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at 808 Mills Building,
El Paso, Texas,
June 1, 1935

Mr. H. V. Lyons,
Shoreham Building,
Washington, D. C.

Dear Sir:

Queen Mine
Mogollon Mining District
Catron County, New Mexico

In this I am reporting to you the results of my recent studies made of the Queen Mine at Mogollon, New Mexico, in which I recommend to you and your associates that you proceed during the next few months with an intensive campaign of development from which some considerable remuneration may be obtained.

SUMMARY

The Mogollon Mining District is located in the northern western edge of the Mogollon Mountains, where rugged topography and box canyons are conspicuous. The mountains are formed by an uplifted block of Tertiary extrusives, consisting of lavas, volcanic breccias, and tuffs, in which small amounts of water sorted materials occur, and in which andesitic rocks predominate over rhyolitic rocks. The district contains a large, complex system of normal faults, many of which run about N 65 W, and

two others run about N 20 E. The faults are the loci of veins of the near-surface type which are highly siliceous and silver-gold bearing. The mineralization contains early and late barren phases, respectively high in silica and calcite, which occur between ore-shoots and above and below them. Ore-shoots rarely extend below 6,100' or above 6,700'. Primary ores predominate. Non-commercial outcrops are the rule, so that much more ore may be found in the district by prospecting neglected stretches of veins.

The Queen Mine is located on the northern part of the Queen Vein, which strikes northerly and forms the eastern boundary of the district. Favorable results are said to be obtained from it now in its central and southern stretches. The property is well situated for tunnel development from Mineral Creek at an elevation below the bottoms of potential ore-shoots. The Queen Tunnel is about 840' long at an elevation of 6,050'. Encouraging stretches of ores have been found at the inner half of its length, which have improved upward with small raising and stoping. Only small areas on the vein should be unfavorable because of tuffs in the walls.

Small tonnages of possible and prospective ores are indicated near the workings. These might total more than 4,000 tons with gross assay values at present of about $11.50 per ton.

Speculative ores at more than 100' above the tunnel and above the present workings might amount to as much as 9,000 tons carrying even higher values. The outlook for ores in several hundred feet north of the workings is speculative but very good in probability. Far to the north and south the outlook for speculative ores in large tonnages is good, so that an extensive program of prospecting will probably be warranted eventually.

A general program for the property is based on the use for the next few months of the present facilities, properly repaired and equipped, for conducting an intensive campaign of development which should yield ores of amount and grade sufficient to secure from milling a high degree of remuneration.

The power plant should be repaired before July 1, 1935 at a cost not in excess of $1,500., and it should be operated thereafter at a monthly cost not in excess of $1,800.

Betterments and equipment for the mine before July 1, 1935 should not cost more than $6,800. Its operation at maximum capacity during July, August, and September, including small items of equipment and supply, should not cost more than $19,000., which might be kept down to $17,000. This work in the mine should open up an "A" level 750' long, a "B" level 325' long, a few connecting supply raises, and smaller raises and stopes. It is obvious that, aside from the main levels, work should be concentrated when possible in the richest ores. The Queen Tunnel should not be driven farther unless demonstrably warranted by ore findings or transportation needs.

The mill should start operating as early as possible in August, on a basis of 75-tons daily and for periods as short as 10 days twice monthly. It should extract 90% of the gross assay value of the ores, of which 66% should return to the property as a net money recovery from the shipments of bullion from the cyanide process. Initial repairs to the mill should not cost more than $1,600. The operation of the mill up to Oct. 1, 1935 should not cost more than $7,450., and it may be possible to do it for much less, as low as $6,000.

The charges for General Labor, General Salaries, and General Expense will be high, probably aggregating $3,000. monthly, so that it will be desirable to get maximum work done in other departments of the property while these inescapable expenditures continue.

It is estimated that the program up to Oct. 1, 1935 should be executed for a total expenditure of $50,000., and that ores milled should return as much as $28,000., an amount to be striven for. If this can be done, the operations, including development, should become self-liquidating at or slightly later than Aug. 15, 1935. These operations should attain an average production of 80-tons daily.

After Oct. 1, 1935 it may prove advisable to add power, air, and mine equipment so that the mill can operate continuously at a rate of 90-tons daily. This could be done in steps at costs ranging from $18,000. minimum to $45,000. maximum. The matter should be studied further during the course of the present program, and suitable financing arranged.

The property has a good prospective outlook and its development is recommended.

I N T R O D U C T I O N

This section of the report is designed to give general information about the district and property, including locations, topography, climate, vegetation, water supply, transportation and supply, and acknowledgments.

LOCATION

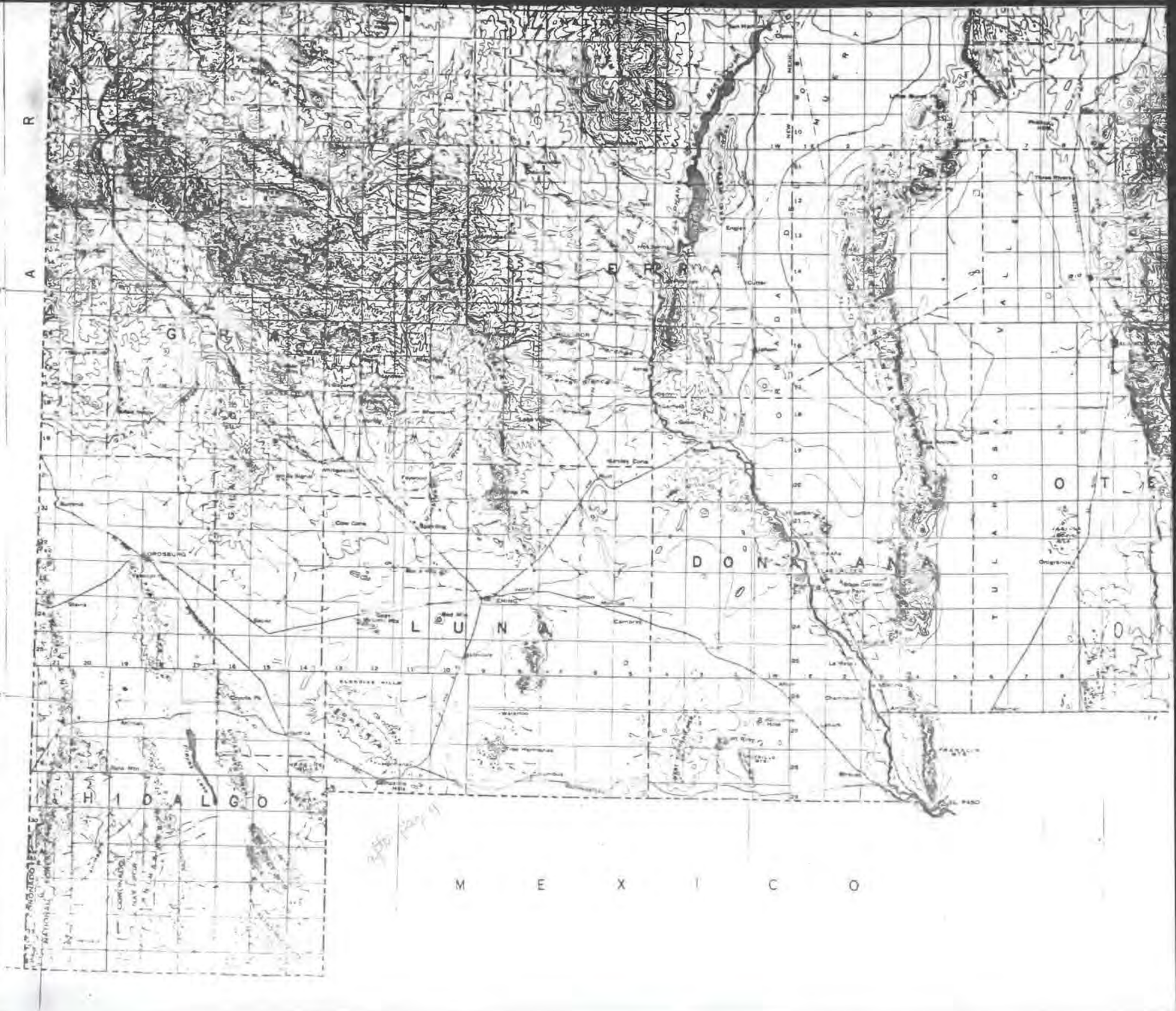
The Mogollon (or Cooney) Mining District is located, as shown on Drawing (1), in the extreme western part of Southern New Mexico, about 53. miles northwesterly from Silver City, at about 33°-24'N, 108°-48'W, in Range 10 South Township 19 West. It is also in southern Catron County whose seat is at Reserve.

The common name for the district is Mogollon (pronounced Mo-go-yohń), although in parts and for certain purposes it is also known as Cooney, from its discoverer. The name Mogollon may be derived from that of a Spanish-Colonial governor, or from a word for mistletoe.

The history of the district is described generally hereinafter, under Ore Deposits, in the section devoted to Geology of the District.

Queen Mine Location

The location of the principal properties of the Queen Mine is shown on Drawing (2). They will be seen to lie in the northeastern part of the district, principally forming a strip of seven claims along the eastern boundary of the district.


SIERRA
GRANT
DONA ANA
LUNA
HIDALGO
OTERO
MEXICO

Mineral Creek and Silver Creek cut deep, narrow box canyons in the district, which are more accentuated to the west until the western, bounding, fault-scarp is reached. They lie respectively at elevations above sea-level of from 5,600' to 5,900' and from 6,100' to 6,550'. Between them, ridges lie at elevations of 6,800' to 7,400', increasing in elevation to the east; while to the south of the latter the ridges go up to 7,500'. To the north of Mineral Creek ridges and plateaus are common between 6,800' and 7,000'. The first thousand feet from the centers of drainage are very steep, the slopes averaging 40° or more, rugged cliffs being included.

CLIMATE AND VEGETATION

In general, the climate is semi-arid, but vegetation such as scrub-oak is found on the ridges. In the main mountain mass east of the district, where snowfall is considerable, there is a good amount of pine forest.

Near the mines, in addition to a small snowfall, a small amount of rain is precipitated. The dryest months are usually the few prior to July. The bulk of the rain is precipitated torrentially during the summer.

The water supply for all purposes at the Queen Mine may be obtained from Mineral Creek, which only rarely dries up completely at that point. In conjunction with the possible development of a permitted water site at several thousand feet farther east, this source of water should be dependably ample.

TRANSPORTATION AND SUPPLY

The central supply points for the district are El Paso, Texas and Silver City, New Mexico. The former is a center of good roads, railroads, and bus and truck lines. Silver City is also amply served by a railroad, a bus line, and truck lines. Airplane service centers at El Paso and Albuquerque.

A main modern highway runs northwestly from Silver City to Reserve and beyond into northern Arizona. From Silver City this route runs westerly across some rolling country for less than a dozen miles to meet the Mango of the Gila River drainage, down which it runs to cross the latter at about 25 miles, near Cliff and Gila. Thence it runs up Duck Creek drainage for about an equal distance to cross a divide over into the San Francisco drainage. From there to Glenwood, a total of about 62 miles, the road keeps to the east of the river, having many curves and reasonable grades as it crosses tributaries from the east. From Glenwood to the crossing of Mineral Creek above Alma is about 6 miles. The branch road to the Queen Mines runs about another six miles up Mineral Creek, through Cooney Box Canyon, where it is very difficult of maintenance in many places.

Transportation to the district from Silver City was often difficult at times in the past, because of former means of transport, poor roads, unbridged flooded rivers, etc. This has been largely cured now by modern roads and trucks, so that truck freights are contracted for at $6. per ton.

There is a chance that the road to the Queen Mine will be improved further by the continuation of a Public Works project

on a road which would run on a ridge between Deep and Copper Creeks to drop into the latter near the Queen Vein and thence to proceed across to Mineral Creek.

ACKNOWLEDGMENTS

During the course of the examination the writer was assisted by several others, as follows: Mr. E. H. Hale, on general subjects; Mr. J. A. McCaskell, on mine sampling and cost estimates; Mr. R. H. Crmsbee, on field work, maps, sections, and general subjects; Professor John F. Graham, on milling; and Mr. R. E. Huthsteiner, on power. The reports by Graham and Huthsteiner are made part of this. Other information has been used freely and in part.

Free use has also been made of parts of publications on the district, especially that of Henry G. Ferguson, The Geology and Ore Deposits of the Mogollon Mining District, New Mexico, being Bulletin 767 of the U. S. Geological Survey. Ferguson gives a bibliography of the district, one important paper being that of S. J. Kidder, A. I. M. & M. E., Transactions, Vol. 72, 1925, pp. 529—548.

GEOLOGY OF DISTRICT

Details of geology of the Mogollon District show certain outstanding generalities. It is a region of thick effusive rocks of the Tertiary, which consist of flat-lying lava flows, volcanic breccias, and tuffs; with sorted and sedimentary rocks occurring in intervals of eruption. These were cut by a complex system of large normal faults, of which there are two, major, northerly striking ones. The Queen is the eastern one of these, and forms the eastern border of the district. The veins were deposited in the fault zones, and near the surface, so they show structures with much splitting, branching and linking. The Queen Vein dips steeply, more than 72°, to the east. Being near the surface, the veins were mineralized with highly siliceous, silver-gold bearing, material which was deposited under low conditions of temperature and pressure. The mineralization contained contemporaneous phases of higher temperature, fine grained silica, and lower temperature calcitic material, both of which are non-commercial. So, the ores occur in shoots of quartz, with small proportions of sulphides, which is only slightly calcitic and which has a granular or "granitic" texture.

The shoots have often had longer horizontal than vertical dimensions, and large proportions of vein area in the strongest veins have been of shoots. The general bottom of

shoots may be expected at 6100' or above, more commonly 6300'. It is likely that 6600' will be an upward limit, with 6000' being the more common general one.

Large tonnages of ores have been found beneath poor outcrops, the shoots generally being some hundreds of feet away from the center of canyons and a few hundred feet beneath surface.

It is believed that careful studies and intelligent prospecting will develop considerable tonnages in the district in the future. Its outlook is good. Good results are said to be now being obtained by such methods at the Bright property (Queen Vein north of Fanney in Fanney ground) and at the Deadwood; and similarly important results should be expected at the Queen Mine.

ROCK FORMATIONS

The following table shows the relative occurrence of the principal formations in the Mogollon District. The generalities have been copied from Ferguson and show the oldest rocks at the bottom. Thicknesses observed in the neighborhood of the Queen Mine have been noted.

It should be noted that, as would be expected from the origin of the series, many formations vary suddenly in thickness and character within short distances in the District. This is especially well shown in the rapid thinning to the north and west of the Deadwood Gulch rhyolite tuff and of the Fanney rhyolite, and of the change of the latter to tuff to the

north of Mineral Creek. It should also be borne in mind that considerable intervals of time intervened between various effusions, during which erosion and sorting of exposed formations occurred.

The oldest rock exposed in the neighborhood of the Queen Mine is the Mineral Creek andesite. Mineral Creek lies at this point below a probable bottom of commercial ore deposits, so that older formations are not exposed at the surface near the Queen Mine and are marked absent in the table. The table is followed by some remarks as to local characteristics of the formations present.

Table of Formations in Mogollon District
(Modified from Ferguson)
(from young to old)

	(Ferguson) Feet	(Local at Queen Mine) Feet
Pliocene or Pleistocene:		
Gila conglomerate (loosely consolidated gravel)	700 plus	absent
Basalt dikes (probably contemporaneous with the Gila conglomerate)		absent
Tertiary:		
Mineral-bearing veins		
Intrusive andesite and diabase		absent
Dog Gulch formation (conglomerate and sandstone with a few lenses of red shale)	400 plus	Thin Remnant

	(Ferguson) Feet	(Local at Queen Mine) Feet
Tertiary: (Cont'd)		
Mogollon andesite (including one or more dacite flows)	600	450
Deadwood Gulch rhyolite tuff	400	50' to 200'
Rhyolite dike (possibly contemporaneous with Deadwood Gulch rhyolite tuff)		absent
Last Chance andesite (flows, breccias, agglomerates, and tuffs)	600	600
Fanney rhyolite (tuff north of Mineral Creek)	1,200	25
Mineral Creek andesite (latite) (flows, breccias, agglomerates, and tuffs)	700	700
Pacific quartz latite (flows in upper part of Cranktown sandstone)	700	absent
Houston andesite (single flow near base of Cranktown sandstone)	40	absent
Cranktown sandstone	500	absent
Cponey quartz latite (flows and tuffs)	1,400	absent
Whitewater Creek rhyolite	700 plus	absent

Mineral Creek Andesite 700'

The Mineral Creek Andesite lies in the foot of and between components of the Queen Vein Zone, near Mineral Creek. Although underlying formations are not exposed to the east of the Twig Vein, it is likely that nearly all of the formation is

exposed, including red-purplish arkose near the base. The formation is composed of thin andesitic flows alternating with beds of volcanic breccia. The flows generally show a well developed amygdaloidal structure. The formation is topped by red-purplish arkose sandstone.

Fanney Rhyolite 25'

This formation, which attains great thicknesses to the south of Mineral Creek and west of the Queen Vein, changes suddenly to a tuff to the north of Mineral Creek and near the Queen Mine, where it does not exceed 25' in thickness. In this neighborhood it forms a conspicuous marking formation because of its white color.

Last Chance Andesite 600' ?

East of the Queen Vein Zone the Last Chance andesite is exposed for a short distance to the north of and a considerable distance to the south of Mineral Creek, patches of the underlying Fanney rhyolite being exposed in the creek bottom. To the west of, and within, the Queen Vein Zone the formation occurs from the neighborhood of the headwaters of King Gulch to about half way south to Mineral Creek. The formation consists of numerous thin flows alternating with volcanic breccias. Tuffs occur occasionally. In places reworked sandstone occurs. The top occurs at about 6150' on the east and at 6750' on the west, which give a rough measure, 500' or more, of the vertical displacement caused by the Queen Vein Zone.

Deadwood Gulch Rhyolite Tuff 50' to 200'

Although elsewhere in the district the Deadwood Gulch rhyolite tuff reaches considerable thicknesses, up to 400', it is much thinner in the neighborhood of the Queen Mine, near where it varies rapidly in thickness. To the east of the Queen Vein near Mineral Creek this formation attains thicknesses of 200', showing a tendency to thin rapidly to the north. This thinning also applies westerly, the formation being only about 50' thick to the west of the Queen Vein north of Mineral Creek. The formation forms a convenient marker because of its conspicuous white color. At the top there is a thin layer of red sandstone. Near the Queen Mine the formation has been highly silicified, forming the high conspicuous reddish white bluffs above the footwall vein from the Queen Tunnel north to the Apache claim.

Mogollon Andesite plus 450'

On the east side of the Queen Vein the Mogollon andesite is the dominant rock northward from the vicinity of the Air Shaft or Raise No. 1. On the west side it occurs largely on the surface northward from the vicinity of the headwaters of King Gulch. In the former case it has a thickness in excess of 450', possibly reaching 600'; and in the latter in excess of 500'. The formation is composed of a large proportion of flows, and includes a few coarse breccia beds of considerable thickness. There is a thin bed of sandstone at about 40' above the bottom and breccia is conspicuous at about 400' up. Tuffs seem to be scarce.

Dog Gulch Formation (Remnant)

North of Mineral Creek along the Eastern and principal component of the Queen Vein Zone a remnant of the Dog Gulch formation occurs at the highest point on the Victoria claim. As seen there it is undoubtedly the bottom conglomerate member of the formation, consisting largely of large sub-angular pebbles of andesitic rocks.

STRUCTURE

Except for the important fault and vein zones the structure of the district is relatively simple.

Attitudes of Rocks

In the neighborhood of the Queen Mine the effusive formations have general easterly strikes with flat dips, 5° to 10°, to the north.

Faulting

In general the district is characterized by complex normal faulting, being crisscrossed by many of them of varying degrees of magnitude. The faulting occurred in two periods, the earlier having been extensive and having served to furnish channels for mineralizing solutions at about the same time.

Earlier Faulting

The bulk of the earlier faulting was later than the Dog Gulch formation, earlier than the Gila conglomerate, and was probably late Miocene in age. There are a few large faults

striking slightly east of north, and in the central part of the district many which strike north of west. As Ferguson points out further, since they are usually the loci of mineralization the faults can be readily seen and traced by prospect workings and vein outcrops. In certain places markers of tuff beds and cross-sectioning by deep canyons assist greatly. Probably only a small amount of tilting of the fault blocks was effected.

The Queen Vein Zone is located on the most persistent and most easterly of the northerly striking faults. Within the zone the displacements may be many in detail. This vein and fault zone dips steeply to the east, 72° to 85°. Near its northerly end, near the Queen Mine, the faulting caused a vertical displacement of about 500'; but in the center of the district and southerly therefrom it was much greater, or about 1,000'. Faults branching westerly from the Queen are common in the center of the district; but they, and such veins, are neither common nor large in the neighborhood of the Queen Mine.

Later Faulting

The later faulting occurred principally near the western border of the district, where it developed the western scarp of the range at its precipitous rise from the mesa above the San Francisco River. The uplift of the mountain mass to the east was probably about 2,000'. This caused the later development of the box canyons near the western edge of the district. In the western part the movement also caused walls and gouges along veins.

ORE DEPOSITS

History

The modern discovery of the district was made by Sgt. James Cooney, 8th Cav., during scouting and later in 1875. Shipments began in 1879. Cooney was killed by Apaches in 1880. Following expulsion of the Indians continuous mining began in 1885. The region has always been a refuge for some lawless people, such traditions being found still among some of the lower grade inhabitants.

The district is said to have produced $5,000,000 prior to 1905, of which the bulk is supposed to have come from a few rich outcrops and from the Cooney coppery silver-gold ores. The application of the cyanide process extended the operations as to areas and lower grade ores. The following table shows some salient points regarding more recent production from the district.

Partial Production from Mogollon District

Yrs. Inclus.	Tons	Gold Oz.	Per Ton	Silver Oz.	Per Ton	Ratio
1904-1910	157,588	46,222.	0.29	2,130,883	13.6	46 to 1
1911-1917	805,344	172,303.	0.21	7,909,473	9.8	46 to 1
1918-1925	424,350	61,811.	0.15	3,114,885	7.3	50 to 1

Beside the cyanide process, Diesel and electric power units played an important role in production after 1910. Costs were high, especially those due to transportation and power. So, in spite

of high silver prices near the end of the World War, lower grade ores having been encountered, tonnages had to be reduced and costs increased considerably. Silver to gold weights in commercial ores in the Queen Mine should give a ratio of about 28 to 1.

Form and Structure

The veins of the district are generally located along faults. Of these the Queen is very large and persistent; and it is the easterly of two major northerly systems, forming an eastern boundary of the district. I believe that the Queen Vein has received too little attention in the past. It has been worked somewhat near the important west-branching veins, between the Deadwood and the Fanney Mines. During the past two years Mr. Ira Wright has been obtaining favorable results on the Queen Vein at about 1200' north of the Fanney. It is also said that the Deadwood now proposes to do considerable work on the Queen Vein in its ground, where it is supposed to have some little ore blocked out.

Nearly all of the mineralization in the district is of the same general type, of highly siliceous material carrying small values in silver and gold, with rare exceptions the base metals being of little or no consequence commercially. I believe that the commercial ores were deposited at no great depth and within narrow ranges of temperature and pressure. They show the textures and structures which are commonly associated with siliceous, near-surface, veins in Tertiary

lavas. It is believed that mineralization in all the veins occurred at nearly the same time, because merging of banding and other textures has been observed at junctions, and because it has been impossible to find any sharp changes in any variances of mineralization.

The veins have shown complex minor structures, especially near junctions and splits, consisting of the linking of small veins between larger ones, along minor faults of readjustment. This can be seen clearly on the surface above the Queen Tunnel, as shown on its surface map.

The veins form well-defined, prominent outcrops with a pronounced topographic expression. This is due to outstanding walls of quartz and high silicification, especially in tuffs. Irrespective of commercial values the veins have shown a high degree of continuity in many mines. It has also been common to find productive thicknesses of from 3' to 10'.

Because of their deposition at no great depth the veins have structures common to near-surface veins. At the present surface one sees a large number of splits, the junctions involved occupying a considerable proportion of the total lengths. Junctions with branching veins are similarly numerous. As is common with this type the veins also show a strong tendency to branch upward.

Minerals

The veins in the district contain minerals and their varieties which are known to be commonly associated with those

deposited near the surface at the time of deposition and under low temperatures and pressures.

Nonmetallic Minerals

The bulk of the minerals are nonmetallic in character. Varieties of quartz and silica predominate, including: small crystals; granular aggregates; banded arrangements; porcelain-like or chalcedonic; and hackly lamellar, probably replacing calcite.

The amount of calcite in veins is large, especially in non-productive portions. It also occurs banded, in places with small quantities of dark manganiferous minerals. Although the proportions vary, greater or less amounts of calcite are present even in ore shoots.

Fluorite is usually greenish in hue, and associated commonly with calcite and quartz intergrowths. It is not commonly found in ore shoots.

Adularia occurs sparcely and with the granular quartz of ore shoots.

Chlorite occurs sometimes with quartz in veinlets branching into the wall rocks, but is present principally as an alteration product in the rocks themselves.

Metallic Minerals

The metallic minerals common to the district in the usual, siliceous, silver-gold veins occur in very small amounts. In the order of decreasing abundance they are believed to be pyrite, FeS_2, chalcopyrite, $CuFeS_2$, galena, PbS, sphalerite, ZnS, argentite, Ag_2S, and stromeyerite, $(Ag, Cu)_2S$. Native silver has been reported as occurring occasionally as a supergene mineral. Pyrite has a wide range

of occurrence in both productive and nonproductive portions as well as in wall rock alteration. The others are associated principally with productive material, especially granular quartz. At the Queen Mine the important metallic minerals seem to be pyrite, and probably argentite. The latter is probably the mineral which shows bluish gray tints in bands and clouds in productive quartz. It is probably very fine in size, small in amount, and many have been deposited as a colloidal mixture with the quartz.

The old Cooney Mine is believed to have contained largely an exceptional phase of the preceding, having produced considerable amounts of copper. It is believed to have contained not only the preceding minerals but also large amounts of chalcopyrite, bornite, chalcocite, and some tetrahedrite. Some pyrargyrite has been reported in concentrates. The amount of calcite was also relatively large for a productive area. Similar mineralization, but weaker, should be expected in the northerly extensions of the Twig Vein from the Cooney Mine.

Paragenesis

The generalities of mineralization, just indicated above, vary considerably in detail from place to place. In the predominant veins the phases of approximately the same age seem to vary from old to young as follows:

(1) fine, porcelain-like quartz, to finely crystalline quartz, with only rare sulphides;

(2) crystalline, drusy, granular quartz, with only minor calcite, showing banded or "granitic" texture, with sulphides locally and relatively abundant;

(3) crystalline quartz, with more calcite, with fluorite relatively abundant, and with rare sulphides;

(4) manganiferous calcite, with only subordinate quartz.

As noted (1) is probably earlier than (2), the latter furnishing commercial ores. In the latter the quartz varies in size of grain, but usually shows comby, banded, and interlocking textures.

Wall rock inclusions in the veins act as nuclei for the banding of quartz and sulphides if they remain unreplaced by quartz.

(2) grades imperceptibly to (3) which shows banded texture in the more abundant calcite and fluorite.

Ore Shoots

Experience in the district shows that the veins have well-defined, hard walls, which stand well over long periods, so that shrinkage stopes may be used.

The best values have been found along the walls, especially along the footwall.

In the largest mines, such as the Last Chance-Confidence and the Fanney, it was found that the shoots were from 300' to 600' high and from 300' to 600' long. In the Last Chance-Confidence the principal production came from between the Tunnel and 500' below it, in which height, with a length of more than 5,000', one-half of the area was in ore shoots. From this it will be seen that, although the horizontal extent was great, the shoots were shallow and limited vertically. While the occurrences of shoots has been somewhat erratic it is well known that they

have been closely connected along the veins with swells, splits, and junctions of all sizes. In depth the shoots have not been known to change markedly in the bulk of minerals concerned, but rather have graded downward into commercially valueless material. The ores have extended down somewhat in small roots or wedges. The change in value downward is probably due to attaining a depth below which the delicate silver minerals could not precipitate because of too high temperature. Pyrite and small gold values should persist slightly deeper.

Outcrops

In the Last Chance-Confidence important ore shoots were found down to the 500' Level which is 850' below the outcrop. In the Fanney the shoots persisted to the 900' Level which is 1500' below the outcrop. The outcrop of the latter is about 300' lower than that of the former.

In the case of the Fanney a long stretch of productive vein nearly reached the surface. But, in the case of the Last Chance-Confidence very important shoots occurred with their tops a few hundred feet below the outcrop. Lately, in the case of both the Wright and Deadwood workings, important ore shoots are said to be found beneath barren outcrops. I believe that no reliance may be placed on surface assays, and that rather the district will develop many additional shoots below barren outcrops. To determine the best chances for this, studies and considerations will have to be made as to vein structures, textures, and minerals, as exposed at the surface.

In considering outcrops and longitudinal projections of veins certain important points should be borne in mind. It is likely that the details of the present topography were largely caused by the pre-existent veins, their shoots, and the relative resistance offered by the proportions of calcite and quartz present. It has already been demonstrated that the Queen Vein is soft and contains the calcitic non-commercial phase for considerable stretches to the north and south of its cutting by Mineral Creek. It also seems likely that shoots occur in veins under the central and higher parts of ridges transverse to the veins. It is also likely true that the upward and flanking extensions of the shoots contain softer and less valuable phases of the mineralization. Consequently strength of outcrop being sufficient, we should expect to find important shoots at some distance from large transverse streams and valleys; under the stronger ridges; and, with present conditions of late and shallow erosion, at some few hundred feet below the surface.

Effect of Wall Rocks

The wall rocks have almost certainly no chemical effect on the deposition of the veins or their shoots.

They may, however, have had an important physical effect on the development of the pre-mineral faults. This would not be pronounced unless both walls were of the same lithologic and textural character. Rhyolite would develop sharper, thinner fractures, with less wall rock in the vein than andesite. Andesite flows would disperse the fracturing effect less than andesitic breccias; but the latter would

permit the formation of wider veins. Tuffs (derived from fine ash beds) would tend to disperse greatly the pre-mineral fractures, probably to an extent that would make subsequent mineralization commercially valueless, although the zone of alteration and silicification would be large and prominent.

But in nearly all cases the faulting has been so great that entirely separate formations occur along the veins. In some places tuffs of one formation may have been thrown opposite those of another, which would probably give poor veins. If tuff occurs in one wall, especially the hanging the mineralization should be expected to be dispersed and poor. As will be seen later this possibility would occur in only few places in the Queen Mine.

Origin and Depth

As already noted, the veins were deposited in large, persistent, normal, open faults; and although all the mineralization occurred at about the same time there were earlier and later noncommercial phases of it. The juices were probably the end phase effluvia of the vulcanism which extruded the country rocks and they were derived from the same deep seated source.

Water Level

The mines of the district are dry, and the depth of the ground water level is not definitely known. It seems likely that the Queen Vein, marking the eastern limit of the district, acts as a natural dam to hold back the underground waters from the higher country to the east. The rough topography of the district and the widely spaced torrential rainfalls result in

high run-off, so that the local precipitation does not penetrate downward in large amount.

Oxidation

Because of these limitations surface waters have caused only slight oxidation of the ores. Their permeation has also been hindered by tight and barren outcrops. Small amounts of oxidation products have been found at all depths, but have been restricted to certain favorable localities near local fractures and junctions.

Vertical Ranges

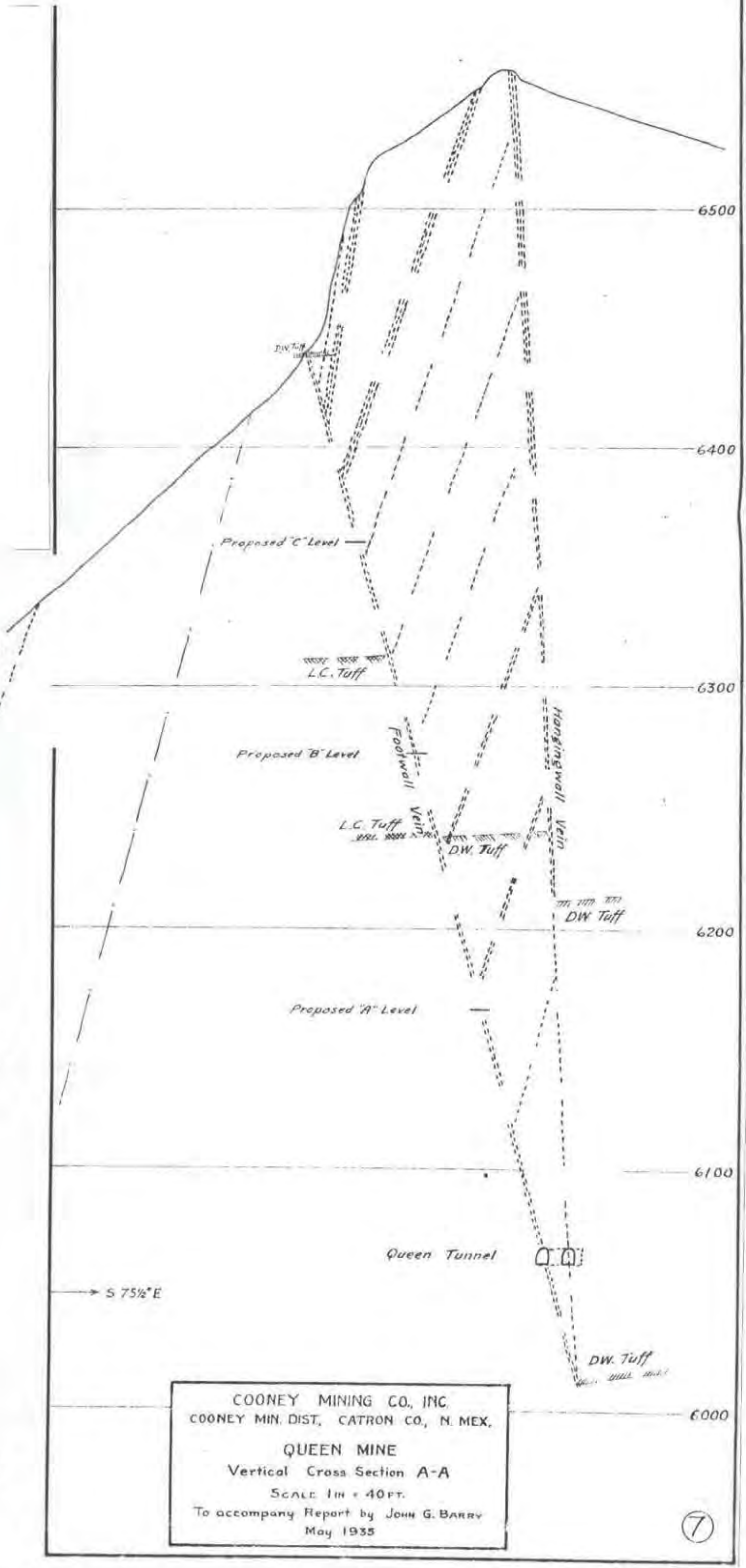
Supergene or secondary sulphide enrichment is not known to have existed in any amount worthy of note. Changes in the original, upward, or hypogene, mineralization are however of very great importance. In the central part of the district there is said to be at the ends and bottoms of shoots a sharp falling off in silver contents from 8. to 5. ounces. At the Queen Mine, however, this seems to be considerably more gradual; and it is commercially important that the gold ratio there is also considerably greater. In depth the shoots should die out in short, rather deep, roots or wedges.

With respect to elevations above sea level knowledge of the vertical limits of ore shoots is shown in the following table:

MINING PROGRAM, SUMMARY OF ALL EXPENDITURES

1938 Period	Equipment Max.	Equipment Min.	Equipment Cumulative Max.	Equipment Cumulative Min.	OPERATIONS Max.	OPERATIONS Min.	OPERATIONS Cumulative Max	OPERATIONS Cumulative Min.	TOTALS Max.	TOTALS Min.	TOTALS Cumulative Max.	TOTALS Cumulative Min.
Before 7/1	6,800.	4,835.	6,800.	4,835.					6,800.	4,835.	6,800.	4,835.
7/1 - 8/15					9,000.	6,800.	9,000.	6,800.	9,000.	6,800.	15,800.	11,635.
8/15 - 10/1	2,000.	1,350.	8,800.	6,185.	8,000.	6,800.	17,000.	13,700.	10,000.	7,850.	25,800.	19,835.
After 10/1	7,000.	4,700.	15,800	10,885.					7,000.	4,700.	32,800.	23,035.

'CLAIM MAP OF THE MOGOLLON DISTRICT



COONEY MINING CO., INC.
COONEY MIN. DIST., CATRON CO., N. MEX.

QUEEN MINE
Vertical Cross Section A-A
Scale 1 in = 40 ft.
To accompany Report by John G. Barry
May 1935

(7)

6500

D.W. Tuff

6400

L.C Tuff

6300

Proposed "B" Level

L.C. Tuff

Footwall Vein

D.W. Tuff

Hangingwall Vein

D.W. Tuff

6200

Proposed "A" Level

No 4 Raise

6100

Nos 4 & 5 Stopes

S 76½° E

Queen Tunnel

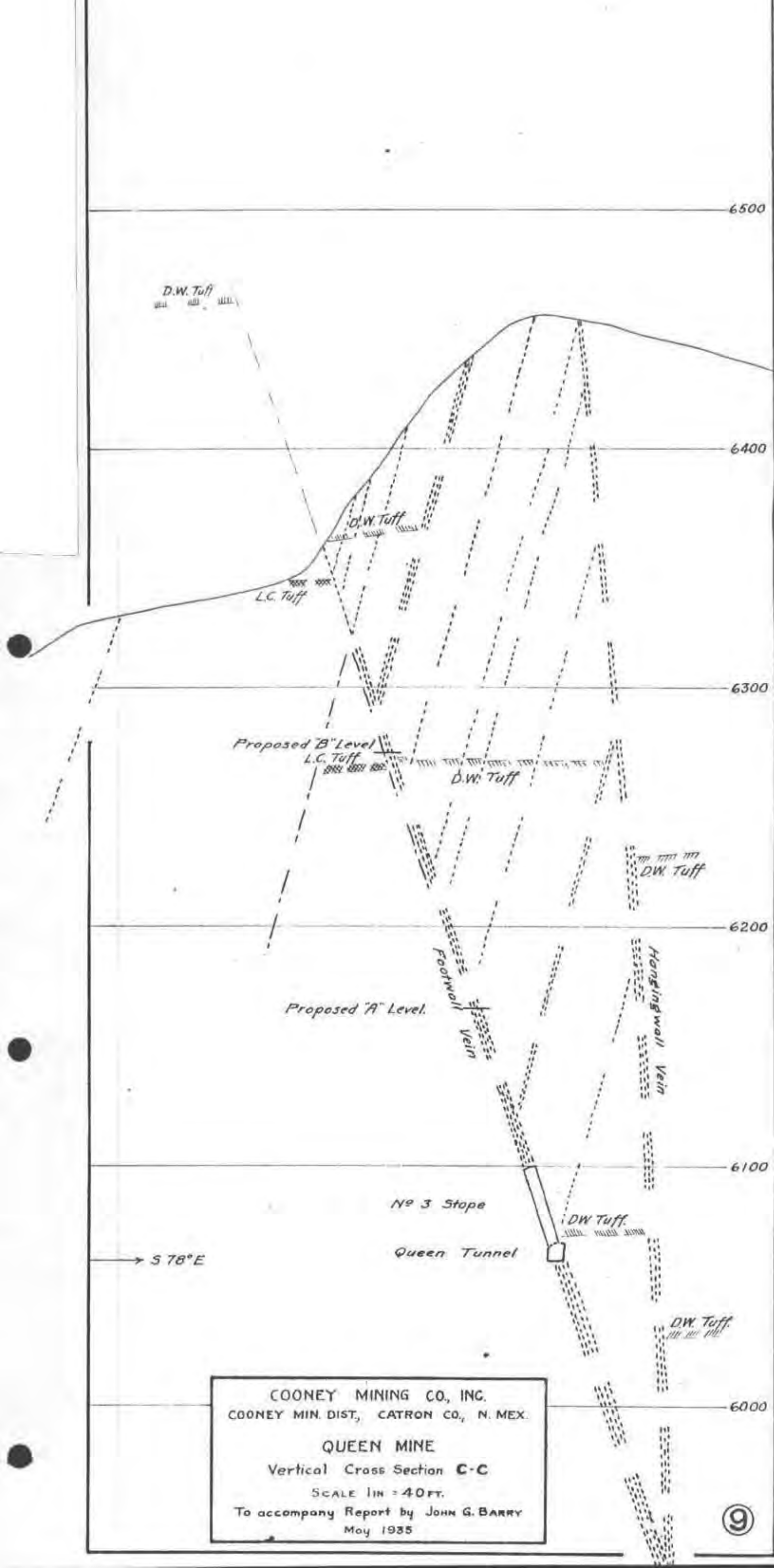
D.W. Tuff

D.W. Tuff

6000

COONEY MINING CO., INC.
COONEY MIN. DIST., CATRON CO., N. MEX.

QUEEN MINE
Vertical Cross Section B-B
Scale 1in. = 40 ft.
To accompany Report by John G. Barry
May 1935



COONEY MINING CO., INC.
COONEY MIN. DIST., CATRON CO., N. MEX.

QUEEN MINE

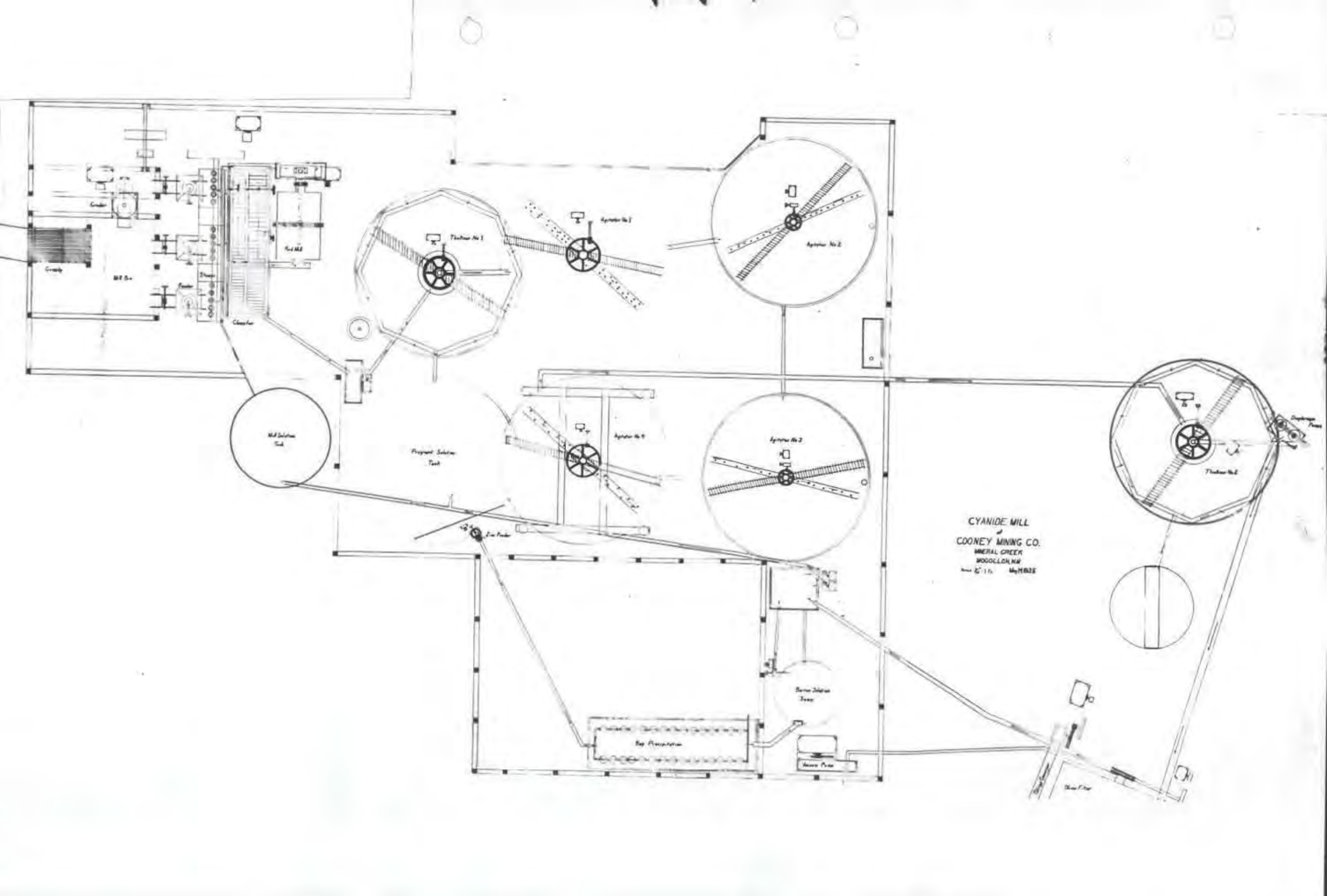
Vertical Cross Section **C-C**

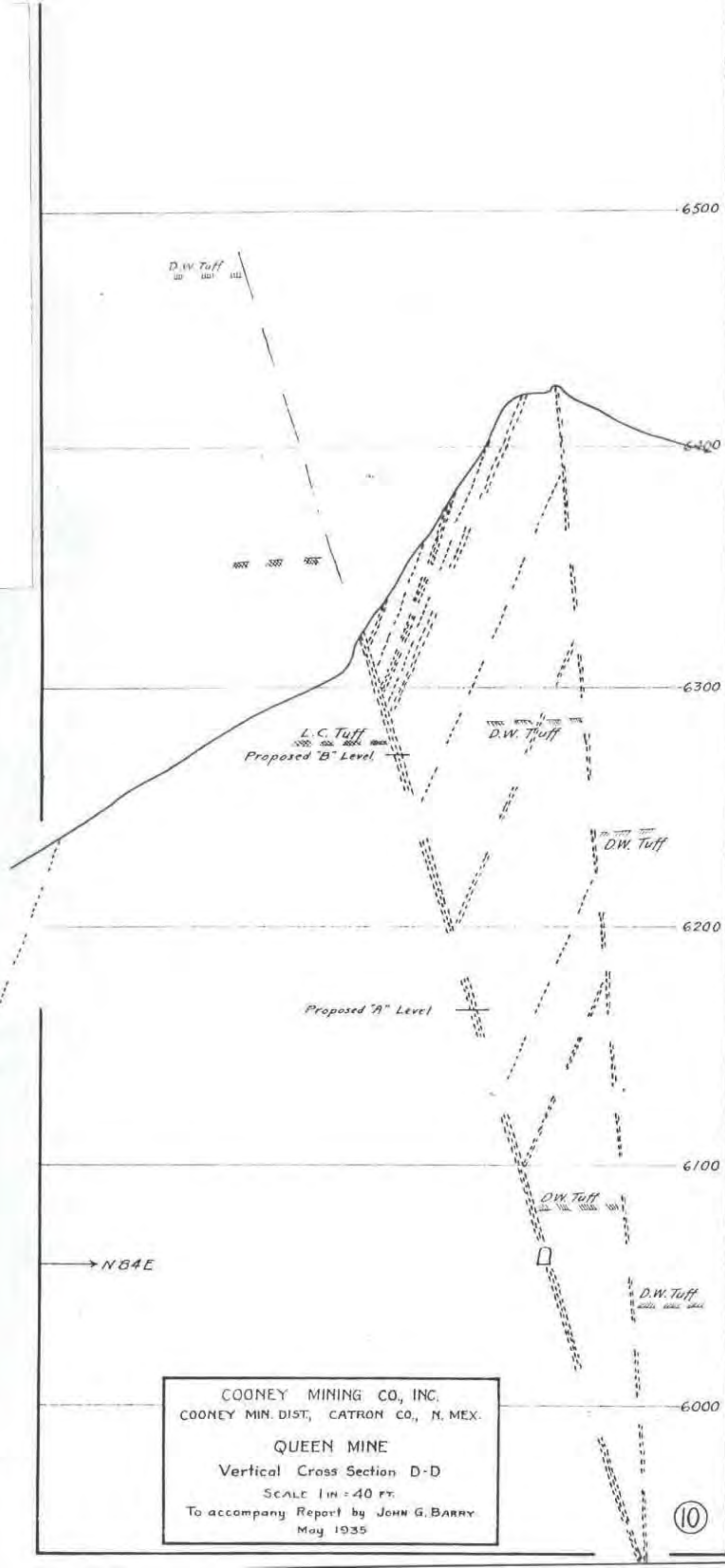
SCALE 1 IN = 40 FT.

To accompany Report by JOHN G. BARRY

May 1935

9


CYANIDE MILL
COONEY MINING CO.
MINERAL CREEK
MOGOLLON, NM



COONEY MINING CO., INC.
COONEY MIN. DIST., CATRON CO., N. MEX.

QUEEN MINE

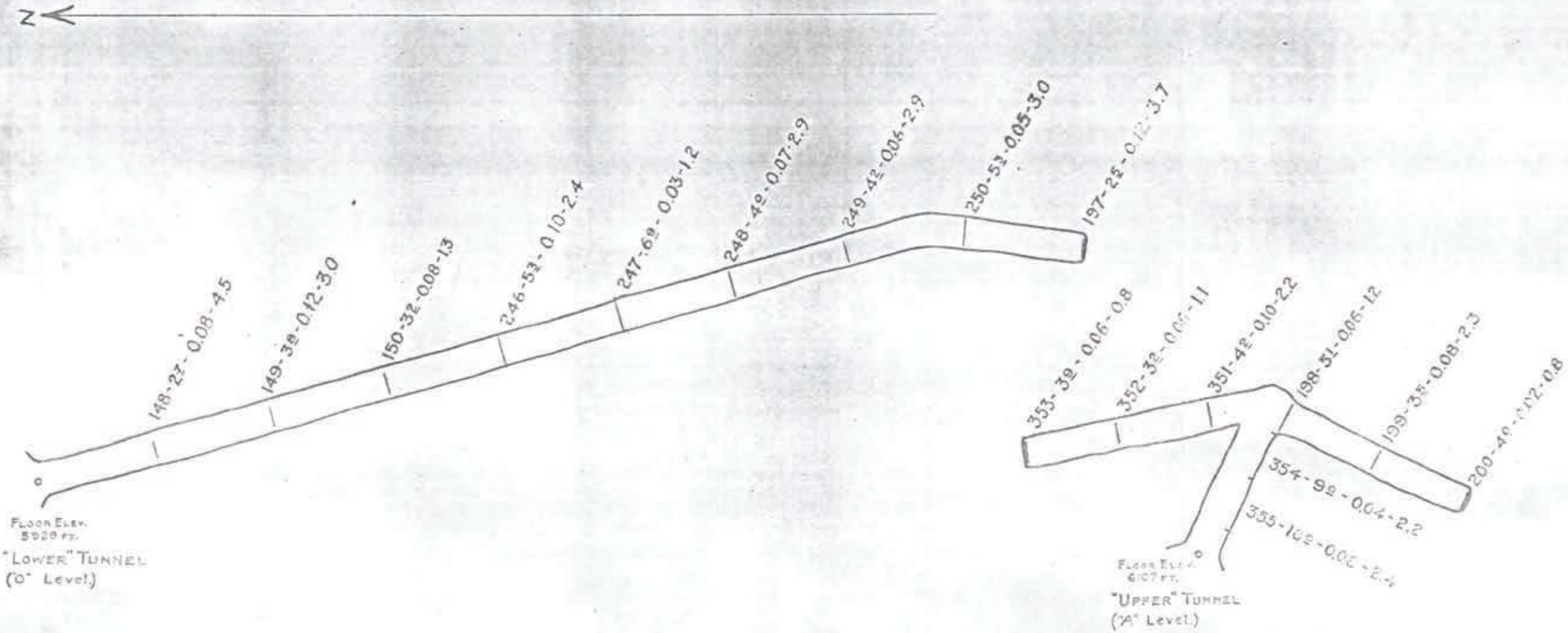
Vertical Cross Section D-D

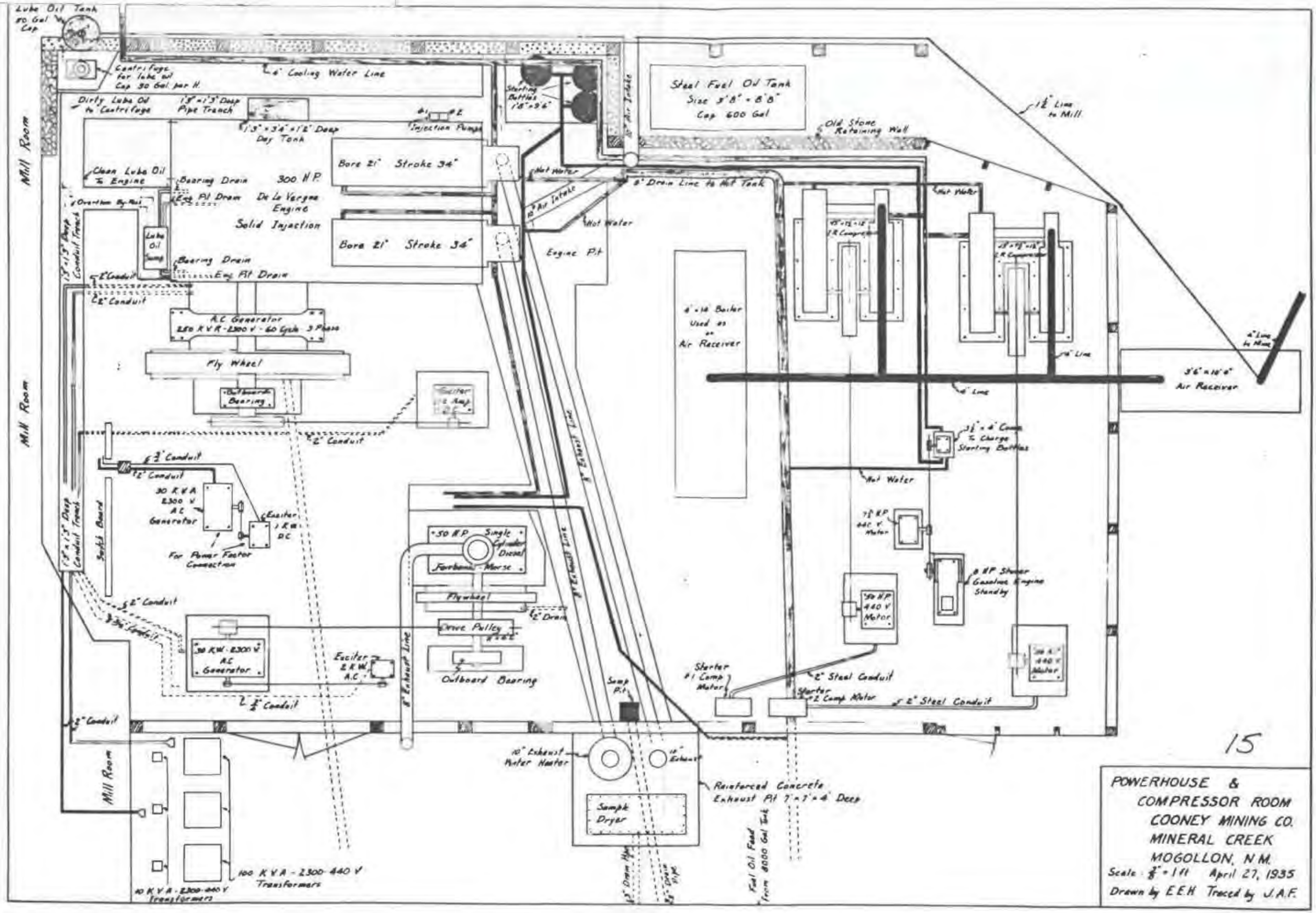
SCALE 1 IN = 40 FT.

To accompany Report by JOHN G. BARRY

May 1935

(10)


N
148-27-0.08-4.5
149-38-0.12-3.0
150-32-0.08-1.3
246-53-0.10-2.4
247-69-0.03-1.2
248-49-0.07-2.9
249-42-0.04-2.9
250-53-0.05-3.0
197-25-0.12-3.7
353-39-0.06-0.8
352-32-0.06-1.1
351-42-0.10-2.2
198-51-0.06-1.2
199-35-0.08-2.3
200-49-0.02-0.8
354-98-0.04-2.2
355-109-0.02-2.4
Floor Elev. 5920 ft.
"Lower" Tunnel
("0" Level)
Floor Elev. 6107 ft.
"Upper" Tunnel
("A" Level)



15

POWERHOUSE & COMPRESSOR ROOM
COONEY MINING CO.
MINERAL CREEK
MOGOLLON, N.M.
Scale: ⅜" = 1 ft April 27, 1935
Drawn by E.E.H Traced by J.A.F.

Cooney (Mogollon) District

Vertical Ranges of Important Ore Shoots

Mine or Locality	Maximum Limits	Bulk Limits
Last Chance-Confidence	6100 - 7100	6300 - 6800
Pacific		6200 - 6600
Maud S.		6200 - 6800
Fanny	5900 - 7100	6100 - 6900
Johnson		6400 - 6800
Eberle and Clifton		6600
Cooney (coppery)		5700 - 6400

At the time of ore deposition the tops of the shoots must have been at some considerable distance beneath the surface, later erosion having exposed only a few upper tips. The bottoms were of course several hundred feet deeper. Because of the heated character of the extruded volcanic masses, and because of the insulating character of surface rock, fairly uniform temperatures must have existed at any given elevation. It is also well known that the silver minerals have a narrow range of low temperatures and pressures for their formation or deposition. I believe that the commercial tops of the shoots developed because of a fairly limited supply of silvery material which was exhausted by deposition lower down. The bottoms of the shoots exist because of a lower limit of elevation below which temperatures and pressures were too high for the deposition of silver minerals. Pyrite and

gold, however, may persist slightly deeper. From the table we may note that the large veins may have shoots persisting to 6100' and the old Cooney Mine indicates that depths greater than for many others might be reached in its locality. The Queen Tunnel already furnishes some presumptive information regarding itself. The above statements are in consonance with observations made in many other similar districts.

Alteration of Wall Rocks

Note has been made above that the vein walls are sharply defined and that they stand well after mining. Fragments of wall rock included in the veins are sometimes replaced by quartz.

The alteration of the wall rocks by nearby mineralization varies with strength of veins, depths, and character of rock. In the rhyolites the alteration is small; but in the tuffs it is of diffused silicification resulting in large, hard outcrops. In the andesitic rocks large amounts of chlorite, calcite, and pyrite are formed in the rocks by rearrangement and some addition of elements over widths up to a score of feet. Greenish red colors result from the oxidation of these.

GEOLOGY OF QUEEN MINE

As will be seen from the discussion of drawings Nos. 3 to 10 inclusive, the principal holdings of the property consist of the Geronimo, Victoria, Apache, Colonel, Copper Queen, Majestic and Majestic No. 2 Claims. Of these the Copper Queen is patented, while application for title has been made on the others. These claims lie along a stretch of about 9,000' on the Queen Vein. This is the eastern and principal part of this system in this part of the district, it having split about 2,000' farther south.

The principal workings are known as the Queen Tunnel and are situated on the Copper Queen Claim. At an elevation of about 6,054' the Queen Tunnel is about 600' long; the inner 420', northerly from the Air Raise is more important. In a stretch of 300' there are 170' stretches of values on which small raising and stoping have been done.

The discussions show that possibly physically unfavorable rocks, tuffs, exist in walls of the vein in this neighborhood; but, it is important to note that they are so situated as not to interfere in any considerable amount with otherwise favorable areas in the vein and its components.

It will be seen that the vein results from the near-surface mineralization, with highly siliceous silver-gold bearing materials, of a strong fault. Consequently, its detailed structure is linked and branching; with many localities favorable to the deposition of ore shoots.

The locality is in the northern end of the district, where mineralization might be smaller but go deeper because of less heat. A dying phase of mineralization in the old Cooney Mine, a short distance to the west, did so. The development up to now in the Queen Tunnel shows increasing strength upward in the strongest part of the vein, as low as 6100'. Consequently, this may be taken now as the elevation of the general bottom limit of shoots if we use 6200' also in less strong stretches.

The outcrops are strong and promising over long stretches as compared to the results obtained from similar ones in the central part of the district. But one should doubt if any considerable stretches of shoots will likely be found above 6,700'; and it seems more probable that 6600' will be the general upper limit of them. This corresponds with much data already collected elsewhere to the south. Consequently, we could assume general shoot limits vertically as 6200' to 6600', with a bottom limit of 6100' for only the strongest occurrences.

The property is admirably located for thorough and cheap prospecting, development, and exploitation. The canyon of Mineral Creek extends so far below likely bottom limits of shoots as to permit the exclusive use of tunnels for long distances northerly and southerly; while the transverse part of King Gulch renders prospecting easy for the extreme northern stretches. This eliminates expensive installations and operations for hoisting and pumping. Although unusual and not theoretically desirable, the actual existence of a workable milling plant makes it possible to obtain rapid and periodic remuneration from prospecting and development.

Some remarks are made as to speculative and prospective ores, as follows:

Geronimo, Victoria, N. 1/2 Apache,	50,000 tons.
S. 1/2 Apache, Colonel,	50,000
Queen, N. of Present Workings	50,000
Majestic and Majestic No. 2	20,000
Majestics, Extensions of Preceding	30,000
Total Speculative Ores	200,000 tons.

It should be distinctly understood that this is not offered as an ore estimate in the ordinary sense. It is purely a speculation as to the potential prospecting chances in the property, and an attempt to answer the common and reasonable questions: Why should the property be prospected and developed?; What general magnitude of results might be obtained? It is assumed that such tonnage would contain values sufficient to pay for its prospecting, development, and exploitation, say above $5.50 gross assay value. It should be realized that these ideas would have to be revised with the progress of prospecting, and that a large proportion of negative results might also be obtained.

DETAILS

It will be seen from the following that it is believed that the geology of the Queen Mine may be most conveniently understood by considering the drawings applying thereto. For further convenience it will be seen that this discussion includes the generalities of various stretches along the Queen Vein; the exposures on surface; the development underground, especially

the Queen Tunnel; the distribution of possibly physically unfavorable rocks; ranges of favorability for prospecting; and some estimate of speculative ores. Regarding the last it is important to recognize clearly the uncertain limits and guesswork involved in the postulation.

Surface Map (3) 1" = 400'

This map shows the principal claims, topography, surface improvements, and veins on surface. Although of small scale it also carries a longitudinal vertical projection of the Queen Vein, showing the principal workings, etc.

In order to avoid complexity the surface distribution of the rock formations is not shown. But the generalities of these details are indicated on the larger scale longitudinal vertical projections, 1" = 100', Nos. 4 to 6, and on the vertical cross-sections, scale 1" = 40', Nos. 7 to 10.

The Queen Vein, a large fault-vein, is the outstanding feature. In this neighborhood it is the principal vein and the eastern branch from the consolidated vein to the south near the Wright workings. As the map shows it forms an outstanding topographic ridge. The several western branches shown on the map have no great strengths. From the northwest one of them approaches closely or joins the main eastern vein near the Majestic-Majestic No. 2 line. The map shows the important splits, junctions, and subsidiary connecting veins occurring between Mineral Creek and King Gulch. Splits, junctions, and a strong vein also occur along the trend northward from King Gulch, southern Colonel claim, to the central part of the Apache claim. In the northern half

The present principal claim is the patented Copper Queen No. 171, which lies north of Mineral Creek at about 7,700' slightly east of north from the town of Mogollon and the eastern center of the district. Also lying on the Queen Vein and about half as far north from the town are the properties and workings now being successfully exploited by Mr. Ira Wright and his associates.

TOPOGRAPHY

The western two miles of this northern part of the Mogollon Mountains are very rugged, resulting from the western edge of an upthrown fault block having been only recently and slightly eroded. To the north and east they change to a high plateau country. To the west occurs similar upthrown country, as in the mining district of Clifton, Arizona and those farther west.

The mountains are bounded on the west in this neighborhood by the San Francisco River, its tributaries here cutting box canyons through the western rim of the mass. Whitewater Creek lies to the south of the district, and Copper and Deep Creeks lie to the north of the district. Silver Creek lies in the center of the district and forms a southern branch of Mineral Creek.

At Alma and Glenwood the San Francisco River lies at elevations above sea-level of 4,900' or less. The mesa between it and the fault scarp which forms the western boundary of the mountains lies at 5,400' to 6,000'.

of Victoria and the southern half of Geronimo evidences of the vein are weak. This is well above 6600' elevation, where the Dog Gulch remnant also exists. It seems likely that the vein may have no great strength above 6,700' elevation in the northern part of the district. Farther north, from central Geronimo to Copper Creek and the bold outcrop on the Tip Top, the vein shows reasonably good strength at the surface.

Small northerly and westerly branching veins of the general Queen system are shown on the Silver Twig, Silver Twig No. 2, Sun, Silver Leaf, and Silver Leaf No. 2 claims, but none of them seem likely to be of any great commercial importance in the near future.

Longitudinal Vertical Projection (4)

This projection, 1" = 100', lies to the north of the principal one (5) and deals with conditions on the Geronimo, Victoria, and northern half of Apache claims. Its northern end reaches to within 800' of Copper Creek and the bold outcrop on the Tip Top.

The topography along this stretch is not bold; nor is the vein strong over a long stretch which lies between elevations of 6600' and 6900'. Where best exposed otherwhere there is largely a reasonably strong single vein of simple structure.

As to physical favorability of wall rocks, as in the case of longitudinal vertical projection (5) to the north of King Gulch, the Deadwood Gulch Tuffs lie in the footwall.

The projection shows the bold, rough topography along the outcrop, one rise of 800' in 1,100' horizontal from the creek being involved.

Generally speaking, much valueless calcitic material is involved in the outcrops for at least 400' south from the creek. The Majestic "C" Tunnel is shown. At 350' south is shown the Majestic "A" Tunnel, comprising a short crosscut and short drifts northerly and southerly. These are located in highly calcitic material where the vein changes abruptly from a S 12 E to a S 27 W direction. On the surface, pockets in gouge material on the hanging are said to have been rich. Between 600' and 1,200' south a branch vein from the northwest approaches closely or joins. The small prospecting done on the "D" tunnel is in calcite material near the hanging, and better results should be expected by following the foot.

In the foot of the vein the rocks are believed to be generally physically favorable, consisting of Last Chance Andesite. On the hanging Tuffs in the Last Chance Andesite occur between 6420' and 6500', and the Deadwood Tuffs occur above 6,650'. It is believed that these rocks will not of themselves cause a great loss of strength in the vein; and, as an opposite effect, they may cause a thickening and concentration of values below their bottoms.

It is believed that the mineralization may change favorably from the calcite phase with penetration south of the creek and with depth below the surface. Rough outlines of zones of favorability are sketched on the projection. It is believed that prospecting would yield best results if a

the foot vein should not be expected to cause bad results. Thus, to the north of the present workings the foot vein should be favorable above 6,100' and the hanging vein above 6,200'.

From what follows under the cross-sections it will be seen that also between the present face and the Air Raise the foot vein should be favorable above 6,100'. In this stretch the hanging vein may be poor below 6,230', but a crosscut from the "B" Level at 6,275' should be in a favorable zone.

We may indulge in speculations as to areas of prospective and potential ores shown on this projection, recognizing the fundamental vagueness of the attempt, as mentioned above. We might guess that north of King Gulch the Colonel and southern half of Apache claims might contain 50,000. tons. Similarly we might guess that north of the present workings as far as King Gulch and above the Queen Tunnel we might find 50,000 tons of ore about equally divided between foot and hanging veins. Speculation regarding ores above the present workings involves a lesser degree of guesswork, which is covered in a consideration of drawing (11).

Longitudinal Vertical Projection (6)

This projection, 1" = 100', extends southerly from Mineral Creek along the vein occurrence in Majestic and Majestic No. 2 claims for a distance of about 1,900', the southern end of these claims (formerly called McKinley) being about 1,750' north from the successful Wright workings on the Queen Vein.

"C" Tunnel here driven southerly for 140', from an elevation of about 6,330' or about 130' above the creek.

In this case speculations as to potential tonnages may be made, subject to the limitations as to probability mentioned earlier. From this we might guess at 50,000 tons, of which 20,000 tons would be somewhat more dependable. The "C" Tunnel mentioned would tend to determine considerably such an outlook, although we should expect the first 200' of it to show only poor material.

Cross-Section A - A (7)

This cross-section, 1" = 40', is located 130' north of No. 4 Raise, and its vertical plane runs S 75°1/2 E. It shows the bold, rough topography of the outcrops, and the linked, upward branching structure of the vein zone, including the foot and hanging veins and the subordinate veins connecting them, part of the last being somewhat diagrammatic.

The Deadwood Tuffs are shown in the hanging for a thickness of 200' (which may be less below 6,200'); between the hanging and foot veins the top might be at 6,250'; while in the foot they should lie at 6,440', or above the present outcrop. Tuffs in the Last Chance Andesite might occur between 6,315' and 6,235'.

From considerations already mentioned it will be seen that the foot vein should be favorable above 6,100'; and the hanging above 6,225'; while favorable connecting veins might exist above 6,250'.

Following favorable results on the foot vein on the "A" Level at 6,167', prospecting on the "B" Level at 6,273', with crosscuts to connecting veins and hanging vein, would be indicated; while thereafter "C" Level at 6370' could also prospect foot, connecting, and hanging veins.

In this and the other three following cross-sections, an attempt is made to show an estimate of the thicknesses of veins by the number of dashes used, each dash indicating approximately one foot of thickness.

Cross-Section B - B (8)

This vertical cross-section, 1" = 40', is located about 15' north of No. 4 Raise, running S 70°1/2 E. It gives a projected idea of Stopes Nos. 4 and 5 and No. 4 Raise. Topography and structure are as indicated for A - A.

Using the method applied in Cross-Section A-A as to rocks and veins, it will be seen that the foot vein should be generally favorable above 6,100'; the connecting veins above 6,200'; and the hanging vein above 6,220'.

The remarks regarding prospecting made for Cross-Section A-A apply here as well as to the two following cross-sections, except that here and farther south work on the "C" Level would doubtless apply only to the hanging and some of the connecting veins unless drifts or crosscuts were run in the foot to the outside for ventilation.

Cross-Section C - C (9)

This vertical cross-section, 1" = 40', is located at 80' south of No. 4 Raise, running S 75° E, at the northern end of No. 3 Stope which is shown. Remarks as to topography and structure are as for A-A and B-B.

The foot vein should be favorable between 6,100' and 6,300'; the connecting veins above 6,280'; and the hanging vein above 6,230'. Preceding remarks as to prospecting by cross-sections also apply here.

Cross-Section D - D (10)

This vertical cross-section, 1" = 40', is located 175' south of No. 4 Raise, running S 75° E, and it is about 20' south of No. 2 Stope. Remarks as to topography and structure are as for preceding cross-sections.

Favorability of veins should be as follows: foot vein, 6,100' to 6,275'; connecting veins, unfavorable or non-existant; hanging vein, favorable above 6,240'. Prospecting should be as noted above in the cases of other cross-sections.

ORE ESTIMATION

From what has preceded and from what follows in this section it will be seen that there are no developed or blocked ores in the Queen Mine, and that there are only small tonnages of possible and speculative ores above the present extent of the Queen Tunnel in less than 100' above the present backs to the proposed "A" Level. From Drawing (11) it will be seen that these are known only on the bottom side. The property contains, however, large, unprospected vein areas which have good chances of developing fair sized tonnages of ores now only to be termed speculative.

It is obvious that a strenuous campaign of prospecting and development is needed. This would include the "A" Level, mentioned later; but it is also necessary that longer and richer shoots be found there. There is a reasonably hopeful outlook for this, however, when one considers the bottoming of ore shoots at or above 6100', as mentioned under Geology.

Sampling

A large proportion of the sampling done for this report was in the Queen Tunnel workings, under the careful personal supervision of Mr. J. A. McCaskell. This is shown on Drawing (11). Similar smaller sampling was also done in the Majestic Tunnels, Queen "O" Tunnel, tunnel south from King Gulch on Colonel, "C" Level prospect on Colonel, etc. None of these last showed any values of importance, the first two being shown on Drawings 13 and 12.

Old samples were necessarily used in some cases, such as, slices in Nos. 4 and 5 Stopes; few samples in ends of Nos. 2 and 3 Stopes; all but one in No. 1 Stope; a few samples and averages south of No. 1 Stope and near the Air Raise, all in the back of the Queen Tunnel; but nearly all of them are more recent than December, 1934. Any of the old samples of any consequence were checked by new sampling wherever possible.

In stating the results of samples on Sample Sketches, they have been located graphically and the results noted in the following order: Number - Thickness, in feet and tenths - Ounces Gold per Ton, to hundredths - Ounces Silver per Ton, to tenths. As far as possible this order has been followed in this report.

Assaying

Assaying at the mine was by Mr. B. S. Godfrey, who was used for other services, such as making rough plan of mill, drafting, etc.

About 20% of the samples, varied as to grade, gold-silver ratio, etc., were brought to El Paso for assaying checking by Mr. O. A. Critchett of Critchett and Ferguson. Contrary to the experience of August, 1934, the results were highly unsatisfactory and erratic. Consequently, much further assaying and checking were done by both Critchett and Godfrey on many other samples, until dependable results were obtained.

A separate report on this has been prepared for the future guidance of the management. Certain remarks may be made here, however:

1. Finer grinding should be done at the mine in order to be sure that all values flux;
2. More careful mixing and weighing of pulps is indicated as necessary;
3. Parting with consecutively stronger nitric acid should be used in order to get complete parting of silver from the gold;
4. The gold balances should be checked, and repaired if necessary;
5. Greater care should be used in weighing gold.

It is believed now that the discrepancies occurred because of items 3, 4, and 5.

Possible Ores in Air Raise

The sampling of the Air Raise has disclosed some small tonnages of possible ores. These are shown on Drawing (11), 1" = 20', which shows the results of the sampling in the principal Queen Tunnel Workings on a Longitudinal Section which is inclined along the dip of the vein, looking easterly or up under the vein. The thicknesses are transverse to the vein, and measurements up or down are inclined on the vein but perpendicular to the strike.

From 18' to 67' below the collar of the raise is ore which has a thickness of 3'.9 and a possible length of 22'. This should give 200 tons - 3'.9 - 0.21 - 5.0.

About half way down ores are indicated for a height of 60', length of 20', thickness of 3'.5, which should yield 150 tons - 3'.5 - 0.32 - 8.3

There is a small spot of ore indicated on north wall of the raise at about 80' above the Queen Tunnel, which might yield 10 tons - 2.5 - 0.25 - 7.2

A root of ore may extend downward from the south drift, about 77' above the Queen Tunnel, down to the back of the Queen Tunnel at about 55' south of south wall of raise. This might have averages of 12.5 length, 65' height, and 3.5 thickness; and might yield 200 tons - 3.5 - 0.32 - 8.3

Prospective Ore in No. 1 Stope

The work in No. 1 Stope has improved upward, and the back shows ore over a length of 15'. To the floor of the proposed "A" level is 85' farther. If this ore could be raised through it might yield 325 tons - 3.5 - 0.20 - 4.2

Prospective Ore in No. 3 Stope

Although signs of ore have been encountered in No. 2 Stope in the past, for the present it must be considered of no importance.

In No. 3 Stope there is a central stretch of ore 20' long, which is 70' below the floor of the proposed "A" Level. If this could be raised through, it should yield 475 tons - 4.4 - 0.25 - 5.7

Broken Ore in No. 4 Stope

A small tonnage of broken ore is stored in No. 4 Stope. Inasmuch as there is always some wall rock breccia in the veins and some wall rock is always broken inadvertently, two small mine cars were drawn from the bottom of this storage, and

sorted carefully into waste and ore of sizes of plus 4" and 2" to 4". The waste was very low grade, about 0.02 gold. From 12.% to 15.% of plus 2" could be sorted out, divided about equally between the two sizes. In this case about 87% would be saved as ore, running 0.11 - 2.9. But because of the values shown in the earlier stoping slices, it is believed that the whole sorted fill should run 0.15 - 4.5. There should be 300 tons of such sorted ore in the stope.

Prospective Ores in No. 4 and 5 Stopes

A record of sampling of old stope backs is shown for this locality. In general it is seen that a decided improvement in value was shown as height was attained. Passing an elevation of 6100' seems to have been helpful, which is also true at Stope No. 3, and to a lesser degree in the Air Raise.

The present back of the combined stopes and raise (No. 4) shows an average of 102' long - 5.0 - 0.19 - 5.2 Between it and the floor of the proposed "A" level there should be 2,000 tons of this material.

Possible Ore in Winze

The sampling in the winze indicates that a root of ore extends downward for 75' below the Queen Tunnel, near the northern end of the No. 5 Stope. This might have an average length of 24' with a thickness of 5.0. Subtracting the contents represented by the winze, there should be 460 tons - 5.0 - 0.20 - 6.2

Speculative Ore Above "A" Level

In a preceding discussion of speculative ore, sufficient allowance has been made for ore which might be encountered above the "A" level, including some as low as the Queen Tunnel, and to the north of the No. 4 Raise.

To the south of No. 4 Raise and above the "A" level we should have good expectations. If only Nos. 1, 3, and 4 Stopes lengthened to have an aggregate length of only 150' in the 300' between the Air Raise and No. 4 Raise, it would seem that they might go up to additional average heights of 125' with thicknesses of 4'. Hence, it would not seem excessive to expect to find upwards of 9,000 tons on the foot, hanging, and connecting veins. A few thousand more tons would be found proportionately with each 50' of additional ore length found on the foot on the "A" Level.

ASSAY AND OTHER VALUES

The values resulting from sampling and estimation may be calculated in money in various ways. A common method is to apply gross value of metals to the assays. At present the figures used are $35.00 per ounce for gold, and $0.77 per ounce for silver. This gives a convenient figure, commonly known as gross assay value.

But it should be realized that this does not give a value for the payment of costs at the mine. In the first place, some of the metal cannot be recovered by milling, a 90% recovery of money being indicated for this case. And then there are charges against the metal after it leaves the mine, commonly

known as marketing costs, which include transportation, insurance, and charges, losses, and deductions at the Mint. In this case a charge of 4% should be allowed for, equivalent to about $0.075 per ounce. This would give 86% of the gross assay value of the ore as recoverable in money at the mine for use there in the operations.

It is also convenient to know the lowest grade ore which would pay all charges against it, and its corresponding assay values. For this one must fix an estimated gross overall charge against each ton. For this purpose, this case, and this stage of operations, $7.00 per ton might be used. With a money recovery of 86% this would required a gross assay value of $8.14 per ton. Using a ratio of 30 silver to 1 gold, the gross assay would have to be 0.14 gold - 4.2 silver. Ore of less value than this should not be considered for development and extraction at the present time. It is of course true that: (1) later it may be possible to lower this figure; (2) and that, if lower grade ore adjoins or is broken in connection with much higher grade ore, it may be taken out to pay lower costs, based on stripped mining and milling costs. If the $7.00 total charge be correct, then all ores with a greater gross assay value than $8.14 per ton will pay that greater amount per ton in profits. It is also evident that both gold and/or silver prices may change in the future, with increases being likely, and with increased profits and lower grade ores being correspondingly involved. At a later date when costs are known better, tables may be prepared to show the effects of such changes.

Prospective Ores

No. 1. Stope, to "A" level	3.5 - 0.20 - 4.2	325 tons
No. 3. Stope, to "A" Level,	4.4 - 0.16 - 5.7	475
Nos. 4 and 5 Stopes, to "A"Level	5.0 - 0.19 - 5.2	2,000
Total Prospective Ores	0.20 - 5.2	2,800 tons
Gold at 35., Silver 0.77	$11.00	

Possible Ores

Near Top of Air Raise,	3.9 - 0.21 - 5.0	200 tons
Midway in Air Raise	3.5 - 0.32 - 8.3	150
Air Raise, N.side near bottom	2.6 - 0.25 - 7.2	10
Air Raise, Foot S.to Queen Tunnel	3.5 - 0.32 - 8.3	200
Broken Ore in No. 4 Stope	0.15 - 4.5	300
Winze below Queen Tunnel	5.0 - 0.20 - 6.2	480
Total Possible Ores	0.22 - 6.2	1,320 tons
Gold at 35., Silver 0.77	$12.47	

From the above certain generalizations may be made: with reasonably good prospecting results, an operation on a 100 ton per day basis might be developed to last several years; as far as the present workings extend, and up to the "A" Level, there is only a small tonnage possibly or prospectively available; and, since there are no developed or blocked ores, a strenuous campaign of prospecting and development is needed, with which might be coupled some extraction and returns.

It will be seen later, however, that an attempt is made to show expenditures and costs by categories and dates, so that profits cannot be easily justified for some time, to come, after which the costs might be considerably less.

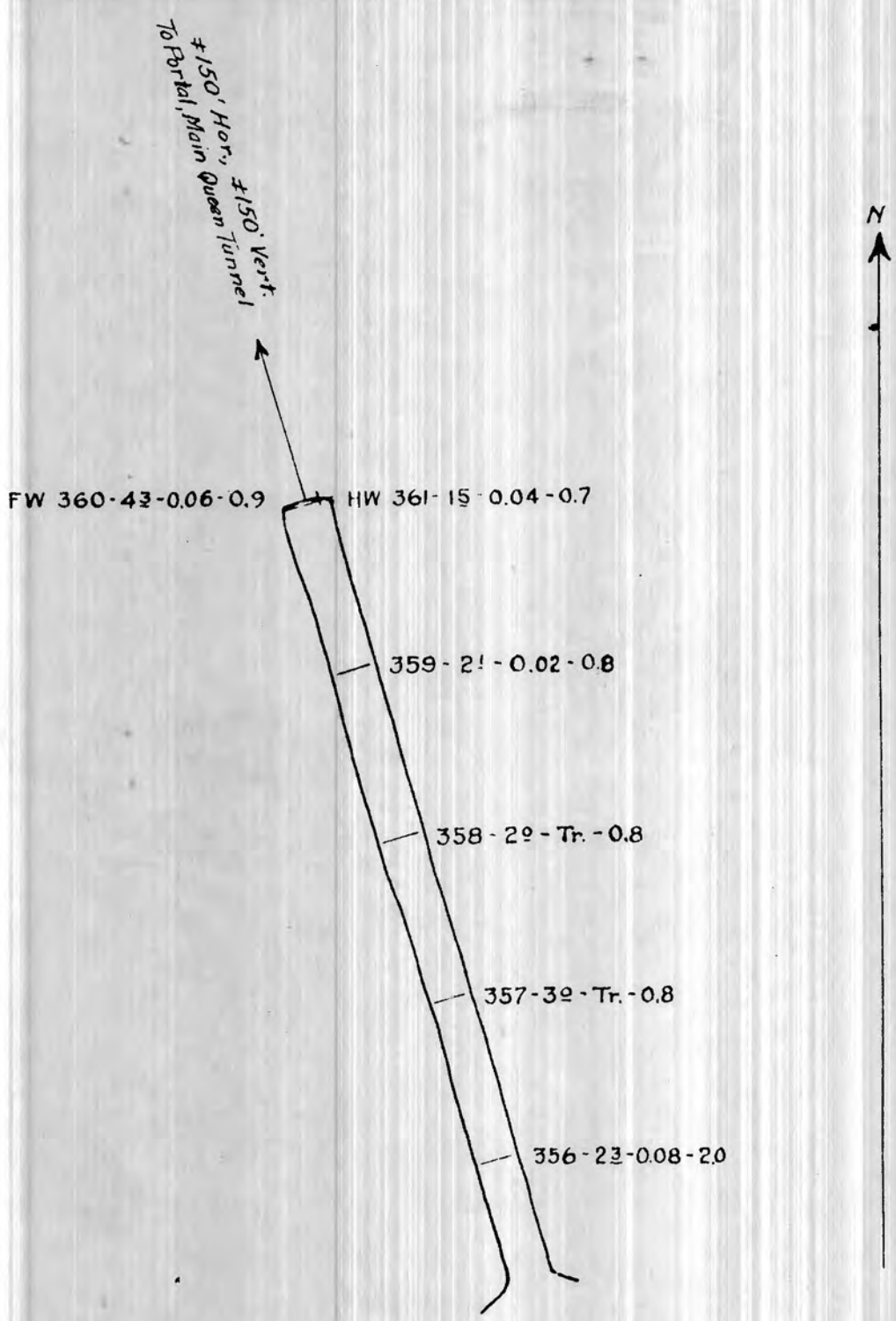
SUMMARY OF ORE ESTIMATION

In the following table all of the ores estimated in all of the preceding are listed. It is important to invite attention to the Speculative Ores, as noted elsewhere, in that they are not ore estimations in the usual sense but are merely deduced to be present by analogy and without the existence of the usual pertinent data, purely for the purpose of establishing the need of prospecting and for guessing at the magnitude of successful results. Comments on them should be referred to as indicated.

Potential Ores in the Queen Mine

Speculative Ores

Geronimo, Victoria, N. 1/2 Apache See Long. Vert. Proj. (4)	50,000 tons
S. 1/2 Apache, Colonel See Long. Vert. Proj. (5)	50,000
Copper Queen, N. of present workings See Long. Vert. Proj. (5)	50,000
Copper Queen, Above "A" Level, S.of No.4 Raise See Sample Sketch (11)	9,000
Majestic and Majestic No. 2, Near possible junctions See Long. Vert. Proj. (6)	20,000
Majestic and Majestic No.2. Extensions of preceding. See Long. Vert. Proj. (6)	30,000
Total Speculative Ores	209,000



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SAMPLE SKETCH OF QUEEN "O" TUNNEL

Samp. Nº - Feet - Oz. Au - Oz. Ag.

1" = 20 ft.

5/10/35 M.M.C.

MINE DEVELOPMENT PROGRAM

From what has preceded, it is obvious that a simple program for prospecting and development, which can be executed quickly with a minimum of expense, is needed. This is generally delineated in this section in an elemental way. Emphasis is placed on the general objectives, remarks as to operations, equipment, costs, and production being reserved for later sections.

QUEEN TUNNEL WORKINGS

A consideration of all of the foregoing shows that rapid prospecting and development is urgently necessary, and that the bulk of it should be concentrated in the near future in the Queen Tunnel.

Proposed "A" Level

The collar of the Air Raise is about 222' inclined and 212' vertical above the floor of the Queen Tunnel. So, it would be convenient to have a level at the collar, and another about half-way up, to be known as "B" and "A" Levels.

The Air Raise would need some simple and rapid preparation for use as a principal supply way for these. Immediately thereafter the "A" Level could be driven level to the north from a floor point at 111' inclined or 106' vertical above the Queen Tunnel.

Work could also be done on the "A" level by driving from the No. 4 Raise southerly on the vein to connect with the work from the Air Raise. At the same time it could also be driven to the north from No. 4 Raise to prospect and open up ore to a long distance to the north of No. 4 Raise.

Proposed "B" Level

The "B" Level would be driven level and northerly from the collar of the Air Raise along the foot vein. For prospecting and development it would have eventually a great length. Part of it could be driven both north and south from Raise No. 4. Consideration of a work program, including operation of the mill, makes it seem likely that work on the "B" level should not begin until several weeks after the beginning of operations.

Proposed "C" Level

Work on a proposed "C" Level would naturally follow the beginning of that on "B" level by several weeks. It should be about 100' vertically higher than "B" level. No doubt the first work on it would be done from a main supply raise from the "A" and "B" Levels located 300' or 400' northerly from No. 4 Raise. The actual findings on the "C" level in its first interior work would determine any proposal for ventilating connection by crosscutting to the surface, or by drifting to the surface along the hanging vein. The last work might also be done first at a generally proper elevation, if sufficient air and drills were available.

Queen Tunnel

From a preceding discussion of the bottom limits of shoots, it will be seen that we should not expect them to persist below 6,100'. Indeed, the proposed "A" level is an even better elevation for prospecting, at an elevation of about 6,160'. It would be likely to encounter a much greater number of shoots and a considerably greater total length of ore than any lower level. At the same time it has chances of being done very quickly, and of yielding some production from prospecting and development work. Consequently, we should not drive the Queen Tunnel farther unless indisputable reasons of large import can be demonstrated. Such reasons would later include: (1) the finding of ore on the "A" Level, considerably to the north of the present workings, so large and persistent in amount as to lead to a belief that considerable tonnages could be extracted between the Queen and "A" Levels; (2) a demonstration that ores from above the "A" Level and to the north of the present workings could be handled so much more cheaply by an extension of the Queen Tunnel that its further driving would be warranted. Hence, no further consideration of this matter need be given for several months from now.

Raises

In this, no attempt is made to consider the raises which would be used in starting or running stopes, this being

better left in the hands of the management to be later worked out in connection with a consideration of ore finding, methods of stoping, costs, etc.

But, occasional large supply raises will be of general importance to the program of prospecting, development, and ventilation. Such raises, with the exception of the Air Raise, should be equipped to handle both waste and ore at the same time, and should also have a good, third, central compartment to contain ladderway, skidway, air and water pipes, and suction-air ejection ventilating tubes. The present Air Raise needs only one chute and no ventilating pipe.

In addition to the Air Raise the next supply raise to the north, at about 310' horizontally, should be the present No. 4 Raise, which has advanced so high as to be raised farther and prepared soon for driving the "A" Level. Farther north on the "A" Level other similar raises should be put up in ore at intervals of 300' or 400'. From the surface, No. 4 Raise, and these other raises, the "B" Level could be driven and connected, which would give a circuit of natural ventilation throughout. It is assumed that the "A" Level would always have a northerly face about 400' in advance of the "B" Level, unless part of the latter were driven southerly from King Gulch.

"B" Level from King Gulch

If the prospecting on "A" level and "B" level gave good results during the next several months, the development would be advisedly and abnormally hastened by crosscutting to the vein

at a proper elevation from the southern side of King Gulch, and by then driving along the vein to the south for a connection.

Inasmuch as the future central power and air supply at the central plant is unlikely to be sufficient for this extra prospecting and development in anticipation of more normal work, then such a proposal should be considered only in connection with the temporary erection of a small Diesel-Air unit in the neighborhood by which the prospecting north from King Gulch would also be done at the same time. Such a unit might have been used earlier at the central power plant and might be used thereafter at the Majestic.

It is of course true that we might consider at least the beginning of prospecting at points far removed from the central plant by means of handwork, but any great amount of handwork is likely to prove overly expensive.

WORK NORTHERLY FROM KING GULCH

Early work northerly from King Gulch should be restricted to driving the existing tunnel, Colonel "C" Level which is shown on Longitudinal Vertical Projection (5), farther north for some 600'. This would be located to give most likely the best prospecting and development results in the northern ground. In Order to measure and to assure the future outlook of the property, it should be done after favorable results are obtained in the Queen Tunnel Workings in the near future, and considerably in

advance of their normal attainment to that objective. So, probably it would not begin before several months from now. It is likely also that it could not begin before the installation of a small subsidiary Diesel-air unit in the neighborhood of King Gulch, which could also be used for several months on this work as well as "B" level to the south, and possibly to the north, from near King Gulch.

WORK SOUTHERLY ON MAJESTICS

From what has preceded it will be seen that some little prospecting work on the Majestics should be done for the purpose of estimating as soon as possible the future outlook of this southerly block of ground. It should be done beginning after several months from now, if favorable results are obtained in the Queen Tunnel Workings. It might be done with the unit mentioned for King Gulch after the work there is completed. Or if connections are made to Queen Tunnel Workings from King Gulch and the unit of the latter is connected to the other air lines, then branch air and water lines, with suitable receivers at their deliveries, could be run from the central plant to the Majestics. It is also obvious that a beginning on this work could be made by hand drilling. The work to be done, Majestic "C" Level, has been described already as to location, and is shown on Longitudinal Vertical Projection (6). This prospecting level would be located so as to obtain maximum prospecting and development results for estimating the future of the ground, and it should be driven southerly for not less

than 300', of which we should not expect good results in the first 200'or 300'.

WORK ON OTHER HOLDINGS

During the ensuing two years work on other holdings would most likely be restricted to that necessary for assessment or patent purposes. It would be done from time to time by hand. However, it would be well to plan it in advance, so that the greatest good from it may be obtained. First of all, suitable locations and elevations for it should be chosen, which should also offer the maximum chances for eventually opening otherwise favorable localities, such as junctions. Possible connection to other workings should also be considered. Also, the work should be in the nature of drifting on a vein and not be done alongside in softer ground.

ORE PRODUCTION FROM DEVELOPMENT

It is to be hoped, and it is likely to expect in some cases, that some little ore will be broken, and saved for milling, during the progress of prospecting and development work. For instance, in the case of the "A" Level, it seems likely that extending No. 4 Raise to a suitable elevation would yield 250 tons; opening the level should yield 700 tons; and the bottoms of stopes above could be broken out quickly thereafter to yield 300 tons. With broken ore now on hand we would thus have a total of about 1500 tons for a preliminary mill run.

POWER PLANT PROPER

The present resume regarding the Power Plant at the Queen Mine is designed to show its present composition and condition, betterments and repairs needed for a steady operation of a few months, estimated future additions, costs of the foregoing; and cost of operations.

PRIME MOVERS

De La Vergne Engine

The principal engine in the plant is an old, second-hand two cylinder De La Vergne engine, which with overhead traveling crane, was moved from Pierro, New Mexico, and somewhat renovated and installed, both in a very faulty manner. This was largely due to overconfidence and incompetence on the part of local shops and mechanics.

After conversion to solid injection this engine was supposed to have a normal rating at sea-level of 350. HP. At 6,000' it should deliver 276.5 HP. By conversion in its attached 250 KVA, 2300 v. generator it should put out 88% or 243. HP. Over short intervals this might reach 255.HP., all of which depends on the perfect condition and good operation of the equipment. From what follows, it will be seen that we might get as little as 215. HP. out of the unit, with 230 HP. at peaks.

Mr. M. M. Muthsteiner made a study of this matter for me. His report is attached to this, which should be referred to, and from which it will be seen that several items of large and careful repairs will be necessary before we can have dependable power for a few months operation on development and milling, as follows:

1. Frame not level; to be corrected by leveling main crank shaft and rebedding and refitting it in its bearings;
2. Dress crank pins, and perfect their bearings;
3. Correct positions, installation, and bearings on Lay and Cam Shafts;
4. Install new Skew Gears, including new hub for the driven one on Lay Shaft;
5. Order and install new piston rings with care, using proper piston funnel;
6. Check pointing of rods;
7. Check clearances and compression pressures;
8. Check fuel oil nozzles;
9. Raise and separate cooling water outlets;
10. Raise Lubricating Oil Tank and install on it a float switch for ringing alarm bell;
11. Provide precise calipers for measuring outside diameters of pistons and rings;
12. Secure the services of an expert, experienced, erector-installer mechanic to take charge of all of foregoing, preferably a man from the De La Vergne organization.

The job done on the liners and pistons is obviously poor to the naked eye. Crude but comparable measurements were made on them which show that the clearances vary from a clearance of 0.033" by as much as 0.043" in excess. The liners vary from equal diameters by as much as 0.032"; the pistons by 0.018". Even though corrected temporarily by special rings, no long continued, efficient operation can be expected; but for present purposes to obtain an idea of the future of the mine, this will have to be good enough.

In the event of increasing the size of the plant, at or after Oct. 1, 1935, a better sister engine might be bought and installed under suitable supervision. It might be accompanied by new liners and pistons which could be installed in the present engine. If such an installation should occur, then attention should be given also to doing the following:

1. Install cooling water thermometers on cylinder heads;
2. Install Lubricating Oil Failure Stop on Fuel Oil Feed Line;
3. Install pyrometer on exhaust gases;
4. Install exhaust gas check valve for charging starting bottles;
5. Provide mandrel and tram for checking pointing of rods.

Costs

The cost of making the urgent, immediate repairs on the engine is estimated at $1,000. Since it is the first essential in any operating scheme it should be possible to complete it just prior to July 1, 1935.

If another sister engine should be added after Oct. 1, 1935, its installation and repairs to old engine should cost about $2,000.

Following repairs, the operation of the present engine, and other nearby machines and compressors should cost $1,000. monthly, as follows:

Labor	18.50	per day
Fuel	30.00	" "
Lubricants	1.35	" "
Waste and Supplies	0.30	" "
Extras	9.85	" "
Total	60.00	" "

Fairbanks-Morse Engine

The power house also contains an old Fairbanks-Morse, vertical, Diesel type engine, supposed to have a rating of 50. HP. It is said to be in poor condition and to deliver only 35. HP. It is used as a standby for emergency operation of lights and agitator motors in the mill. No money should be spent on it at present.

Generators

A reduced photostat of a plan of the Power House and its contents is attached to this.

For De la Vergne

From this it will be noted that a generator is attached to the shaft of the De La Vergne engine. This is rated as 250 KVA, 2300 v., 60 cycle, 3 phase. It is said to be in good running condition.

For Fairbanks-Morse

The drawing also shows that a generator, belt driven, is provided for the Fairbanks-Morse engine, which is rated at 30 KW, 2300 v. and which is belted to its 2. KW exciter.

Main Exciter

The drawing shows further that the main generator is equipped with an 112. amp. D.C. exciter, which is said to consume about 15. HP.

Balancing

It will be noted that to improve delivery it is planned to use a 30 KVA, 2300. v., A.C. generator, belted to a 1. KW. D.C. exciter.

Transformers

The generator currents are stepped down by 3 - 100 KVA, 2300 to 440 v. transformers, and by 3 - 10 KVA, 2300 to 440 v. transformers.

MOTORS DRIVEN

For full operation a list of motors to be driven has been furnished, as follows:

In the Power Plant

1 -	7.5 HP.	440. v.	Pump for Cooling Water, Intermittent?
1 -	0.5	110	Fuel Oil Centrifuge
2 -	100.0	440	Each 50. HP. for Compressors to be loaded to 60 HP. each.
1 -	7.5	440	Running 3" 1/2 x 4" Compressor for starting bottles. Intermittent. Also use 8 HP. Stover Gaso Engine
1 -	15.0	2,300.	Power correction generator exciter
1 -	1.5	440.	Shop grinder. Intermittent.

In the Mill

1 -	30.0 HP.	440. v.	Gyratory (old Comet) Crusher. Interlitten?
1 -	30.0	440.	Driving 15 - 900 lb. stamps
1 -	5.0	440.	Classifier
1 -	50.0	440.	Rod Mill
2 -	3.0	440.	Each 1.5 Thickeners
4 -	6.0	440.	Each 1.5 Agitators
1 -	1.5	440.	Barren Solution Pump 2"
1 -	1.5	440.	Filtrate Pump 2"
1 -	1.5	440.	Solution Pump 2"
1 -	1.5	440.	Dorr Duplex Diaphragm Pump. To be used with new pump (to be bought) on clarifier sump.
1 -	3.0	440.	Wilfley Sand Pump
1 -	1.5	440.	Filter Agitator
1 -	3.0	440.	Filter
1 -	10.0	440.	Vacuum Pump
1 -	10.0	440.	Conveyor
1 -	0.16	110.	Zinc Dust Feeder
1 -	1.0	440.	It and small pump to be bought for pumping #1 Thickner overflow back to mill solution
1 -	0.5	440.	It and small pump to be bought for pumping weak solution from sump onto filter for washing.

For Mine

1 -	1.5	440.	Triplex solution pump for circulating water to mine.
1 -	3.0	440.	10" Ventilating Fan

Changes in Motors

The probable changes in use of motors and additions in above list should be noted:

Load compressor motors to 60. HP. each;

One thickener and one agitator motor may be cut out to save 3.0 HP;

Add one new pump on clarifier and its sump; using diaphragm pump motor;

Add one new 1. HP. motor and one new pump for pumping from Thickener #1 to Mill Solution Tank;

Add one new 0.5 HP. motor and one new pump for circulating weak solution as filter wash.

COMPRESSED AIR PLANT

As shown on the drawing the air compressors are located in the power plant. The two compressors are almost sister machines, being Ingersoll-Rand, Imperial Type, with valve gears, 13" x 7" 1/2 x 12". Their 60" flywheels are belted to 50 HP. sister motors with 10" pulleys, whose speed is supposed to be 1130. r.p.m. at full load. Calculations and measurements check r.p.m. of the compressors at 185. The makers have said that they can be safely speeded up to 210. r. p. m., with 385. cu. ft. displacement each. If this were done the effective displacement would be 346. cu. ft. each, or 690. total. They have been compressing to 100#, whereas considering receiver capacity, new drills and hard ground, 90# should be sufficient. For 346. cu. ft. per min. and 90# about 50 HP. would be required from each motor during peak periods which would occur several times during the busiest six hours of each mining shift. It is believed that for a few

months the motors could be safely overloaded to this extent by equipping them each with 11" diam. pulleys. The motors should be watched carefully at all times with thermometers to see that temperature in excess of 40° C. above air temperature are not allowed. Use of air by excessive blowing in the mine and excessive use of high pressure air in the mill should not be permitted. Consequently, valves controlling all should be exclusively under the control of the power house.

Receivers

The receiving plant is fortunately generously ample, which will aid other power deficiencies and surges. There are two large receivers and a long, about 1300', 4" line.

Low Pressure Air

Per agitator the mill needs about 30. cu. ft. of 15# air. From time to time it also needs a small amount of 90# air for emergency stirring with manually controlled hoses and pipes. The pressure reducing valve should be moved from mill to power house and installed between old boiler receiver and low pressure receiver. For the last the old oil tank could be used by staying its heads together externally by planks and tie rods. From it a 3" low pressure line should be piped to the agitators. The 1" 1/2 high pressure line should be transferred to top of agitators for emergency use, but the line should have its origin in the power house with a valve on it under control of power plant operator, who should enter use in his log. Providing low pressure air for the mill should leave 000 cu. ft. over for the mine.

Betterments and Repairs

As pointed out by Ruthsteiner, checking and repairs of the compressors should involve:

Cleaning of water jackets and coolers;

Checking and provision of piston rings;

Checking and possibly correcting bearings;

Using circulating cooling water of engine system.

If, after Oct. 1, 1935, the power plant were to be increased it would be principally because of need of larger compressed air plant. For a sister Diesel De La Vergne engine one could use an Ingersoll-Rand compressor rated at 248 HP. and 1700 cu. ft. displacement whose new present cost at Silver City with synchronous motor would be about $11,225. If an old machine be acquired great care should be taken in its purchase, including running, measurement, and inspection before dismantling. In any event the installation should be by a factory-furnished erector.

Costs

The cost of operating the compressor plant is included in the total already given for the Power Plant.

Immediate costs of betterments and repairs should not exceed:

Arranging air for mill, as above	$100.
Compressor Repairs	50.
Total	$150.

After Oct. 1, 1935 additional compressing capacity should not cost, carefully installed, in excess of $14,000.

A further temporary alternative as to engine and compressor might be resorted to after Oct. 1, 1933. A combined Diesel-Compressor, such as made by Ingersoll-Rand, might be installed. These machines have an upright Diesel direct connected to a horizontal, tandem, two-stage compressor. They have given excellent service and are thought of well. The medium size has ratings of 604. cu. ft., and 110 HP. They sold formerly for $9,900. delivered here, but the price has been advanced to $11,000. Ingersoll-Rand knows of three in this territory which are for sale at present. The one which is newest type and least used might be had for less than 60% of former listed price. The others are held at higher figures. If such a machine were installed it would be of great help for several months, being able to supply air for six additional stopers. If a larger engine and compressor were installed later, this machine could be used on work at King Gulch, etc. It might be possible to buy and install such a machine for as little as $10,000.

GENERAL

The plant is well housed.

The matter of an adequate and dependable water supply for both Power Plant and Mill, under all conditions, is a matter of great concern. Consequently, to protect against future droughts and to protect the rights, $250. should be spent on a dam to raise the water from bed rock at site already secured. Inasmuch as muddy water is likely to be present during the summer season, the cooling tower for circulation, framed materials being already on hand, should be put up at once.

The items should be covered by a cash expenditure of not more than $300. A future item would be a small, domestic size, water softener for treating additions to the circulating cooling water.

CONTROL OF USE OF POWER

Since adequate power is of prime importance to development and operation its use should be scheduled carefully and controlled rigidly. The management and operators should be able to devise alternatives even better than those in the following.

With the mill inoperative it should be possible to give 690. cu. ft. 90% air to the mine per minute, distributed alternatively:

Scheme A:	1 N - 75	200	
	2 N - 72	340	
	2 N - 79	220	
	Total	760	less for irregular running and surges
Scheme B:	2 N - 72	340	
	3 N - 79	330	
	Total	670	Below capacity

With the mill operative and the mine getting 600. cu. ft. 90% air per minute:

Scheme C:	2 N - 72	340	
	3 N - 79	330	
	Total	670	possible irregularly

From the above it will be seen that full air capacity is sufficient for present and proposed equipment.

Motors

From what has already been said regarding possible electrical output it will be seen that for the next few months we should not count too heavily on more than 215 HP. and 230 HP. for peaks. Of this 15 HP. would be used directly, leaving possible nets of 200 to 215 HP.

In the Power Plant the motor on compressor for starting air, and motor on grinder should not be used unless unavoidable. The other motors have a total rating of 127.5, which might be actually 125. HP. If water storage permitted the intermittent use of the fresh water pump, this would be a great help. The pump on mine water supply should be held down to 1. HP. The mine ventilating fan should not be run when compressor loads are high. In this way about 90. HP. peak load would be available for the mill.

The crusher in the mill should not be run during the busy drilling period in the mine when the compressors are under heavy load. The other motors in the mill show horse-power ratings of 126.16. If stamps and rodmill are run at only 75% capacity, 20 HP. might be not used. Another 16 HP. might not be used because of aggregate normal over-rating, which would permit 75 ton operation of the mill if careful and rigid schedules and inspections were used.

Using the crusher only as an instance of what might be done, it would have a roustabout-oiler-feeder available on each of three shifts. It should be permitted to run only when the two-shift mine was least busy and the load on compressors least, viz.:

7: A.M. to 8:30 A.M.	9 tons	3 hrs. supply
2: P.M. to 3:00 P.M.	6 tons	2 hrs.
3: P.M. to 7:30 P.M.	27 tons	9 hrs.
1: A.M. to 7:00 A.M.	36 tons	12 hrs.
Total	78 tons	

It is believed that stamp feed bin capacity of 40 tons effective out of 53 tons will make this possible. Crushing could also be scheduled during and slightly before and after mine lunch periods, about an hour in the middle of each of the two shifts. Control of mine air supply by a valve in power house would also be helpful.

The intent of all the preceding is to show that probably both mine and mill can be operated on a basis of 75 tons per 24 hrs. insofar as present temporarily properly repaired power equipment is concerned.

SUMMARY OF EXPENDITURES

The following summary statement attempts to estimate expenditures on the Power Plant:

May 15 to July 1, 1935

De La Vergne Repairs	$1,000.
Low Pressure Air Arrangements	100.
Compressor Repairs	50.
Water Supply Dam	250.
Cooling Tower	50.
	$1,450.
Have available	$1,500.

Operation, July 1 to Oct. 1, 1935

3 months, per month $1,800.	$5,400.

After Oct. 1, 1935

Scheme A

Additional engine, installation, repairs, etc.	$12,000.
Compressor and synchronous motor	14,000.
Water Softener	200.
	$22,200.
Have available	$25,000.

Scheme B

Purchase and Installation of 110 HP. - 604 cu.ft. Diesel-Compressor	$10,000.

M I N I N G P R O G R A M

This section of this report is based on the preceding sections, and especially on those related to Ore Estimation, Mine Development Program, and Power Plant Program. It is divided into three principal divisions, related to: mine equipment and betterments; mine operation; and a summary of expenditures indicated in the preceding two.

The expenditures for equipment prior to Oct. 1, 1935 would be made largely before the beginning of operations on July 1, 1935. It will be noted that they involve those for absolutely necessary items of equipment such as air pipe, track, and parts of amounts alloted for cars, muggers, drills, drill steel, etc. In maximum they are necessary for fastest, most economical operation, considering the other large, continuous, general accounts which are a necessary part of the whole basis. Items for betterments are included in the maxima, such as those for water line, ventilating tube, grizzly, etc., which are needed to prevent unseen losses in time and speed of work of men.

In considering operations, a division into two 45-day periods at Aug. 15, 1935 is made. In general, the cost of operations would be about $6,000. monthly on a maximum scheme. On a restricted scheme it might be cut to slightly more than $4,000. monthly, but other general expenditures elsewhere in the business would continue at a high fixed rate. The minimum would also give much less development, ore therefrom, and dependable remunerative mill operation. The division of the operations into periods gives

an opportunity for revisions and decisions as to expenditures to be made in logical steps, to be based on prior results.

At a maximum the first period of operation should result in a new "A" Level, some 450' long, and the opening of some raises and stopes, all of which should give a supply of ore approaching that necessary for a mill run of one month on a 75-ton day basis. The mine would also be well equipped for continuing a similar program of development.

At a maximum the second period of operation, Aug. 15 to Oct. 1, should result in: a long continuation of "A" level, about halfway from present workings to King Gulch; a new "B" level, in as far as present workings; the opening of considerable quantities of raises and stopes; the maximum supply of ore, sufficient to operate the mill on a 75-ton daily basis for two periods of ten days each in each month.

Comments on some details of operation are also made.

It will be seen that the benefits of maximum expenditures at the mine would be:

(1) securing maximum results from otherwise high expenditures elsewhere;

(2) equipment of mine for rapid development;

(3) the possibility of securing a small, only slightly interrupted, production from the mill;

(4) demonstrating quickly the advisability as to further additions

to power plant and mine equipment, with a minimum of total expense on the whole business, and a maximum of partial return from ores.

Consequently, I believe that it should be advisable to provide maximum amounts of money needed for each step and for those at and after Oct. 1, 1935 in order to spend least total money eventually and get quickest ultimate returns.

MINE EQUIPMENT BEFORE JULY 1, 1935

Following suitable temporary repairs to the Power Plant the program of prospecting, development, and production of incidental ores should be ready to proceed on July 1, 1935, provided that suitable additional mine equipment were purchased, delivered, and ready to operate by that time.

Mine Water Line

The time of valuable men will be saved if the mine be equipped beforehand with a simple water system which will deliver water direct to drills without the use of air blown tanks.

Main 2" System

The electric driven triplex pump should be installed at the tanks at the head of the mill and connected to a main 2" water line. The pump should be provided with a by-pass to the tanks in which is a pressure regulating valve which will permit it to pump into the tanks when the main line to the mine is full to the top and under sufficient pressure.

The main 2" line to the mine should run along the inclined tram to the top, thence to the portal of Queen Tunnel, thence to Air Raise, thence up Air Raise to end in a capped line or standpipe above the collar. For present and future use, 1,000' should be on hand. There should be provided also: regulating by-pass valve; check valve; other valves; six elbows, 90°; six elbows, 45°; four tees; four bushings to 1" 1/4, etc. Most of this could be laid at once. The costs would be approximately:

Pipe	$240.00
Fittings	25.00
Labor	50.00
Total	$315.00

1" 1/4 Distribution

Water would be fed direct to the drills by an 1" 1/4 distribution system. This would connect to the 2" line at "A" Level in Air Raise. It would also run from bottom of Air Raise to bottom of No. 4 Raise, and thence up latter for use in raise and "A" level. Beside the pipe on hand, another 600' should be purchased. Fittings would include three valves; six elbows; and four tees. Considerable pipe could be laid at once. The costs would be approximately:

Pipe	$ 85.00
Fittings	10.00
Labor	40.00
Total	$135.00

Air Pipe

Air Pipe for the first part of the program should be on hand, and as much as possible laid in advance.

4" Air Line

About 100' of 4" air pipe should be laid in advance near the No. 4 Raise. This should not cost over $65.00.

2" Air Pipe

About 650' of 2" air pipe should be on hand and be laid up the Air Raise and No. 4 Raise and thereafter in "A" Level. It should cost about:

Pipe	$184.00
Fittings	25.00
Labor	65.00
Total	$274.00

1" Air Pipe

About 300' of 1" air pipe should be on hand for distribution near drills, such as short lines in raises, stopes, etc. With fittings it should cost about $50.00.

Ventilating Tubes

Temporary ventilation in dead ends of raises and drifts may be secured best by suction ejection with small air jets near the outer ends of 8" galvanized tubes. No. 4 Raise should be prepared with it before continuing. This should cost about:

400' galv. 8" tubes	$130.00
Other materials, strapiron, etc.	10.00
Air Line Connections	10.00
Labor	10.00
Total	$160.00

Track

Materials for 500' of additional track, principally for "A" Level, should be on hand. This would include: 1000' of 16#

rails, largely in 12' lengths; two hundred fish plates; one keg bolts and nuts; one keg spikes; two hundred and fifty ties. They would cost approximately:

Rails	$210.00
Fish Plates	20.00
Bolts and Nuts	20.00
Spikes	15.00
Ties	35.00
Total	$300.00

Mine Cars

Twelve more good-condition, second-hand mine cars similar to those on hand, should be provided at a cost of not over $900.00.

Grizzly and Bins

The grizzly above ore bins should be relaid to give as much slant as possible, with a 12' length, and 2" openings. This should not cost more than $40.00.

The ore bins should be firmly anchored to rock, top and bottom by tie rods, which should not cost more than $25.00

Provision should be made for sorting waste out in first 40' of slide below bin, and disposing of it, which should not cost more than $30.00

Tugger Hoists

Two tugger hoists should be provided. One would be used in or at the top of the Air Raise for a long time. The

other would be used in No. 4 Raise for several months before moving. It is believed that the Sullivan Turbinair with a capacity of 1,000# at 110. ft. per min. will be most suitable. Each tugger should be provided with 350' of 5/16" cable, fittings, and a bucket. These items would cost about:

2 Taggers	$590.00
700' - 5/16"	46.50
Fittings	15.00
2 Buckets	40.00
Total	$691.50

Drills

Two more drifting machines will be needed. There is on hand one I-R, K-75, which uses 202 cu. ft. per min., and which is a 3"1/2 machine. It is believed that an K-72, 3"1/4, will drill a satisfactory round each shift. This machine uses 30. cu. ft. per min. less air. Because of limited air and no other places to drill in one shift this is an important possibility. In connection with the purchase an K-72 should be tried for several days before buying the two drills. Water tanks should not be bought, water being provided otherwise as above. The old columns, arms, and clamps at the mine should be studied carefully to see if they will serve on these machines. It is estimated that the two drills with columns, hose and fittings will cost about $1,030. It should be noted that the K-72 does not cost much less than the K-75, but that it is important to get workable drills using the least air possible.

Drill Steel

The drifter on hand is supplied with 1"1/8 round steel. Experiences by the largest companies have shown that this is the largest section that should be used for the hardest ground.

Taking into account the steel on hand, the three drifters will need an additional amount of bitted and shanked, 1"1/8 round steel, as follows: 74 pieces each, in lengths of 1' difference, from 2'6" to 6'6", a total of 370 pieces. This steel will cost about $2,072.

Miscellaneous Drilling Equipment

A hitch cutter should be provided, at a cost of about $95.

Three extra sets of hoses, water and air, each 50' long, with connections, should be provided at a cost of about $111.

Extra Allowances

In order to cover trucking, extra unforeseen freights, and miscellaneous items of extra supplies and extra labor, an allowance of $500. should be made in addition to the above.

Summary of Expenditures

The expenditures on mine equipment before July 1, 1935, may be summarized as follows:

Water line for sinking	$450.00
Air Piping	300.00
Ventilating Tubes	160.00
Materials for Track	300.00
Mine cars (12)	900.00
Changes, Grizzly, Bins, Slide	115.00
Tugger Hoists (2) and Accessories	691.50
Drifting Drills (2) and Accessories without tanks	1,030.00
Drill Steel, 1"1/8 round, 1665', bitted and shanked, lengths 2'6" to 6'6", 1' changes	2,072.00
Miscellaneous Drilling Equipment	296.00
Extra Allowances	500.00
Total	$6,813.50

Consequently, we should have $6,800. on hand for these purposes.

August 15 to Oct. 1, 1935

Water System	$300.00
Air Pipe	150.00
Ventilating Tubes	100.00
Materials for Track	400.00
Drill Steel	300.00
Timber	500.00
Total	$1,750.00

An allowance of $2,000. should be made.

MINE EQUIPMENT AFTER OCT. 1, 1935

At this time a rough estimate may be made of additional amounts to be spent on mine equipment after Oct. 1, 1935, provided that nearby schedules had been followed, that prospecting and development resulted favorably, that an expansion of operations were possible, and that additional air compression were secured, as follows:

Extending mine water lines and installing tank on surface above "C" level	$500.00
Additional Ventilating Tubes	100.00
Materials for 1,000' additional track	600.00
Additional Mine Cars (12)	900.00
Additional Air Pipe	300.00
Additional Stopers (8) with hoses and Steel	4,000.00
Extra Hose Sets (3)	111.00
One Jackhammer, hoses, and steel	475.00
Extra Allowances	200.00
Total	$6,986.00

Consequently, at least $7,000. should be provided.

MINE OPERATIONS JULY 1, TO AUG. 15, 1935

It is assumed that the prospecting and development program outlined above will be generally acceptable, and that with suitable preparations and competent personnel a period of six weeks mine operation should be sufficient to provide enough ore for a preliminary, remunerative run of the mill.

Air Raise Preparation

The Air Raise should be prepared, for driving the "A" level to the north, in 8, 2-shift days which with materials and labor should not cost in excess of $400.

No. 4 Raise Preparation

The preparation of the No. 4 Raise to its present back, with suitable chutes and dimensions, ready for continuing upward rapidly, should not consume more than 7, 2-shift days, which with materials should not cost more than $300.

No. 4 Raise

Thereafter the No. 4 Raise should be raised to a height of not less than 50'. By contracting, it should be possible to do this for $300.

"A" Level

The "A" level is to be driven as rapidly as possible: north from the Air Raise; south from No. 4 Raise to connect with preceding; and north from No. 4 Raise; all on the main foot vein. Three drifters should be used until connection is made, and a minimum of one to the north of No. 4 Raise continuously. It is believed that not less than 450' should be driven during the period, at a contract price of not more than $5. per ft., or a total of about $2,250.

No. 4 Raise Extension

The No. 4 Raise should be extended above the clearance back above "A" Level as rapidly as possible. It is believed that this can be done nearly all the time that driving on the "A" level is being done. It is likely that at least 60' more can be done during the period at a contract cost of $360.

Other Raising

It will be noted that 600. cu. ft. 90# air rating is available as a total, and that there will be an excess during certain periods in the progress of the above work. It is obviously desirable to take full advantage of all air available. It will be noted also that there are three other places in which raising on ore might be done from time to time, namely, the raise south of Air Raise, the No. 1 Stope, and the No. 3 Stope. It is believed that during appropriate intervals in the period, on a two-shift basis, as much as 225' of raising could be done at a contract price of $2,250. An additional allowance of $500. should be made for materials. Some little ore should be broken, say 600 tons, one-half of which could be stored in place.

General Mine Labor

With the use of the contract system mine bossing should be reduced to a minimum. A young, to middle-aged engineer with superior operating experience could probably be had for $7. per day. He would need to be at the mine twice a day to forestall shortages of tools and supplies and to do minor amounts of sampling, and surveying. He could also have general oversight over

the assay office and an assistant there.

Beside this there would be used each day on a two-shift basis the following shifts: two sharpeners; four ore sorters and helpers; two trammers and mules; etc. It is estimated that beyond contractors men this labor account should not exceed $80. per day, or $2,880. for the period.

Extra Mine Supplies

Some mine supplies will be needed in addition to those chargeable to contracts. These would include fuel oil, rag waste, lubricating oil, carbide, tools, fittings, timber, etc. It is believed that these should not exceed $10. per day, or $450. for the period.

Use of Contractors

It is believed that the use of the contract system on a two-shift basis will be best for present requirements. It will secure speedy work from competent men with a minimum of bossing and overhead expense. It is believed that there are many such men available, outside of the Silver City-Mogollon region, who are used to such methods under rigorous conditions, and who may be contacted by talks with various drill and supply representatives. The work may be broken up into as many contracts as desired, but it is believed that there should be not less than two principal contractors, and as many as four might be used. They would secure their own associates or partners on various drills and shifts. They would also secure their

other necessary labor; but they should be discouraged from using labor long resident in the district unless it be used for only the simpler work.

Based on notes as to earlier operations it is believed that prices of $5. per foot for drifts and $6. per foot for raises, the trimming in Queen Tunnel to be done on company account, should be sufficient.

The contractors should be expected to buy from the warehouse powder, caps, and fuse. The company might furnish carbide, oil, and waste. It should also supply drills and their accessories, tools, sharpened steel, air, etc. It should also supply materials for track; timbering; air, water, and ventilating pipes; but the contractors should be required to install them currently in a workmanlike manner. They should also be required to make a reasonable separation of coarse waste during the mucking.

Summary, Maximum Mine Operating Expenditures, July 1 to Aug. 15

Air Raise Preparation	$400.
No. 4 Raise Preparation	500.
No. 4 Raise, for "A" Level	300.
"A" Level	2,250.
No. 4 Raise Extension	360.
Other Raising - Stoping	2,250.
Materials for Raising - Stoping	500.
General Mine Labor	2,250.
General Mine Supplies	450.
Total	$9,060.

Thus, operating expenditures would be at a rate of about $6,000. per month.

Summary, Maximum Available Ores, July 1 to Aug. 15, 1935

The following shows the maximum tonnages of ores which are likely to result from most favorable developments and speeds between July 1 and Aug. 15, 1935.

		Item	Cumulative
No. 4 Stope, Already Broken		310 tons	310
No. 4 Raise, Preparation and Raising clear of "A" Level	50'	200	510
"A" Level	230'	450	960
No. 4 Raise Extension	60'	240	1,200
Other Raising - Stoping	225'	600	1,800

The "A" Level might yield no more than 350 tons, and Other Raising - Stoping could be held back if desired.

Storage

The No. 5 Stope should hold 500 tons of broken ore, and it and the No. 4 Chute might hold two-thirds of the ore broken in the No. 4 Raise and its part of the "A" level. The Air Raise Chute would hold 100 tons, leaving a maximum of 200 tons to be trammed to bins. About half of the ore broken in Other Raising - Stoping would be stored in corresponding workings, leaving a maximum of 300 tons for outside storage. Thus from 300 tons to 500 tons would be stored outside the mine.

The Mine Bin and Slide to Mill is estimated to have a capacity of 400 tons. If the ore develops in large amount with high values it is desirable to push production, rather than hold back; and store the excess on ground about foot of bin, whence

it can be put in slide at no great extra expense.

The above shows that it is possible as a maximum to get a one month, 75-ton daily, ore supply for mill in six weeks. One might also consider starting the mill sooner.

MINE OPERATIONS, AUG. 15 TO OCT. 1, 1935

It is assumed that the mill will be running during this period, so that only 600 cu. ft., 00# air will be available for the mine on a two-shift daily operation.

"A" Level

The "A" level should be continued rapidly to the north. An advance of 315' with one drifter might be made at a contract cost of $1575.

No. 4 Raise

One stoper should be used to raise No. 4 Raise well clear of the proposed "B" Level. If the preceding work had advanced well, 60' more work at a contract total of $360. might be involved.

"B" Level

"B" Level might be advanced during this period from the collar of the Air Raise to beyond the No. 4 Raise at a total contract price not in excess of $1600.

Other Raising and Stoping

It should be realized that the two other stopers could be worked continuously during the period, and another would be available during the latter half of the period; but, that there should also be a number of working places to choose from. These would include finishing raise - stopes on ore above Queen Tunnel at No. 3 Stope, No. 1 Stope, and Air Raise; stoping out Nos. 4 and 5 Stopes, including floor pillar, to "A" Level; and starting and breaking stopes in back of "A" Level. The working places chosen should be those which are likely to yield the highest grade ore, in order to get the largest remuneration most quickly. It may be assumed that during the period 220 stoper shifts may be worked on this type of work at an expense of not more than $2,000.

General Mine Labor and Supplies

It should be realized that during this period, as in the preceding one, it will be necessary to spend about $2,000. for general mine labor; and about $500. for extra supplies.

Summary, Maximum Mine Operating Expenditures, Aug. 15 to Oct. 1

"A" Level	$1,575.
No. 4 Raise, for "B" Level	360.
"B" Level	1,600.
Other Raising and Stoping	2,000.
General Mine Labor	2,000.
Extra Mine Supplies	500.
Total	$8,035.

Thus, operating expenditures should be kept at a rate of slightly less than $6,000. monthly.

Summary, Maximum Available Ores, Aug.15 to Oct.1, 1935

"A" Level, prospecting north	(315')	100'	325 tons	325
No. 4 Raise, to "B" Level		60'	240	565
"B" Level, prospecting to No. 4 Raise	(315')	100'	225	790
Other Stoping and Raising 220 shifts			1,320	2,110

From this and the preceding, similar summary it would seem possible for the mine to produce each six weeks enough ore for a 30-day mill run at a 75-ton daily rate. Thus, the mill might be run ten days in each fortnight at 75-tons daily, securing the most careful treatment, including grinding, and the highest possible extraction on the ores. If between July 20 and July 25 inspection shows that the above rate of ore accumulation is being attained, then plans could be made to begin the first ten-day run on the mill between Aug. 1 and Aug. 15.

In general, it will be seen that ore supply will depend on rushed, carefully scheduled development; and that this can be aided greatly by the installation of more power and air compression. If mine developments have warranted it, a careful consideration should be given early in September to a partial improvement by the possible installation of a 600. cu. ft. Diesel-Compressor unit. This would hasten development, even out stoping, lessen mill shutdowns, and provide greater monthly tonnage.

We should emphasize the need of doing our raising and stoping work in the richest ores.

OTHER DIVISIONS OF MINE OPERATIONS

Some discussion as to certain divisions of mine operations has necessarily entered into the preceding. Of great importance is the use of the contract system, with its foreseeable charges, its competence, its speed, and its elimination of much useless petty bossing on details.

The need for furnishing some general supplies has also been pointed out.

Some little mention has also been made of the need of employing some general mine labor. Under this system, and for this rather small amount of work, one engineer foreman, skilled in operating, and of general adaptability and usefullness should be sufficient. Mention has also been made of the need of trammers, sorters, and sharpeners.

Tramming

It is assumed that for several months, in order to store ore in the mine for intermittent mill operation, all waste will be trammed out as soon as broken. It is assumed further that a trammer and mule can handle a train of 8 - 3/4 ton cars at a rate of not less than 8 trips per 8-hr. shift, including loading and unloading. This should give 48 tons per shift at a maximum cost not in excess of $0.10 per ton.

From a consideration of the preceding it may be seen that during the period July 1 to August 15 no more than 40 tons of waste per day need be trammed from "A" level during the first two-thirds of period; and that no more than 40 tons per day of both waste and ore need be trammed during the last third of the period. Consequently, only one tramming shift will be needed,

and the maximum for general mine labor may be cut by $4.60 per day, or $207.

During the period Aug. 15 to Oct. 1, during which mill would be running intermittently, we should be able to tram an average daily of 90 tons of both ore and waste. Therefore, two tramming shifts would be necessary.

Sorting

The vein contains small quantities of included wall rock which must be broken with it. In regular stoping or stope raises the breaking of wall rock alongside the vein would be carefully controlled to keep from breaking any of it if possible. But in running drifts and main supply raises it will be necessary to break some little wall rock, say from 15% to 40% depending on vein thickness, in order to secure workable final dimensions. In the raises it will be impracticable to sort out the broken waste; but in the drifts, a considerable amount of the coarse wall rock can be sorted and trammed separately as waste during the mucking. Consequently, material which is not definitely waste will have to be sorted, all possible waste being picked out, and the remainder used for ore. This sorting should be done as closely as possible, down to 2" or less in order: to keep up mill heads; to stop spending money on it in the mill; and to use the limited capacity of power plant and mill to greatest remunerative effect. The matter of careful, rapid, cheap sorting is of very great financial importance. Fortunately, we shall be aided somewhat by the present tendency of the waste to break in large sizes.

A trailload at a time, as much as 6 tons, should be dumped on the enlarged, 8" grizzly, where one sorter should be able to give it a good rough sorting between trimming trips. The material not thrown out as waste would fall or be thrown to mine ore bin.

Between the mine ore bin and mill is a large, long, box slide, which might hold 100 tons. If it be desirable to fill this, or when ore is running through it to the mill, the ore should be given a second sorting to pick out waste of fine sizes, not much of it greater than 2" except flat slabs. This would be done by handling from time to time through a staggered board gate a section of about 20' at the upper end of the slide, which would to filled from time to time from the bin.

It seems likely that between July 1 and Aug. 15 only one sorter on one shift, who could work at both places as needed, would be required. Consequently, we may be able to cut the maximum general mine labor roll by as much as three men daily at $3.60, or $10.80 daily, or a total of $486.

During the period Aug. 15 to Oct. 1 sorters should correspond to trammers, working on two shifts. But it might be arranged not to work the sorter on the slide during the night shift, thus saving an expenditure of $5.60 daily, or $162. total.

Sharpening

It seems very likely that in order to take full advantage of conditions it will be necessary to work two shifts on sharpening steel. The time of shifts should be varied to suit operating conditions.

Stoping

No consideration has been given to explosives and stoping methods. It is believed that such choices should be left to be determined by the operators, subject later to some minor checking or suggestions. In general, however, it seems likely that during the next several months the desire for keeping any further investment at a minimum, for securing maximum remuneration, and for building up a large amount of working capital quickly, will lead to the use of small open stopes wherever practicable. If development be pushed then ore storages may be used as shrinkages and the system changed to shrink stopes at a fairly rapid rate. It will be seen that under certain contingencies it may even be necessary to resort to underhanding for short periods.

Personnel

From all that has preceded, it will be seen that none but the most competent men, experienced in this size and type of mining, should be allowed to work at the mine. The choice of contractors and sharpeners is especially important. The services of all possible contacts with southwestern mining should be used in trying to get an expert crew.

MINING PROGRAM, SUMMARY OF ALL EXPENDITURES

In the table which follows is a summary of all estimated expenditures for the Mining Program, by dates, including those for both Equipment and Operations. Maxima are shown as indicated

in the preceding statements in this section. Estimates of minima have also been included, which have been arrived at by eliminating in whole or in part items of betterments, such as water line; items of equipment, such as some drills and cars; and assuming a slower rate of work. It would not be best procedure, however, to use these minima in all cases. They would principally result in less activity without a lessened expense for power, and other general items, such as general salaries, general mine labor, etc. Further, they should have a profound effect on both the rate of development and the rate of remuneration from ores.

M I L L I N G P R O G R A M

This section of this report is divided into divisions dealing with Equipment, Betterments, and Repairs; Operations, including expectations as to tonnages and recoveries; and Summary of Maxium Expenditures.

From the first it will be seen that something less than $1,750. will be required before mid-August, 1935.

The second shows a maximum of $7,450. to be expended between Aug. 10 and Oct. 1, 1935, with the amount to be lessened by as much as $1,500. The tonnages and recoveries should bring in money net to the property approaching a total of $28,000. The maximum total expenditures for the milling program, $9,200., are small compared to the remuneration to be obtained for the business, and the proportion can be made less by rigid efforts in cutting expenditures and in increasing tonnages and grades from the mine.

It should be borne in mind that, as to starting dates, tonnages, grades, and periods of operations, the milling program is completely dependent on a rapid, efficient, and successful program in the mine.

Professor John F. Graham was called in to make a study of the mill, and to test the ores. His report is incorporated with this. Free use has been made of it; of old operation reports, compiled and commented on by J. J. Jones, who was interviewed by Prof. Graham, and of notes and estimates by J. A. McCaskell.

MILL EQUIPMENT

As shown on the Surface Map, the Mill for the Queen Mine is located on Mineral Creek, with it lowest terrace about 150' below and 200' horizontally from the mine track at top of mine ore bin, and its upper floor about 100' below and 100' horizontally from same point. It is important to note that most of the mill is not on the Copper Queen claim, as formerly supposed, but on the newly located Silver Leaf.

With this is a sketch plan of the Mill which shows the arrangement of the elements composing it. The Graham report, the latest, shows that the mill is essentially well constructed; that there is an excess of thickening, agitating and filtering capacity; and that only a few, relatively simple, and inexpensive items of equipment, changes, betterments, and repairs will be necessary before it operates again, as shown in the following table:

Mill Changes and Repairs, Before Aug.15,1935

Crusher Repairs	$ 50.00
Rod Mill, Repairs and Relining	500.00
Rod Mill Motor, New Foundation	100.00
Precipitation - Refining Room	150.00
Thin concrete floor, board walls	
Graham's Additional Recommendations and Estimates	
Change No. 1	90.00
Change No. 2	10.00
Change No. 3	185.00
Change No. 4	10.00
Addition No. 1	80.00
Addition No. 2	430.00
Total	$1,605.00

It would seem that $1,750.00 should be made available for this.

Time of Preparing Mill

Probably not less than 25 days, using mechanical-surface crew and helpers and a few mill men who might arrive early, would be required to prepare the mill. Consequently, some of the work, especially that relating to crushing-grinding department and precipitation-refining room, should be begun as early as between July 5 and 15, 1935. Probably needed equipment and materials would be in transit while this were going on, and some of the work might be continued into the first few days of operation.

Mill Betterments and Repairs, After Oct. 1, 1935

Certain other betterments and repairs will come up. For instance, suggestions have been made as to repairing battery guides, etc., but these can be treated as items of current repairs and maintenance under Mill Operation, where it is believed that sufficient allowances have been made.

There are, however, certain larger and important items to which attention will have to be given in the future, say after Oct. 1, 1935. A large and important one relates to proper conveyance and storage of the tailings. The discharge of the present conveyor should have a scraper installed, as an item of operating expense; but fundamentally the conveyor needs to be extended for about 150' on a high trestle. This

might cost $1,000. In the meantime, the tailings may stack up where they are now storing themselves.

Also about this time, the filter will need to be recovered. Care should be taken to do a good job, much better than the last one, by which the cloth projects through the wires. In the meantime, edges of old belting should be attached to the discharge scrapers.

A serious matter will relate to the use of bags for filtering. It is likely that the Merrill Company holds a patent on this scheme, and it may demand royalties for its use. The matter should be investigated.

From the preceding it is seen that for foreseen items an allowance of $1,200. should be made.

MILLING OPERATIONS

Past Record

The fragmentary old records, and especially the fairly complete statement compiled by J. J. Jones as of mid-March, 1933, show certain favorable things about the mill, more especially as regards its interrupted operation in February and March, 1933, as follows:

(1) Grinding was sufficient;

(2) Extractions were good;

(3) Tails had low values, if washed;

(4) Grinding was showing more than 75% through 150 mesh, and more than 55% through 200 mesh.

These have been verified by Professor Graham in his consideration.

Certain unfavorable features were noted;

(1) Interrupted, spasmodic operation was the rule;

(2) Dependable ore supply was not provided;

(3) Dependable power supply did not exist;

(4) Increased cyanide strength was needed;

(5) Metal losses were not accounted for earlier;

(6) Metal and cyanide losses in the tails were large because of insufficient displacement washing;

(7) Better tailings disposal needed;

(8) Clarification before precipitation needed.

The present studies aim to eliminate the first three; while the others will be cured by Professor Graham's recommendations, made a part of this.

Graham's Report

The report of Professor John F. Graham, made a part of this, should be studied carefully. Regarding operation, he makes certain salient points, which were corroborated by testing:

(1) Sufficient grinding can be obtained;

(2) 36 hrs. agitation should be sufficient;

(3) Strength of solution should be equivalent to that of 4# KCN;

(4) Cyanide consumption should be equivalent to that of 1# KCN per ton;

(5) Alkalinity should demand the equivalent of 6# Ca O per ton;

(6) Extraction should equal or approach 95% of gold and 86% of silver contents;

Some of his recommendations have already been noted under Betterments and Repairs. With respect to operating details he also recommends:

(1) Pump overflow from Thickener No. 1 to mill solution tank ahead of stamps;

(2) Use only 3 Agitators (possibly 2 on 75 tons);

(3) Per agitator, use 30 cu. ft. free air per minute raised to 15# pressure;

(4) Eliminate Thickener No. 2;

(5) Secure effective double displacement washing on filter with barren solution and wash water;

(6) Clarify solutions before precipitation;

(7) Pump zinc dust and clarified solution to precipitating bags;

(8) Keep precipitating bags immersed in tanks of barren solution;

Rates and Periods of Operations
and Tonnages to Be Treated

It will be seen that operation of the mill on a 75-ton daily basis will depend upon repair of power plant; initial date of mine development program; speed and efficiency of mining program; and extent of ores encountered and broken. At present it would seem that the milling should start not later than Aug. 16, 1935.

It is believed that not less than 3,000 tons should be milled by about Oct. 1, 1935. If the mine should produce 3,500 tons between July 1, and Oct. 1, 1935, then the mill would have to operate continuously between Aug. 16, and Oct. 1. If the mining outlooks warrants, which it should, then it might be better to start the mill on Aug. 11 and run continuously during the remainder of month. Operation thereafter in September could be scheduled by mine progress. It should be possible to run on

a maximum basis of at least 20 days in 30, preferably in 4-day periods. The periods could be lengthened as needed.

Certain factors of milling will influence the rates of operation. In the first place, the mining program should have priority in the use of power, so that the mill should be held back to 75 tons daily. This will not be a one-sided evil, because it will enable the mill operators, especially in early periods, to control carefully fineness of grind, full extraction, and careful filtering, washing, precipitation, refining, etc. It is better to run all of the mill continuously on a low tonnage than to run only part of it each day on a larger tonnage, because of the demands of evenness in the process. It is also better to run it at a smaller rate for longer periods than to run large tonnages spasmodically. It is true that detailed costs will be higher than for periods of longer running at higher tonnage rates; but in the first place, early remuneration should be a factor; and in the second place, the crews can be kept better organized if only short lay-offs semi-monthly can be arranged. Several members of the crew would be working during the lay-offs, and some of them could take turns at such work. The work during lay-offs might include precipitation, refining, repairs, betterments, experimentation, etc.

Personnel

The milling crew should be carefully chosen and all members should be highly competent. In the following a crew of maximum size is assumed, which might be cut somewhat after several weeks of operation. It should be headed by an expert foreman of wide experience with this size and character of property, preferably a man with complete technical background. No doubt he would

have to be employed on a monthly basis at between $200. and $250. He should have an assistant on day-shift, preferably a young, energetic, technically trained man, who could soon become competent to do mill sampling, experimentation, special assaying, etc. On each of three shifts there should be a man as follows: repair-oiler-roustabout-crusher man; attendant on stamps, rod-mill, classifier; solution man; attendant on filter, clarifier, and precipitation. The crusher man would be free for other duties during most of the day-shift, when the foreman could use him and man from department concerned to effect adjustments, repairs, etc. The solution men might be eliminated later.

For days of operation the labor cost would be as follows:

Foreman	1 shift	8.00	8.00
Sampler	1 "	4.25	4.25
Crusher-Oiler-Repairs	3 "	4.00	12.00
Stamps-Mill-Classifier	3 "	4.00	12.00
Solutions	3 "	4.25	12.75
Filter, Clarifier, Precipitation	3 "	4.50	13.50
Total per Operating Day			62.50

This might be cut later to $50.00 daily.

On days of lay-offs, the following men would probably be employed:

Foreman	1 shift	8.00	8.00
Sampler	1 "	4.25	4.25
Crusher-Oiler-Repairs	1 "	4.00	4.00
Filter-Clarifier-Precipitation	1 "	4.50	4.50
Helper	2 "	4.00	8.00
Total per Lay-Off Day			28.75

after several weeks this might be kept down to near $20. daily.

If between Aug. 11 and Oct. 1, 3,000 tons were milled at a rate of 75-tons daily, then there would be 11 days of lay-off and the equivalent of as many as 5 others before Aug. 11. Thus, the maximum total labor cost would be:

40 operating days	at $62.50	$2,500.00
16 lay-off days	at 28.75	460.00
Total Mill Labor Maximum		$2,960.00

This would give a labor charge of $0.987 per ton. If, before Oct. 1, the tonnage milled should reach 3,500 tons, the labor charges would increase by $416.67, or a labor cost of $0.985 per ton.

Cost of Supplies

As in other matters, full advantage has been taken of notes and estimates made by Mr. J. A. McCaskell regarding supplies for milling, and this has been checked with Professor Graham. His estimate of $2,183.10 for 2,700 tons is believed liberal. This would give a maximum for supplies up to Oct. 1, 1935 of $2,835.00.

Other Milling Charges

If maximum charges of $3,376.67 for labor, and $2,835. for supplies, be added to, to make a total of $7,450.00 to cover any emergency charges, then it is believed that this total is ample for milling charges up to Oct. 1, 1935. This would give a maximum direct milling cost per ton of $2.48.

It will be noted that, both in the case of mine and mill, power and general charges are not distributed, but kept in lump sums to enter into total expenditures. For milling distribution,

prior will probably run on $0.45 per ton.

Recoveries

From Professor Graham's report it will be seen that he believes that milling operations should strive for and eventually attain recoveries of 95% of the gold and 85% of the silver. For present purposes, we may assume that we can get 90% of the money value of gross assay value, using $35. per ounce for gold and $0.77 per ounce for silver. If we use a silver to gold ratio of 30 to 1, this means a recovery of 92% of the gold and 84% of the silver, or their equivalents, which seems reasonable.

Net Money Recovery

But it has been mentioned earlier that as far as net money at the mine is concerned, an additional deduction of 4% should be made for marketing, so that net money recovery of gross assay value would be about 86%.

Grades of Ores to be Handled

From earlier statements it will be seen that we should avoid breaking any ores running less than 0.14 - 4.2, or its equivalent (0.1 of silver being about equal to 0.02 of gold) which would give $8.14 gross assay value, $7.33 mill recovery value, and $7.00 net money recovery value. It should be easy to keep this type of material at a minimum in the mill feed.

From the mine estimates it will be seen that it should also be easy to obtain an average for the mill feed in excess of 0.17 - 4.7. This would give $9.57 gross assay value, and $8.23 net money value. If 3,000 tons be milled prior to Oct. 1, 1935, the total net money value would be $24,690; if 3,500 tons, then $28,805. These net money values to be recovered would be increased

by either increasing tonnage above 3,000 tons, or by doing all possible to increase grade, or by both. Typical effects of the ranges to be covered are shown in the following table:

Ranges of Net Money Recoveries

Aug. 11 to Oct. 1, 1935

Assay Per Ton Oz. Au	Assay Per Ton Oz. Ag	Gross Assay Value Au at $35. Ag. at .77	Net Money Recovery 80%	Total Recoveries 3,000 tons	Total Recoveries 3,500 tons
0.14	4.2	$8.14	$7.00	Restrict Rigidly $24,690.	$28,805.
0.17	4.7	9.97	8.23	Easy Mine New Ore Average	
0.18	5.0	10.15	8.73	26,190.	30,555.
0.20	5.5	11.24	9.67	29,010	33,845.
0.25	8.5	13.29	11.43	34,290.	40,005.

From this it will be seen why it is imperative to do strenuous mine development work in the most promising places, and why richer ores above "A" level should be given preference in any stope opening. No doubt the management can perfect detailed schedules to achieve maximum returns. But, from this it will be seen that we should endeavor to have $26,000. in net money recovery on hand or in transit by Oct. 1, 1935.

MILLING PROGRAM, SUMMARY OF MAXIMA EXPENDITURES

The preceding discussion in this section may be summarized as to expenditures as shown in the following table:

1935 Dates	Purpose		Totals
7/1 - 8/10	Preparation		$1,750.
	Betterments and Repairs		
8/11 - 10/1	Operation		7,450.
	Labor, includes time before 8/11 and Lay-offs	$2,960.	
	Supplies	2,835.	
	Contingencies	1,655.	
	Total to Oct. 1, 1935		$9,200.
After 10/1	Betterments and Repairs		1,200.

It will be realized that safety would urge one to be prepared to spend $9,200. on the milling program prior to Oct. 1, 1935. But, because the allowances for supplies, contingencies, and labor are so liberal, I believe that with rigid management the expenditures can be cut by as much as $1,500.

GENERAL OPERATING PROGRAM AND CHARGES

It must be realized that, as in all businesses, there are several items of general operations which cannot be allotted at all times to specific parts of the business, such as power plant, mine, and mill. Yet, these services are of great fundamental importance, and inescapable. The greatest care is always needed to keep their costs at a minimum; especially during development and operations, or before the scope of the business can be increased to a size which makes them easy to carry.

EQUIPMENT

Housing and Offices

The principal general buildings, all small and of rough, temporary, frame construction, include: warehouse, office, engineering-assay office, cook-house, and bunk-house. Insofar as possible these should be made to suffice for the first few months; but, it may become necessary to add a small amount of dining room space and also a small amount of shack bedroom space near the offices.

Following successful operations, the housing might be expanded adequately and cheaply after Oct. 1, 1935.

Shops and Tools

There is a small elemental general shop, which with equipment should be made to suffice during the next few months.

But, if the power plant be expended after Oct. 1, 1935, no doubt it will be necessary to increase these facilities to a minor degree..

Transportation

The transportation equipment includes: a small caterpillar tractor and a few heavy trailer trucks; a heavy auto truck; a small pick-up truck. The bulk of supplies can be hauled by contractors either as far as the warehouse, or as far as Glenwood. The caterpillar may be needed variously during the next several months. The pick-up truck may always be needed for emergencies related to both personnel and supplies. When the matter has been studied, including needs likely to arise during construction about Oct. 1, 1935, it may prove desirable to dispose of the large truck.

The warehouse level is connected to the dump at Queen Tunnel by an inclined, single-track tram, as shown on the general map. Materials are hoisted by an old tugger at the top, which is in poor condition and inefficient. Heavy loads are hoisted by use of the caterpillar. The tugger should either be sufficiently repaired or replaced by a larger hoist after Oct. 1, 1935. Consideration might also be given to an installation of a three-rail tram and turnout, with some kind of counterweight to help out the engine, although an improved use of the caterpillar may prove best in the long run.

General

Plans and financial allowances for the foregoing general equipment, which are purposely avoided herein, should be

made in the future.

GENERAL CREW

The need of a general service crew will be obvious. It would include: general mechanic, electrician, carpenter, truck driver, helpers or surface laborers, watchmen, cooks, etc. It is assumed that the members would be picked so that the principal men would help one another as needed, and so that helpers and laborers would have interchanging duties. Policing would be kept to a minimum, but it is likely that one deputy would be needed continuously. It is also assumed that the cost of boarding-house, including wages, will be fully covered by reimbursement from the employes boarded. The position of driver might be eliminated by having it done only occasionally and when absolutely necessary by some competent members of the surface crew.

The cost of surface crew might be expected to run as follows:

General Mechanic	$ 4.50
Electrician	5.00
Carpenter	4.50
Laborers, 4 at $3.	12.00
Deputy	5.00
Total, Daily	$31.00

By keeping laborers and helpers to a minimum, especially after mine and mill betterments for which labor has been allowed, this cost should be kept to not more than $30. daily or $900. monthly.

GENERAL SALARIES

It will also be obvious that a considerable amount for general salaries will be a continuing, inescapable item. The positions would include: a personal representative and financial agent; a superintendent; an accountant; and an assayer. During the next few months both the superintendent and accountant should live continuously at the mine, except for occasional short absences of visit to families living outside. The accountant could easily take personal charge of the warehouse with only occasional aid from some of the members of the surface crew. The assayer would be an assistant to the engineer-mine boss, so that he would not have to be a high paid man.

For salaries, approximate allowances should be made as follows:

Personal Representative	$200.00
Superintendent	300.00
Accountant	200.00
Assayer Assistant	100.00
Total Salaries	$1,000.00 monthly.

This general allowance should not be exceeded during the next few months.

GENERAL EXPENSE

The item of general expense is likely to be difficult to estimate. But it is important to watch it carefully and keep it to a minimum. It would include expenditures for: telephone; telegraph; auditing; compensation insurance; other insurance; taxes; licenses and fees for rights, etc.; special services;

traveling expense; and miscellaneous. Since depreciation and depletion are not immediate out-of-pocket expenses, they are not included. With care and planning it should be possible to keep the first three to a minimum. The insurances will be necessary and continuous. With care it is likely that taxes, licenses, and fees can be deferred considerably and kept to a minimum during the next few months. There is no doubt that special services and traveling expenses will be necessarily and advisably high during the next few months, but it should be possible to cut them to a minimum after Sept. 1, except some which may arise in connection with power-air plant expansion after Oct. 1.

On a monthly basis, these might amount to:

Telephone, Telegraph, Auditing	$ 75.00
Compensation Insurance	225.00
Other Insurance	100.00
Taxes, Rights, etc.	100.00
Special Services	500.00
Miscellaneous and Travel	100.00
Total Monthly	$1,100.00

SUMMARY

From all of the foregoing of this section it will be seen that expenditures for operations and charges of a general nature will sum monthly to:

General Labor	$ 900.00
General Salaries	1,000.00
General Expense	1,100.00
Total	$3,000.00

It is believed that with careful management, $3,000. monthly will be sufficient; but it should be noted that the general charges are high, and continuous, so that it is important to plan carefully for a maximum of accomplishment elsewhere.

SUMMARY OF GENERAL PROGRAM

This section deals with a review of the proposals made in previous sections for the development and operation of the Queen Mine. Notwithstanding past errors in installing the Diesel engine, the construction of a mill at so early a date which might be criticised by some, and the noteworthy lack of attention to mine development; yet, the property should be taken as it is, and a program outlined and accepted in view of the existing circumstances only.

PRESENT PROPOSALS

The essence of the present proposals involves:

(1) Putting present power plant in dependably efficient condition;

(2) Equipping and bettering the mine on a scale commensurate with power available;

(3) Doing the maximum development at maximum rates, including "A" and "B" Levels, and raises and stopes;

(4) Bettering and operating the mill on 75-ton basis to secure remuneration as large and as quickly as possible.

The ultimate outcome will depend upon the speedy and efficient execution of the program, and upon finding longer shoots, greater tonnages, and higher grades of ores on the "A" and "B" Levels, both above and to the north of the present workings.

OPERATING POLICIES

Certain general policies in regard to operations should be considered, decided, and adhered to. Some of these have been mentioned in the foregoing.

Personnel

Choice of personnel and methods of handling is the item of greatest importance for securing a suitable execution of the program. In any event none but the most competent men should be employed, those capable of securing the greatest results in a minimum time at a reasonable and probably cheap, unit cost.

Contract System

The use of the contract system has been mentioned earlier; and it is recommended that all possible work, especially mine development, be done by this system.

Wages and Hours

It is recommended that a liberal scale of wages be paid during the next few months for the purpose of securing from the whole southwestern region the services of the men most competent in their lines for this size and character of operation. Stinting on wages now might jeopardize the progress and total cost of the program. The minimum hourly rates might be as great as:

Mine [illegible]	$0.70
Drill runners	0.60
Muckers	0.55
Trammers	0.45
Sorters	0.45
Laborers	0.40
Sharpeners	0.70

Minimum guaranteed wages underground might be fixed at $0.45 and $0.50, but it would not be surprising if competent man expected to earn at least the above on contracts.

Wages in departments other than the mine have already been mentioned.

The normal day should be 8 hrs.

Most efficient work in the mine will be secured by working two shifts, which with lunch hours included might run from 7:00 A. M. to 3:30 P. M., and from 6:00 P. M. to 2:30 A. M. The arrangements of shifts in other departments will be obvious.

Sources of Labor

Use of labor long resident in the district should be avoided because of its known inefficiency and lack of experience. If any is used it should be small and by contractors for mucking and by company account for temporary surface labor.

Past experience has shown the troubles and inefficiencies arising not only from the use of local labor but also of relatives. The latter has always broken morale in competent crews. The employ of relatives should be forbidden. The only possible exceptions should be possibly in the case of contractors.

It is believed that the desirable competent men may be found by having talks with and getting ideas and recommendations about them from the several representatives of companies dealing in mining equipment and supplies.

Supplies and Transportation

Supplies should be carefully estimated in advance and no emergencies allowed to arise. Minimum stocks should be determined. Deliveries should all be pre-arranged at fixed intervals, which should also fix deliveries at El Paso, Silver City, and the mine.

All transportation of supplies from Silver City to the mine should be by contract trucking. Every effort should be made to eliminate emergency use of company trucks for supplies, and to cut all other use of them away from the property to a minimum.

Accounting

A good accounting system has already been established. This should not be allowed to become too complicated. At the same time it should be kept flexible enough to give daily, weekly, fortnightly, and monthly estimates of current use of labor, supplies and costs, especially for measuring progress and expenditures on the various projects.

The system and accountant should be moved to the mine, where the latter should take charge of the warehouse.

Reports

A system of simple reports should be used continuously.

There should be a daily report which should show: number of men of various categories engaged in each department, work being done, and total labor costs daily.

A weekly news letter should be prepared showing generally the work being done and the progress and results attained.

During the next several months of equipment and development, the work of the departments should be subdivided into projects, with allotments for time, measurements, labor, supplies, and expenditures. Each project should be reported on semi-monthly, showing the foregoing by quantities, percentages of totals allowed, and percentages of completion.

A full financial and cost report should be made monthly which should be accompanied by a full report of work done, progress made, delays incurred, proposals, outlook, measurements, sketches, etc.

EXPENDITURES

Based on earlier sections a general tabulation of proposed expenditures is attached to them. It shows by periods those expected prior to Oct. 1, 19[illegible], grouped by uses and departments. It also shows the proposed maxima and the ultimate minima, but the last are not recommended.

These may be reviewed by uses as follows:

	Before 7/1		7/1 to 8/15		8/15 to 10/1	
	Max.	Min.	Max.	Min.	Max.	Min.
Equipment, etc.	8,300.	5,825.	1,750.	1,750.	2,000.	1,[illegible]50.
Operations			11,700.	9,200.	18,150.	[illegible]
General	4,500.	4,500.	4,500.	4,500.	4,500.	4,500.
Totals	12,800.	10,325.	17,950.	15,450.	24,650.	20,750.

These may also be viewed as to maxima and minima and periods, as follows:

	Ultimate Maximum	Safe Minimum (Max)	Safe Minimum
Before 7/1	12,800.	10,000.	9,000.
7/1 to 8/15	17,950.	16,950.	16,200.
8/15 to 10/1	24,650.	22,250.	22,000.
Totals to 10/1	55,400.	49,200.	47,200.

SUMMARIES of EXPENDITURES

	Before 7/1		7/1 to 8/15		8/15 to 10/1	
	Max.	Min.	Max.	Min.	Max.	Min.
EQUIPMENT BETTERMENTS and REPAIRS						
Power Plant	1,500.	1,500.				
Mining	6,800.	4,325.			2,000.	1,350.
Milling			1,750.	1,750.		
Totals	8,300.	5,825	1,750.	1,750.	2,000.	1,350.
OPERATIONS						
Power Plant			2,700.	2,700.	2,700.	2,700.
Mining			9,000.	6,500.	8,000.	6,200.
Milling					7,450.	6,000.
Totals			11,700.	9,200.	18,150.	14,900.
GENERAL	4,500.	4,500.	4,500.	4,500.	4,500.	4,500.
GRAND TOTALS	12,800.	10,325.	17,950.	15,450.	24,650.	20,750.

Relations of Expenditures

From the foregoing up to Oct. 1, 1935 certain relationships of expenditures to others and to results will be obvious. It has been shown that they would include totals of: Ultimate Maximum, $55,400.; Safe Maximum, $49,200.; Safe Minimum, $47,800.; and Ultimate Minimum, $46,525. The derivation of the ultimate maximum has been down. From it the safe maximum has been derived by making assumptions of reasonable economies in equipment and operation in several places. The safe minimum and the ultimate minimum have been estimated roughly by eliminating items of equipment and betterments; but, both would result in slow and inefficient work, including much wasted time in the use of men.

It has been obvious that certain expenditures of a general nature can neither be cut nor avoided. For both general charges and operation of power plant there will be a fixed general charge of $4,800. monthly, or $14,400. between July 1 and Oct. 1, 1935.

Now, it would seem that the total maximum might be kept down to near $50,000., with fixed general charges of about 29.%. But a minimum program would save temporarily about $4,000., but the general charges would rise to about 32% of it; while, most important of all, it is likely that development work done and remuneration earned would be lessened by as much as 25%. Consequently, a minimum program of equipment, betterments, and mine operation would really be very wasteful. So, only the maximum program delineated in all of the preceding can be recommended.

Charges and Costs

It is obvious that a careful record of detailed costs should be kept for current and future use. But, it is also desirable that we have in advance some general idea of the general allocations of the expenditures made up to Oct. 1, 1935.

Including proper proportions of general charges we might assume that, of a total of $50,000., $12,000. is to be spent for depreciable equipment and betterments; $23,000. for mine development; and $15,000. for mining and milling operating charges on ore treatment.

We might also say that $35,000. is to be spent initially for equipment and development, and $15,000. is to act as working capital. If the last be considered with respect to remuneration, in the following, it will be seen that it would increase rapidly during the operations, perhaps approaching doubling in two months.

Additional Expenditures, About Oct. 1, 1935

It has been shown already that, if the general plan for development, operation, and remuneration were to give good results up to Oct. 1, 1935, it would be desirable then or thereafter to add to the equipment of the property, principally to power plant, air compression capacity, and mine equipment, so that the property could be continued in even more rapid development, and so that ore breaking and milling capacity could be increased to approach 90 tons daily continuously.

studied while the proposed program and results were being attained. We should also consider and study alternatives as to power, the availability and cost of second-hand equipment, etc. But, it may be well to note here certain general limiting figures.

Diesel-Compressor Unit

With other general equipment and that for mine and mill, this might be held as low as $18,000.

Engine and Compressor

This scheme might be held as low as $30,000., but might reach $45,000.

The choice will depend on a variety of factors and circumstances.

Over a long range we should make allowances for development of not less than $2. per ton.

Alternative Plans

More conventional alternative plans have been proposed for the property. In essence these would involve an indefinite postponement of mill operation and remuneration, and a concentration on prospecting and development, including necessary equipment and installations for mine, power, and air, until it could be demonstrated that the mine had considerable tonnages of profitable ores and was also in a condition to begin delivery of 90 tons daily continuously. In general, the objection to them is that they involve a large addition of

money to the enterprise without necessarily first trying to get maximum results from present equipment, and without taking the actually existing mill into consideration.

Because of the general limitations no attempt has been made to calculate them in detail, but they might involve amounts of money about as follows:

Equipment	$ 35,000.
4 months development	40,000.
Additional Working Capital	25,000.
Total	$100,000.

As disclosed in talks with various people, the amount needed might be much more.

It would seem better to lessen the risk in additional money, and try to operate the property on a smaller scale, building up operations gradually from the mine.

REIMBURSEMENTS

From what has preceded it will be seen that we should expect a net money recovery of 86% of the gross assay values of the ores. This net money recovery should easily average $8.25 per ton. If proper attention were given to richer ores, expectations of finding them being good, then the net money recovery might be pushed up to as much as $9.50 per ton.

It has also been shown that we should try to produce ore so that the mill can operate at 75 tons daily during two 10-day periods each month, which would be an average of 50 tons daily, and that we have good prospects of easily producing

3,000 tons or more before Oct. 1, 1935.

Thus, it would seem reasonable to believe that the net money recovery should be made to total $20,000.

It should be borne in mind, however, that there is an inescapable lag in receipts, because precipitates have to be built up in sufficient amount, refining must be done, and time elapses while bullion and money are in transit.

It is of course obvious that the outlook for reimbursements will be enhanced if the preliminary mine work be pushed strenuously and if the mill be started at the earliest practicable date.

Assuming that the preceding factors can be controlled to best advantage, the outlook for reimbursement may be tabulated by calendar months and set against the outlook for expenditures at the same times, as follows:

	Expenditures Due	Reimbursements Due
July 1	10,000.	
Aug. 1	12,000.	
Sept. 1	14,000.	12,000.
Oct. 1	14,000.	15,000.
Totals	$50,000.	$27,000.

If the reimbursements were not actually in hand it is believed that they would be so close that advances could be obtained on them as quickly as expenditures became due.

If steps were taken to increase both grade and tonnages several thousand dollars more might be in transit.

From this it will be seen that there is a good chance

of getting back as much as half of the expenditures up to Oct. 1, 1935. It will also be seen that an amount proper for allocation as working capital in operations would be building up rapidly. It will be seen also that, including a large proportion being spent for development, the property is becoming self-sustaining by Aug. 15, or slightly later, and earlier expenditures on development are being returned rapidly.

TOTAL RESULTS

The general program would result in the property being equipped to develop itself and to produce an average of about 50 tons daily. The power plant and mine would be working at capacity, but the mill would have excess capacity. The mine would have been fairly well prospected and developed, including an "A" Level about 750' long and a "B" level about 325' long, besides connecting raises and small stopes; and it would have considerable valuable equipment. The outlook is also for a relatively high degree of remuneration, possibly enough to keep it operating on that scale.

The property would also have been brought to a point where a program for much greater development and production could be considered, which would include additions of equipment for power, air, and mining.

PROGRESS OF PROGRAM

Great attention should be given to progress of the program. It has been assumed that the initial date for operation of both the power plant and mine will be July 1. If this should be postponed, then all other dates should be postponed accordingly. Stress should again be laid on the need of rapid, efficient work in the mine and of the starting of milling operations at the earliest practicable date.

It should be realized further that the program cannot be expected to work satisfactorily if radical changes in it be made; or if parts of it be permitted to get out of step.

Careful reports of progress should be made semi-monthly; and the whole program should be studied carefully, possibly revised to some extent, and recoordinated and planned in detail, especially at about the first of August and first of September.

C O N C L U S I O N S

A summary list of recommendations is not included here in order to save space, but the places where they are found in detail are indicated. The general recommendations, including that to proceed with development of the property, are included in the section next preceding, Summary of General Program. The detailed recommendations of the plan will be found by steps and dates under their respective departments, Power Plant Program, Mining Program, Milling Program, General Operating Program, where they are summarized by estimated expenditures.

It must be concluded that the Queen Mine is a very promising property, which is worthy of an intensive campaign of prospecting and development for a few months. This could begin without incurring any large expense for equipment, and could be prosecuted in steps by periods. There is a high probability of finding richer ores. The development ores could be milled to secure a return of as much as 60% of a total of $50,000. expended up to Oct. 1, 1935. Including development, it might be possible to put the property on a self-sustaining basis as early as Aug. 15, 1935.

Very truly yours,

John G. Barry,
Consulting Mining Geologist
and Engineer

JGB:H

COLLEGE OF MINES AND METALLURGY
(A BRANCH OF THE UNIVERSITY OF TEXAS)
EL PASO, TEXAS

DEPARTMENT OF MINING AND METALLURGY
JOHN F. GRAHAM
EUGENE M. THOMAS

REPORT
on
THE CYANIDE PLANT
of
THE COOKEY MINING CO.,
LOGOLLON, N. M.
and
CYANIDE TESTS
on
COOKEY MINE ORE

#

JOHN F. GRAHAM
PROFESSOR OF MINING AND METALLURGY
TEXAS COLLEGE OF MINES AND METALLURGY
EL PASO, TEXAS

Submitted, May 11, 1935

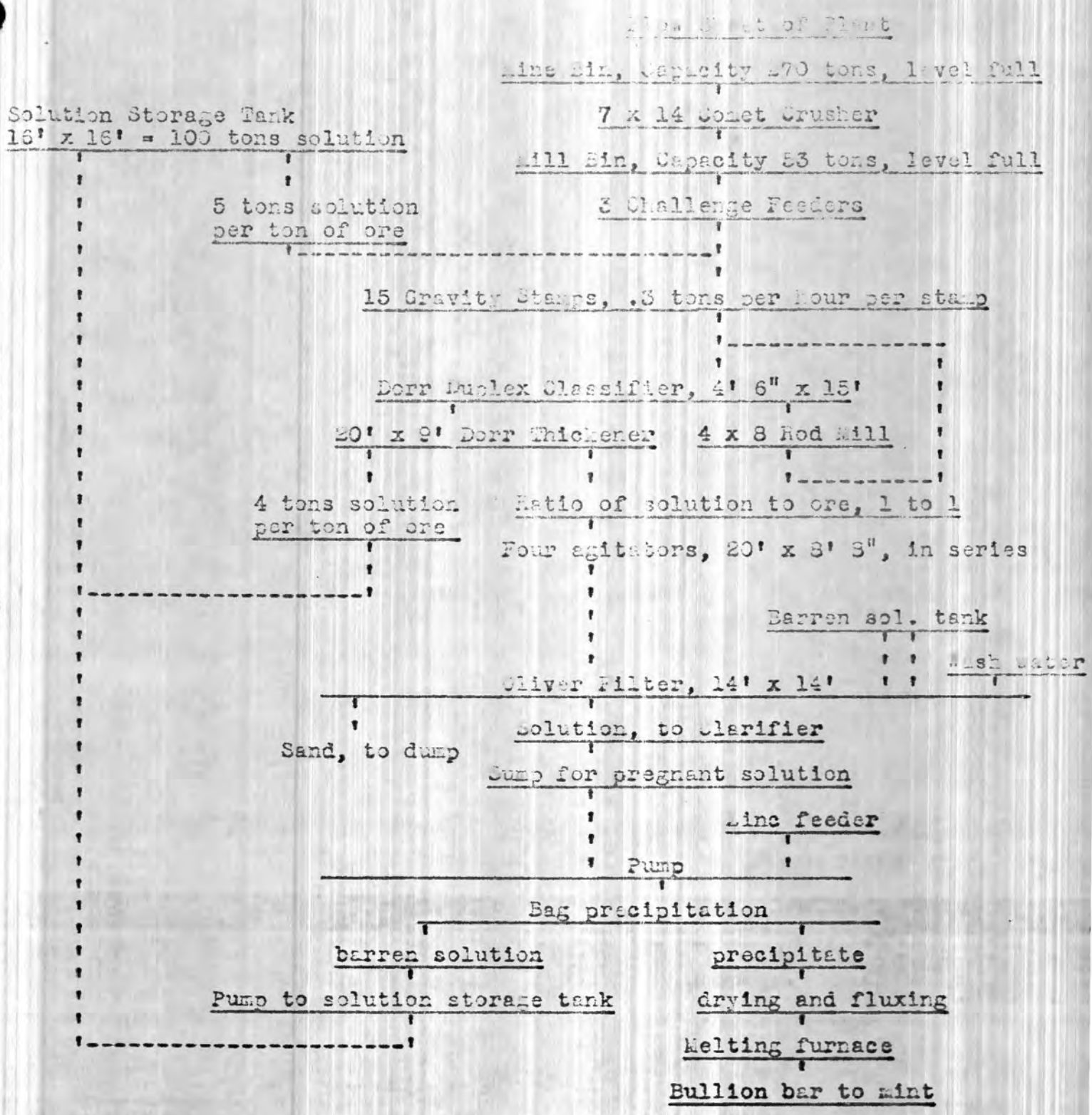
Mr. John G. Barry, Consulting Geologist,
808 Mills Bldg.,
El Paso, Texas.

Dear Mr. Barry:

I hereby transmit my report of mill conditions at the Cooney Mine, on Mineral Creek, Mogollon, N. M. and also the result of laboratory tests on the cyanidation of the ore, made by me in the laboratory of the Texas College of Mines and Metallurgy, El Paso, Texas.

Sincerely yours,

John F. Graham


Flow Sheet of Plant
Mine Bin, Capacity 270 tons, level full
7 x 14 Comet Crusher
Mill Bin, Capacity 53 tons, level full
3 Challenge Feeders
Solution Storage Tank
16' x 16' = 100 tons solution
5 tons solution
per ton of ore
15 Gravity Stamps, .3 tons per hour per stamp
Dorr Duplex Classifier, 4' 6" x 15'
20' x 9' Dorr Thickener
4 x 8 Rod Mill
4 tons solution
per ton of ore
Ratio of solution to ore, 1 to 1
Four agitators, 20' x 8' 8", in series
Barren sol. tank
Wash water
Oliver Filter, 14' x 14'
Solution, to clarifier
Sand, to dump
Sump for pregnant solution
Zinc feeder
Pump
Bag precipitation
barren solution
precipitate
Pump to solution storage tank
drying and fluxing
Melting furnace
Bullion bar to mint

Crusher

The primary crushing plant is a No. B, 7 x 14 Comet Crusher. This is of the gyratory type and is capable of crushing the mine ore to 1½", the approximate size of feed to the stamps. It is powered by a 30 H.P. motor.

Allis-Chalmers letter: (5/7/35) Rated capacity 10 to 15 tons per hour macadam size. Speed 350 R.P.M. Power = 12 H.P.

Crusher Bin

The ore from the crusher drops into a sloping bottom bin, 11' 4" front dimension, 12' front to back, and 10' high on the front. This gives a level cu. ft. capacity of 952 cu. ft. Allowing 18 cu. ft. broken ore to a ton, the bin will hold level full 53 tons.

Challenge Feeders

The ore from the bin is delivered by three Challenge Feeders to the three batteries of stamps. Any attempt to sample the feed will be done on the discharge of these feeders.

Stamps

There are fifteen gravity stamps, in batteries of five each, discharging thru ¼ mesh screen. I accepted the data given on the stamps, namely; -1050# each, dropping 8", at the rate of 106 drops a minute. This figures a horsepower requirement of 42 whereas the motor driving the stamp is 30 H.P. I believe the rate of drop is nearer 90, which will bring the horse power required close to the installed horsepower.

The records show that the stamps are now crushing an average of .3 of a ton per hour. 15 stamps x .3 = 4.5 tons per hour x 24 = 108 tons per day. In order to keep tonnage at 100 tons the stamp must run 92.6% of the time, or 22.22 hours. The stamps could be all down 1 3/4 hours per day or one battery could be down 5¼ hours per day.

Mr. Jones suggests some repairs to the stamps but they are no more than would be necessary in every day operation. The wooden guides can be easily replaced but since you have the cast iron guides on hand they can be put in. However they will require more accurate alignment than wooden guides.

Classifier

The mill is equipped with a 4' 6" x 15' duplex Dorr classifier.

This classifier receives the discharge from the stamps and the rod mill. The overflow goes to #1 Thickener and the underflow back to the rod mill. The classifier is driven by a 5 H.P. motor, is in good condition, and has greater capacity than 100 tons per day.

Rod Mill

The rod mill is 4' diameter by 8' long. Ordinarily a rod mill is a poor machine for grinding to 50% thru 200 mesh, as you are doing, but your ore is very brittle. In the laboratory the rod mill used to prepare the samples for test work takes from 7 to 11 minutes to grind a sample of ordinary ore to 50% thru 200 mesh. Your ore requires only 3 minutes 40 seconds to accomplish this result, and shows why in your case the rod mill can be used. Should you run into an ore tougher or less brittle than the ore you now have the rod mill would not do the work required by the flowsheet. For example, the rod mill at the Empire Mill, Colorado, although 1 foot longer than the Cooney mill, ground only 100 tons per 24 hours and produced a product 20% + 35 mesh, 20% thru 200 mesh.

If the rod mill needed replacement, it should be replaced by a ball mill.

The rod mill is driven by a 50 H.P. motor, which is enough to handle the present load.

Thickener #1

This is a tank 20' diameter by 9 feet deep, containing a Dorr Thickener apparatus, driven by 1½ H.P. motor. The ore, although it grinds easily to -200 mesh does little slimming and settles rapidly. As long as the character of the ore does not change to one producing more slimes, this tank is ample.

Agitators

There are four Dorr Agitators, each 20' diameter and having a clear inside height of 8' 8". This gives a capacity of 2618 cu. ft. The pulp has a solution ratio of 1 to 1, a specific gravity of 1.44, and 44.3 cu. ft. of it equals 1 ton of dry ore. The capacity of one agitator is 59.2 tons dry ore. The four agitators have a combined capacity of 59.2 x 4 = 236 tons of ore. Running the mill at 100 tons per day, the ore will be agitated 2.36 days or 56 hours. If as the laboratory tests show, the agitation is completed in 36 hours three agitators, which will give 42 hours agitation, will be enough. This will be discussed later when the results of the test are analysed.

The Dorr Company, Inc., a letter: "Power requirements etc. for a 20' x 9' Dorr Agitator operating at a dilution of 1:1. For this machine we usually recommend about 15 to 20 cu. ft. of free air per minute at a pressure of about 15 lbs. per square inch. This amount of air would normally take in

the neighborhood of 2 H.P., but the manufacturer of any compressor will naturally have his own rating of power required.

"The arms of this agitator should turn at 2 to 3 r.p.m. The gear ratio is 5:1, and the speed at the belt pulley would then be in the neighborhood of 10 or 15 r.p.m.

"The above data of course applies to a Dorr agitator of these dimensions, and we can identify this machine accurately on our records if you can give us the serial number found upon the name-plate, or tell us just where it is located and the name of the company which originally purchased it from us. We speak of this because there have been some imitations of Dorr Agitators with which we are not entirely familiar, and we can be certain only as to our own."

Filter

From the last agitator the pulp should go direct to the filter. This will eliminate Thickener #2 and give a direct gravity flow to the filter. The filter is amply large. It does need a new manifold arrangement on the valve mechanism so that it can be used with both a barren solution wash and a water wash. It also needs a new filter cloth but at the time the new cloth is put on, every precaution should be taken to see that the new cloth does not suffer injury during operation. The present cloth has been destroyed, not by natural wear, but by being allowed to project beyond the wire winding which should protect it from injury.

Clarification

100 tons of solution are to be precipitated each day. This is 3200 cu. ft. or 24,000 gallons. A sand filter tank 8' in diameter will be large enough to clarify this solution and prepare it for precipitation.

Precipitation

The present method of the Merrill bag precipitation is one that is not in general use but since it is backed by a reputable company and sold in competition with their regular precipitate press it must be workable even though not satisfactory. Therefor I would advise that until such time as you are satisfied that conditions warrant the expenditure of money to make the mill more efficient, every effort be made to adapt conditions of precipitation to the use of the present bag system. I will give you later a complete report on the layout of the precipitation, both with bags and presses.

Recommendations

My first recommendation is to send the overflow from Thickener #1 back to the solution storage tank which delivers to the stamps. All the solution from the precipitation room will also be delivered

to this tank. The main, and perhaps only, objection to doing this is that a rather rich gold solution is kept in a closed circuit at the head end of the mill, and that any loss or leakage will mean loss of values.

The advantages are:

1. Only 100 tons of solution will be precipitated each day instead of 500 tons. This saving will offset many times any possible loss or leakage.
2. Not more than an hour's supply of solution for the stamps, 18 tons, need be kept in the solution storage tank. 18 tons solution is 576 cu. ft. A tank 10 x 10 hold 785 cu. ft., and would be amply large. The present 16' x 16' tank could be used else where.
3. After a short time the solution in closed circuit will strike a balance in gold value, which will always be less than the gold content in the solution overflowing from Thickener #1.

The Agitators

The agitators are handling about as thick a pulp as is ever agitated. Most plants will have a more dilute pulp, perhaps 1¼ or 1½ of solution to 1 of ore instead of 1 to 1 as you have. The pulp is so thick that if anything checks its circulation, settlement starts immediately, and the rakes may be buried before the disturbance is removed. This is clearly shown by the trouble you already have had with the agitators stopping or breaking. I would advise that an auxiliary compressor and power unit be installed to supply the agitators while the Diesel is down. The agitator should never be allowed to stop and under such conditions should give little trouble in operation repairs.

In case it is found that three agitators are sufficient it might be advisable to continue to use the four agitators with a thinner pulp and then use Thickener #2 to thicken the pulp for the filter. This would do two things. It would give a slight increase in extraction and it would reduce the tendency of the agitators to clog. However, it would throw one more machine into the circuit and increase the amount of solution going to precipitation, by 25 to 50%.

The Filter

The filter has a capcity of 300 tons, or 3 times that of the mill. The valve mechanism is designed for drying concentrates, and not for a succession of washes as is needed in cyanidation. A new valve mechanism of the proper type should be installed. For a short run the present valve can be used, using more wash water, and sending all the drained solution and water to precipitation. This will increase the amount of solution to be precipitated perhaps 20%, and since barren solution will have to be wasted to maintain the solution balance in the plant, probably about $6 worth of cyanide would be lost each day. Very evidently, this is only a temporary expedient.

Although the present filter cloth is in bad shape, it can be used for a few days, with a little patching.

Precipitation Plant

Since Merrill is back of it I have every reason to feel that the bag method of precipitation is a success, when properly handled. I believe though that the bags will have to be suspended in a tank. When suspended in a tank of liquid the solution pumped into the bags will remain there until all the bags have filled and the feed pipe has backed full and built up a pressure. The pressure on all the bags will then be the same and all bags should build up a cake evenly. Then the solution is withdrawn from the tank, air is blown into the bags, and the cake dried to the point where it can be easily handled.

The precipitation plant will also need a sand clarifying tank, perhaps 8 feet in diameter.

The present pump which now pumps pregnant solution from the filter to the pregnant solution tank should be directly connected to the feed pipe to the bags. Arrangements should be made to feed the zinc direct into the suction of this pump. By connecting the pump in this manner the pressure in the bags can be controlled as desired.

Remarks

There are two types of cyanide plants. First, the concurrent type where the ore and solution travel together from the top of the plant to the bottom. Your plant is of this type. Second, the counter-current type, where the solution travels against the ore, starting at the bottom of the plant and finally arriving at Thickener #1. There has been some attempt to modify your plant into this type by applying wash solution at Thickener #2.

If your plant were converted to type #2, you would need two more thickeners, and you would have to precipitate perhaps 400 tons of solution per day. The true counter-current plant uses 4 thickeners at the bottom of the plant and no filter, and discharges a ton of water with each ton of ore. By replacing the last thickener with the filter you save the water. This is Wright's proposed layout at the Fanny.

There is no reason for making any change at this time.

Power

The installed H.P. at the mine and mill is:

Crusher motor	30	
Stamps	30	
Classifier	5	
Rod Mill	50	
2 Thickeners 1½	3	
4 Agitators 1½	6	
Zinc dust feeder	0.16	
Barren sol. pump	1.5	
Filtrate pump	1.5	
Diaphragm "	1.5	
Conveyor motor	10	
Filter motor	3	
Wilfley sand pump	3	
Vacuum pump	10	
Fresh water pump	7.5	
2 Compressor motors 50 H.P.	100	
Blacksmith grinder	1.5	
Centrifuge motor	0.5	
Mine blower	7.5	3.0
	271.66	

I have already suggested the installation of a small power unit to maintain continuous power and air for the agitators.

The Mine and Smelter Supply Co. say that in figuring air for Dorr Agitators, that all sizes are computed as using the same amount of air, since the power used is in airlifting the central column. They use 20 cu. ft. free air per minute at about 10# pressure. I expect to have some definite information along this line in the near future.

Since under present conditions it is an impossibility to run the mine and the mill at the same time, and since continuous operation is necessary to avoid constant hiring and discharging of labor, it would seem logical that some scheme such as running the mine two shifts and the mill one shift might be followed.

There are some vital objections:

1. You would not get more than about 7 hours running time out of an 8 hour shift due to starting and stopping.
2. The agitators would have to run 24 hours a day to keep from clogging.
3. The plant would never get tuned up but would always have erratic spots in it.
4. The net results would be higher costs.

The alternative is to run the mine long enough to accumulate say a month's mill run, and then give the mill the right of way on power, using only the surplus at the mine to keep perhaps two drills running.

This has the decided disadvantage of the disruption of labor conditions.

It has the advantage that the mill would run at its greatest

efficiency, and after a few days of running all irregularities would be smoothed out.

Summary

For a temporary run but two major expenditures of money are needed.

1. The clarifying tank.
2. The two steel tanks for use with the bags in the precipitation plant.

To these may be added the substitution of a V-rope drive for the rod mill, instead of the present silent chain. This change can be deferred until after a preliminary run of the mill.

There are a number of smaller items, such as the rearrangement of pump, pipe lines, etc., which will entail no unusual expenditure, being principally labor.

The above statements are built around the idea of operating the mill with the least expenditure of capital, even though such operation does not give the efficiency to be later attained.

Such operation will do two things. It will give some return of capital, and it will bring out changes necessary for the most efficient working of the mill.

Proposed Changes in the Mill

Discussion to be accompanied by the drawing of the mill.

All changes noted on the mill drawing are diagramatic, which means that the actual location of tanks, pumps, etc., will be made to suit local conditions of topography and convenience.

Change #1

The overflow from Thickener #1 will flow into the present Pregnant Solution Tank, and then be pumped into the Mill Solution Tank for re-circulation.

The large Pregnant Solution Tank is not needed at this point and can be replaced with a small tank which will act as a sump for the pump.

Change #2

The Thickener #2 and the diaphragm pumps will be cut out of the circuit and the pulp from the last agitator will flow direct to the filter.

Change #3

The solution from the filter will run to an 8' clarifying tank instead of the wooden box formerly used. Use the small tank between the thickener and the filter for the clarifier.

Below the clarifier add a sump tank. From this sump tank connect to a pump which connects direct to the inlet of the bags.

Change #4

Move the zinc feeder so that it feeds direct into the suction of the pump mentioned above.

Addition #1

Make two steel tanks, 20 ft. long, 18" wide, and 2' deep to keep the precipitation bags submerged in liquid. These tanks should have an overflow leading direct to the wooden box sump, and a drain leading to the present barren solution sump.

Addition #2

A new valve mechanism is necessary for the Oliver Filter to enable it to do good washing of the pulp.

This change also calls for one new vacuum tank, (an oil drum can be used), a weak solution sump, 6' dia., and a pump to lift the solution back onto the filter.

Cyanide Tests on Cooney Ore

The Cooney Mine ore is mainly quartz, exceedingly friable, easily crushed and ground, and making little slimes, therefor having no settling problem.

An examination of the mill records showed that the ore was delivered to the Thickener #1 ground to, in the screen analysis of three different days, 59.7% -200 mesh, 53% -200 mesh, and 58.9% -200 mesh, with about 10% on 65 mesh. In the laboratory it was found possible to produce consistently a product all thru 65 mesh and 50% thru 200 mesh. It was felt that this product approached closely the actual mill product and it was used in all tests.

The ore was ground in a laboratory rod mill with a solution ratio of 1 to 1. It was washed out of the mill with more solution and then decanted until it was once more the ratio of 1 to 1. The pulp was then put in a bottle agitator and subjected to whatever test was being tried.

Conclusion

No change should be made in the present fineness of grinding at the mill. Any change should be towards finer grinding, but any attempt to grind finer would either cut down the capacity of the mill or entail the installation of a ball mill instead of the present rod mill.

The solution strength should be brought up to four pounds of potassium cyanide equivalent per ton of solution.

This is necessary, not because of the gold, but because a stronger solution is necessary to dissolve the silver in a lessened period of time.

The time of agitation need not be longer than 36 hours. However, because of short circuiting of some of the ore thru the agitation tanks it may be found necessary to lengthen this time to 42 hours. The agitation capacity of the plant is more than sufficient to allow for this possibility.

The amount of lime to be used per ton of ore is 6#, expressed in terms of CaO. This may be modified by the water used in the mill. The lime will also aid in the settling of the slimes.

No test was made on the possibilities of amalgamation because:
1. Silver is not caught on amalgam plates.
2. Any gold that might amalgamate is much better caught as a precipitate in the clean-up.

Cyanide consumption is 1# per ton of ore, and is increased but slightly by the use of the stronger solution.

95% of the gold and 85% of the silver will be recovered.

This checks your mill tailing of March 11th to 13th:

Date	Tails Au	Tails Ag	Recovery based on present sample Au	Recovery based on present sample Ag
Mar.				
11	.01	.64	95%	80.7%
12	.01	.44	95%	85.7%
13	.015	.79	92.5%	75.8%

The use of a stronger KCN solution would have increased silver recovery.

Flotation

Two tests were made by flotation. The ore was ground as per the method described previously.

Test #1
Tails Au = .06 Ag = 1.2
Recovery Au = 61% Ag 66%

Test #2
Tails Au = .05 Ag = 1.05
Recovery Au = 69% Ag = 73%

Flotation is evidently not to be considered.

Sizing Test

Sizing Test on Sample #1 Head assay Au = .14 Ag = 3.20

Material	% Wt.	Assay Au	Assay Ag	Tails after 72 hrs. agitation in .3% KCN sol. Au	Tails after 72 hrs. agitation in .3% KCN sol. Ag	% Recovery Au	% Recovery Ag
-65+100	26.9	.08	2.9	.02	.93	75.0	68.0
-100+150	18.0	.08	2.6	.01	.60	87.5	77.0
-150+200	18.9	.08	2.5	.007	.43	91.2	82.9
-200	36.2	.20	4.2	.004	.20	98.0	95.3

This test shows that the finer the grinding the greater the extraction, and that the extraction will drop rapidly if much material is allowed coarser than 100 mesh.

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A sample assaying .14 oz. gold, 3.20 oz. silver was ground 4 minutes in solution washed and assayed. The tails assayed

Au = .09 oz. Ag = 2.6
Recovery = 35.7% = 18.7%

This test was made to find how much of the values go into solution during grinding, and checks very well with results obtained in the plant.

Plant results gold in solution = 40% silver in solution = 6 to 12%
Test " " " " = 3% " " " = 16%

#

Two ideal tests were run. All the ore was ground to -200 mesh, solution strength of .3% KCN (6# to the ton) was used, and agitation was continued for 72 hours. These conditions are all much better than in mill practice and so the results are valuable only to tell what the best possible extraction might be. There is no use expecting more.

	Solution ratio	Tailing assay		Recovery	
		Au	Ag	Au	Ag
Test #1	1 to 1	.008	.30	94.4	90.7
Test #2	2 to 1	.006	.24	95.8	92.6

This test would also indicate that there is a slight gain in extraction by using the more dilute solution in agitation.

Cyanide consumption on these tests were high, being 1.4# KCN per ton of ore.

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The new sample from the mine was received at this time and all further testing was done on it.

Head assay Au = .20 oz. Ag = 3.30 oz.

#

Time of Agitation

Five samples were ground to all thru 200 mesh and agitated one each 24 hrs., 36 hrs., 48 hrs., 60 hrs., and 72 hrs. .3% cyanide solution was used, and the pulp was kept a ratio of 1 solution to 1 ore.

Agitation	Tail assay		Recovery	
	Au	Ag	Au	Ag
24 hours	.005	.19	97.5	94.3
36 "	.002	.10	99.0	97.0
48 "	.005	.22	97.5	93.3
60 "	.002	.18	99.0	94.5
72 "	.002	.16	99.0	95.1

Cyanide consumption was 1.1# per ton regardless of time.

This would indicate that the second sample, which is much whiter in color than the first sample, leaches more easily than the first sample.

Note: Too much credence must not be given to gold samples such as .002, or .005. It is merely the assayer's attempt to present

comparisons between samples. Any reading finer than .01 oz. is only an estimate.

The above tests were on ore ground thru 200 mesh.

The tests were repeated using ore ground to approximate mill conditions, and a cyanide solution with strength of .15% KCN.

Agitation	Tail Assay		Recovery		KCN Consumption
	Au	Ag	Au	Ag	
24 hours	.036	.80	82%	75%	.96#
36 "	.006	.44	97	86.7	.78
48 "	.006	.45	97	86.4	.90

36 hours was accepted as being sufficient time for agitation.

Strength of Solution

Tests were run for 36 hours using solutions of .1%, .15%, .20%, .24% strength.

% KCN	Tails		Recovery		KCN Consumption
	Au	Ag	Au	Ag	
.1	.055	1.10	72.5%	66.7%	.60#
.15	.008	.54	96.0	83.6	.84
.20	.008	.39	96.0	88.2	.78
.24	.006	.36	97.0	89.0	.64

Two more tests were run for 36 hours using .2% KCN solution.

	Tail Assay		Recovery	
	Au	Ag	Au	Ag
Test #1	.008	.50	96.0	84.8%
Test #2	.008	.55	96.0	83.3

Lead acetate was used in test #1 and gave no better results than when not used in test #2.

Tests made on lime additions from 5# to 20# to the ton of ore showed that 6# per ton of hydrated lime would leave an alkalinity of .05# in the solution, which is sufficient.

Tests to Check the Advisability of Using Lead Salts

Two sets of tests were made, one on the regular sample, and one on the first sample. All conditions, except the use of litharge, were as advised in the recommendations.

Sample	Litharge	Tailing assay		Recovery	
		Au	Ag	Au	Ag
First	none	.008	.53	94.3	83.5
First	1# per ton	.01	.55	92.8	89.1
Second	none	.008	.54	96.0	83.7
Second	1# per ton	.01	.55	95.0	89.4

The above interprets as follows:

By adding 9¢ worth of litharge, you gain 14¢ worth of silver and lose 7¢ worth of gold. An apparent loss of 2¢ per ton of ore milled.

Exceptions to the above:
7¢ worth of litharge, or even 6¢ worth, might be enough.
Silver may rise to considerably above 75¢ as calculated here.
There is no reason why litharge should cause a gold loss, so these results are probably due to natural discrepancies of assaying.

Conclusion:
The value of litharge should be demonstrated by trial in the plant.

11th May, 1955.
Wednesday.

Mr. John C. Barry,
Consulting Mining Geologist and Engineer,
El Paso, Texas.

My dear Mr. Barry:

In response to telephonic request of Sunday, 28th April, and again on Wednesday, the 6th May, I visited the Power Plant at the Cooney Mine on Thursday, the 2nd May, and again on Friday and Saturday, the 10th and 11th May, to inspect the 350 HP De La Vergne Diesel Engine and check the erection and installation work and give below a report on what I found, together with recommendations for correction of errors and poor workmanship, and also some suggestions which will increase the dependability of the Unit, and also guard against possible damage to the Engine.

No.1 - ENGINE MAIN FRAME:

The Main Frame of the Engine is not level. It is low on the lay shaft side.

No.1 Bearing shows that it is out of level about 3/1000" per foot.
This indicates very poor workmanship in levelling the frame before grouting it and should have been corrected.

However, it need not be classed a serious defect, provided the Main Shaft itself is level and properly bedded, therefore, it is not recommended that this be corrected.

No.2 - ENGINE MAIN SHAFT:

The Main Shaft of the Engine is not level. It is low on the Outboard Bearing end.
Also, it has not been properly bedded.

continued on page 2.

Micrometer Measurements taken between the Counterweights in 4 positions, are as follows:

Position of Counterweights	Cylinder No.1 Next to Lay Shaft	Cylinder No.2 Next to Flywheel
Top	10.1150	10.26075
	.0170	.00750
Bottom	.1320	.26825
In	10.1235	10.2565
	.01175	.0135
Out	.11175	.2700
Top	10.1195	10.26125
	.0170	.00775
Bottom	.1365	.2690
In	10.1255	10.2575
	.0128	.0125
Out	.1127	.2700
Top	10.1190	10.2610
	.0135	.0095
Bottom	.1325	.2705
In	10.1255	10.2570
	.0128	.0130
Out	.1127	.2700
Top	10.1195	10.2620
	.0125	.0120
Bottom	.1320	.2740
In	10.1255	10.2575
	.0129	.0120
Out	.1126	.2695

Continued on page 3.

The Factory's tolerance on these Readings is 5/1000" and from the above, you will note that the Shaft has not been properly bedded and that considerable additional work by a competent mechanic will be required to properly line up all Bearings and Bed the Shaft to bring the Readings within the Factory's instructions.

The Micrometer Readings indicate that both No.1 and No.3 Main Bearings are higher than No.2. Therefore, they need additional scraping and fitting to lower the shaft into line.

The No.2 Main Shaft Bearing Cap has been hot enough to cause the babbitt to run and fill some of the oil grooves, so that it will be necessary to re-scrape and re-blue this bearing cap.
The fact that the top half of the Bearing has been hot enough to cause the babbitt to run indicates that the bottom half may also have been hot, therefore, it is advisable to remove the bottom half of No.2 Main Bearing Shell to inspect it and refit it if found necessary.

The bottom half of the Main Bearing No.2 should be inspected, refitted and returned to the frame and then the other 2 bearings brought to it.

The Readings also indicate Main Bearing No.1 should be relieved on the inside to throw the end of the shaft towards the cylinder heads.

The Readings further indicate that the Outboard Bearing should be moved towards the back end of the Engine.
i.e., away from the Cylinder Head End.

It is not advisable to operate the engine in this condition for any extended period, because the excessive deflection of the Shaft and Crank Cheeks will eventually cause the Shaft to fail.

I inspected the shaft carefully with a glass in an effort to find signs of a fissure or fractures, but found none.

I also inspected both Crank Pins and found that both of them are in need of some dressing to remove high spots.

No.2 Crank Pin will require more dressing than No.1, as it has one exceptionally high spot in it.

The work of dressing a Crank Pin should be done by a competent mechanic who has had experience dressing Crank Pins.

continued on page No.4.

Mr. John C. Berry

Page 3 - [illegible]

An inspection of the [illegible] centers as installed, [illegible] now on the engine, and also [illegible]

The Clearance at the end of the [illegible] which is about 1/4" too much and reduces the bearing surface on the Gear Teeth.

On closer inspection, it was found that the main shaft of the Engine apparently is not in the correct, or its original location. It is too high in the front.

When questioning your employee, I learned that the Main Shaft Bearing Shells were re-babbitted and then were bored out under size (to a smaller diameter than the shaft) which necessitated a very large amount of scraping to open the bearings, so that the Shaft would enter.

If this information is correct, and it apparently is, then it explains why the Main Shaft as re-installed is too high.

This should not be classed a serious error and it is not recommended that it be corrected, but it is recommended and necessary that the shaft in its new location, should be properly leveled and bedded and this method of correcting the error will necessitate a pair of new Spur Gears of somewhat larger diameter to fit the increased distance between the 2 Shaft Centers.

While, it is always desirable to make no radical changes on an engine in the field, in my opinion the above method of correcting the error will prove satisfactory and will be the least expensive.

However, the new Spur Gears should not be ordered until the Main Shaft of the Engine has been properly leveled and properly bedded.

This work is necessary before a correct measurement can be taken between the 2 shaft centers.

The Lay Shaft, as installed, is not in its proper location. The end of the Lay Shaft at the Crank Shaft End is nearly 3/8" too close to the Engine Frame.

Evidently, the shim which originally was between the Lay Shaft Bearing and the boss on the Main Frame was lost during moving. At any rate, it is not in place.

This Bearing should be shimmed out away from the Engine Frame an amount sufficient to bring the center of the Driven Gear under the center line of the Driving Spur Gear on the Main Shaft.

The Lay Shaft also is not quite level. It should be level.

An inspection of the Governor Driving Gears showed wear, indicating that the teeth were bottoming due to the end bearing being pulled in too near the Engine Frame.

When the Lay Shaft is placed in its correct position, it undoubtedly will completely relieve the excessive pressure on the Governor Gears.

continued on page 5.

No.4 - [illegible]:

The Cam Shaft at present is not at right angles to the lay shaft, and also not quite in line and level. This should be checked and the Cam Shaft placed in its correct position, and when this is done, the Miter Gears at the corner of the Engine will undoubtedly mesh properly and wear evenly.

No.5 - SKEW GEARS:

The Skew Gears at present on the Engine are too small in diameter, because the Main Shaft of the engine has been installed higher than it originally was. This will necessitate a new pair of Skew Gears.

The Driving Skew Gear is split and the 2 halves bolted in place on the Shaft.

The location of the keyway in the Driving Skew Gear is such that the teeth located nearest the Split are in mesh when the Fuel Pumps inject the Fuel Oil, therefore, these are the teeth that are doing the principal work.

It would be better to have the keyway in a different location, about 90° from its present location.

New Skew Gears should not be ordered until both the Main Shaft and the Lay Shaft have been properly leveled and placed in their correct location, when it will be possible to accurately measure the distance between the shaft centers.

When ordering new Skew Gears, your specifications should give the shaft centers and should also specify that there be 1/16" clearance at the end of the teeth and that the clearance in both Gears be the same.

Your specifications should also state that the number of teeth in each Gear must be the same as in your old Gears, so that the timing of the engine will not be changed.

Both Gears may be made of Steel, but it is suggested that the Driving Gear, which is mounted on the Main Shaft of the Engine should be made of Bronze to reduce the wear and thus increase the life of the Gear.

The Driven Skew Gear is made with a demountable rim. i.e., the rim or gear itself is bolted to a hub or spider.

The end of the Lay Shaft is tapered, and the hub of the Driven Gear is bored to a corresponding taper and when both have been properly machined the Driven Gear hub will be in the correct location when tight on the Lay Shaft.

Continued on page 6.

No.5 - SKEW GEARS Continued:

The hub on your Driven Skew Gear is bored out too large, which permits the Gear to go on the lay shaft too far.

On inquiry, I was informed that at one time the hub was cracked and repaired by welding, after which it was trued up and evidently bored out too large, therefore, when ordering a new Driven Gear, a new Hub should also be ordered and the Gear Manufacturer given correct diameters.

No.6 - LINERS:

Both Cylinder Liners were removed from the Engine and bored out over size. The Liners originally were 21" dia. and I was informed that the instructions to the Machine Shop specified that they be bored out to 21-1/4" diameter.

The Liners were bored out, but the surface was left very rough and was not finished with a Grinding Tool, and apparently also was not given a finishing cut to produce a smooth and true surface.

The surfaces are quite rough and the tool marks are nearly 1/8" wide, from which it appears that quite a heavy cut was taken, and that it was not followed with a finishing cut.

The result of this rough finish, is that in the beginning the Engine would be noisy and that the Liners would show excessive wear just as I found, and probably by the time that the Liners have been "run in" or worn to a smooth surface, the diameter will have increased so much that it will be impossible to properly fit Piston Rings.

In fact, the head end of the Liners under the Ring Travel are already considerably worn, so that the Piston Rings already stand open much more than they should.

No.2 Liner shows more wear than No.1, and this cylinder already is much in need of new Piston Rings.

Below on Page 8 , find tabulation of measurements taken on both Liners and Pistons, from which you will note that the 2 diameters are not the same. This may be partly due to wear that has already taken place and apparently also is partly due to the Liners not having been bored out to a true circle and the same diameter the full length.

Continued on page 7.

No.7 - PISTONS:

I was informed that the 8 Pistons now in the Engine are new, and were made in the same Machine Shop where the Liners were bored out, and that the instructions to the Machine Shop were that these new Pistons should be of proper diameter to fit the bored out Cylinder Liners.

Standard practise is to allow clearance between Piston and Liner amounting to 1/1000" per inch of diameter, therefore, the clearance in your engine between Pistons and Liners should be 21/1000".

There was no outside Calipers at the Plant, therefore, we were obliged to make a pair of Calipers large enough to measure the Piston diameter. Obviously, it had no screw adjustment, so that the Readings that we took probably are not as accurate as they would be, if taken with a standard pair of Calipers made for this purpose.

However, we took every precaution and ample time to take the measurements, and while they may not be accurate they are comparable.

Also, because of the very rough finish of both Pistons and Liners, it would be difficult to obtain what might be termed "very accurate" Readings even with correctly made Calipers.

Above remarks also apply equally to Readings taken on Liner Diameters.

We did the best we could with the available tools, and I believe the Readings to be near enough to correct to be comparable.

From the measurements we took, it appears that there was too much clearance between Pistons and Liners to begin with, and obviously because of the very rough finish, the clearance already has been considerably increased.

Below, I give a copy of the measurements taken on the Pistons and Liners.

Continued on page No.8.

No.1 Piston

21.1925 - Vertical at outer end of Skirt.
.2000 - " " Wrist Pin.
.2015 - " " Head Joint.
21.2025 - Horizontal at outer end of Skirt.
---- - " " Wrist Pin
.2105 - " " Head Joint.

No.1 Liner

21.2390 - Vertical at outer end of Skirt.
.2415 - " 1" beyond Oil Ring towards Head, or 42" from outer end of Skirt.
.2675 - " 3" from Head End --- in Ring Travel.

21.2285 - Horizontal at outer end of Skirt.
.2230 - " 1" beyond Oil Ring toward Head.
.2350 - " 3" from Head End --- in Ring Travel.

No.2 Piston

21.2190 - Vertical at outer end of Skirt.
.2185 - " " Wrist Pin
.1995 - " " Head Joint.
21.2140 - Horizontal at outer end of Skirt.
---- - " " Wrist Pin.
.2180 - " " Head Joint.

No.2 Liner

21.2385 - Vertical at outer end of Skirt.
.2495 - " 1" beyond Oil Ring towards Head.
.2615 - " 3" from Head End --- in Ring Travel.
21.2685 - Horizonal at outer end of Skirt.
.2485 - " 1" beyond Oil Ring towards Head.
.2610 - " 3" from Head End --- in Ring Travel.

continued on page No.9.

No.7 - [illegible] Continued:

In my opinion, there was too much clearance to begin with --- and because of the rough finish, excessive wear has already taken place, and will continue for sometime until the high spots are worn down.

The operation of the engine during the short period that it was operated, I would say, was not satisfactory and it is questionable whether it would have pulled rated Load for any considerable period. Very good evidence of this is the excessive blow-by of Cylinder No.2 (note the considerable amount of oil thrown against the Mill wall).

It is my opinion that if the Engine is placed back in service with Pistons, Liners and Rings, as they now are, that it will be difficult, if not impossible, for the Engine to pull rated Load for any considerable time.

In order to place the Engine in what might be called Temporary Service, in the shortest time, and with the least expense, both Pistons should be fitted with New Rings, and care exercised that the joints in the Rings are staggered and not in line, or even nearly in line, as we found them when we removed the Pistons.

By fitting both Pistons with New Rings, the Engine will probably operate in a satisfactory manner and pull Rated Load for a period of 3 or 4 months, possibly longer, when the expected excessive wear will again be so much as to make the openings at the Ring Ends too great, and at that time, you probably will find it necessary to re-grind the Liners to a true and smooth surface, and then fit new Pistons of correct diameter to the trued up Liners.

By following the above procedure, the Engine can be returned to service in the shortest time, and probably will give satisfactory service during a development period, and probably long enough to complete the installation of a Second Unit, and when the Second Unit is installed, then the present Engine should be re-conditioned, by grinding out Cylinder Liners and installing New larger diameter Pistons, and also taking advantage of the opportunity to again carefully check other Parts of the Engine.

When this re-conditioning work--- grinding out Liners, fitting new larger diameter Pistons, Checking Bearings and other Parts of the Engine has been completed in 3, 4, or 6 months from now, by a competent Mechanic familiar with this class of work, then you may reasonably expect very dependable also economical and practically trouble-free operation of the Engine for 3 to 5 years with only reasonable care and attention.

continued on page No.10.

No.3 - PISTON RINGS:

Before ordering New Piston Rings, the Ring Grooves should be carefully measured to insure the new Rings being of the correct width.

The Clearance in the Groove between the Ring and Piston should be only about 2/1000" or 3/1000".

I did not have time to remove all Rings and clean the Grooves and check Groove Widths, but from what I did check it appears that the Rings are too narrow.

A competent Mechanic understands Ring Fitting, and it is better to order the Rings a small amount too wide and depend upon the Mechanic fitting them to the Grooves, because if the Ring is too narrow, there is nothing that can be done about it.

Similarly, care should be exercised that the Rings have the proper Clearance at their ends --- I may add that because of the excessive cylinder wear which has already taken place, you may find it difficult, if not impossible, to have the correct Clearance at the Ring Ends.

It may be advisable to install a Special or Patented Ring with a greater overlap.

No.9 - PISTON FUNNEL:

There is no Piston Funnel in your Plant, and your mechanic made an improvise band to close the Rings sufficient to get them in the Cylinder Liners, but the Cylinder Liners have a very steep chamfer at the end, which makes it difficult to get the Rings to enter without a properly made Piston Funnel.

Much more time is consumed entering a Piston without a Funnel, also there is danger of breaking the Rings when forcing them in, and if broken, there is no visible evidence until the next time the Piston is pulled, and in the meantime the broken Ring may do considerable damage to the Liners.

When we removed the Piston from No.2 Cylinder, the end of one of the Rings was broken off and had already started to score the Liner, but fortunately, you did not operate long enough to do any serious damage.

The Funnel is inexpensive and the time saved when using it only once, will probably nearly save its cost.

continued on page No.11.

No.10 - POINTING OF CONNECTING RODS:

There are no Tools in your Plant to check the Pointing of the Connecting Rods, therefore, we made no effort to check them.

They appear to be correct, or nearly correctly pointed. However, it is better practise to properly check the Pointing and know that it is correct. For this purpose, it is suggested that you purchase and have available a Tram made for this particular engine. This will again be listed below in Special Tools that I recommend you purchase.

No.11 - COMPRESSION PRESSURE AND CLEARANCE BETWEEN END OF PISTON AND CYLINDER HEAD:

As nearly as I was able to learn, the Clearance between the End of the Piston and Cylinder Head was not determined. It should be checked and the Factory's Instructions for this particular Engine is that the Clearance should be measured by inserting a lead wire through a Valve and allow the Piston to mash it flat and then caliper same. The Factory's instructions for this particular type and size of engine is that this Clearance should be not less than 5/32", and not more than 3/16".

Before operating the engine, the Compression Pressure should be determined, and for this particular size and type of Engine, the minimum Compression Pressure should be 340 lbs. at Sea Level, or 270 lbs. at your Mine, elevation 5900 ft.

When developing or pulling Rated Load, the Firing Pressure should not exceed 550 lbs.

The Water Pipes bringing the Cooling Water to your Engine Cylinder Jackets are installed in a manner, which makes it impossible to connect an Indicator on Cylinder No.2.

These pipes should be changed to provide ample room for Indicator installation.

Continued on page No.12

No.12 - [illegible] AND SUBSEQUENT OPERATION:

To insure proper successful and satisfactory operation, and long continuous runs, developing Rated Capacity or near Rated Capacity, it is essential that the Fuel Oil be completely burnt and that the Exhaust Gas should be clean, clear and practically colorless, and to accomplish this, it is vitally necessary that the Compression Pressure be at least as high as specified by the Factory and that the Fuel Oil be completely broken up or vaporized.

The Compression Pressure is determined with an Indicator.

Complete Atomization or Vaporization of the Fuel Oil is only possible with the correct diameter of the orifice in the Spray Nozzles for the Fuel Oil being used.

I was not able to learn definitely what is the Specific Gravity of the Fuel Oil you are using, but was informed that it was anywhere from 26° to 30° Baume', and if that is correct, then a Spray Nozzle orifice .050 is probably the correct size although Fuel Oils of the same Specific Gravity do not all behave in the same manner, so that a small amount of experimenting may be necessary to determine the best diameter. It may be slightly smaller or somewhat larger.

When the Pistons were removed, we found both of them very dirty and large quantities of carbon deposits and some of the Piston Rings stuck, others not free to move, indicating clearly that the Fuel Oil was not being completely burned. The trouble may have been caused by insufficient Compression Pressure or more probably by using a Spray Nozzle with too large an orifice or both.

The Pistons were dirtier than they should be after a year's run.

No.13 - ENGINE CAPACITY:

The Rating which the Factory originally placed on this Engine was 340 HP at Sea Level, as an Air Injection Engine.

This capacity was somewhat increased when the Engine was converted to a Solid Injection Engine, and now may be safely given a Sea Level Rating of 350 HP - 360 HP continuous load, and for intermittent and short periods, it will probably economically pull Loads up to 365 - 370 HP.

It is better to assume Rated Capacity at say 350 HP, and this when depreciated for altitude loss (21% for 6000 ft.) shows a capacity of 276½ HP at your Mine. This is Engine Output.

From this you should deduct Generator Loss which probably will average 12%. This would give 243.3 HP Generator Output, or 182.5 KW Generator Output.

continued on page 13.

No.14 - [illegible]:

Following recommendations for additions and changes are made to insure greatest dependability and longest satisfactory continuous runs and guard against possible damage to the engine.

(a) - Cooling Water Outlet pipe ends should be raised at least 3 ft. or 4 ft. at the Outlet Funnels to place more pressure on the cooling water in the engine, thus to prevent formation of Steam Pockets.

The ends of the Cooling Water Outlet Pipes should all be so installed that they will be plainly visible from many parts in the Engine Room without any special effort by the Operator.

When I was at the Mine, I discussed this point with you and I am sure that you understand what is wanted.

Attached herewith, find a copy of the International Filter Co.'s Analysis No.25360, reported 5/9/35 on the sample of water I obtained on my first visit to your Plant.

From this analysis, you will note that the water contains only a small amount of Dissolved Mineral Matter and is quite soft -- the Hardness being only 2.3 grains per gallon.

This is sufficient, however, to cause some difficulty from scale formation in cylinder Jackets and especially Cylinder Head, and to be safe the water should be softened.

A Zeolite Softener is recommended and the salt required will be about 1.1 lbs. per 1000 gals. of water softened.

You will note that the cost of softening is nominal.

Since you are re-circulating your Engine Cooling Water, the amount of soft water make-up will be very small, so that the cost of softening your requirements is going to be nominal, and I may add that the cost of a Softener of sufficient capacity for your Plant is not a large item.

You, at present, have installed 2 Water Storage Tanks above the Mill, and they are connected up to insure an ample supply of water for the engine at all times, and this arrangement without a Water Softener is good. However, if you install the Water Softener, then these 2 Tanks should be separated, so that you will not use softened water for your mill operations.

Mineral Analysis

Sample sent by: [illegible] Analysis Number: [illegible]

From: Cooney Mining Co. Sample Received: [illegible]

Address: Magdalena, New Mexico Analysis Reported: [illegible]

Source of Water: Mountain Stream Container: 1/2 Gal. Glass

PHYSICAL CHARACTERISTICS

	Parts per Million	Grains per Gallon	
Suspended Matter:	4.0	0.24	
Turbidity:	4.0		
O.C.: (apparent as received)			14
(after filtration thru paper)			14
COD:			None

CHEMICAL CHARACTERISTICS

	Parts per Million	Grains per Gallon
Total Hardness as CaCO3	38	2.3
Calcium Hardness "	20	1.2
Magnesium Hardness "	18	1.1
Alkalinity (M) "	45	2.7
Alkalinity (P) "	0.0	0.0
Sodium Salts	14	0.8
Total Dissolved Solids	79	4.7
Iron as Fe Tr. less than	0.1	
Manganese as Mn	n.d.	
Mineral Acidity	0.0	0.0
Oxygen Consumed	n.d.	
pH 7.4		

HYPOTHETICAL COMBINATIONS

Calcium Carbonate	50
Calcium Sulfate	0.0
Calcium Chloride	0.0
Magnesium Carbonate	15
Magnesium Sulfate	0.0
Magnesium Chloride	0.0
Iron Oxide (unfiltered sample)	n.d.
(sample filtered thru paper)	*Tr.
Silica	30

* Trace less than 0.1

	Parts per Million
Sodium Sulfate	1.0
Sodium Chloride	3.0
Sodium Carbonate	7.0
Free Carbon Dioxide	2.0
Hydrogen Sulfide	n.d.
Total Sulfates, Chlorides and Sodium Carbonate	14

n.d. :: not determined

(Note: To convert parts per million to grains per gallon multiply by 0.06; to convert grains per gallon to parts per million multiply by 17.14)

Received by: F. E. Kuhlmeier, 615 Mills Building, El Paso, Texas

No.14 - [illegible]: Continued

(b) - Install a Dial Thermometer at least 5" or 6" in diameter on the Cooling Water Outlet on each Cylinder Head. This may be a Round Dial Thermometer or a Sectional Dial Thermometer, trade name of which is "Motometer" Dial Thermometer, as installed on the large enginesin the Silver City Power Plant.

(c) - Install a Pyrometer to facilitate taking the temperature of the Exhaust Gases from each Cylinder.
This is the simplest and most accurate method to determine the amount of Load on each cylinder, so that the operator can keep the Load balanced. It should of course at all times be the same on both cylinders.

(d) - Install a Diaphragm Operated Valve in the Pipe Line supplying Fuel Oil to the Engine. This Valve to be operated by the Lubricating Oil Pressure and is commonly called a "Lubricating Oil Failure Stop".

With this Valve installed, it will be impossible to start the Engine until after the Lubricating Oil has been turned on and it will stop the Engine in case of failure of the Lubricating Oil supply.

This is an inexpensive device and insures against a hot and possible burned out Bearings.

(e) - In addition to the installation of a Diaphragm Operated Valve in the Fuel Oil Supply Line, it is recommended that a Float Operated Switch be installed in the Lubricating Oil Overhead Supply Tank to close an Electric Circuit to ring an Alarm Bell when the Oil Level in the Supply Tank is dangerously low. This will afford the operator time to replenish the supply before the engine is stopped by the Lubricating Oil Failure Stop.

continued on page 15.

No.14 - PORTABILITY continued:

(f) - The present Lubricating Oil Overhead Supply Tank should be elevated to a point at least 6 ft. or 8 ft. higher than where it now is installed. The additional Lubricating Oil Pressure is very desirable.

(g) - Install a Water cooled Check Valve, with which it will be possible to re-charge your Starting Air Bottles with Exhaust Gases from the Engine, which is a quicker, cheaper and more satisfactory method to re-charge the Starting Air bottles than with an Auxiliary Gasoline Engine Driven Air Compressor.

The Auxiliary Gasoline Engine Driven Air Compressor is a necessity of course for obtaining the first supply of Starting Air, and also when the Starting Air is accidentally lost.

(h) - Make or preferably purchase a Special Outside Caliper with screw or micrometer adjustment for accurately measuring of Piston Diameters.

(i) - Make or preferably purchase a Mandrel and Tram for checking the Pointing of the Connecting Rods.

No.15 - GENERAL COMMENTS ON THE ENGINE:

Your De La Vergne Diesel Engine is quite an old Model, but is one that has been found very dependable and very economical when properly installed and given reasonable care and attention, and in my opinion, when the many Erection and Installation errors and poor workmanship have been corrected, as above recommended, you will obtain the same dependable economical and practically trouble-free operation from this old De La Vergne Engine that you should and as is being obtained in other similar plants.

Continued on page 16.

AIR COMPRESSORS

Mr. Barry requested me to also look over the two Ingersoll-Rand Air Compressors, now in your plant, and while I did not inspect these Compressors as thoroughly as I did the Diesel Engine, I am of the opinion that they are in a fair state of repair but that they were somewhat neglected in their former installation.

(a) - Very dirty Cooling Water was used, so that large quantities of mud and some scale was deposited in the Cylinder Water Jackets.

Compressor No.1 (nearest the Diesel Engine) contains the most mud and scale. The Low Pressure Cylinder Water Jacket is about one-half full of mud.

All 4 Cylinder Jackets should be thoroughly washed out to remove the mud and then given an acid treatment to remove the scale already formed.

(b) - The Cylinders show some wear, not much, which can be corrected by installation of New Piston Rings.

(c) - It is suggested that all Bearings be gone over and checked to make sure that they are properly set up.

(d) - Cooling Water for the Air Compressors should be taken from the same tank that is used for supplying Cooling Water to the Diesel Engine, so that they also will be cooled with soft or non-scale-forming water.

This is not so important on an Air Compressor as it is on a Diesel Engine, but it is desirable, especially if non-scale-forming water is available.

Respectfully Submitted,

R. E. Hutchinson

REH/f

Aug. 5, 1915

Mr. John G. Barry,
Cooney Mining Co.,
Glenwood, N. M.

Dear Mr. Barry:

Name of Tank	% KCN in Solution	No lbs. to ton
Mill Solution	.0025	.05
6 x 20	.002	.04
#1 Thickener	.022	.44
#2 Thickener	.125	2.50
Small Tank near Filter	.03	.60
Agitator #1	.036	.72
" #2	.07	1.40
" #3	.10	2.00
" #4	.105	2.10

Assay of Solutions for Gold and Silver

(See Dunaway for location)

	Gold	Silver
Tank "A"	.038 oz. per ton	.932 oz. per ton
" "B"	.013	.327
" "C"	.021	.522

Notes on Oliver Filter

An Oliver salesman passed thru Saturday and I had a good talk with him.

They have rubber scrapers but he does not favor them at all. He says to take off the present wire and rewind with 10 gauge (B and S) bright steel wire spacing 1½" to 2". He says that all new filters are being so equipped. The larger gauge wire will protect the cloth.

He agrees heartily with the air agitation, since the mechanical stirrer and the V-bottom are old type, and we can't put in cradle agitation.

If the filter is not fitted with a reducing valve on the blow line reducing to 2#, it must be obtained. I rather think that you have it installed.

It will take 44 ft. of wire to a turn and 113 turns if spaced 1½" apart, a total of 4972 ft. It would be well to buy 5500 ft. of wire because the spacing may not be always 1½". 5500 ft. bright steel wire, 10 gauge, will weigh approximately 250#.

He also says that the spray pipes will have to be located mainly by experiment.

The first spray should hit the cake just as soon as the cake shows signs of dryness. The others must be spaced with one requirement. If the spray pipes are too close the water will run down the outside instead of penetrating the cake.

Three spray pipes should be used for barren solution and carry 48 nozzles.

Two spray pipes should be used for water, one having a full 16 nozzles, the other drilled for 16 nozzles but only carrying 8. This will use the 72 nozzles that Mr. Hale said were on hand. If necessary a dozen more can be ordered on short notice and the pipe filled out.

If you have a stapling machine, staple this in with the last report.

Sincerely yours,

John F. Graham

JFG:mf

July 15, 1933

Mr. John G. Barry,
808 Mills Bldg.,
El Paso, Texas.

Dear Mr. Barry:

I am enclosing a blue-print of my plan for the operation of Cooney mill. Following are a few comments on the situation.

The Merrill Company state that 30 bags each 10" x 4' probably can handle 200 tons of liquid per day.

First: The defects of the present arrangement.

The present lay-out of the mill contemplates crushing 100 tons of ore in 500 tons of solution, taking off 400 tons solution from thickener #1, and sending it, together with 100 tons from thickener #2, and not less than 100 tons from the Oliver filter, a total of 600 tons, to precipitation. This, of course, is impossible, looking at the preceding paragraph.

Second: The above, using 75 tons a day.

If only treating 75 tons a day, using the above plan would give 450 tons solution, still an impossible task.

Third: The proposed plan.

There are two places where solution can be saved from going to the precipitation plant.

One, by circulating the overflow from thickener #1 in the grinding circuit, releasing 400 tons of solution.

The other, by not using thickener #2, releasing another 100 tons.

By this scheme, shown in the blue-print, the precipitation plant will handle 100 tons of original solution from the Oliver filter, plus 30 tons of wash solution also from the Oliver filter.

Handling 75 tons of ore this amount to be precipitated will be reduced from 130 tons to 100 tons.

This plan does not require a new value for the Oliver, but does call for $68.00 worth of nozzles for efficient washing.

Possible alterations of the above plan.

If it proves that the precipitation plant can handle greater capacity, then:

I would propose to bleed from the mill solution surge tank as much solution as needed to build the precipitation plant to capacity. Assuming, in the case of 75 tons of ore capacity, that this can be 100 tons, then this will have to be run into a second sand clarifier and all pumps, tanks, and pipes between the sand clarifier and the mill solution tank made correspondingly larger.

Or:

Thickener #2 can be cut into the circuit and 100 tons of barren solution added to it. This will give 100 tons of solution to a second clarifier and relieve the washing load on the Oliver. I do not believe it needs that help but if circumstances seem to warrant it the change can be quickly made. This means 200 tons to precipitation.

Or:

The 24 hour capacity of the plant can be put over the filter in 12 hours. The cake from this 12 hour period can be repulped with barren solution and re-run over the Oliver during the remaining 12 hour period. This would send 200 tons to precipitation.

I do not favor it because of the rehandling and agitation necessary. 12 hours of plant capacity would have to be stored and agitated, while running on repulped feed, and 12 hours of repulped feed would have to be stored and agitated while running on plant feed.

All of this material, 1 to 1 in texture, would have to be pumped 10' to 12' and a diaphragm wouldn't do it, and it would have to be agitated, and a thickener wouldn't do it.

The idea is sound, from a washing point of view, but I think there are easier ways of accomplishing the same result.

I would suggest that all pipes delivering solution into tanks, with the exception of the Pregnant Solution tank, go over the top of the sides, thus avoiding the use of valves in the discharge lines, and also securing aeration. The Pregnant Solution does not want aeration and anything leading to that should be avoided.

I also suggest that the tanks for the bags be made in four separate compartments, for the sake of flexibility.

These tanks should be made of welded steel, leaving three inches or more clearance on sides and bottom, high enough to completely cover the bags, with a drain outlet at the bottom and an overflow wier or pipe at the top.

The pregnant solution tank must be set so that there never will be more than 11 ft. head on the top of the bags and not much less than 8 ft. This may call for a small auxiliary tank alongside the main tank.

I am assuming that, since the Oliver has been operating, all equipment, except sprays, necessary for its proper operation is installed.

It is well to remember that the stamps, classifier, rod mill, thickener #1, agitators, and filter all work as a unit and that any disruption of the work of any one of them means the stoppage of the whole plant. Therefor a most careful inspection, mechanically, should be made of all pipes, bearings, gears, valves, drives, etc., before the plant is turned over to operation.

A semi-corroded pipe can give way and cause the loss of a considerable sum of gold, besides stopping the whole plant.

I shall send you in a day or so a sketch showing the construction of the sand clarifier and the installation of the zinc feeder.

Sincerely yours,

John F. Graham

JFG:mf

Repairs and changes necessary to place the Cooney Mining Co. mill in operating condition.

Note: Refer to blue print; "Hourly Solution Flow"

A general scheme of surge capacity is planned so that a delay of one hour in any place in the mill will not cause an interruption in the general working of the plant.

The stamps, classifier, and rod mill work together as a single unit. Whatever shuts down one of them will shut down all three.

Mill Solution Tank

This tank, which is 16' x 10', is much larger than needed and could advantageously be replaced by a 10' x 9' tank, leaving the old tank as storage for fresh water. However, the present installation is satisfactory.

Barren Solution Filter Spray Storage

On the top of the mill solution tank will be built a box of 40 cu. ft. capacity, say 4' x 4' x 3'. The barren solution from the bags will be pumped into this box at the bottom and will overflow into mill solution storage.

The pump line from the pump to this box will be tapped on the discharge side of the pump and conducted to the filter.

The Stamps

Miscellaneous items

The piping from the mill solution tank to the stamps is satisfactory and needs no changes.

The collecting launder from the stamps has dried out and needs tightening.

The bearings of the stamp jack shaft should be protected from floods and dirt.

The stamp mill motor should be protected from dirt and splash, and not check ventilation.

The Batteries

The center and east batteries are in good shape ex-

cept for some guide adjustment. The stems on these two batteries are 3 1/4" diameter, while the west battery has stems 3 1/8" diameter. (It would be well if all the batteries were alike but under present circumstances such a change is not recommended.) These two batteries are going to need shoes and dies. I have sent to Allis-Chalmers to see if they still stock parts of this stamp mill or at least have specifications. Upon receipt of their letter I will advise regarding proper shoes and dies.

New dies can be put in as desired provided the anvil level is kept about the same on all of them.

I would suggest that shoes be added only one at a time so as to keep the load on the stamp motor more uniform. If the stamp mill is not being crowded this suggestion will not apply.

The west battery is not in such good shape. The stems and the bosses both are badly worn and the chief operating trouble is to make the boss stay on the stem. This can be corrected by taking out the stems and retapering them. This is a machine shop job, probably at El Paso.

A better alternative, under the circumstances, is to go down to the stamp mill junk pile and by careful selection rig up a complete battery of 3⅛" stems. This makes the stems a little heavier but the tappets and bosses are the same except for hole dimensions. This excess weight can be overcome by using partly worn shoes and so the motor will not be overloaded. There are enough parts in the pile so that an almost perfect battery can be assembled at but little cost.

The dies are not standard for this battery but can be trimmed with the torch and made to fit the mortar.

The Classifier

Rakes

The rakes on the classifier leave no escape on the upward stroke for the fines. All the blades should be burned off similar to the two already burned.

The Rod Mill

The rod mill is being worked over mechanically and should be in good shape. There is an ample supply of rods.

The feed box has at least one rotten board and the box should be pulled out and worked over.

Classifier Discharge to Thickener

Since this discharge does not flow by gravity a Wilfley sand pump is used to lift the pulp into the thickener. To maintain operation one hour, should the Wilfley stop running, a surge tank or sump with a capacity of twenty tons of solution must be provided. Twenty tons of solution is approximately 640 cu. ft.

The present pregnant solution tank is 20' x 6', having a capacity of 1800 cu. ft. Partition this tank into three equal parts, using one part as the sump tank for the Wilfley pump.

The Thickener #1

The overflow of this thickener will flow into one of the compartments of the above tank and act as a surge tank for the pump sending the solution to the mill solution tank. This pipe line and pump is already in.

The Agitators

The agitators are in good shape except that the air for agitation is not connected. This is a good place to emphasize the fact that neither the agitator power nor air should ever stop for as much as ten minutes. This I believe is being taken care of in the power house by the use of the Fairbanks Morse engine as an auxiliary.

The discharge from the agitators now goes direct to the filter instead of to thickener #2 and is not diluted as formerly. A gravity flow for a 1 to 1 pulp to the filter is not possible.

Run the discharge from the agitator direct to the road level, then across the road and under thickener #2, making tight connection with the diaphragm pump. This pipe should not slope less than 1" to the foot and should be the same size as the pump suction so as to produce enough velocity to prevent packing. Tees should be used instead of elbows in all pipe lines to facilitate drainage.

Oliver Filter

Rig up four lines of sprays using the atomizer nozzles in stock. Three of these spray lines will handle barren solution and one line will be for water. Some adjustment will be necessary to insure the proper hourly flow thru these nozzles.

Standard spray pipes are made using 1½" pipe with nozzles spaced at 12 inches.

In addition to the spray line install a drip line for clear water, 1½" pipe with 3/32" holes spaced on 12" centers.

I have written enquiring about rubber scrapers.

A filtrate pump is needed. The original pump is in use and can be returned or a new one bought.

Install seven air agitator lines in the pocket of the filter and stop the agitator. This should remove stuffing box trouble and banking. Prepare the pipes according to the specifications of your mill man, Mr. [illegible].

Sand Clarifier

Remove the rakes from Thickener #2 and use it as a sand clarifier and storage sump. Build the filter bottom supported about 2 ft. above the tank bottom thus leaving storage for at least 10 tons of solution. Details of the sand clarifier will be sent to you separately.

Zinc Feeder

Hook up the zinc feeder and pregnant solution pump below the sand filter. This arrangement will be shown also in the sketch.

Pregnant Solution Tank

Move the little tank from the outside and set it up in the precipitation room so that the inside bottom is 8 ft. above the top of the bags. Connect this tank to a small steel tank 3 ft. tall whose bottom is level with the bottom of the larger tank. Rig up a float which will open and close the discharge from the big tank as the level in the small tank rises and sinks from three feet. This insures a head on the bags which may vary from 8' to 11' and protects the bags from excessive pressure. The big tank acts as a reservoir only.

Precipitation Bags

Remove the union and one nipple from each bag inlet to give needed head room.

Make tanks to clear the bags on the sides about 3". Bottom clearance need be little, perhaps 1". Construct a discharge wier in the back of the box to hold solution level about the middle of the top block. Put drains in the bottom or side of each tank.

Construct launders to carry the overflow to the barren solution surge tank.

Specification for the inner bags is "Brown Pequot Sheeting". Mr. Hale has a sample of the sheeting.

The surge tank for the barren solution is in place with pump attached and piped to the mill solution tank. This pipe connects with the bottom of the 4' x 4' x 3' box already mentioned.

From this pipe is a pipe leading to the barren solution spray of the filter.

Agitator Drain

In case it became necessary to drain an agitator the Wilfley sand pump would be borrowed and the contents of the agitator pumped direct to the filter.

Black Cyanide

The plant has had considerable trouble during the dissolving of the Aero Cyanide. The dissolving tank should have an air lift and there should always be five times as much water as cyanide, preferably up to 10 times. Using this amount of water no acetylene should be generated nor heating occur because of the hydration of the lime.

The present dissolving tank, if fitted with an air lift, can be used. It should have a gravity flow to both agitators and mill solution surge tank, which fixes its location as northwest of the present pregnant solution tank.

Zinc Feeder

You have a zinc feeder which is satisfactory for delivering a measured quantity.

Zinc dust does not wet easily and a mixing cone is usually installed between the feeder and the pregnant solution pump. The cone you have was merely a feeder and not a mixer.

The Merrill Company quote $75 on the mixing cone, with four to six weeks delivery.

The Rosedale Mine has a complete zinc belt feeder and emulsifier for which they ask $150 F. O. B. Magdalena.

You do not need the belt feeder and I shall write them for further details.

Sketches do not accompany this outline but will be forwarded separately.

Queen Mine
Mogollon

At Prescott, Arizona.
August 26, 1934

Mr. Robert W. Lyons,
70 Pine Street,
New York, N. Y.

Dear Mr. Lyons:

In this I am beginning a series of reports to you regarding progress of my work and estimates at the Queen Mine, Mogollon, N. M. I am sending you two additional copies for the use of yourself and associates; but, of course, I shall send other copies elsewhere as you may wish. Pending other arrangements I am sending two copies to Mr. E. E. Hale for the use of himself and his assistants.

I am planning to visit the property about the 30th for the purpose of getting further details in order to formulate plans to cover mine development and equipment, obtaining further cost details, and observing and advising in general, about all of which I shall report to you soon thereafter. I shall plan also to make visits during the ensuing six weeks, which I believe will be a critical period in beginning an orderly and efficient operation.

From what follows in this report you will see that less than half of the stretch of vein now opened is likely to be commercial, that something less than 40,000 tons is likely to be proven later, that costs and losses are likely to reach $8.25 per ton, and that we should not count at present on a profit in excess of $100,000. from the ore tentatively believed present in the Queen Tunnel.

INDEX SAMPLING

As of February 1, 1934, E. B. Godfrey prepared a Longitudinal Section along the Queen Tunnel on which to show preliminary sampling results by which to outline the magnitude of the property for an optimistic outlook. The northern end of the working was obviously the more important and was sampled fairly closely where possible, which work has been improved since then.

During the recent visit the writer had 39 samples taken, almost all of which were to the South of the South Stope. They were spaced as indices to demonstrate character and persistence of mineralization and values. As a result of this the stretch of 380' long lying between the Portal and a point 55' south of the Air Raise may be commercially disregarded in the future. As shown hereafter other stretches still need additional sampling.

The sampling was also governed by the character of the mineralization, separate streaks being cut at various places. Attention was given to visual estimate of values in the samples. Four samples believed to be of good average grade averaged $11.25. Twenty-two samples believed to be very poor averaged $0.70. Of thirteen doubtful samples seven averaged $5.43, and six averaged $1.92. As a result it is important to note that coarse grained quartz is commercially very important; calcite is invariably valueless; and fine-grained and chalcedonic quartz and silica are generally very low grade.

When Godfrey calculated his values he used $34.00 per ounce for gold and $0.64 per ounce for silver. In order to preserve comparisons and avoid recalculations these unit values have been continued in use.

Godfrey's order of listing sampling results has been continued also, as follows: Sample Number (if used) - Thickness of Vein in Feet - Ounces of Gold (to hundredths) - Ounces of Silver (to tenths) - Dollar Value of Combined Gold and Silver.

From Portal to 35' South of Air Raise

The Portal, Air Raise, and Face are convenient general points of reference in considering the detailed results of sampling of the Queen Tunnel.

The stretch between the Portal and 35' South of Air Raise is about 330' long; it is developed on or near the vein. In this stretch the samples varied from the highest of 4.'5 - 0.02 - 2.1 - $2.02 to Nothing. This is a stretch of brecciated rocks along the vein which here as a cement consists largely of calcite in which at places occur small quantities of late, fine-grained, chalcedonic quartz and silica. Sixteen samples gave results of less than $0.70 per ton; 4 samples run between $1.11 and $2.02 per ton.

Consequently, the whole of this long stretch must be considered as commercially valueless. The old Longitudinal Section by Godfrey was designed to show only tentatively and roughly potentialities of the occurrence. But, the samples of low commercial grade shown on it for this stretch must now be considered as sporadic and misleading.

Therefore, the greatest part of the 29,000 tons shown on Godfrey's Longitudinal Section must be thrown out as commercially non-existent.

From 35' South of Air Raise to 20' North of Air Raise

This stretch of 75' long is not yet thoroly sampled. The indications are, however, that it will run about 3.'9 - 0.26 - 10.7 - $15.61.

The sampling in the Air Raise is also incomplete, but it shows that similar ore may exist between 45' and 100' above the track, running 3.'6 - 0.28 - 3.1 - $11.30. The length cannot be seen definitely but should be more than 30'.

It will be advisable to sample this block immediately and as thoroly as possible, including sampling in both Tunnel and Raise; and, ...e development could be done to advantage in the latter as well as the ...ting of an exploratory stope from the former.

From 20' to 80' North of Air Raise

The index samples in this stretch of 60' show no ore of commercial value, running 2.'9 - 0.06 - 2.5 - $3.79.

From 80' to 130' North of Air Raise

The index samples show that this stretch of 50' may have some commercial potentiality running 3.'5 - 0.20 - 2.9 - $8.17.

But more sampling is needed here; and some short raises would be desirable to demonstrate the upward persistence of this short stretch.

From 130' to 180' North of Air Raise
Reaching to South End of South Stope.

This stretch of 50' is of doubtful value and persistence. It is probably non-commercial. The index sampling shows 3.'7 - 0.11 - 2.7 - $5.36.

More sampling and possibly some short raises are needed in this stretch.

From 180' to 220' North of Air Raise,
The South Stope

This stretch of 40' is now being opened up as the South Stope, three chutes having been installed. This stretch was not sampled by me, because it had been sampled before in various ways. The cut samples have shown an average of 4.'7 - 0.31 - 6.5 - $14.70 as the back has been cut up a short distance. Samples from the chutes by the operators have shown $15.00 per ton.

On August 4, 1934 I had a composite sample drawn from the three chutes which ran 0.21 - 4.3 - $10.21. All of this shows that this short stretch has considerable commercial dependability.

The stope should be continued accompanied by close spaced sampling of it in both back and ends.

Between South Stope and North Stope

The stretch between the South Stope and North Stope is 38' long. An index sample in the middle showed 3.'0 - 0.11 - 2.4 - $5.28. Averaged with samples on the ends of the stopes it would give $9.47. It is obvious that more sampling should be done here, altho we must assume for the present that the stretch is non-commercial.

Southern 60% of North Stope.

The southern 55' of the North Stope was sampled closely by Godfrey. His results for this stretch show 4.'5 - 0.23 - 5.4 - $11.06. This stretch ⇄ seems to be dependable. Preperations are being made to carry the stope upward.

Foot Vein, from Southern Part of North Stope to Crosscut

At the northern end of the stretch just preceding the vein splits into a Foot and a Hanging component. The Foot Vein is now developed as far as the Crosscut, a stretch of 60'. The samples by Godfrey show that it should run 6.'7 - 0.17 - 3.4 - $7.96. For the present this should be considered as commercial ore, altho it is evident that more samples should be cut at intermediate intervals.

Hanging Vein, from Southern Part of North Stope to Face

The Hanging Vein is seen in the North Stope and is developed farther north by the crosscut and drift thereon. The southern stretch of 30' should run 6.'2 - 0.17 - 4.1 - $8.40; and the northern stretch of 40' should run 4.'9 - 0.14 - 3.3 - $6.87. The latter needs more samples. For the present we should consider that the total stretch of 90' runs $7.81 and is commercial ore.

Interior Shaft

At the northern end of the North Stope is an Interior Shaft about 95' deep, seemingly sunk largely on the Hanging Vein. The Godfrey samples show that for a depth of 89' this should run 4.'6 - 0.33 - 6.3 - $13.38. Although much more sampling is needed in it as soon as convenient it tends to show considerable downward persistence of the ore body of the North Stope.

OUTLOOK FOR TONNAGE

From the foregoing it is possible to assume that the stretches of commercial ore aggregate 363' in length which might average 4.'6 - $11.11.

It should be realized that almost all of the known ore is opened on only one side and there is no ore tonnage thoroly blocked out on three or four sides. For this and for prospecting and development considerable work will have to be done in the near future. Consequently, at present the ore occurrences have not been determined well as to dependability and considerable uncertainty as to tonnage must exist.

But, some assumptions may be made for the purpose of estimating magnitude in case all proves well in the future. For instance, we should hope that the ore stretches mentioned would persist upward for an average height of 250' and downward to 50' below the Queen Tunnel. If such should prove true, then the 363' stretches to a height of 300' and a thickness of 4.'5 should yield 37,000 tons of ore. This is about all that one could now logically hope for as far as the face in the Queen Tunnel; being about two-thirds of the original tentative estimate.

OUTLOOK FOR COSTS

While in El Paso I tried to get some information on former costs at Mogollon, especially as related to Mogollon Mines Company. From what

follows you will see that they were fairly high; but they were relatively not very high at that time as compared to several similar operations of 100 to 200 tons daily.

From these reports it would seem that recoveries were relatively low and that losses incurred in treatment and marketing were charged as costs. Without the losses the operating costs were probably not lower than $5.50 per ton. Under the old prices for gold and low prices for silver it is doubtful if more than $1.00 per ton profit was made.

Transportation was always a high element in the costs, reaching $0.64 per ton. Now, ten years later, it may be possible to reduce this element.

It seems to me at present that costs at the Queen Mine might be kept as low as $6.00 per ton, divided about as follows:

Mining and Development	$3.00
Milling	2.00
General	1.00
	$6.00

But losses in treatment, and losses and costs in marketing may add as much as $2.25 per ton to the above. Consequently, we should at present consider as of doubtful value any ores running less than $8.25 per ton.

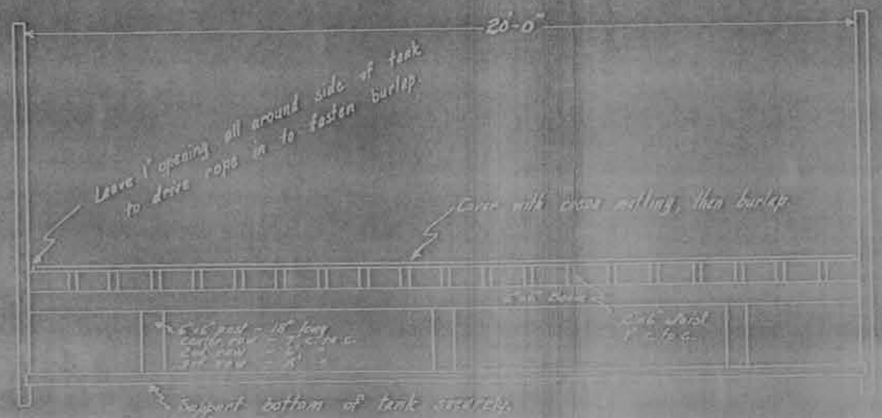
In the case of the tentative tonnage mentioned above we should therefore believe at present that it is not likely to yield a profit much in excess of $100,000.

We realize, of course, that this matter of costs is pre-eminent in importance. During my next visit to the property I shall discuss them in detail with your organization, whereafter I shall advise you further. I shall also try to get from others further details as to the costs in the Mogollon District.

Very truly yours,

John C. Barry,
Consulting Mining Geologist and Engineer.

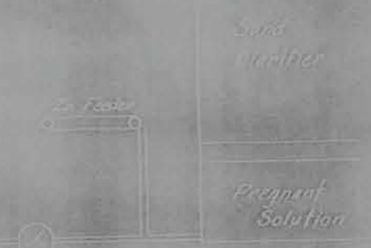
JCB:APB



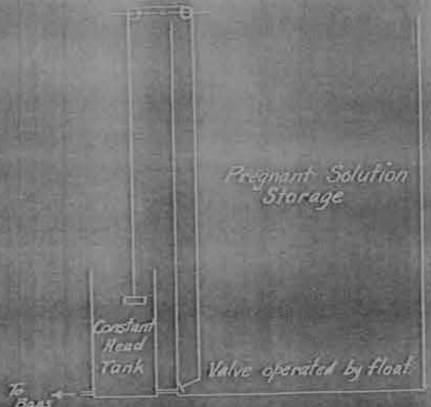
SKETCH
of
SAND CLARIFIER
and
PREGNANT SOLUTION STORAGE
[illegible] Mining Co.
[illegible]

BILL OF MATERIAL

13 Posts	[illegible]	8' - 18"	69	Ft. B.M.
3 Beams	6" x 6"	20'-0"	180	" "
2 "	3" x 6"	12'-0"	72	" "
9 Joists	2" x 6"	20'-0"	180	" "
		16'-0"	64	" "
		14'-0"	28	" "
		12'-0"	24	" "
2 "	2" x 6"	10'-0"	20	" "
160 Planking ft	1" x 1"		14	" "
of [illegible]	[illegible] x 1½"			



ZINC FEEDING ARRANGEMENT



PREGNANT SOLUTION
CONSTANT HEAD

100 TON MILL CAPACITY
HOURLY SOLUTION FLOW
COONEY MILL
COONEY MINING CO.
MOGOLLON, N.M.

JULY 12, 1935 D.C.G.
Revised Aug. 8, 1935

Note:- For 75 ton capacity reduce all figures 25%

Mill Solution
21 tons
5000 gal.
672 cu ft
10' x 9'

15 Stamps

Classifier

Surge Tank

Rod Mill

Pump

135 cu ft.
42 tons

Pump

Surge Tank
10' x 7'
4000 gal.
538 cu ft.
16.8 tons

Thickener #1

Pump

Bleed as necessary to second sand filter

Barren Solution
175 cu. ft.
6' x 8'

40.5 cu ft. Obtain proper head for spray

Agitators in Series
1000 gal - solution - 135 cu ft.

Vacuum Pump

175 cu ft.
5.5 tons

Pregnant Solution
6' x 6'

11" drop in head

Solution Spray

Water Spray

Diaphragm Pump

Oliver Filter
Capacity per Hour
12.5 tons solution
100 cu ft.

Zinc Feeder

Pump

Pump

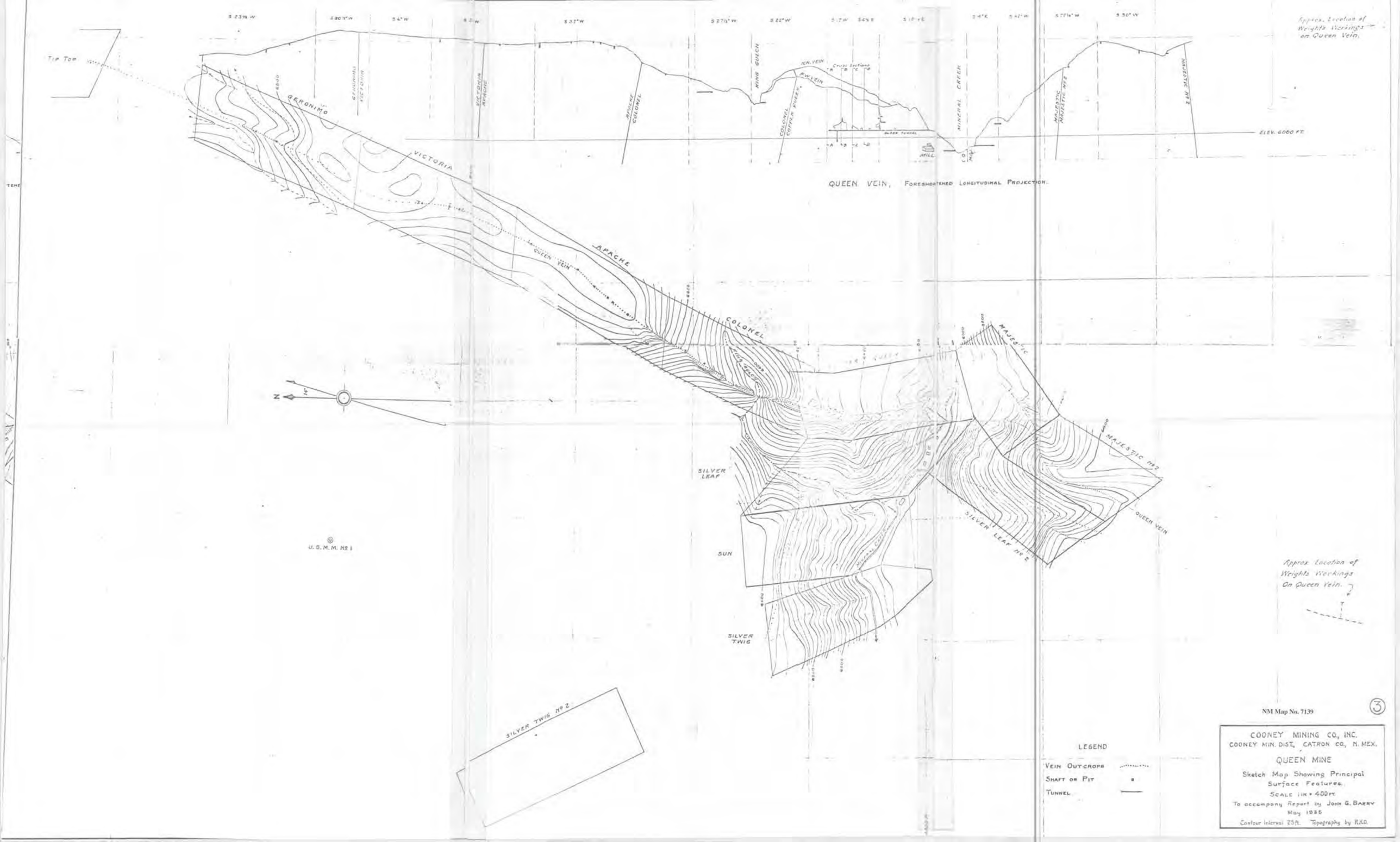
Sand Filter
17.5 cu ft per hr.
20' x 6'

Bag Precipitation

Capacity 8 Tons

Drain to Mill Solution

20 cu ft. Water W

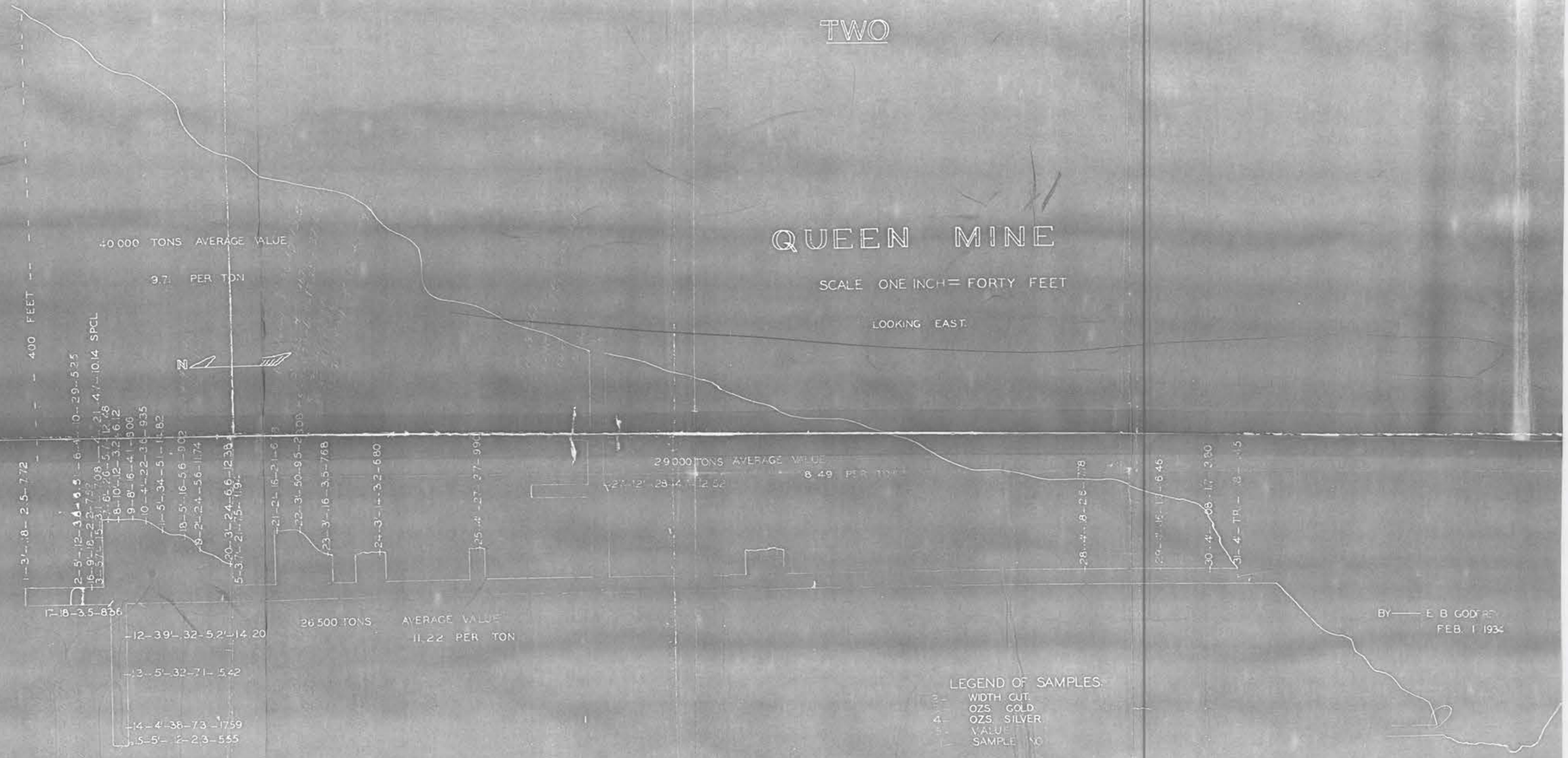

TIP TOP
GERONIMO
VICTORIA
APACHE
COLONEL
SILVER LEAF
SUN
SILVER TWIG
SILVER TWIG No 2
SILVER LEAF No 2
MAJESTIC No 2
QUEEN VEIN
KING QUEEN
MINERAL CREEK
ELEV. 6000 FT.
Approx. Location of Wrights Workings on Queen Vein.
QUEEN VEIN, FORESHORTENED LONGITUDINAL PROJECTION.
U.S.M.M. No 1
LEGEND
VEIN OUTCROPS
SHAFT OR PIT
TUNNEL
NM Map No. 7139
3
COONEY MINING CO., INC.
COONEY MIN. DIST., CATRON CO., N. MEX.
QUEEN MINE
Sketch Map Showing Principal Surface Features.
SCALE 1IN = 400FT.
To accompany Report by JOHN G. BARRY
May 1935
Contour Interval 25ft. Topography by R.K.O.

TWO

QUEEN MINE

SCALE ONE INCH = FORTY FEET

LOOKING EAST



TENED LONGITUDINAL PROJECTION.

Approx. Location of Wrights Workings on Queen Vein.

Approx. Location of Wrights Workings On Queen Vein.

LEGEND

VEIN OUTCROPS	.....
SHAFT OR PIT	●
TUNNEL	———

COONEY MINING CO., INC.
COONEY MIN. DIST., CATRON CO., N. MEX.

QUEEN MINE

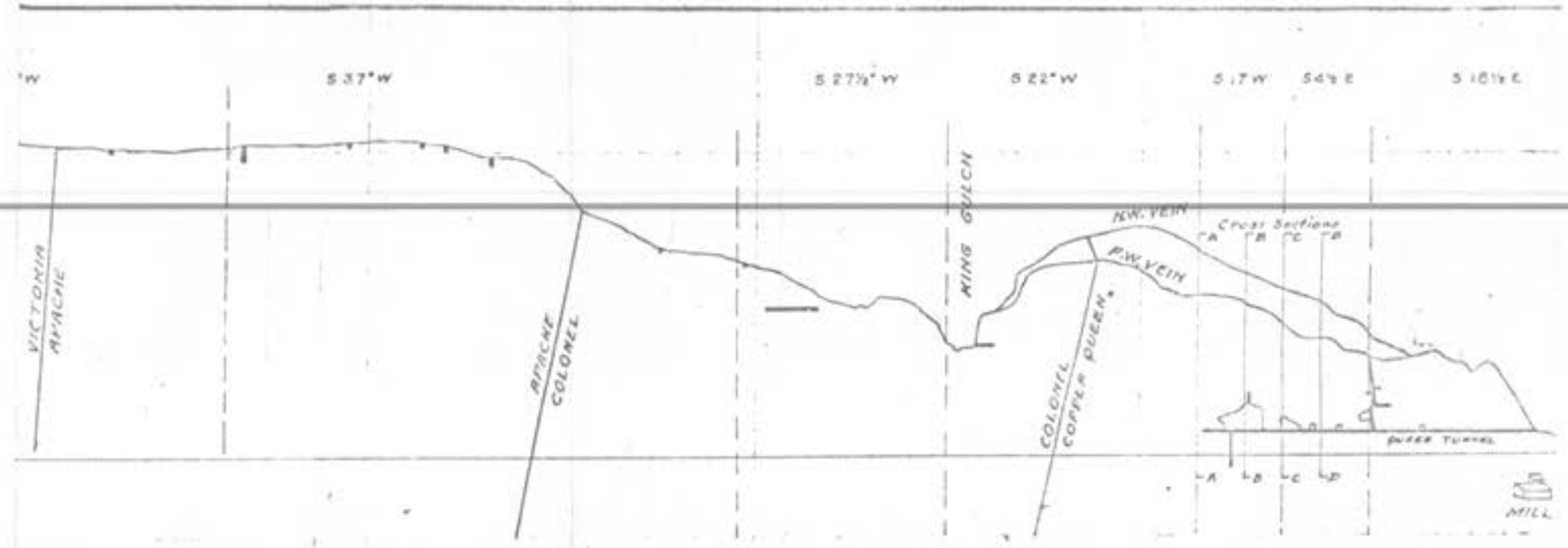
Sketch Map Showing Principal Surface Features.

SCALE 1IN = 400FT.

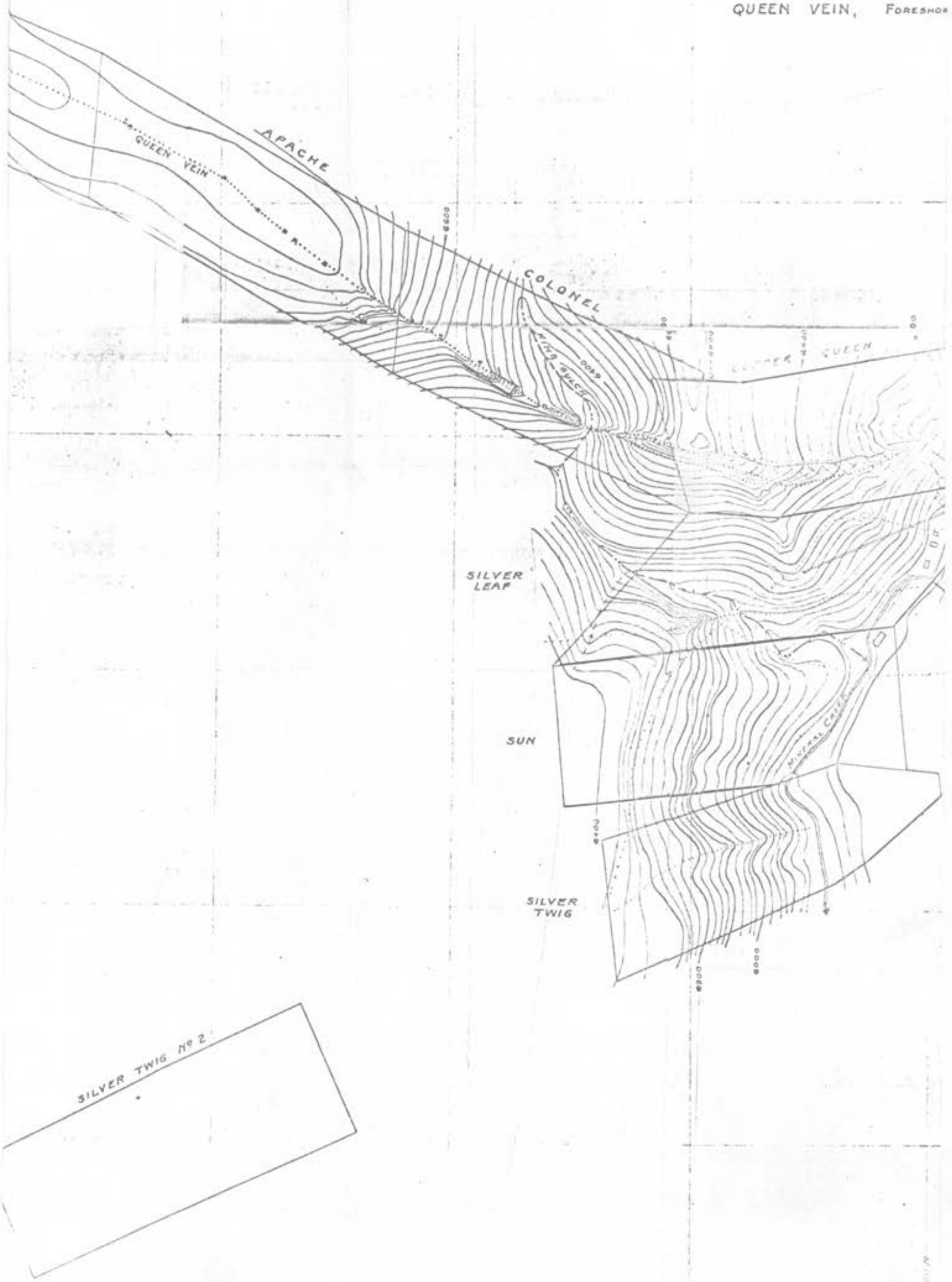
To accompany Report by JOHN G. BARRY
May 1935

Contour interval 25ft. Topography by R.H.Q.

③



QUEEN VEIN, FORESHOR



Surface ± 221.5 above track

Bottom Collar

Queen Mine / John Barry Ranges / UTEP

6800
6700
6600
6500
6400
6300
6200
6100
6000
5900

OUTCROP OF HANGING WALL VEIN
OUTCROP OF FOOTWALL VEIN
COPPER QUEEN
COLONEL
A-1 DRIFT
A-2 DR
A-3 DRIFT
AIR RAISE
No 3 STOPE
No 4 STOPE
No 5 STOPE
QUEEN TUNNEL
"O"
SQ. AIR RAISE
1
2
RAISE
QUEEN WINZE

Intersection of Foot & Hanging Veins

COONEY MINING CO., INC.
COONEY MINING DIST., CATRON CO., NEW MEXICO
QUEEN MINE
PROGRESS SKETCH PLAN ON PLANE OF VEIN.
SCALE 1" = 100 FT. Traced A.G.D.
TO DATE 10-17-35
JULY AUG SEP
OCT. PROPOSED DEVELOPMENT.

NM Map No. 7138