

TO RLH RTB BJB REH  
BOF AMM KEJ

FROM DHUnderhill *DHU*

DATE August 24, 1981

SUBJECT SHOOTARING CANYON SUMMARY REPORT  
REVISED JULY 23, 1981

plateau  
resources  
limited

INTERNAL CORRESPONDENCE

CC

dkr

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The report entitled "Summary of the Shootaring Canyon Project Garfield County, Utah" has been "Revised dated July 23, 1981". This report replaces the report of the same name dated "Revised March 17, 1981".

The new revised edition provides the current ore reserves and gives an overview of the current project status. If you have any occasion to refer to, or to provide this report to other people please confirm that you are making use of the correct edition.

Enclosure: Copy of Report

SUMMARY OF THE  
SHOOTARING CANYON PROJECT  
GARFIELD COUNTY, UTAH

PLATEAU RESOURCES LIMITED  
772 HORIZON DRIVE  
GRAND JUNCTION, COLORADO

REVISED  
JULY 23, 1981

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SUMMARY OF THE SHOOTARING CANYON  
PROJECT OF PLATEAU RESOURCES

ABSTRACT

The Shootaring Canyon Project will mill uranium ores produced from company owned mines located in the Henry Mountains of southeastern Utah. The ores to be mined are located on lands owned by, or leased to Plateau Resources Limited. Nearly 2,000 rotary drill holes, totaling almost 1,000,000 feet, were drilled to evaluate the properties. The host for the uranium ores is the fluvial sandstone of the Salt Wash member of the Jurassic Morrison Formation. Estimated reserves discovered to date comprise 5.4 million tons of ore containing approximately 14.3 million pounds of  $U_3O_8$  at an average grade of .13+%  $U_3O_8$ .

The ores will be produced through two mines located on the property. Ores produced from the Tony M and Frank M mines will be processed at an initial rate of 275,000 tons per year. The current reserves will provide a minimum project life of 20 years.

Mined ores will be processed in a facility using the conventional acid leach solvent extraction process. Design capacity of the plant is 750 tons per day although it is anticipated that the ultimate operating capacity of the plant can be increased to 1,000 tons per day without any modification. It is located on a 270 acre site situated between 3 and 6 miles from the planned mines. The facility was designed and constructed by Mountain States Mineral Enterprises. Construction of the facility was estimated to be 99.6% complete as of July 1, 1981 and milling operations are expected to begin during the first quarter of 1982.

The environmental report for the mill site was prepared by Woodward-Clyde Consultants and the Final Environmental Statement was published by the U. S.

Nuclear Regulatory Commission on August 11, 1979. The Source Material License was issued on September 21, 1979 and construction of the facility was started immediately.

Because of the relatively remote location of the project area, Plateau through its subsidiary Canyon Homesteads, Inc. has developed a new community in order to provide living facilities for the personnel located at the mine and mill complex. The community, known as Ticaboo, is located three miles south of the millsite.

## INTRODUCTION

The thick Salt Wash sands of the Henry Mountains, Utah have been the source of small amounts of uranium ores ever since 1913. However, even though high grade ores occur locally in outcrops, exploration programs performed by at least four mining companies were unsuccessful in discovering significant ore bodies.

In June 1976, Plateau Resources Limited was established as a wholly owned subsidiary of Consumers Power Company. Plateau's responsibility is to discover and to mine and mill uranium ore in order to secure a future supply of uranium to fuel Consumer Power's nuclear generating plants.

As part of its program to achieve this objective, Plateau carried out an aggressive exploration drilling program in the Shootaring Canyon area of the Henry Mountains. The successful exploration program resulted in the discovery of sufficient ores to justify the development of a uranium mine and mill complex. A project was initiated during 1977 in order to develop the complex.

The purpose of this report is to summarize the progress and current status of the Shootaring Canyon Project of Plateau Resources Limited.

## LOCATION AND ACCESS

The project area is located 175 miles southwesterly from Grand Junction, Colorado on the south flank of the Henry Mountains in Garfield County, Utah (Figure 1). The area is located on the west side of Utah State Highway 276. It lies approximately 50 miles directly south of Hanksville, Utah, and 10 to 15 miles north of Bullfrog Marina, located on Lake Powell. A paved airstrip suitable for small twin-engined aircraft is situated just north of Bullfrog Marina.

The ore lies within the northern half of T35S, R11E, S.L.M. The 270 acre millsite is located in Sec. 33 and 34, T35S, R11E, and Sec. 3 and 4, T36S, R11E (Figure 2). The Ticaboo Townsite occupies Sec. 16, T36S, R11E.

## TOPOGRAPHY AND CLIMATE

The project site is located within an area of canyonlands terrain at an elevation of approximately 4500 feet. Topographically, the area consists of a rugged irregular upland surface incised by canyons with vertical walls. Relief of several hundred feet is common and local elevation contrasts of up to 500 feet occur.

The climate is distinctly arid with an average annual precipitation of 7 inches. Vegetation consists of scattered sagebrush interspersed with occasional small pinyon and juniper.

## MINE AND MILL COMPLEX; NRC LICENSING

Once significant uranium ore reserves were discovered at Shootaring Canyon a major program was initiated to plan and develop the necessary facilities to mine and process the ores. The Tony M mine has been under development since September 1, 1977.

Mountain States Mineral Enterprises of Tucson, Arizona was retained to design and construct the uranium processing facility.

Concurrent with mine and mill development, environmental work and site selection were initiated in order to license the processing plant with the U. S. Nuclear Regulatory Commission.

## MILL LICENSING BY THE U. S. NUCLEAR REGULATORY COMMISSION

In order to construct and operate a uranium recovery facility, the plant must be licensed by the U. S. Nuclear Regulatory Commission. In order to meet requirements of the NRC, an extensive site selection study was performed by Woodward-Clyde consultants. The site was selected as a result of the study and a complete environmental report was then prepared for the site (Woodward-Clyde

Consultants, May 1978). The report and license application was then submitted to the NRC.

The Final Environmental Statement was published on August 11, 1979. The U.S. Nuclear Regulatory Commission Materials License SUA-1371 was issued on September 21, 1979. Construction of the processing facility was started on that date.

#### URANIUM PROCESSING FACILITY

The Shootaring Canyon uranium processing facility will treat uranium ores utilizing a conventional process circuit which includes grinding, acid-leach, solvent extraction and precipitation of yellow cake within the flowsheet of operations. The facility occupies 114 acres of Plateau's 270 acre plant site which is located between 3 and 6 miles southerly from the mine portals (Figure 2). The final process flowsheet is based on the metallurgical test data developed by Hazen Research, Inc. of Golden, Colorado and then confirmed by Mountain States Mineral Enterprises, the architect engineer and constructor. The construction phase started during the fourth quarter of 1979 and was about 99.6% complete when construction was suspended on March 1, 1981. Milling operations are expected to begin during the first quarter of 1982. Design capacity of the plant is 750 tons per day although it is anticipated that ultimate operating capacity of the plant will be increased to 1000 tons per day without any modifications. This capacity can be increased to 1250 tons per day with minor equipment additions and at an added cost of approximately one half million dollars.

The uranium recovery techniques involve proven processes which are presently being used by the uranium industry. The primary mill circuit involves grinding the sandstone ore into a sand like material in a semi-autogenous grinding mill, and then dissolving the uranium from the grain surfaces using a sulfuric acid

solution. The uranium rich acid solution will be separated from the leached sands in a six stage counter-current decantation process. The leached sands will be discarded as tailings in a large, below grade, open impoundment with a clay sealed bottom.

The uranium will be transferred from the aqueous acid phase to an organic phase by means of a solvent extraction process. The uranium will be removed from the organic phase by ammonium sulfate and will then be precipitated by the injection of ammonia gas. The final precipitate, commonly called "yellow-cake", will be washed, dried and packed into 55 gallon drums. The finished product will then be shipped to a uranium hexafluoride conversion plant.

The processing facility consist of several buildings and an array of tanks of various sizes. Facilities have been designed and arranged to present a well integrated compact appearance (see Figure 3 for an artist's rendition of the plant). The larger buildings contain:

- \* Grinding and leaching equipment
- \* Solvent extraction equipment
- \* Yellowcake precipitation and drying equipment
- \* Offices
- \* Warehouse and maintenance shop
- \* Laboratory

The six counter-current decantation thickener tanks used to separate the leached sand from the acidic uranium solution are located outdoors. A slurry pipeline will transport tailings from the mill to the tailings impoundment, about 500 feet to the northeast, for permanent disposal. This impoundment has been stripped of topsoil and lined with locally obtained clayey material to prevent seepage. A dam has been constructed to contain the discharged tailings. The slurry will be pumped into the impoundment and deposited through spigots. A unique underdrainage system to drain the tailings liquid from the slurry has

been provided which will reduce the hydraulic head on the clay liner thus reducing the probability of underground seepage. By the time mine and mill operations are completed, the dam will have reached a height of about 100 feet, and the impoundment will cover approximately 2600 acre feet. At the termination of mill operations, the impoundment will be covered with earth fill. This will prevent the tailings and other trapped waste materials from contaminating the surrounding area.

The total operating work force for the processing facility is expected to reach approximately 50 people by early 1982 when the project is on-stream.

#### MINE DEVELOPMENT AT SHOOTARING

Two mines are planned at Shootaring--the Tony M and the Frank M.

The Tony M is being developed through access from the canyon wall. The shallow depth of the immediate entry ores permits this type of development.

The planned mode of entry for the Frank M mine can be through either a shaft or a decline.

The ores will be mined using a modified room and pillar technique designed to follow the irregular configuration of the ore bodies. This is the standard technique which has been developed in the hundreds of uranium mines located in the Colorado Plateau area. Mine equipment being used is of the rubber tired design.

#### TONY M MINE DEVELOPMENT

The Tony M trend is being developed by utilizing a double entry decline method (See Figure 4). The haulage ways consist of two parallel 9 foot by 11 foot adits which are being driven on a 3% grade (i.e., 3 feet/100 feet) along a trend of N22° W. The development was initiated on September 1, 1977 and the twin haulage ways have advanced more than 6,700 feet to date. The total planned

length of the haulage way is approximately 12,000 feet.

Lateral development has been started into and through known ore bearing areas. Development of several production stoping areas is complete. Other laterals are in various stages of development.

A mine dewatering sump has been constructed and a pumping system installed. The mine water is pumped to the surface and impounded in an evaporation pond. Plans are on-going to control increases in mine water as development extends into the known ore bodies.

#### FRANK M MINE DEVELOPMENT

The Frank M mine can be developed either through a shaft or a single entry decline (See Figure 5).

The principal access within the ore bearing horizon will be through double entry main haulage drifts. The planned double entry system is similar to the access system in the Tony M mine. Each of the parallel drifts will be 9 feet by 11 feet and they will be separated by 50 feet, centerline to centerline. The drifts will be inclined to follow the dip of the ore bearing horizon. The inclination will be approximately 5%.

Laterals will be driven from the haulage drift to and through the indicated ore areas.

#### DEVELOPMENT OF TICABOO TOWNSITE

##### Background

Because of the remote location of its operations, the Company is confronted with the problem of arranging housing and other accommodations for the workers at its mine and processing facility, and for support and service personnel, and their families. It is estimated that by 1982 the Company will employ

approximately 250 persons in the mine, the processing facility, and general office.

The only established community within a radius of 100 miles from the site of the Company's mining and processing operations is the town of Hanksville, Utah. Hanksville has a population of approximately 200 people and is located about 50 miles north of the site of the Company's operations.

Inasmuch as the land in the vicinity of the Company's operations is virtually all federal or state owned and is marked by very rough terrain, virtually the only land in the vicinity suitable for a new community is a 640-acre tract of land, now known as the "Ticaboo Townsite", which is owned by the State of Utah.

#### TICABOO TOWNSITE JOINT VENTURE

On March 2, 1979, Plateau, through its subsidiary Canyon Homesteads, Inc., entered into a joint venture known as the "Ticaboo Townsite Joint Venture" with Ticaboo Development, Inc. for the purpose of planning and developing the community of Ticaboo.

The Joint Venture has a Deferred Development Lease from the State of Utah covering the Ticaboo Townsite which grants the exclusive right to develop a community at the Ticaboo Townsite.

As provided in the Master Plan (See Figure 6), Ticaboo will include single and multiple family dwellings, mobile home and medical facilities, a commercial area, and a community services area. The Joint Venture plans to develop Ticaboo in two phases. Phase I consists of roads, sewer, water and electric distribution facilities, housing sites, commercial facilities, a motel and maintenance facilities. The roads, sewer, water and electric distribution facilities are complete. The motel, restaurant and grocery store have been developed and are in operation in the commercial area. Phase II will involve additional development as population growth requires.

EXPLORATION PROGRAM, GEOLOGY, AND ORE RESERVES  
OF THE SHOOTARING CANYON AREA

EXPLORATION PROGRAM

Plateau Resources has had an interest in the Shootaring Canyon area since 1976. Plateau Resources presently controls approximately 22,500 acres in the area surrounding the ore bodies. This land is held through unpatented lode mining claims and Utah State Mineral Leases.

Exploration drilling was initiated in the vicinity of outcrop mineralization during 1976. However, it was not until February, 1977 that drilling commenced in what was to become the Tony M ore trend. Since then, approximately 2,000 rotary drill holes totaling nearly 1,000,000 feet have been completed on the property. Approximately 1,024 holes were drilled in the Tony M area and 470 holes were completed in the Frank M ore trend.

In addition, 24 core holes were drilled in the Tony M area and 17 core holes were completed in the Frank M area. Core drilling provides samples of the ore which are suitable for chemical and amenability testing. These samples are also used to determine the geologic and engineering properties of the ores. Both rotary and core drilling is continuing in the Shootaring area.

Although the drilling program has been very intensive, the irregular rugged topography has an important effect on drilling patterns and has significantly influenced the very irregular grid pattern which was subsequently developed.

All drill holes are systematically logged with a radiometric probe. Additional geophysical probing performed involves self potential, resistivity, neutron and deviation surveys.

Geologic, mineralogic, and chemical studies continue in order to better define the characteristics of the Shootaring Canyon uranium ores. This work is

under the direction of the Plateau technical staff. A cooperative research program is also underway in conjunction with the U. S. Geological Survey. This study provides analytical results which are not readily available to the routine investigator.

Systematic analytical work has established the variability of uranium oxide ( $U_3O_8$ ), vanadium pentoxide ( $V_2O_5$ ), and lime (calcium oxide,  $CaO_2$ ) content in the ores.

Results of the U. S. Geological study have defined the mineralogy, trace element geochemistry and geophysical properties of the ores. Results of the detailed study of core drilling have established ore guides which will be useful in future exploration work in the Henry Mountain area (Ponsler, 1979).

#### GEOLOGY

The uranium ore bodies located in the Shootaring area consist of sandstone ores which are the typical ores of the Colorado Plateau area. The ore mineralization occurs as intragranular disseminations within the fluvial sand facies of the Salt Wash member of the Jurassic Morrison Formation (Figures 7 and 8).

The most abundant uranium ore mineral identified is the uranium silicate Coffinite [ $U(SiO_4)(OH)_4$ ]. Other uranium minerals present are Uraninite ( $UO_2$ ) and Carnotite [ $K_2(UO_2)_2(VO_4)_2 \cdot 1-3H_2O$ ].

Vanadium occurs as Montroseite [ $(VFe)O(OH)$ ] and as vanadium mica.

In the Shootaring Canyon area, the Salt Wash member is 400 to 500 feet thick, and consists predominantly of sandstone. Ore occurs at two levels within the lower portion of the unit. In the Tony M area ores occur over a 30 foot zone located directly above the base of the Salt Wash member. Ores in the Frank M area occur between 60 and 100 feet above the base of the member (Figure 9).

Structural geology in the vicinity of the ore bodies is characterized by a gentle northwesterly dip of between 2 and 5 degrees (Figure 10). No faults or

other structural irregularities are known to occur in the immediate vicinity of the ore bodies (Cook, 1979).

#### ORE RESERVES OF THE SHOOTARING CANYON AREA

The ore reserve is an estimate of the grade and tonnage of a mineral deposit. It is based on sound engineering data and reliable determinations of the concentration of the economic commodity involved. Plateau's extensive drilling and radiometric probing program provides the basis for the estimate of uranium ore reserves at Shootaring Canyon.

Uranium is the only commodity which occurs in economic concentration in the Shootaring ores. Although vanadium mineralization is also present its level of abundance is below the threshold which would justify economic recovery.

The ore reserve estimate for the Tony M and Frank M mines has been made utilizing geostatistical techniques. The geostatistical analysis was prepared for Plateau by Geostat Systems Incorporated of Lakewood, Colorado. Geostat Systems Incorporated is a subsidiary of the Mineral Exploration Research Institute based at McGill University, Montreal, Canada. Geostat specializes in preparing geostatistical ore reserve studies.

The ore reserve estimates for the Tony M and Frank M mines are given below:

#### Geostatistical Ore Reserve Estimate For Shootaring Canyon

<u>Tony M mine</u>	<u>Frank M mine</u>	<u>Total</u>
3.734 million tons	1.494 million tons	5.228 million tons
10.237 million lbs.	3.485 million lbs.	13.722 million lbs.
average grade =	average grade =	average grade =
.137% U <sub>3</sub> O <sub>8</sub>	.117% U <sub>3</sub> O <sub>8</sub>	.131% U <sub>3</sub> O <sub>8</sub>

These results represent a diluted mining grade with a minimum cut off of 4.0 feet of .07% U<sub>3</sub>O<sub>8</sub> (i.e. Grade x Thickness  $\geq$  .28 feet %). A geologic estimate which does not include dilution was also prepared for the Tony M Mine.

This estimate gives 2.79 million tons of ore containing 10.37 million pounds of  $U_3O_8$  at an average grade of 0.186%  $U_3O_8$ . Therefore the diluted estimate includes 34% of dilution as compared to the non-diluted estimate.

The resultant ore reserve estimates are thought to accurately and precisely define the reserves of the major ore bodies. The techniques employed provide both definition of the most probable tonnage and grade, and also give some measure of the amount by which the actual tonnage and grade may vary from this estimate.

The ore reserve estimates of the Tony M and Frank M ore bodies are based upon both statistical analysis and statistical treatment, of drill hole data. The statistical analysis is first performed in order to define the continuity and structure of the ore deposit. This relationship is determined with the aid of the "semivariogram." The semivariogram is used to determine how ore grade and thickness vary between systematic sets of drill holes. From the variogram, it is possible to estimate the distance over which ore continuity may be expected. It is also possible to define the relative variability associated with any given distance of separation.

Once the spatial variability of the ore body is defined with the aid of the semivariogram one may also determine a set of weight coefficients, for any given block and data configuration, which minimizes the evaluation variance. This procedure, known as kriging, yields the best linear unbiased estimation. Kriging provides an estimate of the weighted average grade and thickness of the ore, within a preselected area. In Plateau's case the ore grade and thickness is defined for a series of blocks, each of which is 100 feet square.

For the Tony M ore reserve, the weighted average for each block includes all drill holes located within 200 feet of the center of the block. For the Frank M

ore reserve, each block includes all drill holes included within an ellipse which is centered on the block. The ellipse has a short axis 150 feet long lying along a north-south direction and a long axis of 200 feet, lying along an east-west direction.

Detailed work continues in Plateau's Mining Department in order to refine and update the reserve estimates.

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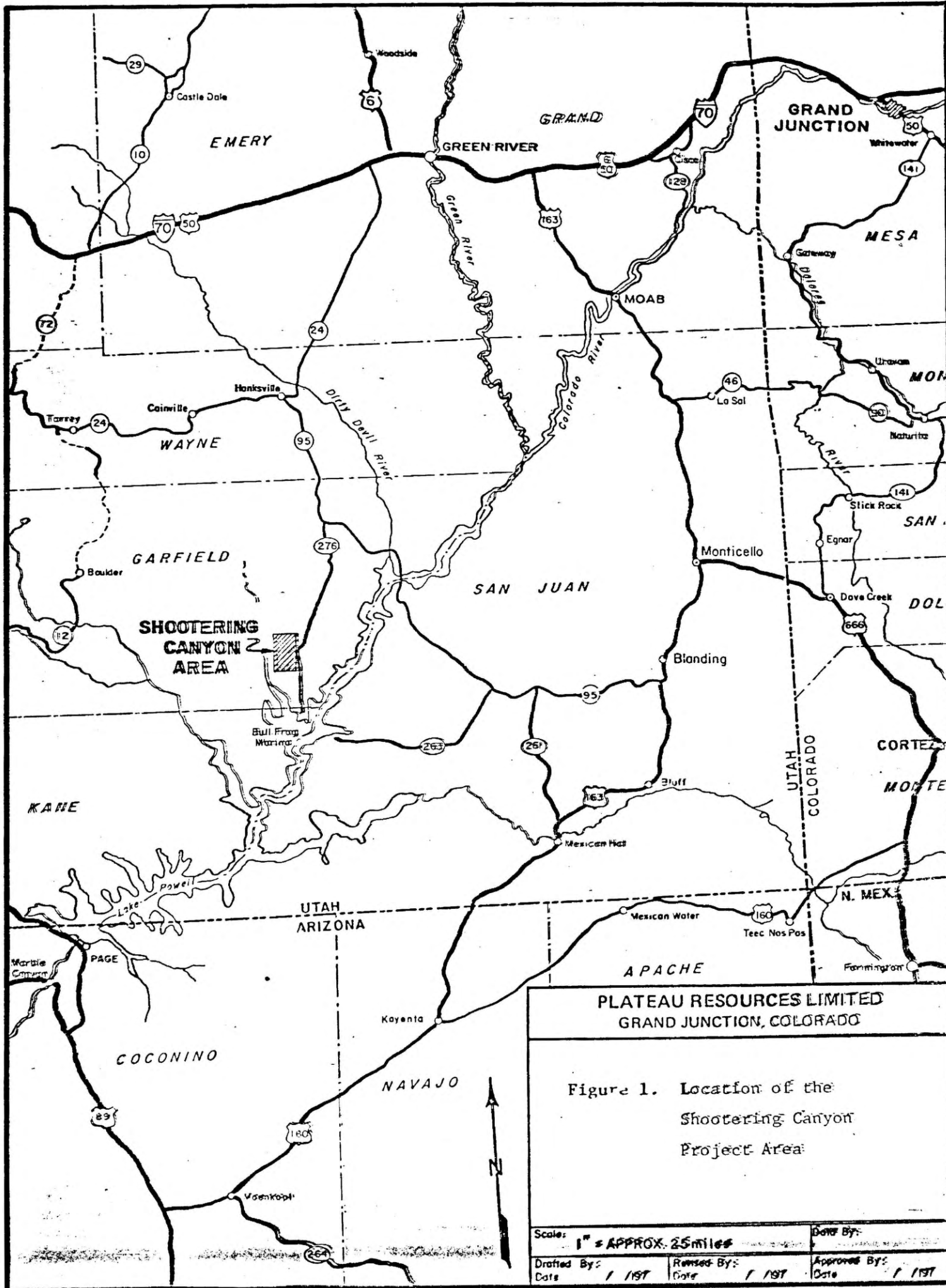
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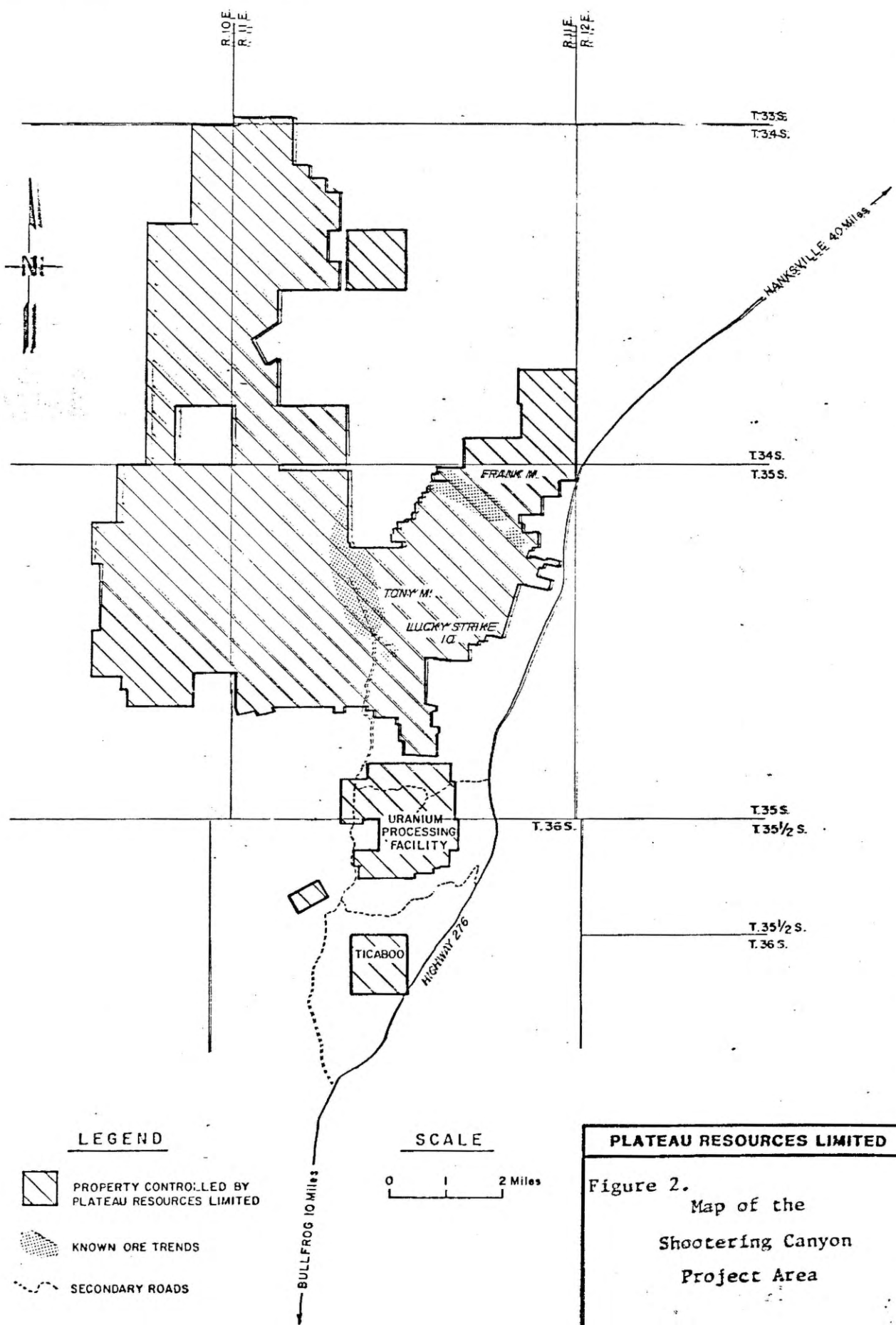
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<b>PLATEAU RESOURCES LIMITED</b>	
Figure 2. Map of the Shooting Canyon Project Area	
Scale: AS SHOWN	Drafted by: B. Berglund Date: 3/12/1980
Checked by: Date: / / 19	Approved by: Date: / / 19

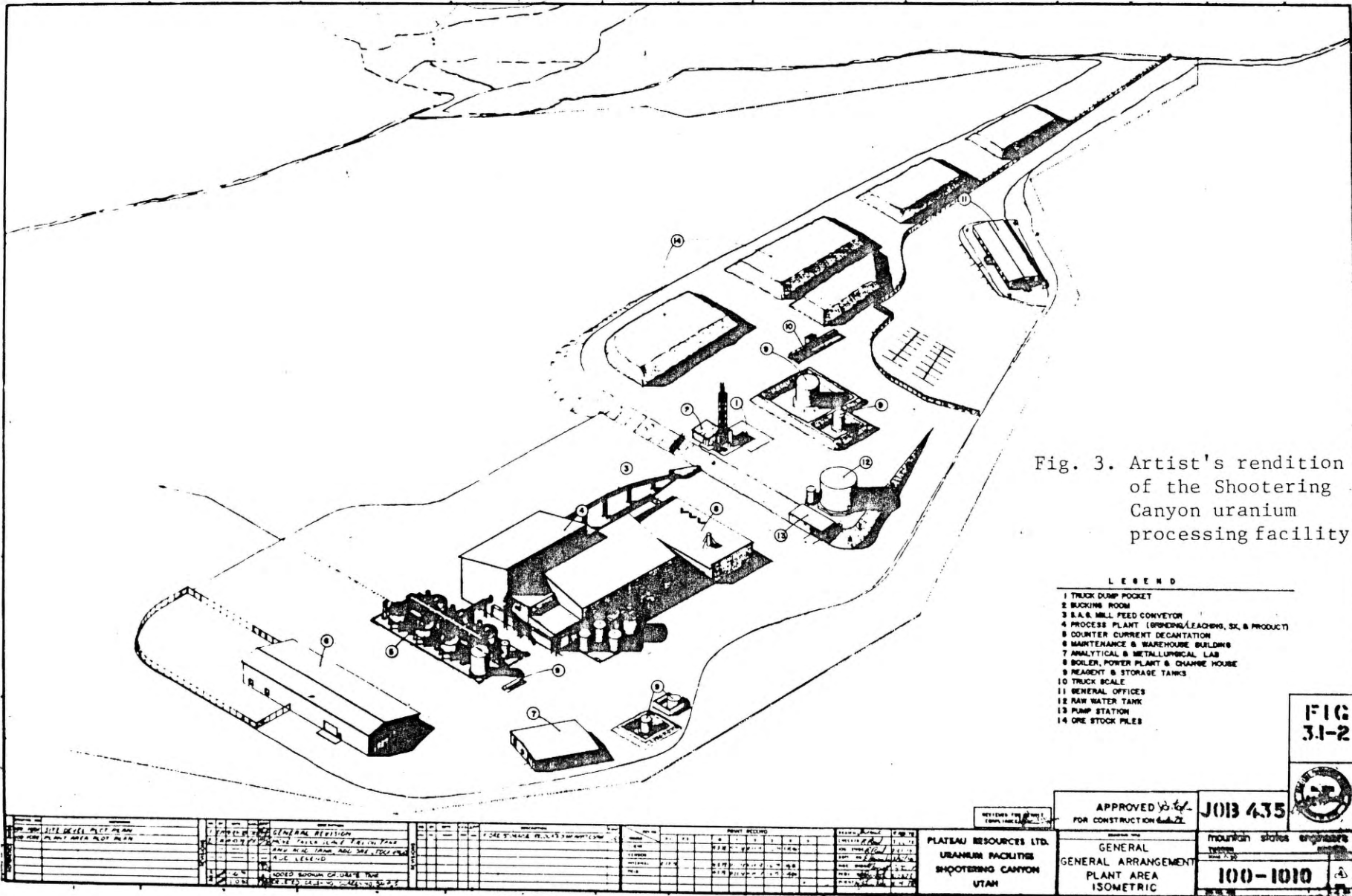


Fig. 3. Artist's rendition of the Shooting Canyon uranium processing facility

LEGEND

- 1 TRUCK DUMP POCKET
- 2 BUCKING ROOM
- 3 S.A.S. MILL FEED CONVEYOR
- 4 PROCESS PLANT (GRINDING/LEACHING, SX & PRODUCT)
- 5 COUNTER CURRENT DECONTAMINATION
- 6 MAINTENANCE & WAREHOUSE BUILDING
- 7 ANALYTICAL & METALLURGICAL LAB
- 8 BOILER, POWER PLANT & CHANGING HOUSE
- 9 REAGENT & STORAGE TANKS
- 10 TRUCK SCALE
- 11 GENERAL OFFICES
- 12 RAW WATER TANK
- 13 PUMP STATION
- 14 ORE STOCK PILES

FIG 3.1-2



APPROVED *ys* FOR CONSTRUCTION *ms*

J013 435

PLATEAU RESOURCES LTD.  
URANIUM FACILITIES  
SHOOTING CANYON  
UTAH

GENERAL ARRANGEMENT  
PLANT AREA  
ISOMETRIC

mountain states engineers  
100-1010

NO.	DATE	REVISION	BY	CHECKED	APPROVED
1		GENERAL REVISION			
2		ADD TANKS AND TUBES TO PROCESS PLANT AND REAGENT & STORAGE TANKS			
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**PROJECTED MINE PROGRESS**

- 1978
- 1979-1980
- 1981-1983

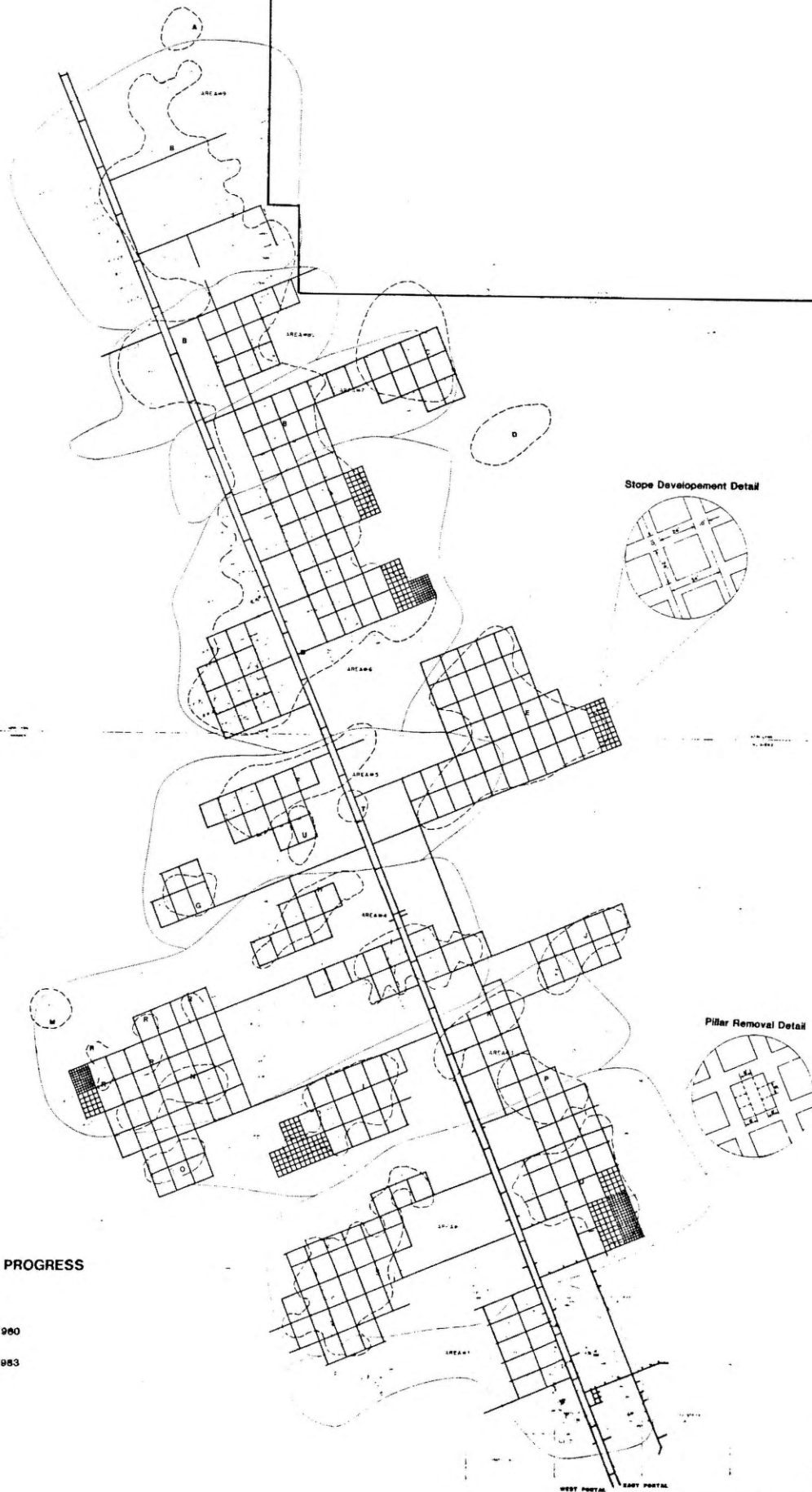
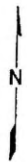


Figure 4

PLATEAU RESOURCES LIMITED  
 BARRON BRANCH, QUEENSLAND

**TONY M. MINE PLAN**  
 1978 THROUGH 1983

— 1978  
 — 1979-1980  
 — 1981-1983

EXXON

RILE



PROJECTED MINE PROGRESS

Stope Development Detail

Pillar Removal Detail

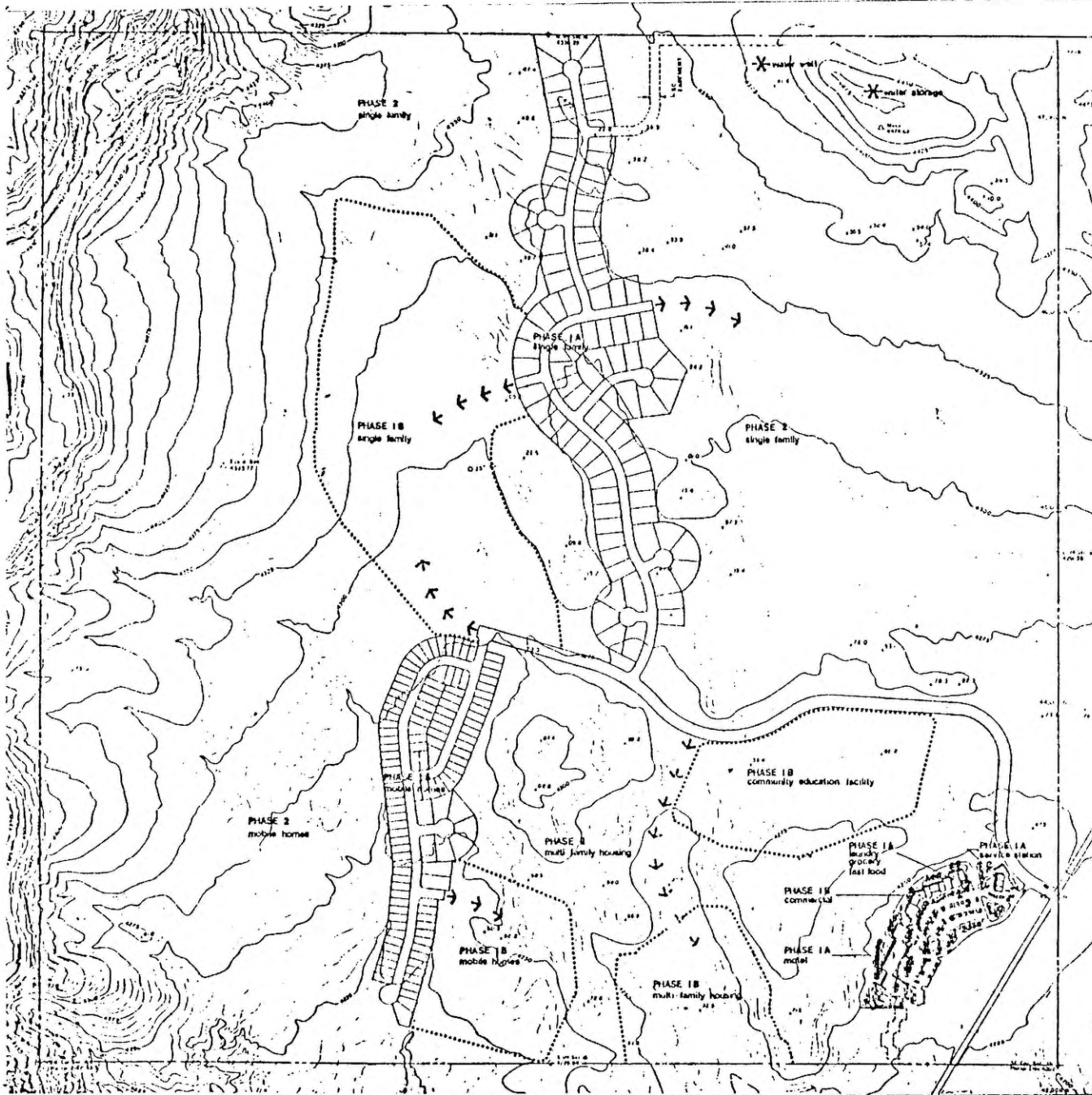
Figure 5

PLATEAU RESOURCES LIMITED  
GRAND JUNCTION, COLORADO

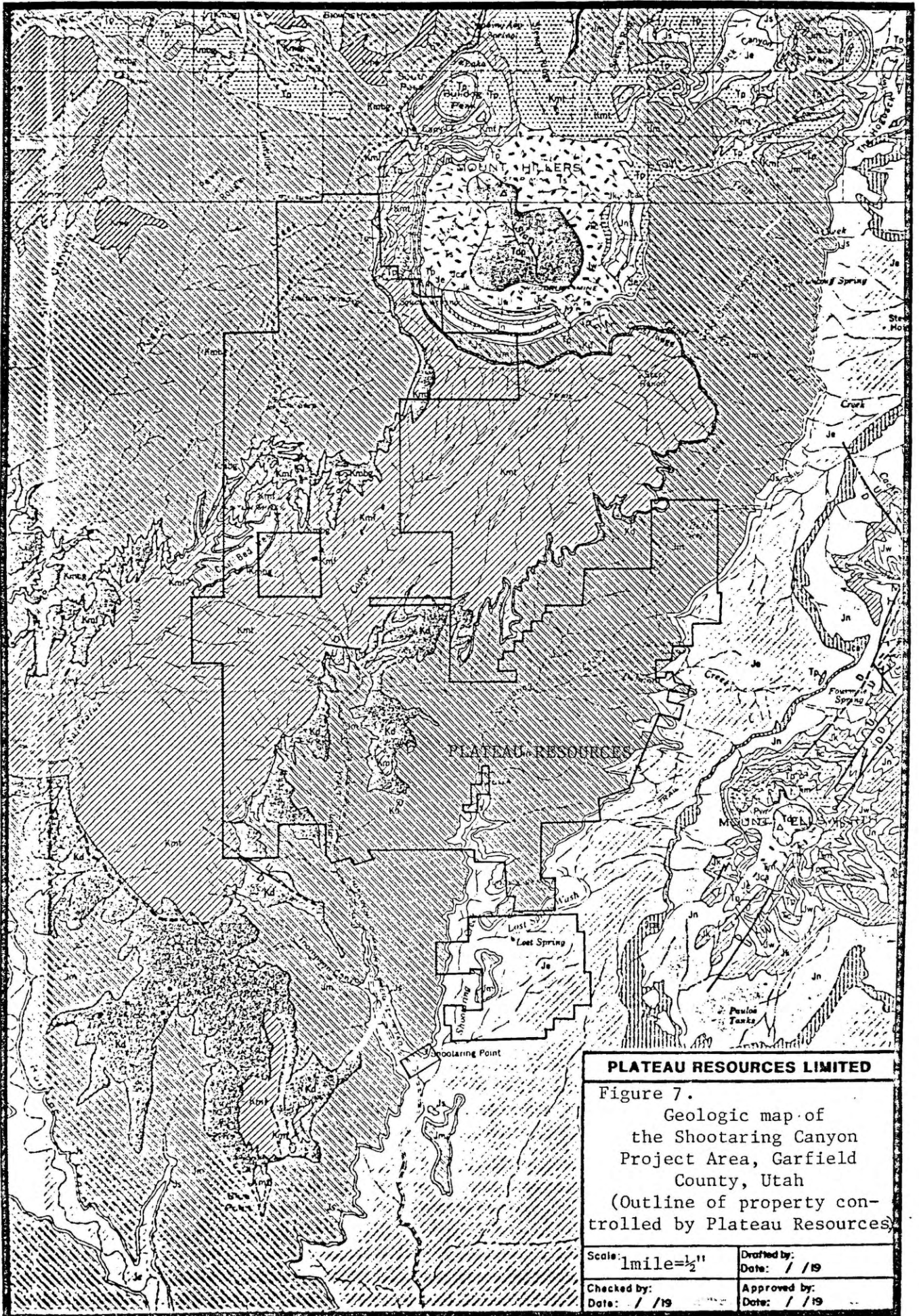
**FRANK M. MINE PLAN**

1" = 200'  
SCALE: 1" = 200'

DATE	BY



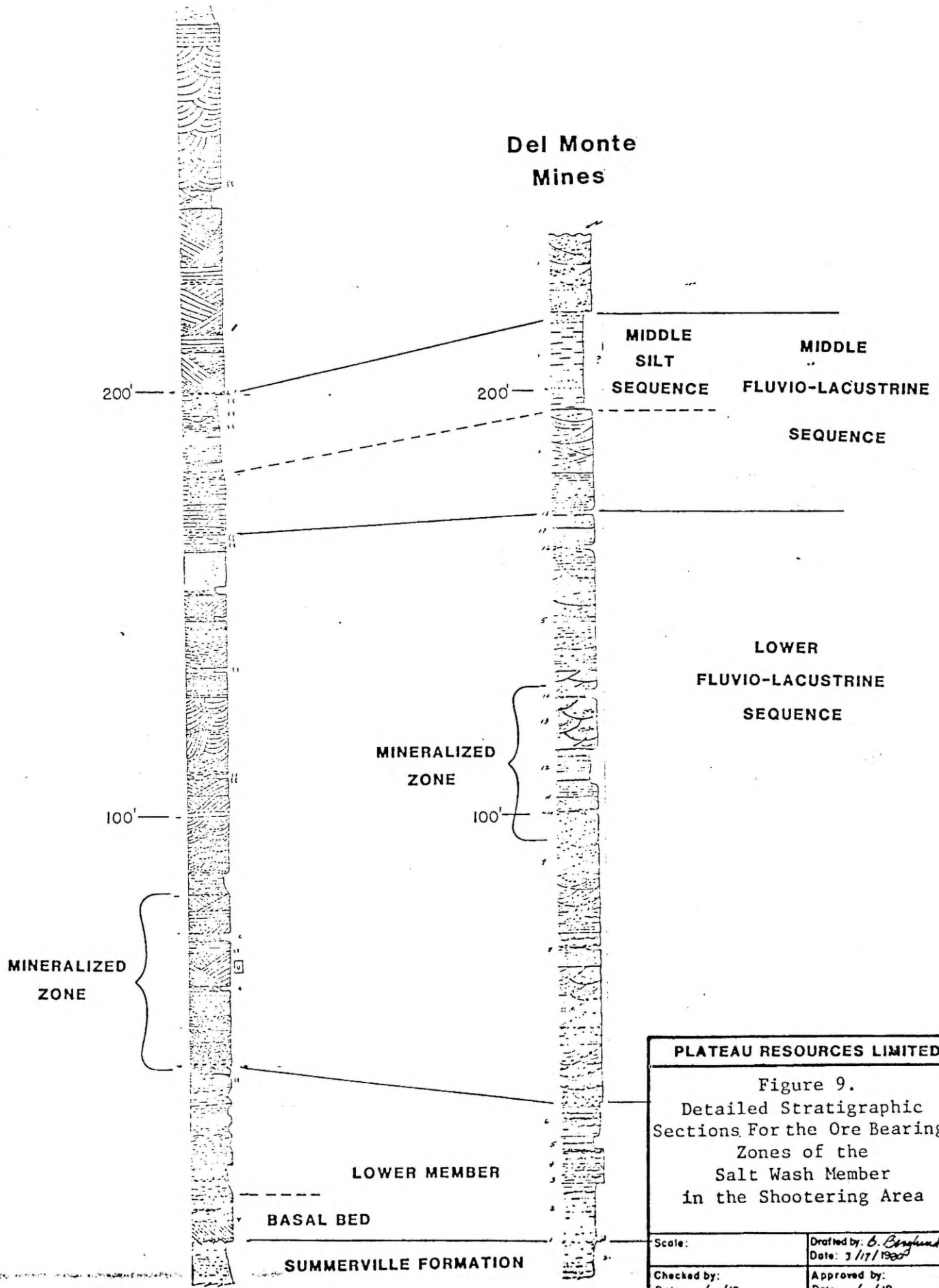
<b>PLATEAU RESOURCES LIMITED</b>	
Map of Ticaboo Townsite	
Figure 6	
Scale: 1" = 800'	Drafted by: Date: / / 19
Checked by: Date: / / 19	Approved by: Date: / / 19



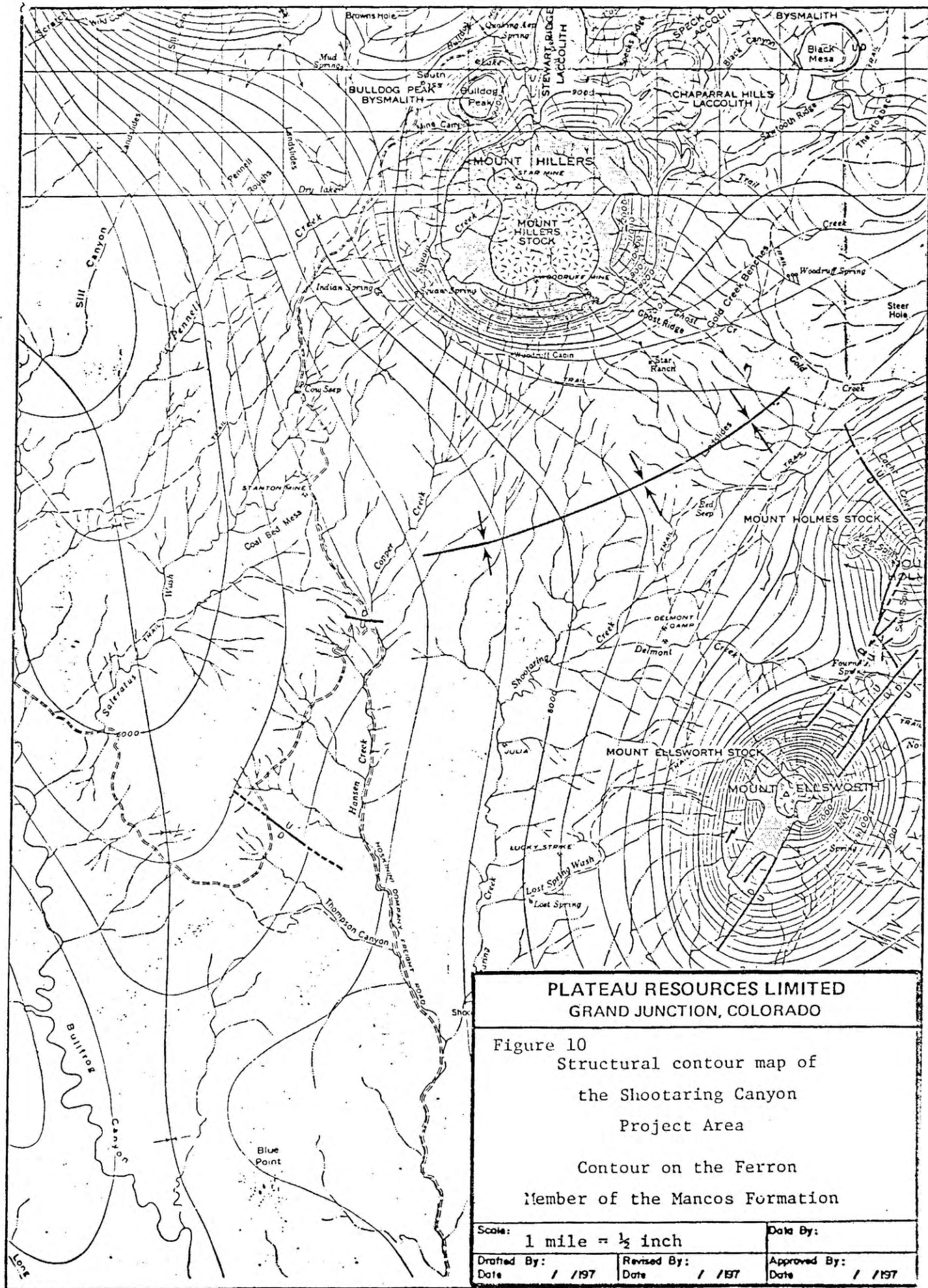


# Shooting Canyon

# Del Monte Mines



<b>PLATEAU RESOURCES LIMITED</b>	
<p>Figure 9. Detailed Stratigraphic Sections For the Ore Bearing Zones of the Salt Wash Member in the Shooting Area</p>	
Scale:	Drafted by: <i>B. Bradford</i> Date: 3/17/1900
Checked by: Date: / /19	Approved by: Date: / /19



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SHOOTARING CANYON PROJECT  
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REVISED

APRIL 19, 1982

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    Uranium Processing Facility

    Mine Development at Shootaring

        Tony M Mine

Development of Ticaboo Townsite

    Background

    Ticaboo Townsite Joint Venture

Exploration Program, Geology and Ore Reserves  
of the Shootaring Canyon Area

    Exploration Program

    Geology

    Ore Reserves

        Discussion

References

Figure 1. Location of the Project Area

2. Map of the Shootaring Canyon Project Area
3. Artist's Rendition of the Shootaring Canyon Uranium Processing Facility
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5. Map of Ticaboo Townsite
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SUMMARY OF THE SHOOTARING CANYON  
PROJECT OF PLATEAU RESOURCES

ABSTRACT

The Shootaring Canyon Project will mill uranium ores produced from a company owned mine located in the Henry Mountains of southeastern Utah. The ores to be mined are located on lands owned by, or leased to Plateau Resources Limited. Nearly 2,000 rotary drill holes, totaling almost 1,000,000 feet, were drilled to evaluate the properties. The host for the uranium ores is the fluvial sandstone of the Salt Wash member of the Jurassic Morrison Formation.

The ores will be produced from the Tony M Mine which is located on the property. Ores produced from the Tony M are scheduled to be processed at a rate which will provide a minimum project life of 15 years.

In addition to the Tony M ore body the company has discovered significant additional mineralization in the Shootaring area. The mineralized areas include the Frank M, the Northern Extension of the Tony M and the Lucky Strike 10 prospects.

Additional work is underway to evaluate the economic feasibility of mining these prospects. Ores extracted from these areas could be processed at the Shootaring Processing Facility should market conditions justify their being mined.

Mined ores will be processed in a facility using the conventional acid leach solvent extraction process. Design capacity of the plant is 750 tons per day although it is anticipated that the ultimate operating capacity of the plant can be increased to 1,000 tons per day without any modification. It is located on a 270 acre site situated about 3 miles from the planned mine. The facility was designed and constructed by Mountain States Mineral Enterprises Inc. Construction of the facility was estimated to be 99.6% complete as of July 1, 1981 and milling operations are expected to begin during the second quarter of 1982.

The environmental report for the mill site was prepared by Woodward-Clyde Consultants and the Final Environmental Statement was published by the U. S. Nuclear Regulatory Commission on August 11, 1979. The Source Material License was issued on September 21, 1979 and construction of the facility was started immediately.

Because of the relatively remote location of the project area, Plateau through its subsidiary Canyon Homesteads, Inc. has developed a new community in order to provide living facilities for the personnel located at the mine and mill complex. The community, known as Ticaboo, is located three miles south of the millsite.

## INTRODUCTION

The thick Salt Wash sands of the Henry Mountains, Utah have been the source of small amounts of uranium and vanadium ores ever since 1913. However, even though high grade ores occur locally in outcrops, exploration programs performed by at least four mining companies were unsuccessful in discovering significant ore bodies.

In June 1976, Plateau Resources Limited was established as a wholly owned subsidiary of Consumers Power Company. Plateau's responsibility is to discover and to mine and mill uranium ore in order to secure a future supply of uranium to fuel Consumer Power Company's nuclear generating plants.

As part of its program to achieve this objective, Plateau carried out an aggressive exploration drilling program in the Shootaring Canyon area of the Henry Mountains. The successful exploration program resulted in the discovery of sufficient ores to justify the development of a uranium mine and mill complex. A project was initiated during 1977 in order to develop the complex.

The purpose of this report is to summarize the progress and current status of the Shootaring Canyon Project of Plateau Resources Limited.

## LOCATION AND ACCESS

The project area is located 175 miles southwesterly from Grand Junction, Colorado on the south flank of the Henry Mountains in Garfield County, Utah (Figure 1). The area is located on the west side of Utah State Highway 276. It lies approximately 50 miles directly south of Hanksville, Utah, and 10 to 15 miles north of Bullfrog Marina, located on Lake Powell. A paved airstrip suitable for small twin-engined aircraft is situated just north of Bullfrog Marina.

The ore body and mineralized trends lie within the northern half of T35S, R11E, S.L.M. The 270 acre millsite is located in Sec. 33 and 34, T35S, R11E, and Sec. 3 and 4, T36S, R11E (Figure 2). The Ticaboo Townsite occupies Sec. 16, T36S, R11E.

## TOPOGRAPHY AND CLIMATE

The project site is located within an area of canyonlands terrain at an elevation of approximately 4500 feet. Topographically, the area consists of a rugged irregular upland surface incised by canyons with vertical walls. Relief of several hundred feet is common and local elevation contrasts of up to 500 feet occur.

The climate is distinctly arid with an average annual precipitation of 7 inches. Vegetation is characterized as desert shrub and is dominated by the blackbrush/Mormon tea associations.

### MINE AND MILL COMPLEX; U. S. NUCLEAR REGULATORY COMMISSION LICENSING

Once significant uranium ore reserves were discovered at Shootaring Canyon a major program was initiated to plan and develop the necessary facilities to mine and process the ores. The Tony M mine has been under development since September 1, 1977.

Mountain States Mineral Enterprises of Tucson, Arizona was retained to design and construct the uranium processing facility.

Concurrent with mine and mill development, environmental work and site selection were initiated in order to license the processing plant with the U. S. Nuclear Regulatory Commission (NRC). Start-up and testing of the Processing Facility commenced on April 13, 1982.

### MILL LICENSING BY THE NRC

In order to construct and operate a uranium recovery facility, the plant must be licensed by the NRC. An extensive site selection study was performed by Woodward-Clyde Consultants, in order to select a plant site which meets the requirements of the NRC. The site was selected and a complete environmental

report was then prepared for the site (Woodward-Clyde Consultants, May 1978). The report and license application was subsequently submitted to the NRC.

The Final Environmental Statement was published on August 11, 1979. The U.S. Nuclear Regulatory Commission Materials License SUA-1371 was issued on September 21, 1979. Construction of the processing facility was commenced on that date.

#### URANIUM PROCESSING FACILITY

The Shootaring Canyon uranium processing facility will treat uranium ores utilizing a conventional process circuit which includes grinding, acid-leach, solvent extraction and precipitation of yellow cake within the flowsheet of operations. The facility occupies 114 acres of Plateau's 270 acre plant site which is located 3 miles southerly from the Tony M mine portals (Figure 2). The final process flowsheet is based on the metallurgical test data developed by Hazen Research, Inc. of Golden, Colorado and then confirmed by Mountain States Mineral Enterprises, the architect engineer and constructor of the processing facility. The construction phase started during the fourth quarter of 1979 and was about 99.6% complete when construction was suspended on March 1, 1981. Start-up and testing of the Processing Facility commenced on April 13, 1982. Design capacity of the plant is 750 tons per day although it is anticipated that ultimate operating capacity of the plant will be increased to 1000 tons per day without any modifications. This capacity can be increased to 1250 tons per day with minor equipment additions and at an added cost of approximately one half million dollars.

The detailed plan of operation for the processing operation is given in the Five Year Plan for Shootaring Canyon Processing Facility 1982 through 1986 (Heiks, et. al., 1981) which will be revised and updated annually. The purpose

of the five year plan is to establish the production objectives of the Facility and to define the capital, operating and human resource requirements necessary to meet the established objectives.

A brief outline of the operation of the facility will be given here.

The uranium recovery techniques involve proven processes which are presently being used by the uranium industry. The primary mill circuit involves breaking down the sandstone ore into its individual sand grains in a semi-autogenous grinding mill, and then dissolving the uranium from the grain surfaces using a sulfuric acid solution. The uranium rich acid solution is separated from the leached sands in a six stage counter-current decantation process. The leached sands are discarded as tailings in a large, below grade, open impoundment with a clay sealed bottom.

The uranium is transferred from the aqueous acid phase to an organic phase by means of a solvent extraction process. The uranium is removed from the organic phase by ammonium sulfate and is then precipitated by the injection of ammonia gas. The final precipitate, commonly called "yellow-cake", is washed, dried and packed into 55 gallon drums. The finished product is then shipped to a uranium hexafluoride conversion plant.

The processing facility consists of several buildings and an array of tanks of various sizes. Facilities have been designed and arranged to present a well integrated compact appearance (see Figure 3 for an artist's rendition of the plant). The larger buildings contain:

- \* Grinding and leaching equipment
- \* Solvent extraction equipment
- \* Yellowcake precipitation and drying equipment
- \* Offices
- \* Warehouse and maintenance shop
- \* Laboratory

The six counter-current decantation thickener tanks used to separate the leached sand from the acidic uranium solution are located outdoors. A slurry pipeline will transport tailings from the mill to the tailings impoundment, about 500 feet to the northeast, for permanent disposal. This impoundment has been stripped of topsoil and lined with locally obtained clay material to prevent seepage. A dam has been constructed to contain the discharged tailings. The slurry will be pumped into the impoundment and deposited through spigots. A unique underdrainage system to drain the tailings liquid from the slurry has been provided which will decrease the hydraulic head on the clay liner thus reducing the probability of underground seepage. By the time mine and mill operations are completed, the dam will have reached a height of about 100 feet, and the impoundment will cover approximately 2600 acre feet. At the termination of mill operations, the impoundment will be covered with earth fill. This will prevent the tailings and other trapped waste materials from contaminating the surrounding area.

The total operating work force for the processing facility is expected to reach approximately 50 people when the project is on-stream.

#### MINE DEVELOPMENT AT SHOOTARING CANYON

The current mine plan calls for the development of a total of approximately 28 miles or 147,840 feet of underground workings by mid 1984 when the principal mine development is complete. This includes the completion of two 12,000 foot long main haulage ways as well as all laterals and crosscuts.

Since September 1, 1977 when the development of the Tony M Mine was initiated more than 13 miles or 68,640 feet of development drifts or workings have been completed. The main haulage ways have been developed to approximately 7,700 feet as of April 16, 1982. Development of several production stoping areas is complete.

The detailed plan of operation is given in the Tony M Mine Five Year Plan 1982 thru 1986 (Heiks, et. al., June 1981) which is revised and updated on an annual basis. The purpose of the plan is to establish the production objectives of the Tony M Mine and to define the capital, operating and human resource requirements necessary to meet the established objectives. A brief outline of the mine operation will be given here.

## TONY M MINE DEVELOPMENT

### General Mine Plan and Operation

The ores of the Tony M Mine occur as a series of individual ore bodies within the lowermost 30 feet of the nearly flat lying Salt Wash sandstone.

In plan view the ore zone is irregular in outline but measures approximately 12,000 feet along a North 20° West trend. The zone has its widest extent in the central area where it is some 3500 to 4000 feet wide. The zone becomes narrower toward each end of the ore trend.

The Tony M mine is being developed by a double entry system of two parallel declines spaced fifty feet apart (see Figure 4). The portals of the two 8 feet high by 12 feet wide main haulageways are located on the northwesterly side of Shootaring Canyon. The declines are being driven down a minus three percent grade (i.e., 3 feet/100 feet) along a trend of North 22° West. This orientation generally coincides with the long axis of the ore trend. The three percent grade was selected as it places the main haulageways either within, or a few feet below, the ore bearing horizon of the Tony M orebody.

Access to the individual ore bodies is through laterals which are being developed at right angles to the main haulage ways. The seven foot high by twelve foot wide laterals are used as entries to known ore bodies which generally lie within 1500 feet along each side of the main haulage ways.

In addition to providing access, the laterals are used to explore and make detailed evaluation of each ore bearing zone through which they pass. The laterals provide access for geologic mapping, long hole drilling, rib scanning and collecting samples. The detailed information provided by the work forms the basis for detailed mine planning and stope development.

The ore will be mined using a modified room and pillar system which is being developed in conjunction with the main lateral development. The technique is designed to follow the irregular configuration of the individual ore bodies and has proven to be successful in the hundreds of uranium mines located in the Colorado Plateau.

During 1982 a study of various detailed stoping techniques is being carried out in the Tony M Mine in order to determine which techniques should be utilized once production mining commences. This study is being performed by W. T. Cohan, an independent Professional Mining Engineer.

Following drilling and blasting, by the 3 man mining crews, broken muck will be transported to the main haulageway in five and ten ton capacity rubber tired load-haul-dump (LHD) ore carriers. At the main haulage the muck will be placed in storage silos for transfer to a conveyor which will carry the muck to the surface. Ores will be trucked to the processing facility from the storage bins.

A thirty-six inch wire rope conveyor will be employed to transport ore and waste to storage bins outside of the portal of the mine. The detailed design of the conveyor system is being prepared by an independent engineering firm. Construction and installation of the system will be started in the fourth quarter of 1982.

#### Mining Conditions

Mining conditions in the Tony M ore body pose no unusual challenges. Mining depths are relatively shallow, the physical rock characteristics compare

favorably with rocks normally encountered in sandstone uranium deposits, and water encountered in mining operations is readily controlled.

The Tony M ore body lies at an average depth of 450 feet below the ground surface. Mining operations should encounter maximum depths of 750 feet below the surface in the northern end of the planned mine. Although as expected, physical rock properties within the ore bearing zone of the Salt Wash member are highly variable the rocks are generally moderately well cemented and rock strength is sufficiently great to support mine development.

Moderate amounts of ground water have been encountered during development of the Tony M Mine. However water is readily controlled, collected and pumped to the surface evaporation pond which was constructed for storage and disposal of the mine waters. Experience in the mine indicates that as a result of such practice the rock ore being dewatered and the volume of inflowing water is decreasing as the rock is allowed to drain and dry out.

## DEVELOPMENT OF TICABOO TOWNSITE

### Background

Because of the remote location of its operations, the Company is confronted with the problem of arranging housing and other accommodations for the workers at its mine and processing facility, and for support and service personnel, and their families. It is estimated that by 1982 the Company will employ approximately 250 persons in the mine, the processing facility, and general office.

The only established community within a radius of 100 miles from the site of the Company's mining and processing operations is the town of Hanksville, Utah. Hanksville has a population of approximately 200 people and is located about 50 miles north of the site of the Company's operations.

Inasmuch as the land in the vicinity of the Company's operations is virtually all federal or state owned and is marked by very rough terrain, virtually the only land in the vicinity suitable for a new community is a 640-acre tract of land, now known as the "Ticaboo Townsite", which is owned by the State of Utah.

#### TICABOO TOWNSITE JOINT VENTURE

On March 2, 1979, Plateau, through its subsidiary Canyon Homesteads, Inc., entered into a joint venture known as the "Ticaboo Townsite Joint Venture" with Ticaboo Development, Inc. for the purpose of planning and developing the community of Ticaboo.

The Joint Venture has a Deferred Development Lease from the State of Utah covering the Ticaboo Townsite which grants the exclusive right to develop a community at the Ticaboo Townsite.

As provided in the Master Plan (See Figure 6), Ticaboo will include single and multiple family dwellings, mobile home and medical facilities, a commercial area, and a community services area. The Joint Venture plans to develop Ticaboo in two phases. Phase I consists of roads, sewer, water and electric distribution facilities, housing sites, commercial facilities, a motel and maintenance facilities. The roads, sewer, water and electric distribution facilities are complete. The motel, restaurant and grocery store have been developed and are in operation in the commercial area. Phase II will involve additional development as population growth requires.

EXPLORATION PROGRAM, GEOLOGY, AND ORE RESERVES  
OF THE SHOOTARING CANYON AREA

EXPLORATION PROGRAM

Plateau Resources has had an interest in the Shootaring Canyon area since 1976. Plateau Resources presently controls approximately 27,000 acres in the area surrounding the ore bodies. This land is held through unpatented lode mining claims and Utah State Mineral Leases.

Exploration drilling was initiated in the vicinity of outcrop mineralization during 1976. However, it was not until February, 1977 that drilling commenced in what was to become the Tony M ore trend. Since then, approximately 2,000 rotary drill holes totaling nearly 1,000,000 feet have been completed on the property. Approximately 1,032 holes were drilled in the Tony M area and 643 holes have been completed in the Frank M trend.

This total includes 24 core holes drilled in the Tony M area and 17 core holes completed in the Frank M area. Core drilling provides samples of the ore which are suitable for chemical and amenability testing. These samples are also used to determine the geologic and engineering properties of the ores.

Although the drilling program has been very intensive, the very rugged topography has significantly affected where drilling sites are located. Therefore an irregular grid pattern of drill holes was subsequently developed.

All drill holes are systematically logged with a radiometric probe. Additional geophysical probing performed involves self potential, resistivity, neutron-neutron and deviation surveys. A majority of the drill holes were logged by Century Geophysical Incorporated.

Geologic, mineralogic, and chemical studies continue in order to better define the characteristics of the Shootaring Canyon uranium ores. This work is

under the direction of the Plateau technical staff. A cooperative research program is also underway in conjunction with the U. S. Geological Survey. This study provides analytical results which are not readily available to the routine investigator.

Systematic analytical work has established the variability of uranium oxide ( $U_3O_8$ ), vanadium pentoxide ( $V_2O_5$ ), and lime (calcium oxide,  $CaO_2$ ) content in the ores.

A systematic program of chemical analysis of ores encountered during developmental mining activities is in progress. Chemical and closed can radiometric analysis of the samples supplemented by analysis of surface drill cores collected from the Tony M orebody provide a definition of the effect of chemical versus radiometric equilibrium. The results of these studies are discussed in Appendix B.

Results of the U. S. Geological study have defined the mineralogy, trace element geochemistry and geophysical properties of the ores. Results of the detailed study of core drilling have established ore guides which will be useful in future exploration work in the Henry Mountain area (Ponsler, 1979).

#### GEOLOGY.

The uranium ore bodies located in the Shootaring area consist of sandstone ores which are the typical ores of the Colorado Plateau area. The ore mineralization occurs as intragranular disseminations within the fluvial sand facies of the Salt Wash member of the Jurassic Morrison Formation (Figures 7 and 8).

The most abundant uranium ore mineral identified is the uranium silicate Coffinite [ $U(SiO_4)(OH)_4$ ]. Other uranium minerals present are Uraninite ( $UO_2$ ) and Carnotite [ $K_2(UO_2)_2(VO_4)_2 \cdot 1-3H_2O$ ]. Additional work continues in order to better define the uranium mineralogy. A significant portion of the uranium appears to occur as a very fine grained phase which is not readily identified without the aid of x-ray techniques.

Vanadium occurs as Montroseite  $[(VFe)O(OH)]$  and as vanadium chlorite.

In the Shootaring Canyon area, the Salt Wash member is 400 to 500 feet thick, and consists predominantly of sandstone. Significant uranium mineralization occurs at two levels within the lower portion of the unit. In the Tony M area ores occur over a 30 foot zone located directly above the base of the Salt Wash member. Mineralization in the Frank M area occurs between 60 and 100 feet above the base of the member (Figure 9).

Structural geology in the vicinity of the uranium bodies is characterized by a gentle northwesterly dip of between 2 and 5 degrees (Figure 10). No faults or other structural irregularities are known to occur in the immediate vicinity of the ore bodies (Cook, 1979).

#### MINERAL RESERVES OF THE SHOOTARING CANYON AREA

The mineral reserve is an estimate of the grade and tonnage of a mineral deposit. It is based on sound engineering data and reliable determinations of the concentration of the economic commodity involved. Plateau's extensive drilling and radiometric probing program, supplemented by chemical analysis of ore samples, provides the basis for the estimate of uranium ore reserves at Shootaring Canyon.

Uranium is the only commodity which occurs in economic concentration in the Shootaring ores. Although vanadium mineralization is also present its level of abundance is below the threshold which would justify economic recovery.

The reserve estimates for the Tony M ore body and for the Frank M and the Northern Extension prospects have been made utilizing geostatistical techniques. The geostatistical analyses were prepared for Plateau by Geostat Systems Incorporated of Lakewood, Colorado. Geostat Systems Incorporated specializes in preparing geostatistical ore reserve studies. Geostat is a subsidiary of the Mineral Exploration Research Institute based at McGill University, Montreal, Canada.

## APPENDIX 1

### FRANK M OREBODY SHOOTARING CANYON GARFIELD COUNTY, UTAH

The Frank M orebody is one of two major ore bodies which Plateau Resources Limited has discovered in the Henry Mountains area of southeastern Utah. The Plateau exploration program commenced during 1976 and the ongoing exploration program in the Shootaring Canyon area resulted in the discovery of what was to become the Frank M orebody during mid-1977.

The Frank M orebody is located in Section 2 and 3 of Township 35 South, Range 11 East S.L.M. Plateau Resources Limited controls the mineral rights through unpatented lode mining claims and a Utah State Mineral Lease.

The host for the uranium ore is the fluvial sandstone of the Salt Wash member of the Jurassic Morrison Formation.

The mineralized zone occurs between 60 and 100 feet above the base of the Salt Wash member. The zone dips between 3 and 5 degrees to the northwest which is generally conformable to the inclination of the sandstone beds which host the ore zone.

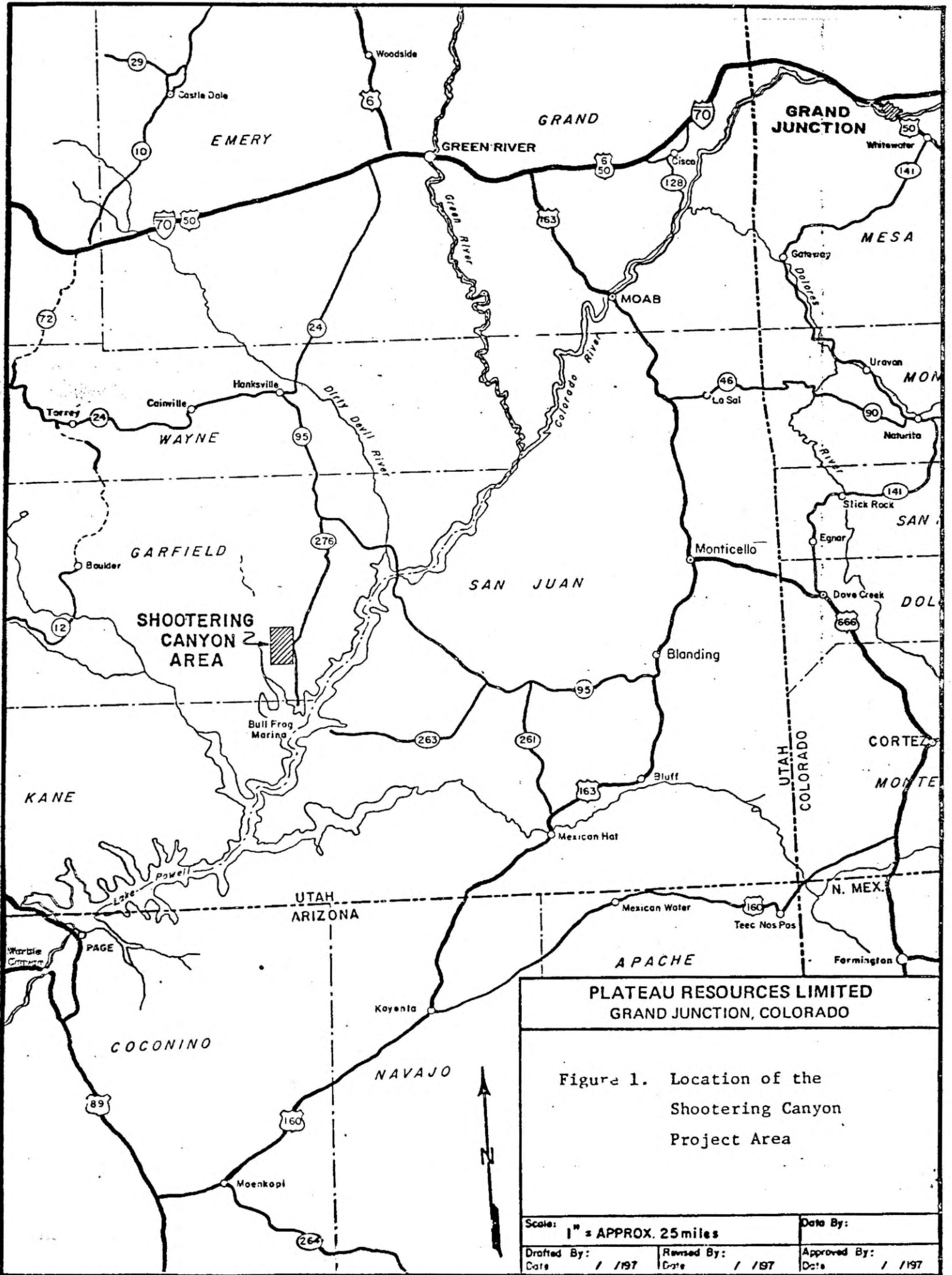
The mineralized zone is oriented along a North 60° West trend. The zone is approximately 7,000 feet long and is commonly between 1500 feet and 2000 feet wide.

The ore zone is located at a depth of 200 feet below ground surface in the east and 500 plus feet below the surface to the west. The average drilling depth in the area is approximately 400 feet.

The uranium ore reserve estimates for the Frank M orebody is a geostatistical estimate based on 507 drill holes. The ore reserve at three different minimum cutoffs is given on the accompanying page.

The ore reserve estimate constitutes a Kriged estimate based on an array of 100 by 100 foot blocks. The computed average for each block includes all drill holes included within an ellipse which is centered on the block. The ellipse has a short axis 150 feet long oriented along a north-south direction and a long axis of 200 feet, oriented along an east west direction.

An additional 50 hole drilling program is planned for the 1982 drilling season in order to further define the ore reserves of the Frank M orebody. The ore reserves will be updated upon completion of this program.



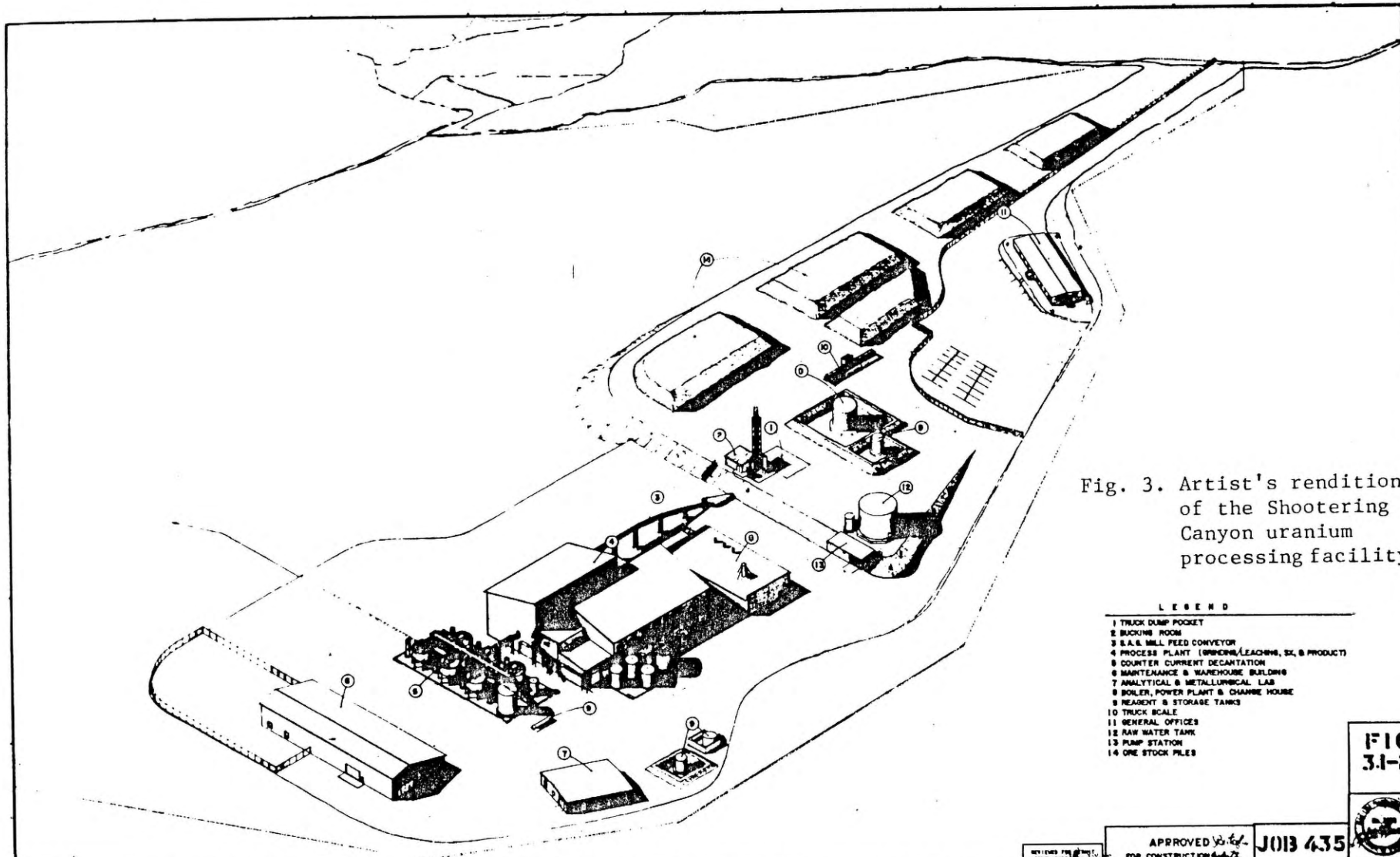


Fig. 3. Artist's rendition of the Shooting Canyon uranium processing facility

- LEGEND**
- 1 TRUCK DUMP POCKET
  - 2 BUCKING ROOM
  - 3 S.A. & MILL FEED CONVEYOR
  - 4 PROCESS PLANT (GRINDING, LEACHING, SX, & PRODUCT)
  - 5 COUNTER CURRENT DECATANTION
  - 6 MAINTENANCE & WAREHOUSE BUILDING
  - 7 ANALYTICAL & METALLURGICAL LAB
  - 8 BOILER, POWER PLANT & CHANGE HOUSE
  - 9 REAGENT & STORAGE TANKS
  - 10 TRUCK SCALE
  - 11 GENERAL OFFICES
  - 12 RAW WATER TANK
  - 13 PUMP STATION
  - 14 ORE STOCK PILES

**FIG 3.1-2**



APPROVED FOR CONSTRUCTION

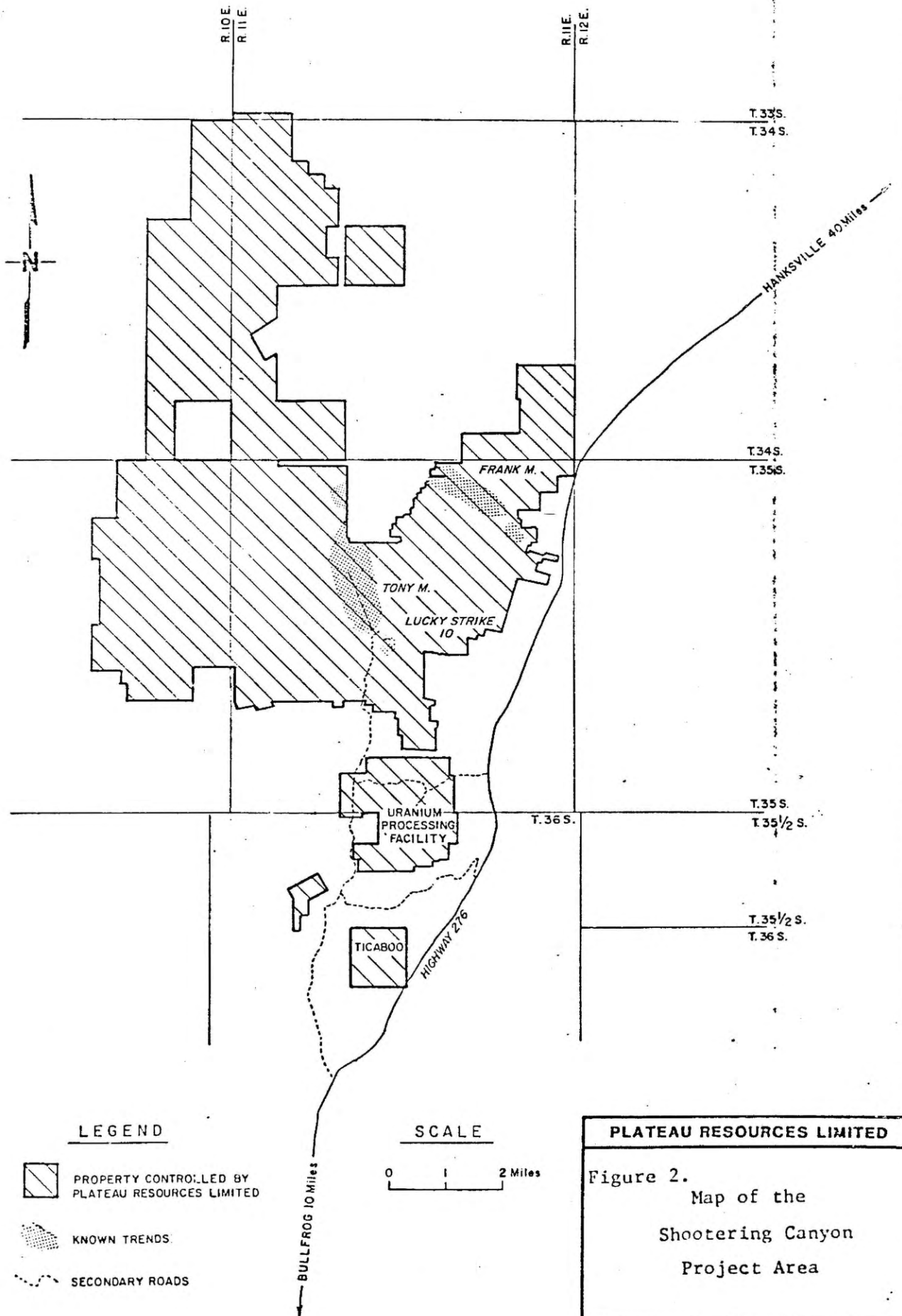
J013 435

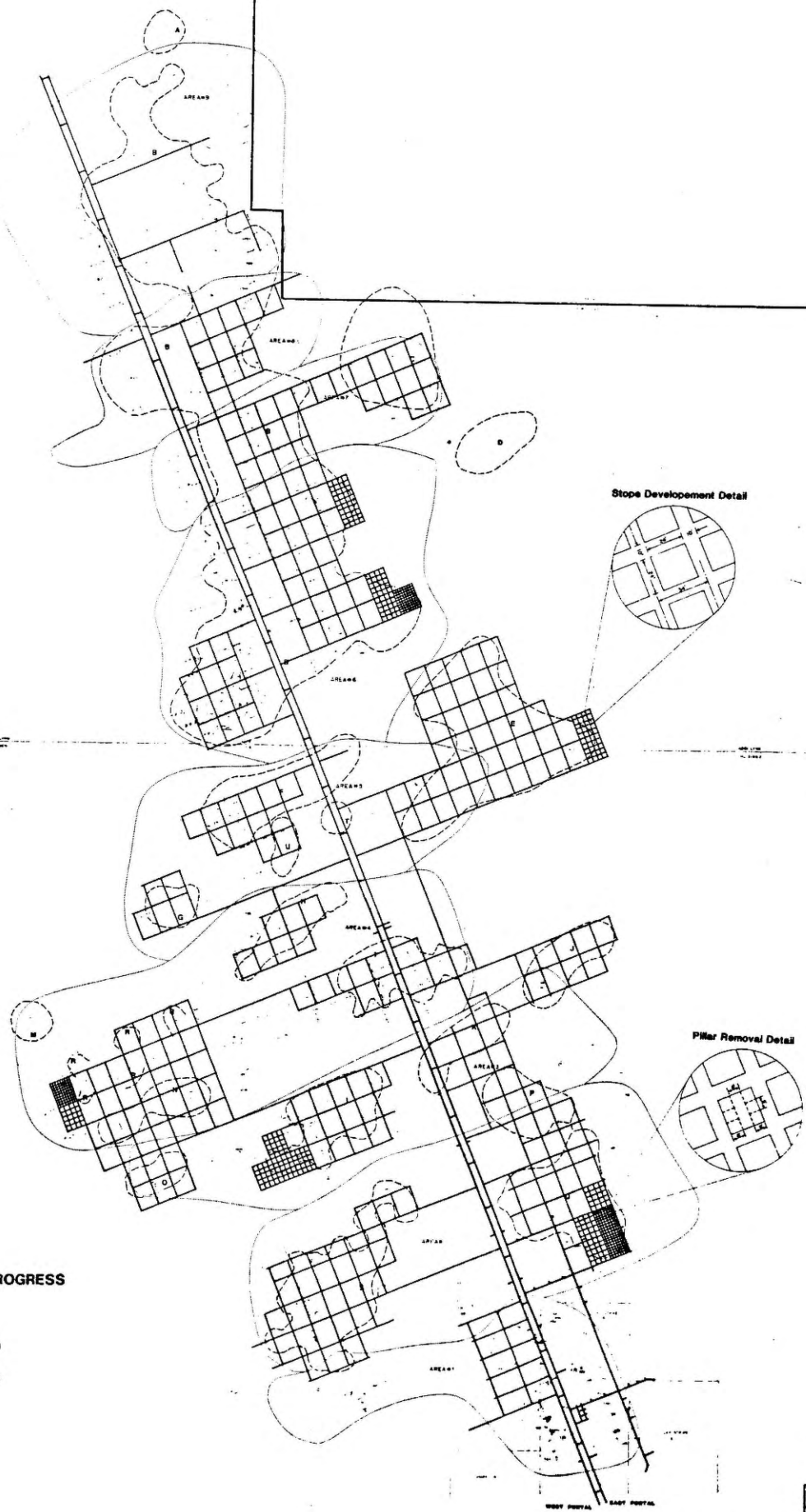
NO.	DATE	DESCRIPTION	BY	CHECKED	APPROVED
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2	11/15/54	PROCESS PLANT	J.M.S.	J.M.S.	J.M.S.
3	12/15/54	CONVEYOR SYSTEM	J.M.S.	J.M.S.	J.M.S.
4	1/15/55	WAREHOUSE	J.M.S.	J.M.S.	J.M.S.
5	2/15/55	LABORATORY	J.M.S.	J.M.S.	J.M.S.
6	3/15/55	OFFICES	J.M.S.	J.M.S.	J.M.S.
7	4/15/55	BOILER HOUSE	J.M.S.	J.M.S.	J.M.S.
8	5/15/55	WATER TANK	J.M.S.	J.M.S.	J.M.S.
9	6/15/55	PUMP STATION	J.M.S.	J.M.S.	J.M.S.
10	7/15/55	TRUCK SCALE	J.M.S.	J.M.S.	J.M.S.
11	8/15/55	STOCK PILES	J.M.S.	J.M.S.	J.M.S.
12	9/15/55	MAINTENANCE	J.M.S.	J.M.S.	J.M.S.
13	10/15/55	ANALYTICAL	J.M.S.	J.M.S.	J.M.S.
14	11/15/55	REAGENT	J.M.S.	J.M.S.	J.M.S.

PLATEAU RESOURCES LTD.  
URANIUM FACILITIES  
SHOOTING CANYON  
UTAH

GENERAL  
GENERAL ARRANGEMENT  
PLANT AREA  
ISOMETRIC

Mountain States Engineers  
100-1010



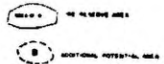


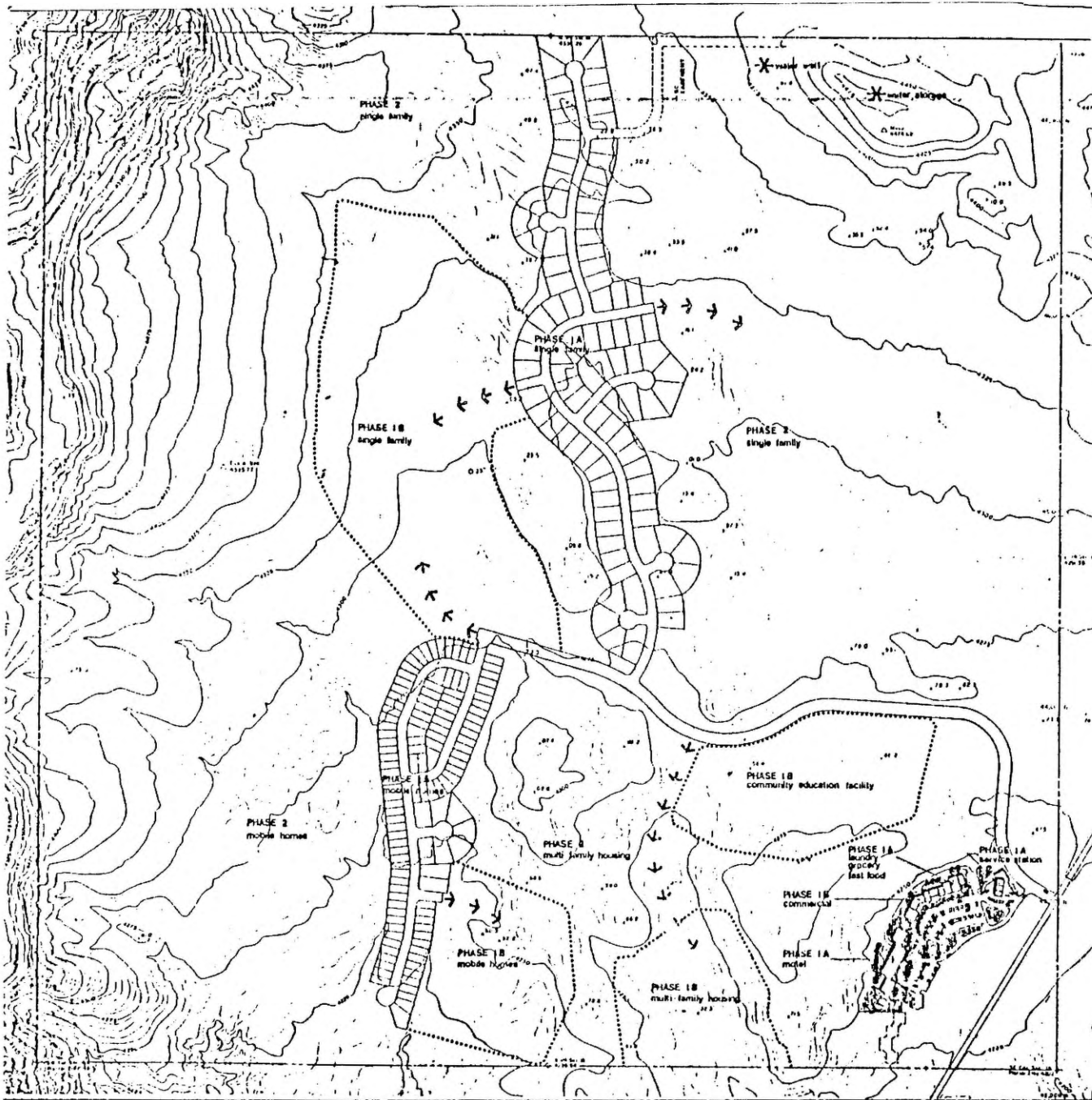
**PROJECTED MINE PROGRESS**

- 1978
- 1979-1980
- 1981-1983

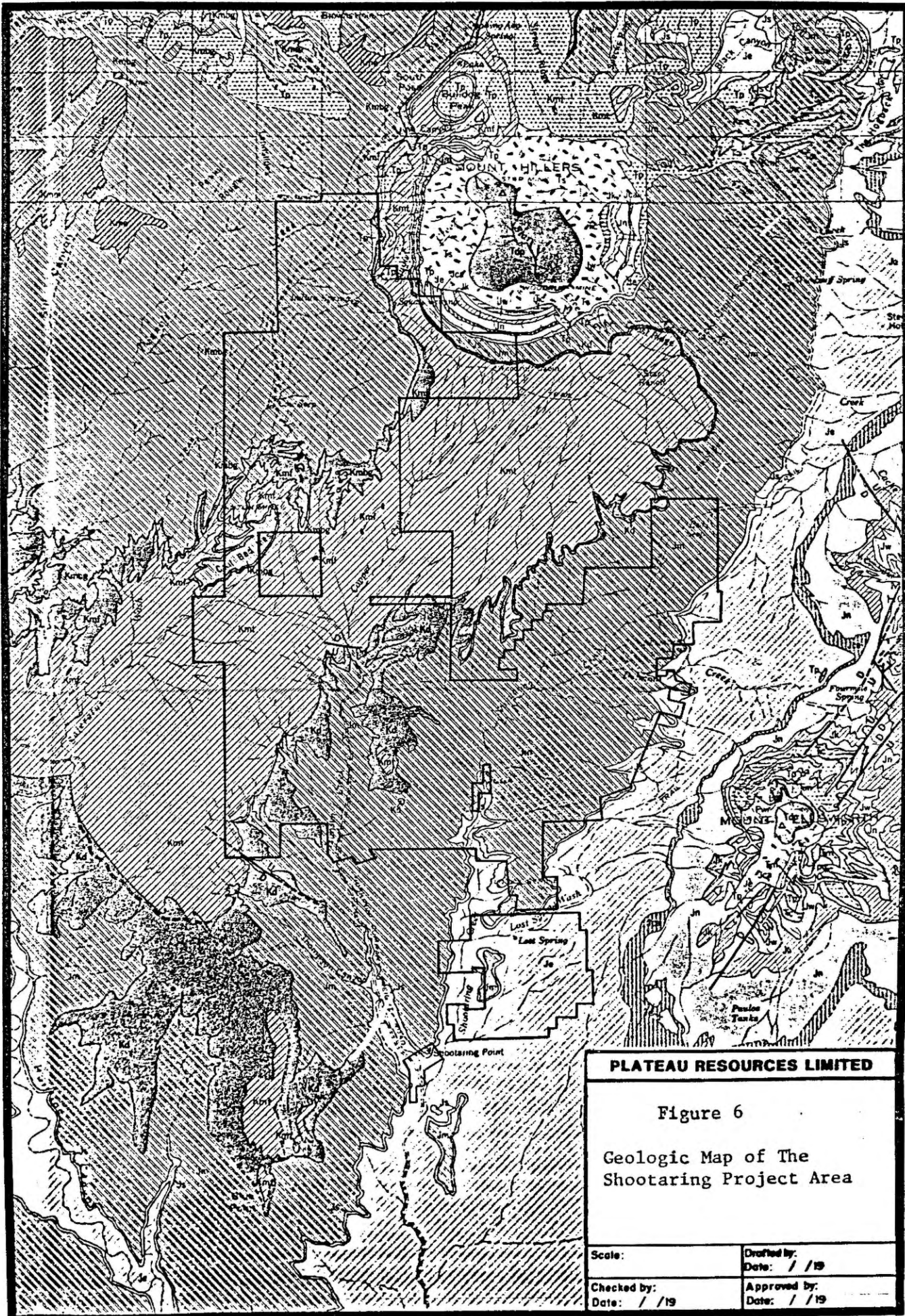
Figure 4

PLATON RESOURCES LIMITED  
 OROONDI AND/OR OROONDI  
**TONY M. MINE PLAN**  
 1978 THROUGH 1983





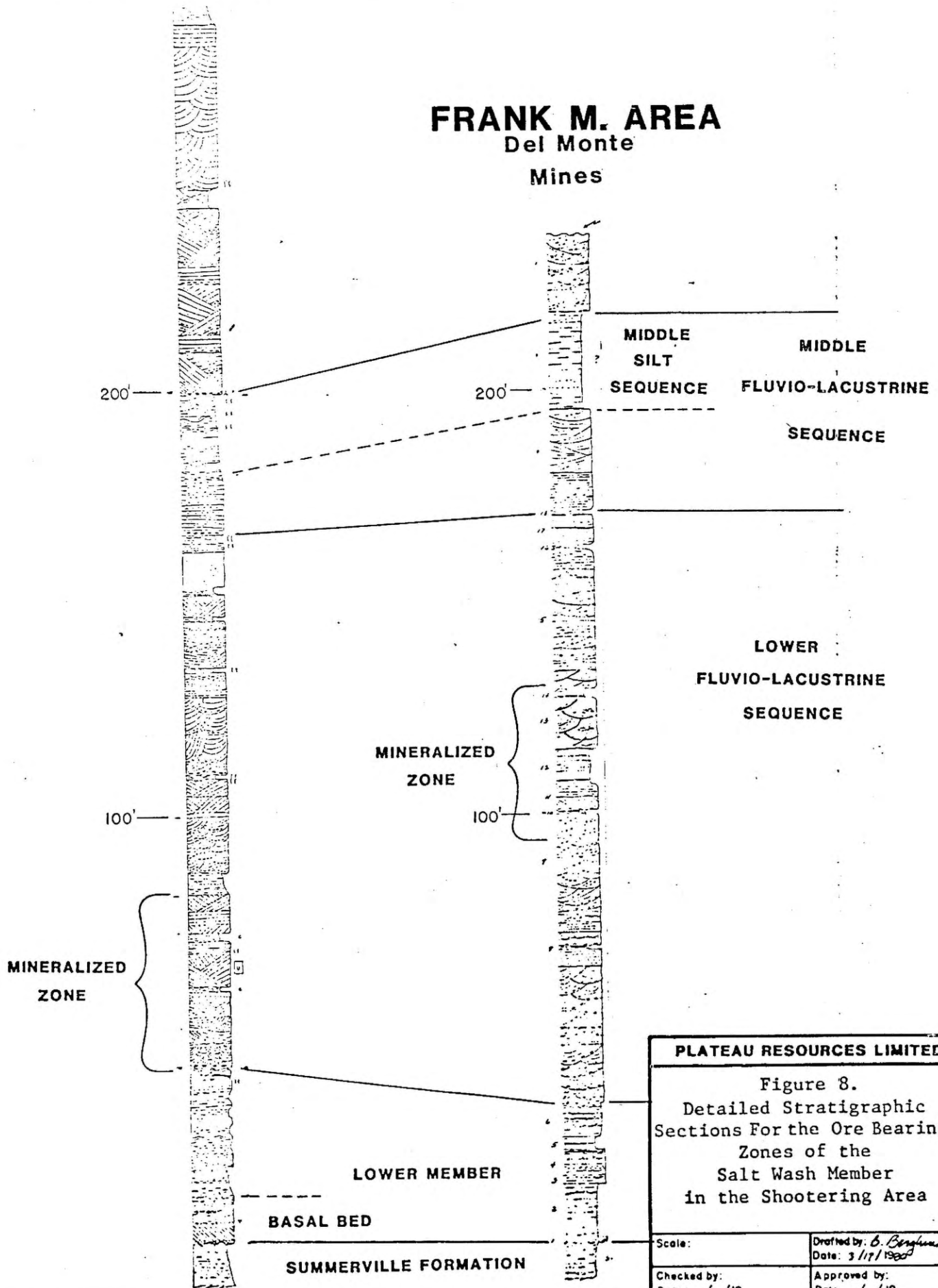
<b>PLATEAU RESOURCES LIMITED</b>	
Map of Ticaboo Townsite	
Figure 5	
Scale: 1" = 800'	Drafted by: Date: / / 19
Checked by: Date: / / 19	Approved by: Date: / / 19



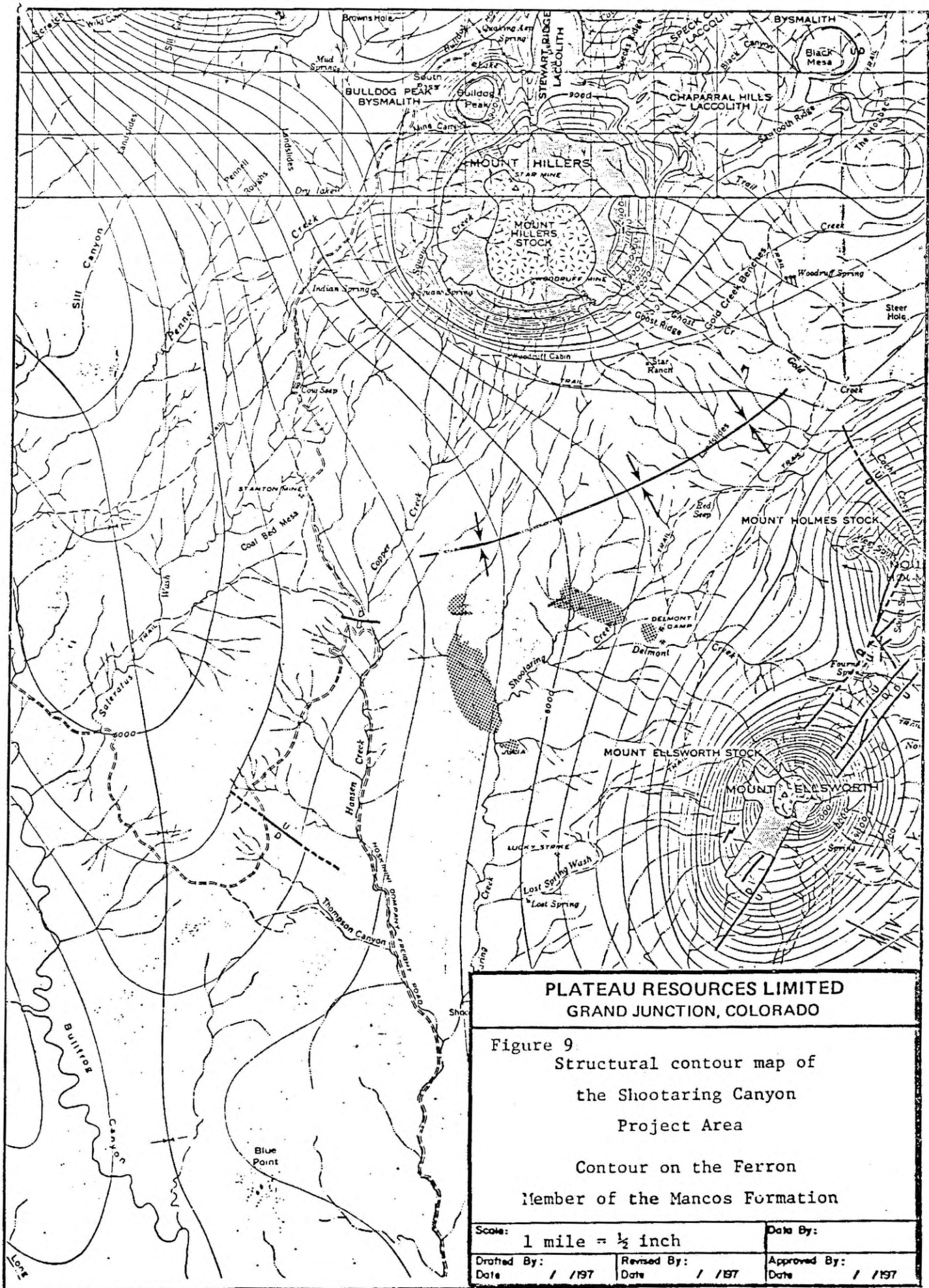


**TONY M. AREA**  
Shooting Canyon

**FRANK M. AREA**  
Del Monte  
Mines



<b>PLATEAU RESOURCES LIMITED</b>	
Figure 8. Detailed Stratigraphic Sections For the Ore Bearing Zones of the Salt Wash Member in the Shooting Area	
Scale:	Drafted by: <i>B. Berglund</i> Date: 3/17/1960
Checked by:	Approved by:
Date: / / 19	Date: / / 19



INFORMAL CHRONOLOGICAL HISTORY OF THE SHOOTARING CANYON PROJECT

AND PLATEAU RESOURCES LIMITED

- 190 million years before present -- Deposition of Salt Wash Member of the Morrison Formation within a braided stream system. Uranium ore deposited from ground waters.
- 38 million years before present -- Intrusion of Mount Hillers and other Henry Mountain igneous rock bodies.
- 1938 -- Lucky Strike claims located in Shootaring Canyon.
- 1943 -- Manhattan Project related geologic studies to locate uranium included mapping and investigations of the Henry Mountain area.
- 1913 to 1965 -- About 50,000 tons of uranium/vanadium ore produced from all of Garfield County.
- 1970 -- Rio Amex carried out drilling program in area of Tony M and Frank M ore bodies without sufficient success to continue program.
- June 7, 1976 -- Plateau Resources Limited incorporated as a Utah Corporation.
- February 1, 1977 -- Grand Junction office of Plateau Resources Limited established.
- February, 1977 -- Ore first discovered in what was to become the Tony M ore body.
- June 17, 1977 -- Woodward Clyde retained; site selection and environmental study initiated for planned uranium processing facility.
- August, 1977 -- Ore first discovered in what was to become the Frank M ore body.
- September 1, 1977 -- Driving the main haulageways for the Tony M Mine was started.
- September 27, 1977 -- Mountain States retained to design Shootaring uranium processing facility.
- May 1, 1978 -- Plateau occupies new offices at 772 Horizon Drive, Grand Junction.
- May 5, 1978 -- License application submitted to Nuclear Regulatory Commission for Shootaring Canyon Processing Facility.
- February 1979 -- Canyon Homesteads, Inc. subsidiary formed to participate in development of the community of Ticaboo.
- September 21, 1979 -- License for processing facility received from Nuclear Regulatory Commission and Construction of Shootaring Canyon Processing Facility started.
- Summer & Fall 1980 -- Peak employment of 400 construction workers at the Processing Facility site. Ticaboo population reaches 850 residents.
- March 31, 1982 -- Processing Facility NRC license amendment issued increasing annual production capacity from 492,750 pounds U<sub>3</sub>O<sub>8</sub> per year to 1,000,000 pounds U<sub>3</sub>O<sub>8</sub> per year.
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SUMMARY OF THE  
SHOOTARING CANYON PROJECT  
GARFIELD COUNTY, UTAH

PLATEAU RESOURCES LIMITED  
772 HORIZON DRIVE  
GRAND JUNCTION, COLORADO

August 1, 1983

Prepared for the August 6, 1983 AIME field trip.

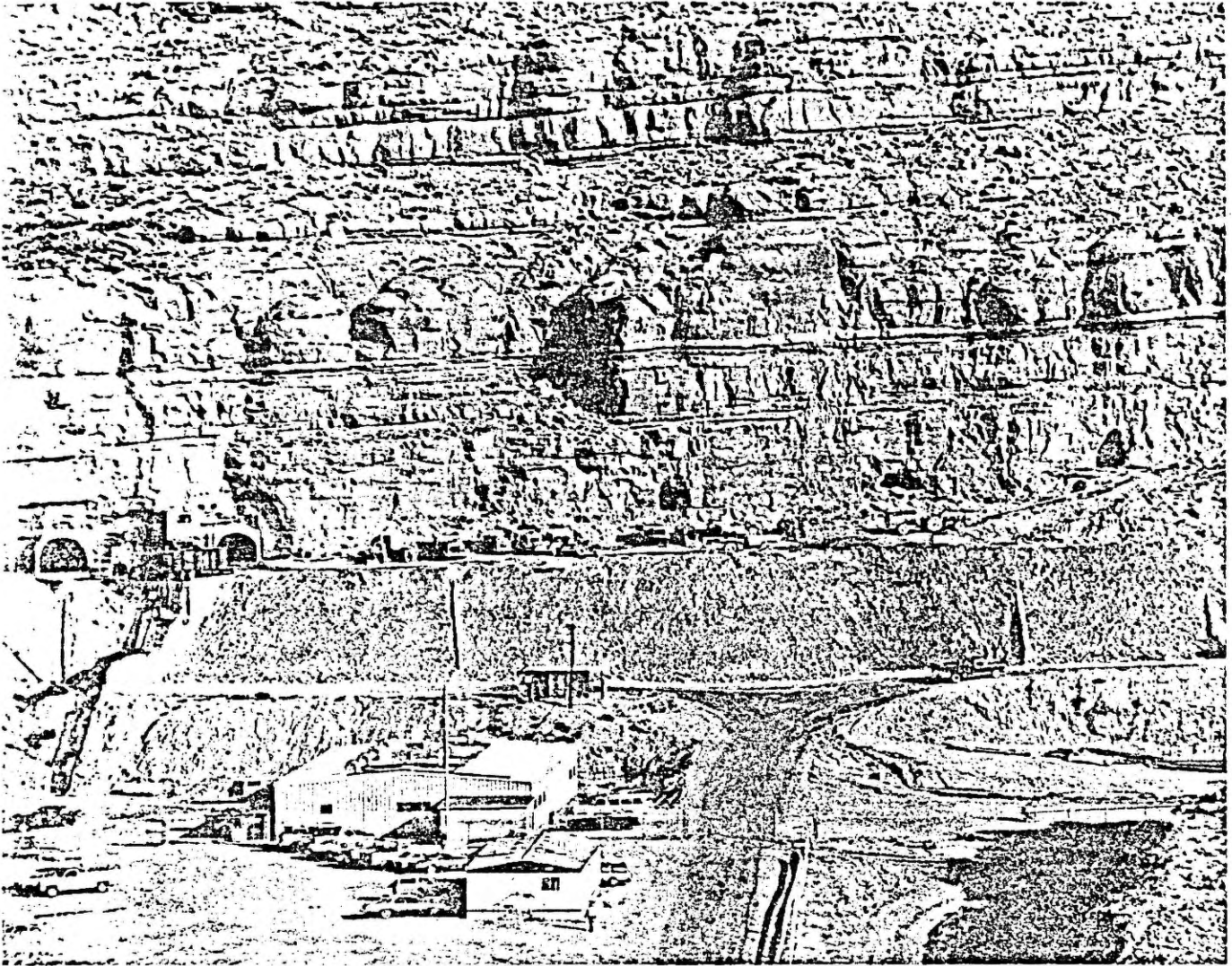


Figure 2

SHOOTARING CANYON MINE SITE. THE PORTALS OF THE EAST & WEST ACCESS DRIFTS ARE LOCATED ON THE LEFT. ORE REACHES THE SURFACE VIA THE EAST DRIFT AND IS DUMPED IN THE STORAGE BINS ACCORDING TO ROYALTY OBLIGATION. THE BUILDING HOUSES MINE OFFICES, CHANGE ROOMS AND SUPPORT FACILITIES. NOTE OLD MINE PORTALS AT RIGHT CENTER.

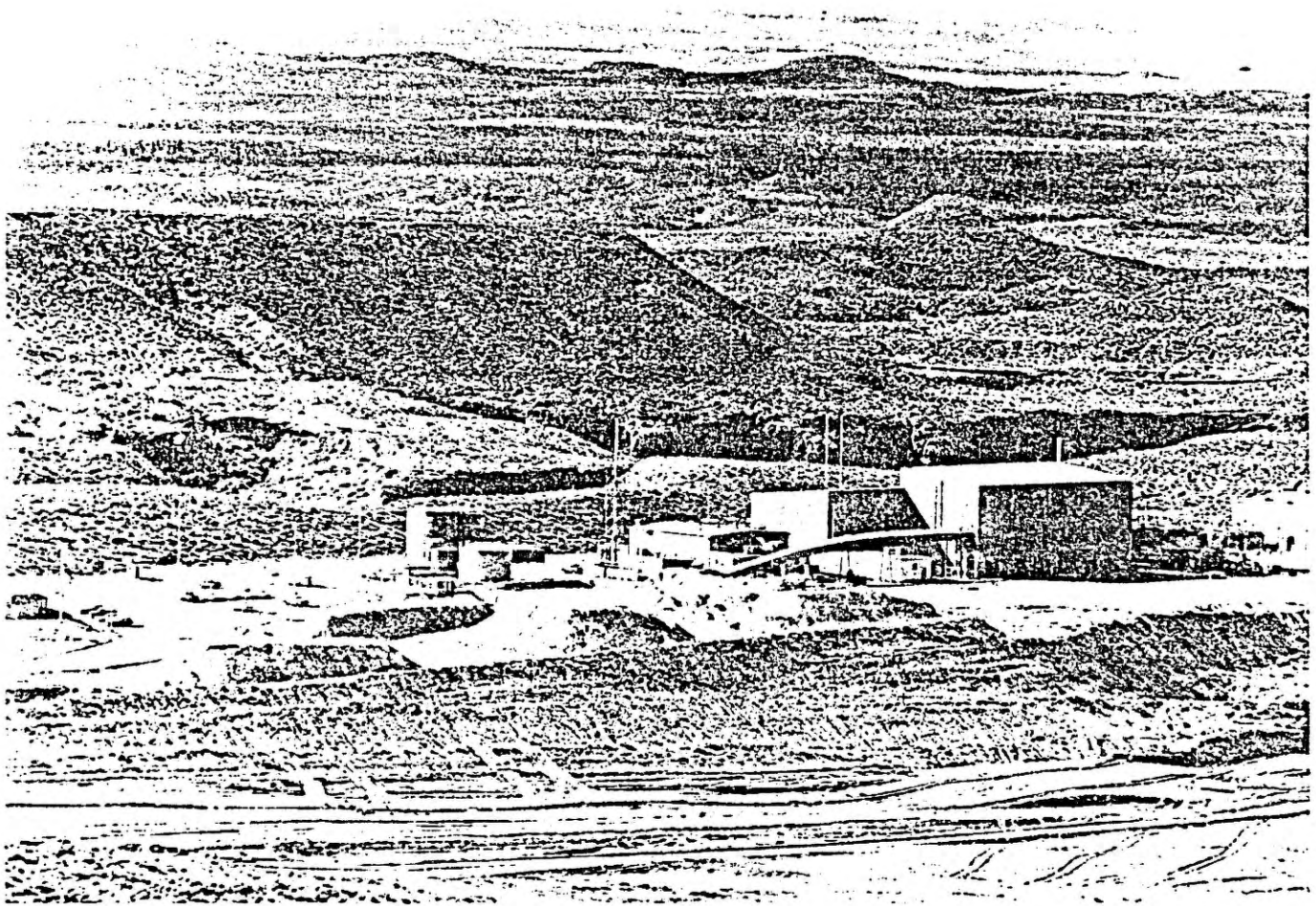


Figure 3

SHOOTARING CANYON MILL SITE SHOWING  
ORE STOCKPILE AREA AND MAIN MILL BUILDINGS

SUMMARY OF THE SHOOTARING CANYON  
PROJECT OF PLATEAU RESOURCES

ABSTRACT

The Shootaring Canyon Project will mill uranium ores produced from a company owned mine located in the Henry Mountains of southeastern Utah. The ores to be mined are located on lands owned by, or leased to Plateau Resources Limited. Nearly 2,000 rotary drill holes, totaling almost 1,000,000 feet, were drilled to evaluate the properties. The host for the uranium ores is the fluvial sandstone of the Salt Wash Member of the Jurassic Morrison Formation. The ores will be produced from the Tony M Mine which is located on the property.

In addition to the Tony M ore body the company has discovered significant additional mineralization in the Shootaring area. Additional work is underway to evaluate the economic feasibility of mining these prospects. Ores extracted from these areas could be processed at the Shootaring Processing Facility should market conditions justify their being mined.

Mined ores will be processed in a facility using the conventional acid leach solvent extraction process. Design capacity of the plant is 750 tons per day. It is located on a 270 acre site situated about 3 miles from the Tony M mine.

The Final Environmental Statement was published by the U. S. Nuclear Regulatory Commission on August 11, 1979. The Source Material License was issued on September 21, 1979 and construction of the facility was started immediately.

Startup and testing of the plant commenced on April 13, 1982. Because of current market conditions, operations were suspended and the plant was put on standby during August, 1982. Results of the testwork demonstrated an operational capacity of 1000 tons per day. With minor modifications the facility can be expected to operate at 1250 tons per day.

Because of the relatively remote location of the project area, Plateau through its subsidiary Canyon Homesteads, Inc. has developed a new community in order to provide living facilities for the personnel located at the mine and mill complex. The community, known as Ticaboo, is located three miles south of the millsite.

## INTRODUCTION

The thick Salt Wash sands of the Henry Mountains, Utah have been the source of small amounts of uranium and vanadium ores ever since 1913. However, even though high grade ores occur locally in outcrops, exploration programs performed by at least four mining companies were unsuccessful in discovering significant ore bodies.

In June 1976, Plateau Resources Limited was established as a wholly owned subsidiary of Consumers Power Company. Plateau's responsibility is to discover and to mine and mill uranium ore in order to secure a future supply of uranium to fuel Consumer Power Company's nuclear generating plants.

As part of its program to achieve this objective, Plateau carried out an aggressive exploration drilling program in the Shootaring Canyon area of the Henry Mountains. The successful exploration program resulted in the discovery of sufficient ores to justify the development of a uranium mine and mill complex. A project was initiated during 1977 in order to develop the complex.

The purpose of this report is to summarize the progress and current status of the Shootaring Canyon Project of Plateau Resources Limited.

### LOCATION AND ACCESS

The project area is located 175 miles southwesterly from Grand Junction, Colorado on the south flank of the Henry Mountains in Garfield County, Utah (Figure 1). The area is located on the west side of Utah State Highway 276. It lies approximately 50 miles directly south of Hanksville, Utah, and 10 to 15 miles north of Bullfrog Marina, located on Lake Powell. A paved airstrip suitable for small twin-engined aircraft is situated just north of Bullfrog Marina.

The ore body and mineralized trends lie within the northern half of T35S, R11E, S.L.M. The 270 acre millsite is located in Sec. 33 and 34, T35S, R11E, and Sec. 3 and 4, T36S, R11E (Figure 2). The Ticaboo Townsite occupies Sec. 16, T36S, R11E.

## TOPOGRAPHY AND CLIMATE

The project site is located within an area of canyonlands terrain at an elevation of approximately 4500 feet. Topographically, the area consists of a rugged irregular upland surface incised by canyons with vertical walls. Relief of several hundred feet is common and local elevation contrasts of up to 500 feet occur.

The climate is distinctly arid with an average annual precipitation of 7 inches. Vegetation is characterized as desert shrub and is dominated by the blackbrush/Mormon tea associations.

### MINE AND MILL COMPLEX; U. S. NUCLEAR REGULATORY COMMISSION LICENSING

Once significant uranium ore reserves were discovered at Shootaring Canyon a major program was initiated to plan and develop the necessary facilities to mine and process the ores. The Tony M mine has been under development since September 1, 1977.

Concurrent with mine and mill development, environmental work and site selection were initiated in order to license the processing plant with the U. S. Nuclear Regulatory Commission (NRC). Start-up and testing of the Processing Facility commenced on April 13, 1982.

### MILL LICENSING BY THE NRC

In order to construct and operate a uranium recovery facility, the plant must be licensed by the NRC. An extensive site selection study was performed in order to select a plant site which meets the requirements of the NRC. The site was selected and a complete environmental report was then prepared for the site. The report and license application was subsequently submitted to the NRC.

The Final Environmental Statement was published on August 11, 1979. The U.S. Nuclear Regulatory Commission Materials License SUA-1371 was issued on September 21, 1979. Construction of the processing facility commenced on that date.

#### URANIUM PROCESSING FACILITY

The Shootaring Canyon uranium processing facility will treat uranium ores utilizing a conventional process circuit which includes grinding, acid-leach, solvent extraction and precipitation of yellow cake within the flowsheet of operations. The facility occupies 114 acres of Plateau's 270 acre plant site which is located 3 miles southerly from the Tony M mine portals (Figure 2). The construction phase started during the fourth quarter of 1979. Start-up and testing of the Processing Facility commenced on April 13, 1982. Design capacity of the plant is 750 tons per day although results of the startup testing demonstrate that it can be operated at a capacity of 1000 tons per day. This capacity can be increased to 1250 tons per day with minor equipment additions.

A brief outline of the operation of the facility will be given here.

The uranium recovery techniques involve proven processes which are presently being used by the uranium industry. The primary mill circuit involves breaking down the sandstone ore into its individual sand grains in a semi-autogenous grinding mill, and then dissolving the uranium from the grain surfaces using a sulfuric acid solution. The uranium rich acid solution is separated from the leached sands in a six stage counter-current decantation process. The leached sands are discarded as tailings in a large, below grade, open impoundment with a clay sealed bottom.

The uranium is transferred from the aqueous acid phase to an organic phase by means of a solvent extraction process. The uranium is removed from the organic phase by ammonium sulfate and is then precipitated by the injection of

ammonia gas. The final precipitate, commonly called "yellow-cake", is washed, dried and packed into 55 gallon drums. The finished product is then shipped to a uranium hexafluoride conversion plant.

The processing facility consists of several buildings and an array of tanks of various sizes. Facilities have been designed and arranged to present a well integrated compact appearance (see Figure 3 for an artist's rendition of the plant). The larger buildings contain:

- \* Grinding and leaching equipment
- \* Solvent extraction equipment
- \* Yellowcake precipitation and drying equipment
- \* Offices
- \* Warehouse and maintenance shop
- \* Laboratory

The six counter-current decantation thickener tanks used to separate the leached sand from the acidic uranium solution are located outdoors. A slurry pipeline will transport tailings from the mill to the tailings impoundment, about 500 feet to the northeast, for permanent disposal. This impoundment has been stripped of topsoil and lined with locally obtained clay material to prevent seepage. A dam has been constructed to contain the discharged tailings. The slurry will be pumped into the impoundment and deposited through spigots. A unique underdrainage system to drain the tailings liquid from the slurry has been provided which will decrease the hydraulic head on the clay liner thus reducing the probability of underground seepage. By the time mine and mill operations are completed, the dam will have reached a height of about 100 feet, and the impoundment will cover approximately 2600 acre feet. At the termination of mill operations, the impoundment will be covered with earth fill. This will

prevent the tailings and other trapped waste materials from contaminating the surrounding area.

The total operating work force for the processing facility is expected to reach approximately 50 people when the project is on-stream.

#### MINE DEVELOPMENT AT SHOOTARING CANYON

The current mine plan calls for the development of a total of approximately 24 miles of underground workings when the principal mine development is complete. This includes the completion of two 10,475 foot long main haulageways as well as all laterals and crosscuts.

Since September 1, 1977 when the development of the Tony M Mine was initiated more than 16 miles of development drifts or workings have been completed. Development of the main haulageways is now complete and the development of lateral and crosscuts is continuing.

A brief outline of the mine operation will be given here.

#### TONY M MINE DEVELOPMENT

##### General Mine Plan and Operation

The ores of the Tony M Mine occur as a series of individual ore bodies within the nearly flat lying Salt Wash sandstone.

The Tony M mine is being developed by a double entry system of two parallel declines spaced fifty feet apart. The portals of the two 8 feet high by 12 feet wide main haulageways are located on the northwesterly side of Shootaring Canyon. The declines are being driven down a minus three percent grade (i.e., 3 feet/100 feet) along a trend of North 22° West. This orientation generally coincides with the long axis of the ore trend. The three percent grade was

selected as it places the main haulageways either within, or a few feet below, the ore bearing horizon of the Tony M orebody.

Access to the individual ore bodies is through laterals which are being developed at right angles to the main haulage ways. The eight foot high by twelve foot wide laterals are used as entries to known ore bodies which generally lie within 1500 feet of the main haulageways.

In addition to providing access, the laterals are used to explore and make detailed evaluation of each ore bearing zone through which they pass. The laterals provide access for geologic mapping, long hole drilling, rib scanning and collecting samples. The detailed information provided by the work forms the basis for detailed mine planning and stope development.

The ore will be mined using a modified room and pillar system which is being developed in conjunction with the main lateral development. The technique is designed to follow the irregular configuration of the individual ore bodies and has proven to be successful in the hundreds of uranium mines located in the Colorado Plateau.

During 1982 a study of various detailed stoping techniques was performed in the Tony M Mine in order to determine which techniques should be utilized once production mining commences.

Following drilling and blasting, by the 3 man mining crews, broken muck will be transported to the main haulageway in five ton capacity rubber tired load-haul-dump (LHD) equipment. At the main haulage the muck will be placed in storage silos for transfer to a conveyor which will carry the muck to the surface. Ores will be trucked to the processing facility from the storage bins.

A thirty-six inch wire rope conveyor will be employed to transport ore and waste to storage bins outside of the portal of the mine. The detailed design of

the conveyor system has been prepared by an independent engineering firm. Construction and installation of the system is planned for a later date.

### Mining Conditions

Mining conditions in the Tony M ore body pose no unusual challenges. Mining depths are relatively shallow, the physical rock characteristics compare favorably with rocks normally encountered in sandstone uranium deposits, and water encountered in mining operations is readily controlled.

The Tony M ore body lies at an average depth of 390 feet below the ground surface. Mining operations should encounter maximum depths of 750 feet below the surface in the northern end of the planned mine. Although as expected, physical rock properties within the ore bearing zone of the Salt Wash member are highly variable the rocks are generally moderately well cemented and rock strength is sufficiently great to support mine development.

Moderate amounts of ground water have been encountered during development of the Tony M Mine. However water is readily controlled, collected and pumped to the surface evaporation pond which was constructed for storage and disposal of the mine waters. Experience in the mine indicates that as a result of such practice the rocks in the vicinity of the mine workings are being dewatered and the volume of inflowing water is decreasing as the rock is allowed to drain and dry out.

EXPLORATION PROGRAM AND GEOLOGY  
OF THE SHOOTARING CANYON AREA

EXPLORATION PROGRAM

Plateau Resources has had an interest in the Shootaring Canyon area since 1976. This land is held through unpatented lode mining claims and Utah State Mineral Leases.

Exploration drilling was initiated in the vicinity of outcrop mineralization during 1976. However, it was not until February, 1977 that drilling commenced in what was to become the Tony M ore trend. Since then, approximately 2,000 rotary drill holes totaling nearly 1,000,000 feet have been completed on the property. Drilling continues in order to better define the details of the orebodies.

Although the drilling program has been very intensive, the very rugged topography has significantly affected where drilling sites are located. Therefore an irregular grid pattern of drill holes was subsequently developed.

All drill holes are systematically logged with a radiometric probe. Additional geophysical probing performed involves self potential, resistivity, neutron-neutron and deviation surveys.

Geologic, mineralogic, and chemical studies continue in order to better define the characteristics of the Shootaring Canyon uranium ores. This work is under the direction of the Plateau technical staff.

Systematic analytical work has established the variability of uranium oxide ( $U_3O_8$ ), vanadium pentoxide ( $V_2O_5$ ), and lime (calcium oxide,  $CaO_2$ ) content in the ores.

A systematic program of chemical analysis of ores encountered during developmental mining activities is in progress. Chemical and closed can radiometric

analysis of the samples supplemented by analysis of surface drill cores collected from the Tony M orebody provide a definition of the effect of chemical versus radiometric equilibrium.

#### GEOLOGY

The uranium ore bodies located in the Shootaring area consist of sandstone ores which are the typical ores of the Colorado Plateau area. The ore mineralization occurs as intragranular disseminations within the fluvial sand facies of the Salt Wash member of the Jurassic Morrison Formation (Figure 7).

The most abundant uranium ore mineral identified is the uranium silicate Coffinite  $[U(SiO_4)(OH)_4]$ . Other uranium minerals present are Uraninite  $(UO_2)$  and Carnotite  $[K_2(UO_2)_2(VO_4)_2 \cdot 1-3H_2O]$ . Additional work continues in order to better define the uranium mineralogy. A significant portion of the uranium occurs within a very fine grained phase whose mineralogy is best defined with the aid of the electron microscope.

Vanadium occurs as Montroseite  $[(VFe)O(OH)]$  and as vanadium chlorite.

Structural geology in the vicinity of the uranium bodies is characterized by a gentle northwesterly dip of between 2 and 5 degrees (Figure 10). No faults or other structural irregularities are known to occur in the immediate vicinity of the ore bodies.

## DEVELOPMENT OF TICABOO TOWNSITE

### Background

Because of the remote location of its operations, the Company is confronted with the problem of arranging housing and other accommodations for the workers at its mine and processing facility, and for support and service personnel, and their families. It is estimated that once full production has started the Company will employ approximately 250 persons in the mine, the processing facility, and general office.

The only established community within a radius of 100 miles from the site of the Company's mining and processing operations is the town of Hanksville, Utah. Hanksville has a population of approximately 200 people and is located about 50 miles north of the site of the Company's operations.

Inasmuch as the land in the vicinity of the Company's operations is virtually all federal or state owned and is marked by very rough terrain, the only land in the vicinity suitable for a new community is a 640-acre tract of land, now known as the "Ticaboo Townsite", which is owned by the State of Utah.

### TICABOO TOWNSITE JOINT VENTURE

A Deferred Development Lease has been obtained from the State of Utah covering the Ticaboo Townsite which grants the exclusive right to develop a community at the Ticaboo Townsite.

As provided in the Master Plan (See Figure 6), Ticaboo will include single and multiple family dwellings, mobile home and medical facilities, a commercial area, and a community services area. Plans to develop Ticaboo consist of two phases. Phase I consists of roads, sewer, water and electric distribution

facilities, housing sites, commercial facilities, a motel and maintenance facilities. The roads, sewer, water and electric distribution facilities are complete. The motel, restaurant and grocery store have been developed and are in operation in the commercial area. Phase II will involve additional development as population growth requires.

INFORMAL CHRONOLOGICAL HISTORY OF THE SHOOTARING CANYON PROJECT  
AND PLATEAU RESOURCES LIMITED

190 million years before present -- Deposition of Salt Wash Member of the Morrison Formation within a braided stream system. Uranium ore deposited from ground waters.

38 million years before present -- Intrusion of Mount Hillers and other Henry Mountain igneous rock bodies.

1938 -- Lucky Strike claims located in Shootaring Canyon. *Crab #16 Mt. Hillers*

1943 -- Manhattan Project related geologic studies to locate uranium included mapping and investigations of the Henry Mountain area.

1913 to 1965 -- About 50,000 tons of uranium/vanadium ore produced from all of Garfield County.

1970 -- Rio Amex carried out drilling program in area of Tony M and Frank M ore bodies without sufficient success to continue program.

June 7, 1976 -- Plateau Resources Limited incorporated as a Utah Corporation.

February 1, 1977 -- Grand Junction office of Plateau Resources Limited established.

February, 1977 -- Ore first discovered in what was to become the Tony M ore body.

June 17, 1977 -- Site selection and environmental study initiated for planned uranium processing facility.

August, 1977 -- Ore first discovered in what was to become the Frank M ore body.

September 1, 1977 -- Driving the main haulageways for the Tony M Mine was started.

September 27, 1977 -- Design of Shootaring uranium processing facility.

May 1, 1978 -- Plateau occupies new offices at 772 Horizon Drive, Grand Junction.

May 5, 1978 -- License application submitted to Nuclear Regulatory Commission for Shootaring Canyon Processing Facility.

February 1979 -- Canyon Homesteads, Inc. subsidiary formed to participate in development of the community of Ticaboo.

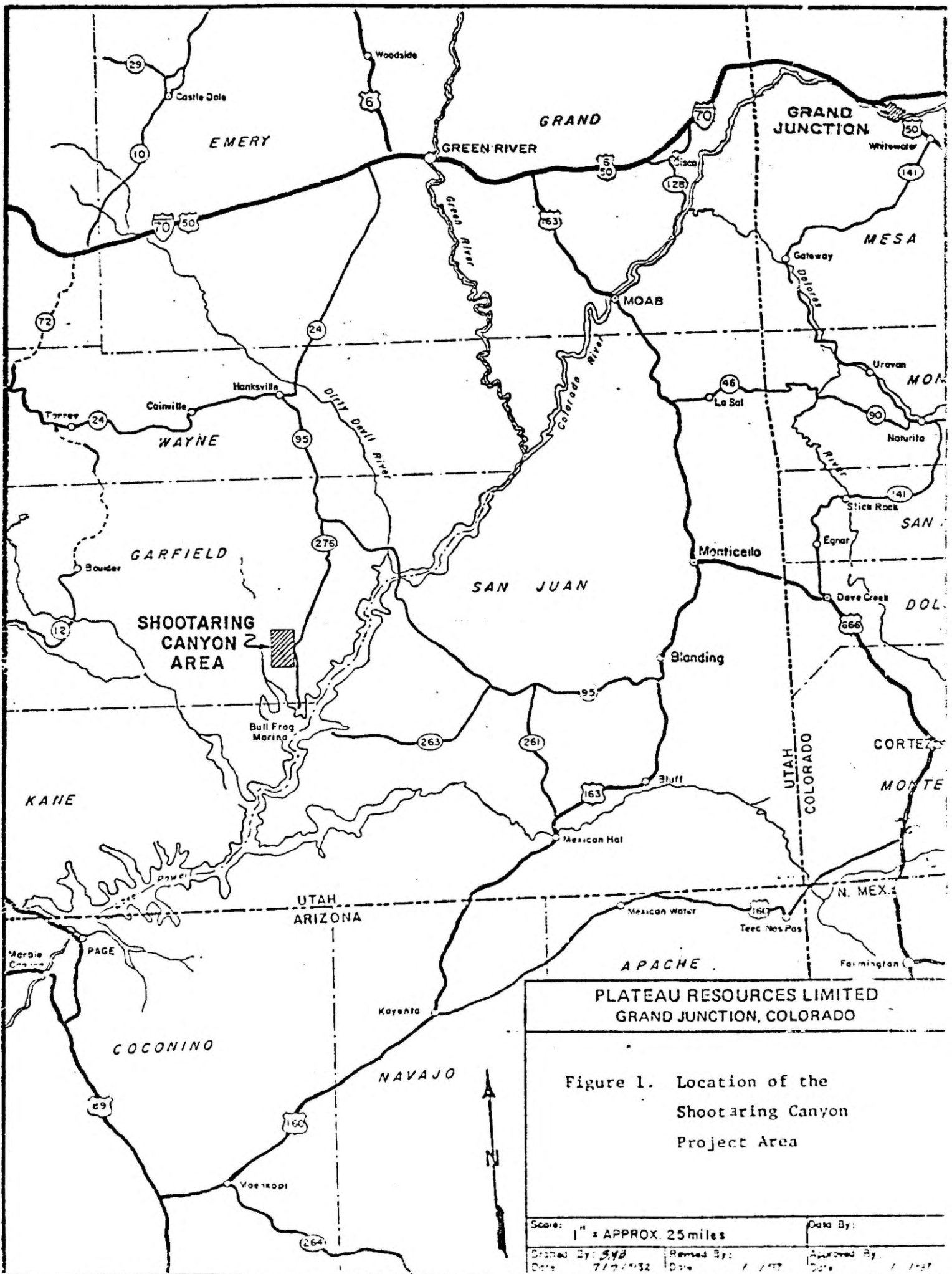
September 21, 1979 -- License for processing facility received from Nuclear Regulatory Commission and Construction of Shootaring Canyon Processing Facility started.

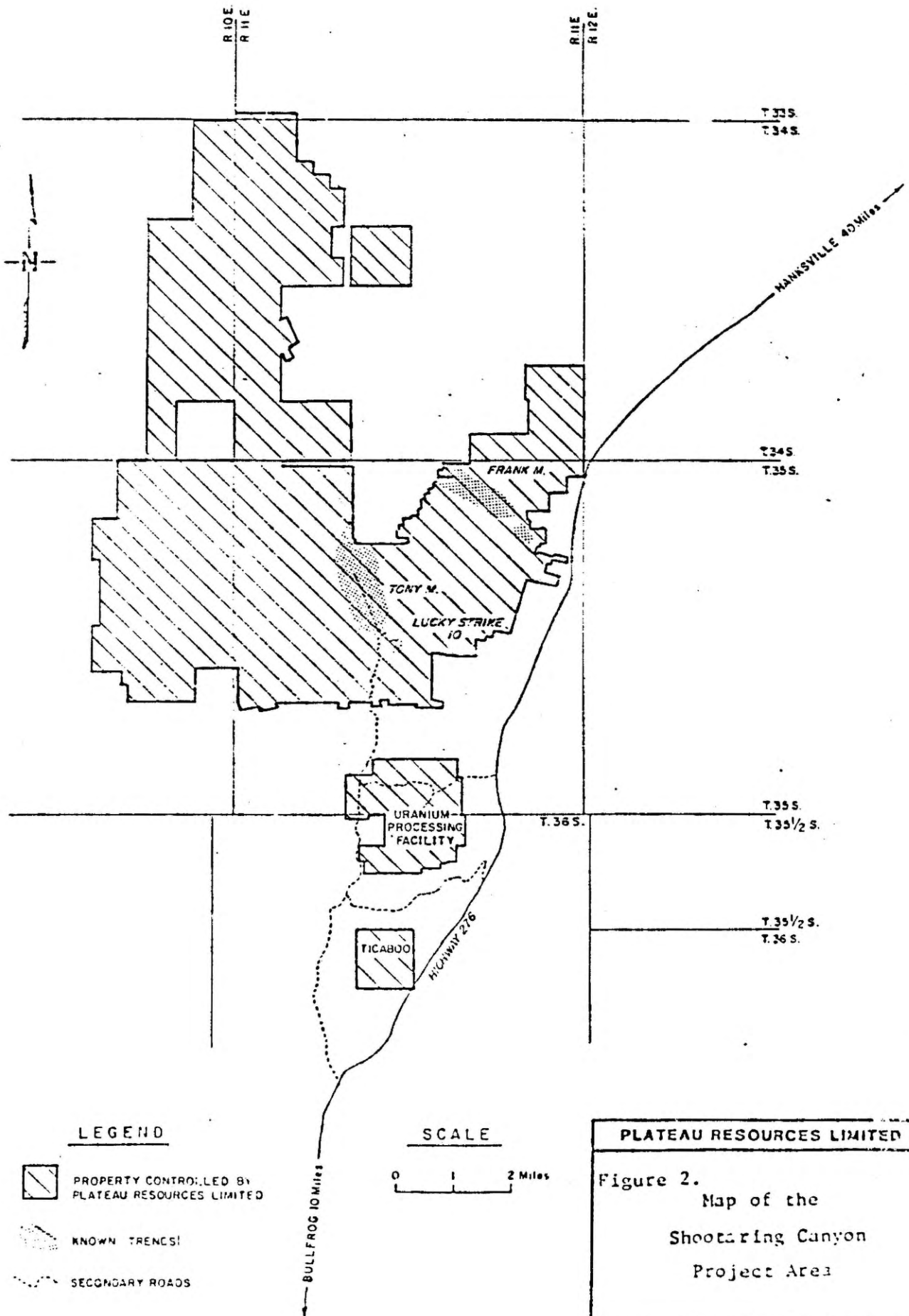
Summer & Fall 1980 -- Peak employment of 400 construction workers at the Processing Facility site. Ticaboo population reaches 850 residents.

March 31, 1982 -- Processing Facility NRC license amendment issued increasing annual production capacity from 492,750 pounds U<sub>3</sub>O<sub>8</sub> per year to 1,000,000 pounds U<sub>3</sub>O<sub>8</sub> per year.




April 13, 1982 -- Startup and testing of the Shootaring Canyon Processing Facility commences.

August 18, 1982 -- Suspension of operations at the Processing Facility occurred because of adverse marketing conditions.





**LEGEND**

-  PROPERTY CONTROLLED BY PLATEAU RESOURCES LIMITED
-  KNOWN TRENDS
-  SECONDARY ROADS

**SCALE**



**PLATEAU RESOURCES LIMITED**

Figure 2.  
Map of the  
Shooting Canyon  
Project Area

Scale AS SHOWN	Drawn by S. Berglund Date 3/2/1980
Checked by Date / / 19	Approved by Date / / 9

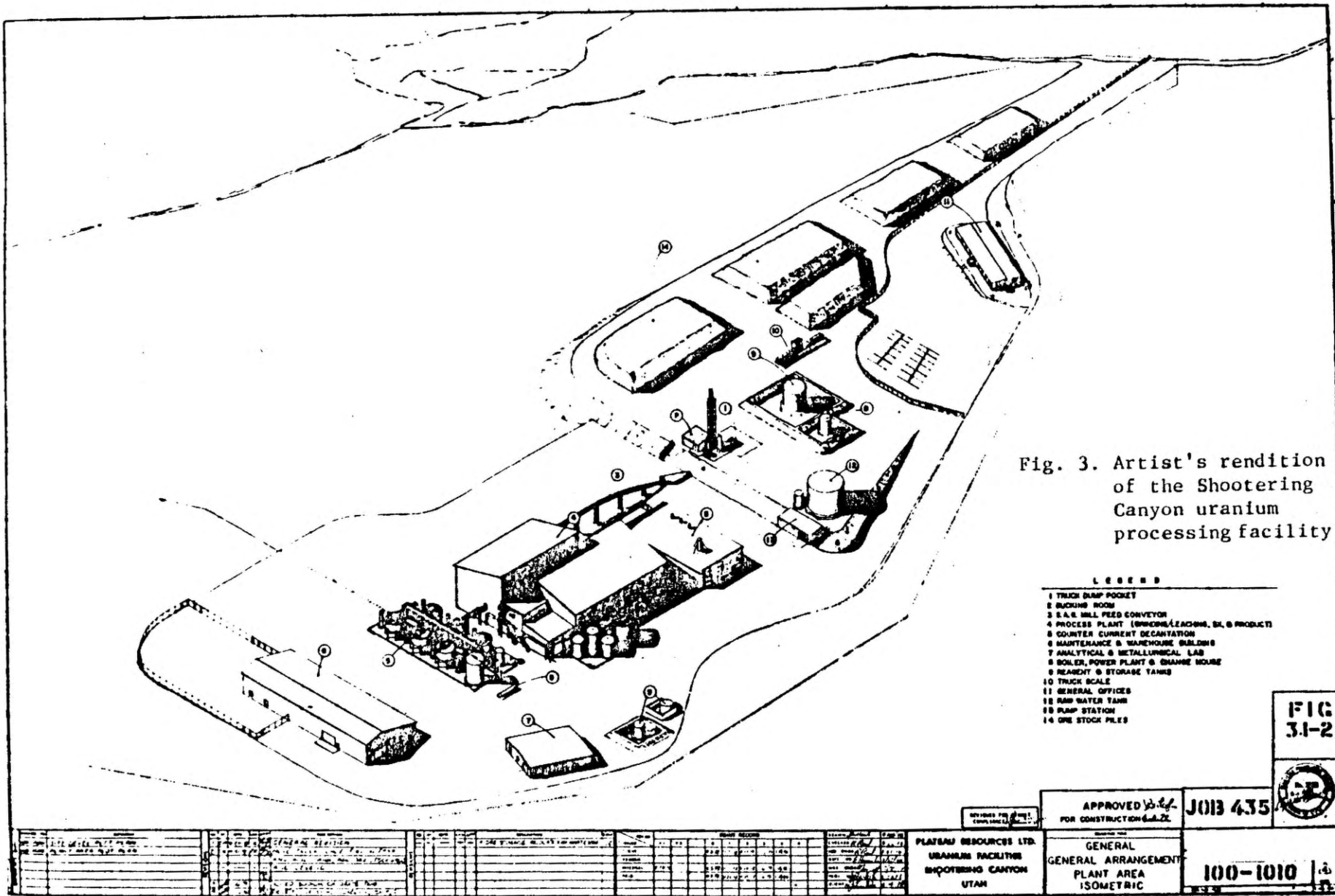


Fig. 3. Artist's rendition of the Shooting Canyon uranium processing facility

- LEGEND**
- 1 TRUCK DUMP POCKET
  - 2 BUCKING ROOM
  - 3 S & S MILL, FEED CONVEYOR
  - 4 PROCESS PLANT (BROMIDE LEACHING, SX & PRODUCT)
  - 5 COUNTER CURRENT DECONTATION
  - 6 MAINTENANCE & WAREHOUSE BUILDINGS
  - 7 ANALYTICAL & METALLURGICAL LAB
  - 8 BOILER, POWER PLANT & CHANGE HOUSE
  - 9 READY TO STOCK TANKS
  - 10 TRUCK SCALE
  - 11 GENERAL OFFICES
  - 12 RAW WATER TANKS
  - 13 PUMP STATION
  - 14 ORE STOCK PILES

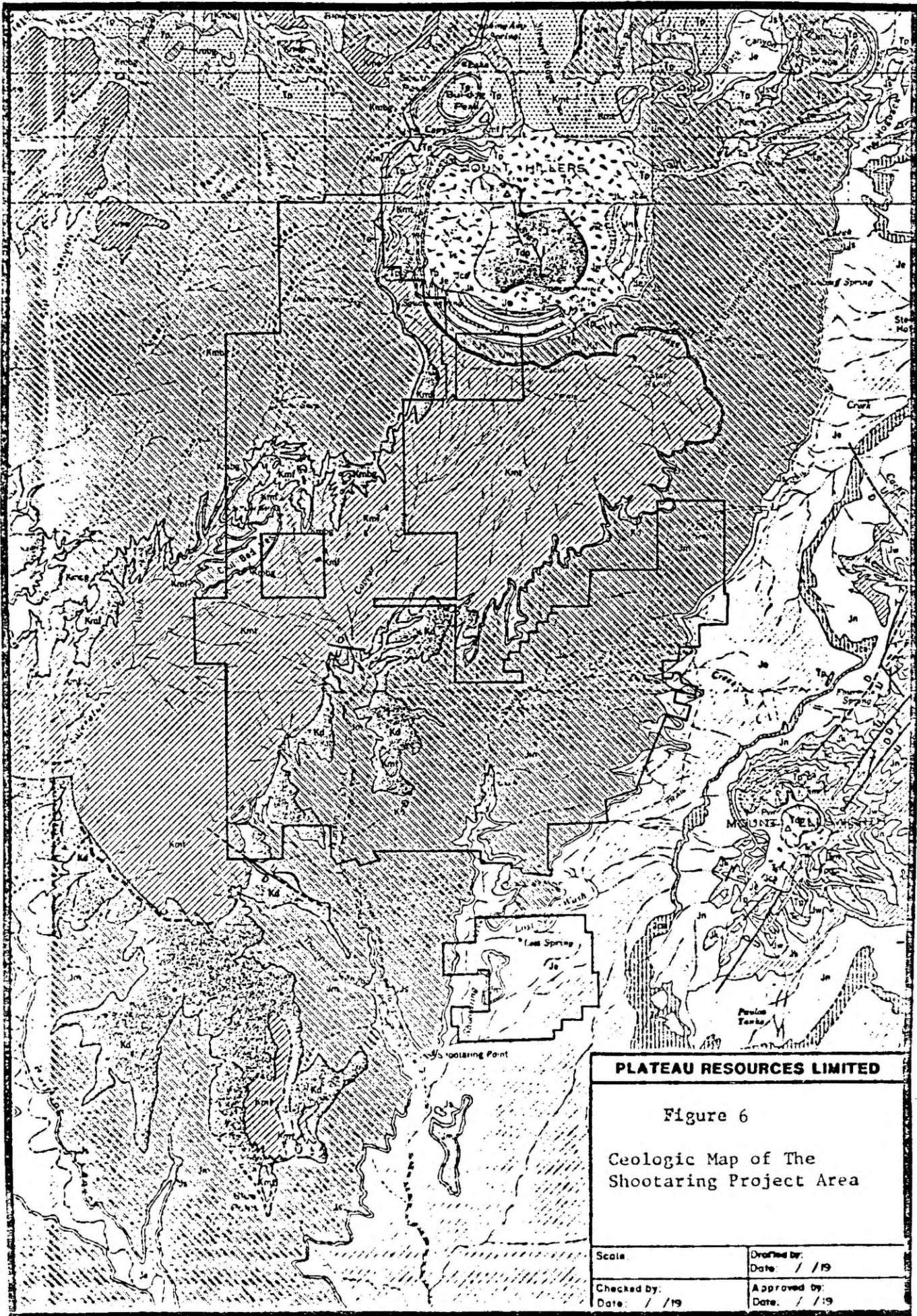
FIG 3.1-2

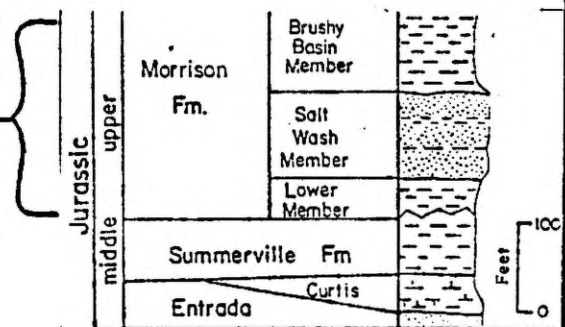
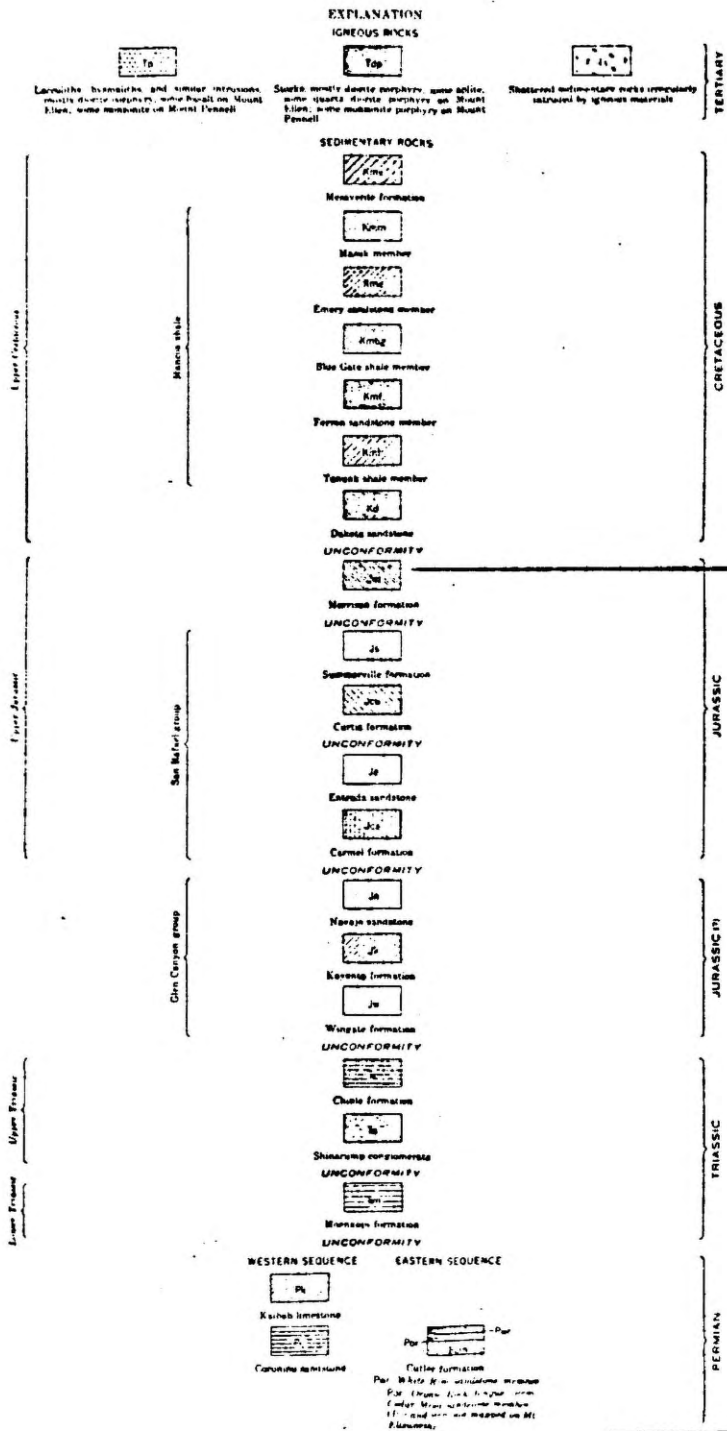


APPROVED FOR CONSTRUCTION	J013 435
PLATTSBURGH RESOURCES LTD. URANIUM FACILITIES SHOOTING CANYON UTAH	GENERAL GENERAL ARRANGEMENT PLANT AREA ISOMETRIC
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62	11/10/69	REVISION	J. D. ...	J. D. ...	J. D. ...
63	12/10/69	REVISION	J. D. ...	J. D. ...	J. D. ...
64	1/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
65	2/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
66	3/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
67	4/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
68	5/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
69	6/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
70	7/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
71	8/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
72	9/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
73	10/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
74	11/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
75	12/10/70	REVISION	J. D. ...	J. D. ...	J. D. ...
76	1/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
77	2/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
78	3/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
79	4/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
80	5/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
81	6/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
82	7/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
83	8/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
84	9/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
85	10/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
86	11/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
87	12/10/71	REVISION	J. D. ...	J. D. ...	J. D. ...
88	1/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
89	2/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
90	3/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
91	4/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
92	5/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
93	6/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
94	7/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
95	8/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
96	9/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
97	10/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
98	11/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
99	12/10/72	REVISION	J. D. ...	J. D. ...	J. D. ...
100	1/10/73	REVISION	J. D. ...	J. D. ...	J. D. ...







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Figure 7 Stratigraphic column  
for the Henry Mountains,  
Garfield County, Utah

Scale:	Date By:	
Drafted By:	Revised By:	Approved By:
Date / / 197	Date / / 197	Date / / 197

