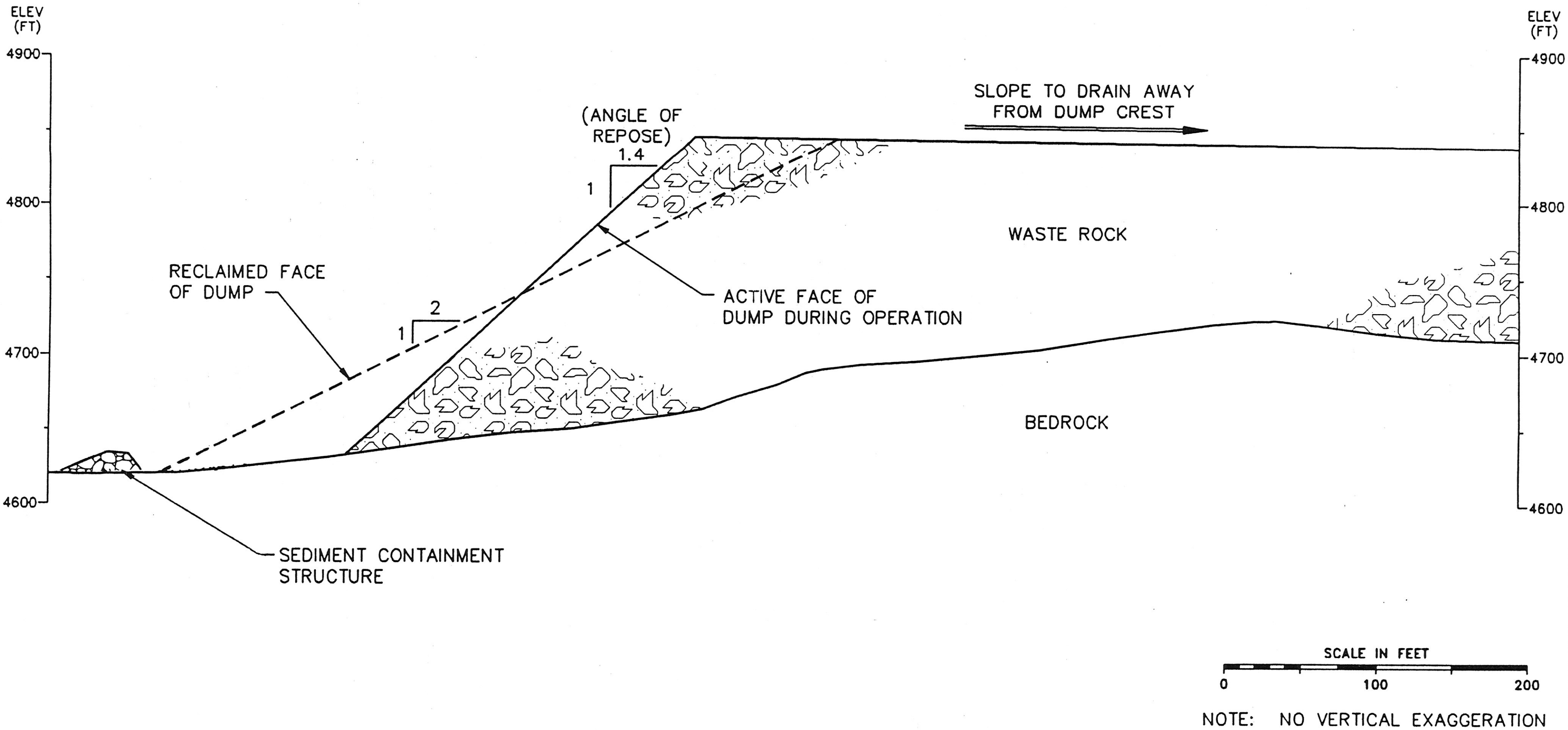


TYPICAL CROSS–SECTION THROUGH SIDE OF HEAP

SCALE: 1" = 40'

NO VERTICAL EXAGGERATION

YARNELL MINING COMPANY A SUBSIDIARY OF BEMA GOLD (U.S.) INC.	TITLE	FIGURE
YARNELL PROJECT YAVAPAI COUNTY, ARIZONA	LEACH PAD CROSS–SECTIONS	7.11



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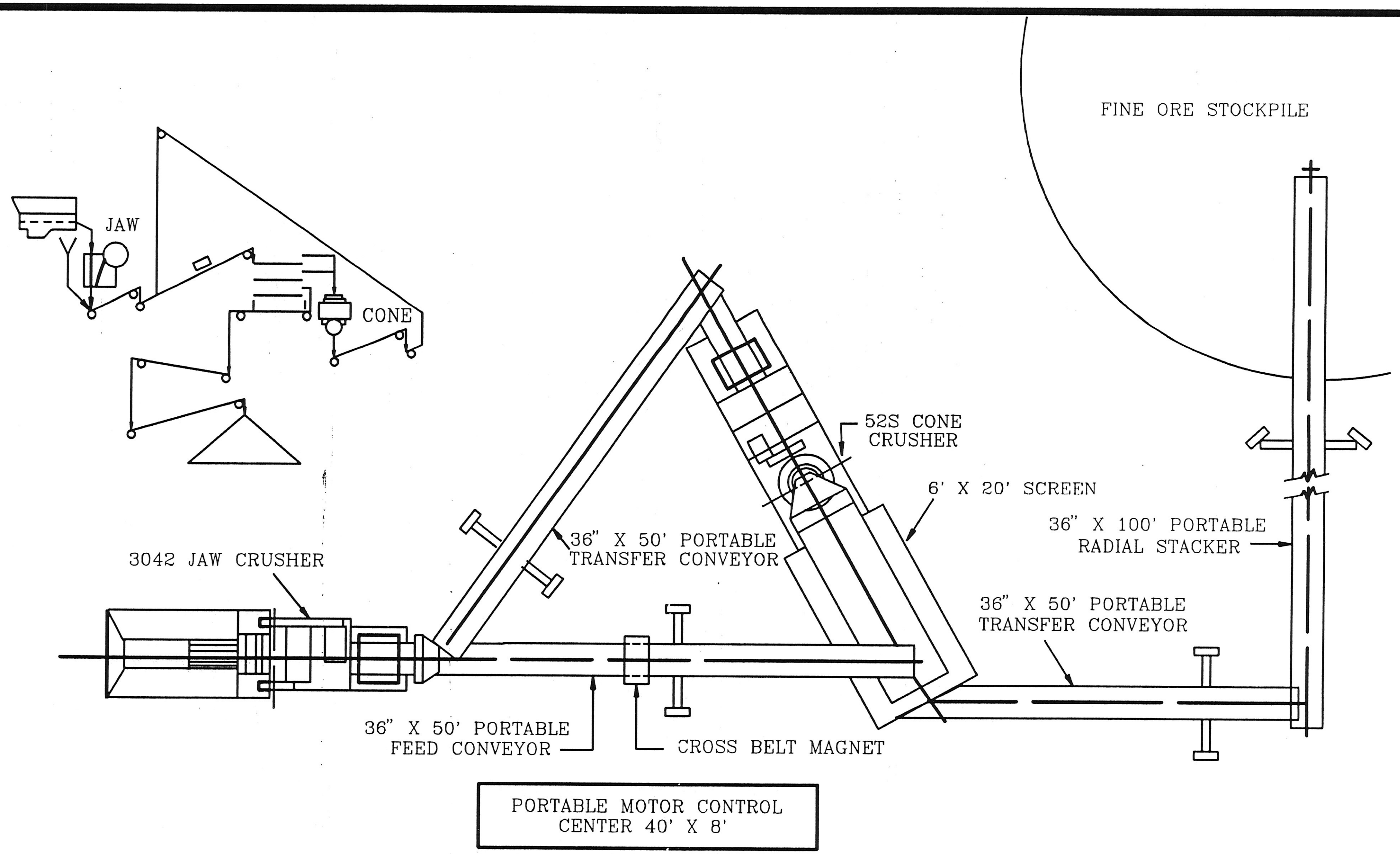
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

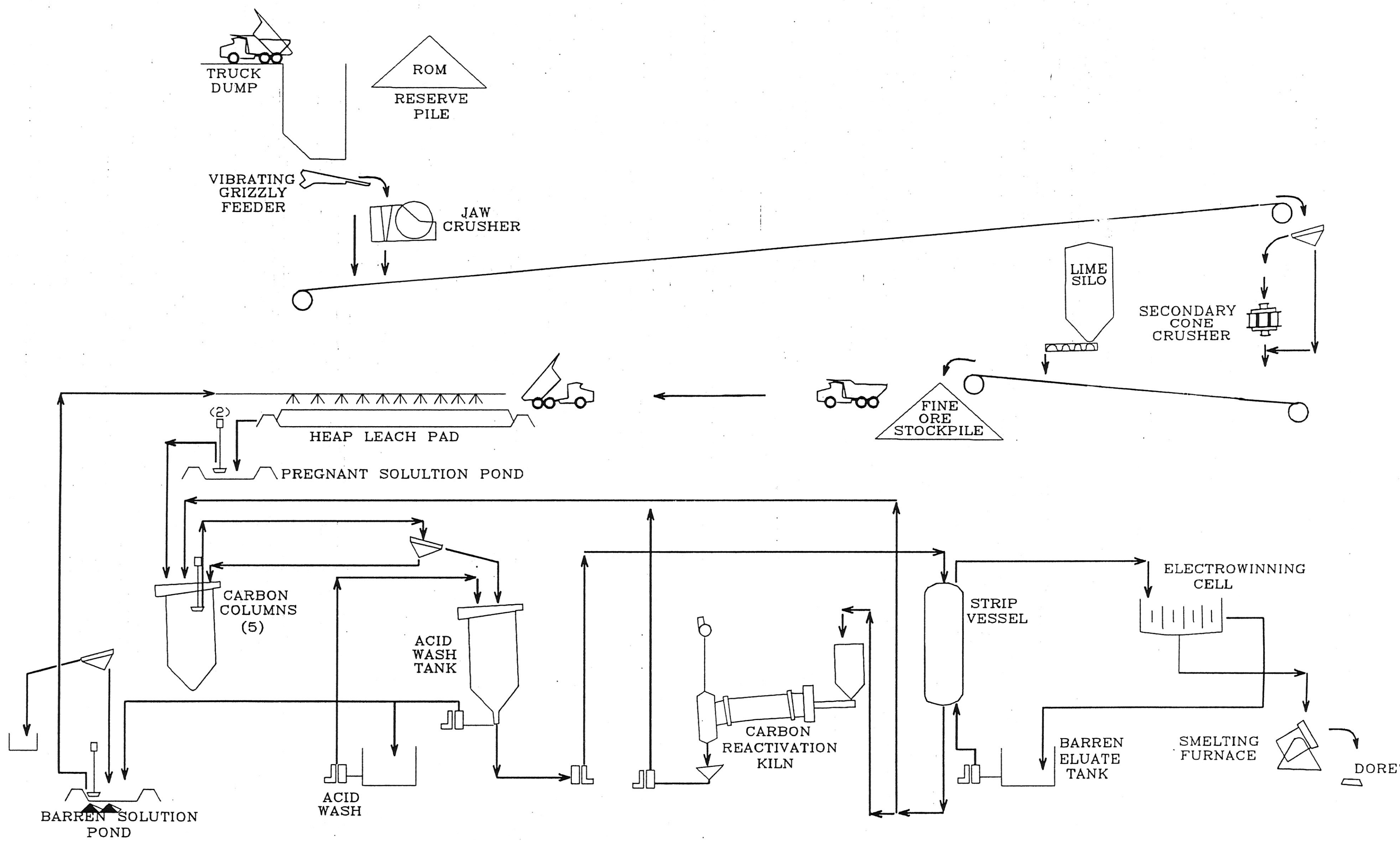
WASTE ROCK DUMP DETAILS

FIGURE

7.6



YARNELL MINING COMPANY A SUBSIDIARY OF BEMA GOLD (U.S.) INC. YARNELL PROJECT YAVAPAI COUNTY, ARIZONA	TITLE CRUSHING PLANT PLAN	FIGURE 7.7



YARNELL MINING COMPANY
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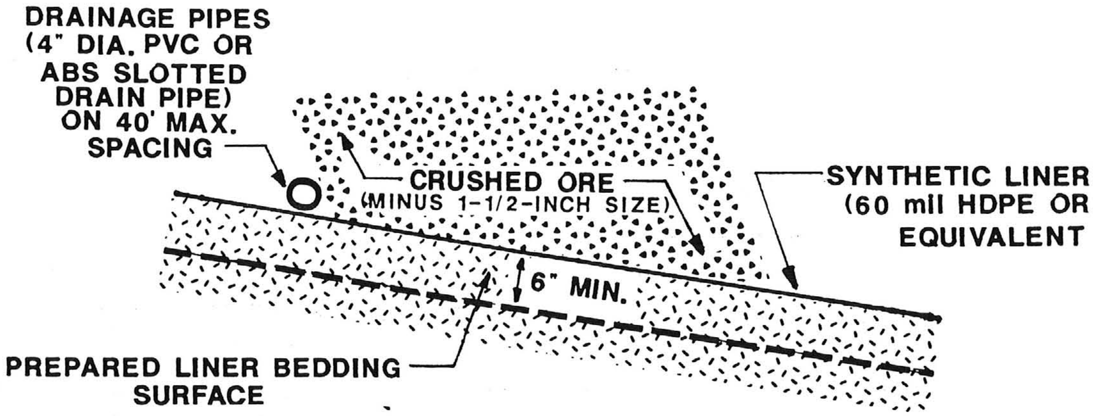
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

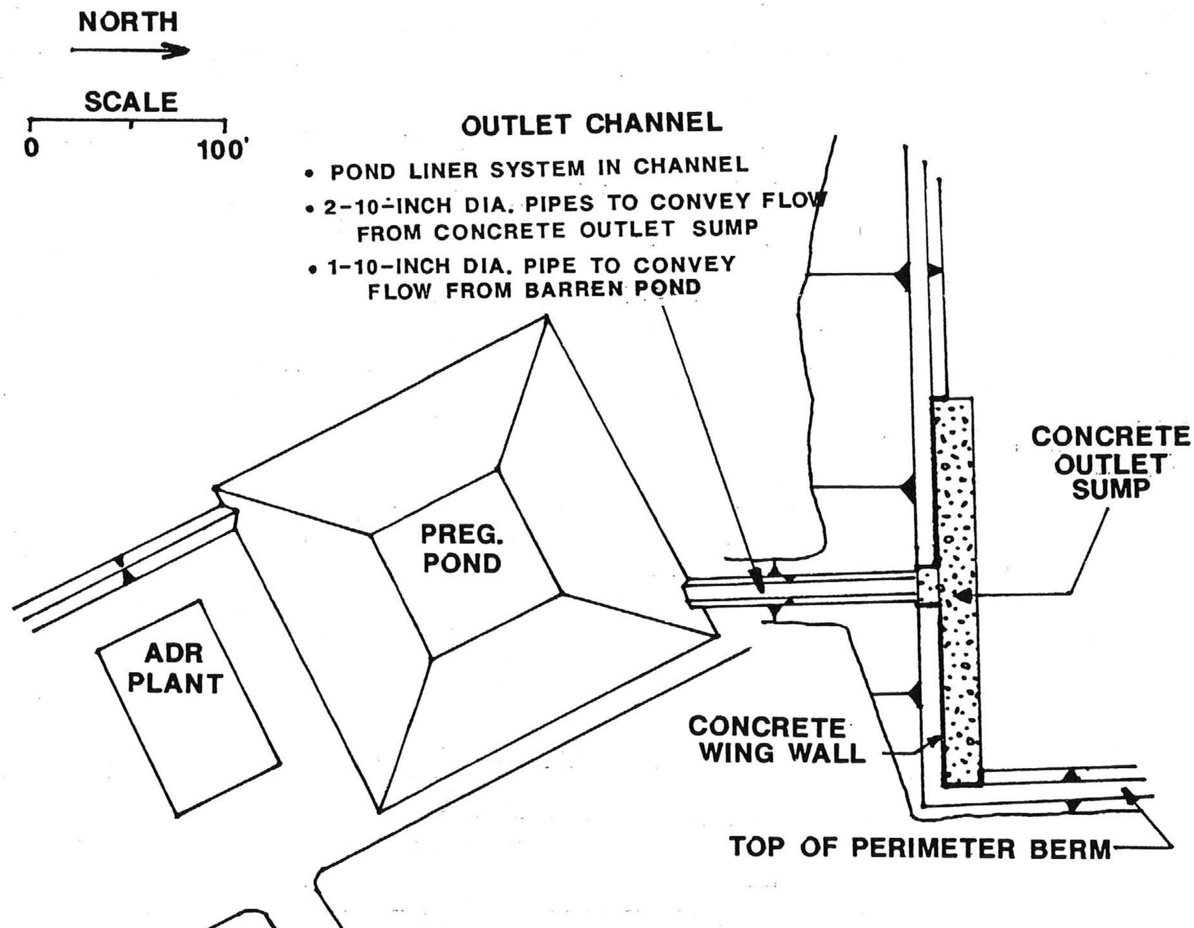
PROCESSING FLOW SHEET

FIGURE

7.8

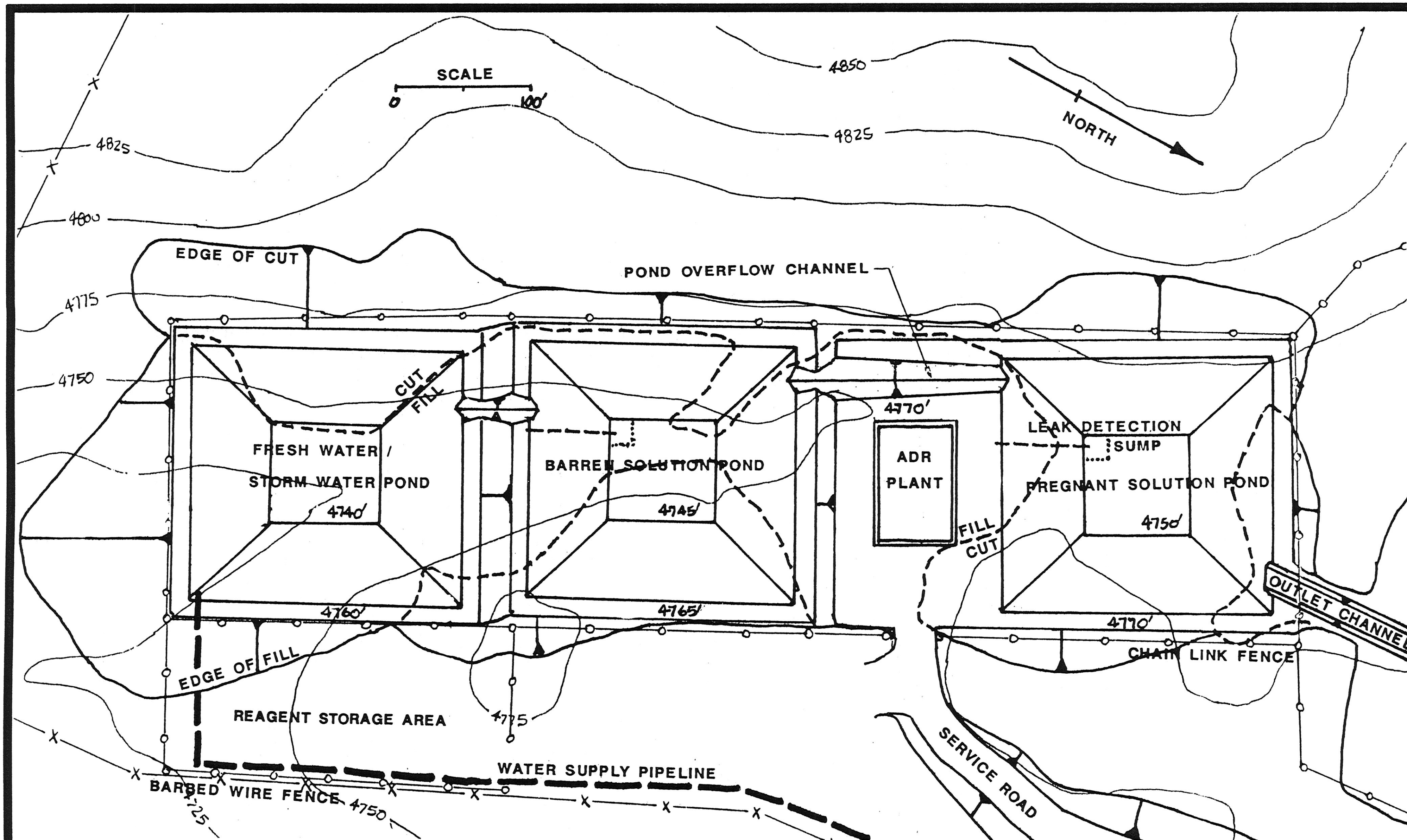


LEACH PAD LINER DETAIL (NOT TO SCALE)

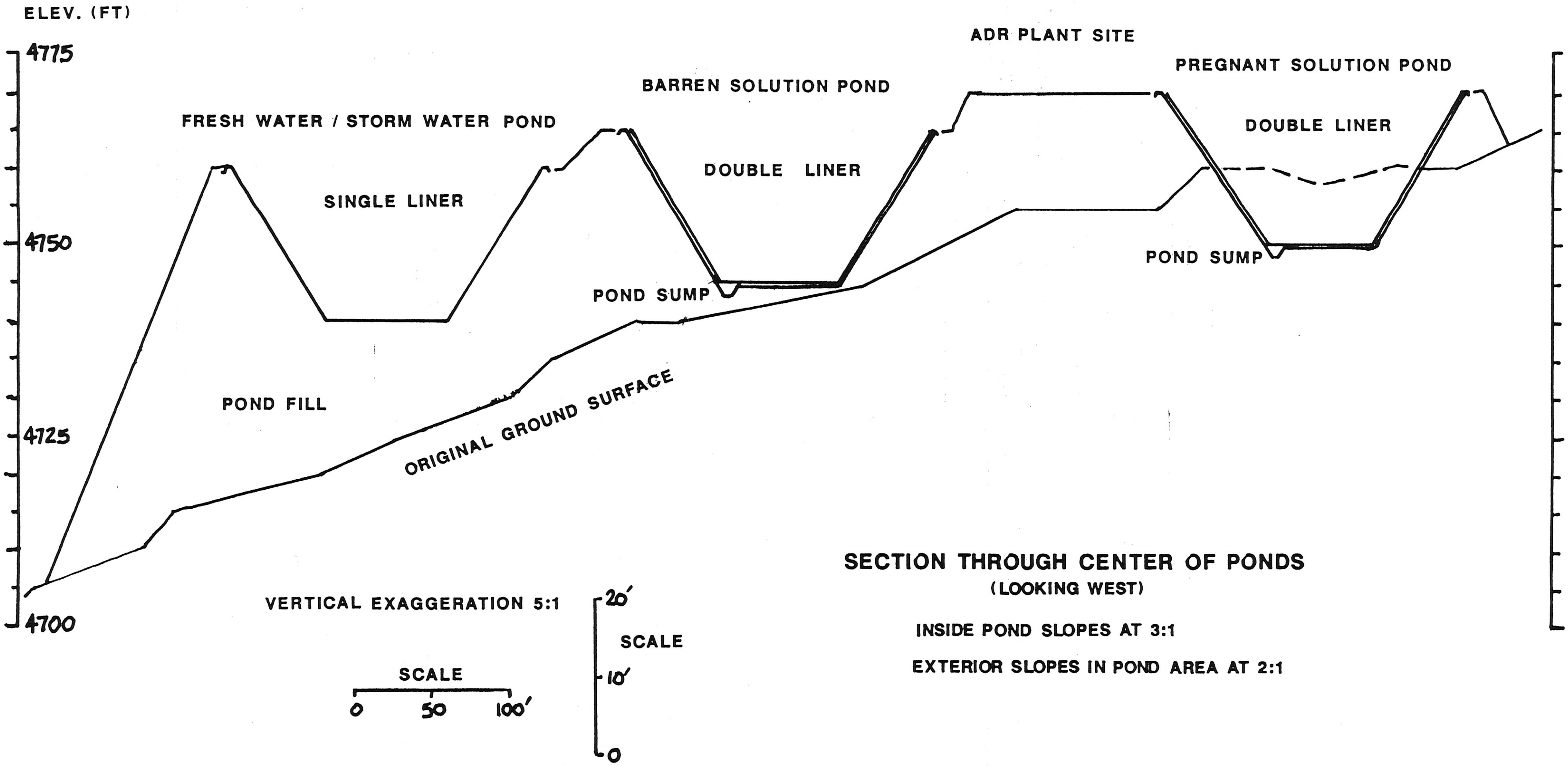


OUTLET DETAIL

YARNELL MINING COMPANY A SUBSIDIARY OF BEMA GOLD (U.S.) INC. YARNELL PROJECT YAVAPAI COUNTY, ARIZONA	TITLE LEACH PAD DETAILS	FIGURE 7.12



YARNELL MINING COMPANY A SUBSIDIARY OF BEMA GOLD (U.S.) INC.	TITLE POND AREA LAYOUT MAP	FIGURE 7.13
YARNELL PROJECT YAVAPAI COUNTY, ARIZONA		



YARNELL MINING COMPANY
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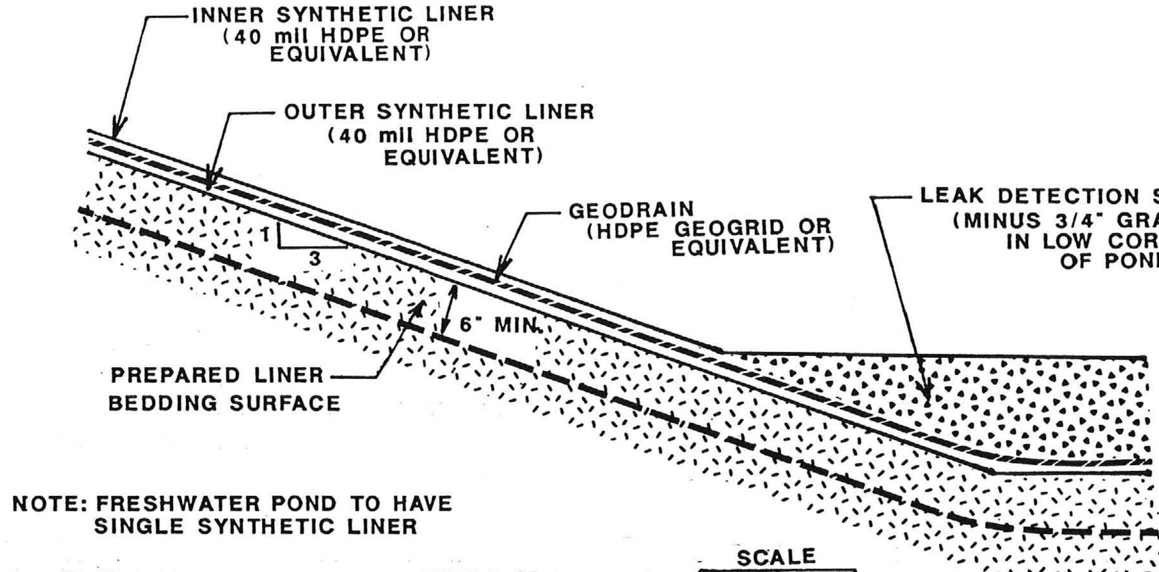
YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

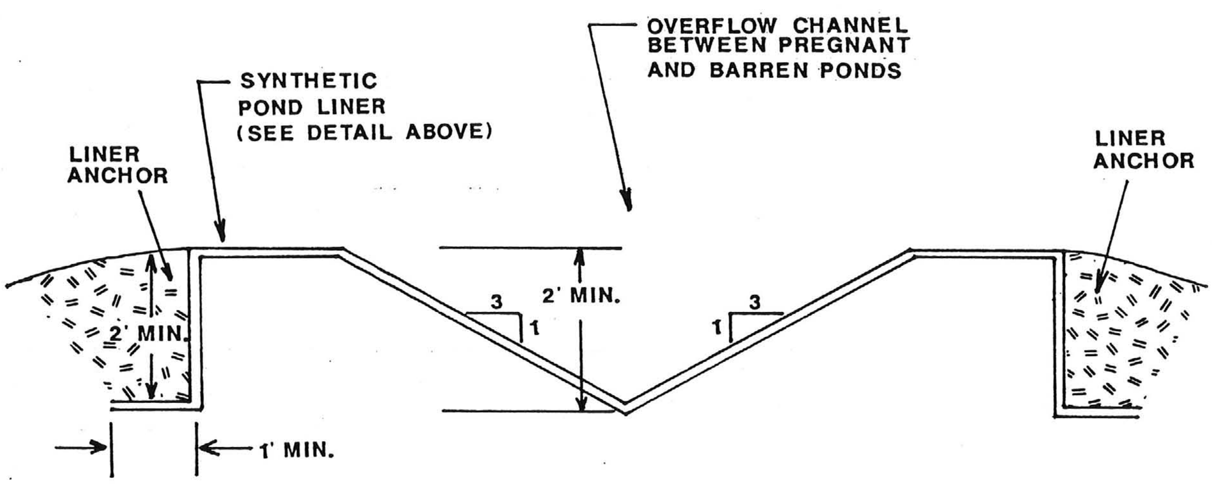
POND CROSS–SECTION

FIGURE

7.14



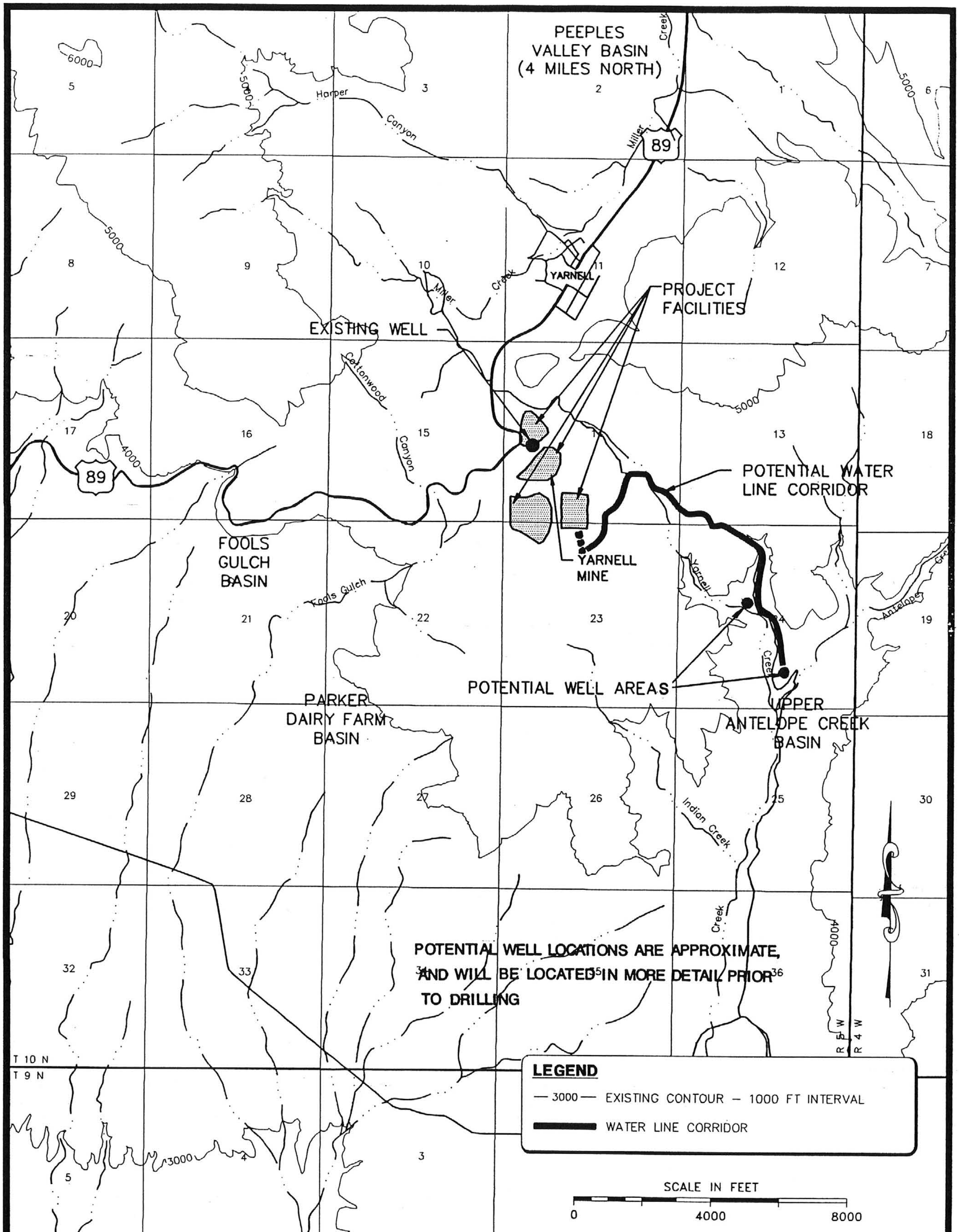
POND LINER DETAIL



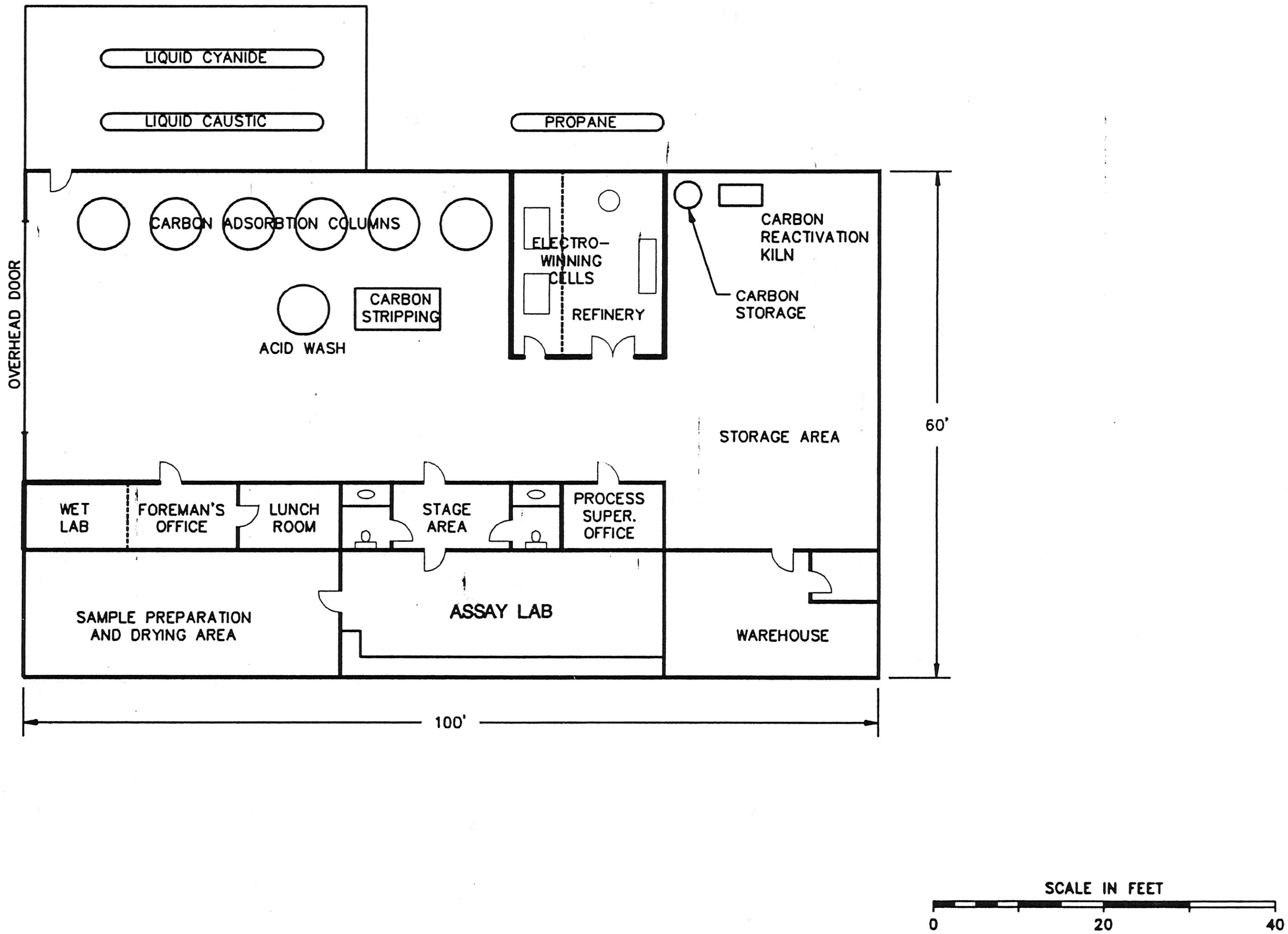
POND CHANNEL AND ANCHOR DETAIL

SCALE
0 1' 2'

YARNELL MINING COMPANY A SUBSIDIARY OF BEMA GOLD (U.S.) INC.	TITLE	FIGURE
YARNELL PROJECT YAVAPAI COUNTY, ARIZONA	POND DETAILS	7.15



YARNELL MINING COMPANY A SUBSIDIARY OF BEMA GOLD (U.S.) INC.	TITLE	FIGURE
YARNELL PROJECT YAVAPAI COUNTY, ARIZONA	WATER SUPPLY LOCATION MAP	7.16



YARNELL MINING COMPANY
A SUBSIDIARY OF BEMA GOLD (U.S.) INC.

YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

PLANT LAYOUT MAP

FIGURE

7.17

8.1 Particulate Emission Controls

The Yarnell Gold Mine is expected to be required to obtain a Class II permit from the Arizona Department of Environmental Quality. The permitting and emission control requirements for a Class II are significantly different from a Class I ("major") source or for a source that is proposing to locate in a non-attainment area. (There are no portions of Yavapai County that are currently classified as non-attainment for any pollutant.). In general, YMC intends to take all reasonable precautions to prevent excessive amounts of particulate matter from becoming airborne due to activities at the project. Specifically, any equipment or mining activities that are specifically covered by emission performance standards in the Arizona Administrative Codes or the United States Code of Federal Regulations will comply with the applicable standard. This section identifies the anticipated control technologies and measures that will be implemented at the project.

8.1.1 Process Emissions of Particulate Matter

Crushers and screens associated with the open-pit mining, and conveyor belt transfer points, storage bins, and truck unloading stations will be subject to 40 CFR 61 Subpart KK "Standards of Performance for Metallic Mineral Processing Plants" (referred to as "NSPS"). As emissions from the primary crushing circuit will be fugitive in nature (i.e., emissions that are not vented to a capture system), a 10 percent opacity standard will be met for emissions from these facilities.

Run-of-mine ore at maximum 24-inch size will be dumped into a hopper and fed with a vibrating grizzly feeder into jaw crusher. Product from the primary will be conveyed to a standard core secondary crusher, crushed to 80% minus 1 1/2 inch size, then conveyed to the secondary triple-deck vibrating screen for fines removal. Dry dust scrubbers and/ore water sprays will be used to control dust from the crusher circuit.

Particulate emissions from loading lime from the lime silo will be controlled by a fabric filter.

8.1.2 Non-Process Emissions of Particulate Matter

The Arizona Administrative Code contains several sections that apply to non-process sources of dust at the project. Following is a list of Code the sections, the sources to which the section applies, and reasonable precautions that the mine may implement to control dust emissions:

Section No.	Section Name	Subject Sources Controls
R18-2-605	Roadways and Streets	haul road wetting; chemical suppressants; mud/dirt removal
R18-2-606	Material Handling	see NSPS controls
R18-2-607	Storage Piles	wetting; chemical stabilization; minimize material fall
R18-2-608	Waste Rock/Tailings	wetting; chemical stabilization; revegetation
R18-2-610	40 Percent Opacity	all non-process controls

In addition, blast hole drills will be equipped with an appropriate combination of water injection, a pneumatic flushing device, and or dust shroud to control particulate emissions.

The mine will implement necessary combination of these controls to take reasonable precautions to prevent excessive amount of particulate matter from becoming airborne. One 5,000 gallon water truck will be maintained on site. To monitor ongoing compliance with the applicable opacity standards, YMC will maintain a certified opacity observer on site.

8.2 Hydrogen Cyanide Emissions

In the process of applying sodium cyanide solution to the leach pad, free cyanide may bind with hydrogen and be emitted as hydrogen cyanide (HCN) gas. Formation of HCN is highly dependent on pH and the primary control for HCN gas emission will be maintaining a leach solution pH at or above 10. To minimize emissions, the project will employ drip emitters or spray bars that minimize the solution's contact with air during application. Emissions of HCN will be controlled to ensure compliance with the Arizona Air Quality Guideline (AQG) of 40 ug/m3 on an hourly or 24-hour average basis.

8.3 *Noise Emission Controls*

It is still unknown whether specific Arizona noise control regulations will apply to the Yarnell Project. Regardless, during the detailed planning of the Yarnell Mine, YMC will evaluate equipment and siting options that will reduce noise emissions. This discussion of mitigation measures identifies possible mitigation options available for the types of noise sources that will likely exist. However, since topography and atmosphere conditions also affect how noise is carried from a source, a detailed evaluation of noise conditions will be performed in concert with the equipment selection and siting process.

The most critical noise mitigation measures for the project are the timing of operation of noise sources (blasting, dozing, crushing, etc.) and barriers (natural, such as hillsides, and manmade, such as a building, wall, or berm) between the noise source and the receptors. Barriers will be at least as high as the top of the noise source (for mobile equipment, this is typically the height of the exhaust pipe). Blasting noise will be mitigated by minimizing the amount of explosives used per blast by using delays between each individual round and by restricting blasting to predetermined time windows.

Mobile equipment will be equipped with, at a minimum, standard exhaust mufflers. Heavy duty mufflers can be applied if necessary. Also, other operating mines near residential areas have explored the noise mitigation technique of replacing back-up alarms on mobile equipment with back-up strobe lights during "sleeping hours." This option may present safety considerations that will be an MSHA issue.

Other possible noise mitigation options include orienting equipment such as fans, blowers, and steam vents away from noise-sensitive receptors and the purchase of low-noise models of pumps (and other small machinery) and/or enclose these devices.

Table 8.1 lists the possible noise sources at the Yarnell Project and presents noise mitigation options for each source.

Table 8.1
Noise Sources and Mitigation

Equipment	Possible Mitigation
Hoppers	Coat outside with dampening compound; locate behind barrier.
Crusher Circuit	Enclose drop points and locate behind barrier. locate behind barrier.
Radial Stacker	Locate behind barrier.
Pumps	Purchase low-noise models; enclose.
Fans/blowers	Orient intake and exhaust away from receptors; attach silencer.
Exhaust stacks	Attach silencer.
Blasting	Blast only during pre-determined time-windows; minimize amount of explosives; use delays between rounds.
Mobile equipment	Use rubber-tired vehicles; replace back-up alarms with back-up strobes

8.4 *Surface and Ground Water Protection*

In order to protect surface and ground water during operation and after closure, several containment measures will be carried out, as outlined below.

Waste Rock Disposal: From geochemical test work presented in Appendix 2, the waste rock is unlikely to be acid generating and not leach constituents of concern for surface or ground water quality. Waste rock is therefore planned for disposal in the north and south waste rock dumps, with controls consisting of stripping and salvage of reclamation soils during dump expansion, retention of sediment from storm runoff during operation, and regrading and revegetation of the dump surface after closure.

Heap Leach Facility: The level of containment for the components of the heap leach facility varies with the planned management of leach solutions, and is consistent with ADEQ BADCT guidelines.

For surface water protection, the heap leach facility has been designed as a closed system, where storm runoff from upstream areas is diverted around the facilities, and solutions within the facility are contained. As described in Section 7.5.6, the solution collection ponds have been sized to contain the operating inventory of process solutions plus the total precipitation volume from the 100-year storm (falling on the leach pad, lined channel and solution pond areas).

For the pregnant and barren solution collection ponds, the level of containment for protection of ground water consists of a double liner system with a leachate collection and recovery system (LCRS) between liners (shown in Figure 7.15). The double liner system is planned since solution will be stored in the ponds on a continuous basis with up to 20 feet of head on the inner liner.

For the fresh water/storm water pond, the level of containment consists of a single synthetic liner. The single liner system is planned since the primary use of the pond will be to store ground water for use as makeup water for the leach process. The pond would store excess storm runoff from the leach pad, if necessary.

For the leach pad, the level of containment for protection of ground water consists of a single synthetic liner on top of a compacted layer of select bedding material. On top of the liner, a system of slotted drainage pipes will be installed prior to stacking with ore. The single liner system is planned since the zone of saturation within the ore above the liner would be present on a transient basis and (when present) limited by the coarse nature of the ore and the drainage pipe system.

8.4.1 Ground Water Monitoring

Ground water monitoring will be conducted as part of compliance with the Aquifer Protection Permit for the project administered by ADEQ. Three wells at the down-gradient locations of the site are planned, as shown in Figures 7.1 and 9.1. These locations were selected to monitor ground water below the major planned mine structures: the north and south waste rock dumps and the heap leach facility. Potential impacts to ground water would be from constituents leaching from the waste rock or from leakage of leach process solutions. Due to the topography of the site, the upgradient area of the site is the open pit, and therefore, no upgradient monitoring wells are planned. The existing well north of the mine will be monitored as part of the monitoring program. The three new monitoring wells and existing well will be pump tested and sampled to provide both background and baseline water level and water quality conditions prior to completion of the Aquifer Protection Permit.

8.5 *Material Handling and Storage, Spill Prevention, and Emergency Response*

Operations at the Yarnell Project represent risks inherent within any industrial operation, including those risks related to the use of chemicals, reagents, and petroleum products, as well as, the operation of equipment and physical plant machinery. To minimize the risks associated with normal plant operations, risk management considerations have been addressed and are outlined within the following sections.

8.5.1 Chemical and Petroleum Products and Usage

The gold mining and recovery process employed at the Yarnell Project will use a number of chemical and petroleum products. The use and disposition of these products requires consideration of measures that minimize risks associated with both handling and disposal. The chemicals and petroleum products at the site will be stored in a manner that provides secondary containment and prevents reaction with other materials.

The chemicals anticipated at the site are summarized on Table 8.2. Material Safety Data Sheets for these chemicals will be collected and stored on-site at various locations. While many chemical products are represented on Table 8.2, most of these receive only limited use. The primary chemicals and petroleum products used at the site are summarized on Table 8.3.

8.5.2 Chemical Storage Facilities

The chemical storage at the Yarnell Project will be established to segregate incompatible materials, store materials close to their point of usage, provide for safety during loading and unloading operations, and provide secondary containment in the event of releases or spills.

Most materials, other than chemicals used in the assay laboratory, will be received in bulk form and stored within the ADR plant. The full bins of cyanide will be stored in an area upgradient and adjacent to the process facilities. This location will allow access by trucks delivering the cyanide and minimizes handling prior to dispensing into the mixing tank.

TABLE 8.2 List of Chemicals and Petroleum Used at the Yarnell Project

Chemical	Location
Acetone	Lab/Warehouse
Acid-Hydrochloric	Lab/AcidWash/Storage
Acetylene	Shop
Ammonium Hydroxide	Lab
Barochem S383	Storage
Barochem S429	Storage
Borax - Sodium Borate	Lab/Refinery
Buffer Solution pH1	Lab
Buffer Solution pH7	Lab
Buffer Solution pH9	Lab
Brake Fluid	Shop
Calcium Fluoride	Gold Room/Lab
Carbon Activated	Plant
Carbon Black	Plant/Warehouse
Caustic Soda Solution	Plant/Warehouse
Caustic Soda Flake	Plant/Warehouse
Contact Cement (Duro TM)	Shop/Warehouse
Oxygen	Plant/Shop
Oil - Thread Cutting	Shop
Polyurethane	Shop
Propane	Storage Tanks
Potassium Iodine	Lab
Potassium Permanganate	Lab
Potassium Nitrate	Lab
Phenolphthalein	Lab
Photoreceptor Xerox	Office
Purocast	Refinery
Rubber natural	Plant/Warehouse
Silver Nitrate	Lab/Plant
Sodium Hydroxide Solution (Liquid Caustic Soda)	Lab/Plant

TABLE 8.2 continued

Chemical	Location
Sodium Hydroxide Solid	Warehouse/Lab
Sodium Nitrate	Lab/Refinery
Soda Ash	Lab/Refinery
Silica Sand	Lab/Refinery
Starting Fluid	Shop
Sealant General Purpose Calk	Warehouse/Shop
Toner - Xerox	Office

TABLE 8.3
Summary of Major Chemical Storage

Reagent	Storage Container	Storage Location
Borax	Paper bags	Warehouse/Refinery
Carbon	Super sacks	Pallets in process area
Caustic Soda	Plastic drums	Process area
Cyanide	Flow bins	Process area
Flourspar	Paper bags	Warehouse
Lime	Silo	Crusher
Hydrochloric Acid	Stainless drums	Process area
Salt	Paper bags	Warehouse
Silica Sand	Paper bags	Warehouse
Soda Ash	Paper bags	Warehouse
Sodium Nitrate	Paper bags	Warehouse

Once the cyanide flow bins are emptied, the bins will be placed within a lined area near the ADR Plant, segregated from the full containers. The lined area will also prevent runon and runoff of surface water.

Caustic soda will be used for pH adjustment during the gold extraction process. Storage of the caustic soda drums will be on a concrete pad that was constructed with berms to provide spill containment. During the winter months when the caustic solution could freeze, the drums will be stored within a heated area of the processing plant.

Hydrochloric acid used in the extraction process will be stored on a concrete pad in the vicinity of the caustic solution storage area. To prevent potential contact, the two areas will be segregated by concrete walls and are equipped with berms for spill containment. Further, the two areas will be segregated sufficiently to prevent contact in the event of simultaneous releases or in the event of an accident during truck unloading.

Lime used in the process will be delivered approximately twice a week by truck to a 60-ton storage silo located near the crusher.

Carbon is stored at the site in super sacks (approximately 1-cubic yard). These sacks will also be covered with plastic to prevent infiltration of water.

The remaining materials stored at the site will be delivered in paper bags and typically stored in the warehouse area. These materials include the following:

- Borax;
- soda ash;
- sodium nitrate;
- flourspar;
- silica sand; and
- salt.

Within the warehouse, these materials will be placed in segregated areas on pallets.

8.5.3 Petroleum Storage Facilities

Petroleum products to be stored at the Yarnell Project will include motor fuels, oils, and greases. These materials will be used to support the operation of heavy equipment and site vehicles and to support routine equipment maintenance. These materials will be delivered by a local jobber using a bulk truck.

Gasoline will be stored in 5,000-gallon above-ground tank(s). This tank(s) will be provided with a lined secondary containment pad and berm sized to meet current above-ground storage tank regulations.

Diesel fuel will be stored at the site in 10,000-gallon above-ground tank(s). A lined secondary containment pad and berm will be constructed beneath the tank to contain potential spills.

New oil will be stored in 55-gallon drums at the shop facility. Drums will be stored on wooden pallets to facilitate movement. Waste oil will be stored in above-ground tanks for recycling by a state approved oil recycling firm.

8.5.4 Materials Loading and Unloading

Chemical and petroleum products delivered to the site will be handled following established protocols. These protocols will be developed to optimize worker safety and minimize the potential for spills or releases. As shipments of materials arrive at the site, they will be inspected for leaks and the adequacy of packaging. Improperly packaged or damaged materials will be rejected and not unloaded. Shipping manifests will be checked to determine the quantity of the material delivered and to assure that the material is in the form ordered. Upon acceptance, materials will be directed to their point of unloading by plant personnel.

Petroleum products will be delivered to the site by an area jobber and pumped from bulk trucks into above ground tanks by the truck driver. Oil and other materials delivered in drums will be off-loaded using a forklift if on pallets, or with a drum handler if not on pallets. Propane delivered to the site in bulk trucks will be transferred to the on-site storage tank by the truck drivers.

Chemicals will be unloaded using the means appropriate for the type of packaging. Materials delivered in drums or paper bags placed on pallets will be off-loaded using a forklift. Barrels not placed on pallets are unloaded using a drum handler. Materials in other containers, such as cyanide flow-bins, will also be unloaded using a forklift.

As materials are unloaded, trucks will be required to be parked in a safe manner that will allow forklift access and maneuvering on a level surface. The unloading of any chemical will also be performed in a manner that will prevent mixing of incompatible materials in the event that a load is accidentally spilled.

8.5.5 Spill Control and Monitoring

The Yarnell Project will follow established procedures to minimize the potential for spills or releases. These procedures will consider both operational and chemical-specific considerations and the monitoring necessary to assure proper evaluation of the plant conditions. Personnel will be trained with respect to these protocols and their individual responsibilities if a release should occur.

In the event of a release or other emergency, the General Manager is responsible for directing personnel during emergency response and site remediation operations. In the event of a release after normal day-time hours, the acting Shift Foreman is responsible for administrating appropriate response actions until the General Manager can be contacted. Until the General Manager arrives at the facility, the Shift Foreman is responsible for securing the area of the emergency or release, and the coordination of emergency efforts.

Any release which occurs, either above or below reportable quantity levels, must be reported to the General Manager. All releases in excess of reportable quantities must also be reported to the President of Bema.

Remediation methods and procedures that are employed, beyond securing the site immediately following a release, will be the responsibility of the General Manager. The on-site administration of actual remediation activities will be the responsibility of the Plant Superintendent.

Communications with applicable State and Federal agencies, beyond the initial release reporting, is the responsibility of the General Manager.

To limit the need for reporting, as outlined previously within this section, facility operations will be structured to facilitate safety within all site activities. The following sections outline the operations monitoring performed to identify releases, and the potential conditions that could cause a release.

8.5.6 Inventory Control

Inventory control will be performed principally on chemical products since petroleum materials are stored in above-ground tanks that have secondary containment and leaks will be evident if they occur. The chemical inventory will be performed through both materials balance accounting and visual inspection of chemical storage areas. Such inventory control facilitates evaluation of the consumptive use and identifies potential leaks within both the process and storage areas.

8.5.7 Facility Inspections

Various components of the Yarnell Project will be inspected on a routine basis. These inspections will be performed to identify conditions indicative of a release and those conditions which may be indicative of a pending release. Having these inspections performed will be the responsibility of the Plant Superintendent.

The actual inspections are performed by different personnel, as selected by the Plant Superintendent, on a rotating basis. This approach allows persons directly familiar with specific process components to inspect and become familiar with all areas of the facility. Further, it offers a continuous system of checks and balances on the effectiveness of the previous inspections by other personnel. The areas of inspection include the following:

- Chemical storage areas;
- petroleum storage areas;
- pregnant solution pond;
- plant area;
- warehouse;
- chemical tanks and pipelines;

In the event that a release is identified, an immediate response will be planned and the required notifications made as outlined elsewhere in this report. The following sections briefly identify the general procedures for performing the inspections on each component of the facility.

8.5.7.1 Chemical Storage Area Inspection

Inspection of chemical storage areas requires visual evaluation of the integrity of the containers, the presence of any leaks or residues indicative of a leak, and the integrity of containment berms.

If leaks, spills, or releases are identified, an immediate response program will be implemented using personnel with adequate health and safety training. These personnel will work to contain the release and subsequently remediate the area impacted by the release. Reporting and remediation of all spills will then be made in accordance with applicable requirements.

8.5.7.2 Petroleum Storage Inspection

The petroleum and waste oil storage areas will be inspected on a routine basis to determine if any leaks or spills have occurred. The visual inspection performed evaluates the integrity of the tanks or drums, the presence of any discolored soils that would indicate a leak, and the integrity of the containment system.

If a leak or a release is identified from the above ground storage tanks, an immediate reconciliation is required on the fuel delivery volume, documented usage, and the volume of fuel remaining in the tank. Spill remediation will then be performed in accordance with applicable requirements.

Releases of materials from within any of the carbon adsorption/acid washing process components will result in reporting and remediation as required.

8.5.7.3 Chemical Tanks and Pipelines

Within the process facility, various tanks are used to store chemicals used in the extraction process. These tanks are visually inspected on a weekly basis and the results recorded. The inspection performed includes evaluation of the tanks, valves, connections, piping, and pumps.

Spills from the chemical tanks and pipelines, and related process components will be reported and remediated as required.

8.5.7.4 Pregnant Solution Pond and Heap Leach Pad Liner

The pregnant solution and barren solution ponds will be constructed with a double-liner system with an integral leach detection system. Routinely the leak detection system will be checked, and if leakage is found, the ponds will be drained, the liner inspected, leaks located and repaired.

8.5.8 Work Zone Monitoring

Within various areas of the plant, work zone atmospheres may be subject to airborne contamination in excess of allowable workplace standards. These atmospheres will be monitored using Draeger tubes and Monotox personal hydrogen cyanide monitoring devices. Personnel equipped with these monitors include one in the assay laboratory and three process area personnel. In addition to these monitoring devices, personnel within the refining area operations and the assay laboratory will be subject to annual evaluation of bloodstream lead concentrations.

8.5.9 Environmental Monitoring

Environmental monitoring at the Yarnell Project will include evaluation of the soils, surface water, and ground water conditions at the site, as well as, wildlife monitoring. The environmental monitoring performed prior to construction will include hydrogeologic investigations that will be used to establish baseline ground water quality. Wildlife monitoring will be performed to assure that wildlife cannot access the ponds or other project areas.

8.5.10 Emergency Response Considerations

The emergency response considerations required in the event of a medical emergency or a chemical or petroleum release, necessitate the training of personnel to adequately respond to such emergencies. Such response includes notification of appropriate agencies, medical personnel, corporate administrators, and remediation groups. The following sections outline the procedures for notification and operational considerations required for emergencies.

8.5.11 Emergency Contacts

In the event of an emergency, communication should be made to appropriate parties as rapidly as possible. Such response should include systematic notification of medical, regulatory, and administrative personnel, based upon the type of emergency.

8.5.12 Emergency Notification

In the event of a chemical or petroleum release, reporting will be performed in accordance with applicable statutes. A protocol for the notification responsibilities will be generated and reviewed with all facility employees.

In addition to appropriate notifications in the event of medical emergencies, notifications will be made in the event of any chemical or petroleum releases in excess of reportable quantities or outside of the limits of the permit boundary.

The protocol for reporting spills or releases of petroleum products is any volume greater than 25-gallons. The protocol for reporting of chemical spills is any quantity in excess of that which is considered reportable to the National Response Center pursuant to the requirements of 40 CFR Part 302. Reporting is also required for any quantity of pollutants defined in NRS 445.178, hazardous waste as defined in NRS 459.430, or contaminants as defined in NRS 445.143 which is not listed in 40 CFR 302.4.

For the materials that will typically be present at the Yarnell Project, the reportable quantities for spills or releases under 40 CFR Part 302 are summarized on Table 8.4. A spill in excess of these quantities must be followed by notification of the appropriate agencies as soon as possible after the release occurs.

The agencies to notify in the event of a release include the following:

- Arizona Department of Environmental Quality/Emergency Response
- Environmental Protection Agency National Response Center (800) 424-8802

Notification of the above listed agencies should occur as soon as possible after the release but not later than the end of the first working day after the release occurs.

TABLE 8.4 Reportable Quantities for Spills

Material	RCRA Waste Number	Reportable Quantity
Petroleum Products		25 gals
Cyanide	P030	10 lbs
Hydrochloric Acid	N.A.	1,000 lbs
Sodium Hydroxide	N.A.	1,000 lbs
All Other Hazardous Materials	N.A.	100 lbs

Any releases in excess of the reportable quantities, or to off-site areas will be considered violations of the zero discharge status and will be remediated as soon as practicable. Reports prepared to summarize any such releases that will be issued to the agencies listed above will include at a minimum, the following information:

- Name, address, and telephone number of the owner or operator;
- Name, address, and telephone number of the facility;
- Date, time, and type of incident, site conditions, and circumstances of the release;
- Type and quantity of materials involved;
- Human and animal mortality or injury;
- An assessment of the actual or potential hazard to human health and the environment outside the facility;
- The estimated quantity and the proposed disposition of recovered waste material that resulted from the incident; and
- The on-going remedial activities being performed, if any remain at the time of reporting.

Following the notification prescribed above, a written summary of the information provided over the telephone will be submitted to the ADEQ within 10-days. This summary will include the information outlined above, as well as a description of the conditions at the time of the report and a summary of any on-going work being performed as part of remediation.

The written report will also include an outline of the measures to be taken to minimize the risks of any future occurrences. Also included with the report will be a description of the methods to be employed to augment existing monitoring of potential conditions that could create future releases. The focus of the monitoring will be on the following:

- Minimization of the potential magnitude of future releases;
- Minimization of releases that could impact State waters; and
- Minimization of the effects of potential releases on humans and wildlife.

8.5.13 Emergency Operations Protocols

In the event of a medical emergency, spill, or release, continued plant operation must be considered. These operations must consider the work place health and safety considerations, the potential for system failures or additional releases, and the potential applicability of source control measures to minimize the spread of contamination.

In the event evacuation of an area, or the entire plant is required, the personnel immediately at the scene will be responsible for securing the area in accordance with their level of safety training. The route of evacuation will be to upwind areas or through the main gate, as appropriate. Personnel will be schooled in the evacuation protocols and the types of responses which may be required. This schooling will include review of the levels of training required to respond to different types of emergencies.

Training of workers at the site will address the responses necessary in the event of tank or piping failures within any area of the process circuit. This training will also review the secondary containment provisions at the facility and the methods to prevent releases.

Under some circumstances, it may be appropriate to require the de-activation of power sources and closure of valves to prevent fluid losses. All such actions will be taken to prevent additional hazards while the situation is being addressed. In particular, actions must consider the potential for contact between reactive chemicals that are present at the facility.

In the event of releases of chemicals or petroleum products that are accompanied by injuries to workers, priority will be given to the injured personnel. Once these personnel have been removed from the incident area and the area secured, the environmental contamination will be immediately addressed as outlined in the following section.

8.5.14 Release Response

In the event of a spill or release of chemical or petroleum products at the Yarnell Project, immediate response to the conditions created will be provided following a generalized process. This process will allow evaluation of the conditions and implementation of remedial alternatives on a rapid basis. The following sections outline the process developed for spill or release response.

The remediation of releases at the Yarnell Project will be performed as rapidly as possible using applicable source control techniques. The techniques selected will depend upon the nature of the release and the implementability of the technology, as outlined within the following sections.

8.5.14.1 Release Response Preparation

To effectively respond to releases, protective gear for employees will be maintained at the site, as well as, materials necessary for remediation of potential spills. A summary of this equipment and materials is provided on Table 8.5. Personnel at the site will be trained in the proper use of response materials and equipment and the release response activities. This training will include the documentation necessary to record the events performed as part of remediation.

8.5.14.2 Petroleum Spill Remediation

In the event of a spill of petroleum products, the source control measures employed will include the application of absorbents to any free product, excavation and isolation of contaminated soils on a synthetically-lined pad, and landfarming of the contaminated soils to prescribed cleanup standards.

The absorbents used to contain free product spills will be stored within the plant area to allow ready access in the event of a release. The absorbents, if required, will be applied to the spill area only long enough to remove free product. The spent absorbents will then be drummed for proper disposal while the soils are excavated.

The excavated soils will be removed to an area provided with a synthetic liner. The lined area will be bermed to prevent runon and runoff from precipitation. The liner material will be covered with a thin layer of soil to allow mechanized spreading of the contaminated soils without risk to the integrity of the liner. The contaminated soils will be spread across the lined area in a manner which minimizes compaction. A maximum thickness of 1-foot of contaminated soils will be placed in each lift to prevent potential accumulation and migration of free product or leachate.

The contaminated soils, once placed, will be periodically tilled to enhance biologic activity and volatilization of aromatic compounds. The soils will be landfarmed until the soils reach the ADEQ required remediation standard. The mine owner reserves the right to ship the petroleum contaminated soil off-site to ADEQ approved thermal treatment contractor.

TABLE 8.5 Release Response Equipment and Materials

Equipment
Chemical resistant gloves Chemical resistant boots Chemical suits Aprons Safety glasses Hard hats Face shields Ear plugs First aid kits Eyewash and safety showers Self-contained breathing apparatus Cartridge Respirators Cyanide antidote kits
Materials
Petroleum Process piping and fittings Overpack drums Hydrogen peroxide Sodium Hypochlorite Synthetic liner

8.5.15 Chemical Spill Remediation

The potential for chemical spills at the facility is related to the use and storage of various chemical materials as summarized previously on Table 1. The types of materials present will require broadly different responses because of the reactivity of some of the chemicals.

In general, releases of solid products will be remediated by isolation and excavation of the spilled materials. Excavated materials will be contained until proper disposition can be implemented.

Spills of liquids will require separate consideration of the means to contain and treat the spilled materials. The liquids which may have the greatest potential of being released in various levels of dilution include the following:

- Cyanide;
- Hydrochloric acid; and
- Caustic solution.

The applicable remediation of spills containing these materials are outlined within the following sections.

Cyanide - Releases of free cyanide will be neutralized with hydrogen peroxide or sodium hypochlorite, as appropriate.

Hydrochloric Acid - Hydrochloric acid is stored within drums in a liquid form. Spills of nitric acid will be remediated through dilution with water to a stable pH value of greater than 4.

Caustic Solution - The caustic solution used at the Project will be stored in plastic drums in liquid form. Spills of this material will be accompanied by dilution with water to a stable pH value of less than 10.

8.5.15.1 Release Area Monitoring

Subsequent to any releases which may occur, monitoring will be performed to establish the adequacy of remediation and the degree of the impacts on the environment. Such monitoring may include evaluation of ground water, surface water, and air quality monitoring, and soils sampling and testing. The degree of monitoring will be determined in cooperation with the ADEQ to identify migration of any contaminants not contained, or to certify complete remediation.

8.5.15.2 Release Remediation Reporting

Upon completion of remedial activities, reports will be generated which provide a summary of the release, notifications, remediation, and monitoring. As noted within the previous section, these reports will include complete information pertaining to the type, extent, and remediation of the release. This information will be supplemented with a description of any recommended or required follow-up activities.

9.1 *Introduction*

The Mining and Minerals Policy Act of 1970 (30 U.S.C. 21a) established the policy for the Federal government relating to mining and mineral development. The Act states that it is policy to encourage the development of "economically sound and stable domestic mining, minerals, metal and mineral reclamation industries." The Act also states that the government should also promote the "development of methods for the disposal, control and reclamation of mineral waste products and the reclamation of mined land, to lessen any diverse impact of mineral extraction and processing upon the physical environment that may result from mining or mineral activities." The U.S. Department of the Interior Bureau of Land Management Solid Minerals Reclamation Handbook (H-3042-1) "provides consistent reclamation guidelines for all surface-disturbing activities conducted under the authorities and implementing regulations."

This reclamation plan outlines the plans for the Yarnell Project proposed gold mining project. The Project will consist of an open pit, heap leach facility, waste rock dumps, ore processing facility and mine facilities. This plan considers the requirements of the Bureau of Land Management and the Aquifer Protection Permit from the Arizona Department of Environmental Quality.

The reclamation plan focuses on the procedures involved in establishing a productive ecosystem through revegetation and wildlife habitat development and achieving visual compatibility with the surrounding landscape. It is intended as a working document and as a practical approach to reclamation in this area of hot desert with unpredictable rainfall. The approach and criteria recommended here will form the basis for construction and operational procedures for reclamation enhancement at mine closure.

9.2 *Reclamation Approach*

The reclamation approach used results from specific site evaluations and reclamation research from other mining projects in similar desert environment. This plan consists of two phases, decommissioning and reclamation. Decommissioning consists of closure of the facilities, removal of buildings and neutralizing the heap. Reclamation involves establishing stable surface and drainage conditions and reestablishing vegetation. During reclamation the concern for future public safety will be addressed through slope stability and removal and/or fencing of structures and landforms that could constitute a public hazard.

The revegetation standards will be based on a percentage of the vegetative cover present on both historically disturbed mining areas and corresponding undisturbed areas. This will be established from the vegetation study which will be submitted as a separate document.

9.3 *Topsoil Salvaging and Plant Salvaging*

As a result of the topsoil survey the areas with sufficient topsoil have been delineated. Prior to any construction or mining activity the topsoil will be removed and stockpiled. The stockpile will be maintained during the life of the project to minimize wind and rain erosion. In addition to topsoil, some inert mill tailings from previous mining activity will be stockpiled. The tailings were characterized as part of the geochemical program and are described in section 4.7 of this document. The tailings are a good source of fine-grained material that will help prevent erosion. The topsoil survey will be submitted as a separate document.

The mine will comply with the Arizona Native Plant Act by surveying areas prior to construction and salvaging and transplanting protected species. An area near the topsoil stockpile will be dedicated to plant nursery and will be maintained. When the mine goes into reclamation the plants will be re-planted.

The project site has one species of yucca, a nolina and several species of cacti protected by the Arizona Native Plant Law. The protected cacti found on the site include:

Yaccu baccata	Banana yucca
Nolina microcarpa	Sacahuista
Opuntia basilaria	Beavertail prickly pear
Opuntia chlorotica	Pancake pear
Opuntia phaeacantha var. *discata*	Engelmann prickly pear

There is no permit required to move the plants out of disturbance area and transfer them to another area on the project site, i.e. a nursery or undisturbed area.

9.4 *Suitability of Topsoil and Mine Waste Rock*

A soil survey of the site was performed and identified four soil horizons. The study concluded that the "Surface soils occurring in the study area are all moderately suitable for topsoil reclamation". The four horizons contain between four and thirty inches of suitable topsoil. Due to the compact size of the project all disturbed areas will be stripped of topsoil. Areas on steep slopes and in the boulder area on the northern boundary of the project will have selective soil stripping due to inaccessibility of equipment.

The topsoil will be stockpiled at the location shown on Figure 2.1. The stockpile will be built with 3:1 slopes or gentler and will be seeded with a rye grass mixture to minimize erosion.

Testing will be performed during the life of the mine to evaluate the suitability of rinsed heap materials and waste rock for revegetation. Varying thicknesses of topsoil will be tested to determine the most efficient soil depths.

9.5 *Interim Reclamation*

The compact nature of the project and the short six-year life span of the mine indicate that there will not be the opportunity for interim or staged reclamation. In addition, the harsh desert climate will not allow any substantial revegetation for short duration, temporary shut-downs. Therefore, interim reclamation will not be evaluated in this reclamation plan.

9.6 *Decommissioning of Facilities*

Decommissioning will consist of activities necessary to eliminate any ground water hazards; heap rinsing and detoxification, plant decommissioning, well abandonment, pond removal, etc. Figure 9.1 shows the site layout after reclamation activities.

9.6.1 Open Pit

The Yarnell Project consists of one open pit with 20 foot high benches. The pit has been designed with ultimate pit wall stability taken into account.

Flat benches that are accessible will be ripped and/or scarified to produce rough surfaces for the anchoring of any soil materials. Surface material will be left in a loose, cloddy condition to aid in moisture collection, decrease wind erosion losses, and encourage establishment of seedlings in small surface crevices.

Some small depressions will be left on the surfaces to aid in moisture retention. These areas will be used to seed native species and transplant selected native shrubs. In addition, over time some natural encroachment of native species adapted to rock outcrop habitats will occur in isolated groupings.

9.6.2 Mine Waste Rock Dumps

Two waste rock dumps are planned with the largest to the south of the pit and a smaller waste rock dump in the valley to the north of the pit. The south dump will be constructed on a side hill while the north pit will be constructed in a valley. Both waste rock dumps will have a total volume of approximately 12 million tons and a final stable slope of 2:1.

Mine waste rock dumps typically have two types of surfaces conditions. The first is loose end dumped undulating surfaces resulting from leaving mine waste rock in place without dozing or grading. The second is hard packed surfaces left from haul truck traffic. The loose areas will be scarified in the direction perpendicular to surface water runoff to minimize erosion. The dense packed areas on top of the dumps and on the access roads will be deeply ripped and scarified and graded to minimize erosion.

9.6.3 Heap Leach Facility

The Yarnell Project leach pad will ultimately have 1.4 million square feet of 60-mil thick single liner. Seven million tons of ore will be placed on the liner in ten 20 foot high lifts for a total height of 200 feet.

9.6.3.1 Neutralization of Heap

Once the leaching cycle is complete, the spent ore requires some type of treatment to decrease the concentration of process chemicals and constituents contained both in the interstitial pore water of the heap and on the surface of the spent ore. The residual cyanide level in the spent ore is the determining factor in terms of reaching an acceptable final waste classification. A number of methods for cyanide degradation and detoxification exist, ranging from passive abandonment (in which the cyanide in the heap is allowed to naturally degrade over time), to rinsing the heap with water (which speeds up the natural degradation process), to fairly intensive chemical treatment with agents such as hydrogen peroxide or bioremediation (which destroy cyanide more rapidly than do more "natural" treatments). A study will be performed during the life of the mine to evaluate the most efficient method to reduce the cyanide level to a target level of 0.2 parts per million weak acid dissociable (WAD) cyanide.

The study will recommend a spacing grid for sampling, sampling intervals and sampling procedures. It will also recommend the amount of time for recirculation of barren water, fresh water and any recommended chemical treatments.

At the end of the detoxification, most of the solution will have evaporated from the heaps and ponds. Pumping and sprinkling of pond water will continue until the minimum pumping depth is reached. The remaining solution will be allowed to evaporate, thus eliminating any discharge from the heap leach. Upon completion of the evaporation process, the sludge remaining in the ponds will be allowed to air dry to a semi-solid state, removed from the ponds and taken to an appropriate disposal or recycling facility.

Following the removal of sludge from the lined ponds, the liners will be freed from the liner anchor, folded in on themselves and covered with a minimum of 20 feet of fill material consisting primarily of waste rock or rinsed heap material. Final grading of the pond area will result in reestablishment of approximate pre-mining contours thus providing for natural drainage.

9.6.3.2 Recontouring and Revegetation

When neutralization of the heap is complete the heap will be recontoured to a stable 2:1 slope. The recontouring will be done in such a manner to leave small ledges and contours to be visually similar to natural surroundings and to minimize runoff. Small depressions will be left in the top of the heap to promote ponding of water and to slow runoff.

Due to the harsh climate at the site, revegetation will consist of placing the stockpiled top soil in areas with the best chances for plant survival. These areas are typically north facing slopes and tops of heaps where water has the chance to accumulate.

9.6.4 Facilities

Mine related facilities at the Yarnell Project will consist of a 3,600 square foot mine office, a 6,000 square foot processing plant with a small assay lab and a

6,000 square foot Maintenance Shop. Removal and salvage of these facilities will be routine. In addition, there will be blasting materials storage facility, aboveground fuel storage tanks and water tanks. After the facilities are salvaged and foundations are either removed or buried, the areas will be ripped to relieve compaction and graded to create a suitable seedbed and substrate conditions for revegetation. As with other disturbance areas, seeding and transplanting will be concentrated in drainages and small depressions.

9.6.5 Roads, Power Lines and Fences

After decisions have been made as to which roads will be abandoned and reclaimed, culverts will be removed and the roads will be graded for sloping and drainage re-establishment. Safety berms and ditches will be graded and filled to create contours that blend with the landscape. The compacted surfaces of the roads will be ripped, and water catchment basins established where possible.

Revegetation will be by direct seeding and by covering portions of the surface with soil as a seed source. Other roads on the Yarnell property will be reclaimed in conjunction with the mine dumps and pit areas.

All overhead power lines will be removed as part of the decommissioning of facilities. Any disturbance related to removal of the power lines will be regraded and provided with a source of seed, if necessary.

At the completion of reclamation, fencing will be left around areas where the BLM considers it beneficial to natural revegetation and/or in areas where the BLM chooses to block access in order to minimize hazards to public safety. The remaining fencing will be removed to re-establish public access to the site.

9.6.6 Final Reclamation

The layout and compact size of the project indicates that the vast majority of the reclamation will occur after the mine has stopped production. Small areas such as abandoned exploration roads and old haul roads may be reclaimed early as test plots but the major reclamation effort will occur once at the end of the mine life. The revegetation will be scheduled the late fall and winter to take advantage of the milder climate and potential of rain

9.6.6.1 Topsoil, Mulching and Seedbed Preparation

Topsoil from the stockpile will be spread in approximately four lifts on the accessible disturbed areas of the mine. The soil will be covered with a straw mulch at about 4000 pounds of mulch per acre. There will not be any need to add fertilizer to the seed mix or mulch

The grading of the tops of the heaps and waste rock dumps will be done to minimize erosion and enhance visual impact. Valleys and small mounds will be left to mimic the natural contours. Prior to placing any topsoil the disturbed areas will be ripped and disced. After the topsoil is placed and the seeds planted the areas will be mulched.

A seed mixture with a blend of perennial grasses, forbs, shrubs, a yucca and a nolina has been developed and is listed on Table 9.1. This diverse native mix has the greatest potential for quickly stabilizing and revegetating the Yarnell site. The seeds will be planted at the rate listed in the Seed Mix. Planting will take place in the fall or winter to take advantage of the potential for rain and the moderate temperatures. There will not be a need for fertilizing or watering the planted areas.

9.6.6.2 Grading, Stabilization and Drainage Control

Accessible pit benches will be ripped perpendicular to the slope or along the contour to allow rain to collect and if sufficient topsoil is available some topsoil replacement and re-seeding will be performed. Where accessible, overhangs and steep portions of the pit walls will be removed for better long-term stability and site safety.

The heaps will be ripped and graded after neutralization. Grading will be along the countour to slow surface runoff and allow rain to penetrate the heaps. The top of the heap will be graded to minimize erosion and to enhance visual impact. The top of the heap will be left with small mounds and valleys to mimic natural contours. Topsoil will be spread in optimum thickness and the top of the heap and suitable north faces will be planted with a seed drill.

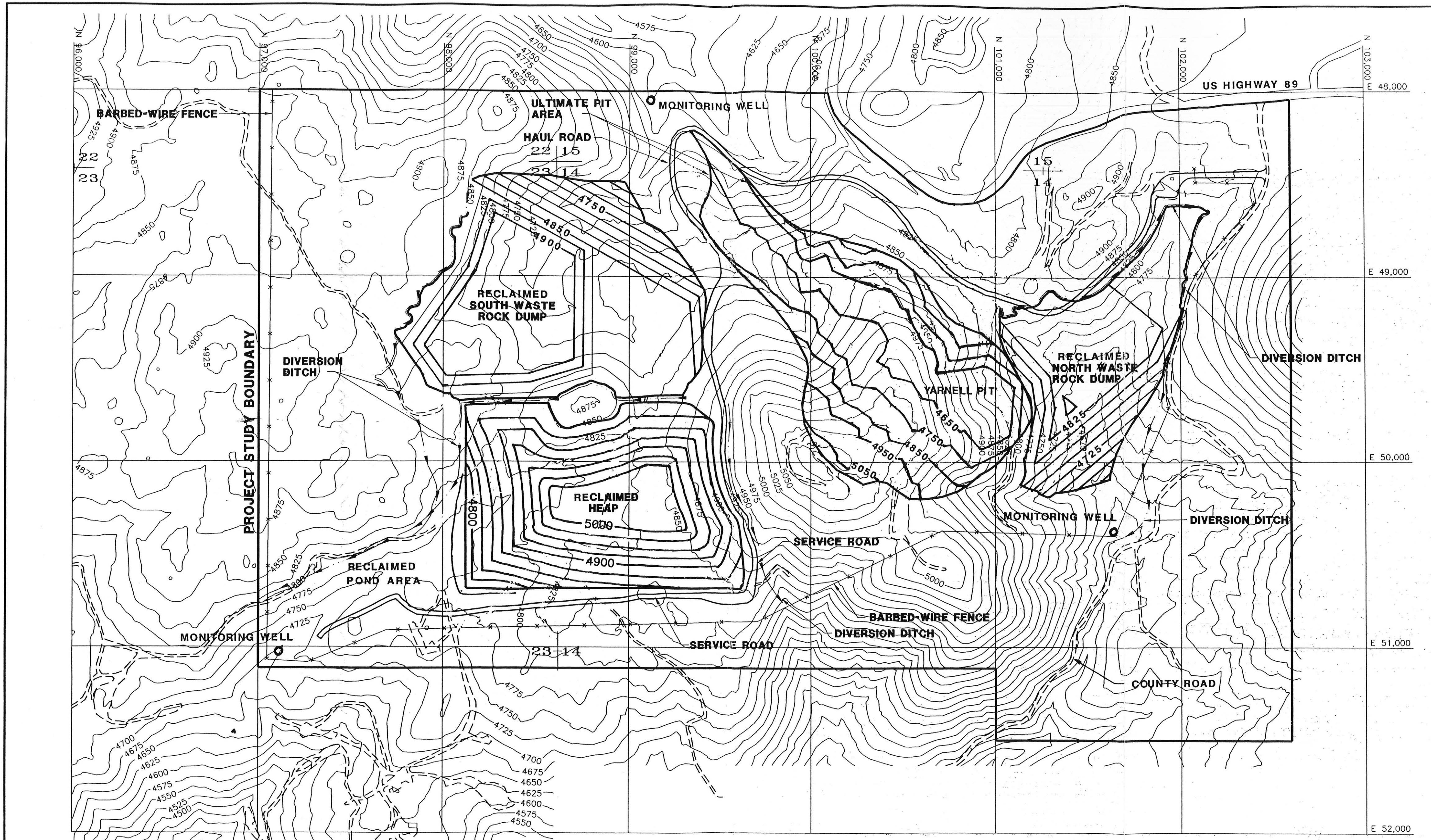
Revegetation of the waste rock dumps is similar to the heaps. The top of the dumps will require more ripping due to the compaction that results from truck traffic. The heaps will be graded away from the heap/valley contact to increase slope stability. The face of the waste rock dumps will be graded to minimize run-off and to enhance the visual impact.

TABLE 9.1
Seed Mix
Yarnell Project

Scientific Name	Common Name	Variety	Application Rate Pounds PLS/acre
Shrubs (seed 4-5)			
Acacia greggii	Catclaw acacia		1
Baccharis sarothoides	Desert broom		1/4
Cercocarpus montanus	Mountain mahogany		1
Eriogonum fasciculatum	Bush buckwheat		1/4
Gutierrezia sarothrae	Snakeweed		1/2
Rhus trilobata	Smooth sumac		1/2
Yuccas/Nolinas (seed both)			
Nolina microcarpa	Sacahuista		1/2
Yucca baccata	Banana yucca		1/2
Perennial Grasses (seed 6-8)			
Aristida purpurea	Purple three-awn		4
Bouteloua curtipendula	Sideoats grama	Niner	4
Bouteloua gracilis	Blue grama	Hachita	4
Eriogrostis intermedia	Lovegrass		1/2
Festuca arizonica	Arizona fescue	Redondo	4
Koeleria cristata	June grass		1/2
Muhlenbergia wrightii	Skike muhly	El Vado	3
Setaria macrostachya	Bristelgrass		3
Sitanion hystrix	Squirreltail		3
Sporobolus cryptandrus	Sand dropseed		1/2
Trichachane californica	Cottontop		4
Forbs (seed 3-4)			
Artemisia ludoviciana	Wormwood		1/16
Barleya multiradiata	Desert marigold		1/8
Cassia covesii	Desert senna		1/2
Eschscholtzia mexicana	Mexican gold poppy		1/2
Castilleja integra	Paintbrush		1/16
Sphaeralcea grassulariaefolia	Globemallow		1/2

Topsoil will be placed on the top of the dumps but may only be placed on suitable slopes, due to slope of the dumps, availability of topsoil and potential for revegetation. Seed will be planted by a seed drill on the top of the dump and accessible slopes.

Mine facilities, roads and power/water corridors will be ripped after foundations are removed. They will be graded to minimize erosion and to blend into the natural contours. All facilities, roads and corridors will have soil replaced and be reseeded.



YARNELL MINING COMPANY
A SUBSIDIARY OF BEMA GOLD (U.S.) INC.

YARNELL PROJECT
YAVAPAI COUNTY, ARIZONA

TITLE

FACILITIES LAYOUT
AFTER RECLAMATION

FIGURE

9.1

10.1 Construction Work Force and Schedule

Construction is scheduled to begin in March 1996, assuming timely receipt of permits and approvals. Facility construction is expected to take three months with YMC acting as the general contractor. Individual subcontracts would be awarded for site preparation, liner installation, crusher installation, process plant construction and buildings. Additionally, YMC would operate mining equipment as a combination pre-stripping/pad construction effort. Construction activities will employ a peak of approximately 100 workers.

10.2 Operations Work Force and Schedule

Operations are scheduled to begin in June 1996, following construction. As previously discussed in Section 1.4, Bema has experience operating low cost, low grade, medium tonnage gold-silver heap leaching operations. A team of suitably experienced management personnel (about 5-10 persons) will be assembled from existing company personnel and/or recruited from the mining industry in the western United States. All operations management and support staff will be on site. Table 10.1 shows average operations phase staffing on a department basis.

Arizona has a large and mature mining industry, from which experienced mining operators can be recruited. YMC would prefer to hire locally for a more stable, long-term workforce. The nearby communities of Yarnell, Congress, Wickenburg and Prescott provide excellent living conditions within a reasonable commute to the project site.

Experienced project staff will train employees. Equipment dealers and their agents will supplement training by providing operator and maintenance training programs.

TABLE 10.1 Manpower Requirements

Department	No. of Employees
Mining	45
Processing	17
Maintenance	15
Engineering	7
Administration	5
Total	89

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