Appendix III

GOLDEN QUEEN MINING COMPANY, INC.

SOLEDAD MOUNTAIN PROJECT
MOJAVE, KERN COUNTY, CALIFORNIA

SURFACE MINING RECLAMATION PLAN

May 1996
Revised August 1996
Revised January 1997
Revised March 1997
Revised April 1997

Submitted to:
Kern County Department of Planning
and Development Services
2700 "M" Street, Suite 100
Bakersfield, California 93301

Prepared for:
Golden Queen Mining Company
11847 Gempen Street
Post Office Box 820
Mojave, California 93501

Prepared by:
WZI Inc.
4700 Stockdale Highway, Suite 120
Bakersfield, California 93309

EXHIBITS

TABLES

ATTACHMENTS

Attachment A	List of Interests Acquired for Project
Attachment B	Biological and Soil Resource Evaluation for Soledad Mountain Project
Attachment C	Soledad Mountain Project, Slope Stability Analysis
Attachment D	Reclamation and Revegetation Procedures for Soledad Mountain Project
Attachment E	Site Drainage Plan

APPLICATION FOR
SURFACE MINING PERMIT AND/OR RECLAMATION PLAN
KERN COUNTY PLANNING DEPARTMENT

OWNER, OPERATOR, AND AGENT:

1. Applicant:

Name **Golden Queen Mining Company, Inc.**
Address **11847 Gempen Street, Post Office Box 820**
Mojave, California 93501
Telephone **(805) 824-1054**

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2. Name (if any) of Mineral Property:

Soledad Mountain Project

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3. Property Owner(s) or Owner(s) of Surface Rights (list all owners):

Name	**Golden Queen Mining Company, Inc.**	**U.S.A.**
Address	**11847 Gempen Street** **Post Office Box 820** **Mojave, California 93502-0820**	**Department of the Interior** **Bureau of Land Management** **300 South Richmond Road** **Ridgecrest, California 93555**
Telephone	**(805) 824-1054**	**(619) 384-5400**

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4. Owner(s) of Mineral Rights:

Name **See Attachment A**
Address
Telephone

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5. Lessee:

Name **Golden Queen Mining Company, Inc.**
Address **11847 Gempen Street, Post Office Box 820**
Mojave, California 93502-0820
Telephone **(805) 824-1054**

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6. Operator:

Name **Golden Queen Mining Company, Inc.**
Address **11847 Gempen Street, Post Office Box 820**
Mojave, California 93502-0820
Telephone **(805) 824-1054**

OWNER, OPERATOR, AND AGENT: (continued):

7. Agent of Process (person designated by operator as his agent for the service of process):

Name	**Richard Graeme**
Address	**11847 Gempen Street** **Post Office Box 820** **Mojave, California 93502-0820**
Telephone	**(805) 824-1054**

(Reference SMARA 2772(C)(1))

LOCATION:

8. Brief description, including legal, of the extent of the mined lands (to be) involved by this operation, including total acreage:

Section(s) 5, 6, 7, 8, Township 10N, Range 12W, SBB&M
Section(s) 1, 12, Township 10N, Range 13W, SBB&M

Assessor's Parcel Number (APN) Attachment A

The project location is west of California State Route 14 and south of Silver Queen Road. Exhibit 1 shows the property boundary as well as the proposed project area. Within the sections shown, Golden Queen acquired control of approximately 2,840 acres. Pursuant to SMARA Section 2772(c)(5), a metes and bounds legal description of the project area is included in Attachment A. The project area is on approximately 1,600 acres of undeveloped desert property.

(Reference SMARA 2772(C)(5))

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9. Description of the access route to the operation site:

Primary access to the site will be from California State Route 14 west on Silver Queen Road which is approximately five miles south of Mojave. Exhibit 2 is a regional location map and Exhibit 3 shows the State Route 14 and Silver Queen Road interchange. The entrance road will turn south from Silver Queen Road opposite the intersection of Silver Queen Road and Goldtown Road. The entrance to the site will be paved within the right-of-way of Silver Queen Road. The remainder of the access road will be surfaced with rock aggregate.

(Reference SMARA 2772(C)(11))

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10. Attach Location and Vicinity Map.

Exhibit 2 is a regional location map and Exhibit 1 shows the topography of the vicinity, as well as property boundaries and the proposed project area.

(Reference SMARA 2772(C)(11))

DESCRIPTION:

11. Mineral commodity (to be) mined:

Precious metals (gold and silver), with aggregate and construction materials as byproducts.

(Reference SMARA 2772(C)(2))

DESCRIPTION (continued):

12. Geologic description, including brief general geologic setting, more detailed geologic description of the mineral deposit (to be) mined, and principal minerals or rock types present:

    The site is located in the western Mojave Desert Geomorphic Province of Southern California. The Mojave Desert is a wedge-shaped fault block which is separated from the Sierra Nevada Mountains to the north by the Garlock Fault Zone and from the Transverse Ranges and coastal areas to the southwest by the San Andreas Fault Zone. The rock types of the western Mojave Desert have been grouped into three main divisions (Dibblee, 1967) which include pre-Tertiary age crystalline rocks, Tertiary age sedimentary and volcanic rocks and Quaternary age sediments and local basalt flows. Soledad Mountain consists of an eroded silicic volcanic center of Middle to Late Miocene age (16.9 to 21.5 million years). The volcanics consist of felsic flows, tuffs and breccias of the Gem Hill Formation, with rock types ranging from quartz latite to rhyolite. The flanks of Soledad Mountain are mantled by Quaternary alluvium deposits consisting of sandstones and conglomerates.

(Reference SMARA 2773(a))

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13. Brief description of environmental setting of the site and the surrounding areas, including existing area land use, soil, vegetation, groundwater elevation, surface water characteristics, average annual rainfall and/or any other factors pertaining to environmental impacts and their mitigation and reclamation:

    See Attached (page 13)

(Reference SMARA 3502 (b)(1))

PROPOSED (EXISTING) SURFACE MINING OPERATION:

14. Time Frame of Project

    a. Proposed Starting Date of Operation: **11/1/97 (Construction Start)**

       Estimated Life of Operation: **16 - 20 years**

       Duration of First Phase: **Construction: 9-12 months**

    b. Operation will be (is):

       Continuous X Seasonal ____ Intermittent ____

       Developed, Not Yet in Operation ____ Temporarily Deactivated ____ Stockpile in Mine ____

(Reference SMARA 2772(C)(3))

PROPOSED (EXISTING) SURFACE MINING OPERATION (continued):

15. Project Production

  a. Annual production will be (is):

  Under 5,000 tons/cubic yds/yr ________________

  5,000 - 50,000 tons/cubic yds/yr ________________

  50,000 - 250,000 tons/cubic yds/yr ________________

  250,000 - 1,000,000 tons/cubic yds/yr ________________

  More than 1,000,000 tons ________X________

  b. Total anticipated production:

  Mineral commodities to be removed - (circle one) tons **60 million**

  Waste retained on the site - (circle one) tons **230 million**

  Waste disposed offsite - (circle one) tons/cubic yds **N/A**

  Maximum anticipated depth **1,300** ft

(Reference SMARA 2772(c)(2) and (4))

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16. Mining Method (check all applicable):

  a.

  Open Pit X

  Single Bench ________

  Quarry:

    Hill Top ________

    Multibench ________

    Side Hill ________

    Dragline ________

    Low Level ________

    Shovel ________

    Underground X

  Gravel Bar Skimming ________

  Gravel/Sand Pit ________

  Drill and Blast X

    Clay Pit ________

  Truck to Processing

    Plant (to RR) X

  Borrow Pit ________

  Tailings Ponds ________

  Slurry Pump ________

  Waste Dump X

  Rail ________

  Other ________

  b. Identify the number and types of vehicles and equipment used in addition to their ADT (average daily trips).

  Table 1 shows the Preliminary Mining Equipment List.

  See Attached (page 22).

  c. Maximum number of employees onsite at any one time **40 during normal operation.**

(Reference SMARA 2772(c)(11))

PROPOSED (EXISTING) SURFACE MINING OPERATION (continued):

17. Processing:

    a. If processing of the ores or minerals mined is planned to be conducted at or adjacent to the site, briefly describe the nature of the processing and explain disposal method of the tailings or waste from processing.
    See Attached (page 22).

    b. Estimate quantity (gallons per day) and quality of water required by the proposed operation, specifying proposed sources of this water and method of its conveyance to this property and the quantity and quality and method of disposal of used and/or surplus water.
    Golden Queen will use water for the heap leach operation and for dust control. Golden Queen will obtain water from wells planned in Section 31, Township 11 North, Range 12 West, S.B.B.M., north of Silver Queen Road. Golden Queen will pipe the water under Silver Queen Road to the project site. Golden Queen proposes to contain the pregnant solution within the heap leach pile and to use fixed-roof tanks for the barren solution rather than uncovered pregnant and barren ponds used at most mining operations. Pregnant leaching solution will be processed for precious metal recovery and then pumped to the barren solution tank to be recycled to the heap leach pad. The proposed project is expected to circulate 5,400 gallons of water per minute in the heap leach process. Daily makeup water demand is estimated to be 750 gallons per minute. Bottled water will be purchased for all potable and laboratory water needs.

(Reference SMARA 2772(c)(11))

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18. If the nature of the deposit and the mining method used will permit, describe and show the steps or phases of the mining operation that allow concurrent reclamation, and include a proposed time schedule for such concurrent activities.
Open pit mining activities will be occurring in several locations throughout the pit area at any one time and disposal of overburden material will take place at all proposed overburden sites throughout the mine life. No project phasing is proposed, therefore, no reclamation will take place until mining operations are completed in a given area.

(Reference 2772(c)(6) and 3503(a)(1))

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19. Attach a map of the mined lands showing the following information:
    a. Boundaries and topographic details of the site.
    b. Location of all streams, roads, railroads, water wells, structures, dwellings, and utility facilities within 500 feet of the site.
    c. Location of all currently proposed access roads to be constructed in conducting the surface mining operation.
    d. Location of areas (to be) mined, and of waste dumps and tailings ponds.
    e. By use of symbol or map overlay, depiction of separate mining phases, if applicable.
    f. The source of map base, orientation (North arrow), and scale (e.g., 1" = 500', etc.) of the map.
    Exhibit 1 Property Boundary and Project Area
    Exhibit 4 Conceptual Plot Plan

(Reference 2772(c)(5))

RECLAMATION PLAN:

20. Indicate on an overlay of map of Item 19, or by symbol on map, those areas to be covered by reclamation plan.

Exhibit 5 Reclamation Areas Acreage **419 acres includes heap leach pad and overburden pile benches if any are necessary since benches at lower elevations would reduce acreage at upper elevations.**

(Reference SMARA 2772(c)(5))

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21. Describe the ultimate physical condition of the site and specify proposed use(s), or potential use(s), of the mined lands as reclaimed.

The proposed reclamation plan will return the land to a post-mining land use similar to the pre-mining land use, consistent with the Specific Plan for Soledad Mountain, which includes future mining, wildlife habitat and open space.

(Reference SMARA 2772(c)(7)

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22. Provide evidence that all owners of a possessory interest in the land have been notified of the proposed use(s) or potential use(s) identified in Item 22. (Attach copy of notarized statement of acknowledgment, etc.)

There are eighty-one (81) land holders with possessory interest in the property (Attachment A). A copy of the letter sent to each holder of possessory interest is included in Attachment A.

(Reference SMARA 2772(c)(7))

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23. Describe how implementation of the reclamation plan will affect future mining in the area.

Implementation of the Proposed Reclamation Plan would not limit future development of mineral resources in the area. Currently uneconomic precious metal resources contained in the walls and floors of the open pit mines would remain accessible for future exploration and development by underground or open pit methods.

(Reference SMARA 2772(c)(9))

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24. Describe how the proposed reclamation plan will affect public health and safety, giving consideration to the degree and type of present and probable future exposure of the public to the site.

See Attached (page 23).

(Reference SMARA 3502(b)(2)

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25. Describe how the project will adhere to the specified requirements for protection of wildlife habitat.

See Attached (page 25).

(Reference SMARA 3703 and 3503(c))

26. Describe the reclamation procedures used to ensure adherence with the specified requirements for backfilling, regrading, slope stability, and recontouring. Indicate on map (Items 19 - 20) or on diagrams as necessary. Discussion should explain why final cut slopes proposed have a minimum slope stability factor of safety which is suitable for the proposed end use and conform with surrounding topography and/or approved end use. Additionally, a sufficient number of cross sections, no larger than 11 inches by 17 inches, which demonstrate existing and proposed final slopes should be incorporated into the plan. <u>**NOTE**</u>: If any final reclaimed fill slopes exceed 2:1 (horizontal to vertical), submit specific geologic and engineering analysis which demonstrates the proposed slope has a minimum slope stability factor of safety that is suitable for the proposed end use and when the proposed final slope can be successfully revegetated.

See Attached (page 26).

(Reference SMARA 3704 and 3502(b)(3))

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27. If revegetation is proposed, describe what procedures will be employed to ensure adherence with the specified requirements. Indicate on map (Items 19 - 20) or on diagrams as necessary. If revegetation is not applicable, indicate why not. At a minimum, the plan should include or elaborate on the following:

a. A baseline study documenting the vegetative density, cover and species richness of the site.
b. Test plots to be employed/monitoring.
c. Need for decompaction.
d. Need for soil analysis.
e. Proposed revegetation mix.
f. When planting will be conducted.
g. Need for irrigation.
h. Protection measures to be employed.
I. Success of revegetation.

*Success of revegetation will be judged upon the effectiveness of the vegetation for the approved end use, and by comparing the quantified measures of vegetative cover, density and species richness, therefore, the plan will also need to specify:

BASELINE	PERFORMANCE STANDARD
Density -	Density -
Cover -	Cover -
Species -	Species -
Richness -	Richness -

See Attached (page 30).

(Reference SMARA 3705 and 3503(g))

RECLAMATION PLAN: (continued)

28. Describe the reclamation procedures used to ensure adherence with the specified requirements for drainage, diversion structures, waterways and erosion control. Additionally, indicate on map (Items 19 - 20) or on diagrams, as necessary, the following:

    a. All existing, interim and final drainage patterns.
    b. Location of any diversion structures. If not applicable, indicate why not.
    c. Erosion control facilities (i.e., sumps).

    See Attached (page 33).
    See Exhibit 14.

(Reference SMARA 3706, 3710, 3502(b)(6), 3503(a)(3),(b)(1),(d) and (e), 2772(c)(8)(b))

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29. Describe the reclamation procedures used to ensure adherence with the specified requirements for prime agricultural land reclamation. If not applicable, please explain why.

    Not applicable.
    The Specific Plan for Soledad Mountain - Elephant Butte and Vicinity does not recognize Soledad Mountain as agricultural land.

(Reference SMARA 3707)

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30. Describe the reclamation procedures used to ensure adherence with the specified requirements for other agricultural land reclamation. If not applicable, please explain why.

    Not applicable.
    Same as above.

(Reference SMARA 3708)

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31. Describe the reclamation procedures used to ensure adherence with the specified requirements for building, structure and equipment removal. Additionally, indicate on the map (Items 19 - 20) or on diagrams, as necessary, the following:

    a. Where all equipment, supplies and other materials will be stored.
    b. Identify which buildings, structures, and equipment will be: (1) dismantled and removed offsite and/or (2) remain onsite as consistent with the approved end use.
    See Attached (page 34).

(Reference SMARA 3709 and 3502(b)(5))

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32. Describe soil conditions. Elaborate on the reclamation procedures used to ensure adherence with the specified requirements for topsoil salvage, maintenance and distribution.
    See Attached (page 35).

(Reference SMARA 3711, 3707(b) and 3503(f) and (a)(2))

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33. Describe how contaminants will be controlled and mine waste will be disposed of (i.e., refuse, fuel storage, tailings, etc.), especially with regard to surface runoff and groundwater. Indicate on map (Items 19 - 20) or on diagrams, as necessary.

See Attached (page 35).

(Reference SMARA 3712 and 2772(c)(8)(a))

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34. Describe the reclamation procedures used to ensure adherence with the specified requirements for closure of surface openings. If not applicable, please explain why.

All water wells and monitoring wells will be properly abandoned or converted to alternative uses. Existing surface openings not destroyed in the mining process and located within the project area will either be fenced or will be destroyed and the surrounding area reclaimed.

(Reference SMARA 3713)

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35. Financial Assurances

Upon approval of the surface mining permit and reclamation plan and prior to commencement of surface mining operations, financial assurance(s) ensuring that reclamation is performed in accordance with the surface mining operation's approved reclamation plan must be submitted to and approved by Kern County. Financial assurances may take the form of surety bonds, irrevocable letters of credit, trust funds or other forms of financial assurances specified by the State Mining and Geology Board and Kern County.

Financial assurance instruments shall be made payable to "Kern County or the Department of Conservation." The financial assurance may also be made payable to additional public agencies, including federal agencies responsible for enforcing reclamation requirements over the mining operation. Financial assurances, along with a copy of the itemized reclamation cost estimate ***(based on the approved reclamation plan)***, must be submitted to Kern County for review and approval prior to commencement of mining operations. The amount of financial assurances required of a surface mining operation for any one year shall be adjusted annually to account for new lands disturbed by surface mining operations, inflation and reclamation of lands accomplished in accordance with the approved reclamation plan.

Golden Queen will post a bond, irrevocable letter of credit or other acceptable instrument which will guarantee completion of project reclamation to the satisfaction of Kern County and the State of California Department of Conservation.

The total proposed project will result in approximately 930 acres disturbed of which 419 acres will be reclaimed. The reclamation costs, expected after two years of project development, are itemized in Table 4.

RECLAMATION PLAN: (continued)

35. Financial Assurances (continued)

The permit application shall include a detailed, itemized estimate of reclamation costs. ***The assumption when preparing the estimate is that the mine operator is incapable of performing the work or has abandoned the surface mining operation, thereby resulting in the County or State hiring an independent contractor to perform the reclamation work.*** At a minimum, the detailed itemized estimate of all associated reclamation costs shall include, but is not limited to:

a. Costs of backfilling, regrading, slope stabilization, and recontouring.
b. Costs of revegetation and wildlife habitat replacement, including any monitoring.
c. Costs of final engineering design.
d. Costs of labor, including supervision.
e. Costs of mobilization.
f. Costs of equipment.
g. Costs of removal of buildings, structures, and equipment.
h. Costs associated with reduction of specific hazards, such as: heap leaching facilities, chemical processing ponds, soil decontamination, in-water slopes, highwalls, landslides, subsidence, or other mass ground failure.
i. Costs of drainage and erosion control measures.
j. Costs of soil tests.
k. Costs of haul road ripping and reseeding.
l. Costs of fencing.
m. Costs of liability insurance.
n. Costs of long-term stabilization, control, containment of waste solids and liquids.

(Reference SMARA 2773.1)

FOR OFFICE USE ONLY

Date Accepted: initial 6/5/96 revised 5/30/97 Received By: SFD

Case # 41 & 22 Map # 213 & 214 S.D. # 2
Floodplain C Zoning Ord. Sec. 19.14.030.G & 19.16.030.H
G.P/S.P Soledad Mtn/Elephant Butte Yes Consistent ___ Not Consistent
Element or Name

Reviewed By: Scott F. Denney, Associate Planner

NOTES: EIR required for project pursuant to Section 21151.7 of CEQA. * = minimum fee. W/O # PP96238

FEES

Case $600 *
Env'l $1100 *
Other $165

Other ______

Total $1865 *

Recpt # 159783

Attachments

STATEMENT OF RESPONSIBILITY

In consideration of approval by the Board of Zoning Adjustment of the County of Kern of this application for a Surface Mining Permit and/or Reclamation Plan, the undersigned, jointly and severally, hereby covenants with Kern County as follows:

(1) That all of the provisions of said permit and/or plan and any and all conditions appended thereto shall be faithfully performed and completed by the undersigned within the time therein provided, or within any additional time as may be allowed pursuant to the Ordinance Code of Kern County (Chapter 19.100).

(2) That the obligations of the undersigned to perform and complete the provisions of said permit and/or plan, including any and all conditions appended thereto, shall be subject to the provisions of said Ordinance Code which are incorporated herein by reference.

(3) That the place of performance by the undersigned of the covenants herein shall be the County of Kern, State of California.

(4) That any notice required to be given, or otherwise given to the undersigned may be by personal service or by ordinary United States mail, postage prepaid, and addressed to the agent, or any of the agents, named in paragraph 7 of the application filed by the undersigned.

Dated this 8th day of January, 19 97 .

R.W. Graeme

R.W. Graeme, Vice President of Operations

for Golden Queen Mining Co., Inc.
(Permittee(s) herein)

(Reference SMARA 2772.C.10)

PLANNING & DEVELOPMENT SERVICES DEPT.
TED JAMES, AICP, Director
2700 "M" STREET, SUITE 100
BAKERSFIELD, CA 93301
Phone: (805) 861-2615
FAX: (805) 861-2061

RESOURCE MANAGEMENT AGENCY
JOEL HEINRICHS, AGENCY DIRECTOR
Air Pollution Control District
Engineering & Survey Services Department
Planning & Development Services Department
Transportation Management Department
Waste Management Department

Dear Applicant for Development Project:

The California Legislature has passed a law that requires persons applying for development projects to review a listing of all hazardous waste sites. If the site of your proposed development project is included on the list of hazardous waste sites, then it shall be so noted. Please review the list of hazardous waste sites (enclosed) and sign the Verification Statement below. A copy of the law requiring this verification is also enclosed for your reference.

VERIFICATION STATEMENT

(Review of list related to hazardous waste sites)

I, Steven W. Banning, as applicant for a development project, have reviewed the lists of projects relating to hazardous wastes pursuant to Section 65962.5 of the California Government Code. The proposed site ~~(is)~~ (is not) included on the list.

Not Applicable
List (if applicable)

Feb. 28, 1996
Date

Signature
Steven W. Banning, President
Golden Queen Mining, Co., Inc.

FORM72.PDS (2/1/93)

13. **Current Land Use** - The primary land use within the project area consists of mineral exploration, mineral development and open space. The zoning within the project area is administered by the Kern County Planning Department. The zoning district for each of the areas in which Golden Queen has acquired an interest is shown below:

Township 11 North, Range 12 West, SBBM

Section 32	A-1 (Limited Agriculture)

Township 10 North, Range 12 West, SBBM

Section 5	A-1 (Limited Agriculture)
Section 6	A-1 (Limited Agriculture)
Section 7	A-1 (Limited Agriculture)
Section 8	A-1 (Limited Agriculture)
Section 18	A-1 (Limited Agriculture)

Township 10 North, Range 13 West, SBBM

Section 1	E (2-½) RS (Estate & Residential Suburban Combining)
Section 12	A (Exclusive Agriculture)

General Plan -The majority of the project area lies within the "Specific Plan for Soledad Mountain - Elephant Butte and Vicinity - South of Mojave," which was adopted by the Board of Supervisors of the County of Kern, State of California by Resolution 73-278, and subsequently, Resolution 73-485 was adopted by the Board of Supervisors on June 18, 1973 to correct clerical errors in the plan.

Legal Restraints - All surface and mineral rights have been obtained. Kern County has a specific zoning plan for Soledad Mountain - Elephant Butte and Vicinity, South of Mojave. All applicable recommendations and guidance contained in the Specific Plan will be incorporated in the design and operation of the proposed project. No private legal challenges are expected.

Five structures are located within the proposed disturbance area. Two of the structures were used as residences. One of the residences has been converted for use as an office. The other residence will be converted to office space at a later time. A former workshop will be used for storage. The remaining two structures will be demolished.

Recreation - The BLM properties in the vicinity of the Soledad Mountain Project consist of islands of land surrounded by private ownership. Most private owners have fenced, gated, or posted their lands restricting access. There are no identified BLM routes for off-highway vehicles (OHV) in the project area. There is limited hiking on the BLM-managed land and some unauthorized OHV use of the desert lands north and west of the project site. Hunting, shooting and other recreational uses are restricted in the project area by the private owners.

Soils - A soil inventory was conducted between August 1989 and May 1990, and in May 1995. The inventory (shown in Attachment B) identified four soil types in the project area, the characteristics of the soil types and the suitability of the soil and substrate material for reclamation. The four soil types are summarized as follows:

Arizo (104) - A sandy loam with 40 percent gravel and small stones to 50 percent stones and cobbles with depth. The soil is loose and friable with good permeability and high wind erosion potential and soil salvage is limited by coarse fragments, texture and nutrient status. Arizo soil is generally located on alluvial toe slopes and fans around the base of Soledad Mountain.

Cajon (114, 116) - A light brown to brown, loose friable, gravelly loam to loamy sand with fine roots containing 15 percent gravel. Gravel content decreases with depth. The soil permeability is very good and wind erosion potential is very high, and salvage is limited due to coarse fragments. Cajon soils are located on alluvial fans and plains with 0 to 4 percent slopes to the west and south of the base of Soledad Mountain.

Rosamond (172) - A reddish to light brown, sandy loam to gravelly sandy loam with moderately slow permeability and high erosion potential. The soil contains 10 percent gravel and is located on the flat areas to the west of Soledad Mountain with slopes of 0 to 2 percent.

Torriorthents (185) - Weathered rock outcrop and shallow to deep residual soils from host rock on the mountain which are not of any one classification series. Soils consist of clay loam to cobbly, loamy sand with up to 60 to 70 percent rocks and cobbles, with permeabilities ranging from moderately slow to moderately rapid, and moderate erosion potential.

Soils on and around Soledad Mountain have been mapped by the United States Soil Conservation Service (SCS, 1981). A general soil map of the site by Bamberg Associates is included in Attachment B. In spite of steep slopes on the mountain, few evidences of slope or soil instability in the form of slides, soil creep or solifluction lobes have been identified.

Vegetative Resources - Plant species found at the project site on Soledad Mountain are typical for the western Mojave Desert area. The plant species are hardy desert shrubs and sub-shrubs which generally grow year round when moisture is available. Annual species which are fall germinating and grow throughout the winter and spring seasons are also present. The major vegetative species at the site have been summarized by Bamberg and Hanne, 1995 (Attachment B).

The lower slopes and alluvial fans in the project area contain a desert shrub/scrub type vegetation with creosote bush the dominant plant species and secondary cover consisting of burrowbush, aster, goldenhead and joint-fir. The plant cover on the lower slopes ranges from 20 to 26 percent and averages about 23 percent.

The mid-slope and upper slope areas of the site are sparsely vegetated by a mixed shrub community with plant species, including hopsage, winterfat, buckwheat and cattle spinach. The scant vegetation on the upper slopes is fairly diverse and varies widely depending on the exposure and soil moisture conditions, as well as previous disturbances, such as mining and burning. Cover in the mixed shrub community of the mid and upper slope ranges from 10 percent in burned areas to 49 percent in other areas.

There were no threatened or endangered species identified on the project site. The Joshua tree, beaver-tail cactus and golden cholla cactus which have been identified on the project site are salvage protected under the California Desert Native Plants Act and will be handled appropriately.

Wildlife Resources - The wildlife species present at the project site are typical for desert habitats. General wildlife populations are low due to the arid climate and alteration of habitats by historical mining, recreation and fires. Surveys of the wildlife species present at the site were conducted by Bamberg and Hanne, 1995 (Attachment B).

The presence of mammals on the site was confirmed by either observation or other signs, such as burrow, scat, tracks or skeletal remains. Predators that inhabit the site include the coyote, bobcat, ring-tailed cat, gray fox and possibly badger. Predators use the site as part of their hunting territory and some may den on the mountain during breeding season.

Small animals on the site, which are typical of the desert scrub habitat, include antelope ground squirrel, jackrabbit, cottontail rabbit, kangaroo rat, woodrat and several species of small rodents. Bird species common to the site include the raven, rock dove, violet green swallow and sparrows. Large birds include the golden eagle, turkey vulture, red-tailed hawk and peregrine falcon. Reptile species common in the study area include the side-blotched lizard, desert iguana, gopher snake and Mojave rattlesnake.

Four animals known to exist in this type of habitat are of possible concern from the threatened or endangered species lists for the federal and California agencies. These species are Townsend's big-eared bat, pallid bat, the desert tortoise and the Mohave ground squirrel. Surveys were conducted for each species and none were found, as noted in Bamberg and Hanne, 1995, and Bamberg, 1997 (Attachment B). A second survey for bats was conducted in August and October 1996 (Attachment B). At least two unidentified species of bats were observed in the project area. A winter bat survey was conducted in early January 1997 (Attachment B), to determine if bats are hibernating in the mine workings. No indication of bat hibernation was found. Therefore, these species are not considered threatened or affected by the proposed action.

Surface Water - The site is located in the northern portion of the Antelope Valley Groundwater Basin. The average annual rainfall at the site is approximately 6.14 inches. Surface drainage at the project location is greatly influenced by the site topography, which varies from steep, rugged hillsides on the upper elevations of Soledad Mountain to a gently sloping desert floor on the flanks. Drainage in the project area on the north side of Soledad Mountain is through a series of deeply incised gullies and channels which are primarily fed by precipitation from winter storms and infrequent summer thunderstorms. Runoff from the project area is channeled to the north, northwest and northeast of Soledad Mountain, eventually draining north and east to the Gloster and Chaffee Hydrologic Areas of the Antelope Hydrologic Unit.[1]

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[1] Regional Water Quality Control Board - Lahontan Region, 1994, *Water Quality Control Plan for the Lahontan Region*.

Surface water beneficial uses identified within the hydrologic area include municipal, agricultural, groundwater recharge, water contact recreation, non-contact recreation, warm freshwater habitat and wildlife habitat.[1] Minor wetlands have been reported well outside the project area with similar beneficial uses.

The project area does not contain any surface waters, including springs, seeps or intermittent streams. The nearest intermittent stream is located approximately three miles to the west of the project site. Oak Creek, an intermittent stream which is one of the primary sources of recharge in the area, is located approximately five miles west of the project site. All precipitation which does not evaporate will percolate into the Antelope Valley groundwater (the designated receiving water). No site-specific information on water quality surface flow is available.

Groundwater/Water Supply - The site is located in the northern area of the greater Antelope Valley Groundwater Basin in the Chaffee subunit[2] or in the Gloster subunit.[3] Limited amounts of groundwater may occur in the fractured crystalline and volcanic bedrock that forms Soledad Mountain, although groundwater has not been noted in the exploration boreholes or the mine shafts. The primary aquifer in the area is the alluvium which fills the areas between bedrock outcrops. Groundwater recharge is primarily from the Tehachapi Mountains via intermittent streams, such as Cache Creek and Oak Creek. The alluvial aquifer is generally poorly consolidated to unconsolidated and composed of silt, sand, gravel and boulders. Beneficial uses of the groundwater basin include municipal, agricultural, industrial and freshwater replenishment.

Available data indicates that total dissolved solids in the groundwater of the area ranges from approximately 200 to 500 mg/l.[4] The dominant anions appear to be

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[2] Ibid.

[3] Duell, Lowell, F. W., Jr., 1987, *Geohydrology of the Antelope Valley Area, California and Design for a Groundwater Quality Monitoring Network*. U.S. Geological Survey, Water Resources Investigations Report 84-4081, 72 pp.

[4] Water, Waste & Land, Inc., 1990, *Hydrology Study Summary for the Soledad Mountain Project.*

sulfate and bicarbonate with concentrations on the order of 100 to 200 mg/l. Chloride concentrations are in the range of 10 to 40 mg/l. Calcium is the predominant cation with concentrations generally ranging from 50 to 100 mg/l followed by sodium with concentrations on the order of 40 to 50 mg/l. Arsenic concentrations in groundwater in the vicinity of Soledad Mountain often exceed the maximum contaminant level of 0.05 mg/l.

As reported by Water, Waste & Land, Inc., 1990, water wells in the area are mostly very low yield wells, on the order of 20 to 40 gpm and are bottomed at less than 300 feet. A water supply well drilled for the project was pump tested at multiple rates from 500 to 750 gpm. One well located one to one and one-half miles northwest of the project site in Section 36, Township 11 North, Range 13 West, known as one of the Gillis wells and designated #25 by Water, Waste & Land, Inc., reportedly tested at a rate of water withdrawal up to 750 gpm. The thickness of alluvium at location #25 was greater than 630 feet, with effective thickness below the water table between 250 and 350 feet. Other wells, a few miles north and west of Soledad Mountain, reportedly tested at rates of 300 gpm or more, and Mojave Public Utility District wells in Section 22, Township 11 North, Range 12 West tested at rates from 250 to 1,000 gpm. A groundwater elevation map, constructed from 1990 groundwater data, indicates a gradient generally from west to east, with local north to south components.

Meteorology - The proposed project is located in Kern County in the Mojave Desert Air Basin. The Mojave Desert Air Basin includes some of the hottest and driest portions of California. The air basin is separated from the coastal regions by two mountain ranges, which provide a climatological boundary. Relative humidity in the desert during summer is very low, with humidities below 10 percent common in the hottest part of the day.

Temperatures can exceed 100o degrees Fahrenheit for 60 to 70 days per year, between May and September, with almost no rainfall. Seasonal differences are noted principally by differences in temperature with hot, dry summers and mild, dry winters. Diurnal variations of approximately 30 degrees Fahrenheit can occur throughout the year. Wintertime temperatures are cool, with highs in the 50's during the day, and lows dropping into the 30's or less at night.

Annual average rainfall in Mojave, located approximately five miles northeast of the project site, is 6.14 inches per year, and in Palmdale, located approximately 25 miles south, is 6.95 inches per year. Table 2 shows monthly rain and temperature information from nearby locations. Onsite meteorological data, collected between October 1989 and August 1991, indicates that typical winds at the proposed project site are out of the northwest, representing flow from the San Joaquin Valley.

Topography - The topography of the western Mojave Desert in the area of the site varies from relatively flat alluvial areas to steep mountains. Elevations vary from approximately 2,000 feet above mean sea level in the flat alluvial-covered areas to over 5,000 feet in some of the mountainous areas. Soledad Mountain is a volcanic peak approximately three miles in diameter. The topography of the project area consists of rugged outcrops and ridges with intervening drainage which grade to alluvial slopes and flat areas on the flanks of Soledad Mountain. The elevation of the project area varies from 4,190 feet above mean sea level at the peak of Soledad Mountain to approximately 2,700 feet above mean sea level along the northeast flank.

Surface disturbances which predate the proposed project include the original Gold Fields of South Africa mines as well as other shafts, trenches, tailings, dumps, open stopes, adits and other facilities associated with the numerous small claims that have historically been worked throughout the project area. Approximately 215 acres of existing surface disturbance are located within the project area.

Cultural and Historical Resources - Soledad Mountain was the scene of previous mining efforts. There were three main periods of development. From approximately

1894 to 1910, there was major prospecting and development. The Karma, Queen Esther and Echo mines were in operation with mills onsite. The Eagle Group and Bobtail Claims were operating, but the ore was taken to offsite mills. During the Depression years until 1942, there were numerous small-scale mining efforts and all ore was hauled to Tropico for milling. In recent years, there has been a limited amount of mining and exploration.

The early operations involved the establishment of small living groups on Soledad Mountain. The remains of buildings, mining equipment and residences are evident on the property. Phase I Archaeological Surveys of the Golden Queen Mine Project Area, Mojave, Kern County, California and Phase II Test Excavations and Determinations of Significance on Soledad Mountain, Mojave, Kern County, California for private property within the subject area were prepared by W & S Consultants. A Class III Inventory of the Golden Queen Mine Project Area, Mojave, Kern County, California was prepared for all federal lands within the project area by W & S Consultants. The archaeological studies are treated as confidential information and will be distributed accordingly.

As a result of the archaeological investigations, one prehistoric site and 10 historical sites were identified on private property, one historical site was identified and two previously identified sites were reviewed on federal land, and one historical site was identified on both private and federal land within the project boundaries. Mitigation for these sites will be incorporated in the EIR/EIS document.

Visual Resources - The landscape characteristics, or form, of the project area consist of broad, relatively flat alluvial areas with steep hills/mountains rising above the desert floor at various locations. Soledad Mountain, the project site, is a volcanic peak approximately three miles in diameter rising more than 1,000 feet above the surrounding desert. The visual line, the path the eye follows, is predominately horizontal. The flat, broad valleys allow long distance views and the horizontal line results from the contact of the ground and vegetation with the sky.

The line is broken by vertical changes such as Soledad Mountain. The landscape color consists of browns, tans and grays. Vegetation colors are generally browns, greens, yellows and tans. Because of the limited vegetation cover, landscape colors meld with vegetation colors from distant view points.

The significant majority of the visitors to the project site will be mine employees, contractors and other mine-related personnel. Access to the actual mining operations will be limited by the company for safety and security reasons.

The project area is visible from major travel routes along State Routes 14 and 58 passing through the Mojave area to the north and east of the project site. The project area is also visible from a county road, Silver Queen/Mojave-Tropico Road, which provides access to the project site and borders the north and west sides of the project site. The project area is in the foreground from the local road and in the background from the state highways.

16.b. The 1995 level of traffic on State Route 14 at Silver Queen Road was approximately 15,000 average daily trips (ADT). The ADT on Silver Queen Road in 1995 was 410. Transport of overburden materials for sale is expected to add 70 ADT's to traffic on State Route 14 and Silver Queen Road. Approximately 100 trucks per month (seven ADT) will deliver supplies to the site. Approximately 412 ADT will be added during construction, and 368 ADT will be added while in normal operations from workers traveling to and from the facility.

All haul roads onsite will be watered to reduce dust emissions. Because of the varying lengths of the roads, determination of ADT for onsite vehicles is very difficult.

17.a. The mined ore will be trucked to a four-stage crushing plant where it will be crushed to nominally minus 10 mesh particles. The crushed ore will be agglomerated with cement and barren solution and stacked on the heap leach pad. Precious metals will be leached from the ore by a dilute cyanide solution. The pregnant solution will be contained inside the heap until it is pumped to the Merrill-Crowe processing plant to recover the precious metals.

Spent ore, which will be left on the heap leach pad, will be rinsed until the following general requirements of the Lahontan Regional Water Quality Control Board have been met:

- Weak Acid Dissociable (WAD) cyanide in effluent rinse water less than 0.2 mg/l.
- Contaminants in any effluent from the processed ore which result from percolating meteoric waters will not degrade surface or groundwater.

The ore on the heap leach pad will be neutralized, graded, resoiled and seeded. Neutralization of the heap leach pile will be accomplished by rinsing to reduce cyanide levels to meet the WDR requirements to be issued by the Lahontan Regional Board prior to operation. With agreement from the Lahontan Regional Board, the time required for neutralization may be reduced by supplemental destruction of cyanide achieved by chemical, biological or other acceptable and demonstrated technologies. The supplemental technology that may be best suited for use at the Soledad Mountain Project will depend upon specific site conditions at the time of neutralization. Sampling and laboratory testing will be conducted to evaluate the neutralization process at the conclusion of heap rinsing. Once neutralization of the heap leach pile has been completed, all process waters and rinse solutions will be neutralized and disposed of by either evaporation or application to land in accordance with RWQCB requirements.

After rinsing and neutralization is complete, the top of the heap will be graded with a slight crown to reduce the amount of precipitation which will be retained on the heap and percolate through the spent ore. The side slopes of the heap leach pile will be dozed to a 2:1 (horizontal to vertical) and the down slope will be dozed to a

2.5:1.0 (horizontal to vertical) finished slope. Some benches will be retained on the slope face to facilitate drainage and erosion control.

24. The overburden piles will be constructed at about 1.5:1.0 (horizontal to vertical) working slopes. This slope is the approximate natural angle of repose for this material. During the operating life of the project, the public safety will be protected by keeping the toes of these slopes back from the property line a sufficient distance to prevent any potential slope failure from damaging adjacent property. At the close of operations the overall slope of the overburden piles will be reduced to 1.8:1.0 (horizontal to vertical) to assure long-term stability of the piles.

Public safety will be enhanced after reclamation when the spent ore heap will be rough graded and contoured to reduce slopes. Stabilization of the heap landform will be achieved through regrading and slope reduction. The decommissioned and salvaged facilities sites such as offices, shops, laydown and boneyard sites will be ripped, contoured and seeded. After decisions have been made as to which roads will be abandoned and reclaimed, culverts will be removed and the roads will be graded for sloping and drainage reestablishment. Safety berms and ditches will be graded and filled to create contours that blend with the landscape. The compacted surfaces of the roads will be ripped, and water catchment basins established where possible. At the completion of reclamation, fencing will be left around areas where beneficial for natural vegetation and/or in restricted areas to block access in order to minimize hazards to public safety. Public health will be protected by neutralizing the cyanide solution when the leach process is complete and before revegetating the heap. Post-closure activities on the site should not have any adverse health impacts.

Permits relating to public health and safety required during operations include:

1) Bureau of Alcohol, Tobacco and Firearms Permit for purchase, storage or transportation of explosives.

2) State Water Resources Control Board Regional Water Quality Control Board Storm Water Permit.
3) State Water Resources Control Board Regional Water Quality Control Board Waste Discharge Permit.
4) California Occupational Safety Health Administration Construction Permit.
5) California Occupational Safety Health Administration Explosive Blaster's License.
6) Kern County Fire Department Hazardous Materials Business Plan.
7) Kern County Fire Department Hazardous Materials Inventory.
8) Kern County Fire Department Fire Protection Plan.
9) Kern County Air Pollution Control District Authority to Construct.

25. Plant species found at the project site on Soledad Mountain are typical for the western Mojave Desert area. The plant species are hardy desert shrubs and sub-shrubs which generally grow year round when moisture is available. Annual species which are fall germinating and grow throughout the winter and spring seasons are also present.

No threatened or endangered species have been identified on the project site. No wetlands, marshes or other environmentally-sensitive habitat areas have been identified on the project site. There is no "specimen tree" or other tree with historic value located on the project site.

Except for approximately 221 acres of disturbed area covered by the open pits, reclamation activities at the site will minimize the overall impacts to vegetation.

- A revegetation plan for the Soledad Mountain Project has been prepared by Bamberg Associates.
- Seeds will be collected from plants onsite for use in conjunction with growth media for revegetation of disturbed areas. Test plots will be constructed during the first two years of operation or when areas become available to evaluate the

success of various revegetation techniques and determine the best technique for use in final reclamation and revegetation of the project site.

- Test plots will be established to evaluate reclamation of disturbed areas with native shrubs and other plant species.

The wildlife species present at the project site are typical for desert habitats. General wildlife populations are low due to the arid climate and alteration of habitats by historical mining, recreation and fires. Surveys of the wildlife species present at the site were conducted by Bamberg and Hanne, 1995 (Attachment B). No threatened or endangered species have been identified on the project site.

Four animals known to exist in this type of habitat are of possible concern from the threatened, endangered or special concern species lists for the federal and California agencies. These species are Townsend's big-eared bat, pallid bat, desert tortoise and Mohave ground squirrel. Surveys were conducted for each species and none were found, as noted in Bamberg and Hanne, 1995, and Bamberg, 1997 (Attachment B). A second survey for bats was conducted in August and October 1996 (Attachment B). At least two unidentified species of bats were observed in the project area. Therefore, these species are not considered threatened or affected by the proposed action.

Impacts to wildlife habitat by the surface disturbance associated with construction and operation of the project will be minimized by disturbing only the areas necessary to construct and operate the project.

The boundaries of the area required for construction and operation will be clearly marked to prevent unnecessary disturbance. Off-road vehicle traffic will be restricted. These steps will aid in preserving the biologic diversity of the site.

26. Exhibit 4 presents a conceptual plot plan of the facilities proposed at the project site showing the proposed locations of the open pit mines, the overburden piles, the heap leach pad and a potential heap leach pad site.

The open pit mining areas will be excavated in volcanic rock. The pit walls will have 20-foot wide safety benches at 60-foot vertical intervals. The resulting overall slope of the pit walls, based on this design, will be 55 to 63 degrees, as appropriate for the area. John Abel Jr., Ph.D. has conducted a slope stability analysis of this design, and his report and two supplements are included as Attachment C. Dr. Abel is an internationally recognized expert in open pit mine stability and a Colorado registered professional engineer, however, he is not a California registered professional engineer. His work has been reviewed by Don Poulter, a California registered professional engineer.

For his review, Dr. Abel directed collection of physical samples of the various rock types and supervised laboratory testing of uniaxial and triaxial compression and direct shear. Over 800 measurements of fractures were made along nine detail lines of fracture mapping covering the major rock types. Dr. Abel utilized a conservative limiting equilibrium slope analysis of the planned 55 degree overall slope angle. The natural fractures provide the potential failure paths for pit wall slope failure. Two modes of potential failure were analyzed: 1) plane shear down a single joint set dipping out of a high wall and 2) wedge shear for the intersection of two joint sets that plunges out of a pit high wall at an angle less than the measured friction angle. The slope stability includes both gravitational loading and the added force developed by the maximum credible earthquake.

The Soledad Mountain topographic high, and the steeply dipping jointing have apparently served to lower the water table in this area of minimal rainfall. Previous underground mining has also provided additional drainage for Soledad Mountain. On this basis, factors of safety for dry 55 degree overall slope conditions have been calculated for the planned pit slopes in the five rock units. The 99.9 percent confidence level factor of safety calculations range from a low of 2.57 to a high of 12.09 under gravitational loading, and from a low of 1.43 to a high of 6.57 under the maximum credible earthquake loading. Dr. Abel concludes that these "factor of safety calculations indicate that all planned Soledad Mountain Project slopes will be stable." Dr. Abel's analysis also indicates that slopes as steep as 63 degrees will be stable in the open pit mining area and these steeper slopes may be used in selected mining areas.

An evaluation of the potential influence of topographic amplification of seismic forces on the stability of the pit slopes was prepared and it was determined that no impact is likely (Attachment C).

Exhibit 6 is a plan map which shows the locations of cross sections made through the current planned mining areas. Exhibits 7 through 11 present cross sections A - A', B - B', C - C', D-D' and E-E', which are sections at various intervals through the facility.

As designed, the greatest depth of mining, approximately 1,300 feet, is represented by the difference between the original ground surface and the projected bottom of the open pit mining area. The actual open pit profile may differ from those depicted on the sections due to ore exposed during mining and the prevailing economic conditions. The approximate maximum linear dimensions of the mine area will be 5,600 feet in length and 4,900 feet in width.

The overburden piles will be built at the natural angle of repose of the materials, approximately 1.5:1.0 (horizontal to vertical) slopes. During reclamation of the site, the overall slope of the overburden piles will be reduced to 1.8:1 (horizontal to vertical). Growth media, if any, will be removed from the entire area of the final footprint at the start of the project to prevent the growth media from being lost.

Slopes will be shaped for reclamation depending on the type of material, erodibility and configuration left by the mining process. The slopes of the final pit walls will be 55 to 63 degrees, as appropriate for the area (Exhibit 12). The down slope portion of the heap leach will be 2.5:1.0 (horizontal to vertical), and the side slopes will be 2.0:1.0 (horizontal to vertical) (Exhibit 13). The slopes of the overburden piles will be graded to 1.8:1.0 (horizontal to vertical) (Exhibit 12). After closure, the pit high walls will be left in a safe and stable configuration, subject to natural processes.

27.a. The vegetation on and around Soledad Mountain is a desert shrub-scrub type adapted to a climate of low, unpredictable precipitation and hot, but variable, temperatures. The adaptations of the native species to the climate include a quick response to rainfall and extended dormancy periods. The dominant vegetation type on the lower alluvial fans and flats is a creosote bush shrub-scrub with widely scattered Joshua trees. The vegetation on the mountain slopes is a mixed shrub-grass type dominated by species adapted to rocky substrates and cooler conditions. These species are common in desert mountain ranges and have affinities to the Great Basin deserts to the north.

Plant communities on portions of Soledad Mountain are extensively disturbed by previous mining activities and mineral exploration. In addition, nearly all the lower slopes, sides and top of the mountain have been altered by frequent burns which change and reduce the shrub cover and increase annual grasses and weeds. Lower plant productivity is the result. There are a few rare areas of undisturbed vegetation on the higher ridges among rock outcrops where burns have not occurred. Sheep have recently grazed in the lower mountain slopes and in the protected valleys and canyons. This grazing was heavy in places in 1990, and had caused a reduction in plant cover.

The Soledad Mountain project site contains plant species (floristics) typical for the western Mojave Desert in Antelope Valley. The plant species are hardy desert shrubs and sub-shrubs which grow year round when moisture is available. Fall-germinating, annual species that grow throughout the mild winter and spring seasons are present. Some shrubs (such as joint-fir, spiny hop-sage and shadscale) grow only at higher altitudes this far south. They are more widely distributed in the Great Basin area to the northeast. We believe this is a result of the cooler temperatures, higher altitude and the steep slopes at Soledad Mountain compared to the lower regions of the Mojave Desert region. Cactus, trees and tall shrubs are not present onsite, with the exception of the Joshua tree and beaver-tail and golden cholla cactus. There is a lack of well-defined drainages or washes, and the type of vegetation characteristic of these washes.

A juniper zone is not present due to the volcanic substrate and the unfavorable dry, warm climate.

There were no threatened or endangered plant species expected or observed on the project site. There were also no unique or different vegetation or habitat types on the site.

27.b. Test plots will be utilized to determine the best combination for enhancing revegetation. Test plot locations will be identified and provided prior to establishment. Table 3 shows the preliminary rate of application for the seed mixture.

27.c. Reseeding will take place at any time of year when the soil is first graded and the surface is loose and friable. This allows the seed to be incorporated into the soil, and germination to take place when the next favorable weather period occurs. Tests of sowing seed at different times of years were not successful, nor did any period, such as fall/winter or spring sowing prove more successful. The germination requirements of a variety of local native species is not well known. Some species germinate after summer rains, some in the fall and others in the late winter or spring period. Seeds can and do remain dormant, but viable, for extended periods of time, as long as 20 years.

27.d. Soil analysis has been conducted. See Attachment B, page 12.

27.e. Table 3 reflects how seeding has been conducted in revegetation testing at other desert mine locations. Rates of application are listed as a percentage of locally available endemic plant species. Percentages reflect local abundance of plant species in the vegetation sampled during the baseline studies. If possible, two banks of seeds will be collected and kept separate; one on the hills and slopes of the mountain, and the other on the lower slopes and flats around the base. These two mixtures will be selectively applied during testing and final reclamation depending on the nature of the reclaimed surfaces.

The seed collected in other revegetation programs has been a mixture of local endemic species of available seed crops. Native seed collected has been on an opportunistic basis, that is, during years of good seed production, seed is collected of all available species. The plant species listed in Table 3 are those known to occur in abundance on Soledad Mountain. This list is not exhaustive, and seed collected during the life of the mine may include minor amounts of local species that produce abundant seed, depending on the year.

Another aspect of the revegetation testing programs used seed available in the upper layers of soil under shrubs and in drainages and depressions. Seeds of desert plant produced in good years fall to the ground and are blown or washed into protected surface locations. These seeds stay viable for long periods of time (up to and exceeding 20 years) and germinate when conditions are favorable. The upper layer of soil and plant debris containing seeds was hand collected and applied to soil surfaces being reclaimed. This store of seed in the soil is always available, even in dry years when little fresh seed is produced. This method of seed collection has produced germination of over 25 species of native plants in recent revegetation trials.

27.f. Optimal time to plant is immediately after the surface has been prepared for revegetation. Seeds sown shortly after surface preparation, while the soil is loose, are easily covered and will remain dormant until sufficient rainfall is received.

The survival and growth of transplanted specimens are generally more successful in the early to late fall period. This allows the plant to become established during the cooler and more moist winter months.

27.g. Irrigation to promote germination is not recommended, since subsequent weather may not be favorable for continued survival and growth.

27.h. Plant protection has not proved to be necessary because of the general absence of large grazing mammals on Soledad Mountain. Rabbits have been observed to graze on new seedlings if these are more succulent than the surrounding vegetation. Long-term monitoring of revegetation test plots at other California locations have not shown rabbit grazing to have a detrimental effect on revegetation success.

27.i. Performance standards are generally determined as a percentage of comparable natural vegetation. The three parameters for comparison are: 1) canopy coverage, 2) density and 3) diversity as species richness. Newly established revegetation on reclaimed mine sites is successional and has a different species composition than in the older, mature natural vegetation. The values proposed in the Reclamation Plan (Attachment D) were 35 percent of the cover, 20 percent of the density and 30 percent of the diversity of the natural vegetation.

The natural vegetation can vary by as much as 400 percent as measured during the baseline biological surveys on Soledad Mountain (an average of 20 percent cover in 1990, after a series of drought years, and an average of 80 percent in 1995, after three years of favorable rains). The monitoring program in the Reclamation and Revegetation Procedures (Attachment D) recommends that the comparison be conducted using concurrent and comparable monitoring in the same year on undisturbed sites on the mountain and in the reclaimed areas using linear transects. Should a natural disaster occur which disturbs all possible comparable monitoring sites, an amendment to the Surface Mining Reclamation Plan could be made which would allow the use of comparable analysis to the 1990 or 1995 baseline surveys. Baseline surveys have established a wide range of these vegetation parameters. This method of concurrent sampling was tried at another mine site, and was an effective and fair means of establishing the values for reclamation performance standards for successful revegetation.

28. Surface drainage at the project location is greatly influenced by the site topography, which varies from steep, rugged hillsides on the upper elevations of Soledad Mountain to a gently sloping desert floor on the flanks. Drainage in the project area on the north side of Soledad Mountain is through a series of deeply incised gullies and channels which are primarily fed by precipitation from winter storms and summer thunderstorms. Runoff from the project area is channeled to the north, northwest and northeast of Soledad Mountain, eventually draining to the Chaffee Hydrologic Area of the Antelope Hydrologic Unit to the west (RWQCB, 1994).

A Site Drainage Plan (Attachment E) has been developed in accordance with Kern County regulations. The Site Drainage Plan has been designed for the 100-year, 24-hour storm event as required by local ordinance, which is greater than the 20-year, one-hour storm event design required by SMARA. The Site Drainage Plan includes the onsite roads, crushing site, process plant site, maintenance site, office site, overburden material piles and site drainage. Portions of the crushing, process, maintenance and office sites will involve engineered fill. These areas are part of the detailed project design engineering which is currently in progress and will be available at a later date to supplement the information presented in this document.

The Site Drainage Plan provides for minimized land disturbance, erosion control through energy dissipation and direction of storm water runoff, away from processing and other mine facilities to sedimentation catchment ponds. The facility is designed as a zero discharge facility. The catchment ponds which will be planted with native vegetation, which will encourage the percolation of storm water into the soil for groundwater recharge.

31. All portable and salvageable structures will be relocated or removed from the site. Permanent structures constructed for the project will be dismantled and removed or converted to another approved continuing use. All foundations will be broken up and buried under at least one foot of clean fill material. All surplus materials, storage containers and trash will be transported to a landfill authorized to accept this material. The remaining waste products and all fuel and similar materials will be removed from the site and disposed of according to state and federal regulations. Any soil material contaminated by regulated waste materials will be disposed of in accordance with state and federal requirements.

All water wells and monitoring wells, if and when abandoned, will be abandoned according to state and county requirements.

32. Four soil types identified on and around Soledad Mountain will be disturbed by the project. Two of the types will be collected for use as growth media. Arizo soil is located in the area of the proposed heap leach pad and other facilities on the north side of the mountain. The top six inches of this material is referred to as growth media by Bamberg Associates in Attachment D because of its seed content, not because of any superior ability to support growth. The proposed open pit mine and overburden piles are to be located in areas covered by Torriorthents. The Torriorthents soil is composed of greater than 50 percent rocks and cobbles and is, therefore, not subject to salvage according to SMARA.

Up to six inches of Arizo and Cajon type soils (approximately 200,000 cubic yards) will be removed from the heap leach pad areas and stockpiled as growth media for use in reclamation and revegetation. Exhibit 4 shows proposed locations for storing growth media. The piles will be approximately 15 feet high. However, Bamberg

Associates describes successful revegetation of overburden materials and heap leach materials without application of growth media.

33. The Site Drainage Plan provides for minimized land disturbance, erosion control through energy dissipation and direction of storm water runoff away from processing and other mine facilities to sedimentation catchment ponds. The facility is designed as a zero discharge facility. The catchment ponds which will be planted with native vegetation, which will encourage the percolation of storm water into the soil for groundwater recharge.

For general reference to the design concept of the proposed pads, the term modified valley-fill heap leach can be used to describe them as dedicated heap leach pads with internal solution control. The heap leach pads will be designed as side hill leach pads with perimeter dikes supporting the toe of the heaps. The dikes will also provide solution storage capacity. Berms will be constructed around those portions of the heap leach pads not enclosed by the perimeter dike. This design was selected for the following reasons:

- The topography is relatively steep with respect to heap stability on a synthetic liner. The toe dike supporting the heap enables the heap to be constructed over the natural topography rather than having extensive earthwork to reduce the pad grade for a stable, unsupported heap.
- One of the most important attributes of the valley-fill concept is the lack of solution ponds exterior to the leach pad. The toe dike will create a pond area for in-heap management of the solutions, runoff from precipitation and retention of the design storm event.
- The lack of barren and pregnant solution ponds minimizes evaporation and hazards to wildlife.

The dike is designed, including allowance for the 100-year storm event, to be no more than 25 feet in height, with the crest serving as an access road. The pad area will be divided into cells by internal berms which will be located such that the storage capacity of the individual cells created by the berms is less than 50 acre-feet prior to the stacking of ore. Based upon this criterion, the dike will not be subject to the jurisdiction of the State of California Department of Water Resources, Division of Safety of Dams (DSDD).

The pad liner system will be constructed as a two-stage composite liner with two distinct sections:

- Down slope portions of each heap leach pad cell will contain standing process solutions and will be lined with an 80 mil High Density Polyethylene (HDPE) top liner and a bottom liner consisting of 12 inches of bentonite amended soils installed with a permeability no greater than 10^{-6} cm/sec. Installed within the amended soil layer will be a leachate collection and recovery system (LCRS) consisting of a geotextile wick drain system that will direct any intercepted liquid to a sampling sump.
- Upslope portions of each heap leach pad cell, which will not contain standing fluid, will be lined with an 80 mil HDPE top liner located directly on top of the 12-inch thick amended soil base installed using bentonite amendment to a permeability no greater than 10^{-6} cm/sec.

This liner system will be in compliance with design requirements for a Group B waste under California Code of Regulations, Title 23, Chapter 15 guidelines. Based on test data, the ore placed on the pads will be classified as a Group B waste during operations and a declassified waste at closure. Final design details will be incorporated in the Report of Waste Discharge which will be filed with the Lahontan Regional Water Quality Control Board.

Initially, three groundwater monitoring wells will be located near the dike outside leach pad number 1, cells 1 and 2. One of the wells will be "up-gradient" from the leach pads. The remainder of the wells will be "down-gradient." The triangular pattern will allow three-point analysis of the local hydraulic gradient. Intra-well and lateral-well statistical comparisons are necessary for constituents of concern. Regionally, "up-gradient" is northwest of Soledad Mountain. Monitoring wells will be added as the heap leach cells are extended to the east and to the additional heap leach pad locations.

Vadose zone monitoring will be done using lysimeters. The lysimeters will be placed under the fluid storage portion of the cells to detect any potential leakage through the liner system. These vadose zone monitors will be placed directly beneath the liner deep enough to exclude condensation moisture resulting from the weight of ore being stacked on the leach pads.

Chemicals will be stored in closed, weatherproof containers in secured, open air or well-ventilated storage areas. All containers will be properly labeled and stored in conformance with state and federal regulations, the Spill Prevention Control and Countermeasure Plan and Golden Queen safety policy. Sodium cyanide in solid form will be delivered to the site in a sealed tanker truck or in sealed 3,000 pound tote bins. The reagent will be off-loaded from a tanker truck by circulating a caustic soda and water solution through the truck tank until the solid sodium cyanide is dissolved and removed from the tanker. Cyanide solution is made from the tote bins by emptying them into an agitated mixing tank containing an alkaline solution. These flow bins are equipped with a bottom-mounted slide door. This slide door only opens over the appropriate mixing tank which prevents accidental discharge and direct operator contact.

Alternatively, sodium cyanide may be received in liquid form as a 30 percent liquid solution. The solution will be off loaded from the truck by pumping the solution from the tanker into the solution storage vessel.

The construction workforce required will be approximately 250 workers. A permanent workforce of about 230 employees, distributed among four crews working 24-hours per day, seven-days per week, will be expected during operation. Golden Queen will provide portable toilet units accessible from all operational areas and will install a septic system designed to accommodate the centralized office and support areas. Permits for the septic systems will be obtained from the Kern County Environmental Health Services Department.

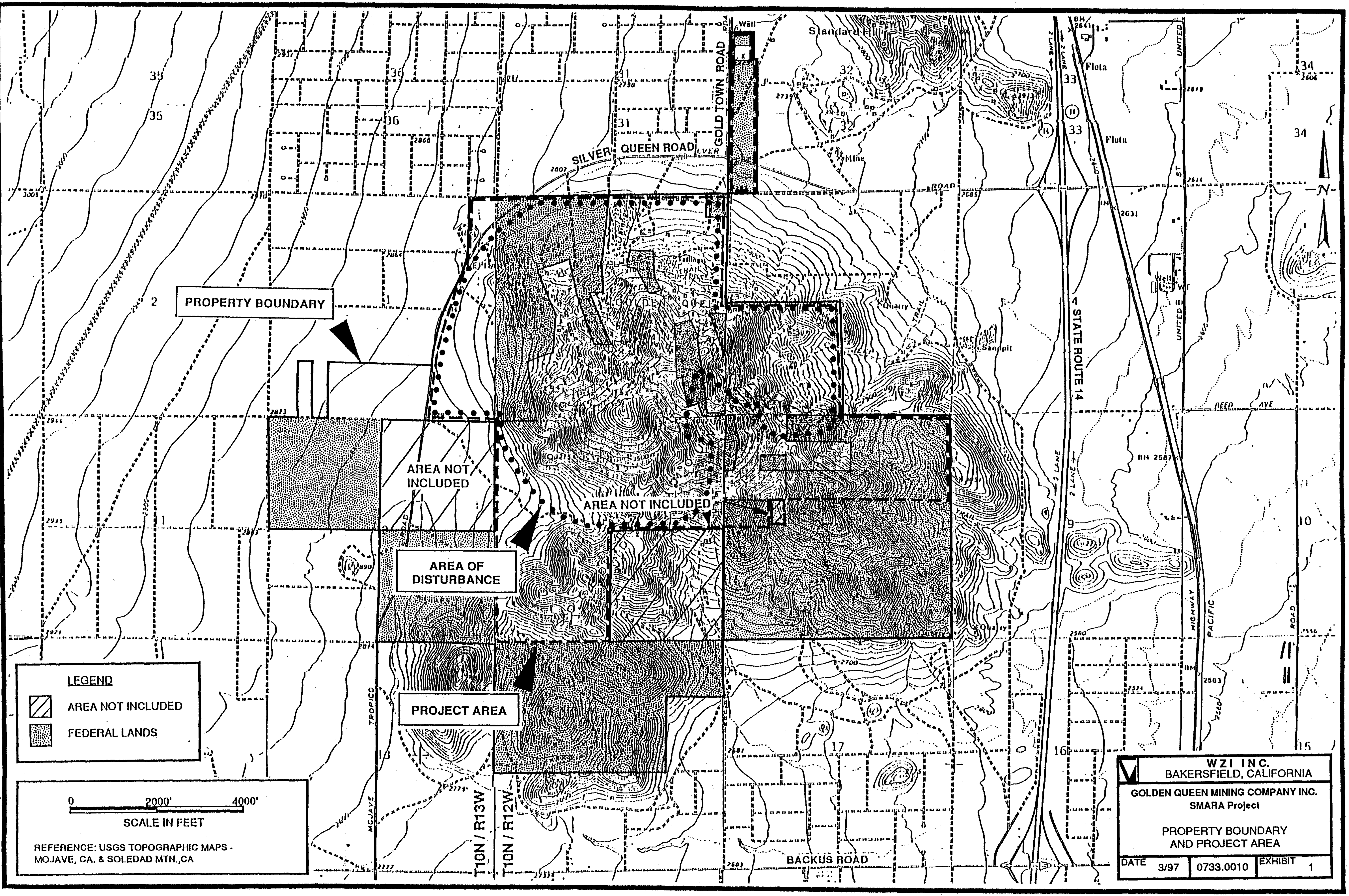
The existing Gold Fields Mill and other miscellaneous structures in the number 1 heap leach pad area will be demolished and all debris will be disposed from the site in accordance with applicable local, state and federal laws and regulations.

Non-mining waste, such as office and lunchroom waste, will be removed from the site by a contract hauler for disposal in an approved landfill. The quantity of this waste is expected to be 10 to 12 cubic yards per week (six to eight tons per month).

Regulated wastes, such as used oil, spent solvents and laboratory wastes, will be manifested and transported from the site by authorized haulers. All wastes will either be recycled or disposed of in accordance with applicable local, state and federal laws and regulations.

The project requires the use of materials which are classified as hazardous. A Hazardous Material Business Plan will be prepared and filed with the Kern County Environmental Health Department. The Hazardous Material Business Plan will contain an inventory of all hazardous materials that exceed the threshold limits of 500 pounds of a solid, 55 gallons of a liquid or 200 cubic feet of a compressed gas. The Hazardous Materials Business Plan will also list the quantity and storage location of the hazardous materials. All materials will be handled, stored and used in conformance with local, state and federal regulations and company safety policy.

Exhibits



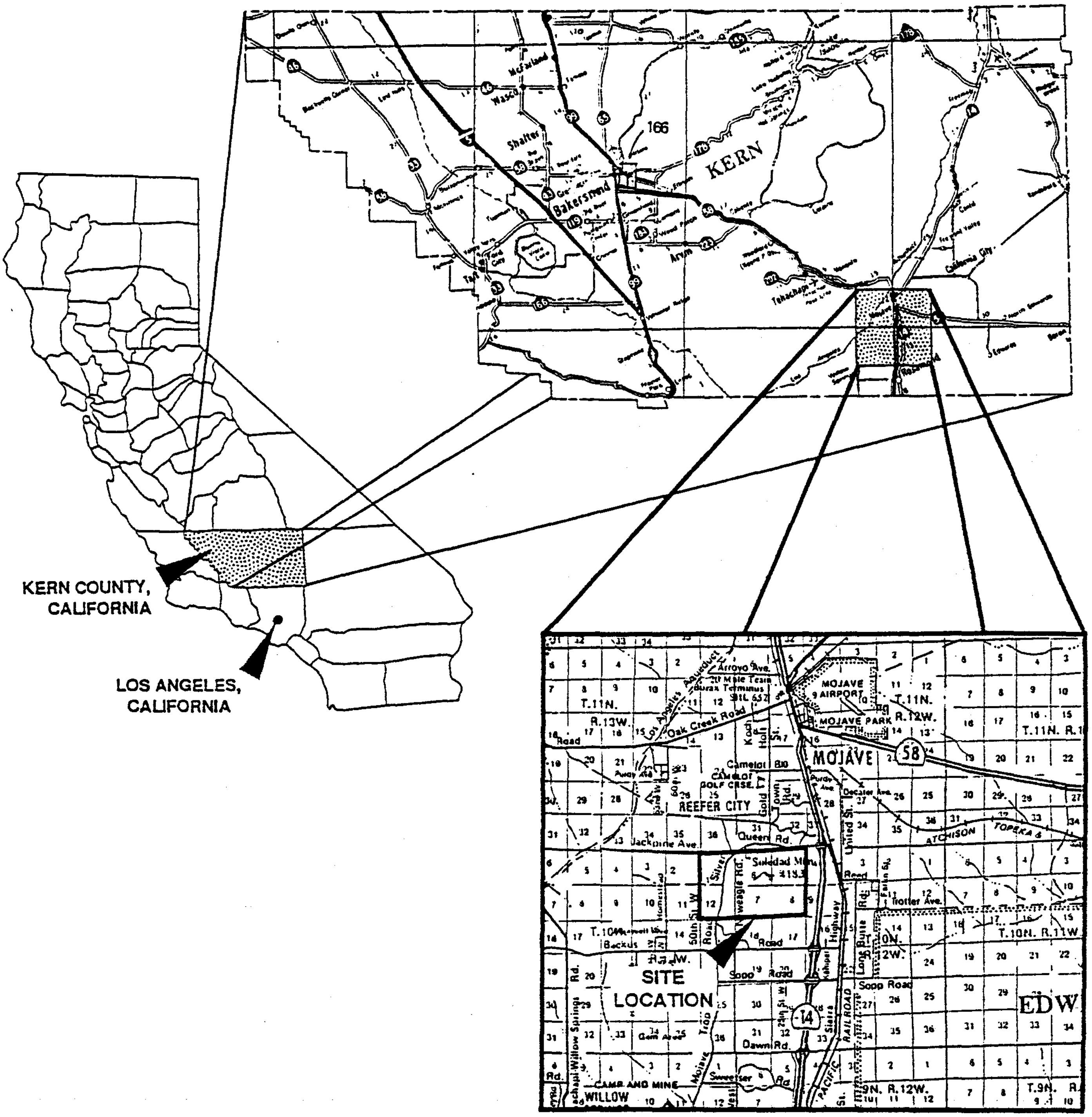
REFERENCE: USGS TOPOGRAPHIC MAPS - MOJAVE, CA. & SOLEDAD MTN.,CA

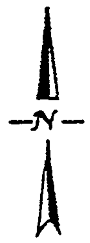
WZI INC.
BAKERSFIELD, CALIFORNIA

GOLDEN QUEEN MINING COMPANY INC.
SMARA Project

PROPERTY BOUNDARY
AND PROJECT AREA

DATE	3/97	0733.0010	EXHIBIT	1



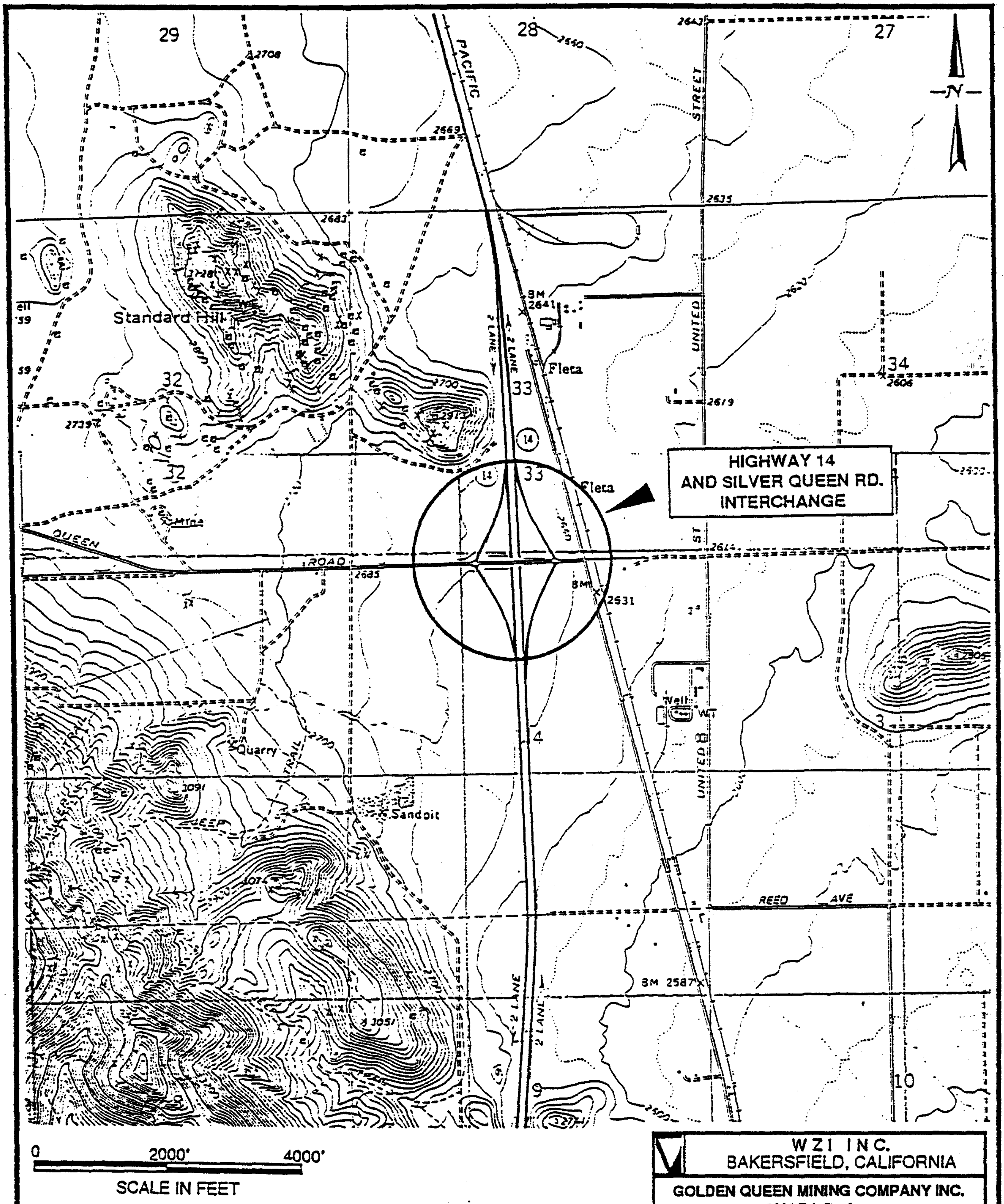


WZI INC.
BAKERSFIELD, CALIFORNIA

GOLDEN QUEEN MINING COMPANY INC.
SMARA Project

REGIONAL LOCATION MAP

DATE 11/96	0733.0010	EXHIBIT 2



HIGHWAY 14
AND SILVER QUEEN RD.
INTERCHANGE

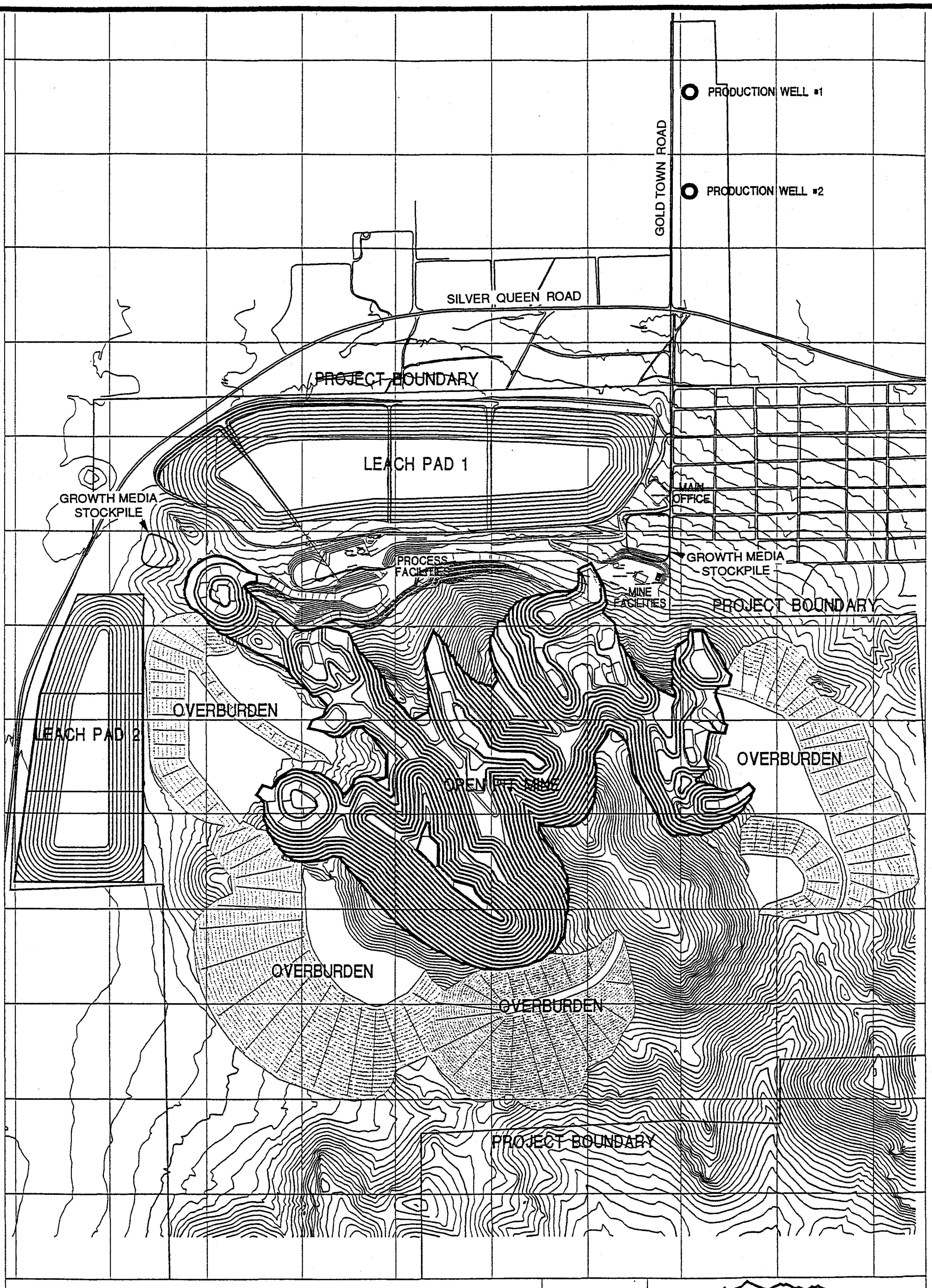
REF: SOLEDAD & MOJAVE U.S.G.S
TOPOGRAPHIC QUADRANGLES

WZI INC.
BAKERSFIELD, CALIFORNIA

GOLDEN QUEEN MINING COMPANY INC.
SMARA Project

INTERCHANGE LOCATION MAP

DATE 11/96	0733.0010	EXHIBIT 3



DESIGNED BY GC Sande	DATE 11/11/96
DRAWN BY GC Sande	11/13/96
APPROVED	
REVISED	
APPROVED	

Golden Queen
MINING CO. INC.

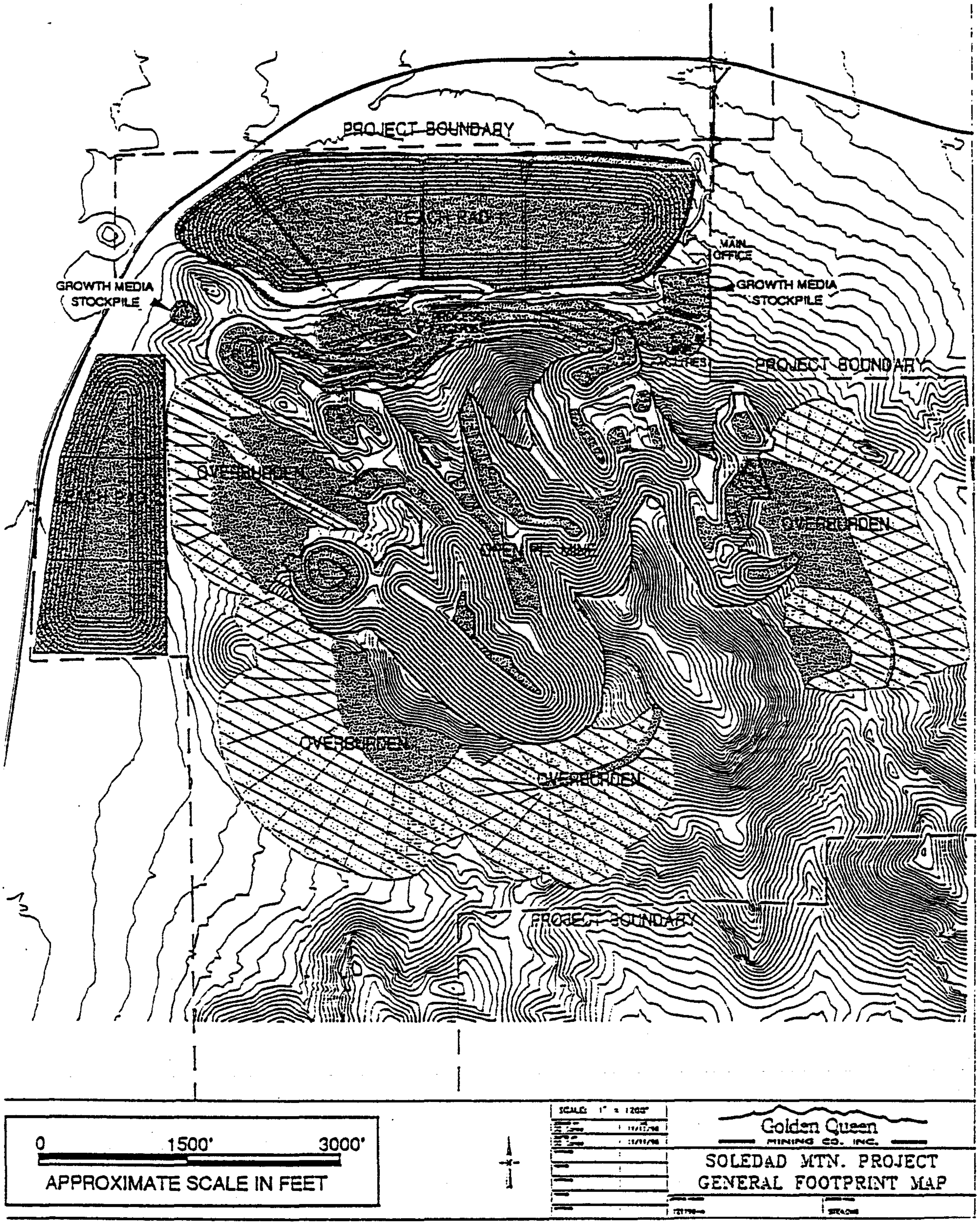
SOLEDAD MTN. PROJECT
GENERAL FOOTPRINT MAP

WZI INC.
BAKERSFIELD, CALIFORNIA

GOLDEN QUEEN MINING COMPANY INC.
SMARA Project

CONCEPTUAL PLOT PLAN

DATE 3/97	0733.0010	EXHIBIT **4**



WZI INC.
BAKERSFIELD, CALIFORNIA

GOLDEN QUEEN MINING COMPANY INC.
SMARA Project

RECLAMATION AREAS

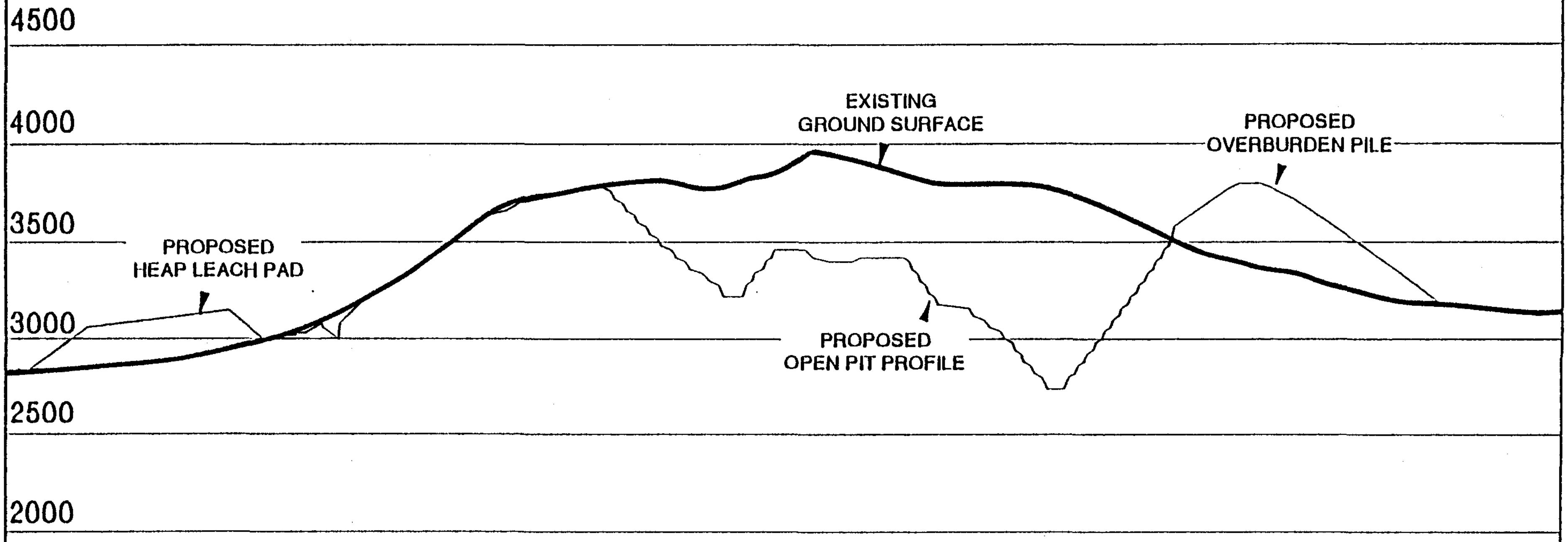
DATE	3/97	0733.0010	EXHIBIT 5

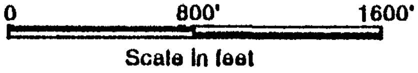
LEGEND

▒ RECLAMATION AREAS SUBJECT TO A REVEGETATION PROGRAM

▨ RECLAMATION AREAS SUBJECT TO GRADING AND NATURAL REVEGETATION

CROSS SECTION
A - A'





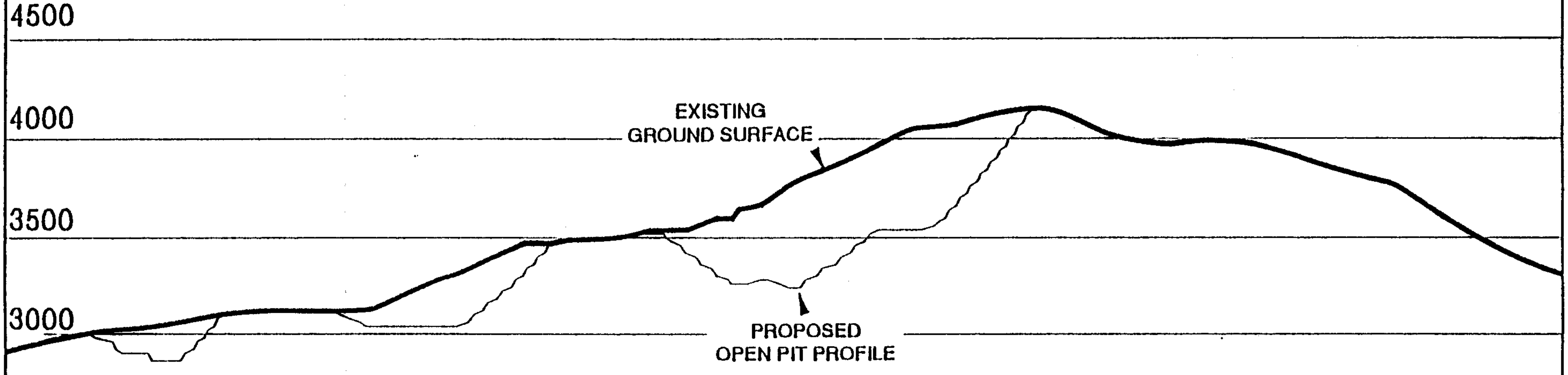
WZI INC.
BAKERSFIELD, CALIFORNIA

GOLDEN QUEEN MINING COMPANY INC.
SMARA Project

CROSS SECTION A-A'

DATE 3/97	0733.0010	EXHIBIT 7

CROSS SECTION
C - C'



2500

2000

0 800' 1600'
Scale In feet

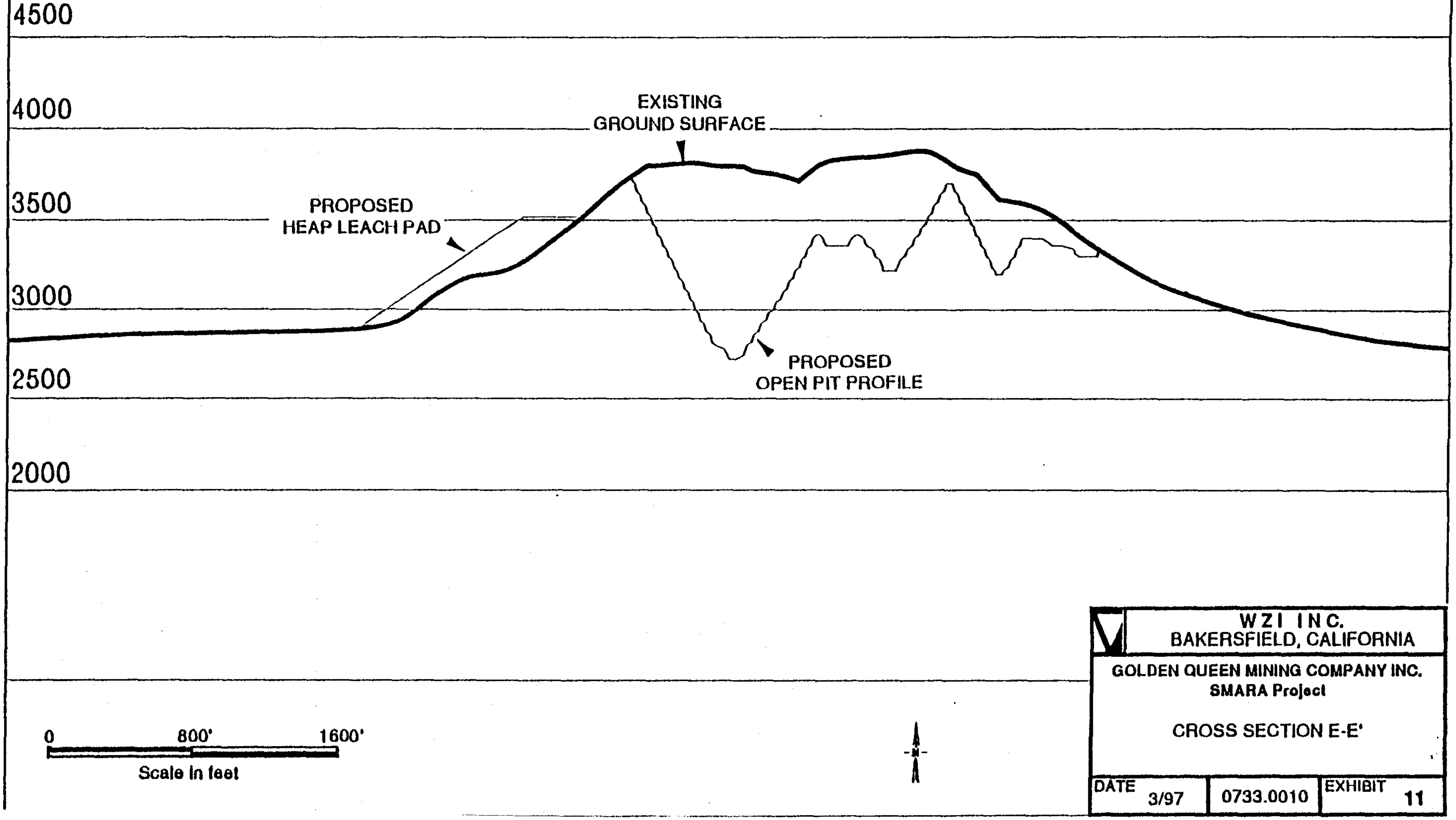
WZI INC.
BAKERSFIELD, CALIFORNIA

GOLDEN QUEEN MINING COMPANY INC.
SMARA Project

CROSS SECTION C-C'

DATE 3/97	0733.0010	EXHIBIT 9

CROSS SECTION
E - E'



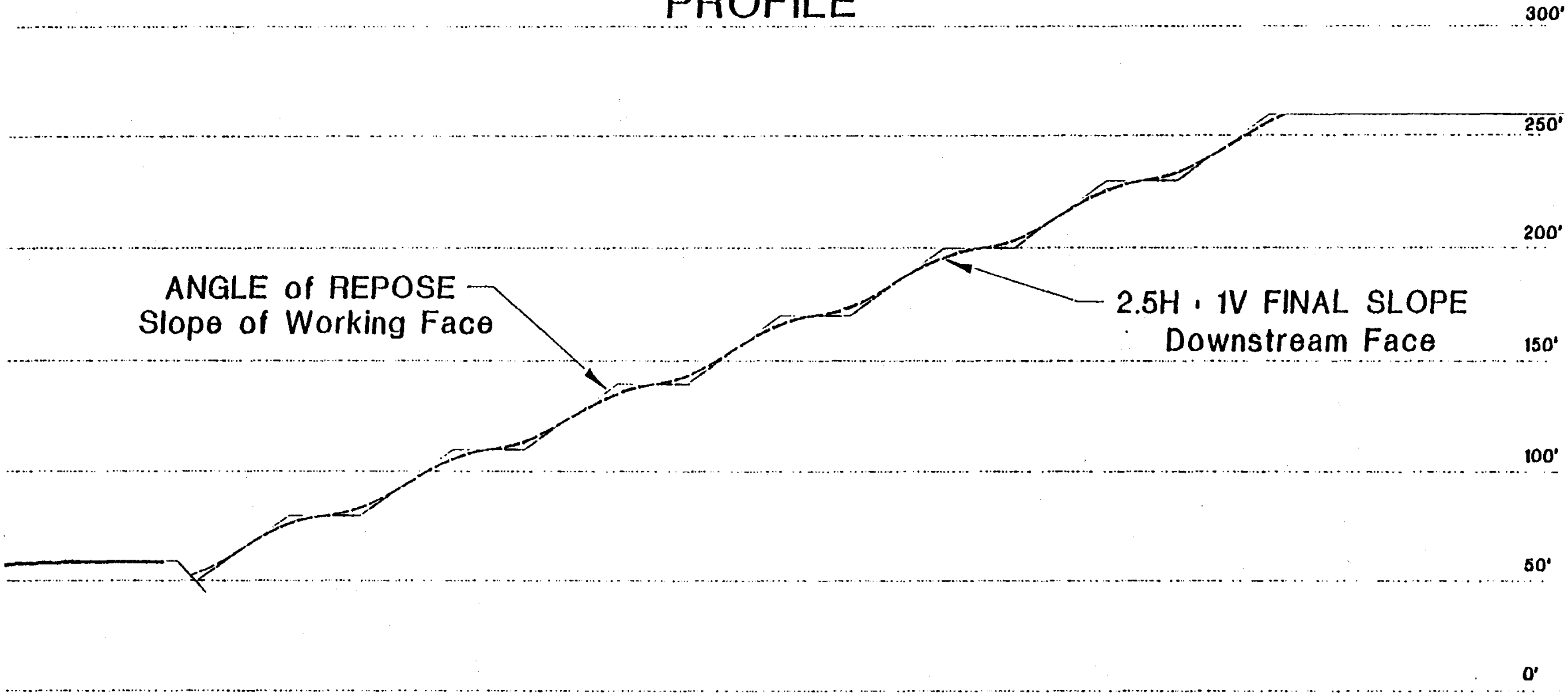
WZI INC.
BAKERSFIELD, CALIFORNIA

GOLDEN QUEEN MINING COMPANY INC.
SMARA Project

CROSS SECTION E-E'

DATE 3/97	0733.0010	EXHIBIT 11

TYPICAL
HEAP LEACH
PROFILE



SCALE: NONE

03/11/97

03/12/97

Golden Queen
MINING CO. INC.

TYPICAL
HEAP LEACH PROFILE

970312-B

WZI INC.
BAKERSFIELD, CALIFORNIA

GOLDEN QUEEN MINING COMPANY INC.
SMARA PROJECT

TYPICAL HEAP LEACH
PROFILE

DATE 3/97	0733.0010	EXHIBIT 13	

Tables

TABLE 1
Preliminary Mining Equipment List

Item	Quantity
Exploration drills (contracted/seasonal)	2
Blast hole drills	3
ANFO truck	1
Wheel loaders	5
Off-road haul trucks	9
Track dozers	4
Water trucks	2
Motor grader	2
Fuel trucks	1
Maintenance/lubrication trucks	3
Passenger van	1
Portable lights	8
Crane	1

TABLE 2 Available Weather Data

Period	Average Temperature (°F)(1)			Rain (inches)	
	Minimum	Mean	Maximum	Mojave	Palmdale
January	30.6	43.6	57.1	1.10	1.23
February	34.4	47.8	61.2	1.11	1.29
March	39.0	51.9	64.7	0.91	1.13
April	44.0	57.9	71.7	0.32	0.41
May	52.1	65.9	79.7	0.11	0.13
June	59.9	74.6	89.2	0.05	0.06
July	65.7	80.8	95.7	0.16	0.05
August	63.7	79.3	94.8	0.20	0.18
September	56.7	82.7	88.7	0.30	0.25
October	46.1	62.1	78.0	0.25	0.23
November	35.2	50.4	65.6	0.83	0.95
December	28.7	42.9	57.0	0.80	1.01 0.60
Mean Annual	46.3	60.8	75.3	6.14	6.95

(1) From Lancaster for the period January 1969 to December 1993.

TABLE 3
Preliminary Plant Seed Mixture for Revegetation

Shrubs		Rate of Application*	
		Slopes	Flats
Acamptopappus sphaerocephalus	goldenhead	5	5
Ambrosia dumosa	burrowbush	5	20
Atriplex confertifolia	shad scale	1	5
Atriplex polycarpa	cattle spinach	3	3
Chrysothamnus nauseous	rubber rabbitbrush	10	5
Encelia virginensis	acton encelia	5	10
Ericameria cooperi	goldenbush	1	2
Eriogonum fasciculatum	California buckwheat	5	5
Eriogonum plumatella	flat-top buckwheat	2	2
Grayia spinosa	spiny hop-sage	10	1
Hymenoclea salsola	cheesebush	2	1
Krascheninnikovia lanata	winter fat	10	1
Larrea tridentata	creosote bush	20	25
Xylorhiza tortifolia	mojave-aster	5	5
Grasses			
Poa secunda	bluegrass	5	1
Pleuraphis rigida	big galleta grass	1	2
Trisetum canescens	trisetum	2	1
Herbaceous Perennials and Annuals		7	4
Camissonia brevipes	evening primrose	+	+
Chaenactis fremontii	Fremont's pincushion	+	+
Dalea mollis	soft indigo	+	+
Eriogonum trichopes	little trumpet	+	+
Lupinus brevicaulis	sand lupine	+	+
Malacothrix californica	desert dandelion	+	+
Phacelia glandulifera	tackstem phacelia	+	+
Platystemon californicus	cream cups	+	+
Salvia carduacea	thistle sage	+	+

* Rate is an estimated percentage of total seed by volume and reflects relative abundance of plant species.

\+ Rate for herbaceous species is variable depending on seed availability.

Table 4
Reclamation Cost Estimate Basis
At End of Two Years

Costs of Backfilling, Regrading, Slope Stabilization, and Recontouring								
Backfilling	None Required							
Regrading			D-10 Dozer			Operator	Total	
	Linear Ft	CY	CY/Hr	Hours	$/Hr*	$/Hr**	Cost	
Pit berms	22,600	20,089	1,660	12	$ 135.00	$ 25.15	$ 1,938	$ 1,938
Slope Stabilization			D-10 Dozer			Operator	Total	
		CY	CY/Hr	Hours	$/Hr	$/Hr	Cost	
Northwest overburden pile		132,194	2,490	53	$ 135.00	$ 25.15	$ 8,502	
Southwest overburden pile		836,974	1,892	442	$ 135.00	$ 25.15	$ 70,831	
South overburden pile								
East overburden pile		2,217,600	2,390	928	$ 135.00	$ 25.15	$ 148,573	
SUBTOTAL		3,186,768		1,423			$ 227,907	$ 227,907
Recontouring								
North heap leach pile		343,500	2490	138	$ 135.00	$ 25.15	$ 22,093	
West heap leach pile								
SUBTOTAL		343,500		138			$ 22,093	$ 22,093
Costs of Revegetation and Wildlife Habitat Replacement, including any Monitoring								
			D-10 Dozer			Operator	Total	
Revegetation	Acres	CY	Acre/Hr	Hours	$/Hr	$/Hr	Cost	
Rip and Prepare Compacted Surfaces								
Pit bottom	44		1.10	40	$ 135.00	$ 25.15	$ 6,406	
Northwest overburden pile	37		1.10	33	$ 135.00	$ 25.15	$ 5,314	
Southwest overburden pile	15		1.10	14	$ 135.00	$ 25.15	$ 2,184	
South overburden pile	-							
East overburden pile	16		1.10	14	$ 135.00	$ 25.15	$ 2,300	
Process plant and facilities (35) and roads (11)	46		1.10	42	$ 135.00	$ 25.15	$ 6,755	
SUBTOTAL	$ 158			$ 143			$ 22,960	$ 22,960
Prepare Loose Surfaces								
Pit Bottom	44		7.15	6	$ 135.00	$ 25.15	$ 986	
North heap leach pile	111		7.15	16	$ 135.00	$ 25.15	$ 2,493	
West heap leach pile	-		7.15	-	$ 135.00	$ 25.15	$ -	
East growth media stockpile	8		7.15	1	$ 135.00	$ 25.15	$ 134	
West growth media stockpile	-		7.15	-	$ 135.00	$ 25.15	$ -	
SUBTOTAL	$ 161			$ 23			$ 3,613	$ 3,613
			992 FEL , 777 Truck, 986 FEL***			Operator	Total	
Growth Media Application	Acres	CY	Equip Hrs/Acre	Hours	$/Hr	$/Hr	Cost	
Pit Bottom	44	17,747	4.0	175	$ 149.25	$ 25.15	$ 30,456	
Northwest overburden pile	37	14,722	4.0	145	$ 149.25	$ 25.15	$ 25,264	
Southwest overburden pile	15	6,050	4.0	60	$ 149.25	$ 25.15	$ 10,383	
South overburden pile	-	-	4.0	-	$ 149.25	$ 25.15		
East overburden pile	16	6,373	4.0	63	$ 149.25	$ 25.15	$ 10,936	
Process plant and facilities (35) and roads (11)	46	18,715	4.0	184	$ 149.25	$ 25.15	$ 32,117	
North heap leach pile	111	44,891	4.0	442	$ 149.25	$ 25.15	$ 77,039	
West heap leach pile	-	-	4.0	-	$ 149.25	$ 25.15	$ -	
East growth media stockpile	6	2,420	4.0	24	$ 149.25	$ 25.15	$ 4,153	
West growth media stockpile	-	-	4.0	-	$ 149.25	$ 25.15	$ -	
SUBTOTAL	275	110,917		1,091			$ 190,349	$ 190,349
						Operator	Total	
Accumulate Seeds	Acres	Qts/Acre	Hr/Qt	Hours		$/Hr	Cost	
	275	2.25	0.633	392		$ 15.00	$ 5,878	$ 5,878
						Operator	Total	
Broadcast Seed	Acres	Acres/Hr		Hours		$/Hr	Cost	
Pit Bottom	44	1		44		$ 15.00	$ 660	
Northwest overburden pile	37	1		37		$ 15.00	$ 548	
Southwest overburden pile	15	1		15		$ 15.00	$ 225	
South overburden pile	-							
East overburden pile	16	1		16		$ 15.00	$ 237	
Process plant and facilities (35) and roads (11)	46	1		46		$ 15.00	$ 696	
North heap leach pile	111	1		111		$ 15.00	$ 1,670	
West heap leach pile	-	1		-		$ 15.00	$ -	
East growth media stockpile	6	1		6		$ 15.00	$ 90	
West growth media stockpile	-	1		-		$ 15.00	$ -	
SUBTOTAL	275			275			$ 4,125	$ 4,125
Wildlife Habitat Replacement	None Required							

* Cost Reference Guide for Construction Equipment, 1996, Dataquest

** Means Site Work and Landscape Cost Data, 1995, 14th Edition

*** See Table 4C

Table 4
Reclamation Cost Estimate Basis
At End of Two Years

Monitoring	Years	Times/Yr	Hrs/Time		Cost/Hr	Cost	
Biologic Monitor	5.00	4	40		$ 60.00	$ 48,000	
Reclamation Monitor	1.25	4	48		$ 60.00	$ 14,400	
SUBTOTAL						$ 62,400	$ 62,400
Cost of Final Engineering Design							
Reclamation Consultant	80	$ 90			$ 7,200	$ 7,200	
	Hrs	$/Hr					
Costs of Mobilization	Percentage included in Summary Costs						
Costs of Removal of Buildings, Structures, and Equipment	See Table 4A for breakdown						
Remove Equipment						$ 420,413	$ 420,413
Dismantle Structures						$ 229,917	$ 229,917
Demolish Concrete						$ 48,816	$ 48,816
Bury Concrete						$ 5,422	$ 5,422
Costs Associated with Reduction of Specific Hazards							
Heap Leaching Facilities	See Table 4B for breakdown						
North heap leach pile						$ 475,567	$ 475,567
West heap leach pile						$ -	$ -
Chemical Processing Ponds	None Required					$ -	$ -
Soils Decontamination	Allowance					$ 25,000	$ 25,000
Hazardous Waste Removal	Allowance					$ 25,000	$ 25,000
In-Water Slopes	None Required					$ -	$ -
Highwalls	None Required					$ -	$ -
Landslides	None Required					$ -	$ -
Subsidence or Other Mass Ground Failure	None Required					$ -	$ -
Costs of Drainage and Erosion Control Measures	Included in regrading, slope stabilization, recontouring, and revegetation surface preparation					$ -	$ -
Costs of Soil Tests	Included in soils decontamination					$ -	$ -
Costs of Haul Road Ripping and Reseeding	Included in itemized costing above					$ -	$ -
				Max	Operator	Total	
Costs of Fencing	Linear Ft	Cost/Ft	Ft/Hr	Hours	$/Hr	Cost	
Maintenance of project fencing	52,800	$ 0.379	40	1,333	$ 15.00	$ 20,000	$ 20,000
Remove fencing	52,800	$ 0.189	79	667	$ 15.00	$ 10,000	$ 10,000
Costs of Liability Insurance	Included in contractor's overhead allowance						
							$ -
Costs of Long Term Stabilization, Control, Containment of Waste Solids and Liquids.							
Long Term Stabilization	Incl in regrading, slope stabilization, recontouring, revegetation, and monitoring						$ -
Control			Included in monitoring				$ -
Containment of Waste Solids and Liquids			None Required				$ -
Total Direct Reclamation Cost							$ 1,801,397
Less heap leach neutralization (Part of RWQCB bonding)							$ 475,567
Direct Cost for First Sequential Bonding Requirement							$ 1,325,830
Indirect Costs							
Supervison						4.2%	$ 55,685
Profit/Overhead						8.3%	$ 110,044
Contingencies						7.0%	$ 92,808
Mobilization/Demobilization (not including Heap Neutralization)						1.0%	$ 13,258
Total Reclamation Cost for First Sequential Bonding							$ 1,597,625

Table 4A
Removal of Buildings, Structures, and Equipment

Summary of Costs

Dismantle buildings	$ 229,917
Remove equipment	$ 420,413
Concrete Demolition	$ 48,816
Bury concrete	$ 5,422
Total	$ 704,567

Dismantle buildings

	Volume		Labor	Equipment	Costs		
	YD3	FT3	$/FT3	$/FT3	Labor	Equipment	Total
Primary Crusher	2,083	56,241	$ 0.072	$ 0.113	$ 4,055	$ 6,372	$ 10,427
Fine Crushing Plant	10,825	292,275	$ 0.072	$ 0.113	$ 21,073	$ 33,115	$ 54,188
Screening Plant	13,770	371,790	$ 0.072	$ 0.113	$ 26,806	$ 42,124	$ 68,930
MCC Bldg, Crusher Area	37	1,000	$ 0.072	$ 0.113	$ 72	$ 113	$ 185
Process Shop	1,473	39,771	$ 0.072	$ 0.113	$ 2,867	$ 4,506	$ 7,374
Process Plant	2,377	64,179	$ 0.072	$ 0.113	$ 4,627	$ 7,271	$ 11,899
Assay Lab	1,622	43,794	$ 0.072	$ 0.113	$ 3,158	$ 4,962	$ 8,119
Mine Shop	11,201	302,427	$ 0.072	$ 0.113	$ 21,805	$ 34,265	$ 56,070
Main Office	2,542	68,634	$ 0.072	$ 0.113	$ 4,949	$ 7,776	$ 12,725
Total					$ 89,412	$ 140,505	$ 229,917
	Estimated labor hours @ $20.00/hr			4,471			

Cost references from Means Site Work and Landscape Cost Data 1995 updated by 3.0% (per CR Briggs)

Table 4A
Removal of Buildings, Structures, and Equipment

Equipment Removal				21.0%	8.8%		25%		
		Cost of Equipment	Cost of Contract	Equipment Installation	Contract Installation	Total Installation	Total Removal		
General Site									
	Signs	$ 5,000		$ 1,050	$ -	$ 1,050	$ 263		
	Fire Hydrants		$ 4,000	$ -	$ 352	$ 352	$ 88		
	Main Substation		$ 429,000	$ -	$ 37,752	$ 37,752	$ 9,438		
							$ 9,789	$ 9,789	
Primary Crusher									
	Control Cab		$ 15,000	$ -	$ 1,320	$ 1,320	$ 330		
	CV07	$ 93,750		$ 19,688	$ -	$ 19,688	$ 4,922		
	CV01	$ 172,500		$ 36,225	$ -	$ 36,225	$ 9,056		
	Jaw Crusher	$ 470,000		$ 98,700	$ -	$ 98,700	$ 24,675		
	Dust Colelctor	$ 50,000		$ 10,500	$ -	$ 10,500	$ 2,625		
	FE17	$ 24,500		$ 5,145	$ -	$ 5,145	$ 1,286		
	FE01	$ 71,700		$ 15,057	$ -	$ 15,057	$ 3,764		
							$ 46,659	$ 46,659	
Fine Crushing									
	MCC - MC07		$ 99,000	$ -	$ 8,712	$ 8,712	$ 2,178		
	MCC - MC08		$ 20,000	$ -	$ 1,760	$ 1,760	$ 440		
	CV02		$ 325,000	$ -	$ 28,600	$ 28,600	$ 7,150		
	FE02-04	$ 22,800		$ 4,788	$ -	$ 4,788	$ 1,197		
	FE05-08	$ 30,400		$ 6,384	$ -	$ 6,384	$ 1,596		
	Std Cones	$ 850,000		$ 178,500	$ -	$ 178,500	$ 44,625		
	Shd Cones	$ 818,000		$ 171,780	$ -	$ 171,780	$ 42,945		
	VSI's	$ 1,054,800		$ 221,508	$ -	$ 221,508	$ 55,377		
	Dust Collector	$ 290,000		$ 60,900	$ -	$ 60,900	$ 15,225		
							$ 170,733	$ 170,733	
Screening/Agglomeration									
	CV03		$ 240,000	$ -	$ 21,120	$ 21,120	$ 5,280		
	CV04		$ 280,000	$ -	$ 24,640	$ 24,640	$ 6,160		
	CV05		$ 146,000	$ -	$ 12,848	$ 12,848	$ 3,212		
	Belt Tripper	$ 15,000		$ 3,150	$ -	$ 3,150	$ 788		
	Agglomeration Drum	$ 95,000		$ 19,950	$ -	$ 19,950	$ 4,988		
	Dust Collector	$ 150,000		$ 31,500	$ -	$ 31,500	$ 7,875		
	Cement Feeder	$ 8,000		$ 1,680	$ -	$ 1,680	$ 420		
	Sampler	$ 18,000		$ 3,780	$ -	$ 3,780	$ 945		
	Banana Screens	$ 1,068,000		$ 224,280	$ -	$ 224,280	$ 56,070		
							$ 85,737	$ 85,737	

Table 4A
Removal of Buildings, Structures, and Equipment

Merrill Crowe Plant									
	MCC - MC05		$ 71,000	$ -	$ 6,248	$ 6,248	$ 1,562		
	Clarifiers	$ 160,000		$ 33,600	$ -	$ 33,600	$ 8,400		
	AC02	$ 30,000		$ 6,300	$ -	$ 6,300	$ 1,575		
	Filter Presses	$ 140,000		$ 29,400	$ -	$ 29,400	$ 7,350		
	Bullion Furnace	$ 17,500		$ 3,675	$ -	$ 3,675	$ 919		
	Mercury Retort	$ 75,000		$ 15,750	$ -	$ 15,750	$ 3,938		
	Preg Soln Pump	$ 9,300		$ 1,953	$ -	$ 1,953	$ 488		
	Barren Soln Pump	$ 10,000		$ 2,100	$ -	$ 2,100	$ 525		
	Vacuum Pumps	$ 50,000		$ 10,500	$ -	$ 10,500	$ 2,625		
	Filter Press Fd Pumnp	$ 12,500		$ 2,625	$ -	$ 2,625	$ 656		
	Precoat Clarifier Pump	$ 6,500		$ 1,365	$ -	$ 1,365	$ 341		
	Precoat Filter Press Pump	$ 6,500		$ 1,365	$ -	$ 1,365	$ 341		
	Furnace Scrubber	$ 14,000		$ 2,940	$ -	$ 2,940	$ 735		
	Preg Soln Tank		$ 60,000	$ -	$ 5,280	$ 5,280	$ 1,320		
	Bar Soln Tank		$ 215,000	$ -	$ 18,920	$ 18,920	$ 4,730		
	DE Tank	$ 37,500		$ 7,875	$ -	$ 7,875	$ 1,969		
	Deareation Tower	$ 20,000		$ 4,200	$ -	$ 4,200	$ 1,050		
	Cyanide Tank	$ 20,000		$ 4,200	$ -	$ 4,200	$ 1,050		
	Caustic Tank	$ 20,000		$ 4,200	$ -	$ 4,200	$ 1,050		
	Anti-scalant Tank	$ 20,000		$ 4,200	$ -	$ 4,200	$ 1,050		
	Transfer Pumps	$ 12,000		$ 2,520	$ -	$ 2,520	$ 630		
							$ 42,304	$ 42,304	
Stacking and Conveying									
	Conveyor Installation Labor								
	Total labor hours								
	3,200					$ 72,000	$ 18,000		
	Conveyor Electrical		$ 483,000	$ -	$ 42,504	$ 42,504	$ 10,626		
							$ 28,626	$ 28,626	
Truck Shop									
	Wash Equipment	$ 10,000		$ 2,100	$ -	$ 2,100	$ 525		
	Oil-Water Separator	$ 8,000		$ 1,680	$ -	$ 1,680	$ 420		
	Diesel Fuel Tank		$ 35,000	$ -	$ 3,080	$ 3,080	$ 770		
							$ 1,715	$ 1,715	
Laboratory									
	Transfromer & MCC		$ 41,450	$ -	$ 3,648	$ 3,648	$ 912	$ 912	
Plant Water System									
	Well Pumps	$ 20,120		$ 4,225	$ -	$ 4,225	$ 1,056		
	Surge Tank		$ 16,000	$ -	$ 1,408	$ 1,408	$ 352		
	Water Tank		$ 160,000	$ -	$ 14,080	$ 14,080	$ 3,520		
	Electrical Systems		$ 77,000	$ -	$ 6,776	$ 6,776	$ 1,694		
							$ 6,622	$ 6,622	
Other									
	Powder Magazinbes		$ 15,400	$ -	$ 1,355	$ 1,355	$ 339		
	Radio Repeater Station		$ 23,975	$ -	$ 2,110	$ 2,110	$ 527		
							$ 866	$ 866	
Pad 3 Sustaining									
	Conveyor	$ 460,000		$ 96,600	$ -	$ 96,600	$ 24,150		
	Pumps	$ 36,650		$ 7,697	$ -	$ 7,697	$ 1,924		
	MCC's		$ 17,100	$ -	$ 1,505	$ 1,505	$ 376		
							$ 26,450	$ 26,450	
Total Equipment Removal								$420,413	

Table 4A
Removal of Buildings, Structures, and Equipment

Concrete	25%	percent of foundations, piers, footings, etc., to be demolished						
		Demolition Cost						
General Site	YD3	Labor/YD3	Equip/YD3	Labor	Equip	Total	Sq Feet	
Propane tank slab	15						100	
Transformer slabs	9						486	
Primary Crusher								
Footings, piers, Etc.	20	$ 92	$ 134	$ 1,840	$ 2,680	$ 4,520	4,611	
Fine Crushing								
Crushing Foundations	56.25	$ 92	$ 134	$ 5,175	$ 7,538	$ 12,713	4,998	
Conveying Foundations	15	$ 92	$ 134	$ 1,380	$ 2,010	$ 3,390	16,609	
Screening/Aggolmeration								
Foundations	64.5	$ 92	$ 134	$ 5,934	$ 8,643	$ 14,577	6,973	
Foundation, Cement Silo	2.5	$ 92	$ 134	$ 230	$ 335	$ 565	incl	
Foundation, Agglom Drum	3.75	$ 92	$ 134	$ 345	$ 503	$ 848	625	
Process Plant								
Foundations	20.5	$ 92	$ 134	$ 1,886	$ 2,747	$ 4,633		
Slabs	107						2,679	
Stacking & Conveying								
Foundations	8.75	$ 92	$ 134	$ 805	$ 1,173	$ 1,978	5,000	Allowance
Buildings & Facilities								
Gas Tank Foundation	2.25	$ 92	$ 134	$ 207	$ 302	$ 509	500	Allowance
Diesel tank foundation	4	$ 92	$ 134	$ 368	$ 536	$ 904	500	Allowance
Wash Slab	37						1,000	
Lube tank slab	33						550	
Truck shop floor slab	315						8,400	
Wash bay floor slab	66						1,800	
Truck shop aprons	91						2,400	
Lab	79						2,400	
Process Shop	102						2,400	
Pumphouse	12						100	
Misc								
Water tank	16	$ 92	$ 134	$ 1,472	$ 2,144	$ 3,616	432	
Cell 3 pump pad	2.5	$ 92	$ 134	$ 230	$ 335	$ 565	135	
Total Concrete	1,082			$ 19,872	$ 28,944	$ 48,816	62,698	
Bury slabs and demolished piers, etc. under 3 feet of overburden								
Cubic yards of overburden required							6,966	
Haul		Avg Rnd Trip	Rnd Trip	Total	Opr	Equip	Total	
Cat 777's	YD3/Truck	Dist. Mi	Time	Time	$/Hr	$/Hr	Cost	
	67	0.76	6.05	12.58	$ 25.15	$ 165	$ 2,393	
Load								
Cat 992	Loader hrs equal truck hours			12.58	$ 25.15	$ 180	$ 2,581	
				Total	Opr	Equip	Total	
Doze	YD3/Hr			Time	$/Hr	$/Hr	Cost	
Cat D-10	2,490			2.80	$ 25.15	$ 135	$ 448	
Total cost for burying concrete							$ 5,422	
						PER YD3	$ 0.78	
Cost references from Means Site Work and Landscape Cost Data 1995 updated by 3.0% (per CR Briggs)								

Table 4B
Heap Leach Neutralization

	1st Rest	1st Rinse	2nd Rest	2nd Rinse	Heap Sampling	Evaporation	Total	
Days	55	55	55	55	15	223	459	
Labor								
Operator		$ 24,191		$ 24,191		$ 40,805	$ 89,187	(10 hrs/day during evap)
Utility		$ 3,240		$ 3,240		$ 13,116	$ 19,596	(5 days/week)
Mechanic		$ 2,430		$ 2,430		$ 9,837	$ 14,697	(5 days/week, 1/2 day)
Lab Tech		$ 864		$ 864	$ 1,644		$ 3,372	(1 day per week)
Subtotal	$ -	$ 30,724	$ -	$ 30,724	$ 1,644	$ 63,758	$126,851	
Power								
Spray		$ 45,358		$ 45,358		$ 76,510	$167,226	
Wells		$ 1,661		$ 1,661			$ 3,322	
Process		$ 2,002		$ 2,002			$ 4,004	
Shop		$ -		$ -			$ -	
Lab		$ 292		$ 292			$ 584	(1 day/per week)
Subtotal	$ -	$ 49,313	$ -	$ 49,313	$ -	$ 76,510	$175,136	
Operating Supplies								
Descalent		$ 4,248		$ 4,248		$ 7,166	$ 15,662	
Calcium Hypochlorite				$ 75,533			$ 75,533	
Sprinklers						$ 3,240	$ 3,240	
Piping						$ 22,500	$ 22,500	
Subtotal	$ -	$ 4,248	$ -	$ 79,782	$ -	$ 32,906	$116,935	
Maintenance Supplies		$ 9,072		$ 9,072		$ 15,302	$ 33,445	
Contract Costs								
Heap drilling					$ 14,400		$ 14,400	
Solution analysis					$ 2,400		$ 2,400	
Solids analysis					$ 6,400		$ 6,400	
Subtotal					$ 23,200		$ 23,200	
TOTAL COSTS	1st	1st	2nd	2nd	Heap			
	Rest	Rinse	Rest	Rinse	Sampling	Evaporation	Total	
LABOR	$ -	$ 30,724	$ -	$ 30,724	$ 1,644	$ 63,758	$126,851	
POWER	$ -	$ 49,313	$ -	$ 49,313	$ -	$ 76,510	$175,136	
OPERATING SUPPLY	$ -	$ 4,248	$ -	$ 79,782	$ -	$ 32,906	$116,935	
MAINT SUPPLY	$ -	$ 9,072	$ -	$ 9,072	$ -	$ 15,302	$ 33,445	
CONTRACT	$ -	$ -	$ -	$ -	$ 23,200	$ -	$ 23,200	
TOTAL	$ -	$ 93,357	$ -	$ 168,891	$ 24,844	$ 188,475	$475,567	
COST PER TON ORE NEUTRALIZED							$ 0.040	

Table 4C
Reclamation Cost Estimate Basis

Recontouring								
D-10 Dozer - SU Blade		North	West					
Dozing Distance, Ft		38						
LCY/Hr		2,500	2,500					
Operator	Excellent	1.00	1.00					
Material	Loose	1.20	1.20					
Slot Dozing	No	1.00	1.00					
Side by Side Dozing	No	1.00	1.00					
Visibility	Good	1.00	1.00					
Job Efficiency	50 min/hr	0.83	0.83					
Grade	0	1.00	1.00					
Production Rate	CY/Hr	2,490	2,490					
Rip and Prepare Compacted Surfaces								
	1.10	acres/hr	per Bamberg					
Prepare Loose Surfaces								
	7.15	acres/hr	per Bamberg					
Growth Media Application								
	966 front end loader		0.50	hrs per acre per Bamburg				
	haul truck		232.5	cu yds per hour per based on 3.8 mile haul @ 15 mph				
	992 loader			need same hours as truck hours				
			operator	equip	hrs	equip $	opr $	
		966 loader	$ 25.15	$ 40.00	138	$ 5,500	$ 3,458	$ 8,958
		haul truck	$ 25.15	$ 150.00	477	$ 71,545	$ 11,996	$ 83,541
		992 loader	$ 25.15	$ 180.00	477	$ 85,854	$ 11,996	$ 97,850
			$ 25.15	$ 149.25	1,091	$162,899	$ 27,450	$190,349
					3.97			$ 692.18
					hrs/acre			$/acre
Purchase/Gather Seed								
		0.63	Hours/quart		per Bamberg			
		2.25	qts seed per acre		per Bamberg			
		$ 9.50	per quart to gather		per Bamberg			
		21.375	$/acre					
Broadcast Seed		hours/acre	Labor/hr		per Bamberg			
		1.0	$ 15.00			$ 15.00	per acre	
Fences								
Fence Installation			$ 0.76	per PAH cost estimate				
Fence Maintenance			$ 0.38	50% of installation cost				
Fence removal			$ 0.19	25% of installation cost				

Attachment A

The project area shown in the attached map consists of those portions of Sections 5, 6, 7 and 8, Township 10 North, Range 12 West, SBBM, Section 1, Township 10 North, Range 13 West, SBBM and Section 32, Township 11 North, Range 12 West, SBBM in Kern County, California, described as Parcel 1 and Parcel 2 below:

Parcel 1

Those portions of Sections 5, 6, 7 and 8, Township 10 North, Range 12 West, SBBM and Section 1, Township 10 North, Range 13 West, SBBM in Kern County, California, described as follows:

Beginning at the Northeast corner of Section 6, Township 10 North, Range 12 West, SBBM; thence, South 88° 30' West along the North line of Section 6 and the North line of Section 1, Township 10 North, Range 13 West, a distance of 6,056 feet to a point; thence, South 0° 22' West a distance of 1,462 feet, more or less, to a point on the Southeast boundary of Mojave Tropico/Silver Queen Road; thence, Southwesterly along the Southeast boundary of Mojave Tropico/Silver Queen Road a distance of 4,525 feet, more or less, to a point on the North boundary of Section 12, Township 10 North, Range 13 West; thence, North 87° 37' East along the North boundary of Section 12 a distance of 1,603 feet to the Northeast corner of Section 12; thence, South 1° 49' West along the East boundary of Section 12 a distance of 5,317 feet to the Southeast corner of Section 12; thence, North 87° 29' East along the South boundary of Section 7, Township 10 North, Range 12 West a distance of 2,643 feet to the South one-quarter corner of Section 7; thence, North 2,585 feet to the Northwest corner of the Southeast quarter of Section 7; thence, North 88° 34' East along the North boundary of the Southeast quarter of Section 7 and the North boundary of the Southwest quarter of Section 8, Township 10 North, Range 12 West a distance of 3,762 feet to a point; thence, North 676 feet to a point; thence, North 88° 21' East 4,203 feet to a point on the East boundary of Section 8; thence, North 2° 21' West along the East boundary of Section 8 a distance of 2,006 feet to the

Northeast corner of Section 8; thence, South 89° 26' West 2,549 feet along the North boundary of Section 8 to the North one-quarter corner of Section 8; thence, North 4° 17' West 2,612 feet to the Northeast corner of the Southwest quarter of Section 5, Township 10 North, Range 12 West; thence, South 89° West 2,578 feet to the West one-quarter corner of Section 5; thence, North 2,474 feet along the Westerly boundary of Section 5 and the Easterly boundary of Section 6 to the point of beginning.

Parcel 2

That portion of Section 32, Township 11 North, Range 12 West, SBBM in Kern County, California, described as follows:

Beginning at the Southwest corner of said Section 32; thence, North 0° 6' East along the Westerly boundary of Section 32 a distance of 3,856 feet; thence, North 89° 0' East a distance of 460 feet; thence, South 2° 18' East a distance of 669 feet; thence, East a distance of 108 feet; thence, South 1° 21' East a distance of 3,191 feet to a point on the South boundary of Section 32; thence, South 88° 30' West along the South boundary of Section 32 approximately 677 feet to the point of beginning.

MAY 06 1996

Golden Queen
MINING CO. INC.

May 3, 1996

David Weiss
WZI, Inc.
4700 Stockdale Hwy, Ste.120
Bakersfield, CA 93309

Dear Mr. Weiss,

Enclosed is the information sent to all property owners as a requirement of the California Surface Mining and Reclamation Act of 1975. Also enclosed is a copy of the "Owners Mailing List".

If you have any questions please feel free to call me at (805) 256-0120.

Sincerely,

Sue Young
Admin. Asst.

/sy

Enclosures

P.O. Box 878, 2997 Desert St., Suite #4, Rosamond, CA 93560-0878
Telephone: (805) 256-0120 • Fax: (805) 256-6526

Golden Queen
MINING CO. INC.

May 1, 1996

Dear Property Owner:

This information is being provided to you as well as all other property owners as a requirement of the California Surface Mining and Reclamation Act of 1975.

Golden Queen Mining Company, Inc. (Golden Queen) has an agreement with you for the use of your property as part of its' Soledad Mountain project. As you are aware, the Soledad Mountain project is a proposed gold mining and processing operation that will use typical open pit mining methods with the ore to be processed using a cyanide -- heap leach recovery technique and final gold recovery by a Merill-Crowe process.

Open pit mining will consist of the drilling and blasting of the non-mineral overburden material as well as the ore. The broken overburden and ore are then loaded into off-road haulage trucks by large front-end loaders. Overburden is to be transported to adjacent areas for final disposal or stockpiled for possible use as a construction material. Ore will be hauled to the crushing facility where it will be broken down to a size of slightly less than one eighth of an inch. Some finer material will be developed as a natural part of this crushing process.

The broken ore will be mixed with predetermined amounts of lime for pH control and cement for the development of desecrate, bonded lumps. This latter process is referred to as agglomeration and is used to insure that the leach solutions and later rinse waters are able to pass completely through the heap as well as make contact with all of the ores in the heap

Conveyors will transport the agglomerated ore to lined leach pads where it is to be stacked to an ultimate height in excess of 160 feet using individual lifts of about 30 feet. After each lift is completed, leach solutions will be applied by drip irrigation systems identical to those often used in agriculture. The leach solutions, a dilute cyanide -- water mixture, pass through the ore, slowly dissolving the gold as well as silver and are collected at the bottom of the ore heap on an impermeable liner where they are allowed to accumulate for pumping to the recovery plant.

Reclamation will be an ongoing part of the operation and will take place as areas are no longer in use. Each of the individual parts of the project will be reclaimed differently The open pits will be left in a stable, safe condition, but will not be back filled. This will allow for future access to the remaining gold bearing material as changing economics and technologies act to make this deposit an important resource once again.

The overburden piles that are not used for construction materials will be left in a stable form with the level surfaces re-vegetated. However, it is expected that a substantial amount of the overburden will be used over an extended period of time as construction materials.

Leach pads will be rinsed to a point where the water from the heap is at an acceptable level for both cyanide and other ions. The heaps will then be graded, surfaced with previously recovered growth media (soil) and re-vegetated

At the completion of the project, the property that Golden Queen has under an agreement from you may contain overburden piles, open pits and/or leach pads. As previously noted, each of these features will be reclaimed in the fashion described with the health and safety of future users very much in mind. Certain financial instruments will be in place before the project starts to cover the cost of reclamation in the unlikely event that Golden Queen is unable to complete the required work.
If you would like additional information, have any questions or concerns regarding the above, please feel free to contact me at the below telephone or address.

Sincerely:

Dick Graeme

Richard W. Graeme, Vice-president

P.O. Box 878, 2997 Desert St., Suite #4, Rosamond, CA 93560-0878
Telephone: (805) 256-0120 • Fax: (805) 256-6526

GOLDEN QUEEN MINING CO., INC.

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(818) 352-4556 (818) 352-6459

Sigl, James P
714 Valita St.
Venice, CA 90291

Slayton, Gean A.
P O Box 1772
St. John's, AZ 85936
(602) 527-1830

Starke, George O.
9442 Mast Blvd.
Santee, CA 92071
(619) 435-2421

Stelzner, Thomas L.
534 Selmart Lane
Petaluma, CA 949542500
7077652832

Thagard Jr., George F.
#60 Linda Isle
Newport Beach, CA 92600
(714) 723-5226 (714) 675-6767

Van Pelt, Donald Richard
P.O. Box 4667
Palm Springs, CA 922634667
(619) 323-0224

Walston, Wilbur
8438 Venus Drive
Buena Park, CA 90620
(714) 527-0196

Warner, William J.
P.O. Box 1363
Sugar Loaf, CA 92386
(909) 585-2612

Wegmann, William F.
P.O. Box 16052
South Lake, CA 961516052
(916) 885-4428

Wilson, W. L.
Western Centennials, Inc.
P.O. Box 2183
Golden, CO 81502
(303) 243-7806

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	B & H - 190 ac all claims	Unpatented	Sec 6 T10N,R12W		41701
Warner, William J.	P.O. Box 1363 Sugar Loaf, CA 92386	3.7500%	Ben Hur - 10 ac total claim	Patent	Sec 6 T10N,R12W		
Kenton, Frank J., Jr.	4911 Leeds St. Simi Valley, CA 93063	8.7500%	Ben Hur	Patent	Sec 6 T10N,R12W		
Moore, Robert L.	3075 San Pasqual Pasadena, CA 91107	18.7500%	Ben Hur	Patent	Sec 6 T10N,R12W	429-190-13-01-8	
Moore, Robert S.	590 Castano Ave. Pasadena, CA 91107	18.7500%	Ben Hur	Patent	Sec 6 T10N,R12W		
Thagard, George F., Jr.	# 60 Linda Isle Newport Beach, CA 92600	50.0000%	Ben Hur	Patent	Sec 6 T10N,R12W	429-190-15-02-3	
Moore, Gaston A. & Wilhelmina, H/W	6150 West Wagoner Rd. Glendale, AZ 85308-1151	50.0000%	Bob Tail - 9.71 ac	Unpatented	Sec 6 T10N,R12W		85131
Daggs, Robert R., and Merlene K.	2038 Westwood Ct., #23 Lancaster, CA 93536	50.0000%	Bob Tail	Unpatented	Sec 6 T10N,R12W		85131
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Bobtail - 190 ac total all claims owned by V. Knight	Unpatented	Sec 6 T10N,R12W		218374
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Bonanza Amendment 320 ac total all claims owned	Unpatented	Sec 18 T10W, R12W		34772
Allen, Mary Ann B.	686 1/2 N. Coast Hwy. Laguna Beach, CA 92651	3.7500%	Calcium - 63.813 ac for all claims in Queen Esther group	Patent	Sec 6 T10N,R12W		
Barrow, Laura T.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Barrow, Thomas D.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Boyle, Barbara	Kingsley Manor 1055 N. Kingsley Dr. #201 Los Angeles, CA 90029	7.5000%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Boyle, John T.	1418 Pasqualito Ave. San Marino, CA 91108	3.7500%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W	429-190-11-01--1	
Letteau, Betty B.	9255 Doheny Rd. #3002 Los Angeles, CA 90069-3248	6.6700%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Letteau, Judge Robert M.	723 No. Roxbury Drive Beverly Hills, CA 90210	1.6650%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mingst, Caryll Sprague	Mudd Estate J. Arthur Greenfield & Co.	6.2500%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024						
Mudd, Harvey II	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	5.0000%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, Henry T., Jr.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	5.0000%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, John W.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	5.0000%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W	429-190-11-02-1	
Mudd, Victoria Kingston	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	5.0000%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, Virginia Bell	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	5.0000%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Nicodemus, Roger E.	733 Briar Hill Circle Simi Valley, CA 93065	1.6650%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Cynthia	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	6.2500%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Elizabeth Mudd	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	6.2500%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Norman F., III	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	6.2500%	Calcium - Queen Esther group	Patent	Sec 6 T10N,R12W		
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Carolyn	Unpatented	Sec 6 T10N,R12W		41691
Knight, Virginia	540 South Arden Blvd.	100.0000%	Carolyn Millsite - 190 ac Total	Unpatented	Sec 6 T10N,R12W		41689

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Los Angeles, CA 90020						
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Charity	Unpatented	Sec 6 T10N,R12W		41697
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Consolidated	Unpatented	Sec 18 T10W, R12W		34767
Karma Wegmann Corp. (GQM)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Desert Rose	Unpatented	Sec 6 T10N,R12W		39600
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Dolly X	Unpatented	Sec 6 T10N,R12W		189836
Birtle, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Echo	Patent	Sec 6 T10N,R12W	429-190-21-00-2C	
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Elephant	Unpatented	Sec 6 T10N,R12W		41696
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Elephant Extension	Unpatented	Sec 6 T10N,R12W		41695
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Excelsior	Unpatented	Sec 6 T10N,R12W		41693
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Faith 1	Unpatented	Sec 6 T10N,R12W		218369
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Faith 2	Unpatented	Sec 6 T10N,R12W		218370
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Faith 3	Unpatented	Sec 6 T10N,R12W		218371
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Faith 4	Unpatented	Sec 6 T10N,R12W		218372
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Faith 5	Unpatented	Sec 6 T10N,R12W		218373
Akin, Charles Jr.	7630 Via Del Reposo Scottsdale, AZ 85258	12.5000%	Fee Land -20 net ac 160 total	Fee	Sec 7, T10N, R12 W	429-020-02-00-7 see S W Refining	7630 Via
Akin-Hatch, Deann	61535 So Hwy 97-9 #150 Bend, OR 97702	12.5000%	Fee Land -20 net ac 160 total	Fee	Sec 7, T10N, R12 W	429-020-02-00-7 see S W Refining	61535 So.
Birtle, Mary J. Southwest Refining	5028 Ladera Vista Dr. Camarillo, CA 93012	75.0000%	Fee Land - 120 net ac 160	Fee	Sec 7, T10N, R12 W	429-020-02-00-7	
Birtle, Mary J. Southwest Refining (GQM)	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Fee Land - 10- ac	Fee	Sec 6, T10N, R12W	429-190-04-00-3	
Birtle, Mary J. Southwest Refining (GQM)	5028 Ladera Vista Dr.	100.0000%	Fee Land - 19.18 ac	Fee	Sec 6, T10N, R12W	429-190-05-00-6	

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Camarillo, CA 93012						
Bruce, Howard E. Estate of Min. Int. below 500'	c/o Nancy Ellen Hassard 12694 Mirado Ave. Grand Terrace, CA 92324	25.0000%	Fee Land - 134.61 ac	Fee	Sec 36, T11N, R13W	N/A	
Cruz (GQM)	8103 Los Ranchos Dr. Austin, TX 78749	100.0000%	Fee Land - 40 ac	Fee	Sec 1, T10N,R13W	345-052-24-00-3	
Golden Queen Mining Co. (Bezzina)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2.5 ac	Fee	Sec 1, T10N,R13W	345-051-32-00-9	
Golden Queen Mining Co. (Courtney)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 10 ac	Fee	Sec 1, T10N,R132W	345-051-28-00-8	
Golden Queen Mining Co. (Dupont)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2.5 ac	Fee	Sec 1, T10N, R13W	345-051-31-00-6	
Golden Queen Mining Co. (F.A.M. CO)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2.54 ac	Fee	Sec 1, T10N, R13W	345-051-34-00-5	
Golden Queen Mining Co (Freddie Mack)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2.28 ac	Fee	Sec 31, T11N, R13W	427-344-08-00-6	
Golden Queen Mining Co. (Gillespie)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 10 ac	Fee	Sec 1, T10N, R13W	345-052-15-00-7	
Golden Queen Mining Co. (Goedecke)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 10.01 ac	Fee	Sec 1, T10N, R13W	345-052-18-00-6	
Golden Queen Mining Co. (Griep)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 19.89 ac	Fee	Sec 1, T10N, R13W	345-051-12-00-01	
Golden Queen Mining Co. (Heineman)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2 ac	Fee	Sec 1, T10N, R13W	345-051-21-00-7	
Golden Queen Mining Co. (Janssen)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2.7 ac	Fee	Sec 1, T10N, R13W	345-051-22-00-0	
Golden Queen Mining Co. (Lamunyon)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 4.1 ac	Fee	Sec 1, T10N, R13W	345-051-30-00-3	
Golden Queen Mining Co. (Meier)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2.6 ac	Fee	Sec 1, T10N, R13W	345-051-26-00-2	
Golden Queen Mining Co. (Mojave Silver Ptnr.)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 5.68 ac	Fee	Sec 5, SW SW SW	246-020-02-00-4	
Golden Queen Mining Co. (Munson)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 40 ac	Fee	Sec 1, T10N, R133	345-052-04-00-5 345-052-04-00-2	
Golden Queen Mining Co. (Peck)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 29.45 ac	Fee	Sec 1, T10N, R13W	345-052-13-00-4 345-052-13-00-1	

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Golden Queen Mining Co. (Prentice)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2.07 ac	Fee	Sec 36, T11N, R13W	427-344-05-00-3C	
Golden Queen Mining Co. (Rice)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2.6 ac	Fee	Sec 1. T10N, R13W	345-051-25-00-9	
Golden Queen Mining Co. (Wood)	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Fee Land - 2.47 ac	Fee	Sec 1, T10N, R13W	345-051-33-00-2	
Gupta (GQM)	9435 Venice Blvd. Culver City, CA 90232	100.0000%	Fee Land - 43.41 ac	Fee	Sec 1, T10N, R13W	345-052-01-00	
Soledad Mojave Mining Syndicate	932 Springwood Lane Encinitas, CA 92024	100.0000%	Fee Land - 320 ac	Fee	Sec 7, T10N, R12W	429-020-01-00-4	
*Stelzner, Thomas Et.Al.	534 Selmart Lane Petaluma, CA 94954-2500	100.0000%	Fee Land - 154.32 ac	Fee	Sec 5, T10N,R12W	246-020-01-00-1	
Wegmann, W.F. (GQM)	P O Box 16052 South Lake, CA 96151-6052	100.0000%	Fee Land - 37.82 ac	Fee	Sec 6, T10N, R12W	429-190-06-00-9	
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GAP No. 1	Unpatented	Sec 6 T10N,R12W		199586
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GAP No. 2	Unpatented	Sec 8 T10N,R12 W		199587
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GAP No. 3	Unpatented	Sec 8 T10N,R12 W		199588
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GAP No. 4	Unpatented	Sec 8 T10N,R12 W		199589
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GAP No. 5	Unpatented	Sec 8 T10N,R12 W		231702
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GAP No. 6a	Unpatented	Sec 8 T10N,R12 W		238923
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GBP No. 1 - 200 ac all GBP,	Unpatented	Sec 6 T10N,R12W		196345
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GBP No. 2	Unpatented	Sec 6 T10N,R12W		196346
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GBP No. 3	Unpatented	Sec 6&7 T10N, R12W,		196347
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Gem - 7 ac	Unpatented	Sec 6 T10N,R12W		49891
Western Centennials Inc., W.L. Wilson	P O Box 2183	100.0000%	Golden Queen - 7.423 ac	Patent	Sec 6 T10N,R12W	429-190-10-00-0	

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Western Centennials Inc., W.L. Wilson	P O Box 2183 Grand Junction, CO 81502-2183	100.0000%	Golden Queen - 7.423 ac	Patent	Sec 6 T10N,R12W	429-190-10-00-0	
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Golden Queen No. 1 - 74.25 ac	Unpatented	Sec 6 T10N,R12W		86322
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Golden Queen No. 2	Unpatented	Sec 6 T10N,R12W		86323
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Golden Queen No. 3	Unpatented	Sec 6 T10N,R12W		86324
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Golden Queen No. 4	Unpatented	Sec 6 T10N,R12W		86325
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Golden Queen No. 5	Unpatented	Sec 6 T10N,R12W		86326
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Golden Queen No. 6	Unpatented	Sec 6 T10N,R12W		86327
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Golden Queen No. 7	Unpatented	Sec 6 T10N,R12W		86328
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Golden Queen No. 8	Unpatented	Sec 6 T10N,R12W		86329
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 14	Unpatented	Sec 12 T10N,R13W		196329
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 15	Unpatented	Sec 12 T10N,R13W		196330
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 16	Unpatented	Sec 12 T10N,R13W		196331
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 17	Unpatented	Sec 12 T10N,R13W		196332
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 18	Unpatented	Sec 12 T10N,R13W		196333
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 19	Unpatented	Sec 12 T10N,R13W		196334
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 20	Unpatented	Sec 12 T10N,R13W		196335
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 21	Unpatented	Sec 12 T10N,R13W		196336
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 22	Unpatented	Sec 12 T10N,R13W		196337

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 23	Unpatented	Sec 12 & 7 T10N,R13W		196338
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 24	Unpatented	Sec 2 & 13 T10N, R13W		196339
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 25	Unpatented	Sec 2 & 13 T10N, R13W		196340
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 26	Unpatented	Sec 2 & 13 T10N, R13W		196341
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 27	Unpatented	Sec 2 & 13 T10N, R13W		196342
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	GQM No. 28	Unpatented	Sec 2 & 13 T10N, R13W		196343
Birtle, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Gray Eagle - 35.960 w/Gypsy	Patent	Sec 6 T10N,R12W	429-190-22-00-5C	
Birtle, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Gypsy	Patent	Sec 6 T10N,R12W	429-190-22-00-5C	
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Herman	Unpatented	Sec 6 T10N,R12W		41694
Godfrey, Eric W. (GQM)	531 Stephens Fillmore, CA 93015	7.4000%	Homestake	Unpatented	Sec 6 T10N,R12W		36726
Meehl, Grace W. (GQM)	714 Valita Street Venice, CA 90291	44.5000%	Homestake	Unpatented	Sec 6 T10N,R12W		36726
Meehl, John G. (GQM)	239 Kittery Place San Ramone, CA 94583	7.4000%	Homestake	Unpatented	Sec 6 T10N,R12W		36726
Meehl, Mary aka May (GQM)	3730 Trieste Dr. Carlsbad, CA 92008	33.3000%	Homestake	Unpatented	Sec 6 T10N,R12W		36726
Sigl, James P. (GQM)	714 Valita Street Venice, CA 90291	7.4000%	Homestake	Unpatented	Sec 6 T10N,R12W		36726
Godfrey, Eric W. (GQM)	531 Stephens Fillmore, CA 93015	7.4000%	Homestake Millsite	Unpatented	Sec 32 T11N,R12W		42415
Meehl, Grace W. (GQM)	714 Valita Street Venice, CA 90291	44.5000%	Homestake Millsite	Unpatented	Sec 32 T11N,R12W		42415
Meehl, John G. (GQM)	239 Kittery Place San Ramone, CA 94583	7.4000%	Homestake Millsite	Unpatented	Sec 32 T11N,R12W		42415
Meehl, Mary aka May (GQM)	3730 Trieste Dr.	33.3000%	Homestake Millsite	Unpatented	Sec 32 T11N,R12W		42415

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Carlsbad, CA 92008						
Sigl, James P. (GQM)	714 Valita Street Venice, CA 90291	7.4000%	Homestake Millsite	Unpatented	Sec 32 T11N,R12W		42415
Birtle, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Hope	Patent	Sec 6 T10N,R12W	429-190-20-00-9C	
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Hope	Unpatented	Sec 6 T10N,R12W		41699
Allen, Mary Ann B.	560 East Villa St. Apt. 1011 Pasadena, CA 91101	3.7500%	Independent	Patent	Sec 6 T10N,R12W		
Barrow, Laura T.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Independent	Patent	Sec 6 T10N,R12W		
Barrow, Thomas D.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Independent	Patent	Sec 6 T10N,R12W		
Boyle, Barbara	Kingsley Manor 1055 N. Kingsley Dr. #201 Los Angeles, CA 90029	7.5000%	Independent	Patent	Sec 6 T10N,R12W		
Boyle, John T.	1418 Pasqualito Ave. San Marino, Ca 91108	3.7500%	Independent	Patent	Sec 6 T10N,R12W	429-190-11-01--1	
Letteau, Betty B.	9255 Doheny Rd. #3002 Los Angeles, CA 90069-3248	6.6700%	Independent	Patent	Sec 6 T10N,R12W		
Letteau, Judge Robert M.	723 No. Roxbury Drive Beverly Hills, CA 90210	1.6650%	Independent	Patent	Sec 6 T10N,R12W		
Mingst, Caryll Sprague	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	6.2500%	Independent	Patent	Sec 6 T10N,R12W		
Mudd, Harvey II	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	5.0000%	Independent	Patent	Sec 6 T10N,R12W		
Mudd, Henry T., Jr.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	5.0000%	Independent	Patent	Sec 6 T10N,R12W		
Mudd, John W.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000	5.0000%	Independent	Patent	Sec 6 T10N,R12W	429-190-11-02-1	

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Mudd, Victoria Kingston	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	5.0000%	Independent	Patent	Sec 6 T10N,R12W		
Mudd, Virginia Bell	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	5.0000%	Independent	Patent	Sec 6 T10N,R12W		
Nicodemus, Roger E.	733 Briar Hill Circle Simi Valley, CA 93065	1.6650%	Independent	Patent	Sec 6 T10N,R12W		
Sprague, Cynthia	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	6.2500%	Independent	Patent	Sec 6 T10N,R12W		
Sprague, Elizabeth Mudd	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	6.2500%	Independent	Patent	Sec 6 T10N,R12W		
Sprague, Norman F., III	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, CA 90024	6.2500%	Independent	Patent	Sec 6 T10N,R12W		
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Intention - 68.84 ac Total ac	Patent	Sec 6 T10N,R12W	429-190-07-00-2	
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Junction	Patent	Sec 8 T10N,R12 W	429-210-02-00-2	
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	King of Desert Amendment	Unpatented	Sec 18 T10W, R12W		34771
Burton, Cecil	P O Box 2 La Grange, CA 95329	50.0000%	Little Chucker No. 1 - 6 ac both	Unpatented	Sec 8 T10N,R12 W		70019
Burton, Terry	5800 Pioneer Rd. #1 Mojave, CA 93501	50.0000%	Little Chucker No. 1	Unpatented	Sec 8 T10N,R12 W		70019
Burton, Terry	5800 Pioneer Rd. #1 Mojave, CA 93501	50.0000%	Little Chucke No. 2	Unpatented	Sec 8 T10N,R12 W		70020
Burton, Cecil	P O Box 2 La Grange, CA 95329	50.0000%	Little Chucker No. 2	Patent	Sec 8 T10N,R12 W		70020

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Marilyn	Unpatented	Sec 6 T10N,R12W		41692
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Marilyn Millsite	Unpatented	Sec 6 T10N,R12W		41690
Benson, Mary M.	1702 Ninth Avenue Yuma AZ 85364	5.0000%	Mojave Bonanza	Patent	Sec 6 T10N,R12W	429-190-12-00-6	
Condit, Alice	c/o Barbara Condit 402 E. McKinley Pomona, CA 91767	12.5000%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Cousins, Joyce	18717 Mill Villa Rd. #626 Jamestown, CA 95327	5.0000%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Fisher, Theodora Frisbee	Kensington Place 1580 Geary Rd. Walnut Creek, CA 94596	4.1670%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Frisbee, Don C.	1500 S W First Ave, Ste 1005 Portland, OR 97496	4.1670%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Hart, Barbara Frisbee	P O Box 600 Winston, OR 97496	4.1670%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Iten, Janice	1010 Maple Drive Ukiah, CA 95482	5.0000%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Lynn, William M.	2100 El Molina Ave. San Marino, Ca 91108	15.0000%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
McMillen, Emma G.	767 Clara Drive Palo Alto, CA 94303	5.0000%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
McMillen, H.L. (Mac)	1427 Madera Way Millbrae, CA 94030-2826	5.0000%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Smith, Selma M.	5272 Lindley Ave. Encino, CA 91316	9.0000%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Starke, George O.	9442 Mast Blvd. Santee, CA 92071	0.50%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Starke, Royden W.	2010 Donahue Drive E. Cajon, CA 92019	0.50%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Walston, Wilbur	8438 Venus Drive Buena Park, CA 90620	25.00%	Mojave Bonanza	Patent	Sec 6 T10N,R12W		
Knight, Virginia	540 South Arden Blvd. Los Angeles, CA 90020	100.0000%	Mountain View	Unpatented	Sec 6 T10N,R12W		41698

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	North Star - 5 ac	Unpatented	Sec 6 T10N,R12W		49887
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Patience - 18 ac	Unpatented	Sec 6 T10N,R12W		39596
Birtle, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Pearl 22.550 ac comb w/hope	Patent	Sec 6 T10N,R12W	429-190-20-00-9C	
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 1 - 200 ac total all Pratt 1-	Unpatented	Sec 12 T10N,R13W		218305
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 10	Unpatented	Sec 12 T10N,R13W		218314
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 11	Unpatented	Sec 12 T10N,R13W		218315
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 12	Unpatented	Sec 12 T10N,R13W		218316
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 13	Unpatented	Sec 12 T10N,R13W		218317
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 14	Unpatented	Sec 12 T10N,R13W		218318
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 16	Unpatented	Sec 12 T10N,R13W		218319
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 17	Unpatented	Sec 12 T10N,R13W		218320
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 2	Unpatented	Sec 12 T10N,R13W		218306
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 3	Unpatented	Sec 12 T10N,R13W		218307
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 4	Unpatented	Sec 12 T10N,R13W		218308
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 5	Unpatented	Sec 12 T10N,R13W		218309
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 6	Unpatented	Sec 12 T10N,R13W		218310
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 7	Unpatented	Sec 12 T10N,R13W		218311

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 8	Unpatented	Sec 12 T10N,R13W		218312
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Pratt 9	Unpatented	Sec 12 T10N,R13W		218313
Allen, Mary Ann B.	560 East Villa St. Apt. 1011 Pasadena, CA 91101	3.7500%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Barrow, Laura T.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Barrow, Thomas D.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Boyle, Barbara	Kingsley Manor 1055 N. Kingsley Dr. #201 Los Angeles, CA 90029	7.5000%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Boyle, John T.	1418 Pasqualito Ave. San Marino, Ca 91108	3.7500%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W	429-190-11-01--1	
Letteau, Betty B.	9255 Doheny Rd. #3002 Los Angeles, CA 90069-3248	6.6700%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Letteau, Judge Robert M.	723 No. Roxbury Drive Beverly Hills, CA 90210	1.6650%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mingst, Caryll Sprague	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, Harvey II	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, Henry T., Jr.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, John W.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W	429-190-11-02-1	
Mudd, Victoria Kingston	Mudd Estate J. Arthur Greenfield & Co.	5.0000%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024						
Mudd, Virginia Bell	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Nicodemus, Roger E.	733 Briar Hill Circle Simi Valley, CA 93065	1.6650%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Cynthia	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Elizabeth Mudd	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Norman F., III	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Quartet - Queen Esther group	Patent	Sec 6 T10N,R12W		
Allen, Mary Ann B.	560 East Villa St. Apt. 1011 Pasadena, CA 91101	3.7500%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Barrow, Laura T.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Barrow, Thomas D.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Boyle, Barbara	Kingsley Manor 1055 N. Kingsley Dr. #201 Los Angeles, CA 90029	7.5000%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Boyle, John T.	1418 Pasqualito Ave. San Marino, Ca 91108	3.7500%	Queen Esther (group)	Patent	Sec 6 T10N,R12W	429-190-11-01--1	
Letteau, Betty B.	9255 Doheny Rd. #3002 Los Angeles, CA 90069-3248	6.6700%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Letteau, Judge Robert M.	723 No. Roxbury Drive Beverly Hills, CA 90210	1.6650%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Mingst, Caryll Sprague	Mudd Estate J. Arthur Greenfield & Co.	6.2500%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024						
Mudd, Harvey II	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Mudd, Henry T., Jr.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Mudd, John W.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Queen Esther (group)	Patent	Sec 6 T10N,R12W	429-190-11-02-1	
Mudd, Victoria Kingston	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Mudd, Virginia Bell	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Nicodemus, Roger E.	733 Briar Hill Circle Simi Valley, CA 93065	1.6650%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Sprague, Cynthia	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Sprague, Elizabeth Mudd	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Sprague, Norman F., III	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Queen Esther (group)	Patent	Sec 6 T10N,R12W		
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Queen of Sheba - 320 ac total	Unpatented	Sec 18 T10W, R12W		34768
Hamilton, Marie & Stussy, John & Betty	3010 Skywood	100.0000%	Queen/King Soledad	Unpatented	Sec 18 T10W, R12W		34768

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Orange, CA 92665						
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Rare Bear # 1 Millsite - 15 ac all	Unpatented	Sec 32 T11N,R12W		239234
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Rare Bear # 2 Millsite	Unpatented	Sec 32 T11N,R12W		239235
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Rare Bear #3 Millsite	Unpatented	Sec 32 T11N,R12W		239236
Allen, Mary Ann B.	560 East Villa St. Apt. 1011 Pasadena, CA 91101	3.7500%	Regina - Queen Esther group	Patent	Sec 6 T10N,R12W		
Barrow, Laura T.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Regina	Patent	Sec 6 T10N,R12W		
Barrow, Thomas D.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Regina	Patent	Sec 6 T10N,R12W		
Boyle, Barbara	Kingsley Manor 1055 N. Kingsley Dr. #201 Los Angeles, CA 90029	7.5000%	Regina	Patent	Sec 6 T10N,R12W		
Boyle, John T.	1418 Pasqualito Ave. San Marino, Ca 91108	3.7500%	Regina	Patent	Sec 6 T10N,R12W	429-190-11-01--1	
Letteau, Betty B.	9255 Doheny Rd. #3002 Los Angeles, CA 90069-3248	6.6700%	Regina	Patent	Sec 6 T10N,R12W		
Letteau, Judge Robert M.	723 No. Roxbury Drive Beverly Hills, CA 90210	1.6650%	Regina	Patent	Sec 6 T10N,R12W		
Mingst, Caryll Sprague	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Regina	Patent	Sec 6 T10N,R12W		
Mudd, Harvey II	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Regina	Patent	Sec 6 T10N,R12W		
Mudd, Henry T., Jr.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Regina	Patent	Sec 6 T10N,R12W		
Mudd, John W.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000	5.0000%	Regina	Patent	Sec 6 T10N,R12W	429-190-11-02-1	

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Los Angeles, Ca 90024						
Mudd, Victoria Kingston	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Regina	Patent	Sec 6 T10N,R12W		
Mudd, Virginia Bell	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Regina	Patent	Sec 6 T10N,R12W		
Nicodemus, Roger E.	733 Briar Hill Circle Simi Valley, CA 93065	1.6650%	Regina	Patent	Sec 6 T10N,R12W		
Sprague, Cynthia	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Regina	Patent	Sec 6 T10N,R12W		
Sprague, Elizabeth Mudd	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Regina	Patent	Sec 6 T10N,R12W		
Sprague, Norman F., III	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Regina	Patent	Sec 6 T10N,R12W		
Allen, Mary Ann B.	560 East Villa St. Apt. 1011 Pasadena, CA 91101	3.7500%	Rex - Queen Esther group	Patent	Sec 6 T10N,R12W		
Barrow, Laura T.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Rex	Patent	Sec 6 T10N,R12W		
Barrow, Thomas D.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Rex	Patent	Sec 6 T10N,R12W		
Boyle, Barbara	Kingsley Manor 1055 N. Kingsley Dr. #201 Los Angeles, CA 90029	7.5000%	Rex	Patent	Sec 6 T10N,R12W		
Boyle, John T.	1418 Pasqualito Ave. San Marino, Ca 91108	3.7500%	Rex	Patent	Sec 6 T10N,R12W	429-190-11-01--1	
Letteau, Betty B.	9255 Doheny Rd. #3002 Los Angeles, CA 90069-3248	6.6700%	Rex	Patent	Sec 6 T10N,R12W		
Letteau, Judge Robert M.	723 No. Roxbury Drive	1.6650%	Rex	Patent	Sec 6 T10N,R12W		

GOLDEN QUEEN MINING COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LAND HOLDINGS

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Beverly Hills, CA 90210						
Mingst, Caryll Sprague	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Rex	Patent	Sec 6 T10N,R12W		
Mudd, Harvey II	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Rex	Patent	Sec 6 T10N,R12W		
Mudd, Henry T., Jr.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Rex	Patent	Sec 6 T10N,R12W		
Mudd, John W.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Rex	Patent	Sec 6 T10N,R12W	429-190-11-02-1	
Mudd, Victoria Kingston	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Rex	Patent	Sec 6 T10N,R12W		
Mudd, Virginia Bell	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	5.0000%	Rex	Patent	Sec 6 T10N,R12W		
Nicodemus, Roger E.	733 Briar Hill Circle Simi Valley, CA 93065	1.6650%	Rex	Patent	Sec 6 T10N,R12W		
Sprague, Cynthia	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Rex	Patent	Sec 6 T10N,R12W		
Sprague, Elizabeth Mudd	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000 Los Angeles, Ca 90024	6.2500%	Rex	Patent	Sec 6 T10N,R12W		
Sprague, Norman F., III	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd., Ste. 1000	6.2500%	Rex	Patent	Sec 6 T10N,R12W		

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Los Angeles, Ca 90024						
Karma Wegmann Corp. (GQM)	714 Valila Street Venice, CA 90291	100.0000%	Reymert	Patent	Sec 6 T10N,R12W	429-190-07-00-2	
Campbell, Louis G., Jr.	821 Crater Camp Dr. Calabasas, CA 91302	12.5000%	Sailor Boy	Patent	Sec 6 T10N,R12W	429-190-13-02-7C	
Moore, Robert L.	3075 San Pasqual Pasadena, CA 91107	18.7500%	Sailor Boy	Patent	Sec 6 T10N,R12W	429-190-13-01-8C	
Moore, Robert S.	590 Castano Ave. Pasadena, CA 91107	18.7500%	Sailor Boy	Patent	Sec 6 T10N,R12W		
Thargard, George F., Jr.	#60 Linda Isle Newport Beach, CA 92600	50.0000%	Sailor Boy	Patent	Sec 6 T10N,R12W	429-190-13-03-6C	
Campbell, Louis G., Jr.	821 Crater Camp Dr. Calabasas, CA 91302	12.5000%	Sailor Girl	Patent	Sec 6 T10N,R12W	429-190-13-02-7C	
Moore, Robert L.	3075 San Pasqual Pasadena, CA 91107	18.7500%	Sailor Girl	Patent	Sec 6 T10N,R12W	429-190-13-01-8C	
Moore, Robert S.	590 Castano Ave. Pasadena, CA 91107	18.7500%	Sailor Girl	Patent	Sec 6 T10N,R12W		
Thargard, George F., Jr.	#60 Linda Isle Newport Beach, CA 92600	50.0000%	Sailor Girl	Patent	Sec 6 T10N,R12W	429-190-13-03-6C	
Allen, Cheryl Catherine	686 1/2 N. Coast Hwy. Laguna Beach, CA 92651	2.1450%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Allen, Douglas Michael	17497 County Rd. #501 Bayfield, CO 81122	2.1450%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Allen, Scott Thomas	304 Clover Lane Fort Collins, Co 80524	2.1450%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Golden Queen Mining Co. (Allen,Steve)	P O Box 878 Rosamond, Ca 93560	2.1450%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Brodine III, Robert C.	6226 West 10052 N Highland, UT 84003	6.0000%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Hanly, Teresa Gail	26382 Mimosa Lane Mission Viejo, CA 92694-1924	2.1450%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Henry, Alma A.	Box 1267 Lyman, WY 82937-1267	2.9100%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Hodges, Beverly Nadine	unknown	2.9100%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
*Hodges, Ella et el	24410 Crenshaw Blvd.	2.9100%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Torrance, CA 90505						
Holmes Evans, Nancy	c/o Mary Slaughter 2540 N. Brimhall Mesa, AZ 85203	2.7270%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Holmes II, George I.	2876 E. Virginia Apache Junction, AZ 85219	2.7270%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W	429-190-14-01-1	
Holmes, Michael Edward	c/o Mary Slaughter 2540 N. Brimhall Mesa, AZ 85203	2.7270%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Holmes, Raymond R.	c/o Mary Slaughter 2540 N. Brimhall Mesa, AZ 85203	2.7270%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Golden Queen Mining Co. (Holmes, Ruby)	P O Box 878 Rosamond, CA 93560	6.0000%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Norton, Carlolyn E.	P O Box 1731 St. John, AZ 85436	1.4550%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Orr, Barbara C.	704 E. Lehi Road Mesa, AZ 85203	2.7270%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Pennington, Marcus A.	8322 Foothill Blvd. Sunland, CA 91040	6.0000%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Pennington, Marlowe	P O Box 4667 Palm Springs, CA 92263-4667	3.0000%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Slayton, Gean A.	P O Box 1772 St. John's, AZ 85436	1.4550%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Thargard, George F., Jr.	#60 Linda Isle Newport Beach, CA 92600	40.0000%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W	429-190-14-02-0 C	
Van Pelt, Donald Richard	P O Box 4667 Palm Springs, CA 92263-4667	3.0000%	Santa Ana Wedge	Patent	Sec 6 T10N,R12W		
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Santa Maria 1	Unpatented	Sec 6 T10N,R12W		39594
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Santa Maria 2	Unpatented	Sec 6 T10N,R12W		39595
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Silver Girl	Patent	Sec 6 T10N,R12W	429-190-07-00-2	
Karma Wegmann Corp. (GQM)	714 Valita Street	100.0000%	Silver Girl 2	Patent	Sec 6 T10N,R12W	429-190-07-00-2	

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Venice, CA 90291						
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Silver Girl Millsite - 1.581 ac	Patent	Sec 32 T11N,R12W	427-130-02-00-5	
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Silver Girl Millsite - 2 ac	Unpatented	Sec 32 T11N,R12W		39599
Allen, Cheryl Catherine	686 1/2 N. Coast Hwy. Laguna Beach, CA 92651	2.1450%	Silver Queen	Patent	Sec 6 T10N,R12W		
Allen, Douglas Michael	17497 County Rd. #501 Bayfield, CO 81122	2.1450%	Silver Queen	Patent	Sec 6 T10N,R12W		
Allen, Scott Thomas	304 Clover Lane Fort Collins, Co 80524	2.1450%	Silver Queen	Patent	Sec 6 T10N,R12W		
Golden Queen Mining Co. (Allen, Steve)	P O Box 878 Rosamond, Ca 93560	2.1450%	Silver Queen	Patent	Sec 6 T10N,R12W		
Brodine III, Robert C.	6226 West 10052 N Highland, UT 84003	6.0000%	Silver Queen	Patent	Sec 6 T10N,R12W		
Hanly, Teresa Gail	26382 Mimosa Lane Mission Viejo, CA 92694-1924	2.1450%	Silver Queen	Patent	Sec 6 T10N,R12W		
Henry, Alma A.	Box 1267 Lyman, WY 82937-1267	2.9100%	Silver Queen	Patent	Sec 6 T10N,R12W		
Hodges, Beverly Nadine	unknown	2.9100%	Silver Queen	Patent	Sec 6 T10N,R12W		
*Hodges, Ella et el	24410 Crenshaw Blvd. Torrance, CA 90505	2.9100%	Silver Queen	Patent	Sec 6 T10N,R12W		
Holmes Evans, Nancy	c/o Mary Slaughter 2540 N Brimhall Mesa, AZ 85203	2.7270%	Silver Queen	Patent	Sec 6 T10N,R12W		
Holmes II, George I.	2876 E. Virginia Apache Junction, AZ 85219	2.7270%	Silver Queen	Patent	Sec 6 T10N,R12W	429-190-15-01-4C	
Holmes, Michael Edward	c/o Mary Slaughter 2540 N. Brimhall Mesa, AZ 85203	2.7270%	Silver Queen	Patent	Sec 6 T10N,R12W		
Holmes, Raymond R.	c/o Mary Slaughter 2540 N. Brimhall Mesa, AZ 85203	2.7270%	Silver Queen	Patent	Sec 6 T10N,R12W		
Golden Queen Mining Co. (Holmes, Ruby)	P O Box 878 Rosamond, CA 93560	6.0000%	Silver Queen	Patent	Sec 6 T10N,R12W		

GOLDEN QUEEN MINING COMPANY, INC.
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Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Norton, Carolyn E.	P O Box 1731 St. John, AZ 85436	1.4550%	Silver Queen	Patent	Sec 6 T10N,R12W		
Orr, Barbara C.	704 E. Lehi Road Mesa, AZ 85203	2.7270%	Silver Queen	Patent	Sec 6 T10N,R12W		
Pennington, Marcus A.	8322 Foothill Blvd. Sunland, CA 91040	6.0000%	Silver Queen	Patent	Sec 6 T10N,R12W		
Pennington, Marlowe	P O Box 4667 Palm Springs, CA 92263-4667	3.0000%	Silver Queen	Patent	Sec 6 T10N,R12W		
Slayton, Gean A.	P O Box 1772 St. John's, AZ 85436	1.4550%	Silver Queen	Patent	Sec 6 T10N,R12W		
Thargard, George F., Jr.	#60 Linda Isle Newport Beach, CA 92600	40.0000%	Silver Queen	Patent	Sec 6 T10N,R12W	429-190-15-02-0 C	
Van Pelt, Donald Richard	P O Box 4667 Palm Springs, CA 92263-4667	3.0000%	Silver Queen	Patent	Sec 6 T10N,R12W		
Allen, Cheryl Catherine	686 1/2 N. Coast Hwy. Laguna Beach, CA 92651	5.1498%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Allen, Douglas Michael	17497 County Rd. #501 Bayfield, CO 81122	5.1498%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Allen, Scott Thomas	304 Clover Lane Fort Collins, Co 80524	5.1498%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Golden Queen Mining Co. (Allen, Steve)	P O Box 878 Rosamond, Ca 93560	5.1498%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Hanly, Teresa Gail	26382 Mimosa Lane Mission Viejo, CA 92691-1924	5.1498%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Hodges, Beverly Nadine	unknown	9.7000%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
*Hodges, Ella et el	24410 Crenshaw Torrance, Ca 90505	9.7000%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Holmes Evans, Nancy	c/o Mary Slaughter 2540 N. Brimhall Mesa, AZ 85203	7.0900%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Holmes II, George I.	2876 E. Virginia Apache Junction, AZ 86219	7.0900%	Silver Queen Extension	Patent	Sec 6 T10N,R12W	429-190-15-01-4C	
Holmes, Michael Edward	c/o Mary Slaughter 2540 N. Brimhall	7.0900%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Mesa, AZ						
Holmes, Raymond R.	c/o Mary Slaughter 2540 N. Brimhall Mesa, AZ	7.0900%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Norton, Carolyn E.	P O Box 1731 St. John, AZ 85436	4.8500%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Orr, Barbara C.	704 E. Lehi Road Mesa, AZ 85203	7.0900%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Slayton, Gean A.	P O Box 1772 St. John's, AZ 85936	4.8500%	Silver Queen Extension	Patent	Sec 6 T10N,R12W		
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Silver Spray Amendment	Unpatented	Sec 18 T10W, R12W		34770
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 1 - 363 ac total all Sol 1-24	Unpatented	Sec 8 T10N,R12 W		130496
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 10	Unpatented	Sec 8 T10N,R12 W		130505
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 11	Unpatented	Sec 8 T10N,R12 W		130506
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 12	Unpatented	Sec 8 T10N,R12 W		130507
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 13	Unpatented	Sec 8 T10N,R12 W		130508
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 14	Unpatented	Sec 8 T10N,R12 W		130509
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 15	Unpatented	Sec 8 T10N,R12 W		130510
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 16	Unpatented	Sec 8 T10N,R12 W		130511
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 17	Unpatented	Sec 8 T10N,R12 W		130512
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 18	Unpatented	Sec 8 T10N,R12 W		130513
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 19	Unpatented	Sec 8 T10N,R12 W		130514

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Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 2	Unpatented	Sec 8 T10N,R12 W		130497
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 20	Unpatented	Sec 8 T10N,R12 W		130515
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 21	Unpatented	Sec 8 T10N,R12 W		130516
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 22	Unpatented	Sec 8 T10N,R12 W		130517
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 23	Unpatented	Sec 8 T10N,R12 W		130518
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 24	Unpatented	Sec 8 T10N,R12 W		130519
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 3	Unpatented	Sec 8 T10N,R12 W		130498
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 4	Unpatented	Sec 8 T10N,R12 W		130499
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 5	Unpatented	Sec 8 T10N,R12 W		130500
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 6	Unpatented	Sec 8 T10N,R12 W		130501
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 7	Unpatented	Sec 8 T10N,R12 W		130502
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 8	Unpatented	Sec 8 T10N,R12 W		130503
Golden Queen Mining Company, Inc.	P.O. Box 878 Rosamond, CA 93560-0878	100.0000%	Sol 9	Unpatented	Sec 8 T10N,R12 W		130504
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #1	Unpatented	Sec 18 T10W, R12W		192601
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #2	Unpatented	Sec 18 T10W, R12W		192602
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #3	Unpatented	Sec 18 T10W, R12W		192603
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #4	Unpatented	Sec 18 T10W, R12W		192604
Hamilton, Marie & Stussy, John & Betty	3010 Skywood	100.0000%	Sole #5	Unpatented	Sec 18 T10W, R12W		192605

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	Orange, CA 92665						
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #6	Unpatented	Sec 18 T10W, R12W		192606
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #7	Unpatented	Sec 18 T10W, R12W		192607
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #8	Unpatented	Sec 18 T10W, R12W		192608
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #9	Unpatented	Sec 18 T10W, R12W		192609
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #10	Unpatented	Sec 18 T10W, R12W		192610
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #11	Unpatented	Sec 18 T10W, R12W		192611
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #12	Unpatented	Sec 18 T10W, R12W		192612
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #13	Unpatented	Sec 18 T10W, R12W		192613
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #14	Unpatented	Sec 18 T10W, R12W		192614
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #15	Unpatented	Sec 18 T10W, R12W		192615
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #16	Unpatented	Sec 18 T10W, R12W		192616
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #17	Unpatented	Sec 18 T10W, R12W		202805/203
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #18	Unpatented	Sec 18 T10W, R12W		202806/203
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Sole #19	Unpatented	Sec 18 T10W, R12W		202807/203
Birtle, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Soledad Ext. - 22.04 ac	Patent	Sec 6 T10N,R12W	429-190-18-00-4C	
Birtle, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Soledad Ext. No. 1 - 4 ac	Patent	Sec 6 T10N,R12W	429-190-18-00-4C	
Birtle, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Soledad Ext. the So. 300' -	Patent	Sec 6 T10N,R12W	429-190-21-00-2C	

GOLDEN QUEEN MINING COMPANY, INC.
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Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Soledad the So. 300' ext No.	Patent	Sec 6 T10N,R12W	429-190-19-00-1C	
Karma Wegmann Corp. (GQM)	714 Valita Street Venice, CA 90291	100.0000%	Southern Queen 29.98 ac for	Patent	Sec 8 T10N,R12 W	429-210-02-00-2	
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	St. Patrick - 10.159 ac	Patent	Sec 6 T10N,R12W	429-190-20-00-9C	
Birtie, Mary J. & Southwestern Refining Corp.	5028 Ladera Vista Dr. Camarillo, CA 93012	100.0000%	Starlight - see Gray Eagle	Patent	Sec 6 T10N,R12W	429-190-17-00-1C	
Godfrey, Eric W. (GQM)	531 Stephens Fillmore, CA 93015	7.4000%	Tepeyac Hill	Unpatented	Sec 6 T10N,R12W		34226
Meehl, Grace W. (GQM)	714 Valita Street Venice, CA 90291	44.5000%	Tepeyac Hill	Unpatented	Sec 6 T10N,R12W		34226
Meehl, John G. (GQM)	239 Kittery Place San Ramone, CA 94583	7.4000%	Tepeyac Hill	Unpatented	Sec 6 T10N,R12W		34226
Meehl, Mary aka May (GQM)	3730 Trieste Dr. Carlsbad, CA 92008	33.3000%	Tepeyac Hill	Unpatented	Sec 6 T10N,R12W		34226
Sigl, James P. (GQM)	714 Valita Street Venice, CA 90291	7.4000%	Tepeyac Hill	Unpatented	Sec 6 T10N,R12W		34226
Allen, Mary Ann B.	560 East Villa St., Apt 1011 Pasadena, CA 91101	3.7500%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Barrow, Laura T.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Barrow, Thomas D.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Boyle, Barbara	Kingsley Manor 1055 N Kingsley Dr. #201 Los Angeles, CA 90029	7.5000%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Boyle, John T.	1418 Pasqualito Ave. San Marino, CA 91108	3.7500%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W	429-190-11-01--1	
Letteau, Betty B.	9288 Doheny Rd. #3002 Los Angeles, CA 90069-3248	6.6700%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Letteau, Judge Robert M.	723 N Roxbury Dr. Beverly Hills, Ca 90210	1.6650%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mingst, Caryll Sprague	Mudd Estate J. Arthur Greenfield & Co.	6.2500%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
	924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024						
Mudd, Harvey II	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, Henry T., Jr.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, John W.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W	429-190-11-02-1	
Mudd, Victoria Kingston	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, Virginia Bell	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Nicodemus, Roger E.	733 Briar Hill Circle Simi Valley, CA 93065	1.6650%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Cynthia	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	6.2500%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Elizabeth Mudd	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	6.2500%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Norman F., III	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	6.2500%	Thurston - Queen Esther group	Patent	Sec 6 T10N,R12W		
Allen, Mary Ann B.	560 East Villa St., Apt 1011 Pasadena, CA 91101	3.7500%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		

GOLDEN QUEEN MINING COMPANY, INC.
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Barrow, Laura T.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Barrow, Thomas D.	4605 Post Oak Place, Ste. 207 Houston, TX 77027-9728	12.5000%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Boyle, Barbara	Kingsley Manor 1055 N Kingsley Dr. #201 Los Angeles, CA 90029	7.5000%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Boyle, John T.	1418 Pasqualilo Ave. San Marino, CA 91108	3.7500%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W	429-190-11-01--1	
Letteau, Betty B.	9255 Doheny Rd. #3002 Los Angeles , CA 90069-3248	6.6700%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Letteau, Judge Robert M.	723 N Roxbury Dr. Beverly Hills, Ca 90210	1.6650%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mingst, Caryll Sprague	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	6.2500%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, Harvey II	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, Henry T., Jr.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, John W.	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W	429-190-11-02-1	
Mudd, Victoria Kingston	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Mudd, Virginia Bell	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	5.0000%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		

Owner		Int %	Claim Name	Patent/ Unpatented/Fee	Location	APN	CAMC #
Nicodemus, Roger E.	733 Briar Hill Circle Simi Valley, CA 93065	1.6650%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Cynthia	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	6.2500%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Elizabeth Mudd	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	6.2500%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Sprague, Norman F., III	Mudd Estate J. Arthur Greenfield & Co. 924 Westwood Blvd. Ste 1000 Los Angeles, CA 90024	6.2500%	Tip Top - Queen Esther group	Patent	Sec 6 T10N,R12W		
Hamilton, Marie & Stussy, John & Betty	3010 Skywood Orange, CA 92665	100.0000%	Victoria	Unpatented	Sec 18 T10W, R12W		34769

*See Owners Mailing List for Names and address on Et. Al.

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EMMETT [illegible] DIFFENBOCK
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3750 UNIVERSITY AVENUE, SUITE 610
RIVERSIDE, CALIFORNIA 92501
TELEPHONE (909) 274-7777

August 14, 1996

<u>SENT FACSIMILE (805) 326-0191</u>
David A. Weiss
WZI Inc.
4700 Stockdale Highway
Suite 120
Bakersfield, California 93309

RE: Notice of Preparation of Comments from State Lands Commission

Dear Mr. Weiss:

Golden Queen Mining Company forwarded a copy of your letter dated July 23, 1996 concerning the above-referenced matter for my review and asked me to contact you. As indicated in the letter the State Lands Commission (SLC) retained an interest in Lots 2 and 20 in Section 6, Township 10 North, Range 12 West, SBM. Their interest is only to receive 6-1/2% of the gross for any mineral values removed from said land. Alex Gonzales of the SLC indicated to me his understanding that no mineral is at this time anticipated to be produced from SLC property. He indicated the letter was simply a notification of their interest and confirmation of their ongoing right to receive this royalty if production occurs. He acknowledged that the site was planned for a dump and other activities and expressed no concern with respect to these uses. Our understanding of the SLC's rights with respect to surface activity is consistent with this stance inasmuch as their sole retained interest is that of receiving royalty. In other words, they retain no rights of access, etc.

Please don't hesitate to contact me if I can provide additional information.

Sincerely,

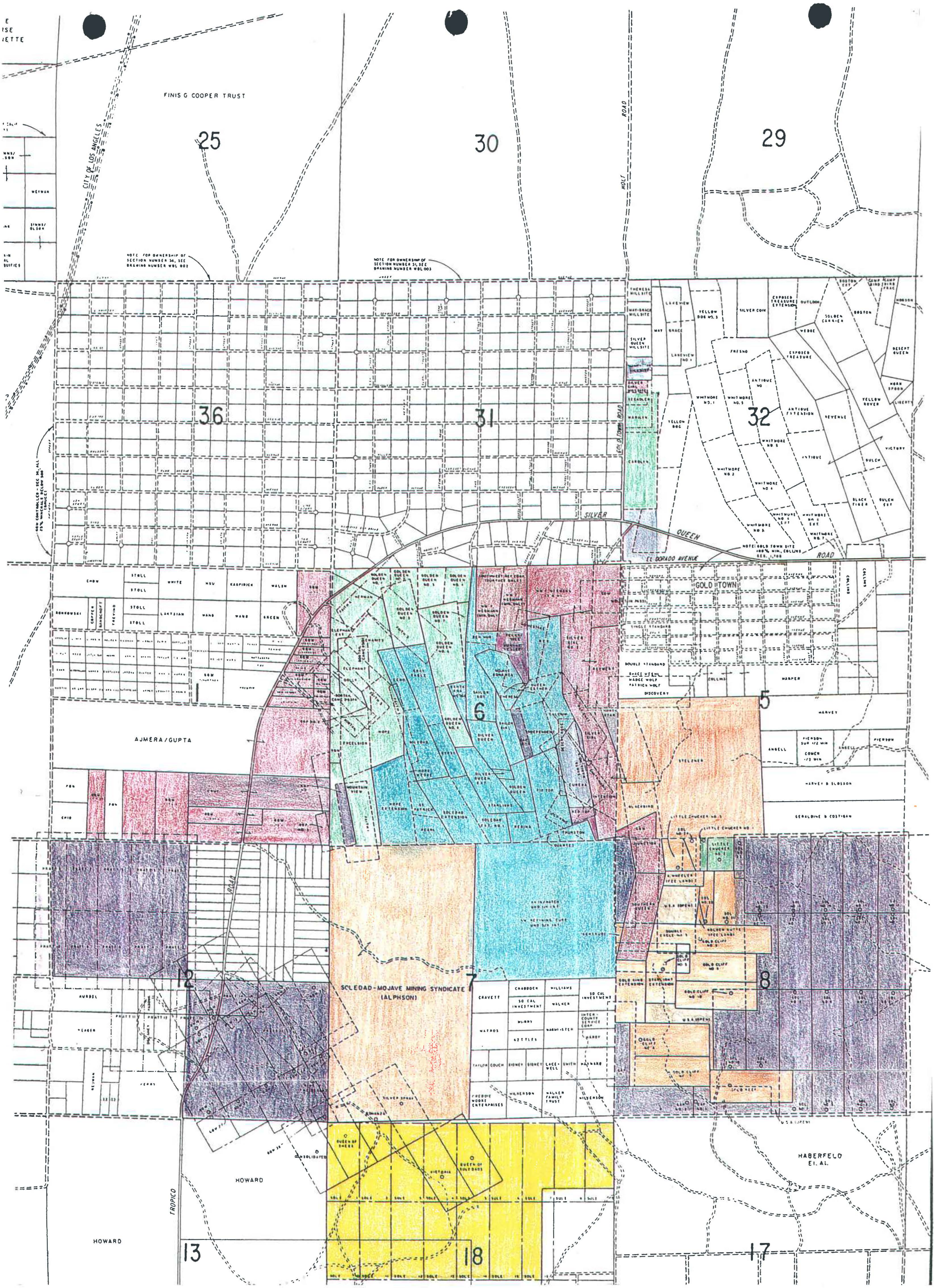
Bill Tilden

M. William Tilden
Of GRESHAM, VARNER, SAVAGE, NOLAN
& TILDEN

MWT:pw

cc: Richard Graeme (sent facsimile 805/256-6526)

GOLDEN QUEEN MINING, COMPANY, INC.
SOLEDAD MOUNTAIN PROJECT
LIST OF INTERESTS ACQUIRED FOR PROJECT



LEGEND:

🟦 FEE/PATENT CLAIMS-LEASED
🟧 FEE/PATENT CLAIMS-OTP
🟥 FEE/PATENT CLAIMS-GQM OWNED
🟫 FEE-LETTER OF INTENT/NEG.

🟩 UNPATENT CLAIMS-LEASED
🟨 UNPATENT CLAIMS-OTP
🟪 UNPATENT CLAIMS-GQM OWNED

GOLDEN QUEEN MINING CO., INC.
LAND STATUS MAP
LDR - ~~10-23-96~~
12/1/96

Attachment B

BIOLOGICAL AND SOIL RESOURCE EVALUATION
FOR
SOLEDAD MOUNTAIN PROJECT

Prepared for:
Golden Queen Mining Co. Inc.
2997 Desert Street, Suite #4
Rosamond, California 93560

Prepared by:
Samuel A. Bamberg, Ph.D.
Ingrid E. Hanne, M.S.
Bamberg Associates
26050 E. Jamison Cir.
Aurora, Colorado 80016

July 1995
Revised November 1995
Revised April 1997

07330010.083

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SUMMARY

The Soledad Mountain Project site is a proposed gold mine near Mojave, California, which will be operated by the Golden Queen Mining Company. This report presents the results of our earlier soils and biological inventories in 1989/90, and a subsequent update in 1995 as a baseline study. In this report, we evaluate the soils and biological resources of Soledad Mountain and present this information for permits, applications, and future reclamation planning and for use in determining impacts and mitigation measures. The principal findings of these studies were the following:

- Soils are skeletal with little profile, and generally rocky or pebbly loams on the slopes, and sandy loams on alluvial fans and flats,
- The general lack of soil development, suitable surface horizons, and coarse texture are major limitations for soil salvage and potential for use in reclamation,
- Vegetation is a creosote bush shrub-scrub on the lower alluvial fans and on the mountain slopes is a mixed shrub/grass type; vegetation is fairly diverse and productive, however the repeated disturbances and burns have locally reduced plant cover, species diversity, and increased annual grasses and weeds,
- Wildlife population are low due to the desert climate, burns, and alterations of habitats, and high winds; wildlife species present are typical for desert habitats with small mammals, reptiles, birds, and their predators as dominant components,
- Three animals of possible concern were potentially present from the threatened and endangered species lists for the federal and California agencies, *Plecotus townsendii* (Townsend's big-eared bat), *Gopherus agassizii* (desert tortoise), and *Citellus mohavensis* (Mohave ground squirrel); specific surveys conducted for each species failed to observe any of these animals present on the site; species are not considered threatened by the Soledad Mountain Project.

Soledad Mountain is an isolated circular volcanic peak about three miles in diameter, rising out of the alluvial flats in northwestern Antelope Valley near the Tehachapi Mountains. Elevations on the mountain range from 2,800 feet mean sea level (msl) at the base to 4,190 feet msl at the highest peak. The slopes are steep with rock outcrops and residual weathered rock and soil below the outcrops. Alluvial fans and flats surround the mountain on all sides except for the northeast. The climate is typical of the Californian deserts with hot, dry summers and cool winters with some moisture and strong and persistent winds. Temperatures range from 70 to 105 degrees fahrenheit in the summer

and 27 to 60 degrees fahrenheit in the winter. Average precipitation is approximately five inches per year with the majority of the rainfall occurring in the winter months from frontal storms. Winds are strong and persistent.

The soil and biological resources are influenced by the desert climate and dry substrate conditions. Soils are generally rocky or pebbly loams on the slopes, and sandy loams on alluvial fans and flats. The vegetation consists of a creosote/burrobush type on the flats and alluvial fans below the mountain. Wildlife is fairly diverse, however populations are small and activity is seasonal. The mountain is characterized by rock outcrops and rocky soils with predominantly desert shrub-grass species that have been altered by frequent burning, and by recreation and mine related disturbances. The human disturbance on the mountain stems from historic mining activities, previous and recent mineral exploration, and past and recent burns. The two activities most influencing biological and soil resources are the previous mining and recent exploration, as well as the repeated fires highly altering the vegetation.

The soil types are related to rock types and substrates influenced by the topography on and around Soledad Mountain. Six soil series were identified and mapped. The soils have a wide range of textures depending on the parent material and degree of weathering. Soils derived from rock altered by hydrothermal activity have increased clay content. Textures range from clay loam to fine sand, with a large amount of coarse fragments. Although the volcanic rock is acidic, it weathers to basic with soils pH ranging from 7.2 to 8.7, and has no acid generating potential. The organic matter content of the soils is very low and variable, and the nutrient status is also low. The soils' physical characteristics and nutrient content are poor as a growth medium for native vegetation. The general lack of soil development and suitable surface horizons are major limitations for soil salvage and potential for use in reclamation.

Our recent revegetation testing for reclamation in the deserts of southern California has shown the salvaged desert soils are not a better growth medium than recontoured overburden piles or spent leach heaps. Surface soil on the project site in alluvial areas and residual accumulations on lower slopes and fans contain seed reserves that can be salvaged and stored as a seedbank. Soil will be collected only as a source of seed.

Vegetation on and around Soledad Mountain is a desert shrub-scrub type adapted to a climate of low, unpredictable precipitation and hot, but variable, temperatures. The dominant vegetation type on the lower alluvial fans and flats is a creosote bush shrub-scrub with widely scattered Joshua trees. The vegetation on the mountain slopes is a mixed shrub/grass type dominated by species adapted to rocky substrates and cooler conditions. Vegetation cover averaged 23% in 1990, and increased to 80% in 1995. Overall, the vegetation is fairly diverse and productive, however the repeated disturbances and burns have locally reduced plant cover, species diversity, and increased annual grasses and weeds. No threatened or endangered species were observed or expected.

General populations of wildlife appear to be low at the Soledad project site, possibly due to the alteration of habitats by historical urbanization, mining, recreational activities and fires. The wildlife species present are typical for desert habitats with small mammals, reptiles, birds and their predators being the dominant components. There are no herbivores such as deer or bighorn sheep on Soledad Mountain. Two animals of possible concern were identified from the threatened and endangered species lists for federal and California agencies: desert tortoise (*Gopherus agassizii*) and the Mohave ground squirrel (*Spermophilus mohavensis*). One species was identified from the California Species of Special Concern: Townsend's big-eared bat (*Corynorhinus townsendii*). Specific surveys conducted for each species failed to detect any of these animals present on the site. No significant impacts to these species is anticipated due to the Soledad Mountain Project.

1.0 INTRODUCTION

The Soledad Mountain Project site is a proposed gold mining operation near Mojave, California. We originally inventoried the soil and biological resources on the site during the winter and spring seasons of 1989/90 during four field trips, and again in spring 1995. Since that earlier comprehensive study, the proposed mining operations have been revised, necessitating that we update the earlier report. The principal revisions in the plan of operations include the elimination of the mill, as well as changes in the locations of the heap leach pads and the overburden piles. The open pit mines on the north and west side of Soledad Mountain have increased in size. The operation will now disturb approximately one thousand acres. The present study area encompasses approximately 3,000 acres as shown in Figure 1-1.

This report presents the results of our inventories as a baseline study. In this report we evaluate the biological resources of Soledad Mountain as information for permits, applications, and to determine impacts and mitigations measures. In addition, this information will be used for future reclamation planning. In our 1989 to 1990 study, we inventoried the site during the growing seasons and provided a comprehensive evaluation of the resources currently on the site. During these earlier winter season 1989/90 studies, this portion of the Mojave Desert in California had low and unevenly distributed rainfall, however most areas on the site received sufficient rainfall to support some plant growth and animal activity. The intervening years have had excellent moisture and the winter/spring of 1995 was cool with abundant moisture. This resulted in excellent growth of shrubs and perennial and annual herbaceous plants.

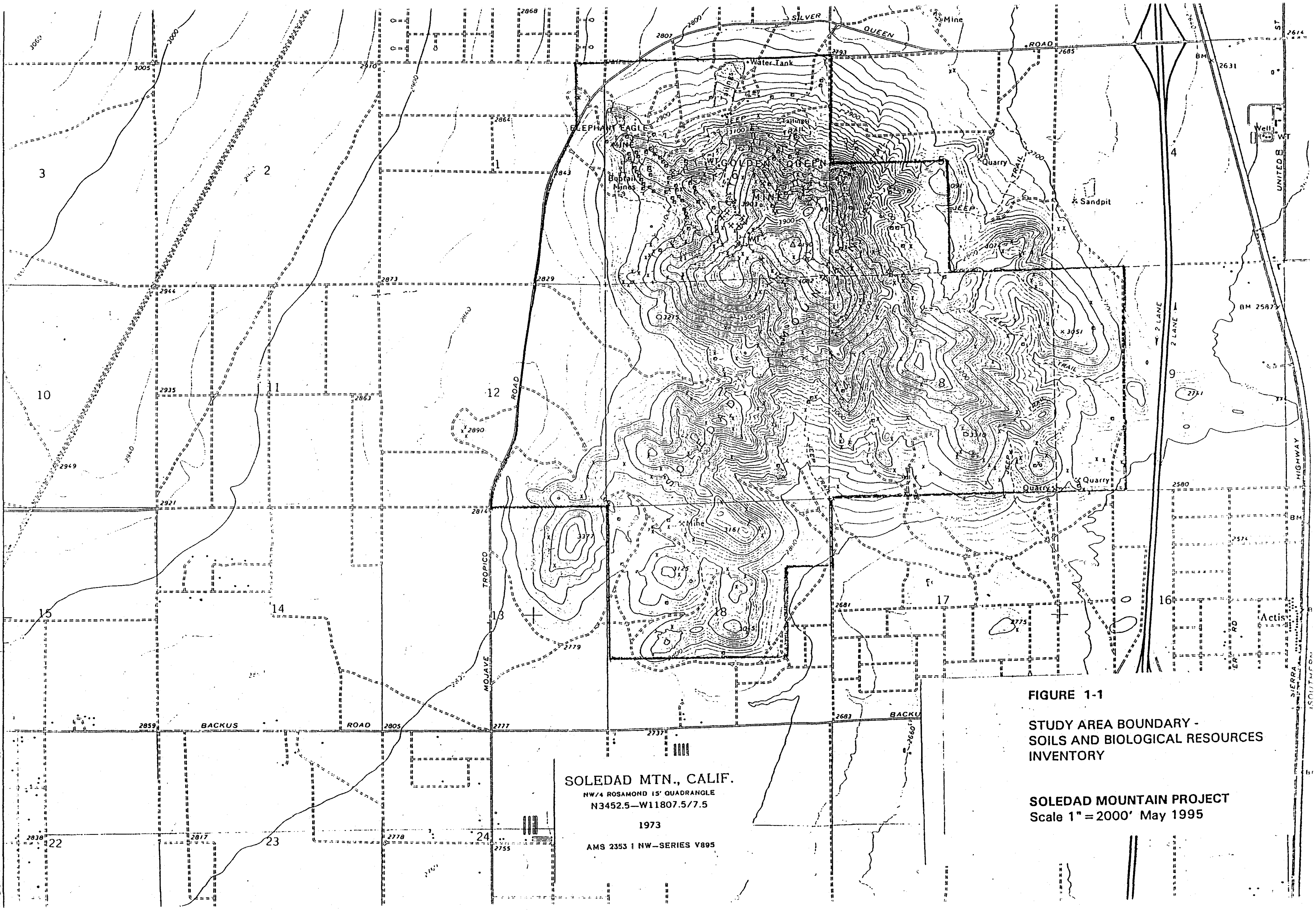


FIGURE 1-1

STUDY AREA BOUNDARY -
SOILS AND BIOLOGICAL RESOURCES
INVENTORY

SOLEDAD MOUNTAIN PROJECT
Scale 1" = 2000' May 1995

2.0 SITE CHARACTERISTICS

The Soledad Mountain Project is located on Soledad Mountain approximately five miles southwest of the town of Mojave in Kern County, California, and 70 miles northeast of Los Angeles on the western edge of the Mojave Desert. Soledad Mountain is an isolated circular volcanic peak about three miles in diameter, rising out of the alluvial flats in northwestern Antelope Valley near the Tehachapi Mountains. See Figures 2-1 and 2-2 for general views of the mountain. Elevations on the mountain range from 2,800 feet at the base to 4,190 feet at the highest peak. The slopes are steep with rock outcrops and residual weathered rock and soil below the outcrops. Alluvial fans and flats surround the mountain on all sides except for the northeast.

The climate is typical of the Californian deserts with hot, dry summers and cool winters with some moisture. This portion of the western Mojave Desert, just east of Tehachapi Pass, is noted for strong and persistent winds. Temperatures range from 70 to 105 degrees fahrenheit in the summer and 27 to 60 degrees fahrenheit in the winter. Average precipitation is approximately five inches per year with the majority of the rainfall occurring in the winter months from frontal storms. With increasing elevations on Soledad Mountain, the temperatures are cooler, there is some increase in rainfall, and snow is more frequent.

The soil and biological resources are influenced by the desert climate and dry substrate conditions. Soils are generally rocky or pebbly loams on the slopes, and sandy loams on alluvial fans and flats. The vegetation consists of a creosote/burrobush type on the flats and alluvial fans below the mountain. Vegetation on the mountain includes more grass and varied shrubs, and is highly modified by recent and recurrent fires. Wildlife is fairly diverse, however populations are small and activity is seasonal. The mountain is characterized by rock outcrops and rocky soils with predominantly desert shrub-grass species that have been altered by frequent burning and recreation and mine related disturbances.

The human disturbance on the mountain stems from historic mining activities, previous and recent mineral exploration, and past and recent burns. In addition, the area is used for recreational vehicle activities and firearm target practice. The two activities most influencing biological and soil resources are the previous mining and recent exploration, as well as the repeated fires highly altering the vegetation.

Figure 2-1 View from the northwest of Soledad Mountain, May 1990

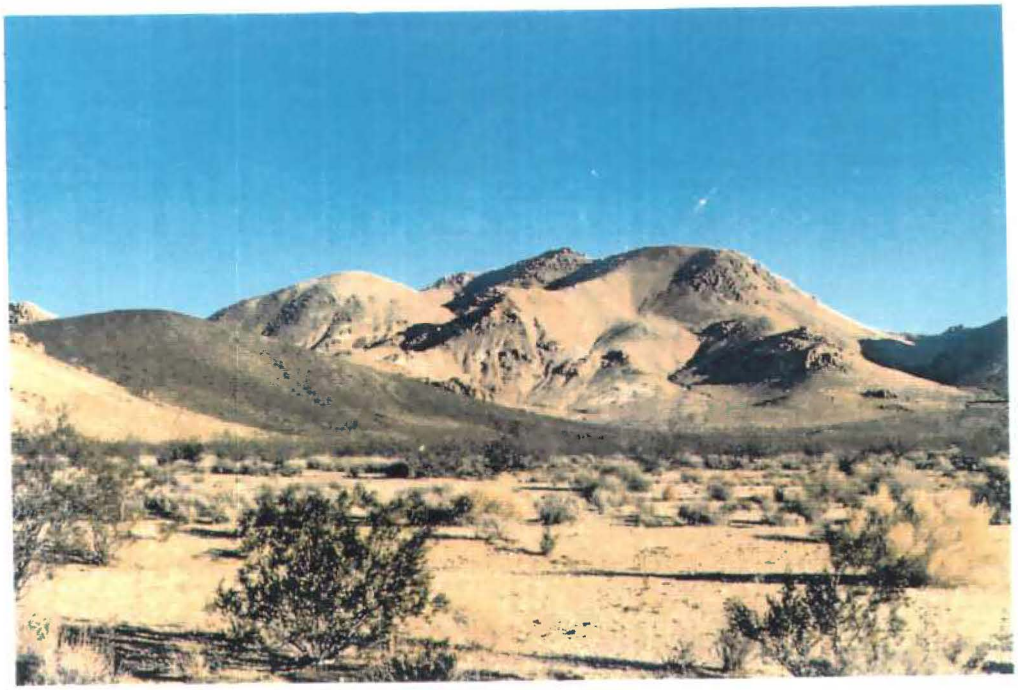


Figure 2-2 View from the northeast of Soledad Mountain, May 1990

3.0 SOILS

We originally inventoried the on-site soils in 1990 to determine the soil types and characteristics and also the suitability and amounts for use as substrate material during reclamation. The soils were again reviewed during the April 1995 field visit for additional information on several soil profiles for depth and suitability for reclamation. With this information, we provide a baseline of the general location of the soil types, and also assess the physical and chemical characteristics for reclamation and revegetation.

The soils on and around Soledad Mountain have been mapped by the US Soil Conservation Service (SCS, 1981.) See Figure 3-1 for a general soil map of the study area. Our activities during the 1990 soil surveys included verification of soil types, checking profile descriptions, collecting soil samples, and determining present soil conditions and resources. We validated this information during the recent field trip in May 1995. Soils and topographic surfaces in this area are relatively stable and do not change significantly over short time periods.

3.1 General Description of Soil Resources

Soledad Mountain formed as a result of volcanic activity and the parent material and soils are, therefore, of volcanic origin. The principal rock substrates consist of three types: 1) two kinds of ryolites (flow and intruded), 2) pyroclastic debris, tuffs and breccias, and 3) quartz alunites and latites. These are acidic volcanic rocks having zones altered by hydrothermal activity. The altered zones may contain clays, quartz, and secondary mineralization. The soils formed from these substrates vary from weathered rock outcrop to deeper droughty soil with a clay loam to sandy loam texture. Soils are skeletal, and soil development has been slow and profile development is incomplete or lacking. The soil surfaces are fairly stable and, in some places, are old and weathered. Soil formation is lacking due to the arid climate. The residual soils on the mountain proper differ from the alluvial soils on the lower fans and flats in that soil textures become increasingly finer out onto the adjacent alluvial flats.

Although the slopes on the mountain are steep, very little evidence exists of slope or soil instability in the form of slides, soil creep, or solifluction lobes. The logic for this is not completely understood at present, but is most likely related to the weathering of the soils producing a clay content that binds soil and rock particles into a stable mass. In this dry climate, the soil does not become saturated enough to move on the bedrock which is rough and without bedding planes.

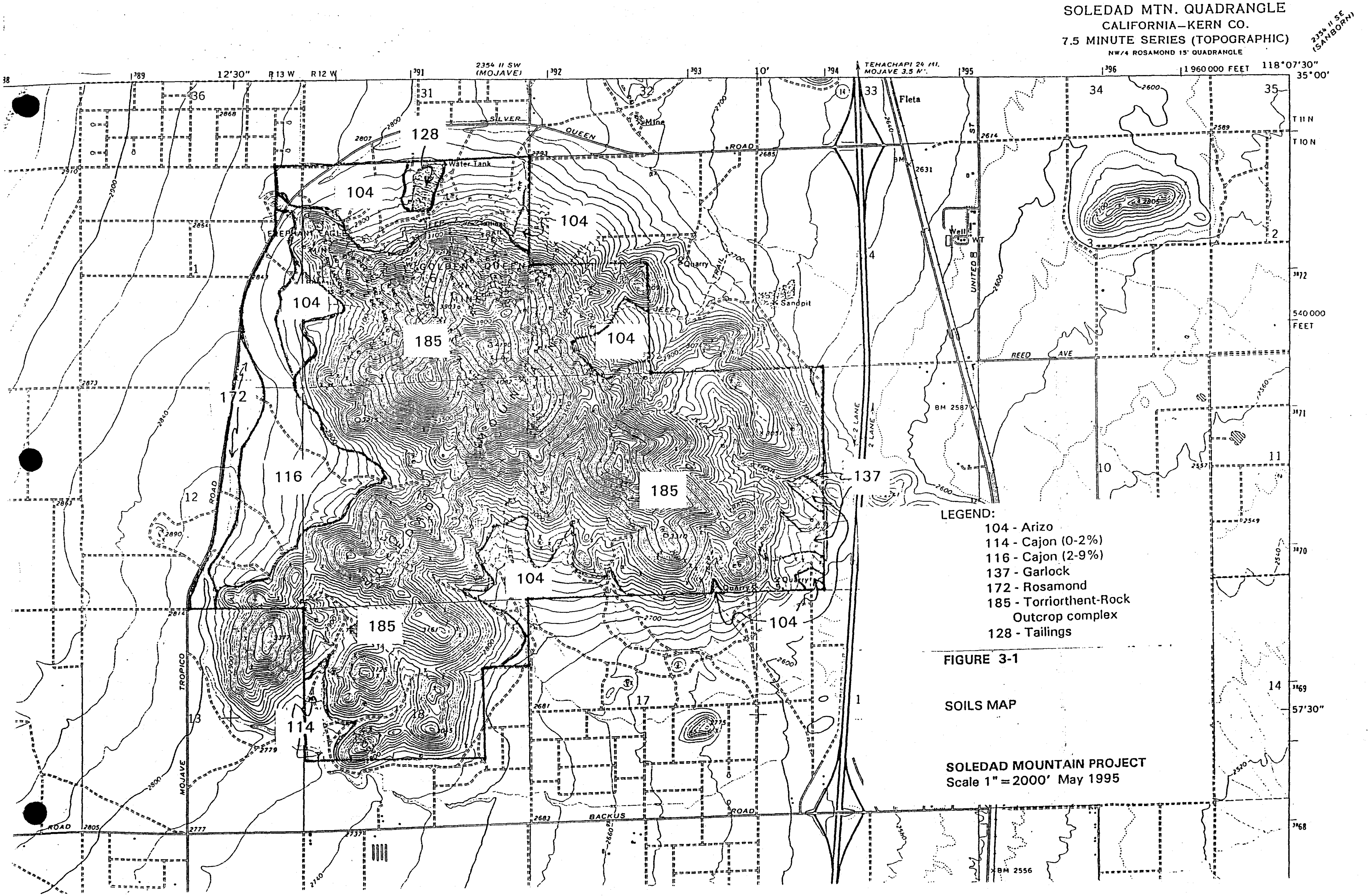


FIGURE 3-1

SOILS MAP

SOLEDAD MOUNTAIN PROJECT
Scale 1" = 2000' May 1995

gravelly sandy loam; cobbly, coarse fragments 40-50%; bedrock at a depth of 12 inches. These soils cannot be stripped for reclamation from the potential mine pits. Salvage is severely limited due to lack of equipment access on steep slopes, and there are inherent limitations of these soils for reclamation.

3.3 Sampling Procedures

We sampled soils in 1990 to identify soil types, general availability, and characteristics of potential soil materials for salvage. We collected 22 soil samples of approximately one half liter each in cloth bags. The samples were collected at two separate depths in ten locations and included samples from old tailings piles. See Table 3-3 for locations. The soils were analyzed in our office and in an analytical laboratory for physical and chemical properties important for plant growth and reclamation. These properties included texture, pH, organic matter and available nutrients.

3.4 Results of Lab Analysis

The lab analysis results are summarized in Tables 3-4 through 3-5. The soils have a wide range of textures depending on the parent material and degree of weathering. Soils derived from rock altered by hydrothermal activity have increased clay content. Textures range from clay loam to loamy sand. Although the volcanic rock is acidic, it weathers to basic with soils pH ranging from 7.2 to 8.7. The one exception is the sample of vuggy clay which is very acidic at a pH of 4.4. The Cation Exchange Capacity (CEC) is medium to high with a high salt content. This is typical and within the range of desert soils. The organic matter content of the soils is very low and variable. This is also typical of desert soils. The nutrient status is mostly low in nitrogen (N), phosphorus (P) and potassium (K). Three samples (GQSS5, GQSS9, GQSS19) had higher NPK values. These samples were located at or near the surface and, therefore, showed a higher organic matter content. One sample from old tailings had an extremely high value for nitrogen, possibly from residual explosives. Lime content was 0% in all sampled soils. Salinity was very low except in one of the tailings samples.

We do not recommend amendments for the alluvial soils based on our revegetation testing using native species. The native plant species are adapted to growing in soils with low organic matter and nutrient status. Fertilization has promoted weed growth which competes with the native species.

Table 3-3 Soil Sample Locations and Classification, Soledad Project

Sample #	Date Collected	Depth (inches)	SCS Soil Classification	Soil Texture	Location Related to Mountain
GQSS1	11/10/89	0 - 3	Arizo	sandy loam	NW side; on alluvial fans
GQSS2	11/10/89	9 - 12	Arizo	sandy loam	NW side; on alluvial fans
GQSS3	11/10/89	0 - 6	Tailing	mine tailings	N side; tailings below mill
GQSS4	11/10/89	0 - 4	Tailing	mine tailings	N side; tailings by entrance rd
GQSS5	11/10/89	0 - 3	Torriorthent	gravelly loam	N side; lower slope
GQSS6	11/10/89	12 - 18	Torriorthent	gravelly-sandy loam	N side, lower slope
GQSS7	11/10/89	12 - 15	Torriorthent	gravelly-clay loam	N side, mid slope
GQSS8	11/10/89	72 - 100	Torriorthent	vuggy clay	N side, mid slope
GQSS9	11/10/89	1 - 3	Torriorthent	loam	N side, mid to upper slope
GQSS10	11/10/89	15 - 18	Torriorthent	loam	N side, mid to upper slope
GQSS11	11/10/89	0 - 3	Rosamond	gravelly-sandy loam	W side; flats (~1000' W of mtn)
GQSS12	11/10/89	9 - 12	Rosamond	sandy loam	W side; flats (~1000' W of mtn)
GQSS13	5/6/90	0 - 3	Cajon	gravelly-loamy sand	W side; on alluvial fans
GQSS14	5/6/90	12 - 15	Cajon	gravelly-loamy sand	W side; on alluvial fans
GQSS15	5/6/90	0 - 3	Garlock	loamy sand	W side; flats (~2000' W of mtn)
GQSS16	5/6/90	12 - 15	Garlock	loamy sand	W side; flats (~2000' W of mtn)
GQSS17	5/9/90	0 - 3	Cajon	loamy sand	SW side; west of Tropico rd.
GQSS18	5/9/90	12 - 15	Cajon	loamy sand	SW side; west of Tropico rd.
GQSS19	5/9/90	1 - 4	Torriorthent	loam	S side; upper slope
GQSS20	5/9/90	18 - 24	Torriorthent	gravelly-clay loam	S side; upper slope
GQSS21	5/10/90	0 - 3	Torriorthent	loamy sand	E side; toe slope
GQSS22	5/10/90	6 - 8	Torriorthent	gravelly-sandy loam	E side; toe slope

Table 3-4 Soil Sample Results, Soledad Mountain Project, November 1989 and May 1990

Sample #	Soil Texture	pH	Cation Exchange Capacity (Meq/100g)	Organic Material (%)
GQSS1	Sandy Loam	7.6	10.4	1.2
GQSS2	Sandy Loam	7.9	8.8	0.4
GQSS3	Silty Loam	7.5	13.6	0.8
GQSS4	Loam	8.7	11.4	0.2
GQSS5	Loam	7.6	20.6	4.8
GQSS6	Sandy Loam	7.2	9.0	0.5
GQSS7	Clay Loam	7.7	16.6	0.3
GQSS8	Clay Loam	4.4	16.4	0.2
GQSS9	Loam	7.6	15.6	2.3
GQSS10	Loam	7.5	12.0	0.5
GQSS11	Sandy Loam	8.1	9.0	0.5
GQSS12	Sandy Loam	8.2	8.8	0.4
GQSS13	Loamy Sand	7.7	7.0	1.0
GQSS14	Loamy Sand	8.2	6.0	0.5
GQSS15	Loamy Sand	8.0	5.8	0.4
GQSS16	Loamy Sand	8.2	5.6	0.3
GQSS17	Loamy Sand	8.1	6.2	0.6
GQSS18	Loamy Sand	8.3	5.8	0.4
GQSS19	Loam	8.1	15.0	2.0
GQSS20	Clay Loam	8.3	16.6	0.3
GQSS21	Loamy Sand	8.0	7.6	1.3
GQSS22	Loamy Sand	8.0	6.6	0.8

Table 3-5 Available Nutrients in Soil Samples, Soledad Mountain Project, November 1989 and May 1990

Sample Number	Available Nutrients (ppm)						
	NO_3	P	K	Ca	Mg	Zn	Fe
GQSS1	14	19	330	1200	110	3.4	54.5
GQSS2	8	8	172	900	75	0.6	55.0
GQSS3	2332	4	662	3700	51	8.3	57.3
GQSS4	26	8	130	1800	49	8.9	11.0
GQSS5	52	144	360	3000	180	4.6	66.9
GQSS6	26	25	443	800	254	0.4	52.2
GQSS7	7	11	334	1100	256	1.6	63.3
GQSS8	31	4	111	1200	325	1.5	45.6
GQSS9	22	19	450	1700	275	2.6	11.9
GQSS10	8	10	190	1300	462	0.5	63.1
GQSS11	8	13	240	1500	133	0.6	16.2
GQSS12	6	7	115	1500	145	0.4	5.8
GQSS13	9	17	143	600	43	1.0	5.9
GQSS14	8	10	120	600	50	1.1	3.2
GQSS15	6	10	124	800	40	1.0	7.5
GQSS16	4	10	140	1000	104	0.6	12.1
GQSS17	8	14	175	1100	57	0.6	3.6
GQSS18	7	25	99	1900	211	0.8	14.2
GQSS19	24	31	669	1500	296	2.8	8.9
GQSS20	11	18	307	1800	298	0.6	9.8
GQSS21	10	21	323	1500	112	3.1	49.3
GQSS22	13	12	408	1500	268	0.7	31.8

3.5 Soil Suitability and Availability for Reclamation

There are several competing uses for the salvageable soils in the area to be disturbed during mining. These uses are: 1) as a plant growth medium or seed source in reclamation, 2) as plating for erosion control, and 3) as foundation material for construction of planned facilities. For our report, we evaluated soils use as a resource in reclamation and revegetation.

The soils' physical characteristics and nutrient content are poor as a growth medium given that they are salvaged from areas with little soil development. There is little soil material differentiation between horizons. The general lack of soil development and suitable surface horizons, poor soil texture, and large amount of coarse fragments are major limitations for soil salvage and potential for use in reclamation. The upper slopes have some development of soil because of higher moisture content and cooler temperatures, but are limited by equipment access and small extent. If frequent burns did not occur, then the mountain soils would, most likely, be more productive. These soils are residual and, in the past, had a higher vegetation cover and productivity prior to disturbance from mining and other disruptive activities (fire and vandalism.) As discussed in the map unit descriptions, soils developed on slopes and alluvial fans on the study area have physical limitations for salvage. These limitations include steep topography, rock outcrops and boulders on the mountain, and shallow soils with large amounts of coarse fragments in the surface and subsurface soils. Salvage of these soils is not possible given the conditions on the site. The major limitation to soil salvage at the mountain base is the large coarse rock fragment content which varies depending on topographic location and slope, the lack of organic matter except on the surface, and low nutrient status.

The physical and chemical characteristics of the soil itself (such as texture, pH, soluble salts and nutrients) permit growth of native plant species. The soils located at or near the surface had a better nutrient status with higher NPK values and some residual organic matter. The surface soils contain abundant seed, and revegetation tests have shown good germination and growth from seeds in salvaged surface soils.

Our recent revegetation testing for reclamation in the deserts of southern California has shown the salvaged soils are not a better growth medium than recontoured overburden piles or spent leach heaps. These testing results suggest that large scale stripping and stockpiling of soils is not necessary for successful revegetation during reclamation. Soils near the more moderately sloped areas around the base of the mountain potentially could be salvaged at the surface to a depth of about 0.5 feet as a source of seed. This stockpiles soil would act as a seedbank for distribution on surfaces to be reclaimed. For use in reclamation, we do not recommend fertilizer be used since our recent tests of reclamation to native species have been successful with no amendments.

The locations and amounts of soil materials of this 0.5 feet that can be salvaged can be determined once final mining configuration and design details of facilities are determined. The amounts will be calculated during the reclamation planning, and presented in the reclamation plan. The balance of salvaged soil materials can be calculated, and the storage or distribution can be determined and become part of the reclamation planning. Experience has shown that an initial field determination of soil salvage and suitability at the time of construction may be necessary.

4.0 VEGETATION

We surveyed vegetation in the study area for general vegetative types, species present (floristics), and the conditions of the vegetation in 1990 and again in 1995. We sampled the vegetation for the dominant species, general canopy cover by species, densities of perennial species, and diversity. Our sampling in 1995 followed a record period of high moisture resulting in vigorous plant growth and productivity.

4.1 General Observations

The vegetation on and around Soledad Mountain is a desert shrub-scrub type adapted to a climate of low, unpredictable precipitation and hot, but variable, temperatures. The adaptations of the native species to the climate include a quick response to rainfall and extended dormancy periods. The dominant vegetation type on the lower alluvial fans and flats is a creosote bush shrub-scrub with widely scattered Joshua trees. The vegetation on the mountain slopes is a mixed shrub/grass type dominated by species adapted to rocky substrates and cooler conditions. These species are common in desert mountain ranges and have affinities to the Great Basin deserts to the north.

Plant communities on portions of Soledad Mountain are extensively disturbed by previous mining activities and mineral exploration. In addition, nearly all the lower slopes, sides, and top of the mountain have been altered by frequent burns which change and reduce the shrub cover and increase annual grasses and weeds. Lower plant productivity is the result. There are a few areas of undisturbed vegetation on the higher ridges among rock outcrop where burns have not occurred. Sheep have recently grazed in the lower mountain slopes and in the protected valleys and canyons. This grazing was heavy in places in 1990, and had caused a reduction in plant cover.

4.2 Survey Methodology

We surveyed the project site during 1990 for general vegetation types and dominant species using topographic maps and aerial photographs in combination with walking the area for ground truth. We recorded plant species and collected several for identification and verification in a herbarium. We mapped the vegetation types and determined which areas to sample.

We sampled vegetation for species composition and canopy coverage using one of two methods. The first method employed a visual estimate of an area by recording species and assigning a cover value. We used this qualitative method on steep mountain slopes and in small or isolated areas when a long transect was not possible. The second method utilized coupled linear quadrats (50'x10') in a transect. Each plant rooted in the quadrat was recorded as to species and size. We recorded 10 quadrats in a line. This method was used on lower alluvial fans and flats and provided quantitative data on large plant stands. We employed identical methods during 1995 to measure plant cover, density, and diversity.

We made observations on the extent and types of disturbance to the vegetation, as well as the plant species type that had colonized recent and older bare ground. Response of the vegetation to other climatic and edaphic factors were observed and recorded to aid in understanding the relationship of vegetation type and productivity to topography and weather for reclamation planning.

4.3 Results of the Vegetation Surveys

We present the results of the qualitative vegetation surveys here for the vegetation types and distribution (mapping) and dominant species present. The quantitative surveys provided information on plant species present, cover, and shrub density and diversity.

4.3.1 Major Plant Species

The Soledad Mountain project site contains plant species (floristics) typical for the western Mojave Desert in Antelope Valley. The plant species are hardy desert shrubs and sub-shrubs which grow year-round when moisture is available. Fall-germinating, annual species that grow throughout the mild winter and spring seasons are present. Some shrubs (such as joint-fir, spiny hop-sage, and shadscale) grow only at higher altitudes this far south. They are more widely distributed in the Great Basin area to the northeast. We believe this is a result of the cooler temperatures, higher altitude, and the steep slopes at Soledad Mountain compared to the lower regions of the Mojave Desert region. Cactus, trees, and tall shrubs are not present on-site with the exception of the Joshua tree and beaver-tail and golden cholla cactus. There is a lack of well-defined drainages or washes, and the type of vegetation characteristic of these washes. A juniper zone is not present due to the volcanic substrate and the unfavorable dry, warm climate.

The major plant species are listed in Appendix A, Table A-1. We generated this list from observations of plant species on the site, plants collected and identified using floristics manuals (Munz and Keck, l968; and Jepsen, 1993), and additional plant species verified in a herbarium (Weber, 1990 and 1995, University of Colorado Herbarium.) Many of the plant species do not have common or vernacular names, so the plants were given common names based on a translation of the scientific name. The majority of the species were named according the most recent California flora (Jepsen, 1993).

There were no threatened or endangered plant species expected or observed on the project site. There were also no unique or different vegetation or habitat types on the site.

4.3.2 Vegetation Types and Distribution

We mapped the vegetation types according to the two dominant types: shrub scrub and mixed shrub/grass. Zones of vegetation on and below the mountain are naturally divided by topography. Figure 4-1 is a map of the vegetation types. Figures 4-2 to 4-5 are contrasting photographs of the same areas from 1990 and 1995 of the shrub vegetation on the lower alluvial fans around the north side of the mountain. The lower slopes on alluvial fans and flats contain a desert shrub/scrub dominated by the *Larrea tridentata* (creosote bush) and a secondary cover of *Ambrosia dumosa* (burrobush), *Xylorhiza tortifolia* (mojave-aster), *Acamptopappus sphaerocephalus* (goldenhead), and *Ephedra nevadensis* (joint-fir). Plant zonation at the base of the mountain is dominated by *Ambrosia dumosa* (burrobush) and taller growths of *Larrea tridentata* (creosote bush). There is less plant variety at the base of the mountain, most likely due to a less diverse topography and the greater disturbance discussed in Section 2.0.

The vegetation on the mid- and upper-slopes of the mountain consists of a mixed shrub/grass community including *Grayia spinosa* (spiny hopsage), *Krascheninnikovia lanata* (winterfat), *Eriogonum* sp. (buckwheat), and *Atriplex polycarpa* (cattle spinach) common in the Great Basin. Much of the land surface is covered by rock outcrops and rock slides. Some plant species are found more commonly among the rocks than in the soils. Overall, the vegetation is fairly diverse and productive, however the repeated disturbances and burns have reduced the plant cover and species diversity.

During 1995, we again surveyed soils in two areas on the lower mountain alluvial fans where the heap leach area is planned. These deeper alluvial soils consist of partially sorted sands and silts with varying amounts, up to 75%, of coarse rock fragments. These soils were evaluated for stripping and use in reclamation. The following section discusses the soil types and mapping in relation to topography and substrate type.

3.2 Soil Types

The soil types are related to rock types and substrates influenced by the topography on and around Soledad Mountain. The taxonomic classification of the soils on the project site are given in Table 3-1, and are based on the soil survey of southeastern Kern County (SCS 1981). A description of the soil series are given in Table 3-2, and are based on the general descriptions of the SCS, and also on field observations during the present surveys.

Descriptions of profiles and soil development for typical soils in place are given below. The local soil types generally match the descriptions of the SCS soil classification series soil types. The information includes physical factors such as structure, consistency, depths, percentage rock, erosion potential, and permeability.

Arizo

The Arizo soil is generally located on the alluvial toe slopes and fans around the base of the mountain at 2 to 10% slopes. The soil is a sandy loam with 40% gravel and small stones to 50% stones and cobbles with depth (see Figure 3-2.) It has no structure and is loose and friable with good permeability and high wind erosion potential. Portions of the leach heap are planned on these soils. A soil pit dug to 36 inches showed the following: alluvial sloping (4-5^0) to the north, no profile development (not even A horizon); sandy clay loam to sandy loam; cobbles increase with depth, 40% cobbles at 30 inches of depth, and 65% coarse materials at greater than 30 inches. Soil salvage is limited by coarse fragments, and soil suitability is low due to poor nutrient status and texture.

Table 3-1	SCS Taxonomic Classification of Soil Series, Soledad Mountain Project
Series Name	Classification
Arizo	Sandy-skeletal, mixed, thermic Typic Torriorthents
Cajon	Mixed, thermic Typic Torripsamments
Garlock	Fine-loamy, mixed, thermic Typic Haplargids
Rosamond	Fine-loamy, mixed, (calcareous), thermic Typic Torrifluvents
Torriorthents	Undifferentiated
Rock Outcrop	Unclassified
Other	
Mined rock	Variable texture, size and weathering
Mill tailings	Fine textured, uniform

Table 3-2	SCS Soil Series Descriptions on Soledad Project
Series Name	Description
Arizo	Deep, sandy loam soils on alluvial toe slopes and fans around the base of the mountain, 2 to 10% slopes.
Cajon	Deep, sandy to loamy sand, 0 to 5% slope, on alluvial fans and plains out from the base of the mountain.
Garlock	Very deep, loamy sand to sandy loam, well drained, gently sloping and gently rolling soil on alluvial fans and terraces, 2 to 9% slopes.
Rosamond	Very deep, sandy loam to clay loam, well drained, nearly level on alluvial plains, 0 to 2% slopes.
Torriorthents	Weathered rock outcrop and shallow to deep residual soils from host rocks on the mountain; mostly skeletal soils with light brown clay to sandy loam texture, 60 to 70% rock and cobbles, irregular boundary to C horizon (bedrock or residual weathered rock)
Rock Outcrop	Occurs on all aspects on the mountain as crags, cliffs and along ridges and peaks
Mined rock	Piles of various sizes and materials from mining
Mill tailings	Rhyolite tailings and mined rock; some has been sold as construction material

Cajon

The Cajon soils are located to the west and south on alluvial fans and plains out from the base of the mountain. Slopes are from 2 to 15%. The soil consists of a loose friable, gravelly loam to loamy sand, with numerous surface fine roots. The soil color is light brown to brown. Gravel content is 15% and reduces with depth. Permeability is rapid and wind erosion potential is very high. Portions of the western heap leach site may be developed on these soils. A soil pit showed the following: alluvial fan with slopes to 15%; no profile development; gravelly loamy sand to loamy sand, friable; coarse fragments, cobbles to 15 inches at 60%, no structure, no development, erodible by wind; severe limitations for salvage due to coarse fragments on portions of the alluvial fan.

Garlock

The Garlock soils are very deep, loamy sand located on the alluvial flat lands surrounding Soledad Mountain to the north and northwest. A lag gravel surface can exist on these loose, friable, brown soils. The 0 to 1% sloped soils have a 5% gravel content near surface, and a dense, slightly blocky structure and increased clay content with depth. Permeability is moderately slow. Water erosion hazard is slight or moderate. Wind erosion potential is high. Soils in this unit will not be disturbed by the present mining. Limitations for reclamation use are an increased clay and mineral content out onto the flats and the low nutrient status.

Rosamond

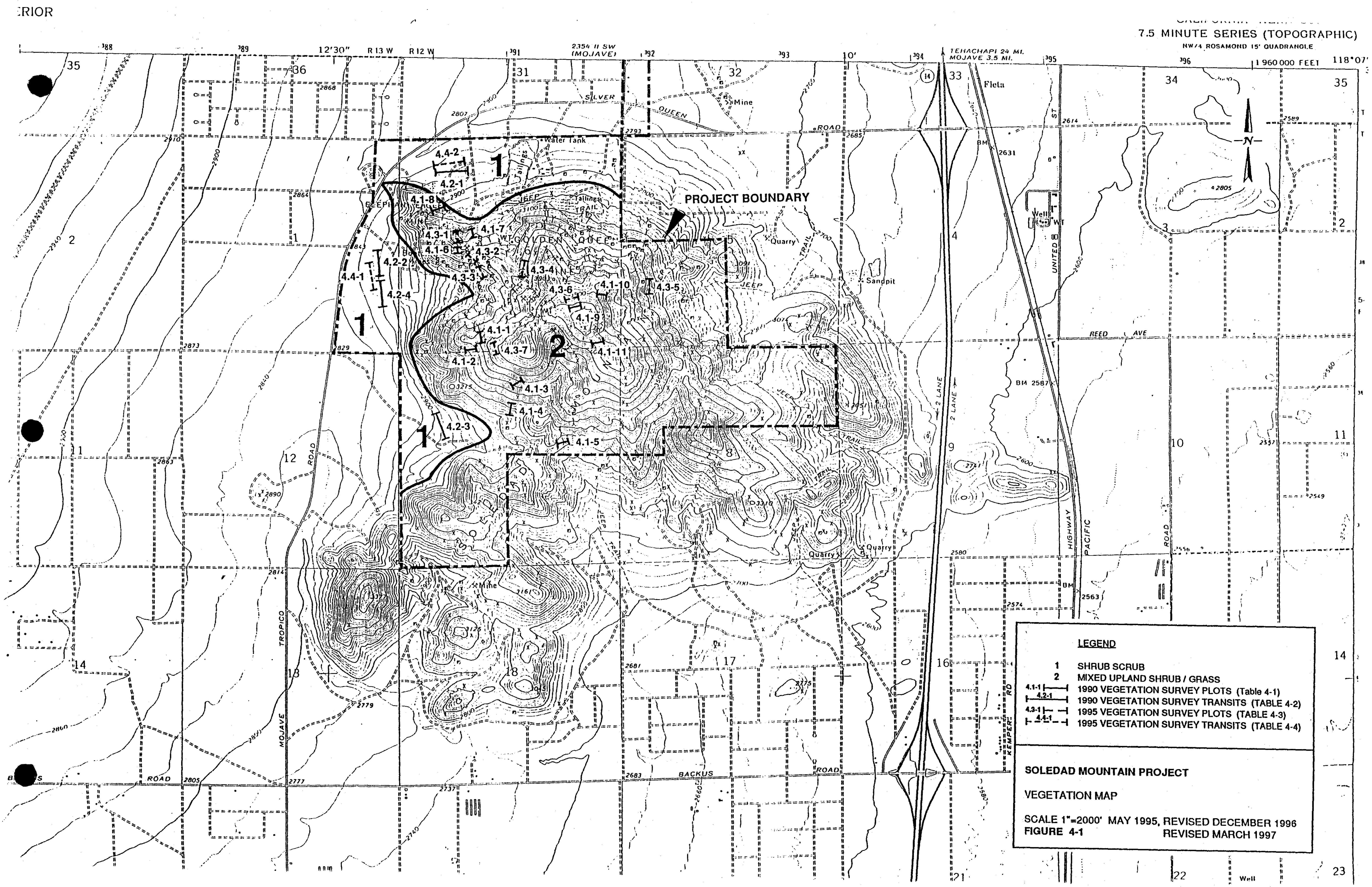
The Rosamond soils are located on the flats to the west of the mountain. The sandy loam to gravelly sandy loam soil has 10% gravel and stones, is slightly blocky, reddish to light brown, and contains very low to no organics. These alluvial soils are on 0 to 2% slopes, permeability is moderately slow, and erosion potential is high. Soil in this unit will not be disturbed during present mining, with limitations on use due to erodability and high gravel and lime content.

Torriorthents

Although not of any one soil classification series, the torriorthents consist of weathered rock outcrop and shallow to deep, residual soils from host rocks on the mountain. The soils range from a clay loam to a cobbly, loamy sand with up to 60 to 70% rock and cobbles on slopes of 50 to 75% (see Figure 3-3.) Permeability ranges from moderately slow to moderately rapid with a moderate erosion potential. A 1995 soil pit on slopes at 8-10% showed the following: alluvial soil washed in from upslope; no profile development;

Figure 3-2 Surface of an Arizo Soil on the northwest slope of Soledad Mountain, May 1990 (note rock and gravel)

Figure 3-3 Torriorthents soil on the slopes of Soledad Mountain, May 1995 (note large rock fragments)



SOLEDAD MOUNTAIN PROJECT

VEGETATION MAP

SCALE 1"=2000' MAY 1995, REVISED DECEMBER 1996
FIGURE 4-1 REVISED MARCH 1997

Figure 4-2 Creosote vegetation on alluvial fan on the lower western slopes of Soledad Mountain, May 1990 (contrast with photo in Figure 4-3)

Figure 4-3 Creosote vegetation on the lower western slopes of Soledad Mountain, May 1995 (note excellent growth of vegetation)

Figure 4-4 Vegetation on the northern slopes of Soledad Mountain, April, 1990

Figure 4-5 Vegetation on north slope of Soledad Mountain, May 1995 (note gray shed, and compare with photo in Figure 4-4)

4.3.3 Vegetation Cover, Density and Diversity

The results of our stand survey for composition and cover completed in 1990 are given in Table 4-1 for the estimation plots in the mixed shrub/grass community, and Table 4-2 for the linear transects in the creosote bush shrub-scrub. Common names of plant species are given in Table A-2 in the Appendix A. Vegetative cover was sparse with small shrubs, a few clumps of grasses and scatterings of forbs during the winter season in 1990. Cover in 1995 was greater due to increased moisture and improved growing conditions (see Table 4-3 through 4-5 for comparisons.) In 1990, the total canopy cover of the shrub-scrub on the alluvial fans and flats ranged from 20 to 26% and averaged 23% for the 4 linear transects. Individual plots within the surveyed plots varied from 9 to 35%. The vegetation is fairly uniform with a dominant cover of *Larrea tridentata* (creosote bush), and a secondary cover of *Ambrosia dumosa* (burrobush) and *Acamptopappus sphaerocephalus* (goldenhead). Few other species have more than 1 to 3% percent cover except for *Xylorhiza tortifolia* (mojave aster) in a few plots.

We compare the results of the two transects surveyed in 1995 in Tables 4-4 and 4-5. The primary difference is the large increase in plant cover from averaging 23% in 1990 to approximately 80% in 1995. The annual grasses and forbs had the greatest increase in percent ground cover and the shrubs were also larger due to the recent rains.

In 1990, the mixed shrub community on the mountain slopes consisted mainly of annual grasses with a cover value of 10% due to fire. In areas protected from fire, the shrubs *Atriplex confertifolia* (cattle spinach) and *Tetradymia axillaris* (horsebrush) dominated with a cover value of 49%. In 1995 in the same area, we estimated total cover values at approximately 80%. The vegetation is extremely variable. Additional dominant species include *Grayia spinosa* (spiny hopsage), *Ephedra nevadensis* (joint fir), several species of perennial *Eriogonum* (buckwheats), and grasses such as *Achnatherum* sp. (needlegrass), *Poa secunda* (bluegrass), and *Elymus elymoides* (squirreltail). The extreme differences in cover between 1990 and 1995 demonstrates the highly variable nature of the vegetation depending on exposure, weather, and soil moisture conditions (see Tables 4-1 and 4-3.)

In 1995, we conducted plant surveys using linear transects on the potential heap leach areas. These areas are located on the northern and western alluvial lower slopes of the mountain. Results of these surveys are presented in Tables 4-4 and 4-5. Our results indicate that this was an excellent year for plant growth (averaging about 80% cover). Shrub densities in 1995 averaged 3700 and 4300 plants per hectare (1480 to 1720 per acre.) Perennial densities were not determined in 1990, however we assume that the densities were lower due to the prolonged drought. Perennial densities of vegetation change slowly. Plant species diversity (average number of species per plot) in 1995 were fairly uniform at 13.6 and 14.0 plant species recorded per 20 square meter plot with a range from 11 to 17. These values for density and diversity are average for desert vegetation and do not indicate unusual conditions.

Table 4-1 Upland Perennial Plant Species and Percent Ground Cover in Non-dimensional Vegetation Surveys, Soledad Mountain Project, 1990

Plant Species	Plot Number										
	1	2	3	4	5	6	7	8	9	10	11
Shrubs											
Atriplex polycarpa						30	+	10			
Chrysothamnus nauseosus					+	2					
Ephedra nevadensis			8	2	2	6	4	4	2	4	2
Ericameria cooperi				+	+	10					
Ericameria laricifolia					+	1		3			
Eriogonum fasciculatum	4	2	5		½		3		6	6	
Grayia spinosa	+	+		3		2	8	15	3	15	2
Gutierrezia sarothrae	+				1	2	1		1		
Krascheninnikovia lanata			1				1				
Larrea tridentata					2						
Lycium andersonii					+		3				1
Lycium cooperi		+	1								
Tetradymia axillaris			+								
Tetradymia glabrata					1	8					
Grasses											
Achnatherum speciosum	10	3	4								
misc. perennial grasses				6			4	5	2	4	3
annual grasses	4	2	10				+	3	1	+	2
Herbs											
Amsinckia tessellata					+						

Table 4-1 Upland Perennial Plant Species and Percent Ground Cover in Non-dimensional Vegetation Surveys, Soledad Mountain Project, 1990

Plant Species	Plot Number										
	1	2	3	4	5	6	7	8	9	10	11
Eriogonum baileyi					+		+				
Eriophyllum wallacei					+						
Erodium circutarium					+						
Mirabilis multiflora	½						+		+		
Phacelia glandulifera					+						
Stephanomeria spinosa	1	1	2		+		+	1		+	
annual herbs	3	1	3		4		+	+	+	+	+
total vegetation	25	10	36	17	11	49	27	41	19	34	32
rock	60	85					45	50	60	50	65
bare	20						28	9	9	29	3

Table 4-2 Percent Cover of Perennial Vegetation In Linear Plots, Soledad Mountain Project, November 1989 and May 1990

Plant Species	Percent Cover of Perennial Vegetation by Plot									
	1	2	3	4	5	6	7	8	9	10
SURVEY 1										
Larrea tridentata	14	11	22	1	18	12	10	15	28	2
Ambrosia dumosa	4	3	1	4	2	3	3	1	0.2	0.3
Xylorhiza tortifolia	1	0.4	1	1	1	1	1	0.3	0.3	0.4
Achnatherum speciosum	0.2	0.4	0.04	1	0.04	0	0.2	0	0	0
Grayia spinosa	0	1	2	0	0	0	1	1	0.2	2
Ephedra nevadensis	0	0	1	5	0	0	0	0	0	0
Chrysothamnus nauseosus	0	0	0	1	1	0	0	0	0	0
Krascheninnikovia lanata	0	0	0	0	0	1	0	0	0	0
Yucca brevifolia	0	0	0	0	0	0	0	0	0	0
Average	20	15	26	14	22	17	17	18	39	4
SURVEY 2										
Larrea tridentata	0	22	0	9	19	8	11	1	17	21
Ambrosia dumosa	0	0	0.2	0	0.2	0.04	1	0.2	0.3	0.2
Achnatherum speciosum	0	0	0	0	0.04	0.2	0	0.2	0.04	0
Grayia spinosa	0	0	0	0	0.3	0.2	0.3	1	0	0
Ephedra nevadensis	0	0	0	2	0	3	0	0	0	0
Krascheninnikovia lanata	0	0	0	0.4	0	0	0	0	0	0
Acamptopappus sphaerocephalus	5	3	3	5	2	4	4	3	2	2
Eriogonum fasciculatum	0.2	0	0	0	1	2	0.3	1	0	0.04
Tetradymia axillaris	1	0	0	0	0	0	0	0	0	0
Lycium cooperi	0	1	0	0	0	0	0	0	0	0
Lycium andersonii	0	0	0	0	0	0.2	0.4	0	0	0
Average	7	26	3	16	3	17	18	7	20	23
SURVEY 3										
Larrea tridentata	14	18	0	4	17	0	9	4	36	16
Ambrosia dumosa	4	2	8	0	2	2	1	4	2	6
Xylorhiza tortifolia	1	1	1	4	3	4	3	4	2	4

Table 4-2 Percent Cover of Perennial Vegetation In Linear Plots, Soledad Mountain Project, November 1989 and May 1990

Plant Species	Percent Cover of Perennial Vegetation by Plot									
	1	2	3	4	5	6	7	8	9	10
Achnatherum speciosum	0.3	0.08	0	1	0.3	1	0.04	0.04	0	0.04
Grayia spinosa	0	0.4	0	0	0	0	0	0	0	0
Ephedra nevadensis	0	0	0	0	0	0	0	0	3	0
Krascheninnikovia lanata	0.2	0	0	0	0	0.04	0	0.04	0	0
Yucca brevifolia	0	0	0	0	0	4	0	0	0	0
Achnatherum hymenoides	0	0	0.2	0	0	0	0	0	0	0
Opuntia echinocarpa	0	0	0	0	0	0	0.2	0	0	0
Average	20	22	9	10	23	11	14	13	42	26
SURVEY 4										
Larrea tridentata	11	17	7	5	20	12	10	3	4	15
Ambrosia dumosa	0	0.2	1	6	0.04	2	0	2	0	0
Xylorhiza tortifolia	0	0.2	1	0.2	1	1	0.2	3	10	1
Achnatherum speciosum	0	0	0.3	0.04	0.2	0.4	0.1	1	2	1
Ephedra nevadensis	13	1	3	1	1	3	5	2	5	5
Krascheninnikovia lanata	0	0	0	0.2	0	0	0	0	2	0
Yucca brevifolia	0	0	0	0	0	0	0	0	0	6
Eriogonum fasciculatum	0	0	0	1	0	0	0.4	2	0	0
Eriogonum heermannii	0	0	0	0	0	0	0.04	0	1	0
Achnatherum hymenoides	0.2	0	0	0	0	0	0	0.2	0	1
Gutierrezia microcephala	3	0	0.4	0.3	2	2	6	0	2	2
Average	28	18	13	14	25	20	22	12	26	32

Table 4-3 Qualitative Plots Results, Soledad Mountain Project, June 1995

	Veg.	Litter	Rock	Bare
(1) LOWER SLOPES - Low Fans and Drainages				
burned & previously mined, partially naturally reclaimed, W of old facilities				
spotty shrubs: *Larrea tridentata*, *Atriplex polycarpa*, *Tetradymia axil*, *Ericameria linearifolia*; upto 20% perennial grasses	80%	10%	5%	5%
(2) LOWER SLOPES - Burned Areas				
Bromus rupens, *Ericameria linearifolia*, *Atriplex polycarpa*, *Stipa* sp., perennial grasses, annual forbs	82%	3%	10%	5%
(3) LOWER SLOPES - Steep Areas				
Bromus rupens, *Tetradymia axil*, *Ericameria linearifolia*, perennial grasses, annual forbs	87%	5%	5%	3%
(4) MID SLOPES				
not burned recently on a W facing slope near glory holes				
Eriogonum fasciculatum, *Bromus rupens*, *Grayia spinosa*, *Poa* sp., *Atriplex polycarpa*, *Ephedra nevadensis*, *Sitanion* sp., annual forbs	80%	3%	15%	2%
(5) MID-UPPER SLOPES				
burned & grazed on the E side of mountain				
Bromus rupens, *Eriogonum fasciculatum*, *Atriplex polycarpa*, *Ephedra nevadensis*, *Gutierrezia sarothrae*, *Poa* sp., annual forb	75%	5%	15%	5%
(6) UPPER SLOPES				
some burned stumps on N facing slope below peak near rock talus				
dominated by *Ephedra nevadensis; Eriogonum fasciculatum*, *Eriogonum plumatella*, *Sitanion* sp., *Bromus rupens*, *Poa* sp., *Stephanomeria spinosa* (on scree), annual forbs	80%	5%	10%	5%
(7) ROCK OUTCROPS				
W facing mid slope				
Poa sp., *Stipa* sp., *Ericameria laricifolia.*	30%	5%	65%	0%

Table 4-4 Plant Cover Percentages for Proposed Heap Leach Sites, Soledad Mountain, May 1995

Plot No.	Vegetation	Litter	Rock	Bareground
Proposed West Side Heap Leach Area				
1-1	75	5	10	10
1-2	86	5	4	5
1-3	75	10	10	5
1-4	80	5	10	5
1-5	75	10	5	10
1-6	83	10	3	4
1-7	75	15	5	5
1-8	78	10	8	4
1-9	77	5	10	8
1-10	75	10	5	10
Average	78	8	7	7
Proposed North Side Heap Leach Area				
2-1	75	5	10	10
2-2	75	10	10	5
2-3	75	10	10	5
2-4	82	10	5	3
2-5	75	15	5	5
2-6	88	7	3	2
2-7	86	10	2	2
2-8	82	10	5	3
2-9	84	5	8	3
2-10	80	5	10	5
Average	80	9	7	4

Table 4-5 Vegetative Parameters for Transects on the Proposed Heap Leach Sites, Soledad Mountain, May 1995

Plot No.	Cover (%)			Species diversity	Shrub density	
	shrub	perennial grass	annual		#/hectare	#/acre
Proposed West Side Heap Leach Area						
1-1	35	6	45	14	2500	1000
1-2	37	6	40	17	4500	1800
1-3	41	6	40	13	7000	2800
1-4	27	1	60	12	1000	400
1-5	19	+	70	11	2500	1000
1-6	34	3	50	13	3000	1200
1-7	24	6	55	15	6000	2400
1-8	28	5	55	12	4500	1800
1-9	47	4	35	14	6000	2400
1-10	29	1	55	15	6000	2400
Average	32.1	3.8	50.5	13.6	4300	1720
Proposed North Side Heap Leach Area						
2-1	30	+	55	15	3000	1200
2-2	15	1	70	14	1500	600
2-3	22	0	65	13	4500	1800
2-4	28	+	60	12	4000	1600
2-5	20	0	65	15	2000	800
2-6	33	2	50	15	5000	2000
2-7	30	1	55	14	3500	1400
2-8	25	6	55	14	4500	1800
2-9	26	4	55	15	5000	2000
2-10	28	4	55	13	4000	1600
Average	25.7	2.25	58.5	14	3700	1480

5.0 WILDLIFE RESOURCES

Wildlife species present on the Soledad project site are typical of desert habitats, with small mammals, reptiles, and birds being the dominant components. General populations of wildlife appear to be low due to fires, and historic and recent disturbances to native habitats by mining, recreational activities, and urbanization. This area of the western Mojave Desert in Antelope Valley is being developed by mining, farming, and housing. The effect on animal populations has been fragmented and reduced habitat availability, including the total displacement of large herbivores. There were no deer or bighorn sheep observed on Soledad Mountain.

5.1 Survey Methodology

Wildlife surveys consisted of a general reconnaissance followed by specific walking and driving transects for target species or groups of animals. In general, all observations and sighting of animals or sign were recorded while on site. The small mammal species were sampled in conjunction with the Mohave ground squirrel trapping. Surveys were conducted in August and November 1989, March and May l990, and to a limited extent in May 1995. Surveys were conducted at dawn and dusk for small mammals and birds, including raptors. Specific surveys were conducted for raptors and their nesting sites. The underground workings at the site were extensively examined for seasonal bat use and for other general wildlife. Dr. Patricia Brown, a specialist in bat studies, led this aspect of the study. Her results are presented in Appendix B. Dr. Brown was assisted by Dr. Scott Altenbach in a winter survey of mine workings in 1997.

One federal-listed threatened species, the desert tortoise (*Gopherus agassizii*), and a California-listed threatened species, the Mohave ground squirrel (*Spermophilus mohavensis*), were surveyed using special techniques. Desert tortoise presence was determined by walking a standard 1.5 mile triangular transects in 1990. Shorter linear transects were also walked in smaller areas in early morning or late afternoon. Surveys for desert tortoise were repeated in 1995 in the same locations.

Dr. Patricia Brown directed the surveys for Mohave ground squirrel using grids of live traps in two locations. The sampling protocol followed the revised (February 1990) survey guidelines of the California Department of Fish and Game (CDFG); see Appendix C.

Two bat species listed as California Species of Special Concern, Townsend's big-eared bat (*Corynorhinus townsendii*) and the pallid bat (*Antrozous pallidus*), were specifically surveyed by Dr. Brown during two separate periods from Spring 1990 to January 1997. The first two bat surveys, focusing on Townsend's big-eared bat, were conducted in mine openings, stopes, and glory holes, on Soledad Mountain during late March and June 1990.[1] During the surveys, 55 openings were entered and visually inspected for bats,

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[1] Brown, Patricia, Ph.D., A Survey *for Bats of the Soledad Mountain Project, Mojave, Kern County, California*, July 2, 1990.

guano, or other animal signs. A second series of bat surveys were conducted in summer, 1996 and winter, 1997. The August and October, 1996[2] bat surveys included over 70 workings searched for bats and guano deposits. During the January, 1997[3] survey, over 30 mine workings were searched by Dr. Brown and Dr. Scott Altenbach used a hoist to survey mine shafts.

5.2 Wildlife Species Present

During the August and November 1989 wildlife surveys, little evidence of animal presence or activity was observed. This most likely resulted from the time of year surveys were conducted and the overlapping 18-month drought. Animal populations are also affected, in general, by the high Santa Anna winds characteristic of this region. Most wildlife were hibernating or aestivating in late summer and fall, and few animals were observed. Populations may also have been reduced by mortality and/or depressed reproduction.

The March and May, 1990 and May, 1995 surveys were conducted during a period of greater wildlife activity resulting from recent rains and the late and unseasonably cool spring of 1995. No hoofed animals or large herbivores were present, however the area did reflect relatively recent grazing by domestic sheep in 1990, but not in 1995. Much of this grazing has been illegal on open desert, and was severe in local areas on Soledad Mountain.

Desert reptiles, rodents, and lagomorphs occur on the study area as well as coyote (*Canis latrans)* and other small predators and raptors that prey on these species. Several game birds, including chukar (*Alectoris graeca*), quail (*Lophortyx californicus*), and mourning dove (*Zenaida macroura*) are also present. The major animal species observed or expected on the study area are listed in Table A-2, Appendix A. This list is relatively complete, based on the wildlife surveys conducted, and known distributions of animal species.

Mammals

Mammal presence on the site was determined either by observation of the animal itself or by other signs such as burrow, scat, tracks, or skeletal remains. Some of the animal species listed are known to be present based on literature or other records, although sign of these species may not have been observed on the site.

Predators: Predators inhabiting the site are wide ranging, common mammals that prey on reptiles, birds, and other small mammals. These include coyote, bobcat (*Lynx rufus*),

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[2] Brown, Patricia, Ph.D., Brown-Berry Biological Consulting, *Warm Season Bat Surveys at Soledad Mountain, Kern County, California*, October 28, 1996.

[3] Brown, Patricia, Ph.D., *Winter Bat Survey at Soledad Mountain, Kern County, California*, February 3, 1997.

ringtail (*Bassariscus astutus*), gray fox (*Urocyon cinereoargenteus*), desert kit fox (*Vulpes macrotis*), [not the San Joaquin kit fox (*Vulpes macrotis mutica*), a federal endangered subspecies], and possibly badger (*Taxidea taxus*). Predators use the site as part of their large home range and hunting territory. Some of these predators may den on the mountain during the breeding season.

Small mammals: Small mammals on the site are typical of those with affinities to desert scrub and rock-slopes, the two dominant habitats on the mountain. Common mammals include antelope ground squirrel (*Ammospermophilus leucurus*), black-tailed jackrabbit (*Lepus californicus*), cottontail (*Sylvilagus audubonii*), kangaroo rat (*Dipodomys merriami*), desert woodrat (*Neotoma lepida*), and several species of small rodents (see Table A-2). Antelope ground squirrels were abundant and were captured on both grids during the two trapping periods.

There were no large grazing mammals, such as deer, mountain sheep, or feral burros, observed, nor any sign of recent activity. All three of these species have inhabited the site and while habitats have been degraded, some occasional use may still occur.

Birds

Birds observed and common to the site include the raven (*Corvus corax*), rock dove (*Columba livia*), violet green swallow (*Tachycineta thalassina*), and Brewer's sparrow (*Spizella breweri*). Raptors observed included the golden eagle (*Aquila chrysaetos*), turkey vulture (*Cathartes aura*), and red-tailed hawk (*Buteo jamaicensis*). Peregrine falcons (*Falco peregrinus)* were reported by Dr. Pat Brown and are discussed further in Section 5.4, below. An active golden eagle nest containing two nestlings was observed on the southeast side of Soledad Mountain, outside the study area, in 1990. There was no activity, and no sign of recent use, at this nest during May 1995. Golden eagles may alternate between three to four nesting sites between years. Raptor perches were observed on high points on the project site. No waterfowl were observed on the study area in this dry portion of the desert that lacks any surface or flowing water. Waterfowl, however, are attracted to any open body of water in the desert.

Reptiles

Several species of reptiles are common in the study area. The most common were the side-blotched lizard (*Uta stansburiana*) and desert iguana (*Dipsosaurus dorsalis*). The potential for the presence of the desert tortoise (*Gopherus agassizii*) is discussed in detail in Section 5.4.

Bats

Little evidence of bats was found in the openings or mine workings. One western pipistrelle (*Pipistrellus hesperus*) was trapped in a mist net over a nearby water tank, and other pipistrelles and pallid bats were observed flying in the evening. High winds and low numbers of flying insects may have accounted for the low numbers of bats, and possible low populations. No bats were observed in the mines, and only small amounts of guano were observed in two prospects holes and a stoped adit. A few bats were observed entering or leaving mine workings. Based on these surveys, at least two unidentified species of bats were observed in the project area. Small bats flying around and exiting the mines were probably California myotis (*Myotis californicus*) and/or western pipistrelle. Two species of bats were observed entering or leaving a large open cut, one was a light-colored, broad-winged bat, and the others were 14 large, light-colored bats. Visual characteristics and lack of echolocation were consistent with either Townsend's big-eared bat or pallid bat.

During the winter survey (conducted in January 1997 and included in Appendix B), no bats were observed hibernating in the mine workings, and only a few pieces of fresh guano were detected in one mine adit. Dr. Brown observed that the large number of interconnected, inaccessible workings could not be adequately surveyed, and therefore more bats may be resident than observed. Dr. Altenbach, in a report to Dr. Brown as part of the winter survey (included in Appendix B), saw no sign of bats or guano in the extensive drifts, stopes, and shafts he surveyed. He concluded that although there was an absence of evidence, this does not preclude the presence of bats. He does state, however, that if there were significant numbers of bats, he would have observed signs, and that the absence of bats was unprecedented in such large underground workings. The few bats present would present a difficult or impossible task to exclude prior to mine development. The number of bats possibly killed by mining activities would be low based on the indications of the surveys.

Bat use of the mine workings may be characterized as seasonal use by a low number of individuals representing moderate species diversity. Two species possibly present, Townsend's big-eared bat and pallid bat, are California Species of Special Concern. However, the mine workings do not appear to support any maternity roosts nor large hibernacula.

5.3 Habitats Present

The Soledad site supports three natural wildlife habitats and one resulting from human disturbance. All of these habitat type are shrub/grass communities with a ground layer of annual forbs and grasses in the spring. Habitat diversity is low on the project area and resource productivity is unpredictable because of harsh desert conditions. Shrubs and other plants in these habitat types are widely spaced with low and variable productivity. Animals using these habitats for shelter, food, and reproduction are generally highly adapted to the xeric desert environment.

These habitats, and their common wildlife associates, are as follows.

Mountain rock outcrops, rock slides

These habitats occur on peaks and ridges on the mountain proper throughout the study area. These rocky areas have scattered shrubs and grass species which grow in crevices and intermingled soil pockets. Plants at times have luxuriant growth due to water collection, and the absence of fires. These areas are used for denning and foraging of small mammals and as perches for birds including raptors. Common wildlife species are:

predators: coyotes, bobcats, ringtails
reptiles: lizards, snakes
small mammals: jackrabbit, woodrat and other rodents
birds: game birds, passerine, ravens, raptors, raptor's nests and perches

Scrub/grass on steep mountain slopes

These steep slopes have shallow soils over rocky substrates. The vegetation is a shrub/grass with dominant species of creosote bush, saltbush, joint-fir, and spiny hopsage. Grasses grow as single clumps or under and through the shrubs. These habitats have been highly modified by repeated fires and past grazing, and on large areas are mainly annual grasses dominated by bromes and forbs. Vegetative cover varies from 20 to 80 depending on seasonal rains and time since last fire. Wildlife species are the same as above, except raptors' nests and perches are not present. These slopes are used for foraging and denning of small mammals, which are hunted by raptors.

Creosote bush scrub on fans and alluvial flats

This is the common habitat on the lower slopes and fans (bajadas) around the base of the mountain. This is a creosote bush shrub vegetation with widely spaced joshua trees on the upper bajadas. Perennial grasses grow between and underneath the shrubs, and annual grasses form a ground cover. Wildlife species are:

predators: raptors, coyotes, foxes
reptiles: lizards, snakes
small mammals: jackrabbit, ground squirrels, rodents
birds: wrens and other passerine, ravens, overflights of raptors

Human altered areas and habitats

The mining and other human activities have increased habitat diversity by creating underground openings and abandoned buildings. Surface mining facilities, roads, and grading have reduced vegetation productivity, but increased use by different wildlife species. Evidence of animal use in underground workings included desert woodrat, deer mouse, ringtail, and bobcat. Domestic pigeons and barn owls were observed roosting in mine workings with vertical cuts to the surface. A dead golden eagle and mummified desert tortoise were observed at the bottom of a shaft in the Eagle Adit. These remains had obviously been there for many years. Underground working proved important structural habitat for bats such as roosts and hibernicula. Without these workings, some of the bats species might not occur on or use the site.

The following are human created habitats with associated wildlife:

> mine workings entrances of shafts/adits/glory holes (cliff type): pigeons, owls and raptors, greater abundance of woodrat
> buildings (very few standing): lizards, bats, barn owls
> mine adits and tunnels: pigeons, woodrat, ringtail cat (a few bats observed)

5.4 Threatened, Endangered and Species of Special Concern

Three threatened or endangered species are potentially present in the study area. These are the federal and state listed endangered peregrine falcon, the federal and state listed threatened desert tortoise, and the Mohave ground squirrel, a California listed threatened species. A peregrine falcon was observed crossing a road to the north of the project area, and may hunt the abundant pigeons on the proposed mine site. Specific surveys conducted for the latter two species failed to observe animals or sign present on the site.

Several species of special concern (formerly federal or state C2 candidate species) occur, or potentially occur, on the study area. Of specific concern are the Townsend's big-eared bat and the pallid bat. Other wildlife species of special concern are listed in Table A-1. These species include the golden eagle, burrowing owl, loggerhead shrike, chuckwalla, ringtail, and American badger.

Threatened and Endangered Species:

Peregrine falcon (*Falco peregrinus*)

The peregrine falcon is currently listed by both the state and federal governments as endangered. A peregrine falcon was observed in the spring of 1990 by Dr. Brown flying across a road that borders the northern boundary of the study area. This species, along with other raptors, probably uses the site as a portion of large hunting territories. Peregrine falcons were not observed on the project site during extensive wildlife surveys. There are no peregrine eyrie on-site or in surrounding areas such that the project area would be included within critical habitat for this species. Preferred habitat for nesting and foraging is cliff faces, usually near streams or bodies of water. The proposed project site is not considered good foraging habitat due to distances to suitable habitat types for nesting and wetland habitats. However, peregrines will frequently travel at least 10 miles from their eyrie to procure prey. Pigeons on the study area may represent a prey that could be part of a hunting base for a local pair.

Desert Tortoise (*Gopherus agassizii*)

No live tortoises or recent active sign of any type were observed. Desert tortoise surveys were conducted in areas with suitable habitat during both survey periods. In a total of seven triangular surveys conducted in 1990, there were five possible tortoise signs as inactive burrows underneath creosote bush. The burrows were old, collapsed, and could have been made by other burrowing animals. No other types of tortoise sign were observed. Three similar surveys for tortoises in May 1995 did not reveal any tortoise sign either as burrows, scat, or other signs of activity. If tortoises had been present during this year of high plant growth, then their presence would have been detected. One mummified tortoise was found at the bottom of a mine shaft by Dr. Pat Brown in 1990 during her bat surveys, indicating an earlier presence of tortoises in this area.

This area in Antelope Valley may have supported tortoise in the past, however recent surveys have not detected tortoises west of Highway 14, according to the US Fish and Wildlife Service. The area around Soledad Mountain is not designated desert tortoise habitat, and the nearest designated preserve, the Desert Tortoise Natural Area, is north of California City approximately 20 miles to the northeast of the project site.

Mohave ground Squirrel (*Citellus mohavensis*)

No Mohave ground squirrels were captured or observed during the surveys. The Soledad Mountain site is on the edge of the Mohave ground squirrel's known historical range. The trapping grids were conducted using the 1990 revised Mohave Ground Squirrel Guidelines of the CDFG. Two 100-trap grids were laid out for two trapping periods (March and May 1990) in the vegetation and habitat type most likely to support this species. See Appendix C for details on the location and trapping procedures.

The surveys were conducted during drought conditions which may have influenced the results. However, additional visual surveys have not detected this species near the study area.

Other Special Status Wildlife Species

Several species of wildlife recorded as present or potentially present are designated by the BLM as Sensitive Species, USFWS Special Status Species, or as California Species of Special Concern. These species are discussed below with respect to their presence on the mine site.

Bats:

Townsend's big-eared bat(*Corynorhinus townsendii*)

Townsend's big-eared bat was given special attention as a California Species of Special Concern that has the potential to move into man-made structures such as mines and caves. Surveys for sensitive bat species were conducted on two separate occasions by Dr. Brown in the underground stopes and glory holes in Soledad Mountain. Based on distribution and habitat preference this area could potentially support this species. A tentative identification of Townsend's big-eared bats was made by Dr. Patricia Brown during out-flight surveys of underground mine workings in the summer/fall of 1996. However, positive identification of Townsend's big-eared bat on-site was not possible. If this species is present, seasonal use is limited to low numbers of individuals. There are no large maternity roosts or hibernacula associated with the Soledad underground workings.

Pallid bat (*Antrozous pallidus*)

The pallid bat was also tentatively identified during the same out-flight monitoring of underground workings by Dr. Brown. The species observed were either pallid and/or Townsend's big-eared bats. The bats were not echolocating which is consistent with identification of the species. Positive identification was not possible, since it was impossible to capture specimens exiting from large underground workings with multiple openings. As with the Townsend's big-eared bat, if the pallid bat is present on the mine site, seasonal use is limited to low numbers of individuals. There are no pallid bat maternity roosts or hibernacula associated with the Soledad underground workings.

Raptors:

Golden eagle (*Aquila chrysaetos*)

A pair of golden eagles nested and fledged two birds in spring of 1990 in a nest approximately one mile south of the proposed mine pit. This nesting site was not used in spring 1995. Golden eagles were observed soaring and hunting on Soledad Mountain and the adjacent Tehachapi Range to the northwest during surveys in 1989/90. Golden eagle, and their nests, are protected by the Bald Eagle Protection Act, but are not a threatened or endangered species. Mine construction and operation are expected to reduce the prey base of all large raptors in the area.

Burrowing owl (*Speotyto cunicularia*)

Burrowing owls are a California Species of Special Concern. The owls were neither seen, nor expected, in the study area. These birds are common in the agricultural areas of Antelope Valley, and utilize abandoned animal or self-constructed burrows. The project is not expected to impact this species.

Other birds:

Loggerhead shrike (*Lanius ludovicianus*)

The loggerhead shrike occurs in shrub habitat throughout California, and was observed on the project site. This species is listed as a California Species of Special Concern. The proposed mine project will impact the habitat of this species, but overall effects on populations are not expected on this widespread bird.

Ladder-backed woodpecker (*Picoides scalaris*)

This resident bird inhabits scrub deserts, woodlands, and residential areas in southern California, east to the plains, and south into Mexico. The species was observed in shrubs on the project site on one occasion. The project will impact the habitat of this bird, but will not affect the overall population.

Mammals:

Ringtail *(Bassariscus astutus)*

This small predator is present on the study area, and scat was occasionally observed in underground mine workings. Ringtails are common in rock habitats throughout the southwestern U.S., from Texas to the west coast. The proposed project will impact habitat and displace the animals in the underground workings.

Badger (*Taxidea taxus*)

This short, stout predator is widely distributed in the western U.S., north into Canada, and south into Mexico. Although not observed on Soledad Mountain or in the study area, there is badger habitat on the site and the presence of badgers is possible. The project is not expected to impact this species, if present.

Reptiles:

Chuckwalla (*Sauromalus obesus*)

This large herbivorous lizard inhabits rock outcrops and rock slopes throughout the California deserts. Chuckwallas were not observed on the project study area for the project, but based on habitat affinities, they may potentially occur on the site. Impacts on this species are expected to be minimal, due to a small or non-existent population in the project site.

Warm Season Bat Surveys at Soledad Mountain
Kern County, California

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October 28, 1996

Introduction: The purpose of the current surveys was to document the warm season use by bats of the historic mine workings on Soledad Mountain near Mojave, Kern County, California. A previous survey conducted by us between March and June 1990 did not document any bats roosting in the mines. At this time, only mine workings that could be safely entered were surveyed, and no nocturnal monitoring of openings was conducted, nor were winter surveys for hibernating bats. Since 1990, the amount of property likely to be impacted by renewed mining has expanded due to acquisitions of adjacent claims. The property now under the control of Golden Queen Mining Company contains an estimated 700 openings to underground workings, many of which are inaccessible open stopes. The majority of the workings are interconnected so the complex is comparable to Swiss cheese. Conducting a definitive bat survey under these conditions is a challenge.

Methods: Warm season surveys were conducted August 13-14 and October 6-9, 1996. Survey methods consisted of entering accessible adits and shafts in search of bats and guano. At dusk, inaccessible workings were watched with night vision equipment . Anabat ultrasonic detectors connected to tape recorders via delay switches were positioned outside of other workings that could not be safely entered in order to remotely record bat activity. If high levels of sonar signals were recorded within the hour after dark, that opening was targeted for subsequent surveillance with night vision equipment.

Results: During the two survey periods, over 70 workings were entered to search for bats or guano. No bats were observed in the mines during the diurnal surveys, and small amounts of guano (*Myotis* sp.) were observed in only 2 prospects and a stoped adit. Of the 18 separate workings watched at dusk, bats emerged from 4 of them. Two of these had only single little brown bats (*Myotis* sp.) exiting, but in the open stope at the top of the highest west saddle, (in addition to *Myotis)* a light-colored, broad-winged bat (either *Corynorhinus* or *Antrozous*) was seen flying in the stope. On August 14, the large open cut on the southwest side had a large bat exit and then 14 large, light-colored bats entered (including 4 pairs that may have been mother/young couples). No echolocation pulses were detected at this time, which is consistent with the identification of either Townsend's big-eared bat (*Corynorhinus townsendii*) or pallid bat (*Antrozous pallidus*) since both of these species emit faint signals and at times do not ecolocate, but rely on vision. On October 6, 2 bats exited from this stope.

The Anabat recording system was placed in front of 10 separate openings, and some bat activity was detected at all of them, varying from only 2 pulses/night to over 60. Most activity was concentrated in the 2 hours after dusk as determined from the time stamp recorded when the unit was activated. The number of passes does not usually indicate the number of bats. Therefore the openings with high activity on the Anabat were watched at dusk. In one case, a single *Myotis* circled multiple times, triggering the Anabat with each pass. In the open stope above the

Elephant Eagle, almost 50 passes were recorded, most of them within the first hour after dusk. When this opening was watched on the next evening, no bats were seen exiting. Probably the bats detected the observer's presence and left via another opening to the same mine complex.

As a result of this survey, it was determined that at least 2 species roost in the mines at Soledad, but since it was impossible to capture bats exiting from large stopes, absolute identification as to species was not possible. Table 1 lists the species that could occur in the area near Soledad Mountain based on existing range maps, museum specimens and a recent survey completed by us at Edwards Air Force Base. The small bats seen flying around the mines in the evenings are probably California myotis (*Myotis californicus*) and/or western pipistrelle (*Pipistrellus hesperus*). The larger bats are either Townsend's big-eared bats or pallid bats, both of which are California Department of Fish and Game Species of Special Concern. *Corynorhinus* was also a C2 Candidate prior to the deletion of this category by U.S. Fish and Wildlife Service, although they continue to monitor the status of this species. Mexican free-tailed bats (*Tadarida brasiliensis*) were detected flying over the area, but they would probably not be roosting within the mines. They could possibly roost within crevices in large boulders on Soledad Mountain.

Discussion and Recommendations: Only small numbers of bats were discovered in the mine workings that we monitored. However, given the large number of interconnected, inaccessible workings, more bats could be resident within the mines than can be documented. Bats will usually roost in areas that are inaccessible to humans if given an option. When monitoring outflights from mines with multiple entrances, bats can exit out of an opening without an observer. All that can be stated at this point is that some bats of at least 2 species (and possibly 4 different species), are resident within the mines. Excluding the bats from the interconnected mines prior to renewed mining will be a difficult task. The best hope is that as activity begins, the bats will voluntarily desert the mines. If mining commences during the maternity season (May through July), flightless juveniles would be killed.

Many of the mine workings are very cool and could possibly support hibernating bats, and they would probably be killed if mining commenced in the winter months. To eliminate the possibility that the mines are a hibernaculum, a winter bat survey should be conducted in the coolest workings. This will probably entail the use of special vertical techniques to reach otherwise inaccessible areas of the mines.

TABLE 1

BAT SPECIES POTENTIALLY OCCURRING AT SOLEDAD MOUNTAIN

Scientific Name	**Common Name**	**Probability of occurrence**	**USFWS**	**CDFG**
Vespertilionidae	Plain-nosed bats			
Myotis yumanensis	Yuma myotis	L	C2	-
*Myotis californicus**	California myotis	H	-	-
Myotis ciliolabrum=leibii	Small-footed myotis	M	C2	-
*Pipistrellus hesperus**	Western pipistrelle	H	-	-
Eptesicus fuscus	Big brown bat	M	-	-
Lasiurus cinereus	Hoary bat	L	-	-
Euderma maculatum	Spotted bat	L	C2	CSC
*Corynorhinus townsendii**	Townsend's big-eared	H	C2	CSC
*Antrozous pallidus**	Pallid bat	H	-	CSC
Molossidae	Free-tailed bats			
*Tadarida brasiliensis**	Mexican free-tailed bat	H	-	-
Eumops perotis	Western mastiff bat	L	C2	CSC

USFWS	**CDFG**
U.S. Fish and Wildlife Service	California Department of Fish and Game
Endangered Species Act	CSC = California Species of Concern
C2 = recent Category 2 candidate	

Probability of occurrence H=high M=medium L=low
*Bats possiby detected in current survey

Winter Bat Survey at Soledad Mountain
Kern County, California

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February 3, 1997

Introduction: The purpose of this survey was to document the cold season use by bats of the historic mine workings on Soledad Mountain near Mojave, Kern County, California. The property under the control of Golden Queen Mining Company contains an estimated 700 openings to underground workings, many of which are inaccessible open stopes. The majority of the workings are interconnected so the complex is comparable to Swiss cheese. Conducting a definitive bat survey under these conditions is a challenge. Warm season surveys conducted in August and October 1996 determined that at least 2 species (as determined by size and flight pattern) roost in the mines at Soledad Mountain, but since it was impossible to capture bats exiting from large stopes, absolute identification as to species was not possible. Table 1 lists the species that could occur in the area near Soledad Mountain based on existing range maps, museum specimens and a recent survey completed by us at Edwards Air Force Base. The small bats seen flying around the mines in the evenings were probably California myotis (*Myotis californicus*) and/or western pipistrelle (*Pipistrellus hesperus*). The larger bats are either Townsend's big-eared bats (*Corynorhinus townsendii*) or pallid bats (*Antrozous pallidus*), both of which are California Department of Fish and Game Species of Special Concern. *Corynorhinus* was also a C2 Candidate prior to the deletion of this category by U.S. Fish and Wildlife Service, although they continue to monitor the status of this species, as does the Bureau of Land Management. Mexican free-tailed bats (*Tadarida brasiliensis*) were detected flying over the area, but they would probably not be roosting within the mines. They could possibly roost within crevices in large boulders on Soledad Mountain.

Many of the mine workings are very cool (about 50 F) and could possibly support hibernating bats, therefore necessitating a winter survey. Hibernating bats would select areas in the mines where they would normally not be disturbed by human entry, since any arousal will cause the expenditure of stored fat that is necessary for survival until spring.

Methods: Cold season surveys were conducted between January 4-6, 1997, during a period of cool and windy weather with low temperatures around 22 F and highs in the low 50's. Survey methods consisted of entering accessible adits and shafts in search of bats and guano. Dr. Scott Altenbach of the University of New Mexico utilized a hoist to reach otherwise inaccessible levels in vertical shafts.

Results: During this survey, over 30 mine openings were entered to search for bats or guano, although an accurate count of the number of workings is difficult since many of them connect underground at various levels. The lower levels usually are cooler and would provide more desirable temperatures for hibernating bats. Temperatures in many of the lower levels of the breathing mines were between 45 and 55 F which is cool enough for hibernation for desert bat species. The hoist system was used by Dr. Altenbach to access 5 shafts (report attached). No bats were observed in the mines during the surveys, and only a few pieces of fresh guano (*Corynorhinus*) were found in one of the Bobtail Mine adits by Brown and Berry.

Discussion and Recommendations: Only small numbers of bats were discovered exiting the mine workings that we monitored during the warm season surveys, and no bats were encountered in the workings entered during the winter. However, given the large number of interconnected, inaccessible (and unsurveyed) workings, more bats could be resident within the mines than were observed. Bats will usually roost in areas that are inaccessible to humans if given an option. Some of the workings surveyed with ropes or a hoist could not have been previously disturbed by people, and yet no bats were encountered. Temperatures measured in some areas in the winter were suitable for hibernating bats. The paucity of bats in the vicinity of Soledad Mountain may be due to the high winds that are present most nights throughout the year. Previous bat surveys conducted near Mojave showed that few bat sonar pulses were detected at times when wind speeds exceeded 20 mph. Insect availability decreases as winds increase, and bats have difficulty flying in winds above 20 mph. Winds in excess of 20 mph are a common occurrence near Soledad Mountain.

In this mining project, it is fortunate that few bats were found, since excluding the bats from the interconnected mine workings prior to renewed mining would be a difficult task (and probably impossible). The best hope is that as mining activity begins, any bats present will voluntarily desert the mines. If mining commences during the maternity season (May through July), any flightless juveniles could be killed. Hibernating bats in the winter might also perish. Bats roosting in rock crevices around the Soledad Mountain would be affected as well as those living in mines. The number of bats possibly killed by the mining activity should be low if the results of these surveys are any indication. As mitigation for any loss of roosting habitat, several mine workings that will not be disturbed by the project (on lands controlled by Golden Queen Mining Company) will have gates installed that exclude humans, but allow bat access. These workings should be monitored during warm and cold seasons for several years after gating to assess the success of this mitigation method.

TABLE 1

BAT SPECIES POTENTIALLY OCCURRING AT SOLEDAD MOUNTAIN

Scientific Name	Common Name	Probability of occurrence	USFWS	CDFG
Vespertilionidae	Plain-nosed bats			
Myotis yumanensis	Yuma myotis	L	C2	-
*Myotis californicus**	California myotis	H	-	-
Myotis ciliolabrum=leibii	Small-footed myotis	M	C2	-
*Pipistrelius hesperus**	Western pipistrelle	H	-	-
Eptesicus fuscus	Big brown bat	M	-	-
Lasiurus cinereus	Hoary bat	L	-	-
Euderma maculatum	Spotted bat	L	C2	CSC
*Corynorhinus townsendii**	Townsend's big-eared	H	C2	CSC
*Antrozous pallidus**	Pallid bat	H	-	CSC
Molossidae	Free-tailed bats			
*Tadarida brasiliensis**	Mexican free-tailed bat	H	-	-
Eumops perotis	Western mastiff bat	L	C2	CSC

USFWS	**CDFG**
U.S. Fish and Wildlife Service	California Department of Fish and Game
Endangered Species Act	CSC = California Species of Concern
C2 = recent Category 2 candidate	

Probability of occurrence H=high M=medium L=low
*Bats possibly detected in current summer survey

RECEIVED
FEB 05 1997

To: Dr. Patricia Brown-Berry
Brown-Berry Biological Consulting

From: Dr. J. Scott Altenbach
Department of Biology
University of New Mexico
Albuquerque, NM 87131

A SUMMARY REPORT ON INTERNAL BAT SURVEYS OF ABANDONED MINE FEATURES AT SOLIDAD MOUNTAIN, MOJAVE, CA

Exploration 4 - 6 January, 1997

Shaft Feature # 1 (Elephant Eagle Mine)

Description: This is a 40 ft shaft with a 30 ft stoped drift to the Southeast at about 20 ft and stoped drifts to the Southeast and Northwest at the level of the sump. There is no connection to other workings.

Percent of Mine Workings Seen: All

Description of Bat Use: No sign of bat use was observed.

Recommendation: This feature could be consumed by the open pit or waste rock without consequence.

Shaft/Open Stope Feature # 2 (Elephant Eagle Mine)

Description: This is an open stope which is one of multiple openings in a stoped vein system with a Northwest/Southeast strike and a steep dip to the Northeast. The squareset timbering which is situated at what looks like a shaft collar may indicate the opening was used for removal of ore at one time. I descended about 50 down this stope and could see down another 25 to 30 ft. Deeper descent was blocked by an elongate stock tank wedged precariously between the hanging wall and foot wall. From this point I could see that the stope continued along a Southeast strike. The stope continued to the Northwest and opened at multiple points to the surface.

Percent of Mine Workings Seen: Unknown, probably only a small portion.

Description of Bat Use: No sign of bat use was observed.

Recommendation: This feature could be consumed by the open pit or waste rock dump without consequence. Any volant wildlife, bats included, could easily exit this feature as disturbance from backfilling or blasting approached.

Adit Assoc. with Shaft/Open Stope Feature # 2 (Elephant Eagle)

Description: This is an adit entry to over 1000 ft of drifts and stopes on the adit entrance level. Stopes and ore passes continue below as well as above at least 100 ft. Based on strong, cold airflow from above, many clearly connect to surface openings above. I evaluated only the adit level workings.

Percent of Mine Workings Seen: Unknown, probably only a small portion.

Description of Bat Use: No sign of bat use was observed.

Recommendation: This feature could be consumed by the open pit or waste rock dump without consequence. Any volant wildlife, bats included, could easily exit this feature as disturbance from backfilling or blasting approached.

Adit Feature above Karma Shaft (Mine Name Unknown, Karma?)

Description: This is an adit entry to over 1000 ft of drifts on the adit entrance level. Ore passes continue below at least 100 ft. I evaluated only the adit level workings.

Percent of Mine Workings Seen: Unknown, probably only a small portion.

Description of Bat Use: No sign of bat use was observed.

Recommendation: This feature could be consumed by the open pit or waste rock dump without consequence. Any volant wildlife, bats included, could easily exit this feature as disturbance from backfilling or blasting approached.

Adit Feature (Starlight/Golden Queen Complex)

Description: This is an adit entry to thousands of feet of drifts on the 200 level. It intersects/connects with huge stopes and clearly connects all the way to the 600 level as indicated by the fumes we smelled from a blast on the 600 level. We explored this mine above the 200 to the zero level and 100 ft below the 200 level.

Percent of Mine Workings Seen: Unknown, probably only a small portion.

Description of Bat Use: No sign of bat use was observed although we covered thousands of feet of drifts and large stopes over a vertical relief of over 300 ft.

Recommendation: This feature could be consumed by the open pit or waste rock dump without consequence. Any volant wildlife, bats included, could easily exit this feature as disturbance from backfilling or blasting approached.

Shaft Feature on West Edge of Proposed Cell 3 (Shaft West of Existing Mill Tailings

Description: This is about a 200 ft shaft. The first 100 ft is through alluvial material with cobbles of various sizes imbedded in sand. The timbering of the narrow hoist compartment and manway is intact an almost fully lagged. At somewhat over 80 ft, there is a transition to soft, moist, uncemented sand which can be dug with a finger. At this transition the timber becomes loose and by 100 ft all timber is gone. Large chunks of sand have fallen away from the rib and the sandy rib can be seen all the way to a sand plug at about 200 ft. I did not descend below 100 ft because of the high probability of falling timber and large chunks of the sandy rib. I could see the bottom but could not see any lateral workings. They are almost certainly buried by the large amount of sand which has fallen off of the rib after the fall of the timber and lagging.

Percent of Mine Workings Seen: Unknown but any lateral workings are very likely buried.

Description of Bat Use: No sign of bat use was observed. The plate timbers and offsets in the manway were carefully checked for bat sign but none was noted.

Recommendation: This feature could be backfilled without consequence to any wildlife. I would recommend that the timber be burned before backfilling so that backfill will completely fill the shaft and not leave voids along the shaft rib.

Shaft Feature on West Edge of Proposed Cell 4 (Shaft Below and to the West of the Karma)

Description: This shaft is in competent rock and roughly 80 ft deep. The collar set and first few plate sets remain and some 1 X 12 inside lagging is still attached. There appear to be drifts to the East and West at the sump level but access is blocked by plate timber, long pieces of lagging, rocks and dirt which have fallen from the collar and rib.

Percent of Mine Workings Seen: Unknown, but I do not believe the lateral workings are extensive.

Description of Bat Use: I looked carefully at the "jackstrawed" timber and material at the bottom of this shaft and saw no sign of bat use.

Recommendation: This feature could be backfilled without consequence to any wildlife if it is done in **warm season (May through September)**. I would recommend that the timber at the bottom and that which still remains below the collar be burned before backfilling so that backfill will completely fill the shaft and not subside later when the wood at the bottom decomposes to give fill material access to whatever lateral workings there may be.

Shaft Feature Above and Southeast of the Karma (Independant)

Description: This shaft is in competent rock and is roughly 120 ft deep. It dips about 20 degrees from vertical to the West and there is a drift to the Southeast at about 70 ft. There appears to be a drift at the sump level but access is blocked by footwall plates which have fallen and are wedged in place with large to medium sized rocks. The drift at the 70 ft level is blocked at about 50 ft by loose material which has almost certainly fallen out of an overhand stope or old ore pass. The wood posts and a door near the beginning of the drift are badly decomposed and wood blocking the ore pass could have collapsed and allowed the run of loose material. This drift almost certainly connected to the shaft immediately to the Southeast along the strike of the vein.

Percent of Mine Workings Seen: Unknown. The sump level working could be extensive.

Description of Bat Use: I looked carefully in the drift and at the material at the shaft bottom and saw no sign of bat use.

Recommendation: This feature could be consumed by the open pit without consequence to any bats. **I would recommend that if it is backfilled with waste rock, the backfilling be started slowly during warm season (May through September)** to **give any bats which might be there the chance to be driven out by the dust and crashing of the first rocks.**

Adit Feature Above the Karma Shaft (Karma)

Description: This is an entry to several hundred feet of drift on the adit entry level. It intersects/connects with stopes above and huge stopes fully 200 ft below where a haulage level connects to an opening to the hillside.

Percent of Mine Workings Seen: Unknown, probably only a small portion.

Description of Bat Use: No sign of bat use was observed although we covered hundreds of feet of drifts and large stopes over a vertical relief of over 200 ft.

Recommendation: This feature could be consumed by the open pit or waste rock dump without consequence. Any volant wildlife, bats included, could easily exit this feature as disturbance from backfilling or blasting approached.

SUMMARY

I have spent well over 7000 hours underground in abandoned mines in New Mexico, Colorado, Texas, Nevada, Arizona, Minnesota, Michigan and Wisconsin looking for bat activity. In that experience, I have never seen mine features with so much appropriate habitat for bats that are as devoid of bats, or even sign of bats, as the mine working in Solidad Mountain. The vast majority of these workings are dry enough that bat guano should remain intact and obvious for many years. Parts of the workings had temperatures that would be ideal for hibernation of some species and even though I looked carefully, in many cases where no humans had been for decades, I saw none. Although the "absence of evidence" is not necessarily "evidence of absence", I believe that if there were significant numbers of bats using these workings, I would have seen some sign. As I have stated in the accounts above, I saw no sign whatever.

In mines which have so many large, interconnected, and often nearly inaccessible openings, exclusion of bats would be a virtual impossibility. In as much as a high proportion of the abandoned workings are interconnected and have multiple openings to the surface at a variety of levels, I believe that even if there were a few bats present in the workings, they could escape the advance of the open pit mining. The shafts that are to be covered with the leach pads do not present significant, unvisited habitat as one is filled above lateral workings and the other, which has too small a dump to have extensive workings, is nearly so.

I think it would be prudent that some of the old workings on the mountain should be left open so that if any bats are displaced by mining activities, there will be available habitat. As I look at the map of the proposed open pit(s) and waste rock dumps, it appears that this is the case. Given the unprescidented absence of bats and bat sign during the exploration of a very large amount of mine workings and given that at least some old workings remain, I do not believe that the proposed mining activity will have a significant impact on what bats may be present in the area.

J. Scott Altenbach, Ph.D.
Professor

APPENDIX C

MOHAVE GROUND SQUIRREL SURVEY

A Survey for Mojave Ground Squirrels
Soledad Mountain Project
Mojave, Kern County, California

Prepared for

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12596 West Bayaud Avenue
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By

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619 375-5518

August 2, 1990

INTRODUCTION

A live-trapping study was conducted in order to ascertain whether Mojave ground squirrels (Spermophilus mohavensis) occur on the Soledad Mountain Project located in portions of sections 1, 12 and 13 of Township 10 N, Range 13 W. and sections 5, 6, 7, 8, and 18 of Township 10 N., Range 12 W. in the unincorporated area of the County of Kern, State of California. The Mojave ground squirrel (MGS) is listed as Threatened by the California Department of Fish and Game and was trapped in the city of Mojave approximately 10 years ago by Dr. Tony Recht (pers. comm. 1990).

METHODS

In conducting the live-trapping survey, the 1990 revised Mojave Ground Squirrel Survey Guidelines of the CDFG were followed. Two 100-trap grids of either 5 by 20 or 4 by 25 Pymatuning traps spaced 25 meters apart were laid out in the vegetation and habitat types most likely to support Mojave ground squirrels. The majority of Soledad Mountain is steep, rocky terrain with scattered mine tailings which was deemed unsuitable as MGS habitat. However, to the west of the mountain are level areas which are planned to be heap leach pads and mine dump sites, and upon which two habitat types occur which could support MGS. Grid 1 was located on a sloping alluvial fan in the west central portion of Section 7, R12W, T10N in an area of creosote bush/Joshua tree scrub on loose sandy loam crossed by several shallow washes. Grid 2 was on flat creosote bush scrub with scattered Joshua trees on more compacted clay soil west of Tropico Road in the south central portion of Section 1, R13W, T10N. Both areas supported a good cover of annual plants this spring, especially fiddleneck (Amsinckia tessellata), which is a favorite food of MGS. Another preferred food plant, wolfberry (Lycium andersonii), was flowering and fruiting. Both areas had received minimal surface disturbance and appeared to represent good MGS habitat.

The traps were baited with commercial horse feed ("sweet feed") and a mixture of rolled oats and peanut butter. Traps were opened from approximately 9 AM to 6 PM each day for 5 days for a total of 4500 trap/hours per session. The first trapping session was conducted from March 29 through April 3, and the second from May 7 through 11, 1990. On the night of April 2, traps were left open throughout the night to sample nocturnal rodents. All captured animals were weighed and their sex and reproductive status recorded. They were then labeled on their stomach with a waterproof marking pen for future identification.

During the first trapping session, daytime temperatures ranged between 70 and 85 F, and during the second period the diurnal range was 75 to 90 F. Typically mornings were clear and still with strong winds usually arising in the mid-afternoon, although during both sessions at least one day was overcast and windy.

RESULTS

Although the habitat was equivalent to that in which Mojave ground squirrels occur throughout their known range, none were captured or observed during the course of the survey. However, during the April-May session, 4 captures of 2 pregnant Antelope ground squirrels (Ammospermophilus leucurus) occurred on Grid 1 and 14 captures of 6 individual AGS on Grid 2 comprised of 2 lactating and 1 non-reproductive female and 2 scrotal and 1 non-scrotal male. During the May trapping period, Grid 1 had 35 captures of 16 individual AGS which included 6 lactating, 1 post-lactating, 1 non-reproductive and 2 juvenile females and 3 scrotal and 3 non-scrotal males. On Grid 2, 10 AGS were captured 25 times (4 lactating and 1 juvenile female and 3 scrotal and 2 non-scrotal males).

During the nocturnal trapping, 20 Merriam's kangaroo rats (Dipodomys merriami) (7 males, 8 females and 5 not sexed) were captured on Grid 2 and 4 kangaroo rats (2 males and 2 females) on Grid 1. The Pymatuning traps are not sensitive enough to capture any rodent smaller than a kangaroo rat.

CONCLUSIONS

During the course of the trapping survey conducted on two grids to the west of Soledad Mountain near Mojave, no Mojave ground squirrels were captured or observed. However, this area lies within 5 miles of a known past record for this species. Because of the drought conditions, the Mojave ground squirrel populations have been severally impacted throughout their range. Researchers have not found them in areas in 1989 and 1990 were they had been captured in the past during the same season. In areas where they have been trapped during 1989 and 1990, few animals had reproduced.

This bias should be considered in evaluating the results of current trapping studies.

The Antelope ground squirrels appeared to be common and reproducing on both grids. On Grid 1, 8 times as many animals were captured in May as in the March 29 to April 3 session, while on Grid 2, the number in May only doubled over the results of the first trapping period.

APPENDIX D

DESERT TORTOISE PRE-CONSTRUCTION CLEARANCE SURVEYS

Desert Tortoise Pre-construction Clearance Surveys
April, 1997

Prepared for:

Soledad Mountain Project
Golden Queen Mining Company, Inc.
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Mojave, CA 93501

Prepared by:

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April 15, 1997

1.0 Introduction

Intensive surveys for the desert tortoise (*Gopher agassizii*) were conducted on portions of the Soledad Mountain Project with suitable habitat. The purpose of these surveys was to confirm the presence or absence of tortoises during an optimum time of year. The surveys are to serve as pre-construction surveys to permit activities to begin during later 1997.

The desert tortoise is a federal listed endangered species. Though the area around Soledad Mountain is not officially designated as desert tortoise habitat, it does contain tortoise habitat requirements. The nearest designated preserve, the Desert Tortoise Natural Area, is north of California City, approximately 20 miles to the northeast and east of the project site (Figure 1-1).

Desert tortoise surveys have been previously performed on the Soledad Mountain property. Surveys were conducted in areas with suitable habitat in 1990 and 1995. No live tortoises or recent active sign of any type were observed during these surveys. One mummified tortoise was found at the bottom of a mine shaft by Dr. Pat Brown in 1990 during bat surveys, indicating an earlier presence of tortoises in this area.

2.0 Methods

The survey was conducted April 4 and 5, 1997 as a two-level effort. The first level consisted of reconnaissance transects walked through all suitable tortoise habitat in the study area. The purpose of this reconnaissance was to locate any tortoise sign over a large area, and then concentrate surveys if tortoise sign was observed. A second level survey was performed by the same observer in a 200 feet grid in areas specifically slated for construction disturbance. Any area that could entrap a tortoise, such as shallow shafts and adits, was also examined for tortoise remains in this second area.

All types of tortoise sign (live animals, tracks, shell remains, active and inactive burrows, pallets, scat, courtship rings and drinking depressions) were looked for during the survey. Any observed sign would be noted. If definite sign were observed, then it would be closely examined for recent use, relationship to surrounding conditions and photographed. Predator roost sites, and any observed predator scat or regurgitation pellets, were also examined for tortoise remains.

3.0 Results

No direct or indirect sign of desert tortoises was observed during these surveys on the study area. No live tortoises were observed, nor were any desert tortoise shells, burrows, pallets, scat or drinking depressions located. All tracks and wildlife trails observed were consistent with small mammals. No tortoise remains were found among predator nest litter or in predator scat or regurgitation pellets, and no sign of tortoise use or occupation were noted in shafts or adits. Specific areas surveyed are discussed below (see Figure 3-1 for a map of the reconnaissance surveys and survey grid locations).

3.1 Reconnaissance surveys

<u>Survey Site One</u> This site consisted of transects walked moving east from the office complex to the eastern boundary ridge and included the drainage north of the road, the

western edge of the proposed heap and the perimeter of the entire existing heap site. Small mammals trails/tracks and scat were observed under shrubs in this area. These included black-tailed jackrabbit (*Lepus californicus*), ground squirrels, packrat (*Neotoma lepida*) and kangaroo rat (*Dipodomys merriami*). Coyote (*Canis latran*) or fox (*Vulpes macrotis* or *Urocyon cinereoargenteus*) scat, packrat and rabbit scat was also observed in this area. A large barn owl (*Tyto alba*) roost in an abandoned building and a roost in a shallow shaft was littered with regurgitation pellets that contained rodent skulls, tibias, inner ear vestibules and scapulas, but no tortoise bones or shells. No tortoise sign was observed.

<u>Survey Site Two</u> These transects included the West Dump Site. Transects were walked in the same locations as the 1990 and 1995 surveys. No tortoise sign was observed.

<u>Survey Site Three</u> These transects were conducted at the Southwest Dump Site (east of a residence) and included an alluvial fan and topographical toe slopes. A road runner (*Geococcyx californianus*) and Audubon cottontail (*Sylvilagus auduboni*) were observed during these transects. An old eroded sheep skull was also located. No tortoise sign was observed.

<u>Survey Site Four</u> These transects were performed in the east dump area. This area has been subjected to recent burns, and was heavily grazed by sheep in 1990. No tortoise sign was observed and the habitat was marginal.

3.2 Close spaced grid surveys

<u>Survey Site Five</u> This site included the west end of the leach heap pad and was surveyed on a 200 foot grid as well as specific surveys in likely habitats not on the grid pattern. Two mine shafts were also examined at this site. Litter under a barn owl roost in the bottom of one of the shallow shafts included three packrat carcasses. The owl was observed roosting on a beam in the shaft. An animal burrow located under a Joshua tree (*Yucca brevifolia*) was determined not to be of tortoise origin. Packrat and fox scat were found in the vicinity of the burrow. A pair of breeding pigeons (*Columba livia*) was found in the second shaft, but no tortoise sign. A black-tailed jackrabbit, antelope ground squirrel (*Ammospermophilus leucurus*), and California ground squirrel (*Spermophilus beechyi*) were observed at this site. No tortoise sign was observed.

<u>Survey Site Six</u> This site was also surveyed on a 200 foot grid. This area has extensive previous disturbance from historic mining including homesites. No tortoise sign was observed.

<u>Survey Site Seven</u> This site was also surveyed on a 200 foot grid. An American kestrel (*Falco sparverius*) was observed overhead at this site. No tortoise sign was observed.

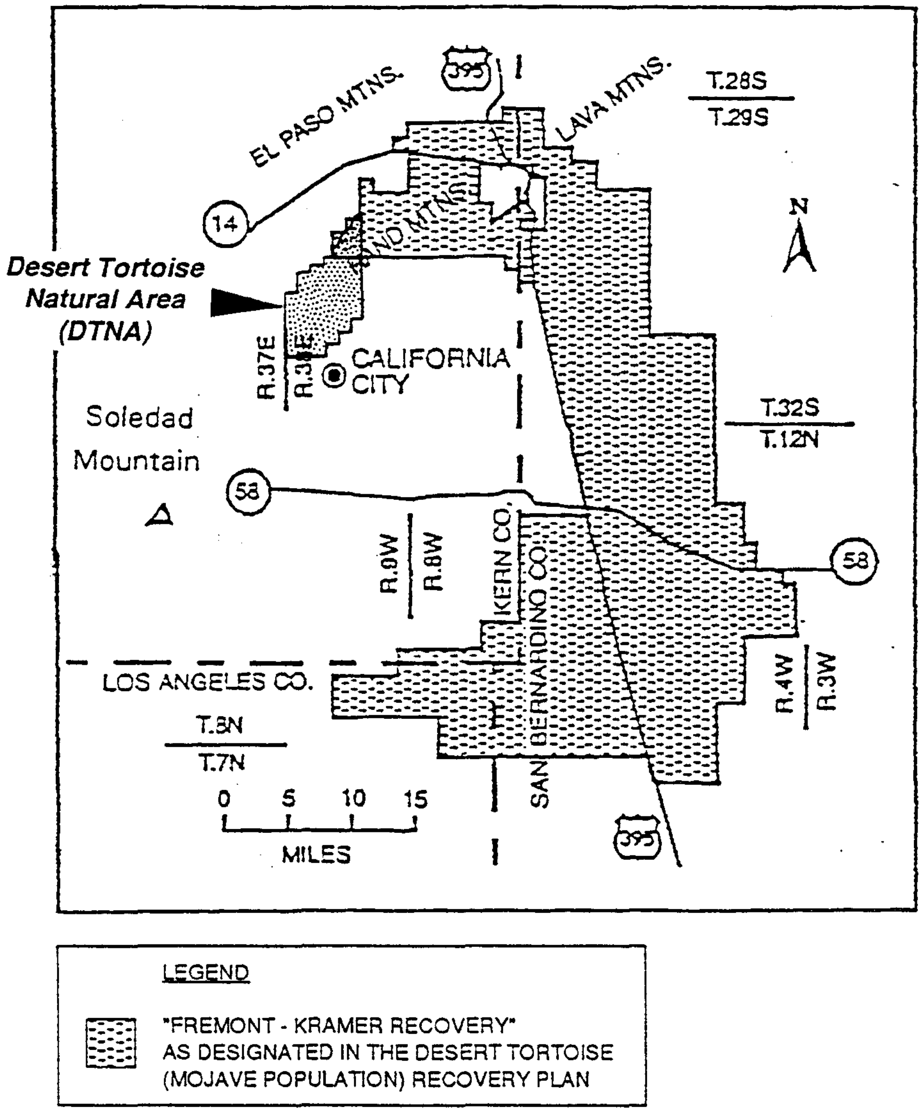
A close spaced grid survey was not conducted in the area of survey site four because the habitat was marginal and no desert tortoise were observed in other grid surveys containing more suitable habitat.

4.0 Survey Conclusions

Despite the fact that the Soledad Mountain site contains appropriate habitat for desert tortoise, this survey, like those conducted in 1990 and 1995, located no direct or indirect sign of desert tortoise habitation. The United States Fish and Wildlife Service also reports that recent surveys west of State Route 14 in the Antelope Valley have also not detected tortoises. While this region of the Antelope Valley may have supported the tortoise in the past, human activities such as mining, and road and building construction have undoubtedly reduced the populations and quality of habitat for tortoises and they no longer inhabit the area. The potential for tortoise to reestablish east of the interstate is low to nonexistent.

Historic mine sites at other desert locations in California have been observed by the surveyor to be devoid of or have few tortoises. Around Soledad Mountain, subsequent roads, agriculture and residential/commercial development have slowed or prevented the desert tortoise from reinhabiting former territory within its range.

Figure 1-1. Relative locations of the Soledad Mountain Project and the Desert Tortoise Natural Area.



APPENDIX A

PLANT SPECIES LIST AND ANIMAL SPECIES LIST

APPENDIX A - PLANT SPECIES LIST AND ANIMAL SPECIES LIST

Table A-1 List of Plant Species, Soledad Mountain Project	
Scientific Name	**Common Name**
Trees and Tall Shrubs	
Yucca brevifolia	joshua tree
Shrubs	
Acamptopappus sphaerocephalus	goldenhead
Ambrosia dumosa	burrobush
Atriplex confertifolia	shad scale
Atriplex polycarpa	cattle spinach
Chrysothamnus nauseosus	rubber rabbitbrush
Chrysothamnus teretifolius	terete rabbitbrush
Encelia virginensis	acton encelia
Ephedra nevadensis	joint-fir
Ericameria cooperi	goldenbush
Ericameria cuneata	goldenbush
Ericameria laricifolia	turpentine bush
Ericameria linearifolia	interior goldenbush
Ericameria palmeri	goldenbush
Eriogonum fasciculatum	California buckwheat
Eriogonum heermannii	hermann buckwheat

Table A-1 List of Plant Species, Soledad Mountain Project	
Scientific Name	**Common Name**
Eriogonum plumatella	flat-top buckwheat
Grayia spinosa	spiny hop-sage
Gutierrezia microcephala	sticky snakeweed
Gutierrezia sarothrae	broom snakeweed
Hymenoclea salsola	cheesebush
Krascheninnikovia lanata	winter fat
Larrea tridentata	creosote bush
Lycium andersonii	box thorn
Lycium cooperi	box thorn
Stephanomeria pauciflora	wire lettuce
Tetradymia axillaris	striped horsebrush
Tetradymia glabrata	felt-thorn
Xylorhiza tortifolia	mojave-aster
Grasses	
Achnatherum speciosum	desert needlegrass
Achnatherum hymenoides	indian ricegrass
Aristida adscensionis	three-awn
Bromus diandrus	ripgut grass
Bromus hordeaceus	soft cheese

Table A-1 List of Plant Species, Soledad Mountain Project	
Scientific Name	**Common Name**
Bromus madritensis	red brome
Bromus tectorum	cheat grass
Elymus elymoides	squirreltail
Hordeum jubatum	foxtail barley
Hordeum murinum	Mediterranean barley
Muhlenbergia richardsonis	may muhly
Poa secunda	bluegrass
Pleuraphis rigida	big galleta grass
Schismus arabicus	tufted grass
Schismus barbatus	Mediterranean grass
Sporobolus flexuosus	mesa dropseed
Trisetum canescens	trisetum
Vulpia octoflora	six-week fescue
Herbaceous Perennials and Annuals	
Abronia villosa	sand verbena
Allium haematochiton	onion
Allium parryi	onion
Amsinckia tessellata	fiddleneck
Arabis inyoensis	rock cress

Table A-1 List of Plant Species, Soledad Mountain Project	
Scientific Name	**Common Name**
Astragalus lentigenosus	locoweed
Calochortus kennedyi	mariposa lily
Camissonia brevipes	evening primrose
Camissonia lacustris	big tooth-leaved primrose
Centrostegia thurberi	thurber's spineflower
Chaenactis fremontii	fremont's pincushion
Chamaesyce albomarginata	white-fringed sandmat
Claytonia perfoliata	miner's lettuce
Coreopsis bigelovii	tickseed
Cryptantha circumscissa	western forget-me-not
Cryptantha pterocarya	wing-nut forget-me-not
Dalea mollis	soft indigo
Delphinium andersonii	Anderson's larkspur
Delphinium parishii	larkspur
Dichelostemma capitatum	blue dicks
Eriastrum diffusum	eriastrum
Eriogonum baileyi	bailey buckwheat
Eriogonum fasciculatum	California buckwheat
Eriogonum gracillimum	slender-stemmed buckwheat

Table A-1 List of Plant Species, Soledad Mountain Project	
Scientific Name	**Common Name**
Eriogonum nidularium	whisk broom
Eriogonum reniforme	kidney-leaved buckwheat
Eriogonum trichopes	little trumpet
Eriophyllum lanosum	wooly sunflower
Eriophyllum multicaule	wooly sunflower
Eriophyllum pringlei	pringle's wooly sunflower
Eriophyllum wallacei	wallace's wooly sunflower
Erodium circutarium	storksbill
Eucrypta micrantha	eucrypta
Gilia spp.	gilia
Gilia brecciarum	gilia
Guillenia lasiophylla	California mustard
Layia glandulosa	white layia
Linanthus parryae	linanthus
Lessingia lemmonii	vinegar weed
Lomatium mohavense	mohave wild parsley
Lupinus brevicaulis	sand lupine
Malacothrix californica	desert dandelion
Malacothrix coulteri	snake's head

Table A-1 List of Plant Species, Soledad Mountain Project	
Scientific Name	**Common Name**
Mentzelia pectinata	mentzelia
Mentzelia albicaulis	small-flower blazing star
Mirabilis bigelovii	four o'clock
Mirabilis multiflora	four o'clock
Monoptilon bellioides	desert star
Nama demissum	purple mat
Nemophila pedunculata	nemophila
Oenothera deltoides	basket evening primrose
Oenothera villosa	evening primrose
Pectocarya recurvata	comb-bur
Pectocarya setos	comb-bur
Petalonyx thurberi	sandpaper plant
Phacelia glandulifera	tackstem phacelia
Pholistoma membranaceum	fiesta flower
Plantago ovata	plantain
Platystemon californicus	cream cups
Salvia carduacea	thistle sage
Salvia columbariae	chia
Sisymbrium altissimum	tumble mustard

Table A-1 List of Plant Species, Soledad Mountain Project	
Scientific Name	**Common Name**
Sisymbrium irio	London rocket
Sphaeralcea ambigua	apricot mallow
Stephanomeria parryi	wire lettuce
Stephanomeria spinosa	skeleton weed
Streptanthella longirostris	small jewelflower
Thelypodium intergrifolium	thelypodium
Xylorhiza tortifolia	mojave-aster
Cactus	
Ferocactus cylindraceus	barrel cactus
Opuntia basilaris	beavertail cactus
Opuntia echinocarpa	golden cholla

Table A-2
Wildlife Species Present, Soledad Mountain Project

Scientific Name	Common Name	Identif-cation[1]	Status[2]
BIRDS			
Raptors			
Aquila chrysaetos	Golden eagle	Obs	CSSC
Buteo jamaicensis	Red-tailed hawk	Obs	
Falco peregrinus	Peregrine falcon	Obs	FE/SE
Falco sparverius	American kestrel	Obs	
Speotyto cunicularia	Burrowing owl	Pos	BLM/FWS/CSSC
Tyto alba	Barn owl	Pos	
Game Birds			
Alectoris graeca	Chukar	Obs	
Lophortyx californicus	California quail	Obs	
Zenaida macroura	Mourning dove	Obs	
Other Birds			
Amphispiza bileneata	Black-throated sparrow	Obs	
Carpodacus casinii	House finch	Obs	
Cathartes aura	Turkey vulture	Obs	
Cathatus guttatus	Hermit thrush	Obs	
Columba livia	Rock dove (domestic pigeon)	Abt	
Corvus corax	Raven	Abt	
Dendroica coronata	Yellow rumped warbler	Obs	
Eremophila alpestris	Horned lark	Abt	
Junco hyemalis	Oregon junco	Obs	
Lanius ludovicianus	Loggerhead shrike	Obs	BLM/FWS/CSSC
Picoides scalaris	Ladder backed woodpecker	Obs	CSSC
Salpinetes obsoletus	Rock wren	Obs	
Sayornis saya	Say's phoebe	Obs	

Table A-2
Wildlife Species Present, Soledad Mountain Project

Scientific Name	Common Name	Identif-cation[1]	Status[2]
Spizella breweri	Brewer's sparrow	Obs	
Tachycineta thalassina	Violet green swallow	Abt	
Toxostoma lecontei	Le Conte's thrasher	Obs	CSSC
Zonotrichia atricapilla	White crowned sparrow	Obs	
REPTILES			
Callisaurus draconoides	Zebra-tailed lizard	Obs	
Cnemidophorus tigris	Western whiptail	Obs	
Crotalus scutulatus	Mojave rattlesnake	Obs	
Crotophytus insularis	Desert collared lizard	Obs	
Dipsosaurus dorsalis	Desert iguana	Obs	
Gopherus agassizii	Desert tortoise	Pot	BLM/FT/ST
Pituophis melanoleucus	Gopher snake	Obs	
Sauromalus obesus	Chuckwalla	Pos	BLM/FWS
Sceleporus magister	Desert spiny lizard	Obs	
Uta stansburiana	Side-blotched lizard	Abt	
RODENTS			
Chaetodipus penicillatus	Desert pocket mouse	Pos	
Dipodomys merriami	Kangaroo rat	Obs	
Perognathus longimembris	Little pocket mouse	Pos	
Neotoma lepida	Desert woodrat (packrat)	Obs	
Peromyscus crinitus	Canyon deermouse	Obs	
Peromyscus maniculatus	Long-tailed deermouse	Pos	
BATS			
Antrozous pallidus	Pallid bat	Pos	CSSC
Eptesicus fuscus	Big brown bat	Pos	
Eumops perotis	California mastiff bat	Pos	
Myotis californicus	California myotis	Obs	

Table A-2
Wildlife Species Present, Soledad Mountain Project

Scientific Name	Common Name	Identif-cation[1]	Status[2]
Pipistrellus hesperus	Canyon bat	Obs	
Corynorhinus townsendii	Townsend's big-eared bat	Pos	CSSC
Tadarida brasiliensis	Mexican free-tailed bat	Obs	
SMALL MAMMALS			
Spermophilus mohavensis	Mojave ground squirrel	Pot	ST
Ammospermophilus leucurus	Antelope ground squirrel	Abt	
Spermophilus beechyi	California ground squirrel	Obs	
Lepus californicus	Black-tailed jackrabbit	Obs	
Sylvilagus auduboni	Audubon cottontail	Obs	
Thomomys bottae	Valley pocket gopher	Pos	
PREDATORS			
Bassariscus astutus	Ringtail cat	Obs	CProt
Canis latrans	Coyote	Obs	
Lynx rufus	Bobcat	Obs	
Taxidea taxus	Badger	Pos	CSSC
Urocyon cinereoargenteus	Gray fox	Pos	
Vulpes macrotis	Desert kit fox	Pos	

Legend:

1 Identification

- Obs - observed by sight or sign
- Abt - abundant by sight or sign
- Pos - possible on site, but not observed
- Pot - potential habitat on site, but not observed or expected

2 Status

- BLM - US Bureau of Land Management sensitive species
- FWS - US Fish and Wildlife Service sensitive species
- FE - Federal listed as endangered
- SE - State listed as endangered
- FT - Federal listed as threatened
- ST - State listed as threatened
- CSSC - State Special Species of Concern
- CPROT - State protected species

APPENDIX B

BAT SURVEYS

A SURVEY FOR BATS OF THE SOLEDAD MOUNTAIN PROJECT
MOJAVE, KERN COUNTY, CALIFORNIA

Prepared by

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July 2, 1990

INTRODUCTION

A field survey was conducted for sensitive bat species in the the mines of the Soledad Mountain Project located near Mojave in Sections 5 through 9 of Township 10 North, Range 12 West in the unincorporated area of the County of Kern, State of California. The mining activities span the period between the 1880's to the present, although most work ceased about 1942. The workings themselves are numerous and range from traditional adits and shafts to the excavation of parallel veins which intersect the surface as stopes and glory holes. The present plans for the mountain include a large open pit mine, mill site and heap leech operation. Since mines can provide refugia for bats and other wildlife, a survey was conducted of the present underground workings. Special attention was given to looking for Townsend's big-eared bat (Plecotus townsendii) which is a California Department of Fish and Game (CDFG) Species of Special Concern and United States Fish and Wildlife Service (USFWS) Category 2 Candidate Species for Threatened or Endangered Status.

Townsend's big-eared bat is basically a cave-roosting species that has moved into man-made caves such as mines and buildings. Unlike many other bats, they are unable to crawl into crevices, and usually roost in exposed areas where they are vulnerable to disturbance. Plecotus is quite sensitive to human disturbance, and this appears to be the primary cause of population decline for this species. This bat is colonial during the maternity season, when compact clusters of up to 200 individuals might be found. Maternity roosts form in the spring and remain intact during the summer. Great fidelity exists for a roost site, and if undisturbed the bats will use the same roost for many generations.

In the winter, Plecotus hibernate in cool caves and mine tunnels. Hibernation is a critical time for the species, since disturbance which causes arousal may expend energy reserves needed to survive the winter. The hibernation period in the California desert will vary with ambient temperature, but is generally from late November through early March.

METHODS

The mine survey was conducted from March 29 through April 2 and June 23 to 25, 1990. Survey methods consisted of entering mines during the day, and noting any bats, guano or other animal sign present. Temperature and humidity readings were taken in several of the mines.

On the evening of June 23 a mist net was placed over the entrance of the Soledad Extension to capture any bats as they emerged at dusk. On April 2 and June 24, mist nets were placed near a water tank on the north boundary of the project. A bat detector was used to monitor ultrasonic signals since many species emit distinctive sonar signals. A night vision scope was employed to watch bats flying over the tank in order to determine the species and approximate number present.

RESULTS

Of the over 100 mine workings occurring on Soledad Mountain which would be impacted by the proposed project, over 55 were deemed safe enough to enter to check for bats or other animal sign. Among these were the workings of the Golden Queen, Queen Esther, Elephant, Eagle, Bobtail, Starlight, Gypsy, Echo, Miner's Dream, Abertolli and 4 Jacks. No bats or guano were seen during this survey. Many of the mines had shafts or cross-cuts to the surface, and so cool drafts ran through the workings. Where the air was still, temperatures ranged from 64 to 70.5 F. Table 1 lists bat species which might be found in this area.

Evidence of other animals was present in the mines. Most contained scat and nests of the desert woodrat (Neotoma lepida), and in two cases a rat was observed. Droppings of the deer mouse (Peromyscus maniculatus) were also scattered throughout the mine. Several mines contained scat and footprints of the ringtail cat (Bassariscus astutus), and prints of a bobcat (Lynx rufus) were seen in two adits. A dead golden eagle (Aquila chrysaetos) was appropriately found in the Eagle adit at the bottom of a shaft leading to the surface. In this same mine complex, a mummified desert tortoise (Xerobates agassizzi) was found at the bottom of a shute. Domestic pigeons (Columba livia) were found roosting in the diggings with vertical cuts to the surface.

The mist nets over the Soledad Extension on June 23 did not catch any bats. The evening of April 2, a male western pipistrelle (Pipistrellus hesperus) was captured in the mist net by the water tank. Many other pipistrelles as well as two pallid bats (Antrozous pallidus) were seen that evening, and their ultasonic signals detected. As soon as the winds arose, bat activity ceased. This was also the case on the evening of June 24.

TABLE I

1. Order Chiroptera	Bats
Family Molossidae	Free-tailed bats
Tadarida brasiliensis	Mexican free-tailed bat
Eumops perotis	California mastiff bat
Family Vespertilionidae	Plain-nosed bats
*Antrozous pallidus**	Pallid bat
Plecotus townsendii	Townsend's big-eared bat
*Pipistrellus hesperus**	Western pipistrelle or canyon bat
Eptesicus fuscus	Big brown bat
Myotis californicus	California Myotis

DISCUSSION

Although appropriate habitat exists for bats in the Soledad Mountain mines, none were encountered during this survey. This is the most time that I have spent underground without seeing a bat or guano. Other wildlife, principally woodrats, deer mice, and ringtail cats are resident. The temperatures within the mines are appropriate for winter roosts of _Plecotus_, although their distinctive guano was not seen. Few bats were observed flying around Soledad Mountain at night or heard with the bat detector.

High winds are a constant evening feature of Mojave. Small bats have difficulty flying in strong winds. Flying insects, upon which bats feed, are also conspicuously low in numbers, especially on windy evenings. These may be the reasons for the low numbers of bats in an area which otherwise would appear to provide favorable habitat.

Attachment C

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November 8, 1995

SOLEDAD MOUNTAIN PROJECT, SLOPE STABILITY ANALYSIS

by

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Sept 6, 1996
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Exp. 8-23-97
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EXECUTIVE SUMMARY

The 55° design slope angles for the Ultimate Pit Boundary on Soledad Mountain and the pitwalls for the interconnected pits inside the Ultimate Pit Boundary of the planned open pit mine on Soledad Mountain should be stable. In fact, the pitwall slope angles could be safely increased to 63.4 degrees (two vertical to one horizontal) without hazarding the stability of the final planned pit slopes. The factors of safety are for dry slope conditions, assuming that the old mine workings have released any pore pressure that could otherwise be present along adversely oriented fracture(s). Table 1 presents the limiting equilibrium factors of safety for the critically oriented planned pit highwalls. Figure 1 presents the Ultimate Pit Boundary and the location of smaller interconnected pits inside the Ultimate Pit Boundary. The stability of the planned 55° pit slopes is primarily the result of the generally steep dip of most of the natural fractures (joints) present in the various rock types exposed on Soledad Mountain. The favorable steep dip of the natural fracture orientations more than makes up for the one low (Rhyolite Porphyry) and two medium (Upper Pyroclastic Unit and Middle Pyroclastic Unit) strength rock types. It is the favorable natural fracture orientations present that accounts for the resistance to erosion that has preserved Soledad Mountain surrounded by adjacent flat semi-desert. Figure 2 presents the planned ultimate pitwalls, rock type distribution and structural domains identified along, around and within the Ultimate Pit Boundary. Figure 3 indicates the critical maximum-height pitwall slopes along, adjacent to and inside the Ultimate Pit Boundary.

Five rock types are present in the area of the planned pit. All the rock types are Tertiary in age. These rock units are from oldest to youngest the Quartz Latite Porphyry (Tql), the Middle Pyroclastic Unit (Tmp), the Aphanitic Rhyolite (Tr), the Upper Pyroclastic Unit (Tup) and the Rhyolite Porphyry (Trp). The volcanic nature of the Tql, Tr and Trp rock types is indicated by the flow-banding present and by the pyroclastic nature of the Tmp and Tup rock types. Locally the rocks at the mine site are covered by thin alluvial and talus deposits of Quaternary age.

The strengths necessary for analyzing the planned pit slopes in the five rock units was measured by a program of compression and direct shear testing. The detailed test results are presented in Appendix A. The test results demonstrate that the shear strength of natural fractures present of these rock types is consistently more than two orders of magnitude lower than the shear strength of the intact rock type. This can be seen by inspection of Table 2, a tabulation of the measured rock type strengths. Samples were collected at each detail line fracture mapping site. The strength

Table 1. Relative stability of planned 55° slopes.

	Location Information			Slope	Slope	Factor of Safety		
Side of Pit	Structural Domain	Rock Type	Slope Ident.	Height (ft)	Angle (°)	@ Confidence Level 80%	98%	99.9%
East	11	Tup	1	800	63.4°	Failure paths >		
					55°	possible slopes		
	12	Tmp	2	850	63.4°	1.97	1.87	1.87
					55°	3.89	3.80	3.79
	1	Tql	3	400	63.4°	2.69	2.56	2.56
					55°	2.69	2.57	2.57
North	2	Tr	4	550	63.4°	2.53	2.42	2.42
					55°	2.91	2.80	2.80
Northwest	5	Tmp	10	240	63.4°	5.37	5.28	5.27
					55°	12.19	12.09	12.09
			11	180	63.4°	No failure path		
					55°			
			12	220	63.4°	7.30	7.02	7.01
					55°	9.05	8.78	8.77
West	8	Trp	9	650	63.4°	Failure paths >		
					55°	possible slopes		
South			8	1100	63.4°	Failure paths <		
					55°	residual friction		
	10	Trp	7	780	63.4°	Failure paths <		
					55°	residual friction		
			6	700	63.4°	No failure path		
					55°			
	11	Trp	5	600	63.4°	Failure paths >		
					55°	possible slopes		

Table 2. Strength of rock types.

Rock Type (Detail Lines)	Unconfined Compression Strength (psi)	Angle of Internal Friction	Intact Rock Cohesion (psi)	Residual Angle of Surface Friction	Residual Surface Cohesion (psi)
Tr (A&H)	13970	60.6°	1835	29.1°	3.58
Tup (B&C)	12940	54.8°	2054	23.5°	2.59
Tr (D)	19960	64.5°	2261	29.2°	2.95
Tmp (E&F)	15950	56.5°	2397	30.0°	2.00
Trp (G)	6250	52.0°	1075	30.5°	1.32
Tql (I)	21340	55.3°	3329	31.3°	0.00

Figure 1. Interconnected planned pits within Ultimate Pit Boundary.

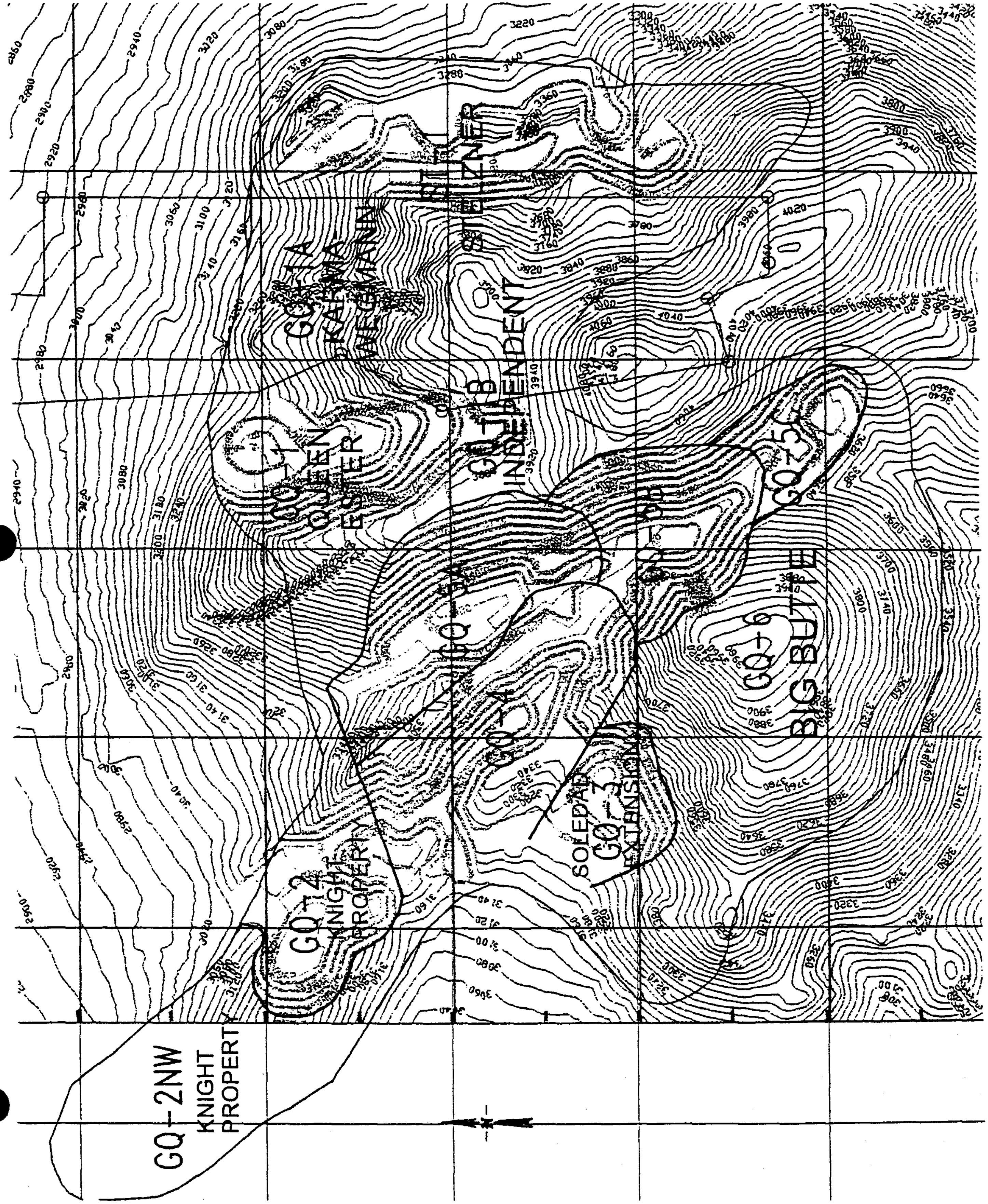


Figure 2. Structural domains for Soledad Mountain Project.

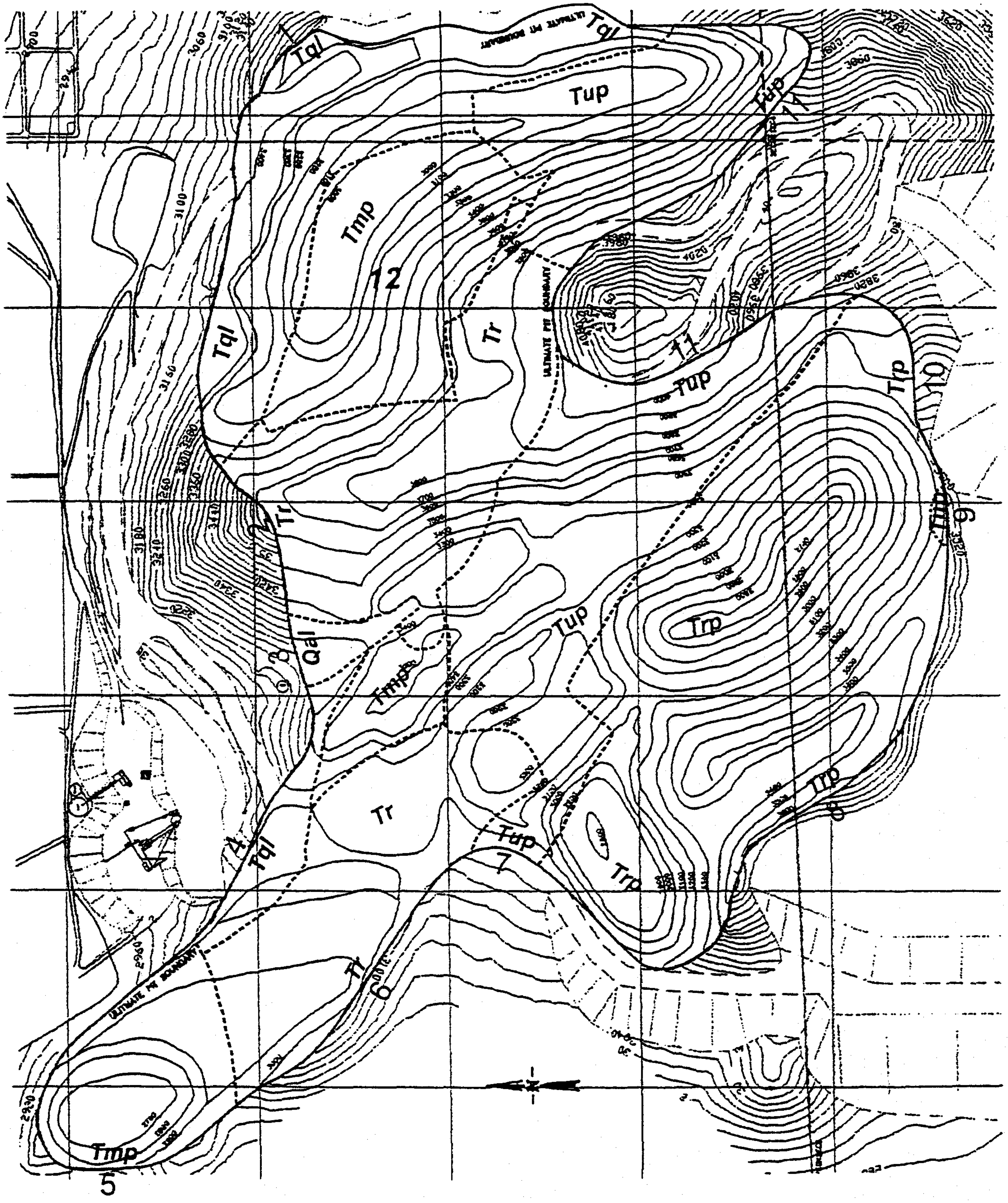
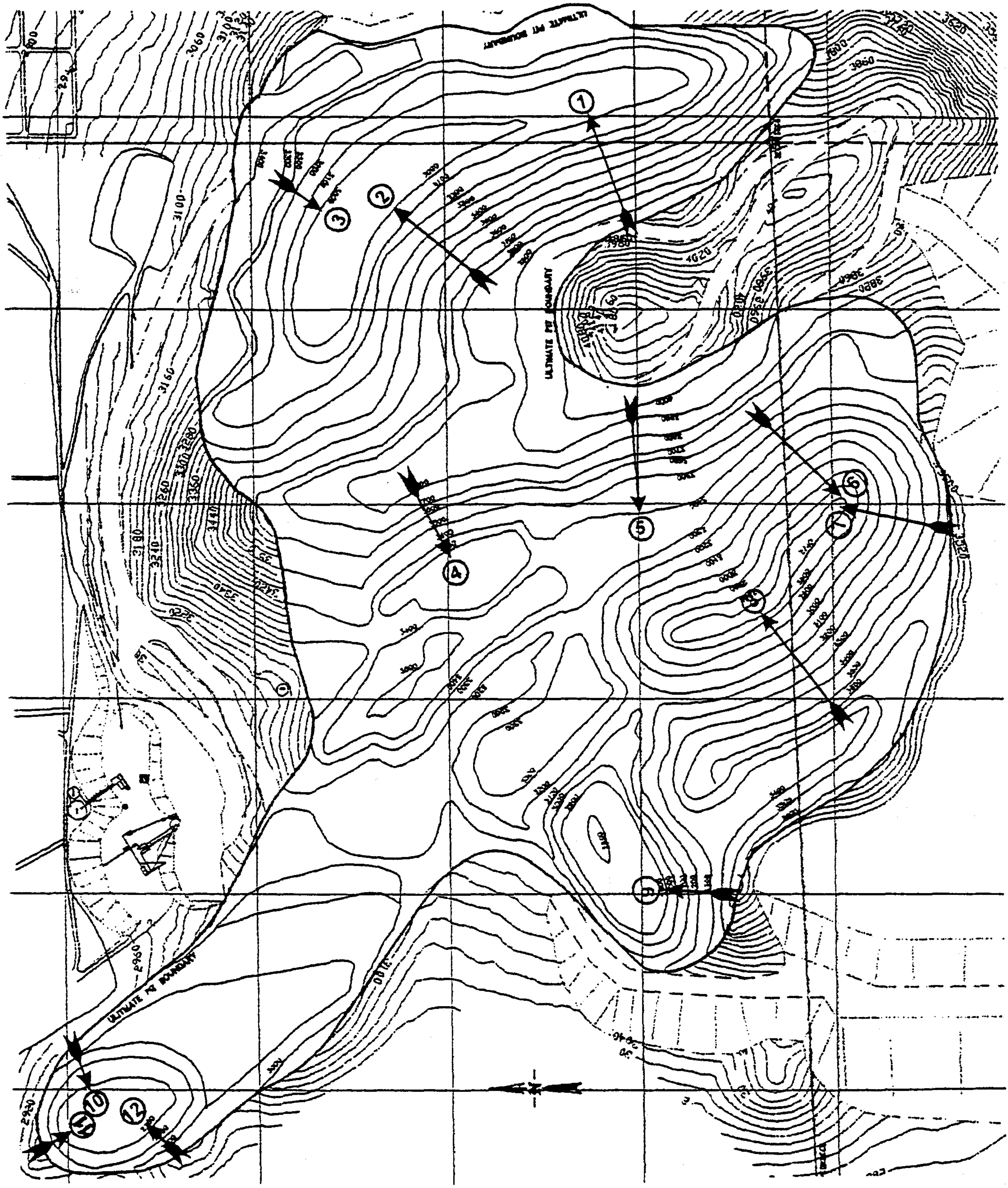


Figure 3. Critical, worst-case highwalls for Soledad Mountain Project.



of similar rock types were combined except for the Aphanitic Rhyolite. The strength of the Aphanitic Rhyolite is sufficiently variable that the test results were kept separate for slope stability evaluation.

The natural fractures provide the potential failure paths for pitwall slope failure. The natural fracture patterns present in each of the various rock types were measured by taking nine detail line samples of the natural fracturing present at rock type outcrops. A total of 824 natural fractures (joints) were recorded in the detail line mapping program. The purpose of the fracture mapping of the natural rock weaknesses was to provide the preferential orientations (strikes and dips), spacing, continuity (trace length) and irregularity of the fracture weaknesses present. The fracture data, therefore, provided the information essential to the determination of the presence or absence of any potentially adverse fracture weakness with respect to planned pitwall orientations. The fracture spacing and trace length measurements provided the data necessary to conservatively estimate the proportion of intact and broken rock along adversely oriented fractures. The orientations of statistically significant fracture sets were determined from Schmidt equal-area plots. The irregularity angles along potential failure paths along adversely oriented fractures were measured from the Schmidt diagrams.

Two modes of potential failure were analyzed, plane shear down a single joint set dipping out of a highwall, i.e. with dips flatter than the slope angle but steeper than the measured residual friction angle, and wedge shear for the intersection of two joint sets the plunges out of a pit highwall at an angle less than the measured friction angle.

The factor of safety calculations indicate that all planned Soledad Mountain Project slopes will be stabile, the lowest factor of safety in the case of the critical slope in Domain 1 is for plane shear failure; the critical slope in Domain 12 is wedge shear; the critical slope in Domain 2 is wedge shear; two of the critical slopes in Domain 5 are wedge shear. All other slopes either will not daylight a plane or wedge shear geometry or the daylighted plane or wedge shear geometry is flatter than the residual angle of surface friction for the rock type involved.

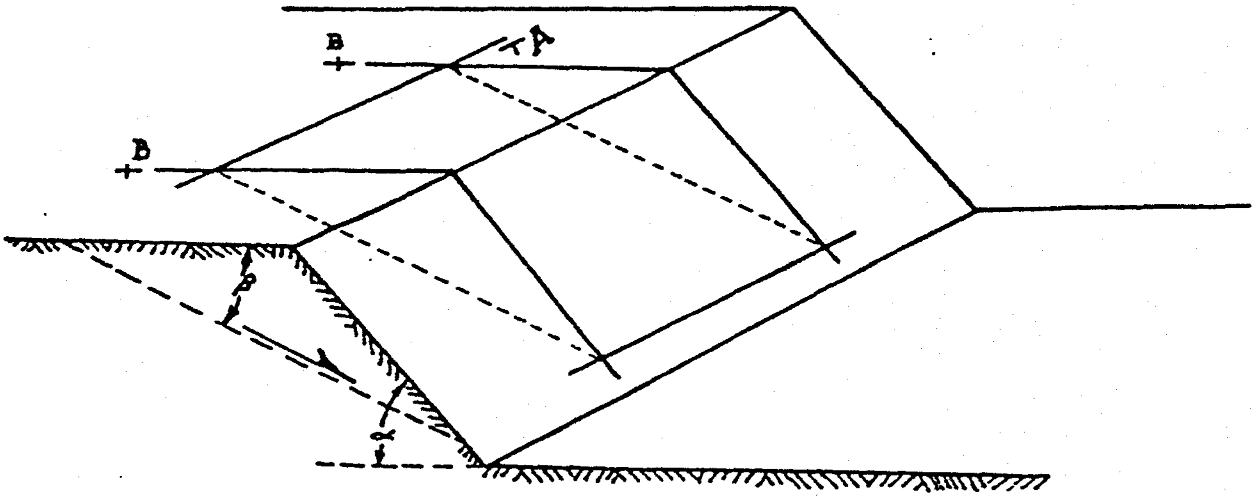
INTRODUCTION

The following analysis of planned 55° pitwall slope angles was undertaken to evaluate their stability. The analysis involved compositing the physical properties of the rocks involved and the structural geology and fracture data provided to calculate the factors of safety for the planned slope angles and potentially steeper 63.4° maximum possible slope angles. The limiting equilibrium method was used to calculate the factors of safety between the potential driving thrust tending to produce slope failure of the block of rock above a daylighted joint set or joint wedge and the resisting force along the worst-case position for the potential sliding block. Figure 4 shows the plane shear and wedge failure modes analyzed.

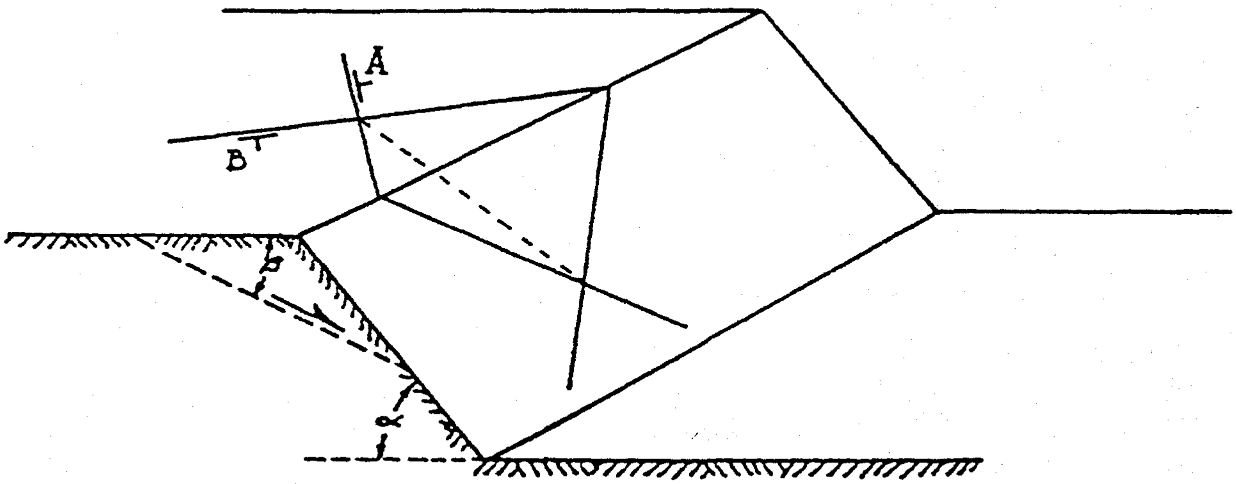
Slope failure by sliding (shear) is resisted by friction and cohesion across joints plus the friction and cohesion through intact rock bridges between joints. Additional frictional resistance to sliding is provided by the irregularities on the potential sliding surface. The angle of surface friction measured for planar machined surfaces was increased to account for the difference in dip between joints that define the average dip of the failure surface. Patton (1966) measured the variable inclination of actual limestone failure surface after the rock above the failure surface had slid, as shown on Figure 5. The idealized irregularity angle approximation used to include the resisting affect of dip irregularity measured by the detail line fracture mapping is shown on Figure 6. The irregularity angles were taken from the Schmidt equal-area projections of the detail line data. Slope stability was analyzed for the worst-case, maximum height locations within structural domains and for the potential slope failure through the toe of the slope.

The size of rock bridges between individual joints of a single joint set potentially subject to plane shear failure (sliding), or two joints in the case of an adverse intersection of two joint sets potentially subject to wedge shear failure (sliding), out of the planned pitwalls was estimated from the minimum joint spacing and maximum trace length measured during the detail line fracture mapping. Intact rock bridges provide the greatest frictional and cohesive resistance to sliding because of their much greater shear strength. The shear strength of intact rock is more than two orders of magnitude greater than the resistance provided by the residual shear strength of natural joints. The proportion of intact rock along potentially adverse natural fracture orientations was conservatively assumed to be one-dimensional, i.e. only in the dip direction as shown on Figure 7. Calculations were made for two-dimensional intact rock distribution but were not used in the evaluation of pitwall stability. The strength of the intact rock bridges was conservatively degraded to account for the decrease in strength associated with increasing size of the rock bridges in

Figure 4. Potential plane and wedge shear failure modes.

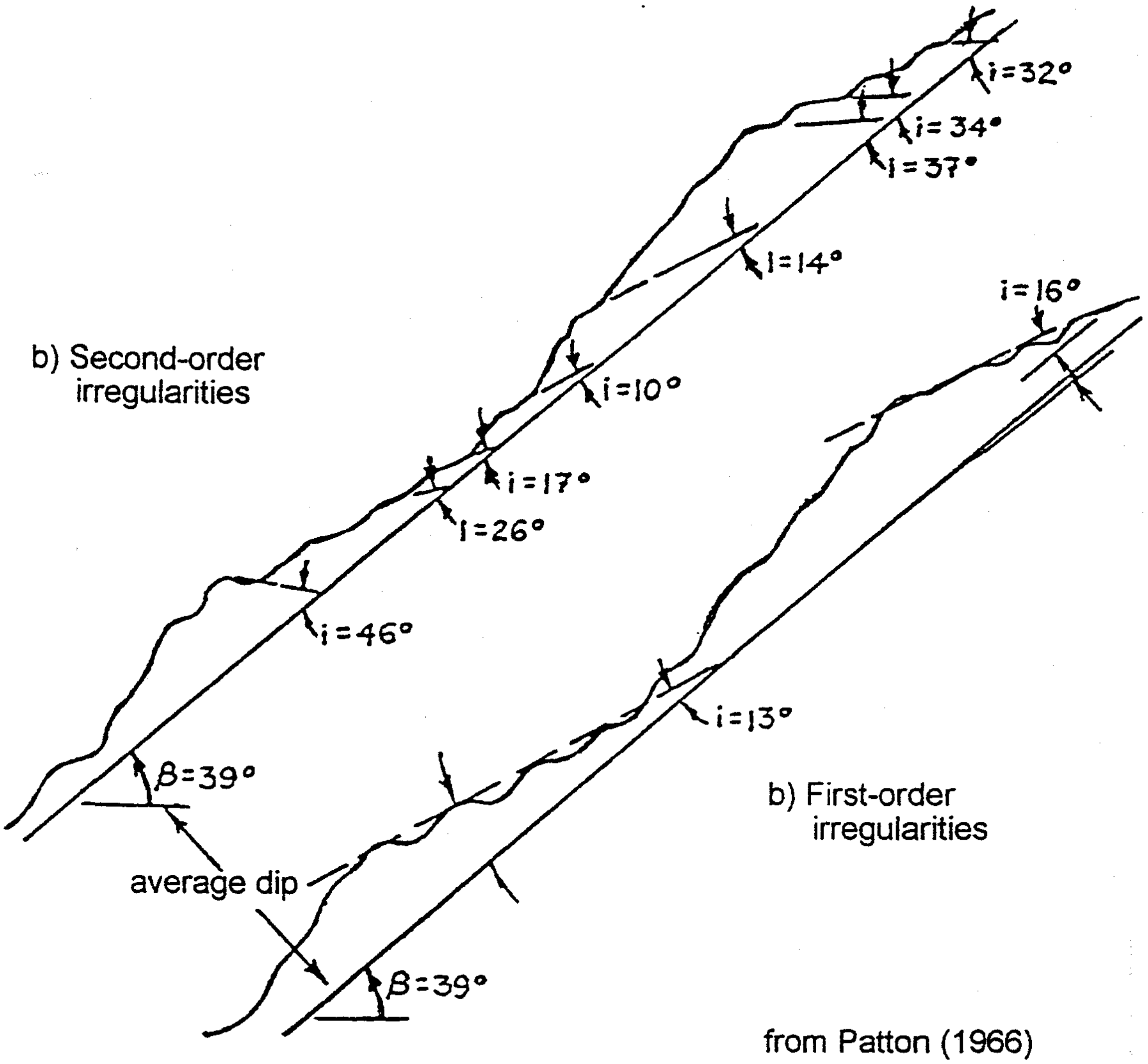


Isometric sketch of failure geometry for daylighted plane shear fracture dipping into pit, showing end release fractures.



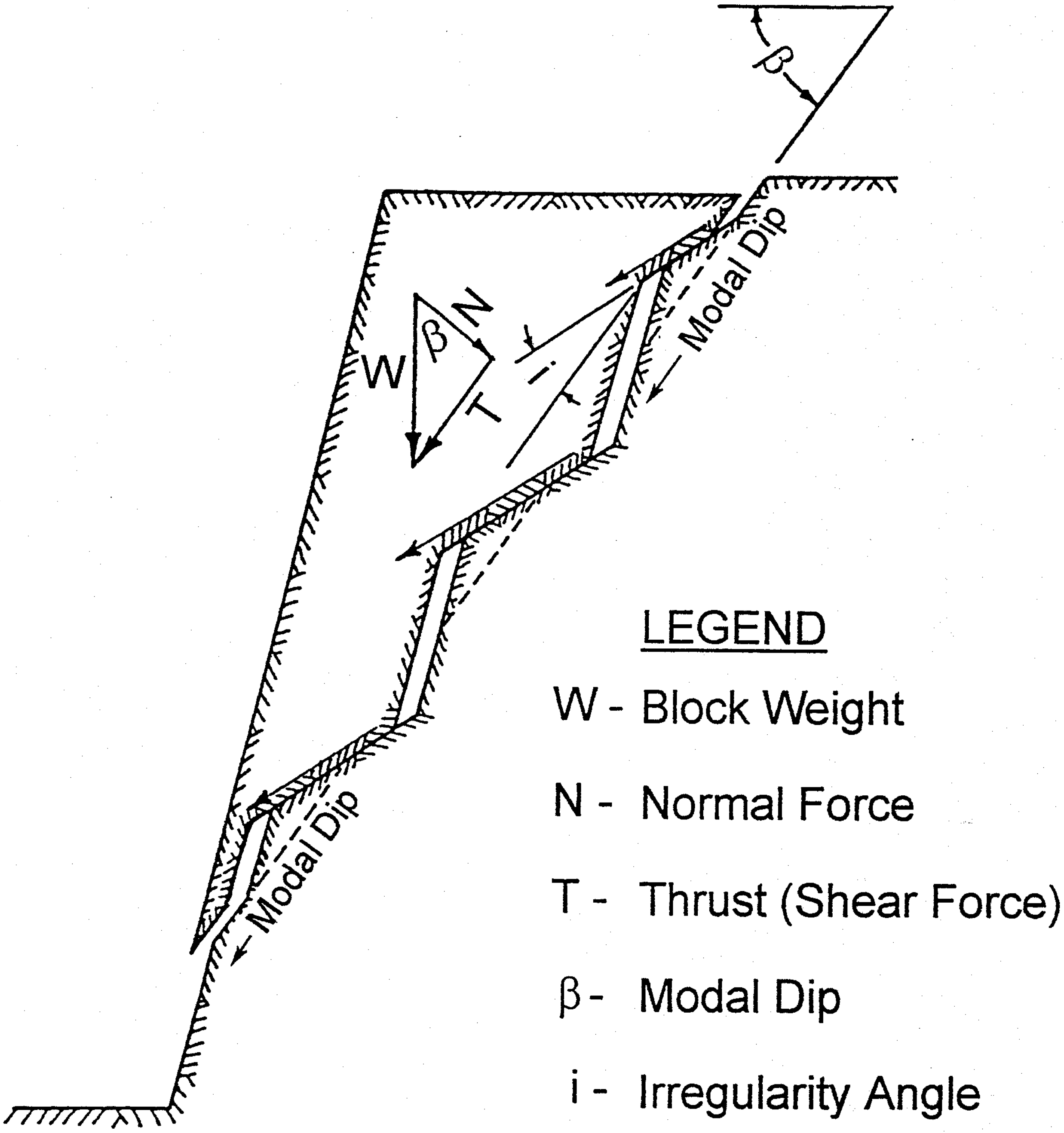
Isometric sketch of failure geometry for daylighted wedge shear condition, intersection of two fractures plunging into pit.

Figure 5. Irregularity angles measured on failed limestone slope (Patton, 1966).



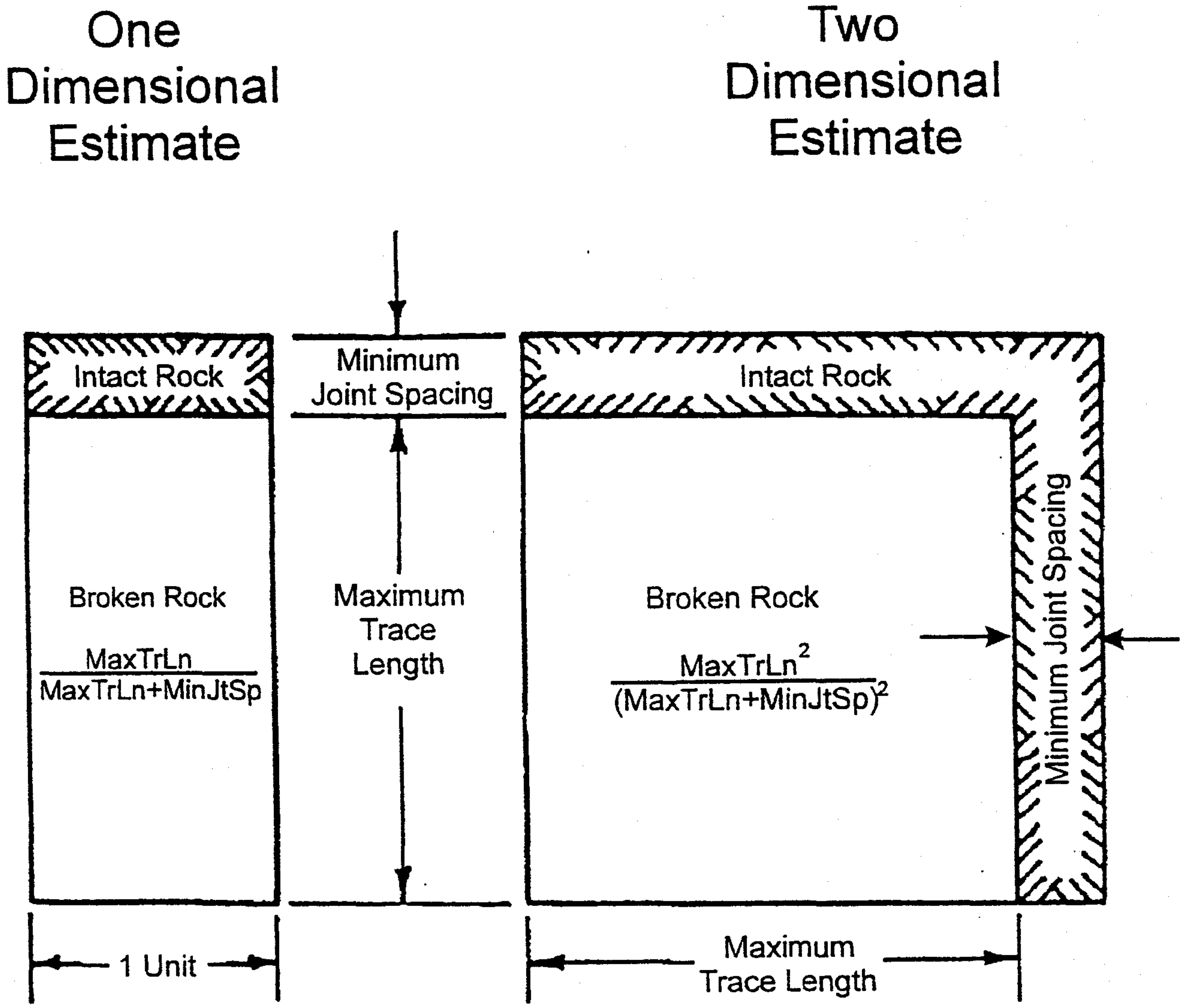
from Patton (1966)

Figure 6. Idealized irregularity resistance to slope failure.



No intact rock shown

Figure 7. One and two-dimensional intact rock bridge simulation.



relation to the 2-in. samples tested. The method employed was based on the coal strength/size data provided by Bieniawski (1968). The statistical best-fit power curve equation for that data was used to relate the measured strength of the 2-in. test samples to the size of rock bridges estimated from the minimum joint spacing. The equation is:

$$\text{Strength (psi)} = 7330(L)^{-0.658}$$

The term "L" is the diameter of the compression test specimen or the length of the rock bridge, estimated from the minimum measured joint spacing extracted from the tabulated detail line data for an adverse joint set for a critical pitwall within a structural domain.

Calculations were also made for fully saturated slopes, as shown on Figure 8. The uplift force (U) provided by hydraulic pressure (u_{max}) distributed along a potential joint controlled failure surface (L_j) reduces the total normal force (N) acting across the adverse failure surface. The frictional resistance (T_p) to sliding is directly related to the total normal force by the following equations:

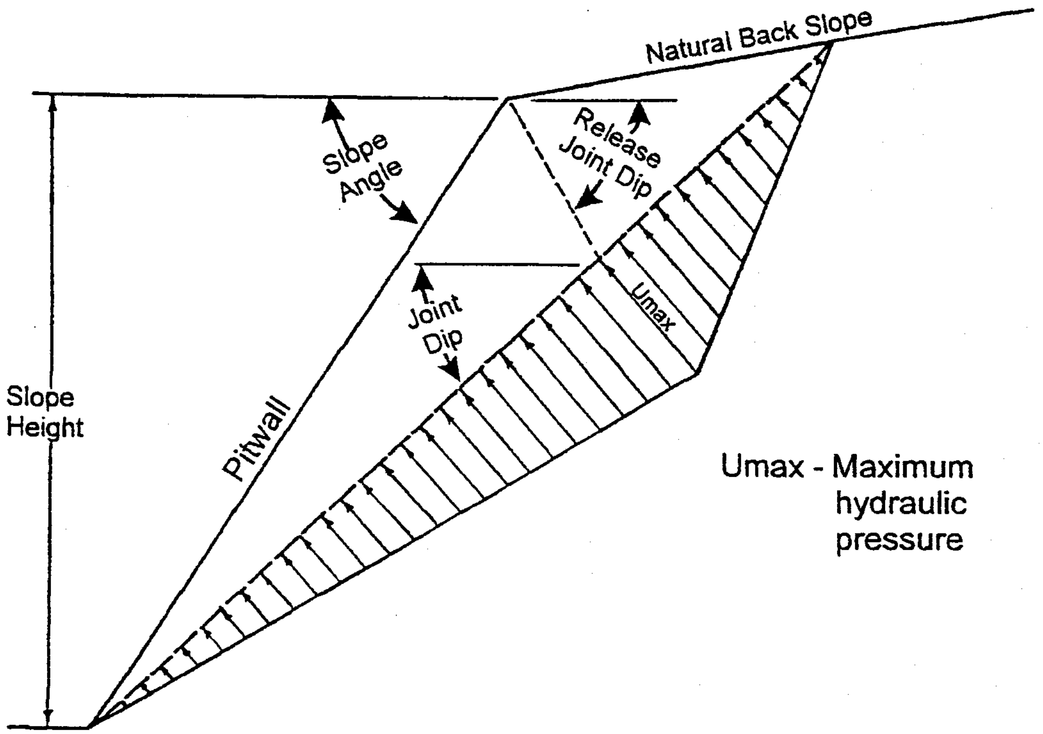
$$T = (N - U)\text{Tan}(\Phi - i) \qquad U = \left(\frac{u_{max}}{2}\right)L_j$$

Calculations were made for completely dry and fully saturated critical slope locations and geologic conditions. When inspected the underground workings were found to be generally dry, or at most in some locations damp. The topographic high represented by Soledad Mountain would tend to drain toward the alluvial plains surrounding the mountain. The overall evaluation of slope stability assumed that any hydraulic pressure that may have been present prior to previous underground mining was released by that mining. The stability of the critical highwalls has been increased by the drainage of water from the mountain and the magnitude of that increase is indicated on the factor of safety tables for the individual critical slopes.

GEOLOGIC INPUT DATA AND ANALYSIS

The slope stability study for the Soledad Mountain Project started with the preparation of a geologic structure and rock type map of the area by Golden Queen's geologic staff. This map provided the basis for initial selection of structural domains for the mine area. A structural domain is a three-dimensional volume of rock within which the fracture fabric is consistent. A structural domain may, or may not, include more than one rock type. Similarly, a structural domain may, or may not, change across a fault. Structural domains were selected on the basis of rock types

Figure 8. Assumed distribution of hydraulic uplift pressure along an adverse joint set in a fully saturated slope.



and major faults. Based on this map and on a field inspection, locations were selected for nine detail lines of fracture mapping for the five rock types. The locations of the nine detail lines are shown on Figure 9. Two detail lines of fracture orientation data were collected in the Aphanitic Rhyolite (Tr), the Upper Pyroclastic Unit (Tup) and the Middle Pyroclastic Unit (Tmp). The detail line fracture field data for the individual detail lines is presented as Appendix C to this report. Figure 2 presented the twelve structural domain locations finally selected based on similarities and differences between the statistically significant fracture orientations developed after the fracture data was plotted as Schmidt equal-area projections. The Schmidt plots for the nine individual lines are included as Appendix B to this report.

Structural Domain 3, on Figure 2, is in Quaternary Alluvium and Talus (Qal) and, therefore, is not actually a structural domain because it not a rock and contains no fractures. The Qal unit includes no highwall, entering the Ultimate Pit Boundary horizontally from the north facing side of Soledad Mountain. It was listed to provide a means to identify a difference in material along the Ultimate Pit Boundary. Structural Domains 11, 7 and 9 are really only one structural domain, all in the same Upper Pyroclastic (Tup) rock type, intersected along the sinuous Ultimate Pit Boundary. Structural Domains 8 and 10 are, also, only one structural domain, all in the same Rhyolite Porphyry (Trp) rock type, intersected along the sinuous Ultimate Pit Boundary. Structural Domains 5 and 12 are, also, only one structural domain, all in the same Middle Pyroclastic (Tmp) rock type, intersected along the sinuous Ultimate Pit Boundary and inside the pit at a critical high slope location and pitwall orientation. On the other hand, the fracture orientations mapped in Structural Domain 2 and Structural Domain 6, both in the Aphanitic Rhyolite (Tr), were so different that they were treated as separate structural domains.

The statistically significant fracture sets for the strike and dip data from each detail line and from each rock type are presented in Table 3. Statistical significance was determined at three level of confidence; 80%, 98% and 99.9%. These confidence levels were based on the probability of obtaining the listed confidence levels when selecting strikes and dips from a uniformly distributed random number table, i.e. uniform probability for all possible strikes and dips. Figure 10 presents the percentage of poles per 1% area necessary for the statistical confidence level desired and for the total number of poles in the Schmidt equal-area plot. The result is the percentage of poles needed within a 1% area of the Schmidt equal-area net to provide the selected level of confidence that the fracture set is real and not the result of chance.

Figure 9. Location of detail line fracture mapping locations in relation to planned Ultimate Pit.

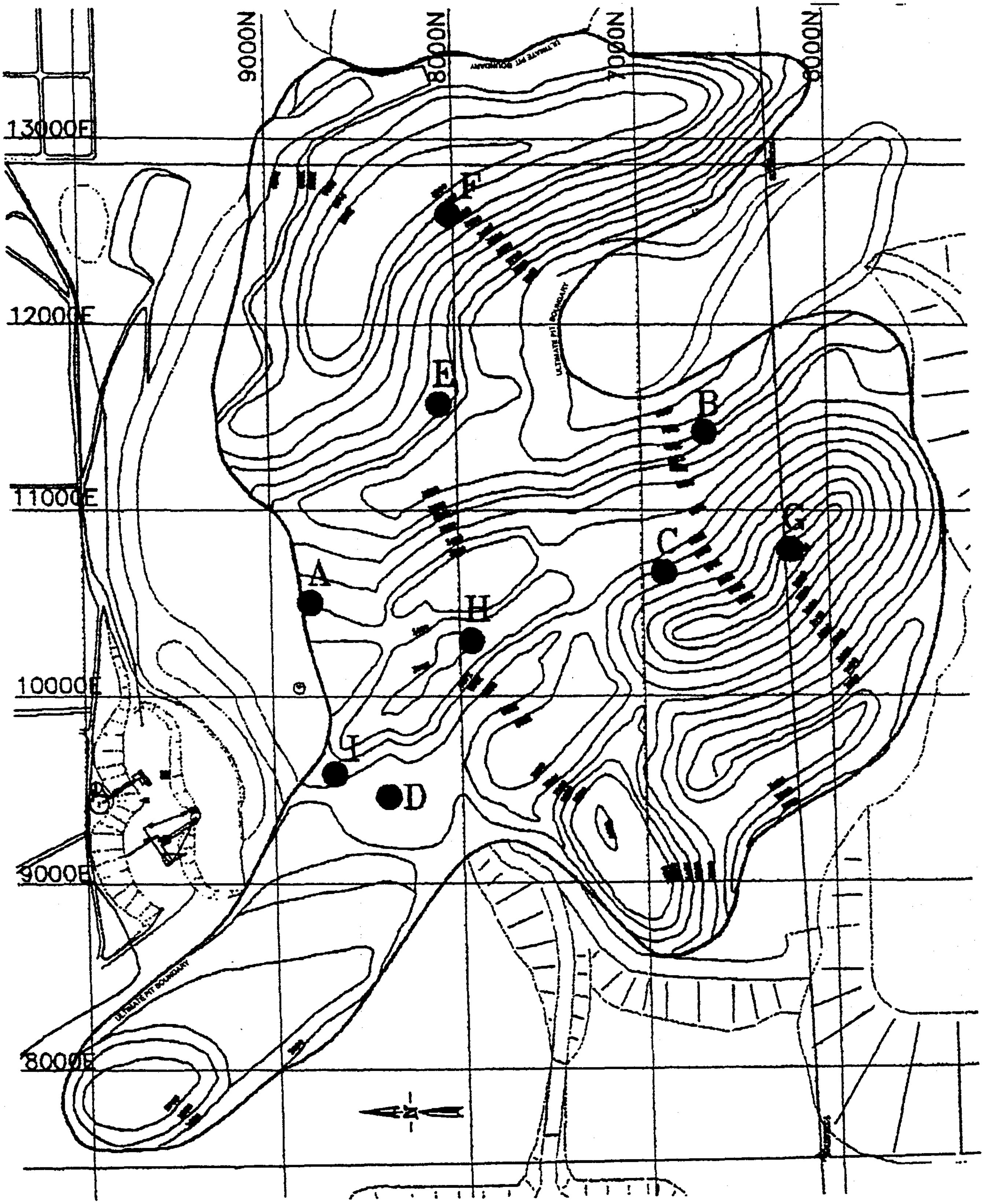


Table 3. Significant detail line fracture sets

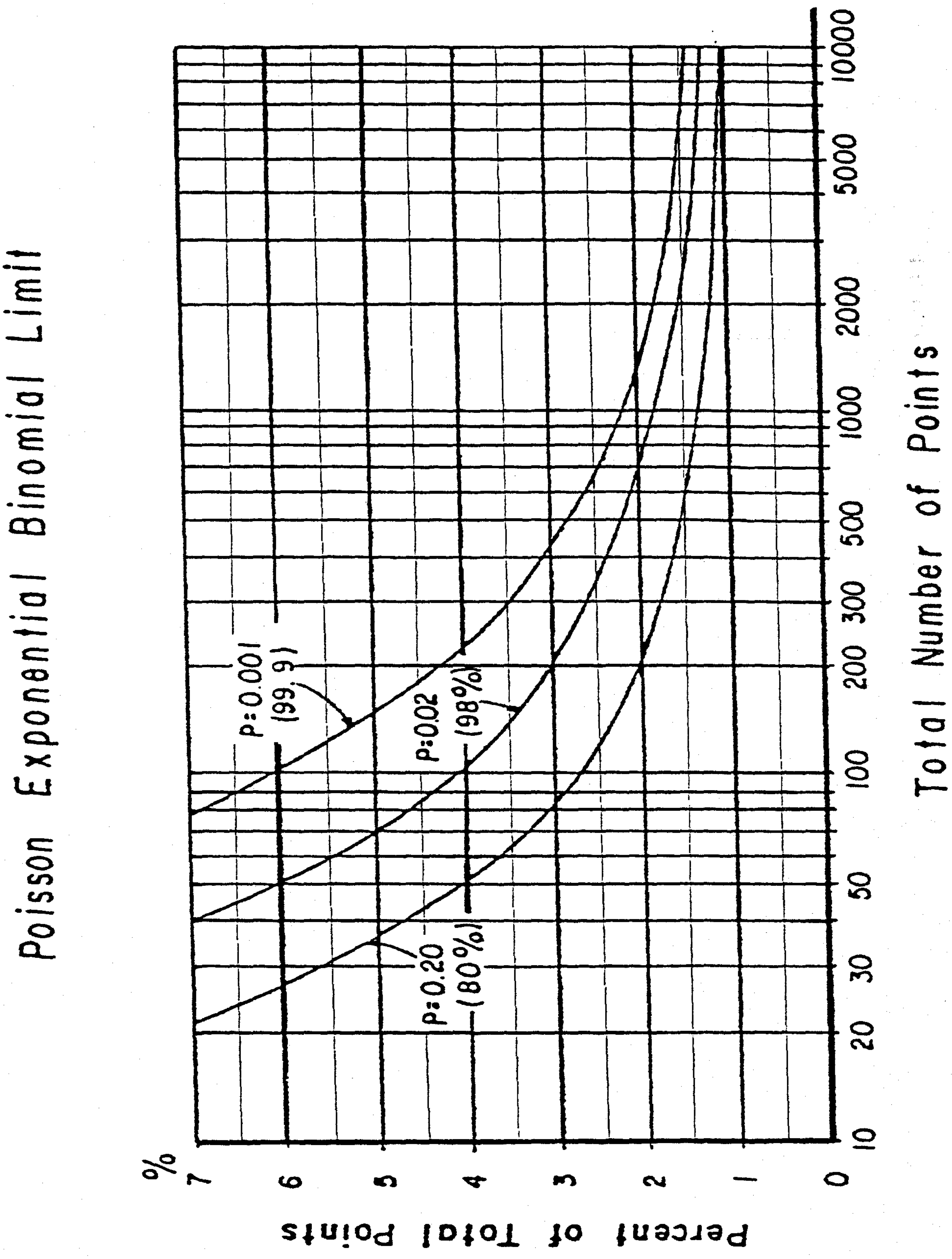
Measurement Location and Description	Significant Joint Sets @ Confidence Level						No. of Poles
	>99.9%		98%		80%		
	Strike	Dip	Strike	Dip	Strike	Dip	
DETAIL LINE "A"	N20E	78NW	N53W	69NE	**N80W**	**38SW**	100
Tr - Aphanitic	N15W	65NE	N42E	66SE	**N03E**	**53NW**	
rhyolite, banded	N60E	83SE	N83E	75SE			
DETAIL LINE "B"	N31W	83SW	N52E	69NW			38
Tup - Upper	N52E	84SE	N01E	88SE			
pyroclastic unit	N68E	84SE					
DETAIL LINE "C"	N32W	75NE	N37E	84NW			99
Tup - Upper	N13W	74NE	N68E	75NW			
pyroclastic unit							
DETAIL LINE "D"	**N30W**	**32SW**	**N51E**	**62NW**			93
Tr - Aphanitic	N73E	86NW	N04E	88SE			
rhyolite, banded	N14W	81NE	N55E	84SE			
			N57E	70SE			
DETAIL LINE "E"	N70E	84NW	N18E	82NW	**N54W**	**38SW**	97
Tmp - Middle			N47E	80NW	N18E	80SE	
pyroclastic unit			N83W	74NE	N54E	82SE	
			N30W	81NE	N68E	75SE	
			N13W	78NE			
			N11W	**48NE**			
DETAIL LINE "F"	N68W	84SW	**N44W**	**43SW**	N53E	70NW	97
Tmp - Middle	N18E	85NW	N32E	85NW	N71E	72NW	
pyroclastic unit			N10W	77NE			
DETAIL LINE "G"	**N38E**	**40SE**	N52E	87NW	N75W	82NE	100
Trp - Rhyolite	N77E	82SE	**N72E**	**50NW**	N15E	68SE	
porphyry, banded			N09W	15NE	N41E	64SE	
			N11E	**27NE**			
DETAIL LINE "H"	N10W	84SW	N87W	83SW			100
Tr - Aphanitic	N78E	80NW	N62W	18SW			
rhyolite, banded	N11W	83NE	N57W	83NE			

Table 3 (Continued). Significant detail line fracture sets

Measurement	Significant Joint Sets @ Confidence Level						No.
Location and	>99.9%		98%		80%		of
Description	Strike	Dip	Strike	Dip	Strike	Dip	Poles
DETAIL LINE "I" Tql - Quartz latite porphyry, massive banded	N48E	85NW	N18W	76SW	N48W	70SW	100
			N02W	80SW	**N20W**	**22SW**	
			N60W	82NE	N84E	90	
					N22W	**55NE**	
					N17W	78NE	
					N07W	**38NE**	
					N06E	**56SE**	
DETAIL LINES "A"+"H" Tr - Aphanitic rhyolite, banded	N12W	83SW	N19E	78NW	N62W	18SW	200
	N12W	81NE	N77E	78NW	N45E	70NW	
			N73W	82NE	N54W	18NE	
			N57W	78NE			
			N39E	66SE			
			N63E	82SE			
DETAIL LINES "B"+"C" Tup - Upper pyroclastic unit	N32W	75NE	N49E	84NW			137
			N68E	80NW			
			N53E	88SE			
DETAIL LINES "E"+"F" Tmp - Middle pyroclastic unit	N67W	85SW	N82W	73NE	**N50W**	**37SW**	194
	N17E	83NW			N47W	83SW	
	N55E	82NW			**N13W**	**51NE**	
	N72E	80NW					
	N12W	76NE					

Bold face joint set orientations have dips potentially hazardous to the stability of overall slope angles steeper than their dips and whose slope direction is parallel to the the joint set strike.

Figure 10. Percentage of fracture orientation poles needed for confidence that a statistically significant fracture set is present.

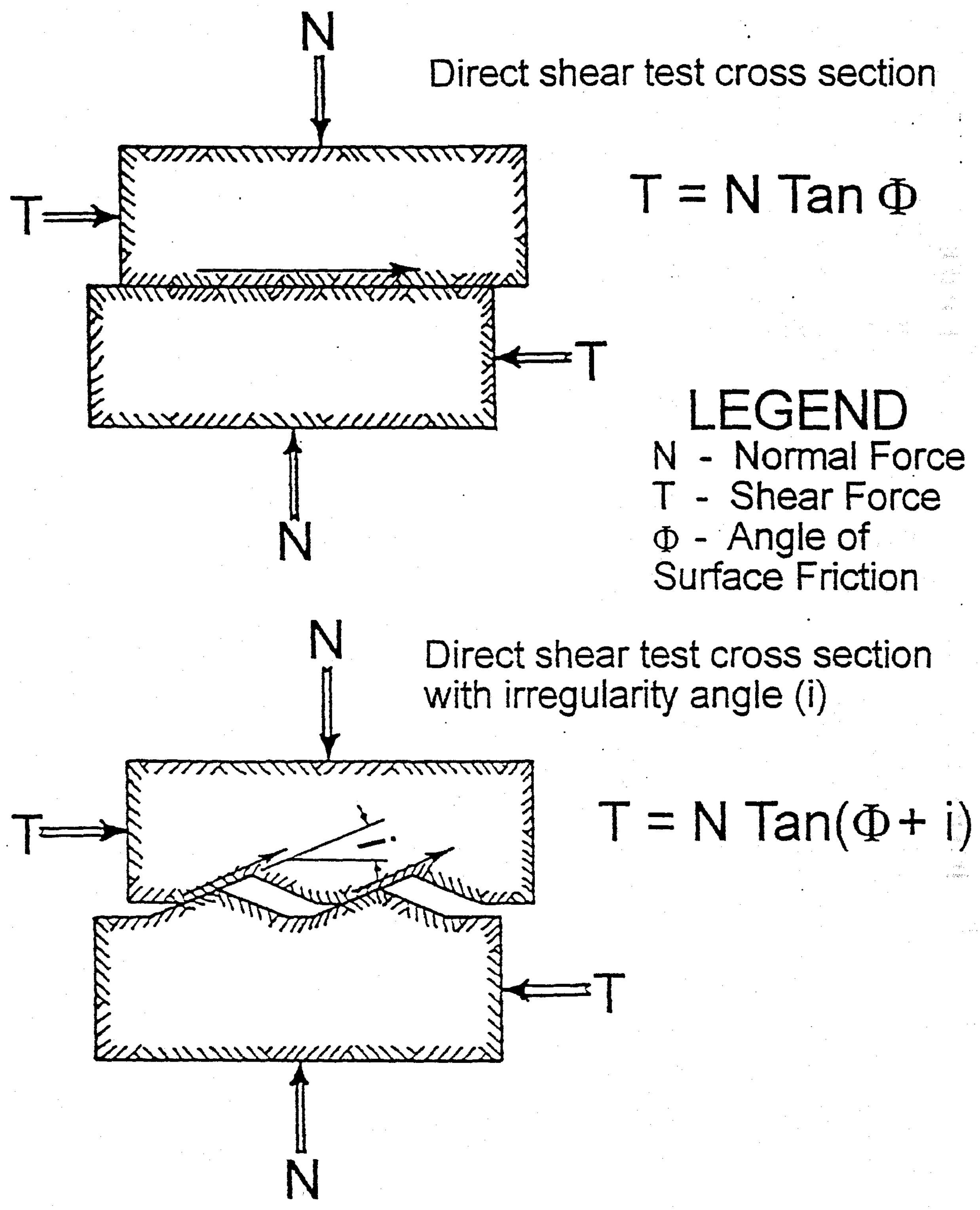


PHYSICAL TESTING PROGRAM

The study included a physical testing program. The physical testing program for the Soledad Mountain Project consisted of uniaxial and triaxial compression testing and direct shear testing of each of the five rock types. Blocks of rock were collected at each detail line location and shipped the Advanced Terra Testing, Inc. in Lakewood, CO. There samples were cored from these blocks of rock. Test specimens, nominally 2 inches in diameter by 4 inches in length, were cut from the sample cores, surface ground and tested. The uniaxial compression tests were performed in accordance with the American Society for Testing and Materials (ASTM) Standard D 2938 and the triaxial compression testing in accordance with ASTM Standard D 2664. The direct shear tests were performed in accordance with an ASTM soil test, ASTM Standard D 3080, except that two pieces of core, approximately 2 inches in diameter and 1 inch thick were cut and surface ground on one side, were utilized for each set of three normal load tests instead of a single soil sample. The ground surfaces were placed against each other in the shear machine, immersed in water, loaded normal to the ground surface contact and the shear force necessary to produce sliding measured. Three normal loads were applied, calculated to result in 50 psi, 100 psi and 200 psi normal stress on the ground specimen surfaces. The upper cross section on Figure 11 indicates the plane surface subjected to shear stress. The angle of surface friction (Tan Φ) is calculated from the three different normal forces (N) applied and the shear force (T) measured each time when the rock specimens slipped.

In addition to the shear properties of intact and broken rock, the density of each compression specimen was measured as part of the physical testing program. The individual detail line and rock type densities are presented in Appendix A.

Figure 11. Direct shear test cross section and effect of surface irregularities on frictional shear strength.



LIMITING EQUILIBRIUM SLOPE STABILITY ANALYSIS

Daylighted fracture, or joint, sets are potentially subject to plane shear sliding failure whenever the fracture is flatter than the slope angle and steeper than the angle of surface friction of the rock type involved. The wedge formed by two fracture sets is subject to sliding failure when the plunge of their line of intersection plunges flatter than the slope angle, is daylighted, and steeper than the angle of surface friction of the rock type involved. Wedge failures are less common than plane shear failures, possibly because there is more area to shear across each unit of the highwall face. Only the critical pitwall identified on Figure 3 by the number 3 (Structural Domain 1, rock type Tql) is primarily at risk because of the potential of plane shear sliding along a daylighted fracture. The critical slope highwall identified by number 2 (Structural Domain 12, rock type Tmp) is at risk for plane shear failure. However, a potential wedge shear failure present in the same critical slope has a lower factor of safety. Wedge shear provides the only potential failure mode for the critical highwalls identified by the numbers 4 (Structural Domain 2, rock type Tr), 10 and 12 (Structural Domain 5, rock type Tmp).

PLANE SHEAR SLOPE ANALYSIS

Table 3 lists in bold face type all fracture sets present in the fracture orientation data mapped in each detail line that are potentially subject to plane shear failure. These potentially hazardous fracture sets are potentially subject to sliding failure out of either the planned 55° overall slope angles or the maximum possible 63.4° overall slope angles in the pitwalls along the Ultimate Pit Boundary and inside the pit boundary. The first step in the plane shear slope stability analysis was the calculation of the true minimum spacing (TMS) of the potentially adverse plane shear fracture delineated from inspection of the significant fracture sets listed in Table 3. The minimum apparent spacing (MAS) along the frequently plunging detail line must be corrected for the inclination of the line, for the difference in direction between the direction of the detail line and the mean strike of the potentially adverse fracture set and for the mean dip of the potentially adverse fracture set. Table 4 presents the results of this calculation for each potentially adverse fracture set plus a sample calculation for the N54°W striking, 38°SW dipping joint set.

The next step in the plane shear slope stability analysis was the measurement of the irregularity angles for each potentially adverse fracture set on the Schmidt equal-area projections in Appendix B. The measured irregularity angles are also presented in Table 4.

Table 4. Daylighted joint properties for potential plane shear failures along Ultimate Pit Boundary.

Detail Line and Rock Type	Joint Strike	Joint Dip	Joint Spacing Minimum (ft)	Joint Trace Length Maximum (ft)	Irregularity Angles (degrees) Confidence Levels		
					80%	98%	99.9%
A - Tr	N80°W	38°SW	1.04	4	3	0	0
	N03°E	53°NW	0.06	3	4	0	0
B - Tup	No Adverse Joint Sets						
C - Tup	No Adverse Joint Sets						
D - Tr	N30°W	32°SW	0.02	6	9	5	3
	N51°E	62°NW	0.43	5	8	3	0
E - Tmp	N11°W	48°NE	0.77	8	6	2	0
	N54°W	38°SW	0.56	3	2	0	0
F - Tmp	N44°W	43°SW	0.12	4	8	3	0
G - Trp	N38°E	40°SE	0.09	8	14	9	7
	N72°E	50°NW	0.03	4	6	3	0
	N11°E	27°SE	0.44	8	8	4	0
H - Tr	Potentially adverse joint set flatter than residual friction						
I - Tql	N20°W	22°SW	1.85	2	4	0	0
	N22°W	55°NE	6.49	6	3	0	0
	N07°W	38°NE	0.59	2	5	0	0
	N06°E	56°SE	2.21	4	6	0	0
A+H-Tr	Potentially adverse joint sets flatter than residual friction						
B+C-Tup	No Adverse Joint Sets						
E+F Tmp	N50°W	37°SW	0.47	3	7	0	0
	N13°W	51°NE	0.71	6	2	0	0

Example calculation of minimum true spacing between joints of the potentially adverse Joint Set that strikes (S) N54°W and dips (D) 38°SW and Detail Line "E", which bears N29°W (B) and plunges 11° (PL) in that direction from the minimum slope distance measured (See Detail Line "E" field notes in Appendix C. These are recorded lines 7 to 9 on page 4/4..

Table 4. Continued

1) Correct minimum apparent spacing (MAS) of joints along sloping tape to horizontal distance (HD) between line 9 - 110.8 ft to line 7 - 108.6 ft

$$\mathrm{Cos(PL)} = \frac{\mathrm{HD}}{\mathrm{MAS}} \qquad \mathrm{Cos}(11^\circ) = \frac{\mathrm{HD}}{(110.8-108.6)} \qquad \mathrm{HD} = \mathrm{Cos}(11^\circ)2.2 = 2.16\ \mathrm{ft}$$

2) Correct for minimum perpendicular horizontal distance (PHD) between closest joint in set for difference in direction between Detail Line bearing (B) and Joint Set strike (S)

$$\mathrm{Sin}(B-S) = \frac{\mathrm{PHD}}{2.16} \qquad \mathrm{Sin}(54^\circ - 29^\circ) = \frac{\mathrm{PHD}}{2.16} \qquad \mathrm{PHD} = \mathrm{Sin}(25^\circ)2.16 = 0.91\ \mathrm{ft}$$

3) Correct for true minimum spacing (TMS) between closest joints in set

$$\mathrm{Sin(D)} = \frac{\mathrm{TMS}}{0.91} \qquad \mathrm{Sin}(38^\circ) = \frac{\mathrm{TMS}}{0.91} \qquad \mathrm{TMS} = \mathrm{Sin}(38^\circ)0.91 = 0.56\ \mathrm{ft}$$

Table 5. Daylighted joint proportion of intact rock and strength reduction factor for size of minimum intact rock bridge to be sheared between joints along potentially adverse joint sets along Ultimate Pit Boundary.

Detail Line and Rock Type	Joint Strike	Joint Dip	Proportion of Intact Rock	Minimum Spacing of Joint Set (ft)	Strength Reduction Divisor
A - Tr	N80°W	38°SW	0.206	1.04	3.33
	N03°E	53°NW	0.020	0.06	1.00
D - Tr	N30°W	32°SW	0.003	0.02	1.00
	N51°E	62°NW	0.079	0.43	1.87
E - Tmp	N11°W	48°NE	0.088	0.77	2.74
	N54°W	38°SW	0.157	0.56	2.22
F - Tmp	N44°W	43°SW	0.029	0.12	1.00
G - Trp	N38°E	40°SE	0.011	0.09	1.00
	N72°E	50°NW	0.007	0.03	1.00
	N11°E	27°SE	0.052	0.44	1.89
I - Tql	N20°W	22°SW	0.006	1.85	4.87
	N22°W	55°NE	0.520	6.49	11.12
	N07°W	38°NE	0.228	0.59	2.30
	N06°E	56°SE	0.356	2.21	5.48
E+F - Tmp	N50°W	37°SW	0.135	0.47	1.98
	N13°W	51°NE	0.106	0.71	2.60

1) Calculation of proportion of intact rock (PIR):

PIR equals Minimum Joint Spacing (JS) divided by Maximum Trace Length (TL) plus Minimum Joint Spacing (JS). Joint Set "E" with N54°W Strike and 38°SW Dip, 0.56-ft Minimum Joint Spacing (JS) and 8-ft Maximum Trace Length (TL).

$$\mathrm{PIR} = \frac{\mathrm{JS}}{\mathrm{TL+JS}} = \frac{0.56}{3+0.56} = 0.157$$

Table 6. Continued

2) Calculation for Strength Reduction Divisor (SRD) for size of rock bridges along potential Joint Set "E" failure surface. Size of Joint Set "E" bridge defined by Minimum Joint Spacing (JS) of 0.56-ft. Standard size taken as the 2-in diameter for specimens tested in accordance with American Society for Testing and Materials (ASTM) standards for uniaxial and triaxial rock testing (ASTM D 2938 and ASTM D 2664) respectively. The strength reduction with respect to size (SZ) in inches, is taken from statistical best fit of the testing results reported by Bieniawski (1968), as follows:

$$ST = 7330\left(SZ^{-0.658}\right) \quad ST_2 = 7330\left(2^{-0.658}\right) = 4646\text{psi} \quad ST_{0.56} = 7330[0.56(12)]^{-0.658} = 2093\text{psi}$$

$SRD = \frac{ST_2}{ST_{0.56}} = \frac{4646}{2093} = 2.22$ The estimated shear strength of the 0.56-ft (6.72-in) rock bridge is then the 2397 psi cohesion of the 2-in diameter specimens of the Detail Line "E", Tmp - Middle pyroclastic unit, divided by 2.22, or 1080 psi.

The next step in the plane shear stability analysis was the calculation of the proportion of intact rock along the worst-case failure path through the toe of the slope. The results of this calculation for each potentially adverse fracture set is presented in Table 5. Table 5 includes a sample proportion of intact rock calculation for the same N54°W striking, 38°SW dipping joint set used in the Table 4 example. This calculation should be conservative because the minimum joint spacing was used to estimate the intact rock along the assumed failure path and the maximum fracture trace length was used to estimate the naturally broken rock along the assumed failure path.

The strength reduction divisor was calculated to account for the reduction in rock strength with increase in size of the rock bridge. The conservative Bieniawski (1968) size/strength relationship equation, presented previously was used to calculate the strength reduction divisor. The sample calculation included in Table 5 is for the same joint set used in the previous examples.

The slope stability analysis then shifted to the structural domains and the detail lines involved in each structural domain. Figure 2 presented the structural domains. Table 6 presents the side of the pitwall along the Ultimate Pit Boundary for each of the eleven structural domains that intersect the pit boundary. Table 6 also presents the direction the pitwall faces along the Ultimate Pit Boundary within each structural domain, the detail lines in the structural domain and the rock type. Table 6 includes Structural Domain 12, which lies inside the Ultimate Pit Boundary. The same data is presented for Structural Domain 12.

Table 7 presents the results from the analysis of the topographic and planned Ultimate Pit excavation. The information included the crest direction of the pitwall within each structural domain. The variation of the crest direction for the highwall in each structural domain is important because any potentially adverse fracture set with a strike within the range of highwall directions in that structural domain represents a critical highwall, provided only that the dip direction is out of the highwall, as was indicated for plane shear slope failure in Figure 4. Table 7 also presents the maximum heights of the pitwalls in each structural domain. These heights are for the critical, worst-case, pitwalls indicated on Figure 3. The north side pitwall slopes of Structural Domains 2, 3 and 4, plus a portion of Structural Domains 1 and 5 on Soledad Mountain have no indicated height because the pit excavation along the Ultimate Pit Boundary proceeds into the north side of the mountain. This situation can be seen on Figure 2. Structural Domain 1 and Structural Domain 5 are exceptions. The planned Ultimate Pit excavation in Structural Domain 1 cuts back into the rock toward the east end of the north side of Structural Domain 1 to extract the GQ-1A Pit (Karma-Wegmann orebody). Structural Domain 5 includes relatively shallow, less than 240

Table 6. Structural Domains, orientation of Ultimate Pitwall, Detail Lines and rock types

Structural Domain	Ultimate Pitwall Orientation Side of Ultimate Pit (Direction Pitwall Faces) From - Through - To	Detail Line(s) Involved	Rock Type
1	N90E - N30E - N40W (S90W - S30W - S40E)	I	Tql
2	N40W - N55W - N07W (S40E - S55E - S07E)	A	Tr
3	N07W - N11W - N15W (S07E - S11E - S15E)	None	Qal
4	N15W - N10E - N50E (S15E - S10W - S50W)	I	Tql
5	N50E - N45W - S50W (S50W - S45E - N50E)	E + F	Tmp
6	S50W - S25W - S86W (N50E - N25E - N86E)	D	Tr
7	S86W - N70W - N52W (N86E - S70E - S52E)	C	Tup
8	N52W - S45W - S05W (S52E - N45E - N05E)	G	Trp
9	S05W - S00W - S05E (N05E - N00E - N05W)	B or C	Tup
10	S05E - S30E - S60E (N05W - N30W - N60W)	G	Trp
11	S60E - S25W - N90E (N60W - N25E - S90W)	B or C	Tup
12	S10W - S35W - S30E (N10E - N35W - N30W)	E + F	Tmp

Table 7. Maximum height of Ultimate Pitwall within Sructural Domains

Structural Domain & Detail Line	Ultimate Pitwall Direction Start - Central - Finish (Parallel to adverse strike)	Maximum Height Slope Plunge Bearing (ft)	Rock Type
1 - I	N00E - N60W - N50E	400 - East 0 - N	Tql
2 - A	N50E - N35E - N80E N50W - N35W - N70W	0 - N 550 - NE	Tr
3 - None	N83E - N79E - N75E	0 - N	Qal
5 - E+F	N40W - N45E - N40W	220 - SW 180 - NW 240 - NE	Tmp
6 - D	N40W - N65W - N04W	220 - SW	Tr
7 - C	N04W - N20E - N38E	240 - NW	Tup
8 - G	N38E - N70W - N85W	860 - SW	Trp
9 - B&C G	N85W - N90W - N85E	40 - S 740 - S	Tup Trp
10 - G	N85E - N60E - N30E	760 - S	Trp
11 - B&C	N30E - N65W - N00W	1300 - NE 780 - SE 960 - SW	Tup
12 - E+F	N80W - N35W - N10W	850 - SW	Tmp

feet, planned excavation of the GQ-2NW Pit (Knight Property) into the northwest ridge off Soledad Mountain. Most of the planned slopes for GQ-2NW extend to the Ultimate Pit Boundary. Structural Domain 2 extends inside the Ultimate Pit Boundary and planned excavation of GQ-5A Pit (Pit 4 Extension) will develop a 550-foot high southwest facing pitwall, well inside the Ultimate Pit Boundary. Table 7 also includes the 850-foot maximum pitwall height in Structural Domain 12. Structural Domain 12 lies well inside the Ultimate Pit Boundary.

Table 8 presents the conservatively calculated factors of safety for the Structural Domain 1 daylighted fracture set that strikes N20°W and dips 22° SW. Table 8 presents the plane shear factors of safety of the potential plane shear failure using one-dimensional and two-dimensional estimates of intact rock along the potential failure surfaces and for a dry and a fully saturated slope. The calculated factor of safety for 99.9% confidence, 55° dry slope is 2.57. The planned slope is predicted to be stable under the absolutely worst-case plane shear conditions of one-dimensional intact rock and fully saturated conditions, factor of safety of 1.62.

Table 9 presents the conservatively calculated factors of safety for the Structural Domain 12 daylighted fracture set that strikes N13°W and dips 51° SW. Table 9 presents the plane shear factors of safety of the potential plane shear failure using one-dimensional and two-dimensional estimates of intact rock along the potential failure surfaces and for a dry and a fully saturated slope. The calculated factor of safety for 99.9% confidence, 55° dry slope is 5.70. The planned slope is predicted to be stable under the absolutely worst-case plane shear conditions of one-dimensional intact rock and fully saturated conditions, factor of safety of 5.49.

Table 10 presents the conservatively calculated factors of safety for one Structural Domain 5 daylighted fracture set, the one that strikes N50°W, dips 37° SW and is a potential hazard to the 240-foot high northeast side of GQ-2NW Pit. Table 10 presents the plane shear factors of safety of the potential plane shear failure using one-dimensional and two-dimensional estimates of intact rock along the potential failure surfaces and for a dry and a fully saturated slope. The calculated factor of safety for 99.9% confidence, 55° dry slope is 9.81. The planned slope is predicted to be stable under the absolutely worst-case plane shear conditions of one-dimensional intact rock and fully saturated conditions, factor of safety of 9.34.

Table 11 presents the conservatively calculated factors of safety for one Structural Domain 5 daylighted fracture set, the one that strikes N13°W, dips 51°NE and is a potential hazard to the 220-foot high southwest side of GQ-2NW Pit. Table 11 presents the

Table 8. Factors of safety for potentially hazardous plane shear joint set striking N20°W and dipping 22°SW, Domain 1 (Detail Line I), for Ultimate Pit Boundary at GQ-1A (Karma-Wegmann) Pit.

Quartz Latite Porphyry, overall slope height - 400 ft.

FACTORS OF SAFETY

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	2.69	2.56	2.56	3.17	3.10	3.10
55	2.69	2.57	2.57	3.18	3.11	3.11

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	1.69	1.61	1.61	2.01	1.96	1.96
55	1.70	1.62	1.62	2.02	1.97	1.97

Table 9. Factors of safety for potentially hazardous plane shear joint set striking N13°W and dipping 51°SW, Domain 12 (Detail Lines E + F), on northeast facing pitwall, Domain 12 (Detail Lines E + F), for inside the Ultimate Pit at GQ-1A (Karma-Wegmann) and GQ-1B (Independent) Pits.

Middle Pyroclastic Unit, overall slope height - 850 ft.

FACTORS OF SAFETY

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	2.39	2.35	2.35	4.05	4.02	4.02
55	5.73	5.70	5.70	10.34	10.31	10.31

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	2.16	2.14	2.14	3.81	3.79	3.79
55	5.51	5.49	5.49	10.10	10.08	10.08

Table 10. Factors of safety for potentially hazardous plane shear joint set striking N50°W and dipping 37°SW, Domain 5 (Detail Lines E + F), for Ultimate Pit Boundary at GQ-2NW Pit; Knight Property.

Middle Pyroclastic Unit, overall slope height - 240 ft.

FACTORS OF SAFETY

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope	Confidence Level			Confidence Level		
Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	7.85	7.65	7.65	13.73	13.56	13.56
55	10.01	9.81	9.81	17.75	17.06	17.06

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope	Confidence Level			Confidence Level		
Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	7.28	7.18	7.18	13.12	13.04	13.04
55	9.44	9.34	9.34	17.14	17.06	17.06

Table 11. Factors of safety for potentially hazardous plane shear joint set striking N13°W and dipping 51°NE Domain 5 (Detail Lines E + F), for Ultimate Pit Boundary at GQ-2NW Pit; Knight Property.

Middle Pyroclastic Unit, overall slope height - 220 ft.

FACTORS OF SAFETY

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope	Confidence Level			Confidence Level		
Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	7.65	7.61	7.61	13.95	13.92	13.92
55	20.57	20.54	20.54	38.27	38.24	38.24

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope	Confidence Level			Confidence Level		
Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	7.43	7.41	7.41	13.71	13.71	13.71
55	20.35	20.33	20.33	38.04	38.02	38.02

plane shear factors of safety of the potential plane shear failure using one-dimensional and two-dimensional estimates of intact rock along the potential failure surfaces and for a dry and a fully saturated slope. The calculated factor of safety for 99.9% confidence, 55° dry slope is 20.54. The planned slope is predicted to be stable under the absolutely worst-case plane shear conditions of one-dimensional intact rock and fully saturated conditions, factor of safety of 20.33.

It is unlikely that the planned highwall slopes of the Soledad Mountain project will be subject to any hydraulic uplift pressure. Inspection of the old underground workings indicate that ground water has been drained from Soledad Mountain. The hydraulic uplift pressure and force, shown on Figure 8, would if present in Soledad Mountain decrease the stability of the slopes because it reduces the normal force acting across the potential failure surface and, therefore, the frictional resistance to failure. The drainage of ground water from Soledad Mountain could have been through the old underground mine workings or by the gravitational effect of Soledad Mountain's elevation above the adjacent plain, or some combination of both.

WEDGE SHEAR SLOPE ANALYSIS

The potential wedge shear sliding hazards present at the Soledad Mountain Project were analyzed by first using the Schmidt equal-area plots to construct the diagrams in Appendix C to determine the dihedral angles, bearings and plunges of all potentially hazardous wedge intersections. Experience has demonstrated that the same limiting condition criteria govern the development of wedge shear slope failures as do plane shear sliding, i.e. plunge of the line of intersection less than the slope face and greater than the residual friction angle for the rock type. Therefore, the first effort was put into determining the wedge intersection parameters.

Table 12 lists all wedge intersections that were determined from the fracture sets detected in the fracture orientation data mapped along Detail Line I. The plunge of all the wedges is either too steep, greater than 63.4°, or too flat, less than 31.4° the angle of surface friction of the latite Porphyry to provide a failure path.

Table 13 lists all wedge intersections that were determined from the fracture sets detected in the fracture orientation data mapped along Detail Lines E and F. Three of the potential wedge failure geometries have plunges between the 30.0° residual friction angle of the Middle Pyroclastic Unit and the planned slope angle. One of these wedges had a dihedral angle of 64°, much too narrow to slide as a wedge. Experience indicates that edges with dihedral

Table 12. Potentially hazardous wedge intersections at Ultimate Pit Boundary along ST-1 Pit (Stelzner Pit) and GQ-1A Pit (Karma-Wedgmann deposit), Domain 1 (Detail Line I), Quartz Latite Porphyry

Joints Involved	Joint Orientations in Order				Dihedral Angle	Bearing	Plunge
	Strike	Dip	Strike	Dip			
A - E	N48°W	70°SW	N48°E	85°NW	87°	S62°W	87°
B - E	N20°W	22°SW	N48°E	85°NW	100°	S50°W	21°
C - E	N18°W	76°SW	N48°E	85°NW	114°	S50°W	76°
D - E	N02°E	80°SW	N48°E	85°SW	130°	S79°W	80°

NOTES: 1) Wedge formed by joint sets A and E does not represent a hazard because the dihedral angle is too narrow, < 90°. 2) Wedge formed by joint sets B and E has a plunge less than residual friction angle and, therefore cannot fail. 3) Wedges formed by joint sets C and E and by joint sets D and E do not represent hazards because their plunges are steeper than any reasonable overall slope angle.

Table 13. Potentially hazardous wedge intersections at Ultimate Pit Boundary along GQ-2NW Pit (Knight Property), Domain 5 (Detail Lines E + F), Middle Pyroclastic Unit

Joints Involved	Joint Orientations in Order				Dihedral Angle	Bearing	Plunge
	Strike	Dip	Strike	Dip			
A - H	N67°W	85°SW	N13°W	51°NE	64°	S62°E	42°
B - D	**N50°W**	**37°SW**	**N17°E**	**83°NW**	**109°**	**S21°W**	**36°**
B - G	N50°W	37°SW	N82°W	73°NE	74°	N87°W	74°
B - H	N50°W	37°SW	N13°W	51°NE	97°	S28°E	16°
G - H	**N82°W**	**73°NE**	**N13°W**	**51°NE**	**116°**	**N75°E**	**50°**

NOTES: 1) Bold face joint wedge orientations are potentially hazardous to the stability of overall slope angles steeper than their plunges. 2) Wedges formed by joint sets A and H and by joint sets B and G do not represent hazards because their dihedral angles are too narrow, < 90°. 3) Wedge formed by joint sets B and H has a plunge less than residual friction angle and, therefore cannot fail. 4) Wedge formed by joint set B and G does not represent a hazard because the plunge is steeper than any reasonable overall slope angle.

angles less than 104° do not slide, apparently because of their large surface area and resulting cohesion along the potential failure surface. The other two wedge geometries in Table 13 require additional analysis to determine their potential to fail as wedges.

Table 14 lists all wedge intersections that were determined from the fracture sets detected in the fracture orientation data mapped along Detail Line D. The 55° plunge of one wedge intersection lies within the range that could result in failure. However, one of these has a dihedral angle of 160°. Wedge failure is not predicted because the dihedral angle is wider than approximately 130°. Dihedral angles greater than approximately 130° fail as plane shear geometries.

Two of the three wedge geometries in Table 15 have plunges that lie in the critical range between the residual friction angle of 23.5° for the Upper Pyroclastic Unit and the planned pit slopes. However, these two wedge geometries have extremely narrow dihedral angles.

Table 16 presents the wedge geometries extracted from the fractures mapped along Detail Line G (Trp). Two of the four wedge geometries have plunges that are less than the 30.5° residual friction angle of the Rhyolite Porphyry. Of the remaining two wedge geometries one has too narrow a dihedral angle and the other too wide.

The fracture orientation data from Detail Line A indicated the single potentially adverse wedge geometry shown in Table 17. This wedge geometry meets all the criteria for potential failure and required further analysis.

The potentially adverse wedge geometry in Domain 12, Detail Lines E + F, the Middle Pyroclastic Unit, inside the Ultimate Pit contains one potentially adverse wedge geometry. Table 18 presents the dihedral angle, bearing and plunge of this potentially adverse wedge.

The next step in wedge shear analysis is the measurement of the irregularity angles for the potentially adverse wedge failure geometries extracted from Detail Lines E + F, Domain 5, and from Detail Line A, Domain 2. The irregularity angles are measured on the Schmidt equal-area data plot for the detail line found in Appendix B. The irregularity angles are measured in the direction of potential movement and failure. Table 19 presents the irregularity angles for the Domain 5 wedge failure geometries and Table 20 presents the irregularity angles for the Domain 2 wedge failure geometry. Table 21 presents the irregularity angles for the Domain 12 wedge failure geometry. Tables 19, 20 and 21 also present the minimum joint spacing and maximum trace length for each potentially adverse wedge geometry.

Table 14. Potentially hazardous wedge intersections at Ultimate Pit Boundary; Domain 6; GQ-2 Pit and GQ-2NW Pit (Knight Property); Detail Line D; Aphanitic Rhyolite

Joints Involved	Joint Orientations in Order Strike	Dip	Strike	Dip	Dihedral Angle	Bearing	Plunge
C - D	N73°E	86°NW	N14°W	81°NE	90°	N47°E	80°
D - G	N14°W	81°NE	N57°E	70°SE	110°	S42°E	70°
D - F	N14°W	81°NE	N55°E	84°SE	121°	N76°E	81°
E - G	N04°E	85°SE	N57°E	70°SE	125°	S03°E	67°
F - G	N55°E	84°SE	N57°E	70°SE	160°	S24°W	55°

NOTES: 1) Wedges formed by joint sets C and D, joint sets D and G, joint sets D and F and joint sets E and G do not represent hazards because their plunges are steeper than any reasonable overall slope angle. 2) Wedge formed by joint sets F and G does not represent a wedge failure hazard because the dihedral angle exceeds 130°, meaning failure can only occur as the result of plane shear failure. 3) Wedges formed by joint sets D and G, joint sets E and G and joint sets F and G do not represent hazards because they plunge south and not northeasterly out of rhyolite exposed in Domain 6, between N50°E and N86°E.

Table 15. Potentially hazardous wedge intersections at Ultimate Pit Boundary, Domains 7 and 9 along GQ-6 Pit (Big Butte Pit) and Domain 11 along nose of waste between GQ-5C Pit, GQ-5B Pit and GQ-5A Pit (Pit 4 Extensions), GQ-1B Pit (Karma-Wegmann) and ST-1 Pit (Stelzner); Detail Lines B + C, Upper Pyroclastic Unit

Joints Involved	Joint Orientations in Order Strike	Dip	Strike	Dip	Dihedral Angle	Bearing	Plunge
A - B	N49°E	84°NW	N68°E	80°NW	161°	N28°E	72°
A - D	N49°E	84°NW	N53°E	88°SE	6°	N56°E	48°
B - D	N68°E	80°NW	N53°E	88°SE	17°	S51°W	47°

NOTES: 1) Wedge formed by joint sets A and B does not represent a hazard because its plunge is steeper than any reasonable overall slope angle. 2) Wedges formed by joint sets A and D and by joint sets B and D do not represent hazards because their dihedral angles are too narrow, < 90°. 3) Wedge formed by joint sets A and B does not represent a wedge failure hazard because the dihedral angle exceeds 130°, meaning failure can only occur as the result of plane shear failure.

Table 16. Potentially hazardous wedge intersections at Ultimate Pit Boundary, Domain 8, 9 and 10 along GQ-6 Pit (Big Butte Pit); Detail Line G; Rhyolite Porphyry.

Joints Involved	Joint Orientations in Order Strike	Dip	Strike	Dip	Dihedral Angle	Bearing	Plunge
B - E	N72°E	50°NW	N11°E	27°NE	114°	N54°E	19°
B - F	N72°E	50°NW	N15°E	68°SE	70°	N33°E	37°
B - H	N72°E	50°NW	N41°E	64°SE	71°	N52°E	22°
F - H	N15°E	68°SE	N41°E	64°SE	156°	S42°E	64°

NOTES: 1) Wedges formed by joint sets B and F and by joint sets B and H do not represent hazards because their dihedral angles are too narrow, < 90°. 2) Wedge formed by joint sets F and H does not represent a wedge failure hazard because the dihedral angle exceeds 130°, meaning failure can only occur as the result of plane shear failure. 3) Wedges formed by joint sets B and E and by joint sets B and H have plunges less than residual friction angle and, therefore cannot fail.

Table 17. Potentially hazardous wedge intersection inside Ultimate Pit Boundary, Domain 2 along GQ-5A Pit ; Detail Line A; Aphanitic Rhyolite.

Joints Involved	Joint Orientations in Order Strike	Dip	Strike	Dip	Dihedral Angle	Bearing	Plunge
A - B	**N80°W**	**38°SW**	**N03°E**	**53°NW**	**123°**	**S36°W**	**36°**

NOTE: The bold face joint wedge orientation is potentially hazardous to the stability of overall slope angles steeper than its 36° plunge.

Table 18. Potentially hazardous wedge intersection inside Ultimate Pit Boundary, Domain 12 in area of GQ-1 Pit (Queen Ester) and GQ-1B Pit (Independent); Detail Lines E + F; Middle Pyroclastic Unit.

Joints Involved	Joint Orientations in Order Strike	Dip	Strike	Dip	Dihedral Angle	Bearing	Plunge
G - H	**N82°W**	**73°NE**	**N13°W**	**51°NE**	**116°**	**N75°E**	**50°**

NOTE: The bold face joint wedge orientation is potentially hazardous to the stability of overall slope angles steeper than its 50° plunge.

Table 19. Daylighted joint properties for potential wedge shear failures at Ultimate Pit Boundary; Detail Lines E + F; Domain 5; at GQ-2NW Pit; Knight Property; Middle Pyroclastic Unit.

Domain Number	Joint Strike	Joint Dip	Joint Spacing Minimum (ft)	Joint Trace Length Maximum (ft)	Irregularity Angles (degrees) Confidence Levels 80%	98%	99.9%
5	N50°W	37°SW	0.47	3	8	0	0
Tmp	N17°E	83°NW	1.00	20	10	7	5
5	N82°W	73°NE	0.20	20	10	5	0
Tmp	N13°W	51°NE	0.71	6	5	0	0

Table 20. Daylighted joint properties for potential wedge shear failures inside Ultimate Pit Boundary, Domain 2 along GQ-5A Pit ; Detail Line A; Aphanitic Rhyolite.

Domain Number	Joint Strike	Joint Dip	Joint Spacing Minimum (ft)	Joint Trace Length Maximum (ft)	Irregularity Angles (degrees) Confidence Levels 80%	98%	99.9%
2	N80°W	38°SW	1.04	4	3	0	0
Tr	N03°E	53°NW	0.06	3	5	0	0

Table 21. Daylighted joint properties for potential wedge shear failures inside Ultimate Pit Boundary; Detail Lines E + F; at GQ-1 Pit (Queen Ester) and GQ-1B Pit (Independent); Domain 12; Middle Pyroclastic Unit

Domain Number	Joint Strike	Joint Dip	Joint Spacing Minimum (ft)	Joint Trace Length Maximum (ft)	Irregularity Angles (degrees) Confidence Levels 80%	98%	99.9%
12	N82°W	73°NE	0.20	20	10	5	0
Tmp	N13°W	51°NE	0.71	6	5	0	0

The proportion of intact rock and the strength reduction divisor were calculated for the potential wedge failure geometries in Domain 5, Domain 2 and Domain 12. These values are presented in Table 22.

Table 23 presents the conservatively calculated factors of safety for the Structural Domain 5 daylighted fracture wedge intersection that bears S21^{0}W and plunges 36^{0}. Table 23 also presents the conservatively calculated factors of safety for the other potentially hazardous wedge intersection in Structural Domain 5 that bears N75^{0}E and plunges 50^{0}. Table 23 presents the wedge shear factors of safety for one-dimensional and two-dimensional estimates of intact rock along the two joint sets that provide the potential failure surfaces in each case and for a dry and a fully saturated slope. The planned 55° slopes are predicted to be extremely stable, factors of safety of 11.87 in the first case and 8.20 in the second case, under the absolutely worst-case plane shear conditions of one-dimensional intact rock and fully saturated conditions.

Table 24 presents the conservatively calculated factors of safety for the potentially hazardous wedge intersection in Structural Domain 2 that bears S36^{0}W and plunges 36^{0}. Table 24 presents the wedge shear factors of safety for one-dimensional and two-dimensional estimates of intact rock along the two joint sets that provide the potential failure surfaces and for a dry and a fully saturated slope. The planned slope is predicted to be stable under the absolutely worst-case plane shear conditions of one-dimensional intact rock and fully saturated conditions. The calculated factors of safety for this wedge are sufficiently low, at least 2.20 for fully saturated 55° slope angles and 99.9% confidence, to warrant occasional inspection of the crest of the slope for the development of headwall cracks, an early indication of approaching slope instability.

Table 25 presents the conservatively calculated factors of safety for the potentially hazardous wedge intersection in Structural Domain 12 that bears N75^{0}E and plunges 50^{0}. Table 25 presents the wedge shear factors of safety for one-dimensional and two-dimensional estimates of intact rock along the two joint sets that provide the potential failure surfaces and for a dry and a fully saturated slope. The planned slope is predicted to be stable under the absolutely worst-case plane shear conditions of one-dimensional intact rock and fully saturated conditions. The calculated factors of safety for this wedge are sufficiently low, at least 3.58 for fully saturated 55° slope angles and 99.9% confidence, to warrant occasional inspection of the crest of the slope for the development of headwall cracks, an early indication of approaching slope instability.

Table 22. Daylighted joint proportion of intact rock and strength reduction factor for size of minimum intact rock bridge to be sheared between joints in potentially adverse wedges.

Structural Domain and Rock Type	Joint Strike	Joint Dip	Proportion of Intact	Minimum Spacing of Joint Set (ft)	Strength Reduction Divisor
5 - Tmp	N50°W	37°SW	0.135	0.47	1.98
	N17°E	83°NW	0.048	1.00	3.25
5 - Tmp	N82°W	73°NE	0.010	0.20	1.13
	N13°W	51°NE	0.106	0.71	2.60
2 - Tr	N80°W	38°SW	0.206	1.04	3.34
	N03°E	53°NW	0.020	0.06	1.00
12 - Tmp	N82°W	73°NE	0.010	0.20	1.13
	N13°W	51°SW	0.106	0.71	2.60

Table 23. Factors of safety for potentially hazardous wedge intersections, Domain 5 (Detail Lines E + F), for Ultimate Pit Boundary at GQ-2NW Pit; Knight Property.

Wedge G - H FACTORS OF SAFETY

Middle Pyroclastic Unit, overall slope height - 240 ft.

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	5.37	5.28	5.27	9.68	9.59	9.59
55	12.19	12.09	12.09	22.63	22.55	22.54

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	5.12	5.06	5.06	9.42	9.36	9.36
55	11.93	11.88	11.87	22.37	22.32	22.32

Wedge B - D FACTORS OF SAFETY

Middle Pyroclastic Unit, overall slope height - 220 ft.

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	7.30	7.02	7.01	12.62	12.38	12.37
55	9.05	8.78	8.77	15.94	15.70	15.68

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	6.58	6.45	6.45	11.88	11.77	11.76
55	8.34	8.21	8.20	15.20	15.08	15.08

Table 24. Factors of safety for potentially hazardous wedge intersections, Domain 2 (Detail Line A), for Ultimate Pit Boundary at GQ-5A Pit.

Wedge A - B FACTORS OF SAFETY

Middle Pyroclastic Unit, overall slope height - 550 ft.

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	2.53	2.42	2.42	3.75	3.65	3.65
55	2.91	2.80	2.80	4.43	4.33	4.33

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	1.87	1.82	1.82	2.98	2.93	2.93
55	2.25	2.20	2.20	3.66	3.61	3.61

Table 25. Factors of safety for potentially hazardous wedge intersection on northeast facing pitwall, Domain 12 (Detail Lines E + F), for inside the Ultimate Pit at GQ-1A (Karma-Wegmann) and GQ-1B (Independent) Pits.

Wedge G - H FACTORS OF SAFETY

Middle Pyroclastic Unit, overall slope height - 850 ft.

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	1.97	1.87	1.87	3.20	3.12	3.11
55	3.89	3.80	3.79	6.86	6.77	6.77

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	1.72	1.66	1.66	2.94	2.89	2.89
55	3.64	3.58	3.58	6.60	6.55	6.54

SUMMARY AND CONCLUSIONS

A conservative limiting equilibrium slope analysis of the planned 55° overall slope angles for the Soledad Mountain Project indicated that all of the planned pit slopes should be stable. The primary reasons for the indicated slope stability are geologic. The fracture mapping performed demonstrated that the predominant fracture orientations are steeply dipping. The majority of the fractures mapped are steeper than the planned 55° slopes. In fact, the majority of the fractures mapped would be steeper than slopes at two units vertical to one unit horizontal, 63.4°. The two vertical to one horizontal slope is about as steep that a slope can be excavated while providing catch benches for occasional ravel.

The Soledad Mountain topographic high, and the steeply dipping jointing have apparently served to lower the water table in this area of minimal rainfall. Previous underground mining has provided additional drainage for Soledad Mountain. The old underground mine workings inspected in Soledad Mountain were generally dry and occasionally damp, but not wet.

The weakness paths presented by the generally steeply dipping natural fractures resulted in wedge shear being the predominant potential mode of slope failure. The intersection geometry of wedge shear provides a line of intersection that is flatter than the dip of either of the two fracture sets that form the wedge. Therefore, at the Soledad Mountain Project wedge shear is more likely mode of slope instability. Plane shear is the more frequent failure mode in areas where the natural jointing pattern contains more flat dipping fracture sets.

REFERENCES

Abel, Jr., J.F., 1990, Rock mechanics MN321 handouts: unpublished lecture notes, 275 p.

Bieniawski, Z.T., 1968, The effect of specimen size on the compression strength of coal: Intl. Jour Rock Mech. & Min. Sci., v. 5, no. 4, p. 325-335

Calder, P., 1977, Perimeter blasting: Chap 7, Pit Slope Manual, CANMET Rpt 77-14, Energy, Mines & Resources Canada, 82 p

Call, R.D., 1986, Cost-benefit design of open pit slopes: in Annals 1st Colloquium on Open Pit Mining, Antofagasta, Chile, 18 p

Hoek, E. & J. Bray, 1974, Rock slope engineering: Inst. Min. & Met., London, 358 p.

La Pointe, P. R. & J. A. Hudson, 1981, Characterization and interpretation of rock mass jointing patterns: Univ. of Wisconsin (Madison), Engrg. Exp. Station Rpt.

Major, G., H-S Kim & D. Ross-Brown, 1977, Plane shear analysis: Pit Slope Manual, Supplement 5-1, CANMET Rpt. 77-16

McMahon, B. K., 1974, Design of rock slopes against sliding on pre-existing fractures: Proc. 3rd Cong. of Int'l. Soc Rock Mech., Denver,v. II-B, p 803

Patton, F.D., 1966, Multiple modes of shear failure in rock and related materials: Ph. D. Thesis, Univ IL

Schneider, B., 1967, Moyens nouveaux de reconnaissance des massifs rocheux (New means of surveying rock masses): Supplement aux Annales de l'Institut Technique du Batiment et des Travaux Publics, Serie: Sols et Foundations (62), v. 21, no. 235-236

APPENDIX A

PHYSICAL TEST RESULTS

APPENDIX A

Table A1. Uniaxial and Triaxial Compression Test Results

Sample Ident.	Length (in.)	Diam. (in.)	Confining Pressure (psi)	Failure Load (lb)	Failure Stress (psi)	2 x 1 Corrected (psi)	Structua Control of Failure
Detail Lines "A" and "H", Tr - Aphanitic Rhyolite, flow banded							
A3#2	3.777	1.944	0	42000	14150	14100	Yes
A3#4	3.787	1.950	0	27100	9070	9040	Yes
A3#3	4.010	1.941	250	58500	19750	19830	Yes
A1#2	4.506	1.954	500	46600	15520	15780	Minor
A3#1	4.409	1.948	750	67400	22570	22900	Yes
A4#3	4.057	1.955	1000	139200	46320	46530	Yes
A2#1	4.254	1.941	1250	121000	40810	41260	Yes
A1#1	4.583	1.944	1500	54000	18100	18450	Yes

Failure Strength (psi) = 13970 + 14.497(Confining Pressure - psi)

Angle of Internal Friction = 60.6°
Internal Cohesion = 1835 psi

$r^2 = 0.379$; $S_{yx} = 11340$ psi; $T_{calc} = 1.915$ (90%)

Detail Line "B" and "C", Tup - Upper Pyroclastic Unit							
B1#3	3.852	1.934	0	62250	21190	21180	Minor
B3#3	4.391	1.939	0	20000	6770	6870	Moderat
B1#2	4.416	1.940	250	33400	11280	11460	Minor
B3#1	4.436	1.940	500	58100	19620	19940	Minor
B1#4	4.863	1.937	750	42300	14300	14680	Yes
B1#7	4.499	1.933	1000	90100	30630	31180	No
B3#2	4.388	1.940	1250	71300	24040	24390	Minor
B1#5	4.706	1.938	1500	75000	25320	25900	Moderat

Failure Strength (psi) = 12940 + 9.922(Confining Pressure - psi)

Angle of Internal Friction = 54.8°
Internal Cohesion = 2054 psi

$r^2 = 0.489$; $S_{yx} = 6200$ psi; $T_{calc} = 2.395$ (95%)

APPENDIX A (Continued)

Table A1. Uniaxial and Triaxial Compression Test Results (Con't)

Sample Ident.	Length (in.)	Diam. (in.)	Confining Pressure (psi)	Failure Load (lb)	Failure Stress (psi)	2 x 1 Corrected (psi)	Structural Control of Failure
	Detail Line "D", Tr - Aphanitic Rhyolite, flow banded						
D5#2	3.646	1.990	0	12500	4020	3970	Yes
D5#1	3.771	1.989	0	46600	15000	14900	Moderate
D2#3	3.898	1.986	250	112800	36410	36320	Minor
D1#2	4.088	1.987	500	131500	42400	42550	Minor
D2#1	4.323	1.987	750	108000	34820	35170	Yes
D1#3	4.315	1.982	1000	161000	52160	52700	Moderate
D2#2	4.367	1.989	1250	103000	33130	32510	Moderate
D1#1	4.402	1.984	1500	131000	42350	42870	Yes

Failure Strength (psi) = 19960 + 19.487(Confining Pressure - psi)

Angle of Internal Friction = 64.5°
Internal Cohesion = 2261 psi

$r^2 = 0.483$; $S_{yx} = 12320$ psi; $T_{calc} = 2.368$ (95%)

	Detail Line "E", Tmp - Middle Pyroclastic Unit						
E3#2	3.804	1.985	0	65600	21200	21080	Minor
E4#3	3.922	1.980	0	33350	10830	10820	Minor
E3#1	3.966	1.986	250	51700	16680	16680	Minor
E5#3	4.135	1.988	500	83500	26890	27020	Minor
E2#2	4.064	1.986	750	47000	15160	15200	Yes
E2#1	4.600	1.989	1000	68000	21870	22250	Moderate
E1#1	4.538	1.987	1250	73000	23520	23890	No
E4#1	4.718	1.986	1500	63000	20310	20720	Yes
E10#1	4.063	1.957	500	105000	34880	35040	Minor
E11#1	3.877	1.957	750	49300	16360	16340	Moderate
E10#3	3.888	1.956	1500	165300	54940	54900	Minor

Failure Strength (psi) = 15950 + 11.947(Confining Pressure - psi)

Angle of Internal Friction = 56.5°
Internal Cohesion = 2397 psi

$r^2 = 0.244$; $S_{yx} = 11120$ psi; $T_{calc} = 1.704$ (88%)

APPENDIX A (Continued)

Table A1. Uniaxial and Triaxial Compression Test Results (Con't)

Sample Ident.	Length (in.)	Diam. (in.)	Confining Pressure (psi)	Failure Load (lb)	Failure Stress (psi)	2 x 1 Corrected (psi)	Structual Control of Failure
Detail Line "F", Tmp - Middle Pyroclastic Unit							
F2#2	3.423	1.992	0	67200	21560	21130	Moderate
F3#4	3.552	1.994	0	63500	20340	20030	Minor
F2#3	3.733	1.991	250	86200	27680	27460	Minor
F3#1	4.052	2.008	500	71300	22520	22540	Minor
F3#2	4.056	2.005	750	96700	30600	30670	No
F5#1	4.255	1.945	1000	60000	20140	20350	Moderate
F1#1	4.329	1.985	1250	51800	16720	16890	Yes
F3#3	4.540	2.008	1500	105100	33200	33680	Moderate
F12#2	3.931	1.976	250	38600	12580	12570	No
F13#1	3.002	1.972	750	82600	27020	26000	No
F11#1	3.628	1.973	1000	157000	51320	50770	No
F12#1	3.475	1.973	1250	31900	10400	10220	Yes
F10#1	4.124	1.975	1500	72100	23490	23620	Minor

Failure Strength (psi) = 21680 + 3.413(Confining Pressure - psi)

Angle of Internal Friction = 33.1°
Internal Cohesion = 5867 psi

$r^2 = 0.031$; $S_{yx} = 10620$ psi; $T_{calc} = 0.595$ (43%)

Detail Lines "E" and "F", Tmp - Middle Pyroclastic Unit

Failure Strength (psi) = 18960 + 6.938(Confining Pressure - psi)

Angle of Internal Friction = 48.4°
Internal Cohesion = 3600 psi

$r^2 = 0.111$; $S_{yx} = 10540$ psi; $T_{calc} = 1.662$ (89%)

APPENDIX A (Continued)

Table A1. Uniaxial and Triaxial Compression Test Results (Con't)

Sample Ident.	Length (in.)	Diam. (in.)	Confining Pressure (psi)	Failure Load (lb)	Failure Stress (psi)	2 x 1 Corrected (psi)	Structual Control of Failure
	Detail Line "G", Trp - Rhyolite Porphyry, flow banded						
G#3	3.824	1.940	0	6900	2330	2330	Moderate
G#6	4.009	1.974	0	14300	4670	4680	Minor
G#1	4.490	1.972	250	23700	7750	7870	Minor
G#2	4.525	1.965	500	32500	10700	10880	No
G#4	4.500	1.978	750	66800	21720	22050	No
G#5	4.193	1.978	1000	58300	18950	19080	Yes
G#7	4.082	1.977	1250	40900	13290	13340	Minor
G#8	4.014	1.973	1500	43100	14050	14080	Minor

Failure Strength (psi) = 6250 + 8.444(Confining Pressure - psi)

Angle of Internal Friction = 52.0°
Internal Cohesion = 1075 psi

$r^2 = 0.496$; $S_{yx} = 5200$ psi; $T_{calc} = 2.430$ (95%)

	Detail Line "I", Tql - Quartz Latite Porphyry						
I#7	3.994	1.990	0	38300	12310	12320	Minor
I#8	4.074	1.987	0	63000	20320	20380	No
I#1	4.463	1.993	250	97300	31190	31610	Minor
I#2	4.442	1.991	500	109500	35160	35630	No
I#3	4.420	1.991	750	72000	23120	23410	Yes
I#4	4.315	1.991	1000	100000	32110	32420	Yes
I#5	4.121	1.990	1250	106250	34150	34290	Minor
I#6	4.196	1.990	1500	107000	34380	34610	Minor

Failure Strength (psi) = 21340 + 10.273(Confining Pressure - psi)

Angle of Internal Friction = 55.3°
Internal Cohesion = 3329 psi

$r^2 = 0.474$; $S_{yx} = 6610$ psi; $T_{calc} = 2.326$ (95%)

APPENDIX A (Continued)

Table A2 Direct Shear Test Results

Sample Ident.	Sample Diameter (in.)	Normal Load (lb)	Normal Stress (psi)	Shear Force (lb)	Shear Stress (psi)
Detail Lines "A" and "H", Tr - Aphanitic Rhyolite, flow banded					
A4#2	1.942	148.10	50.00	91.00	30.72
		296.20	100.00	173.00	58.41
		592.40	200.00	330.20	111.41
A4#3	1.941	147.95	50.00	92.00	31.09
		295.90	100.00	173.00	60.83
		591.80	200.00	355.00	119.97
A4#6	1.954	150.00	50.02	94.00	31.35
		300.00	100.04	182.00	60.69
		600.00	200.08	340.00	113.38

Shear Strength (psi) = 3.58 + 0.558(Normal Stress - psi)

Angle of Surface Friction = 29.1°
Surface Cohesion = 3.58 psi

$r^2 = 0.996$; $S_{yx} = 2.56$ psi; $T_{calc} = 40.690$ (>>99%)

Detail Line "B" and "C", Tup - Upper Pyroclastic Unit					
B1#1	1.941	147.95	50.00	71.00	23.99
		295.90	100.00	142.00	47.99
		591.80	200.00	266.20	89.90
B1#6	1.942	148.10	50.00	70.00	23.63
		296.20	100.00	131.00	44.23
		592.40	200.00	252.00	85.08
B4#6	1.954	147.95	50.00	72.00	24.33
		295.90	100.00	140.00	47.31
		591.80	200.00	275.00	92.94

Shear Strength (psi) = 2.59 + 0.434(Normal Stress - psi)

Angle of Surface Friction = 23.5°
Surface Cohesion = 2.59 psi

$r^2 = 0.994$; $S_{yx} = 2.41$ psi; $T_{calc} = 33.665$ (>>99%)

APPENDIX A (Continued)

Table A2. Direct Shear Test Results (Con't)

Sample Ident.	Sample Diameter (in.)	Normal Load (lb)	Normal Stress (psi)	Shear Force (lb)	Shear Stress (psi)
Detail Line "D", Tr - Aphanitic Rhyolite, flow banded					
D3#1	1.988	155.20	50.00	93.00	29.96
		310.40	100.00	179.00	57.67
		620.80	200.00	348.20	112.11
D4#1	1.987	155.05	50.00	95.00	30.64
		310.10	100.00	184.00	59.34
		620.20	200.00	350.00	112.87
D4#2	1.991	155.65	50.00	95.00	30.51
		311.30	100.00	192.00	61.67
		622.60	200.00	368.00	118.20

Shear Strength (psi) = 2.95 + 0.558(Normal Stress - psi)

Angle of Surface Friction = 29.2°
Surface Cohesion = 2.95 psi

r^2 = 0.997; S_{yx} = 2.95 psi; T_{calc} = 48.002 (>>99%)

Detail Line "E", Tmp - Middle Pyroclastic Unit					
E4#2	1.989	155.35	50.00	102.00	32.83
		310.70	100.00	198.00	63.72
		621.40	200.00	370.00	119.08
E5#1	1.984	145.50	50.00	87.00	28.14
		309.00	100.00	194.00	62.75
		618.00	200.00	369.00	119.36
E6#2	1.990	155.50	50.00	83.00	26.69
		311.00	100.00	190.00	61.09
		622.00	200.00	354.00	113.82

Shear Strength (psi) = 1.77 + 0.583(Normal Stress - psi)

Angle of Surface Friction = 30.2°
Surface Cohesion = 1.77 psi

r^2 = 0.994; S_{yx} = 3.23 psi; T_{calc} = 33.699 (>>99%)

APPENDIX A (Continued)

Table A2. Direct Shear Test Results (Con't)

Detail Line "F", Tmp - Middle Pyroclastic Unit

Sample Ident.	Sample Diameter (in.)	Normal Load (lb)	Normal Stress (psi)	Shear Force (lb)	Shear Stress (psi)
F1#2	1.962	151.15	50.00	95.00	31.42
		302.30	100.00	183.00	60.53
		604.60	200.00	350.00	115.77
F2#1	1.992	155.85	50.00	89.00	28.56
		311.70	100.00	181.00	58.08
		623.40	200.00	340.00	109.10
F4#1	1.946	148.70	50.00	93.00	31.27
		297.40	100.00	187.00	62.87
		594.80	200.00	374.00	125.75

Shear Strength (psi) = 2.23 + 0.575(Normal Stress - psi)

Angle of Surface Friction = 29.9°
Surface Cohesion = 2.23 psi

$r^2 = 0.986$; $S_{yx} = 4.79$ psi; $T_{calc} = 22.434$ (>>99%)

Detail Lines "E" and "F", Tmp - Middle Pyroclastic Unit

Shear Strength (psi) = 2.00 + 0.578(Normal Stress - psi)

Angle of Surface Friction = 30.0°
Surface Cohesion = 2.00 psi

$r^2 = 0.990$; $S_{yx} = 3.83$ psi; $T_{calc} = 39.927$ (>>99%)

APPENDIX A (Continued)

Table A2. Direct Shear Test Results (Con't)

Detail Line "G", Trp - Rhyolite Porphyry

Sample Ident.	Sample Diameter (in.)	Normal Load (lb)	Normal Stress (psi)	Shear Force (lb)	Shear Stress (psi)
G#A	1.962	151.15	50.00	95.00	32.60
		302.30	100.00	183.00	63.20
		604.60	200.00	350.00	130.30
G#B	1.992	155.85	50.00	89.00	29.60
		311.70	100.00	181.00	56.60
		623.40	200.00	340.00	114.80
G#C	1.946	148.70	50.00	93.00	30.00
		297.40	100.00	187.00	58.70
		594.80	200.00	374.00	120.40

Shear Strength (psi) = 1.32 + 0.588(Normal Stress - psi)

Angle of Surface Friction = 30.5°
Surface Cohesion = 1.32 psi

$r^2 = 0.994$; $S_{yx} = 3.27$ psi; $T_{calc} = 33.271$ (>>99%)

Detail Line "I", Tql - Quartz Latite Porphyry

I#A	1.962	151.15	50.00	95.00	32.90
		302.30	100.00	183.00	60.90
		604.60	200.00	350.00	122.40
I#B	1.992	155.85	50.00	89.00	31.70
		311.70	100.00	181.00	56.50
		623.40	200.00	340.00	113.70
I#C	1.946	148.70	50.00	93.00	30.80
		297.40	100.00	187.00	58.30
		594.80	200.00	374.00	122.50

Shear Strength (psi) = -0.43 + 0.610(Normal Stress - psi)

Angle of Surface Friction = 31.3°
Surface Cohesion = 0.00 psi

$r^2 = 0.988$; $S_{yx} = 4.72$ psi; $T_{calc} = 24.144$ (>>99%)

APPENDIX A (Continued)

Table A3. Density Measurements

	Sample Ident.	Density (PCF)	Sample Ident.	Density (PCF)
	Detail Lines "A" and "H"		Detail Lines "B" and "C"	
	A3#2	147.4	B1#3	158.2
	A3#4	144.8	B3#3	154.1
	A3#3	144.2	B1#2	154.4
	A1#2	129.4	B3#1	153.4
	A3#1	142.9	B1#4	145.1
	A4#3	148.6	B1#7	157.7
	A2#1	146.9	B3#2	153.9
	A1#1	131.5	B1#5	152.1
Mean		142.0		153.6
Standard Deviation		7.4		4.0
	Detail Line "D"		Detail Line "E"	
	D5#2	153.9	E3#2	150.6
	D5#1	156.2	E4#3	142.7
	D2#3	151.0	E3#1	142.9
	D1#2	151.9	E5#3	143.5
	D2#1	152.4	E2#2	146.0
	D1#3	153.0	E2#1	141.6
	D2#2	148.5	E1#1	147.9
	D1#1	152.5	E4#1	144.4
			E10#1	150.7
			E11#1	138.5
			E10#3	152.6
Mean		152.4		145.6
Standard Deviation		2.2		4.4
	Detail Line "F"		Detail Line "F"	
	F2#2	153.1	F12#2	142.2
	F3#4	145.8	F13#1	147.4
	F2#3	152.4	F11#1	151.8
	F3#1	144.6	F12#1	141.3
	F3#2	141.8	F10#1	142.1
	F5#1	155.5		
	F1#1	152.7		
	F3#3	143.1		
Mean				147.2
Standard Deviation				5.2

APPENDIX A (Continued)

Table A3. Density Measurements (Con't)

	Sample Ident.	Density (PCF)	Sample Ident.	Density (PCF)
	Detail Line "G"		Detail Line "I"	
	G#3	125.5	I#7	152.9
	G#6	140.3	I#8	150.6
	G#1	142.9	I#1	154.5
	G#2	137.8	I#2	154.1
	G#4	149.0	I#3	144.8
	G#5	148.9	I#4	153.6
	G#7	142.2	I#5	148.3
	G#8	138.7	I#6	149.9
Mean		140.7		151.1
Standard Deviation		7.4		3.4

Figure A1. Compression test plot.

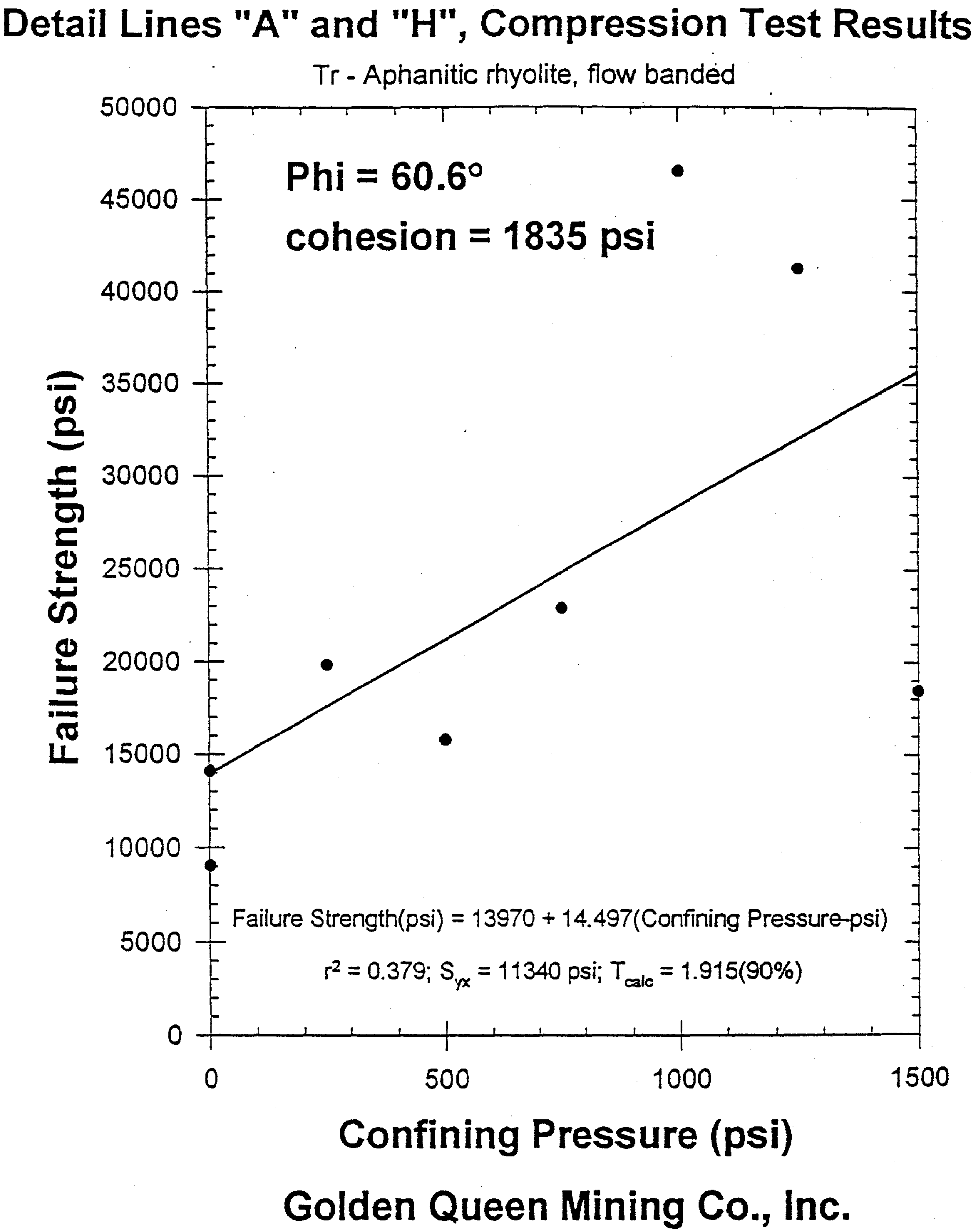


Figure A2. Direct shear test plot.

Detail Lines "A" and "H", Direct Shear Test Results

Tr - Aphanitic rhyolite, flow banded

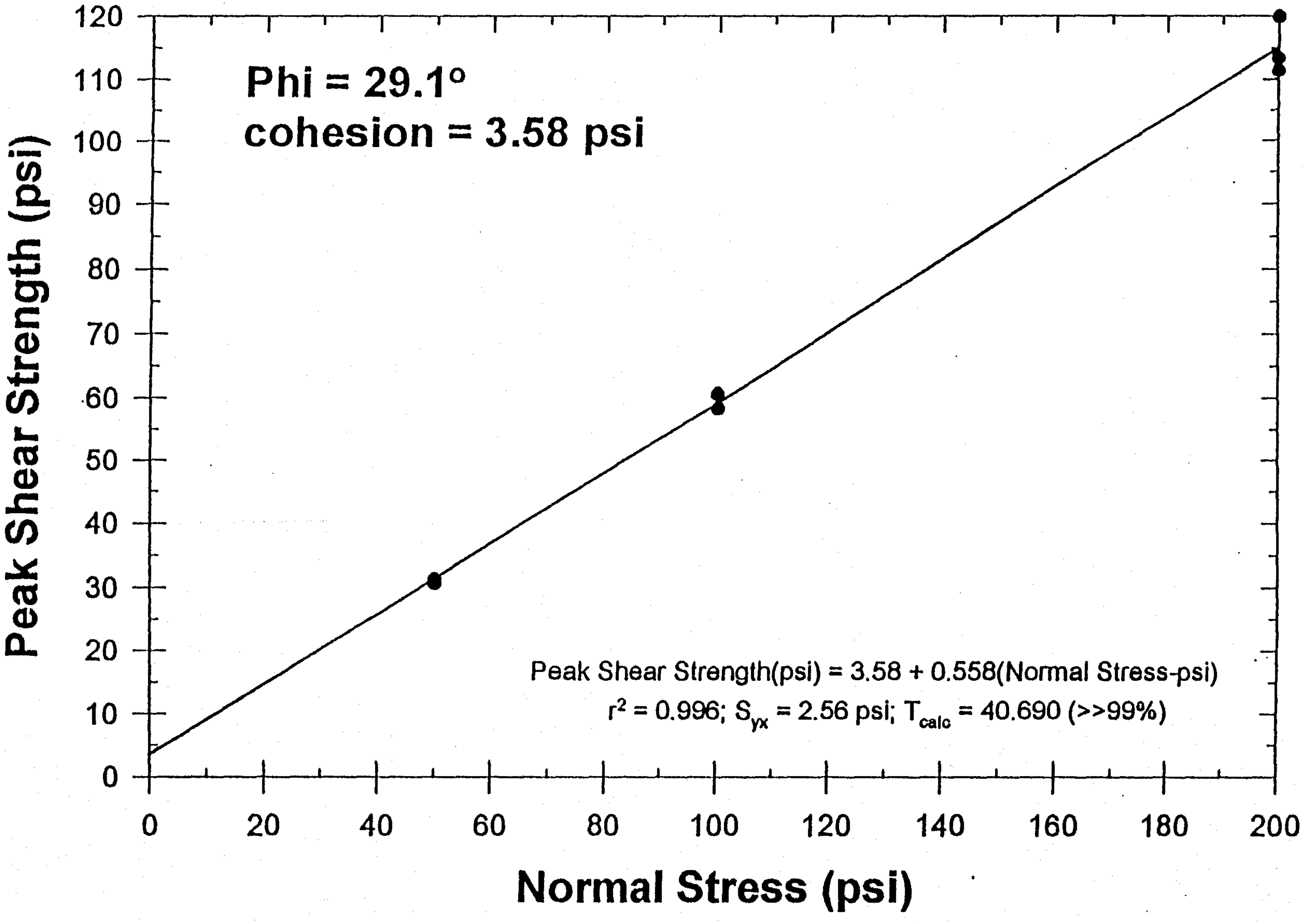


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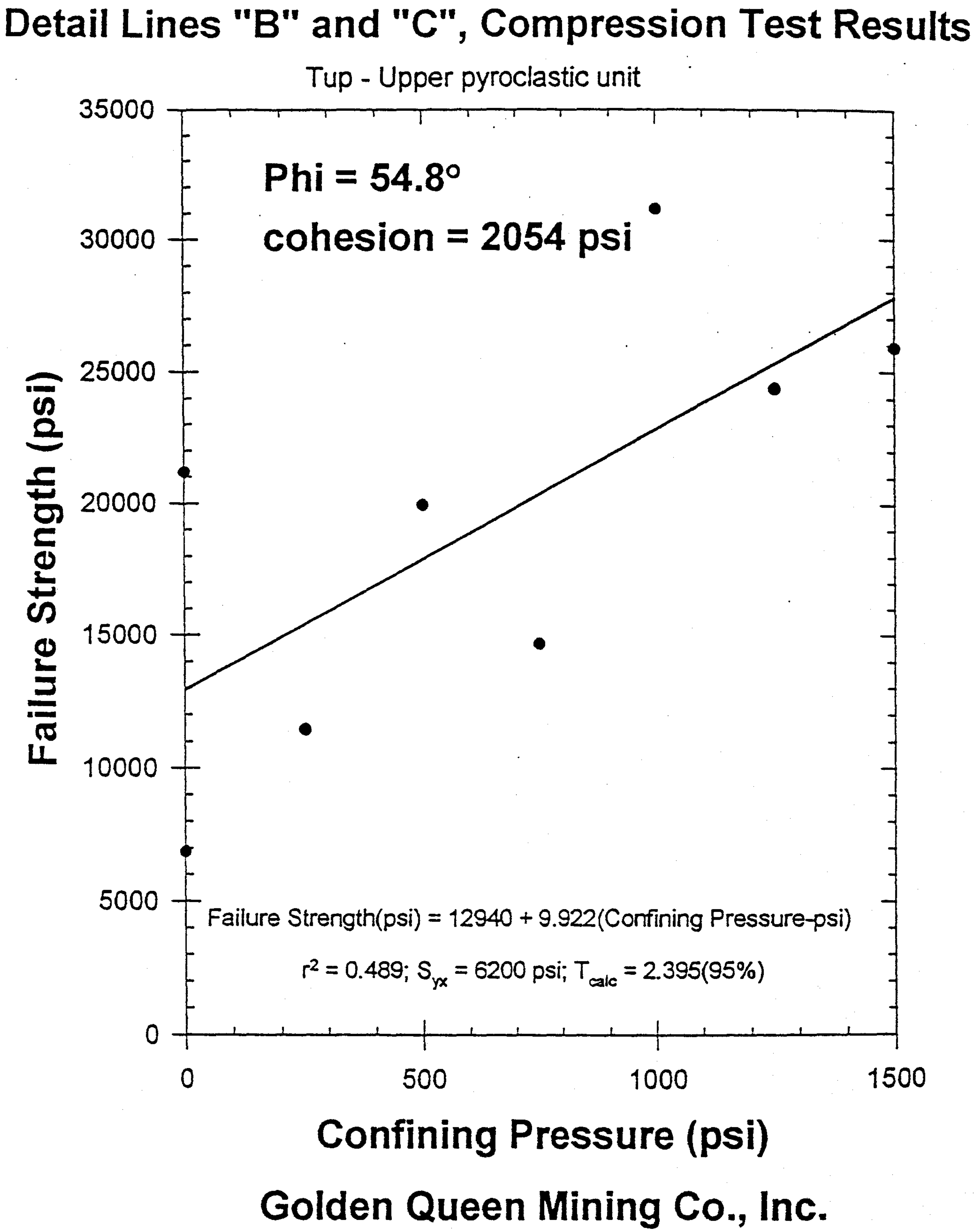
Figure A3. Compression test plot.



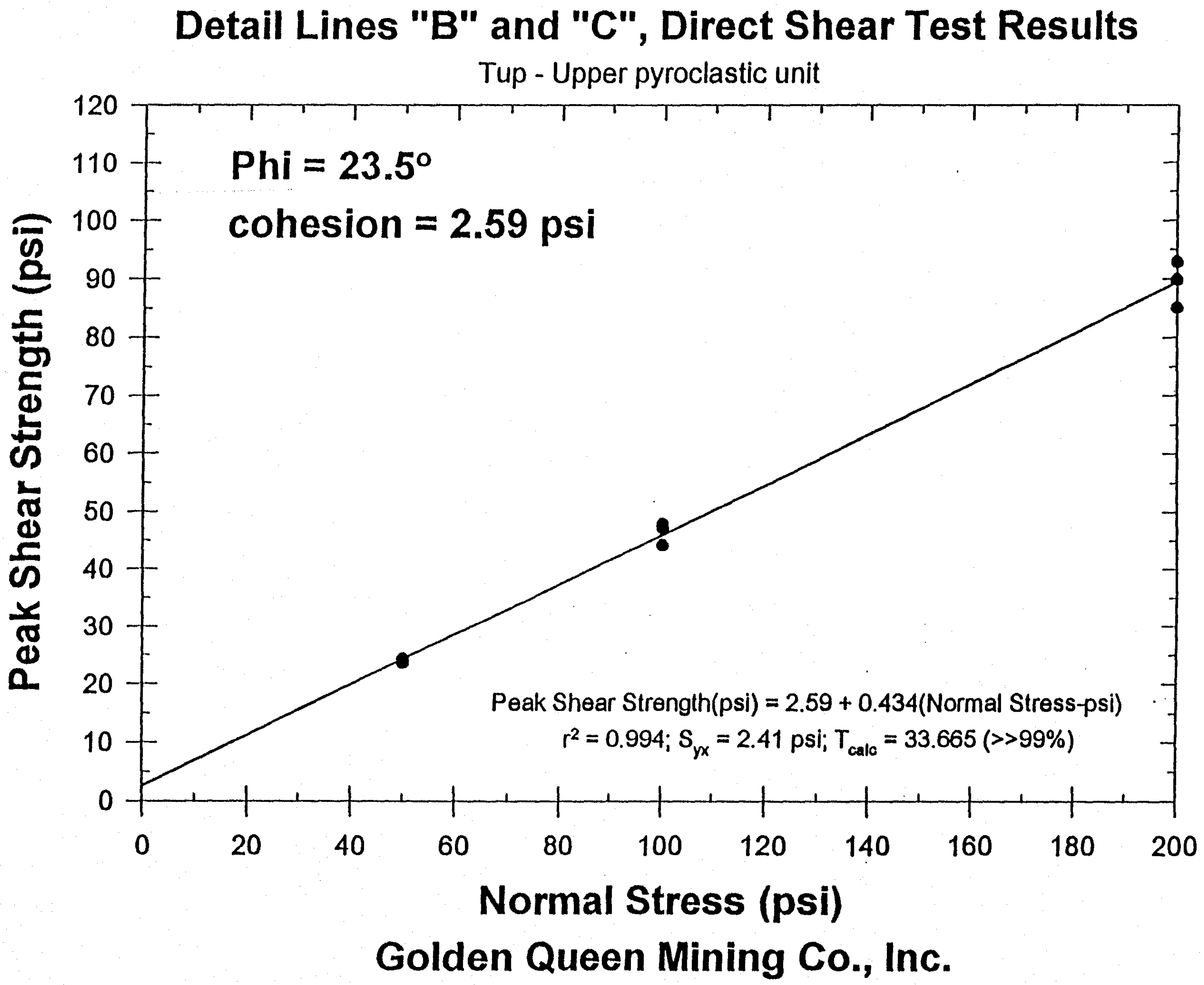


Figure A4. Direct shear test plot.

Figure A5. Compression test plot.

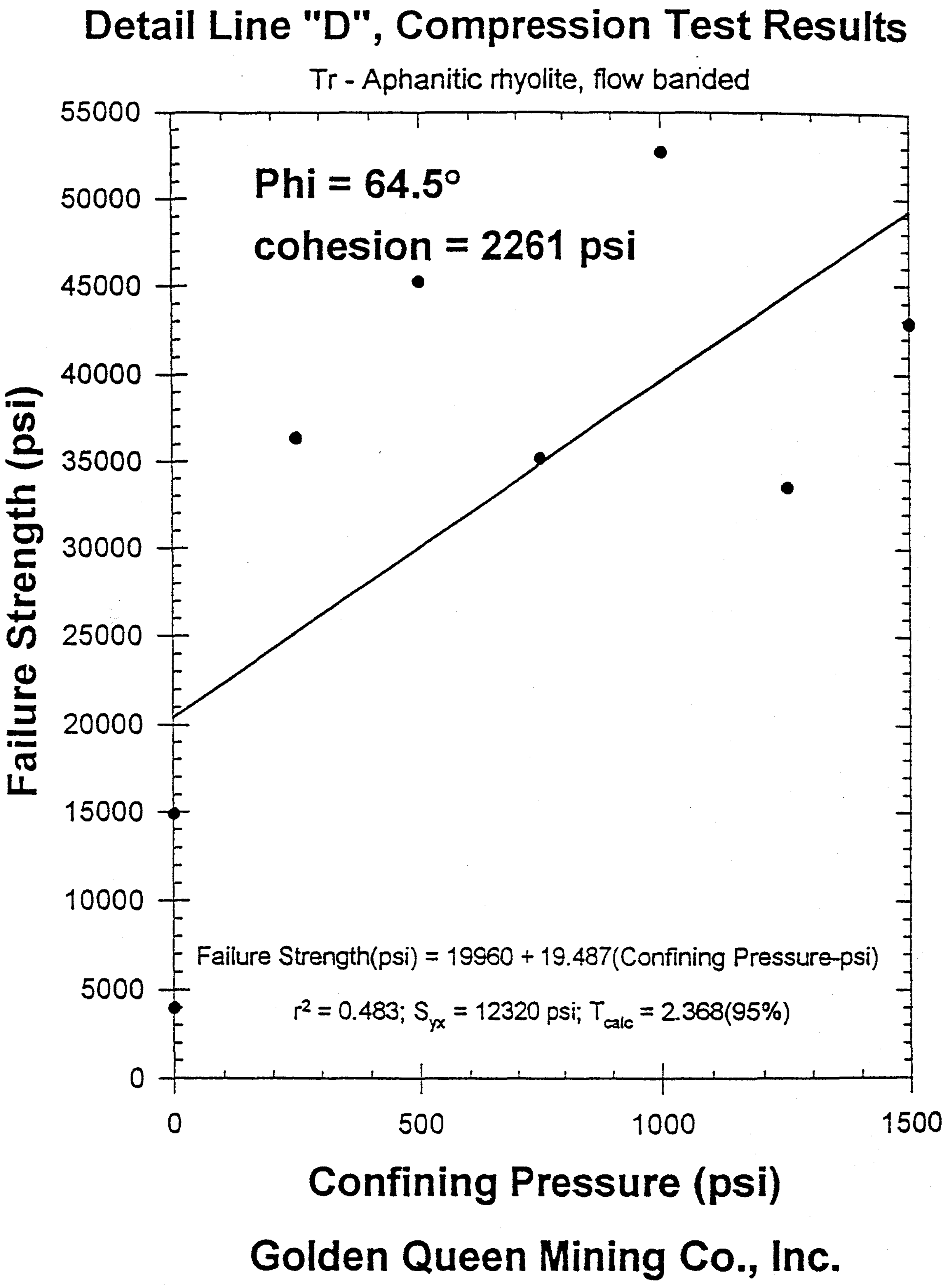
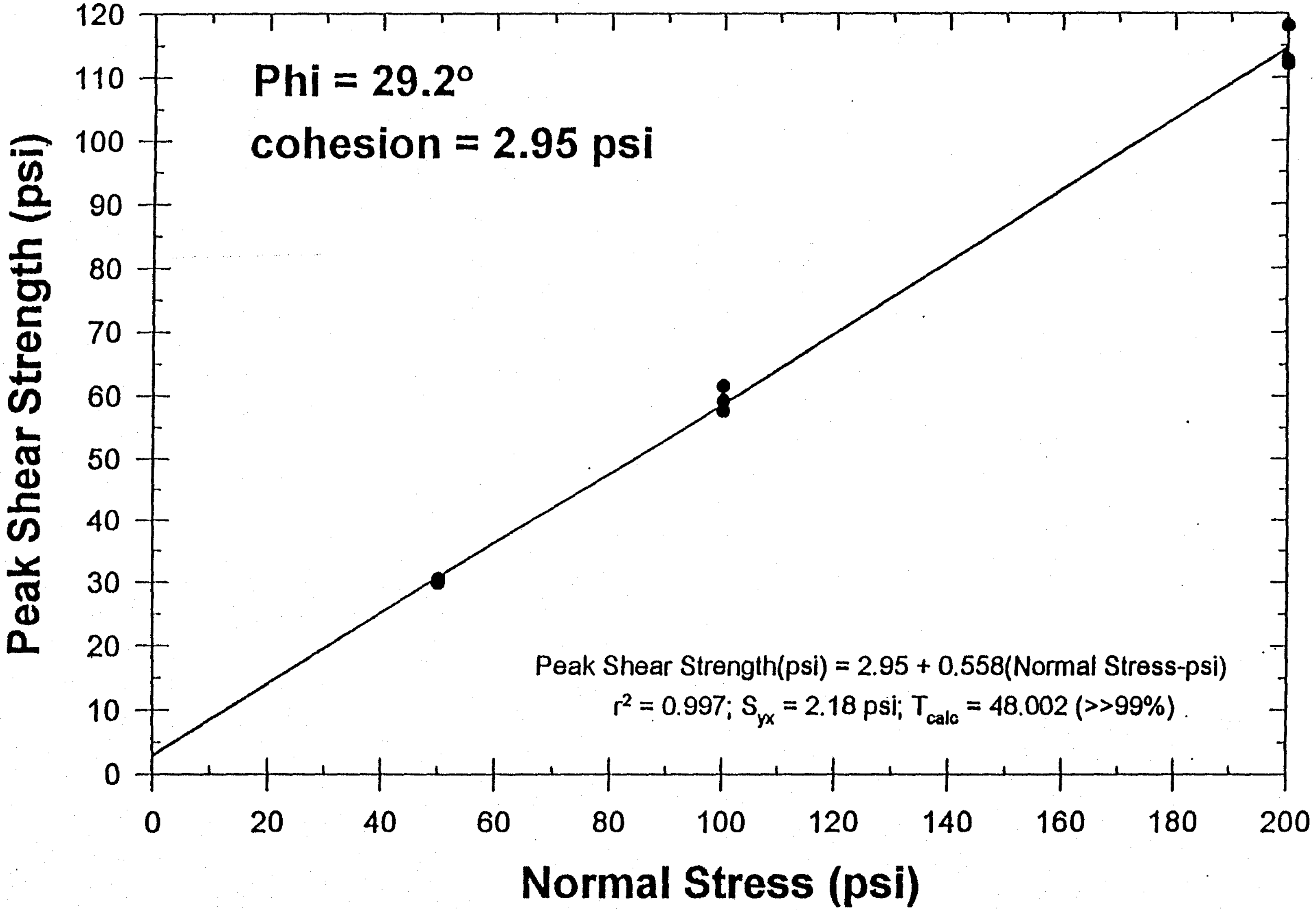


Figure A6. Direct shear test plot.



Detail Line "D", Direct Shear Test Results

Tr - Aphanitic rhyolite, flow banded

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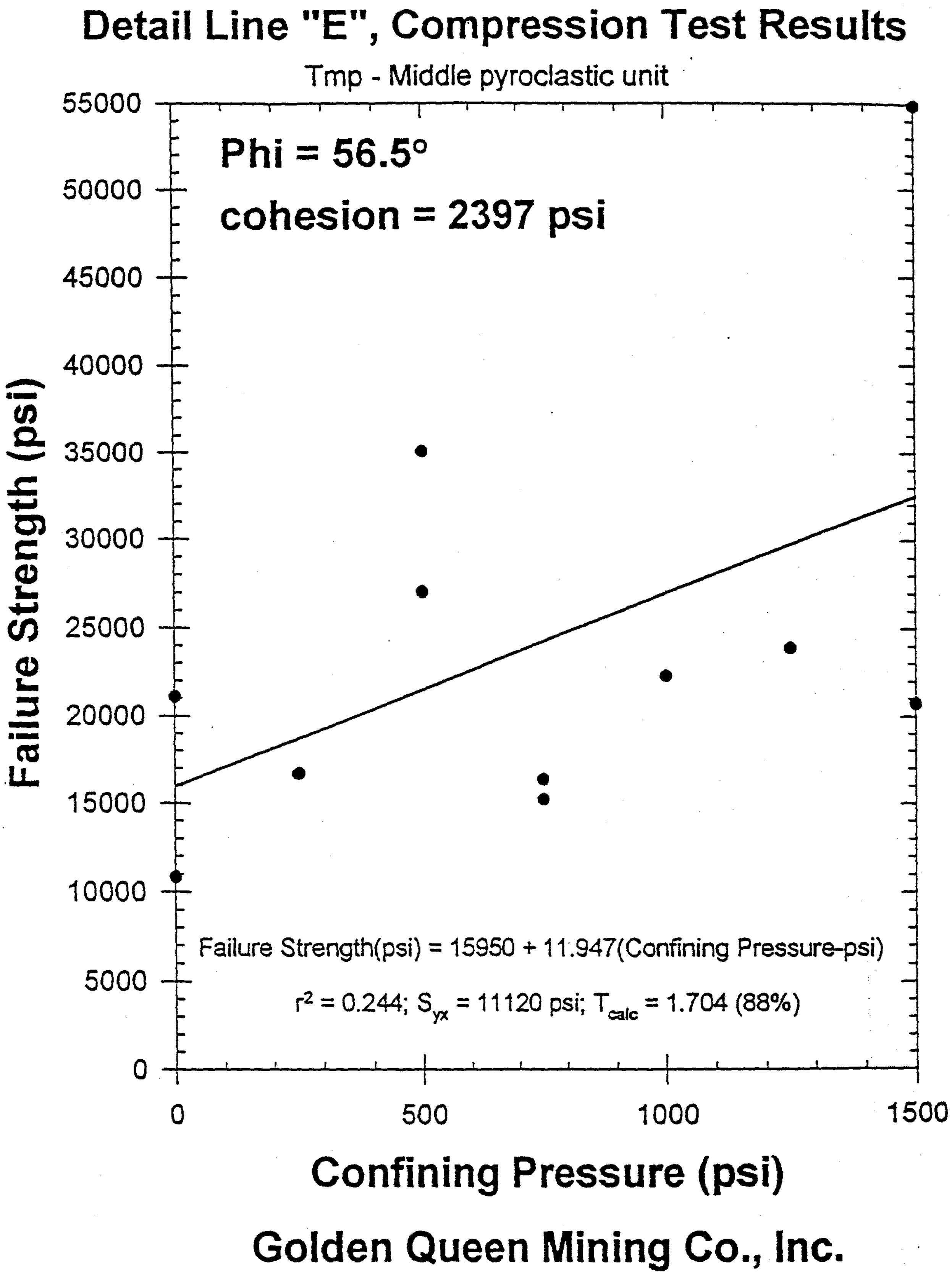
Figure A7. Compression test plot.



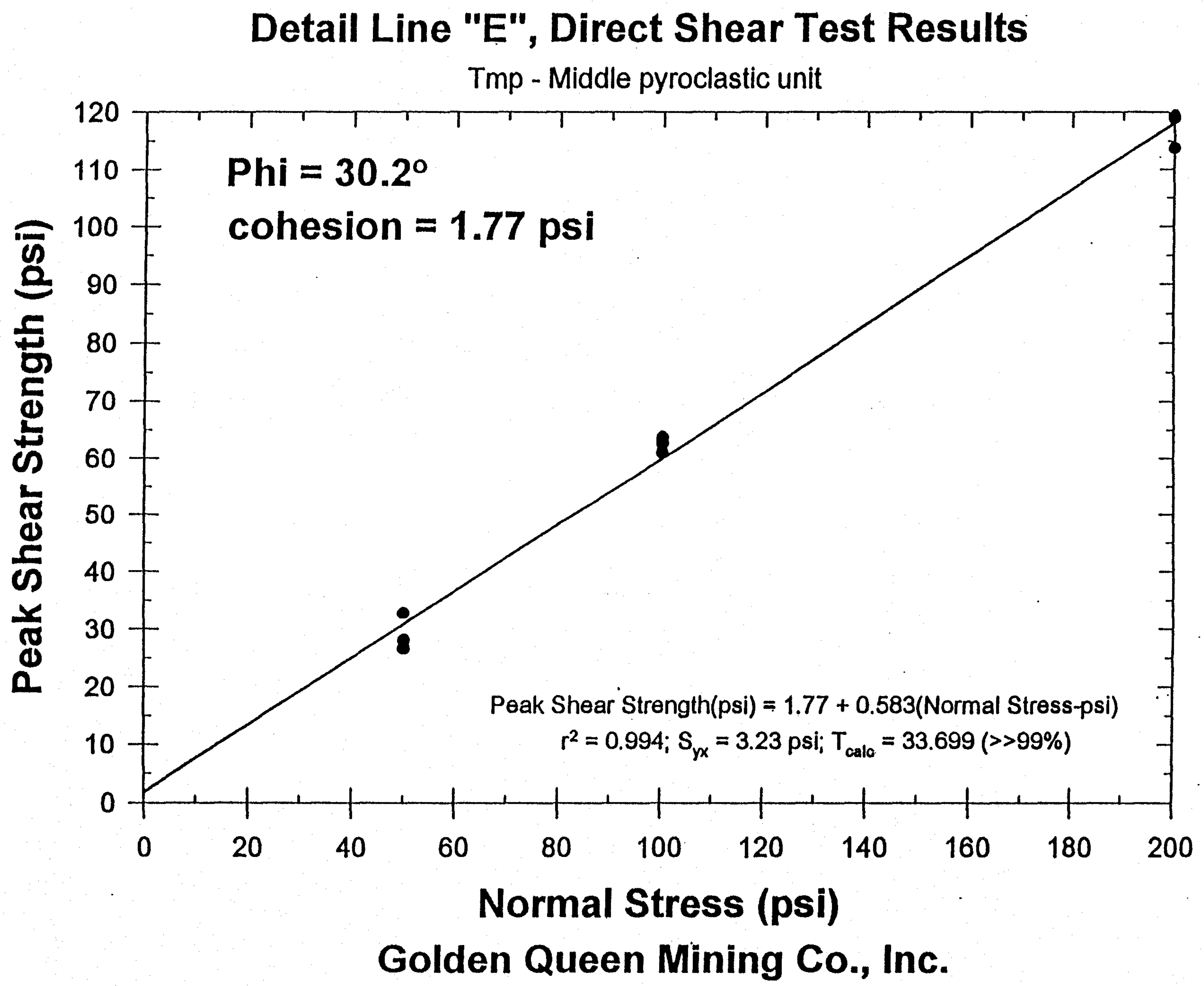
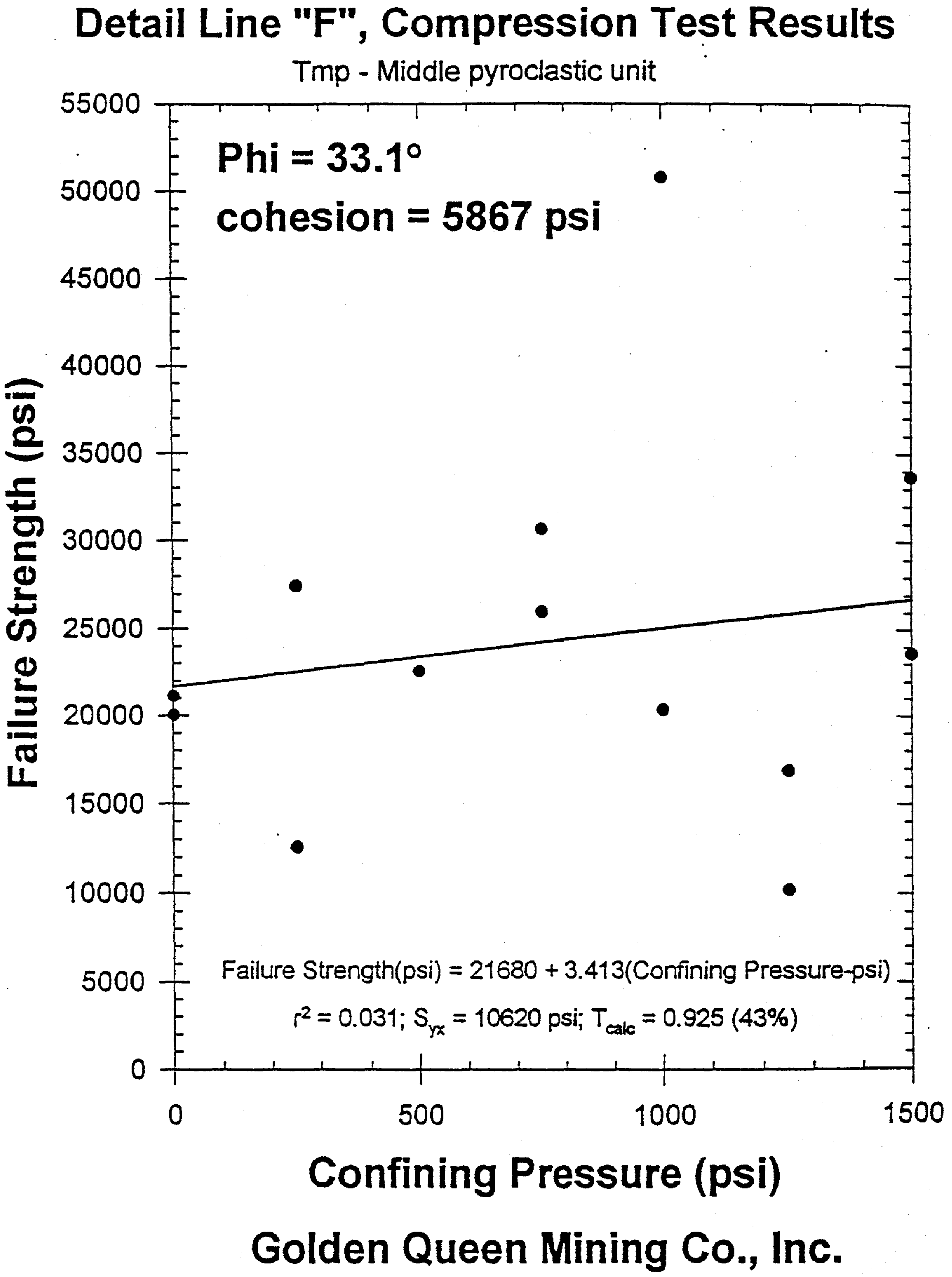


Figure A8. Direct shear test plot.

Figure A9. Compression test plot.



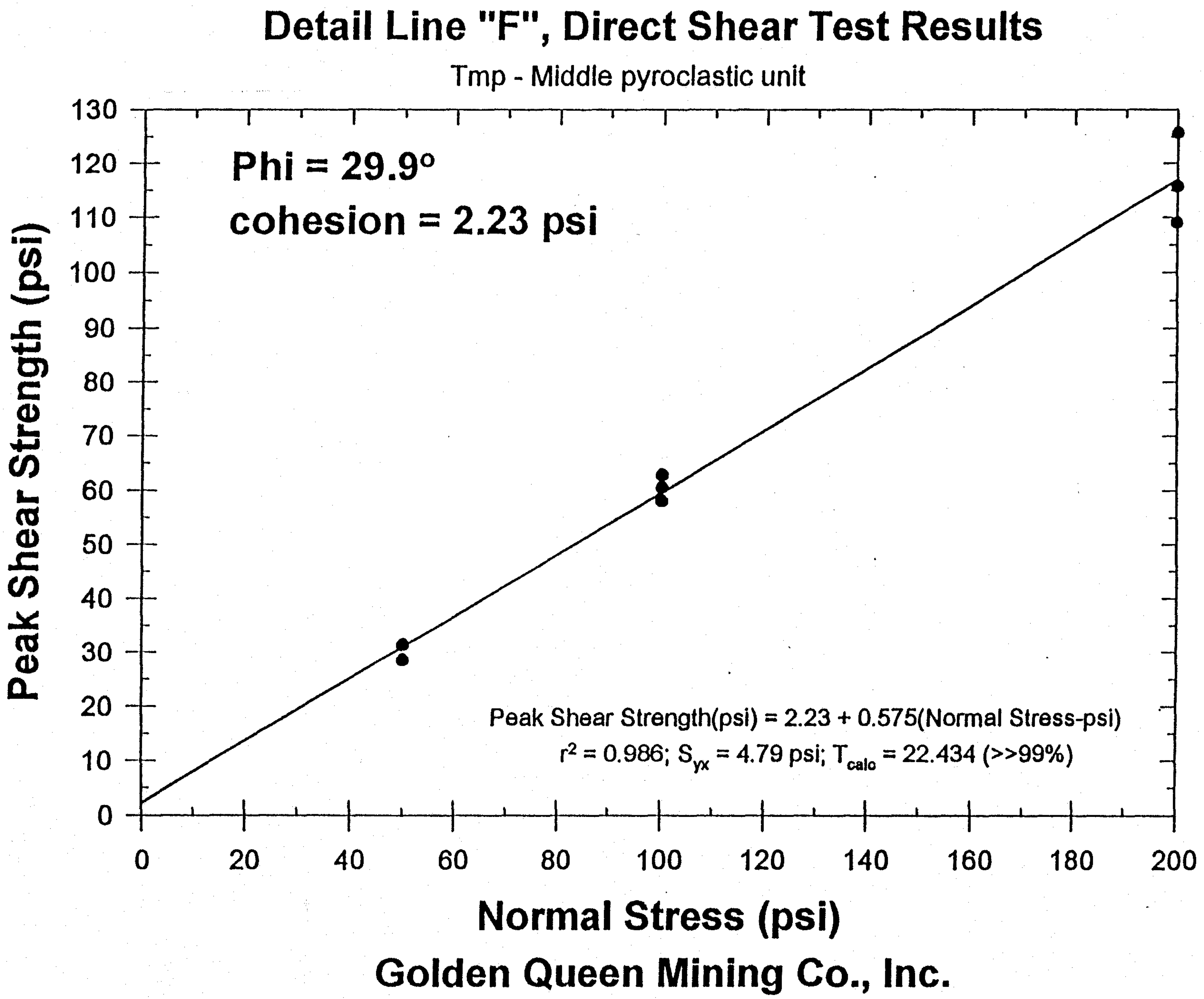
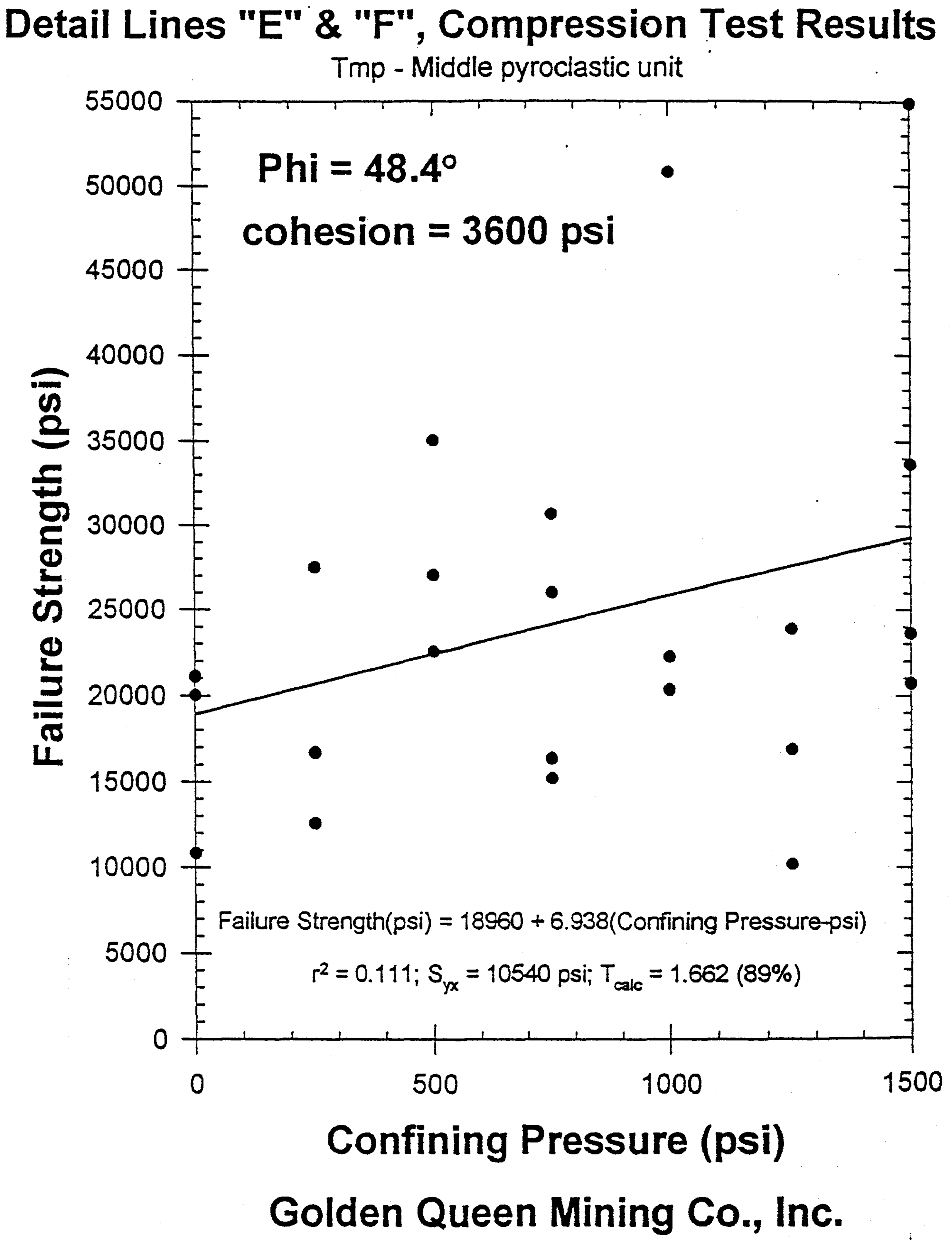


Figure A10. Direct shear test plot.

Figure A11. Compression test plot.



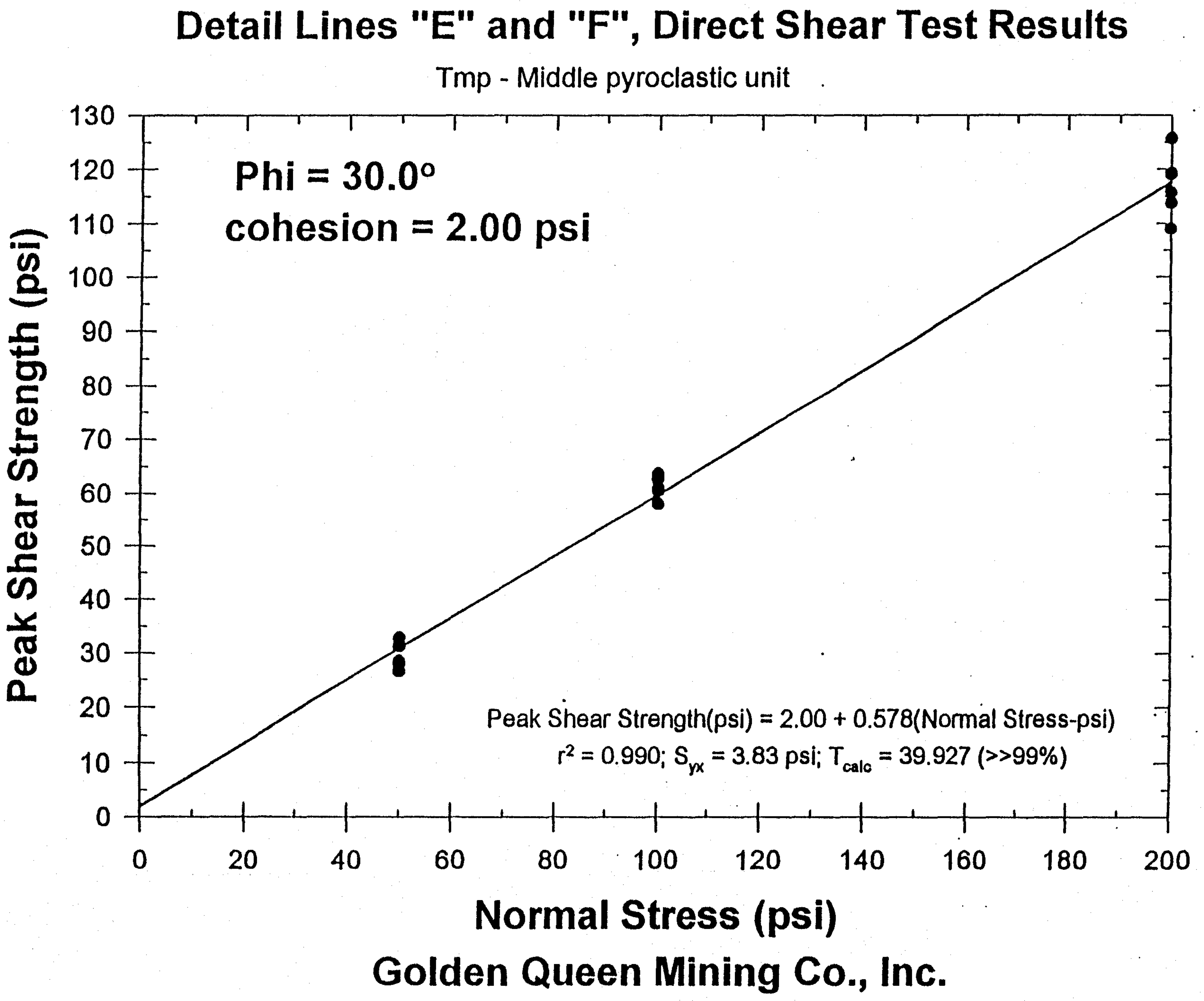


Figure A12. Direct shear test plot.

Figure A13. Compression test plot.

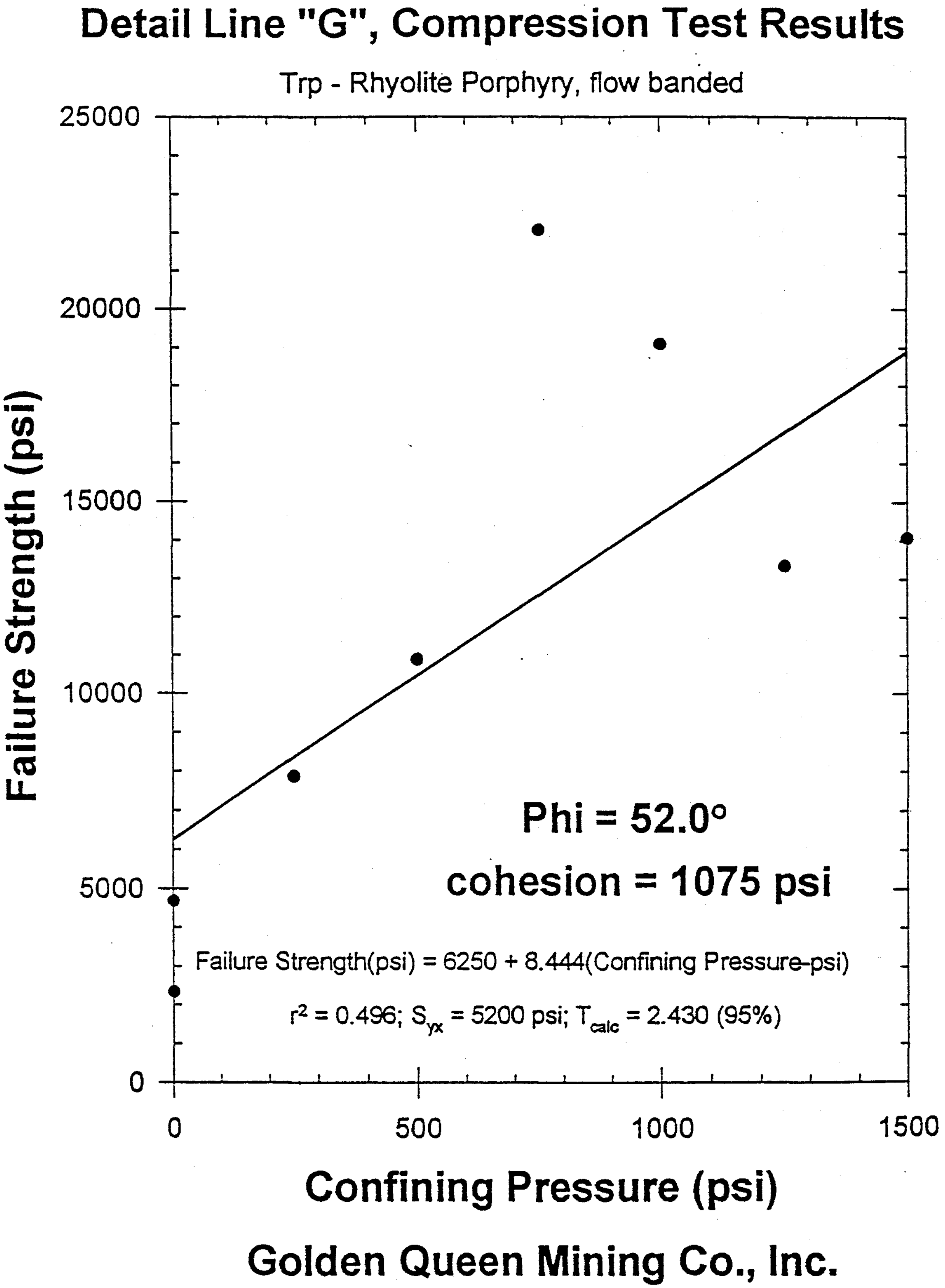
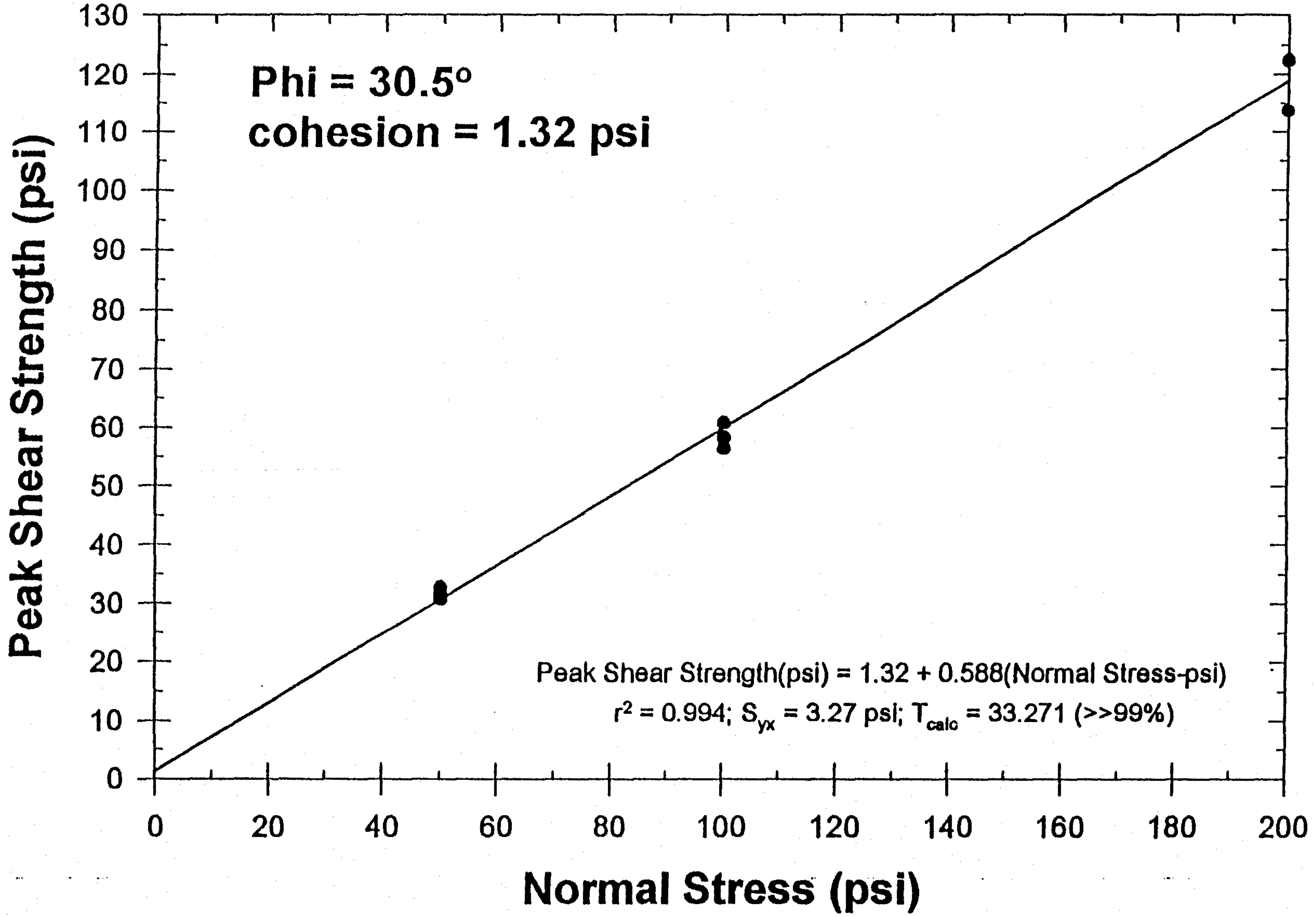


Figure A14. Direct shear test plot.



Detail Line "G", Direct Shear Test Results

Trp - Rhyolite Porphyry

Phi = 30.5°
cohesion = 1.32 psi

Peak Shear Strength(psi) = 1.32 + 0.588(Normal Stress-psi)
$r^2 = 0.994$; $S_{yx} = 3.27$ psi; $T_{calc} = 33.271$ (>>99%)

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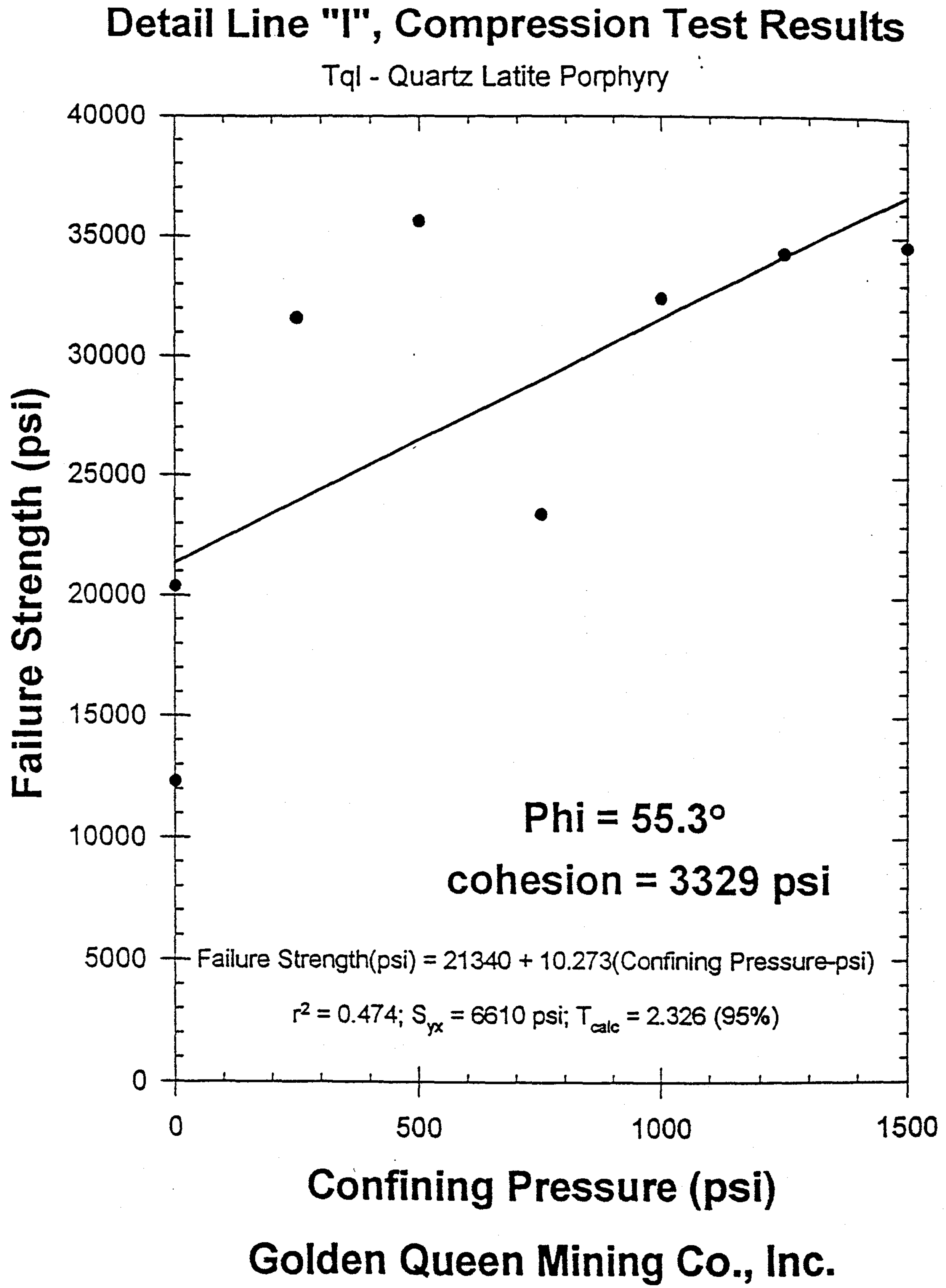
Figure A15. Compression test plot.



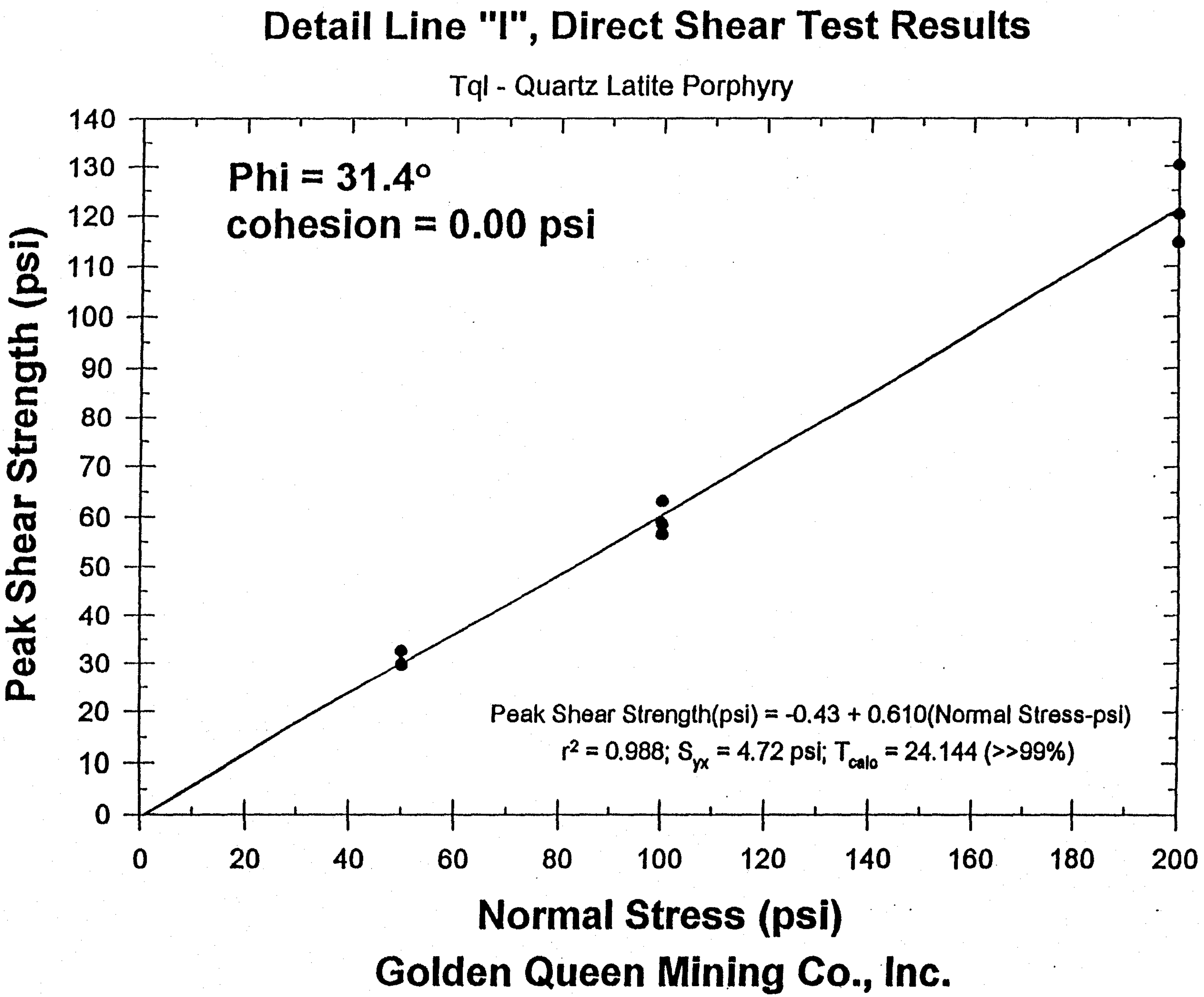
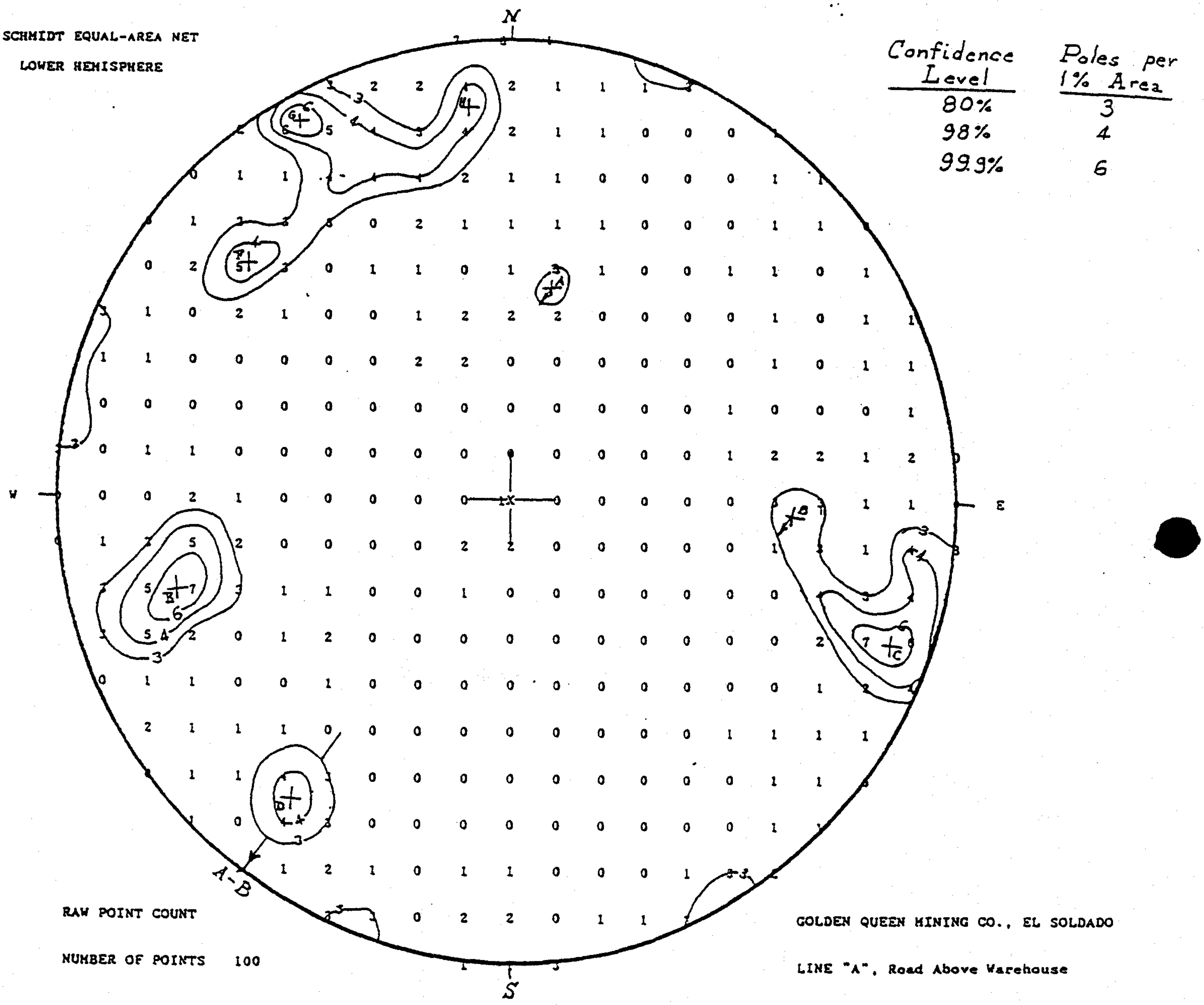


Figure A16. Direct shear test plot.

APPENDIX B

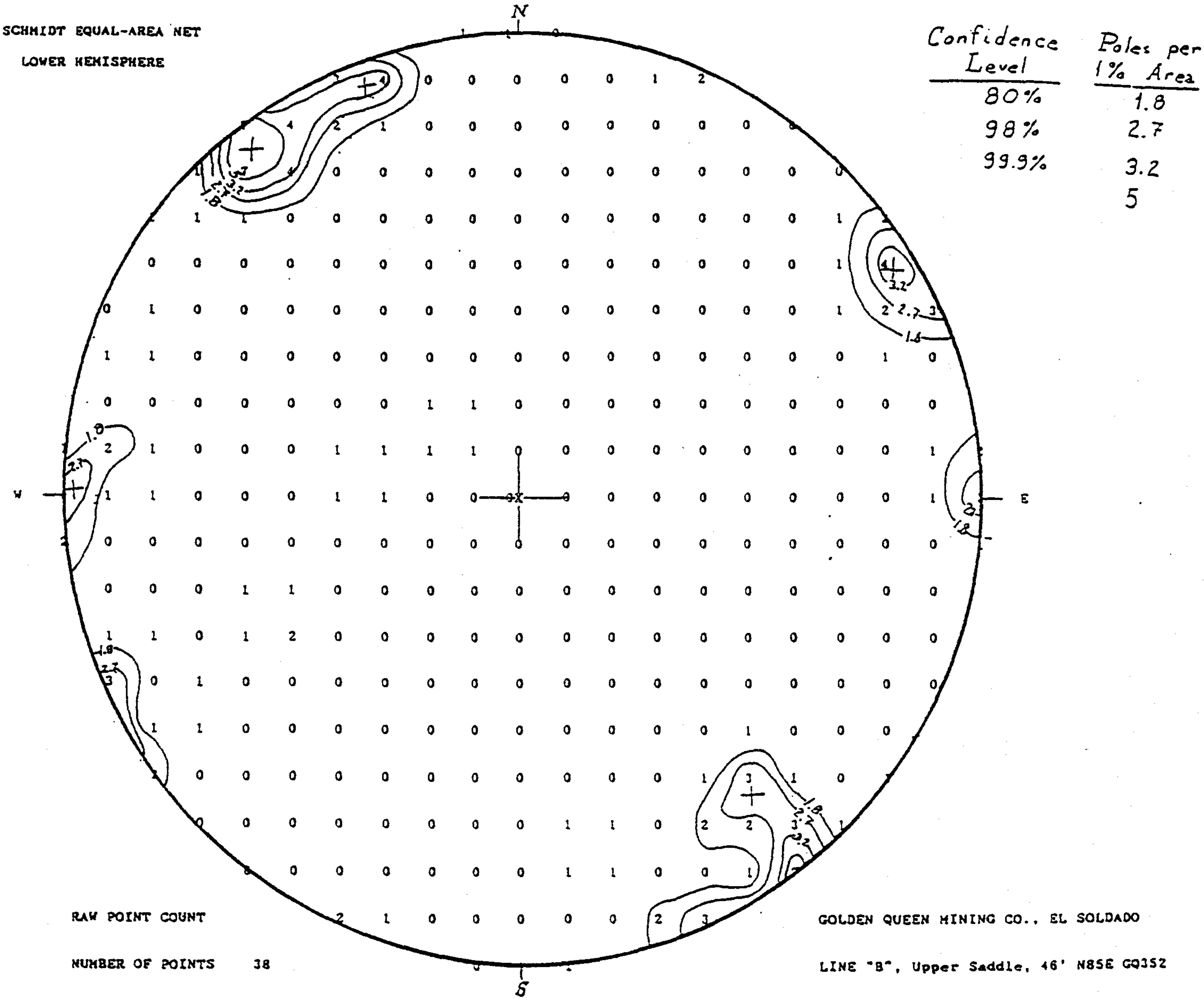
SCHMIDT EQUAL-AREA FRACTURE DATA PROJECTIONS

Figure B-1. Schmidt equal-area plot of Detail Line A fractures.



Confidence Level	Poles per 1% Area
80%	3
98%	4
99.9%	6

Figure B-2. Schmidt equal-area plot of Detail Line B fractures.



Confidence Level	Poles per 1% Area
80%	1.8
98%	2.7
99.9%	3.2
	5

Figure B-3. Schmidt equal-area plot of Detail Line C fractures.

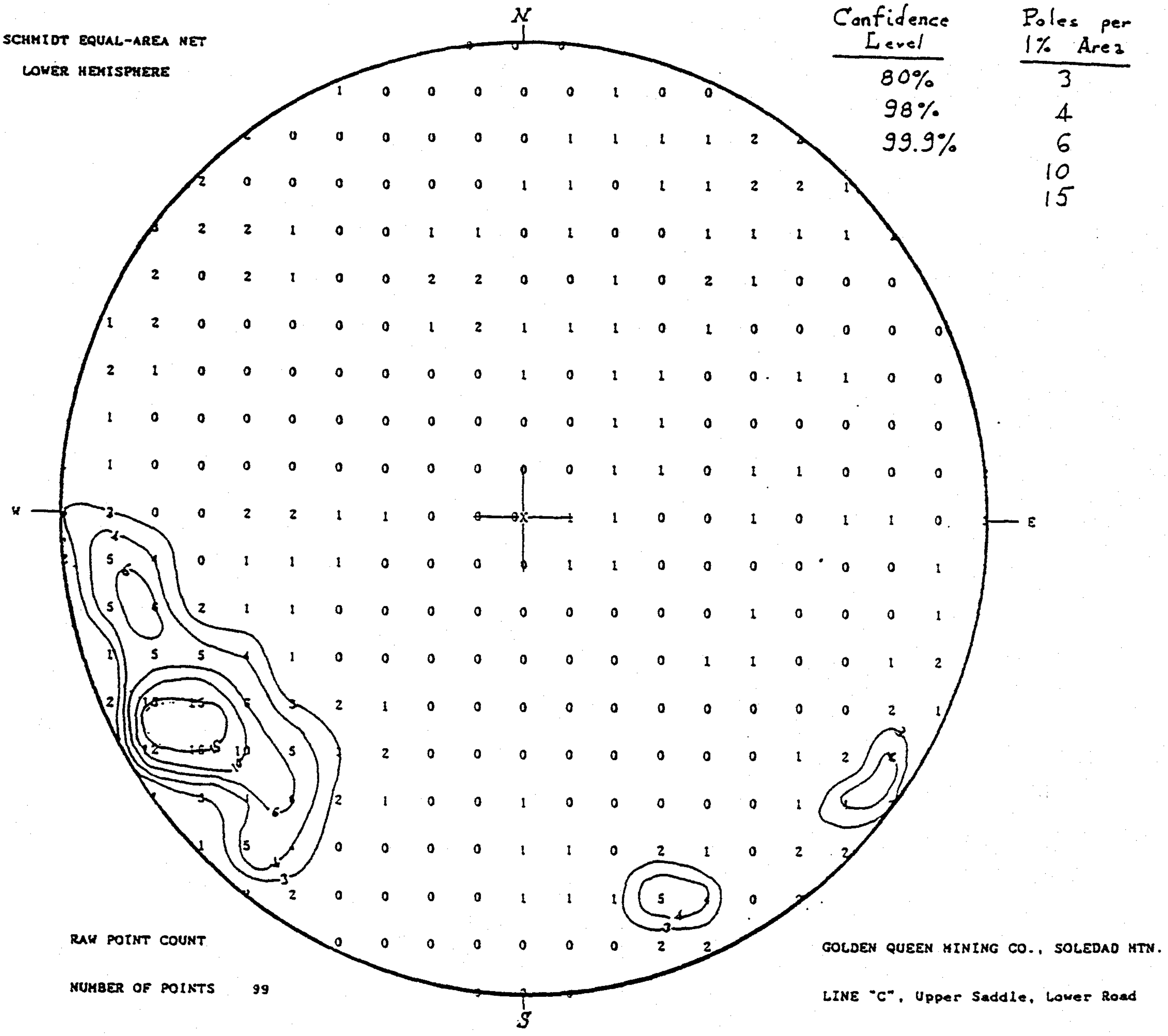
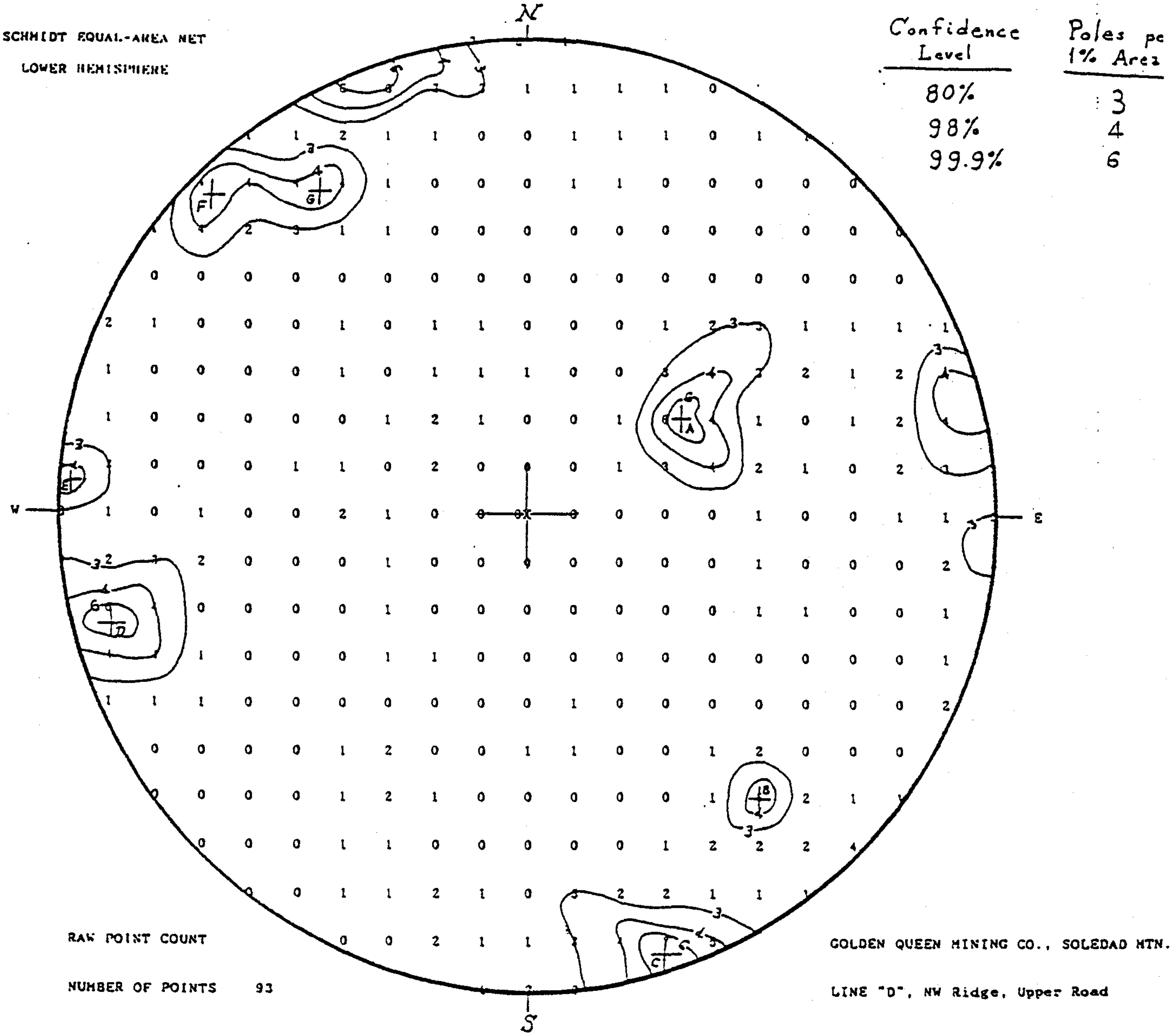
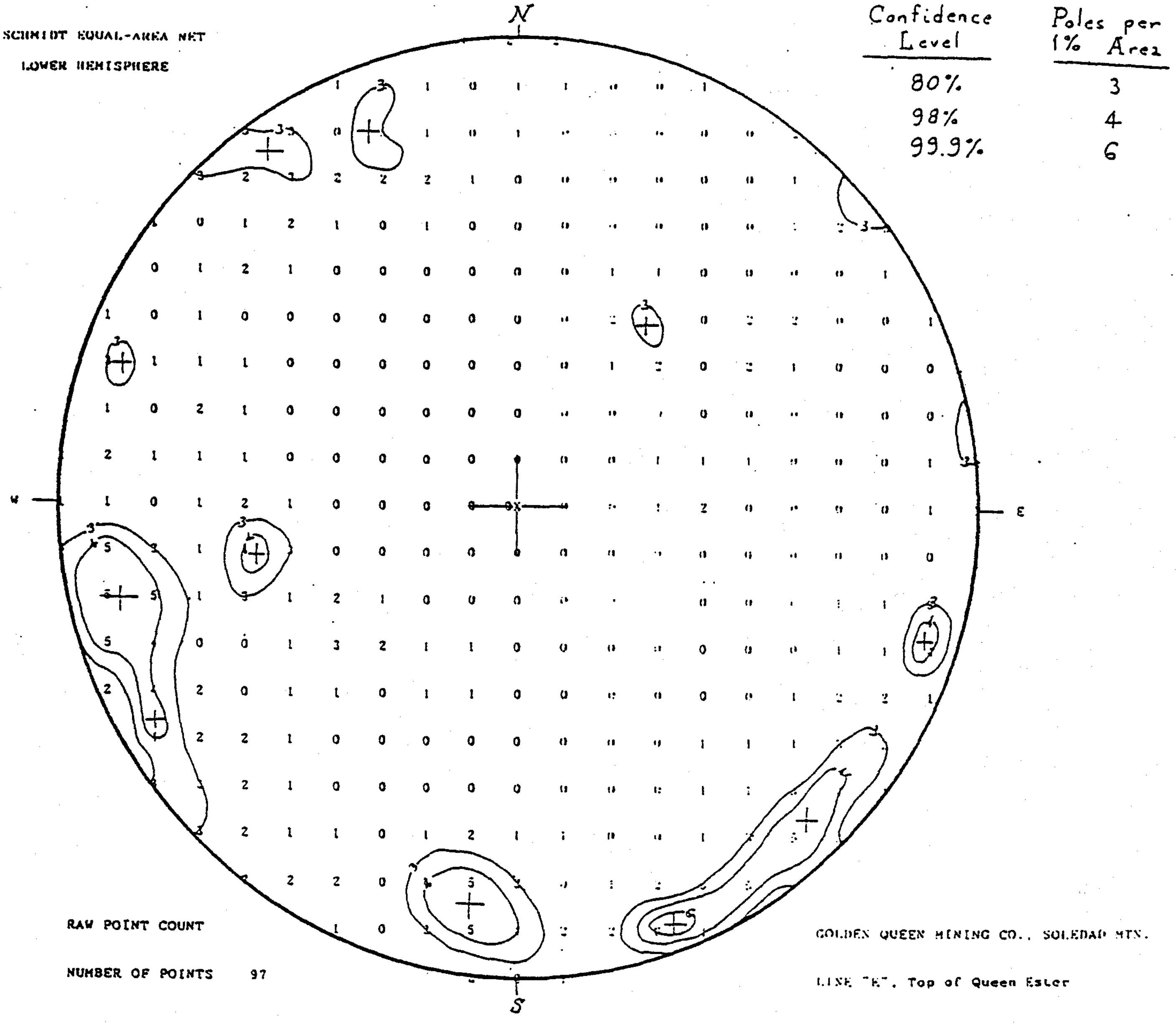


Figure B-4. Schmidt equal-area plot of Detail Line D fractures.



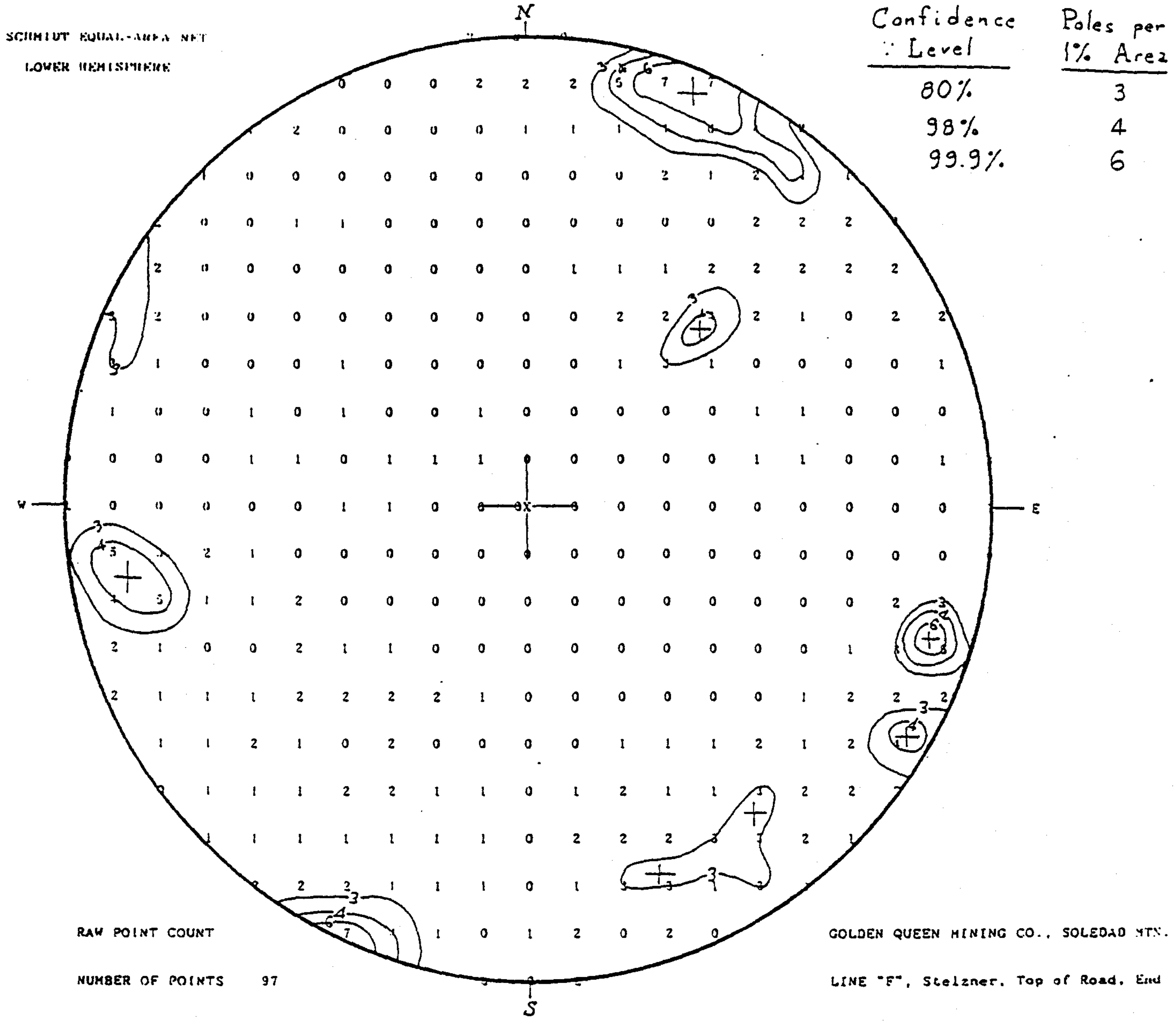
Confidence Level	Poles per 1% Area
80%	3
98%	4
99.9%	6

Figure B-5. Schmidt equal-area plot of Detail Line E fractures.



Confidence Level	Poles per 1% Area
80%	3
98%	4
99.9%	6

Figure B-6. Schmidt equal-area plot of Detail Line F fractures.



Confidence Level	Poles per 1% Area
80%	3
98%	4
99.9%	6

Figure B-7. Schmidt equal-area plot of Detail Line G fractures.

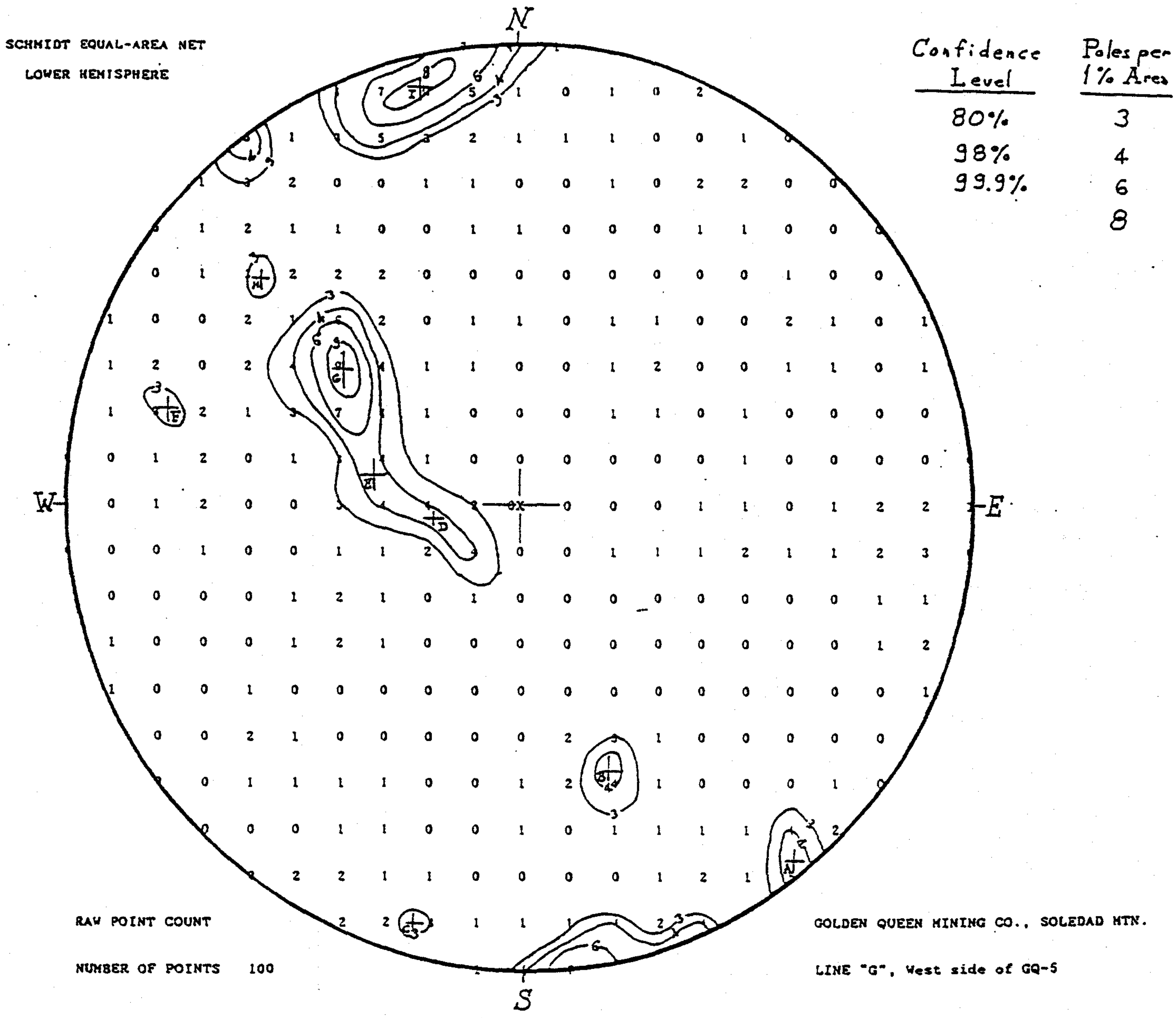


Figure B-8. Schmidt equal-area plot of Detail Line H fractures.

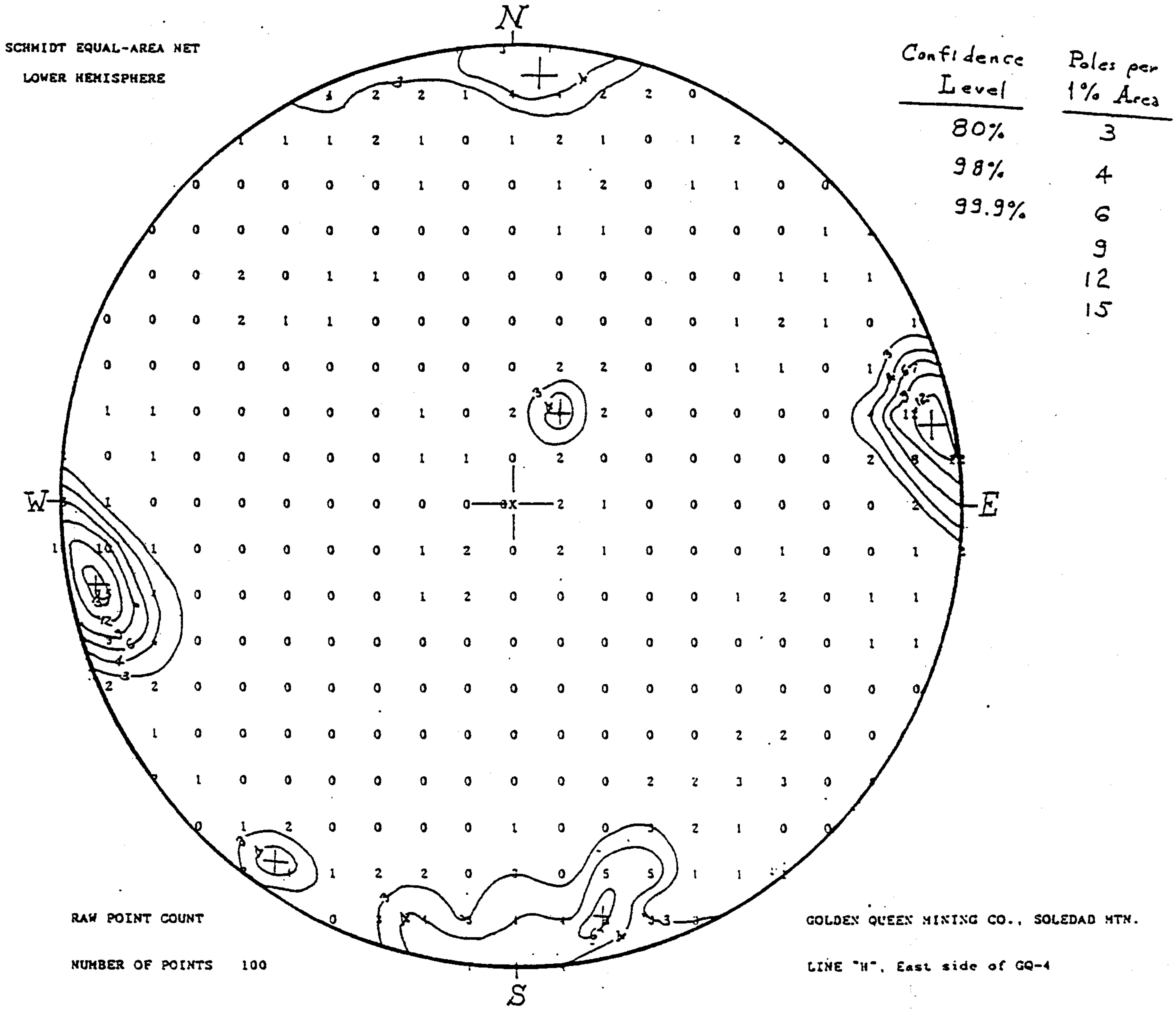
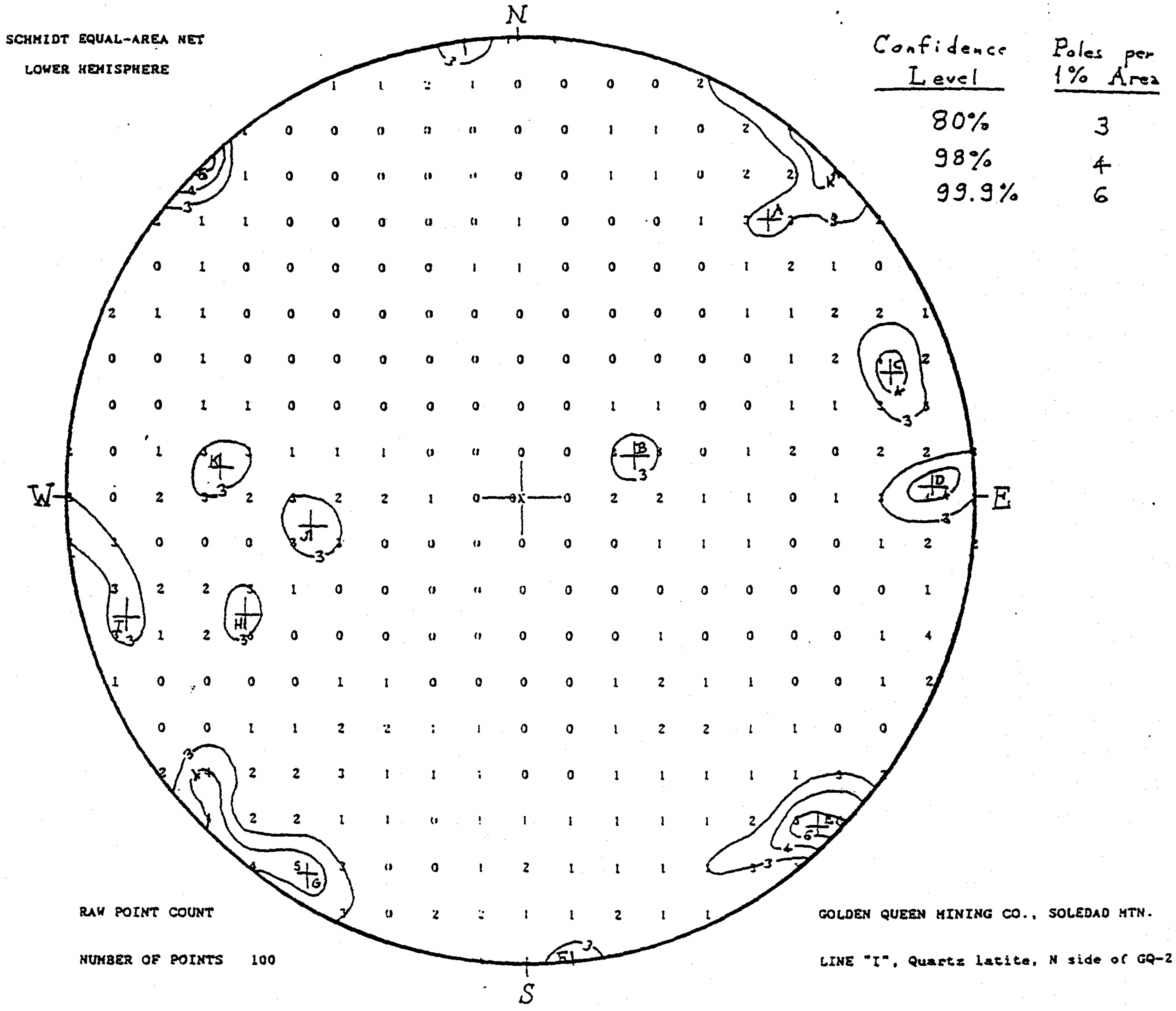
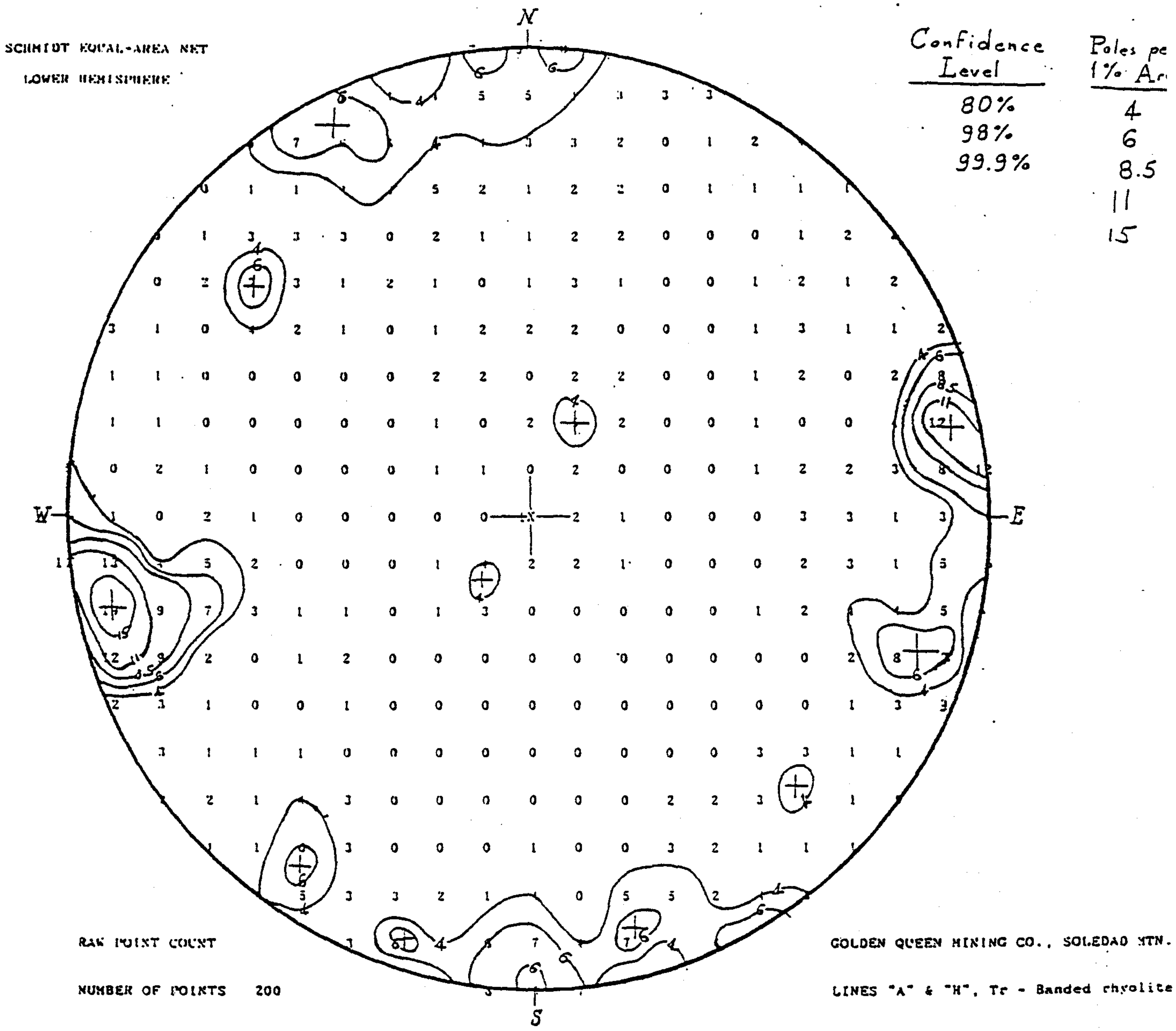


Figure B-9. Schmidt equal-area plot of Detail Line I fractures.



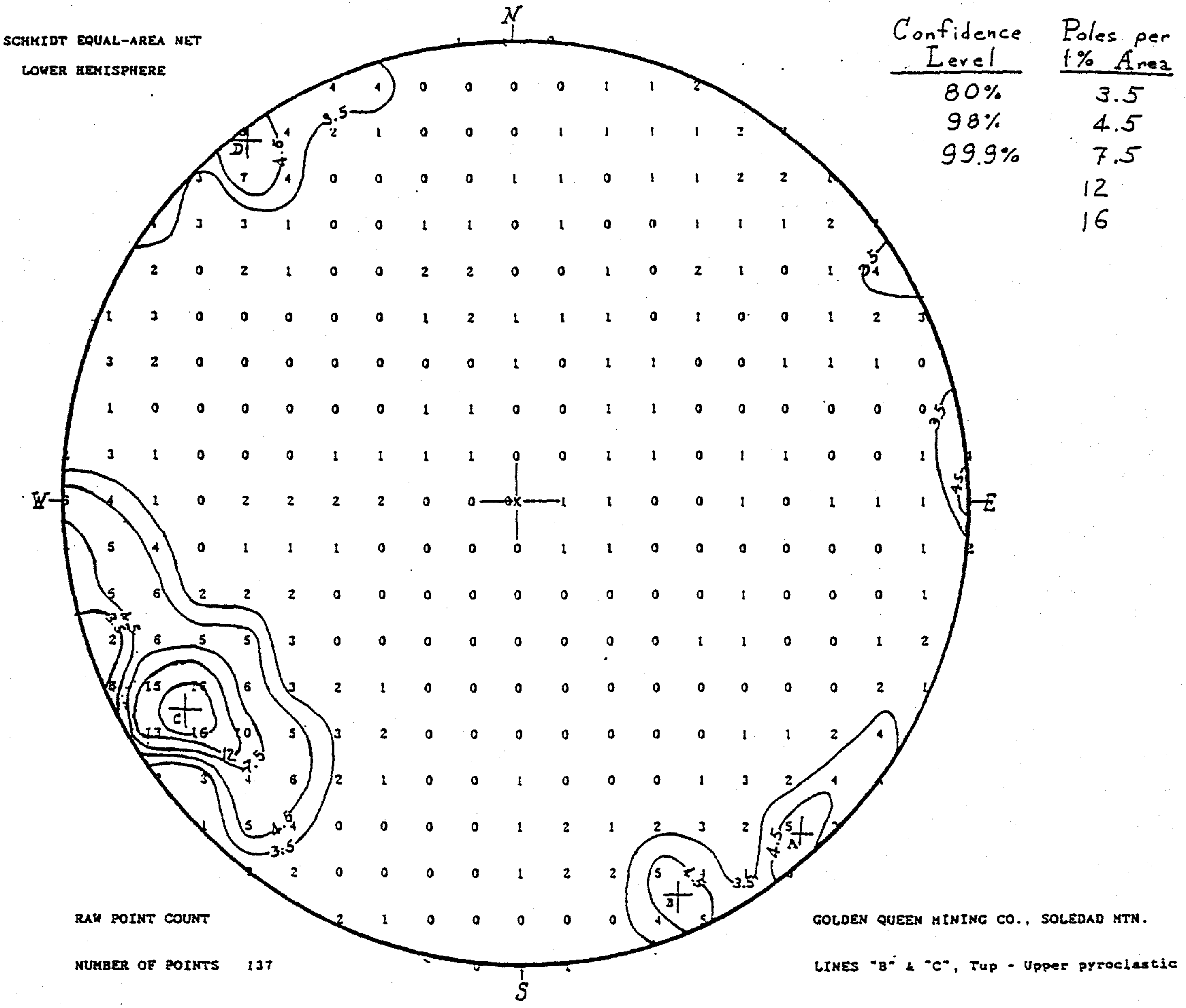
Confidence Level	Poles per 1% Area
80%	3
98%	4
99.9%	6

Figure B-10. Schmidt equal-area plot of Detail Lines A + H fractures.



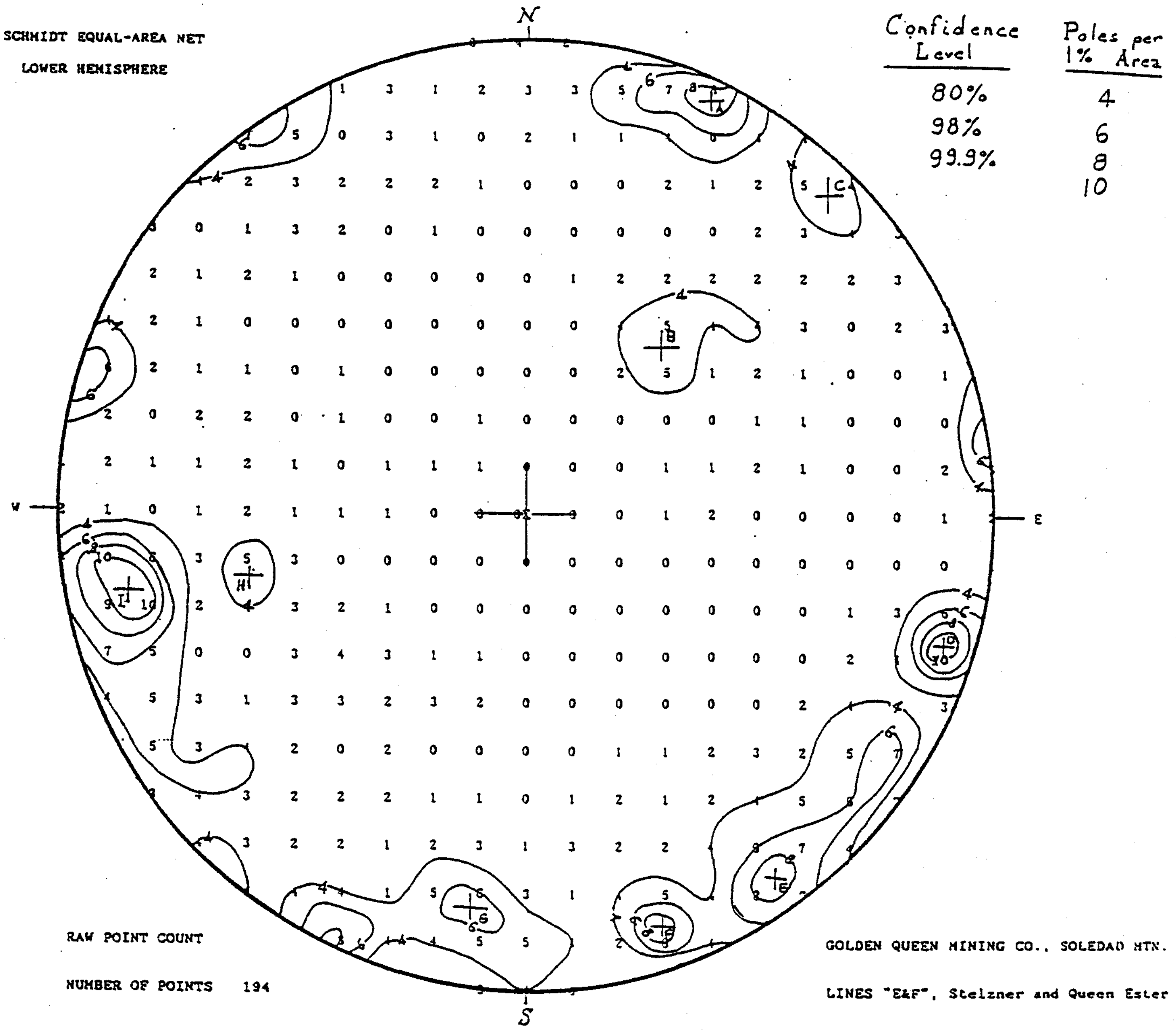
Confidence Level	Poles pe 1% Ar
80%	4
98%	6
99.9%	8.5
	11
	15

Figure B-11. Schmidt equal-area plot of Detail Lines B + C fractures.



Confidence Level	Poles per 1% Area
80%	3.5
98%	4.5
99.9%	7.5
	12
	16

Figure B-12. Schmidt equal-area plot of Detail Lines E + F fractures.



Confidence Level	Poles per 1% Area
80%	4
98%	6
99.9%	8
	10

APPENDIX C

WEDGE-SHEAR FRACTURE INTERSECTION CONSTRUCTIONS

Figure C-1. Wedge intersection construction for Detail Line A fracture sets, see Figure B-1.

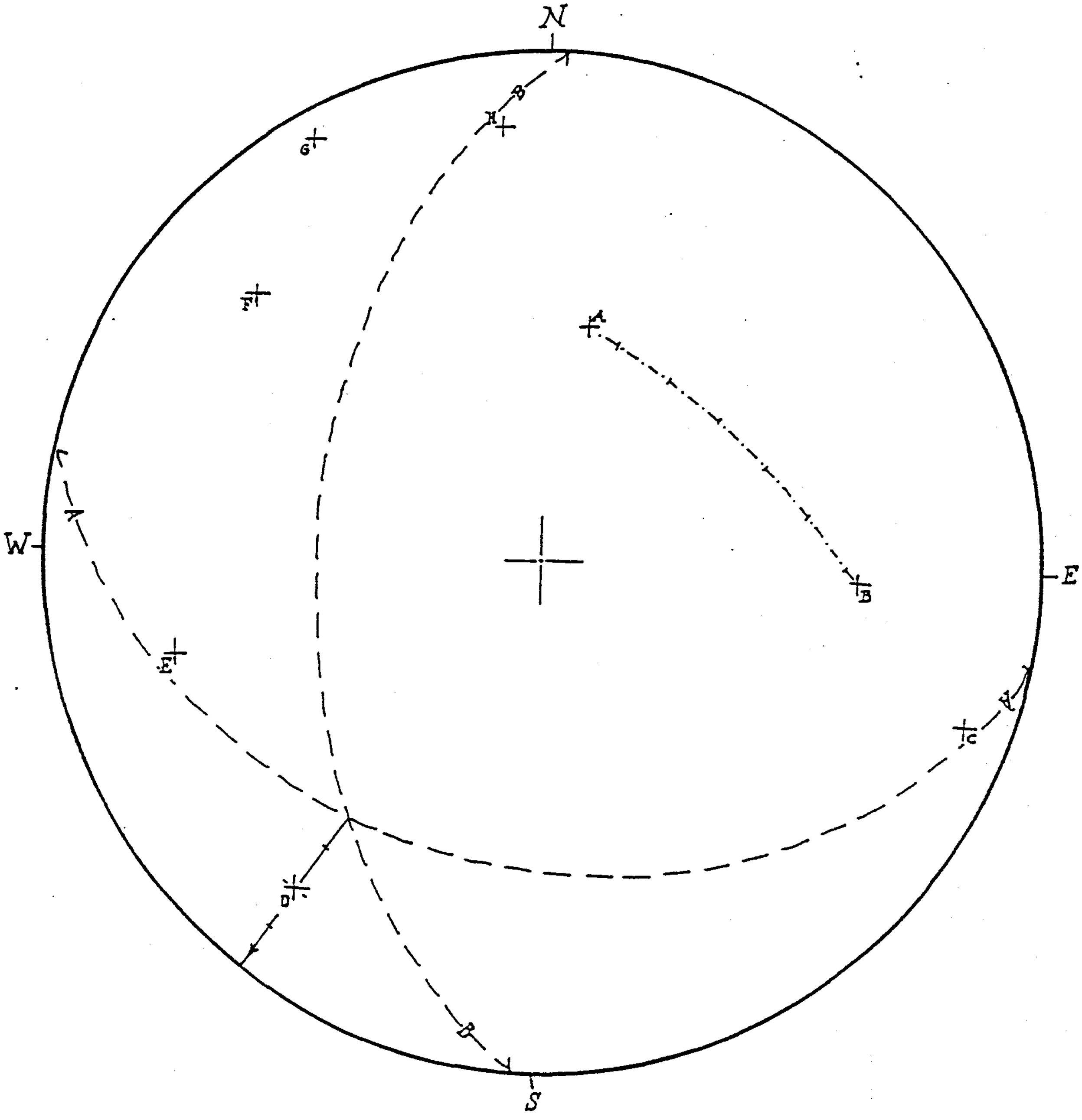


Figure C-2. Wedge intersection construction for Detail Line D fracture sets, see Figure B-4.

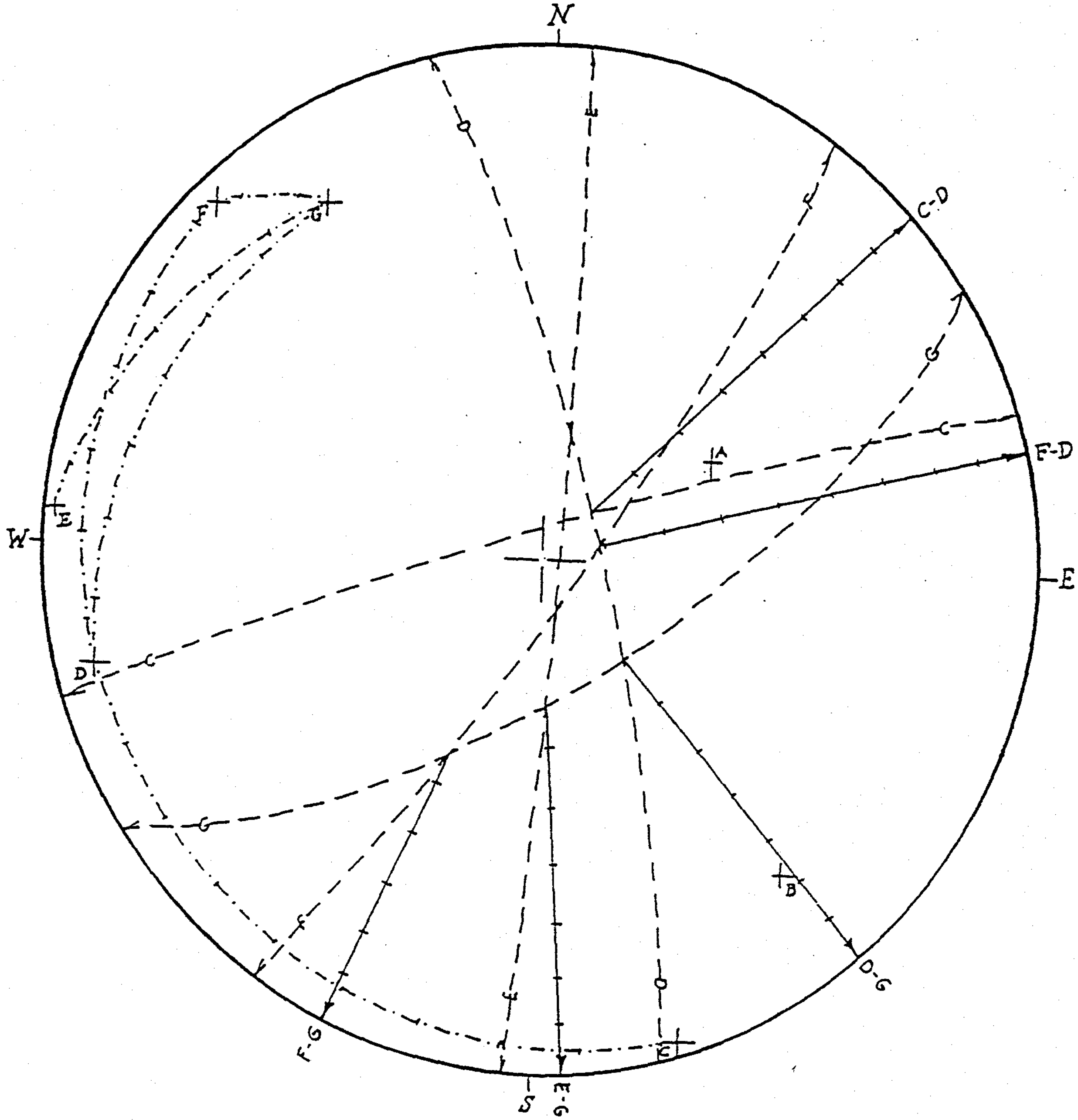


Figure C-3. Wedge intersection construction for Detail Line G fracture sets, see Figure B-7.

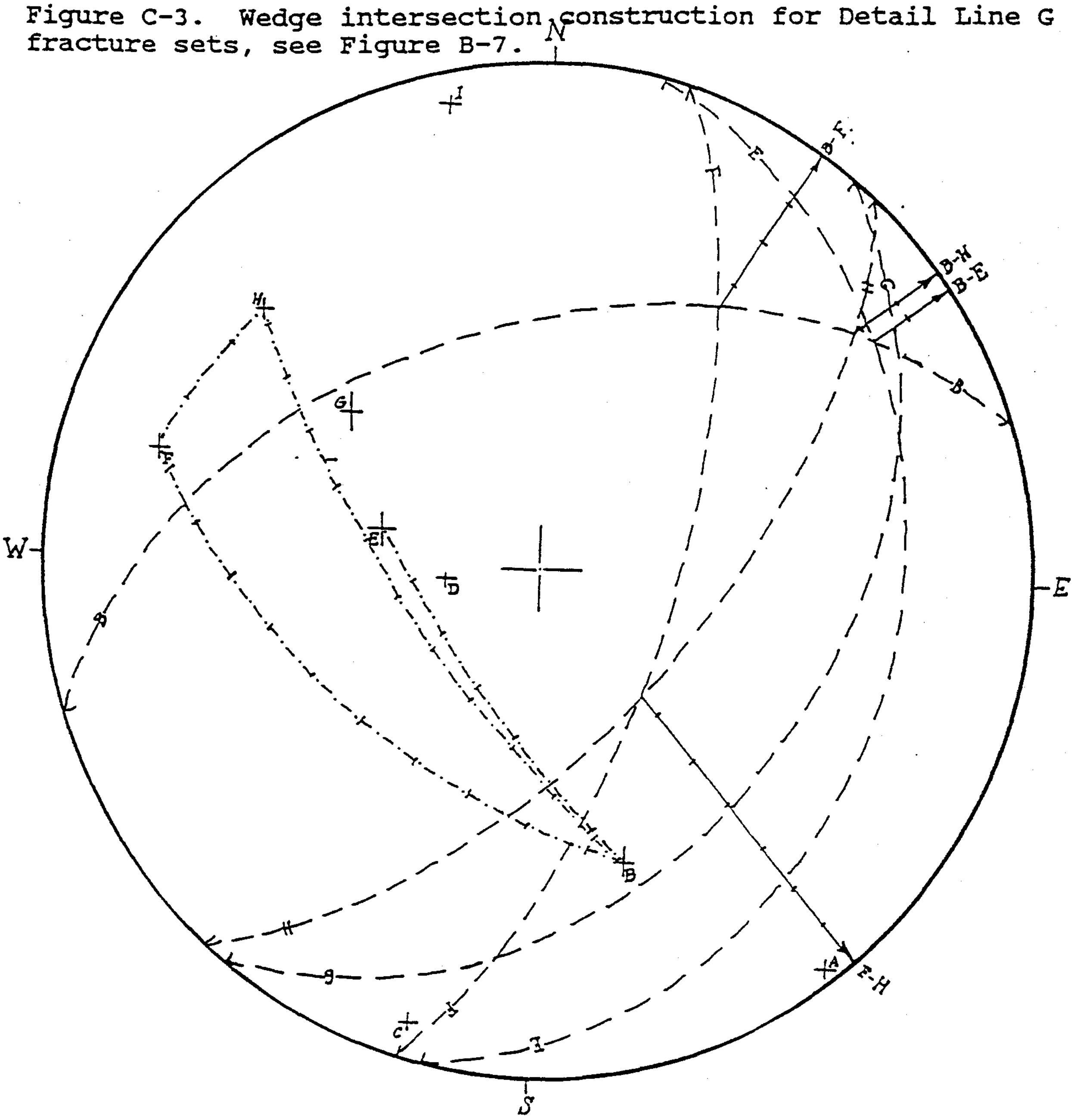


Figure C-4. Wedge intersection construction for Detail Line I fracture sets, see Figure B-9.

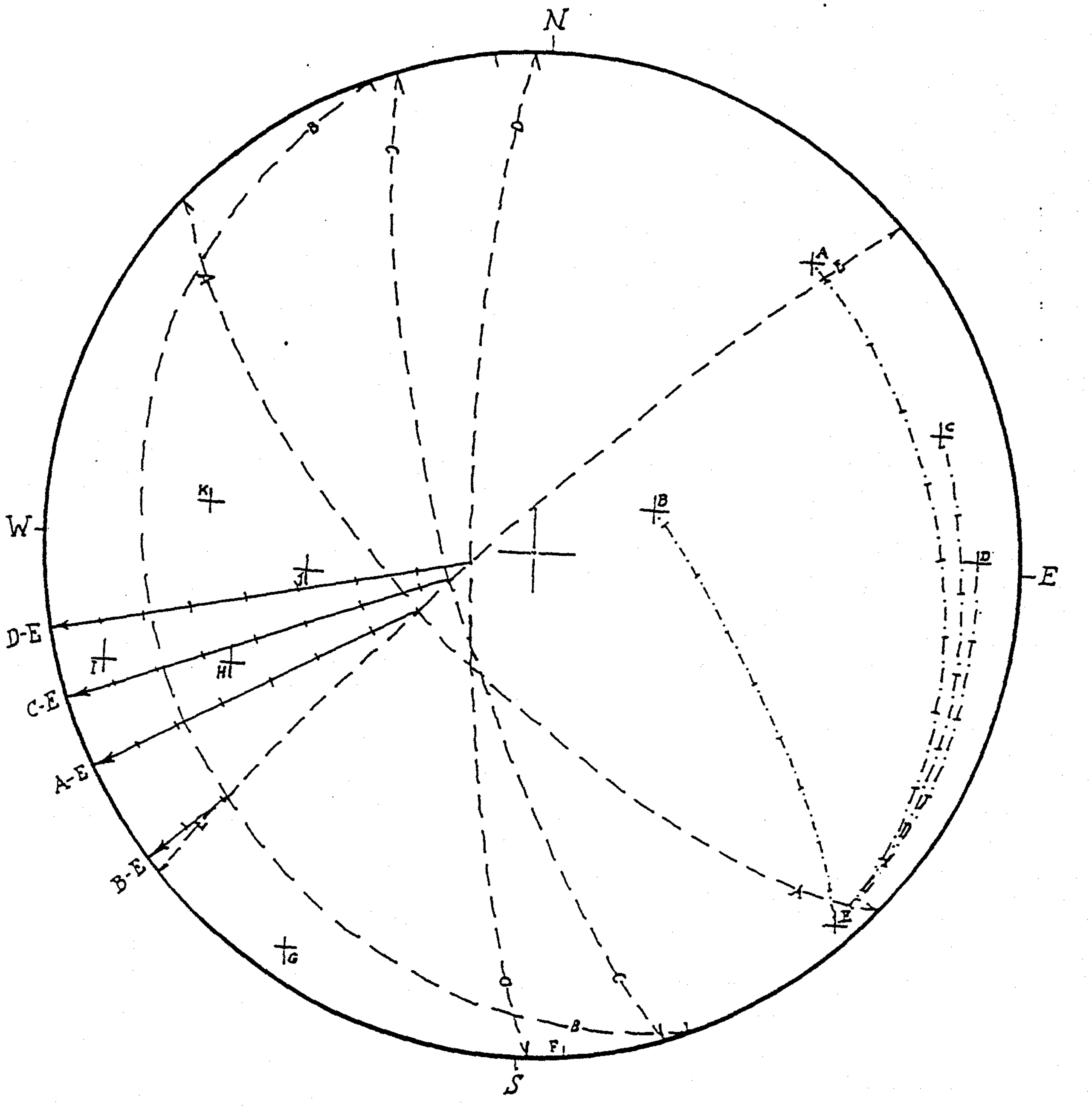


Figure C-5. Wedge intersection construction for Detail Lines B + C fracture sets, see Figure B-11.

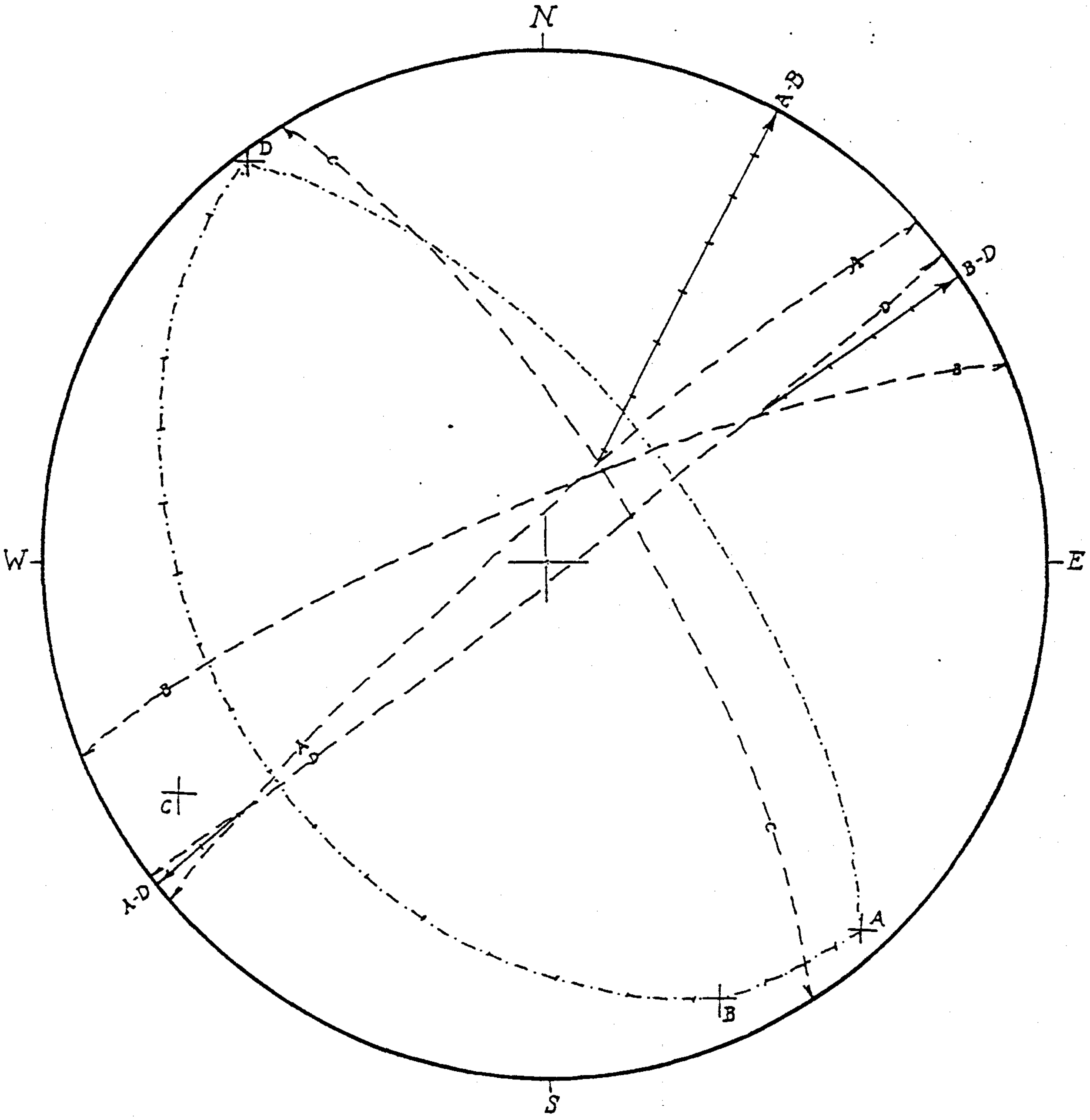
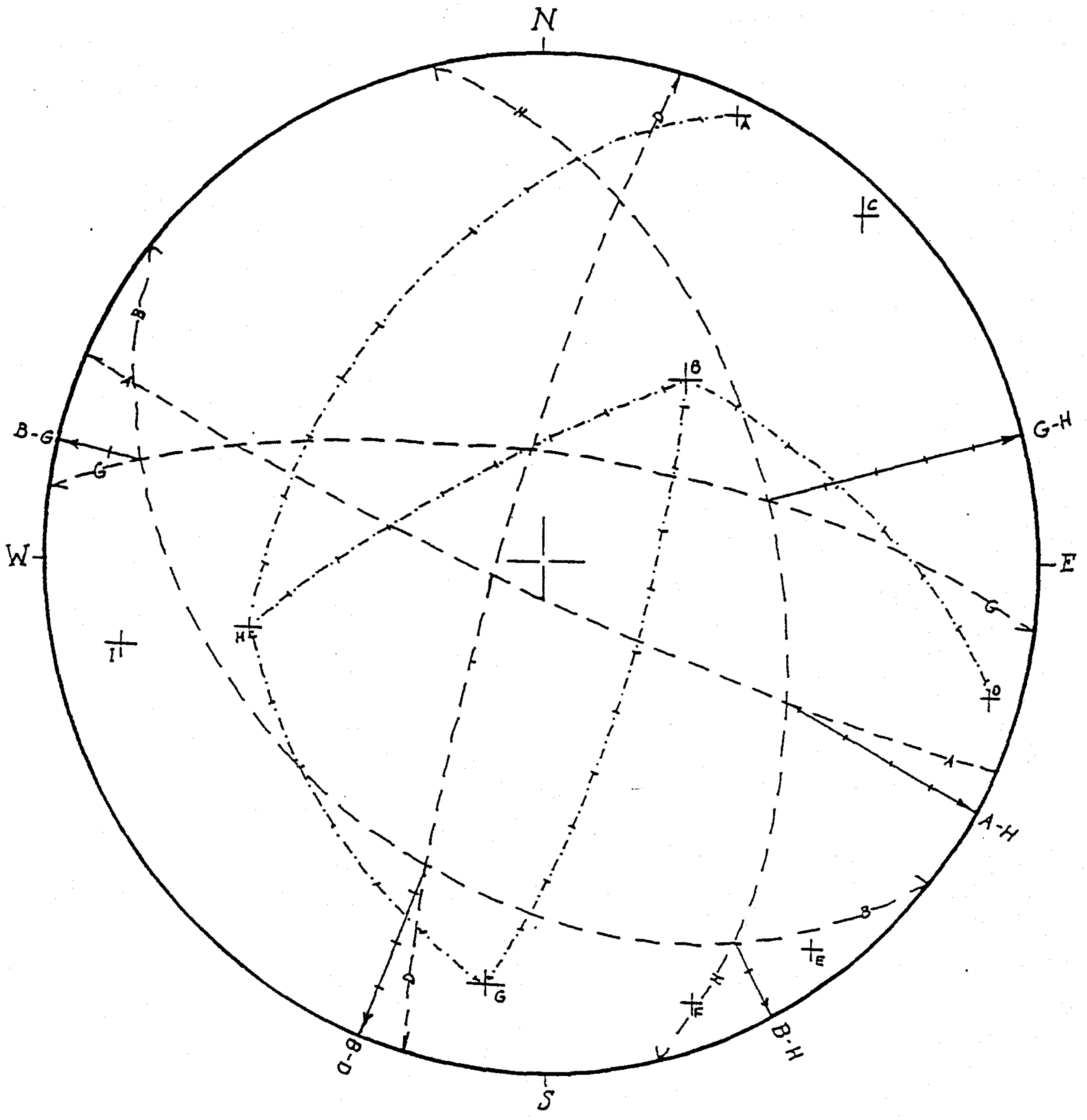


Figure C-6. Wedge intersection construction for Detail Lines E + F fracture sets, see Figure B-12.



APPENDIX D

DETAIL LINE FIELD DATA FRACTURE MAPPING SHEETS

203.

Date ____

Detail Line A ; Bearing 96° ; Plunge NW

Location ROAD ABOVE WAREHOUSE Page 1 of ____

No.	Tape Distance	Strike	Dip	Trace Length	Fracture		Remarks
					Type	Filling	
1	19	N36E	63SE	13'	Fault	Breccia Gouge	6" Filling
2	48	N22E	82NW	15'	Joint		
3	42-82	N29W	44NE	40'	Joint	Gouge	2" Filling
4	45-89	N19W	65NE	44'	Joint	Gouge	1" Filling
5	70-79	N14W	60NE	9'	Joint	mud	1/2"
6	7	N19W	79NE	1			Flow banding trend
7	12	N7W	74NE	0.5			" " "
8	6	N22W	79SW	1	Joint		
9	7	N39E	71SE	3	Joint		Tight
10	7.5	N59E	77SE	3	Joint		Tight
11	8	N63E	81SE	4	Joint		"
12	6.5	N9W	79SW	1	"		" Yes, West
13	7	N9E	63NW	1	"		" Yes, East
14	9	S74E	8NE	2	"		Tight
15	8	N84E	72SE	2	"		" 16=10" above 14
16	9.5	S16E	70NE	1.5	"		"
17	9	S59E	11NE	2	"		" 17 = 12" below 14
18	9.5	N69E	73SE	1	"		"
19	10.5	N61E	87SE	4	Shear Fault	Gouge	1/2"
20	12	N13W	72NE	3	Fault	Gouge	1"
21	14.5	S6E	53SW	12	Joint		Tight
22	15	N58E	87SE	2	Joint		Tight
23	16.5	N40E	59SE	5	Joint		Tight
24	18.5	N8E	84NW	2	Joint		Tight
25	22.5	N56W	85NE	1	Joint		Tight

203.

Date ______

Detail Line A ; Bearing 96° ; Plunge ______

Location ROAD ABOVE WAREHOUSE Page 2 of 4

Look for 35 mark on cut

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	26.5	N22E	75NW	0.5	Joint		Tight
2	29.5	N46E	65SE	1	Joint		Tight
3	34.0	126°	70NE	2'	J	—	Tight
4	34.7	143°	76NE	3'	J	—	Tight
5	35.4	19°	83NW	10'	J	—	Tight
6	36.1	136°	68NE	2'	J	Qtz	1/4" THICK Tight
7	39.4	68°	29SE	2½'	J	—	Tight
8	39.6	164°	63NE	3½'	J	—	Tight
9	41.0	71°	28SE	2'	J	—	Tight
10	42.8	68°	90	2½'	J	—	Tight
11	42.3	186°	88NW	½'	J	—	Tight
12	45.7	134°	67NE	1'	J	—	Tight
13	45.7	43°	62NW	1'	J	-	Tight
14	46.8	33°	74NW	1'	J	-	Tight
15	47.2	101°	74SW	3'	J	-	Tight
16	48.3	162°	76NE	4'	J	-	Tight
17	50.2	86°	82SE	2'	J	-	Tight
18	50.2	147°	62SW	1'	J	-	Tight
19	50.5	92°	84NE	1"	J	-	Tight
20	51.9	198°	85NW	1½'	J	-	Tight
21	51.9	175°	69NE	5'	J	-	Tight
22	52.7	151°	58SW	1'	J	-	Tight
23	55.2	88°	68SE	1½'	J	-	Tight
24	55.2	164°	59NE	3'	J	-	Tight
25	55.4	44°	79NW	½'	J	-	Tight

N36°E from 312, 27.5 feet

N6°E bearing of baseline

203.

Date

Detail Line A ; Bearing 96° ; Plunge

Location ROAD ABOVE WAREHOUSE Page 3 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture		Remarks
					Type	Filling	
1	55.7	55°	64SE	2½'	J	–	Tight
2	56.9	168°	62NE	1'	J	–	Tight
3	57.4	203°	86NW	2'	J	–	Tight
4	58.8	186°	88NW	3'	J	–	Tight
5	58.8	188°	60SE	6'	J	–	Tight
6	61.1	242°	72SE	1½'	J	–	Tight
7	62.0	72°	68SE	2'	J	–	Tight
8	62.5	293°	86NE	2'	J	–	Tight
9	63.4	54°	88SE	1'	J	–	Tight
10	63.9	40°	74SE	3½'	J	–	Tight
11	63.9	172°	53NE	3'	J	–	Tight
12	65.0	12°	61NW	2½'	J	–	Tight
13	65.8	73°	67SE	3'	J	–	Tight
14	66.0	164°	84NE	1½'	J	–	Tight
15	66.0	109°	44SW	1'	J	–	Tight
16	66.0	260°	90	4'	J	–	Tight
17	66.5	19°	64NW	2½'	J	–	Tight
18	66.9	81°	52SE	2'	J	–	Tight
19	67.7	73°	82NE	3'	J	–	Tight
20	67.7	315°	68NE	2½'	J	–	Tight
21	68.6	101°	36SW	3'	J	–	Tight
22	69.0	102°	52SW	3'	J	–	Tight
23	70.3	99°	36SW	3'	J	–	Tight
24	69.8	84°	87NE	2'	J	–	Tight
25	70.9	19°	84NW	4'	J	–	Tight

203.

Date ______

Detail Line A ; Bearing 96° ; Plunge ______

Location ROAD ABOVE WAREHOUSE Page 4 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	71.4	16°	78NW	3'	J	—	Tight
2	71.6	58°	66SE	2'	J	—	Tight
3	72.2	321°	43NE	1/2'	J	—	Tight
4	72.8	77°	60SE	1'	J	—	Tight
5	72.8	272°	76NE	2'	J	—	Tight
6	73.2	164°	44SW	1'	J	—	Tight
7	74.0	198°	72NW	5'	J	—	Tight
8	74.1	344°	54NE	10'	J	—	Tight
9	74.9	294°	82NE	2'	J	—	Tight
10	75.6	183°	54NW	3'	J	—	Tight
11	76.0	256°	69SE	2'	J	—	Tight
12	76.5	66°	47SE	1'	J	—	Tight
13	77.1	199°	69NW	1 1/2'	J	—	Tight
14	77.5	174°	53SW	1'	J	—	Tight
15	78.5	84°	78SE	1'	J	—	Tight
16	80.6	191°	83NW	4'	J	—	Tight
17	81.5	324°	77NE	1'	J	—	Tight
18	83.2	322°	90	1'	J	—	Tight
19	83.8	24°	78SE	1'	J	—	Tight
20	84.3	316°	84SW	1'	J	—	Tight
21	84.6	51°	64SE	3'	J	—	Tight
22	85.6	62°	83NW	4'	J	—	Tight
23	85.9	329°	90	2'	J	—	Tight
24	86.4	60°	84SE	4'	J	—	Tight
25	86.9	178°	78SW	2 1/2'	J	—	Tight

203.

Date 2/20/95

Detail Line B ; Bearing 116 ; Plunge 2°

Location 46' @ 85° from GQ352 UPPER SADDLE Page 1 of 2

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	0	51°	90	1	J		
2	0	51°	81SE	2	J		
3	4	328°	72NE	2	J		
4.	6	111	85NE	2	J		
5	6	111°	85SW	4	J		
6	9	57°	71NW	4	J		
7	9	328°	87SW	2	J		
8	9	57°	87°SE	6	J		
9	13	336°	90	2	J		
10	13	43°	18SE	2	J		
11	15	332°	87SW	10	J		
12	16	5°	87SE	3	J		
13	17	71°	89SE	4	J		
14	18	72°	88SE	4	J		
15	20	10°	27SE	6	J		
16	20	78°	64NW	6	J		
17	23	336°	47NE	2	J		
18	25	332°	53NE	5	J		
19	25	66°	87SE	5	J		
20	25	326°	76°SW	6	J		
21	28	67°	84SE	10	J		
22	33	5°	75SE	5	J		
23	34	22°	76SE	2	J		
24	34	340°	83NE	2	J		
25	35	324	87SW	14	J		

UPPER PYROCLASTIC

203.

Date 2/20/95

Detail Line B ; Bearing 116 ; Plunge 2°

Location 46'@ 85° from GQ352 UPPER SADDLE Page 2 of 2

No.	Tape Distance	Strike	Dip	Trace Length	Fracture		Remarks
					Type	Filling	
1	37	48°	79SE	1	J		
2	40	48°	74NW	3	J		
3	41	54°	80SE	2	J		
4	42	54°	80SE	4	J		
5	43	54°	80SE	4	J		
6	43	48°	90	2	J		
7	43	48°	63NW	2	J		
8	45	356°	86SW	3	J		
9	46	356°	90	3	J		@ GQ 355
10	51	56°	62NW	1	J		
11	54	39°	84SE	2	J		
12	55	336°	79SW	4	J		
13	55	86°	90	1	J		
14							ALLUVIUM
15							↓
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							

203.

Date 2/20/95

Detail Line C; Bearing 248; Plunge 2°

Location UPPER SADDLE LOWER ROAD Page 1 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	4	172°	74NE	3	J		
2	4	248°	74NW	2	J		
3	4.5	172°	75NE	3	J		
4	4.7	172°	74NE	3	J		
5	5	180°	85 E	5	FLT	BRECCIA ≤ 1/2"	3" WIDE
6	7	330°	85NE	5	FLT	BRECCIA ≤ 1/2'	18" WIDE
7	9	325°	72NE	6	J.	CLAY	1/2" WIDE
8	9	38°	90	4	J		
9	9	310°	62°SW	1	J		
10	9	310°	80°SW	1	J		
11	11	326°	56° NE	1	J		
12	11	276°	57SW	2	J		
13	12	309°	55NE	2	J		
14	13	22°	76NW	8	J		
15	14	325	74.NE	2	J		
16	15	113°	43SW	17	J	CLAY	1/2" WIDE
17	17	310°	65NE	2	J		
18	17	5°	90	1	J		
19	18	43°	73NW	2	J		
20	18	322°	72NE	5	J		
✓21	18	97°	48	2	J		
22	19	90°	52N	3	J		
23	20	346°	76NE	4	J	CLAY	1" WIDE
24	20.5	30°	90	3	J		
25	21.0	329	76NE	1	J		

203.

Date 2/20/95

Detail Line C; Bearing 248; Plunge 2°

Location UPPER SADDLE LOWER ROAD; Page 2 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	21.6	330	64° NE	2	J		
2	23	324°	67 NE	3	J		
3	23.4	31°	90	2	J		
4	24	30°	47 NW	2	J		
5	24	75°	46° SE	3	J		
6	24.4	325	75° NE	2	J		
7	26	330	80° NE	3	SHEAR		SHEAR ZONE HANGINGWALL FROM FLT
8	26.2	331	79° NE	3	SHEAR		
9	26.5	331	80 NE	3	SHEAR		
10	27.0	330	80° NE	3	SHEAR		
11	27.2	330	81° NE	5	FLT	BRECCIA ≤ 1/2"	BRECCIA ZONE 14".
12	28.6	334	81° NE	2	JT		
13	29	334	58 SW	1	J		
14	29.3	334	81° NE	3	J		
15	30	45	65° SE	7	J		
16	30	319	90°	2	J		
17	30.2	21°	78° SE	6	FLT	BRECCIA ≤ 1/2"	BRECCIA ZONE 5" THICK
18	32.5	308	31 SW	1	J		
19	33.0	341	64 NE	5	FLT	GOUGE	1 inch thick
20	34.3	336	77 NE	3	J		
21	34.3	248	82 NW	1	J		
22	34.4	325	24 SW	1	B		FLOW BANDING
23	35.2	322	78 NE	2.5	J	CLAY	1/2" thick
24	35.2	311	51 SW	2	J	CLAY	1" thick
25	35.2	356	49 NE	10	FLT	BRECCIA ≤ 3"	3.5 ft thick

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Date 3/1/95

Detail Line C ; Bearing 248 ; Plunge 2°

Location UPPER SADDLE LOWER ROAD Page 3 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	39.5	338	52 NE	6	J		
2	40.3	69	40 SE	1	J		
3	41	39	84 NW	25	J		
4	42.3	194	15 NW	3	J		
5	42.8	322	69 NE	1.5	J		
6	43.5	316	62 NE	1	J		
7	43.5	245	71 NW	7	J		
8	46.0	304	56 NE	1	J		
9	48.4	323	72 NE	6	J		
10	48.6	356	32 NE	1	J		
11	49.8	338	70 NE	4	J		
12	50.3	283	74 SW	1	J		
13	54.0	304	87 NE	5	J	CLAY	1/2" THICK
14	54.4	26	88 SE	7	J		
15	57.7	306	87 NE	4	J		
16	58.0	265	31 SE	4.5	B		FLOW BEDDING
17	58.7	331	78 NE	2	J		
18	58.8	334	77 NE	2	J		
19	58.9	330	77 NE	2	J		
20	59.6	325	75 NE	4	J		
21	60.1	329	79 NE	4	J		
22	60.3	44	74 SE	13	J		
23	61.0	311	74 NE	2	J		
24	62.4	319	61 NE	3	J		
25	63.2	358	45 NE	2	J		

203.

Date 3/3/95

Detail Line C ; **Bearing** 248 ; **Plunge** 2°

Location UPPER SADDLE LOWER ROAD **Page** 4 **of** 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	63.5	0	68 W	1	J		
2	64.2	319	65 NE	3	J		
3	64.2	294	39 SW	3	J		
4	65.6	316	50 NE	2	J		
5	65.6	296	69 SW	1	J		
6	66.4	313	62 NE	2	J		
7	68.4	336	73 NE	5	FLT	BRECCIA ≤1"	4" THICK
8	70.0	32	83 NW	7	J		
9	70.6	35	84 NW	2	J		
10	71.6	310	74 NE	1	J		
11	72.2	311	76 NE	1	J		
12	72.8	311	72 NE	2	J		
13	72.8	265	68 NW	6	J		
14	74.3	326	71 NE	2	J		
15	74.8	16	90	1	J		
16	75.3	342	77 NE	3	J		
17	77.3	346	68 NE	5	FLT	GOOD [illegible] BRECCIA	≤6" [illegible] 77.3 - 79.5 2.2 THICK
18	80.4	358	85 NE	2	J		
19	82.3	354	80 NE	2	J		
20	82.4	245	78 NW	2	J		
21	85.0	306	73 SW	3	J		
22	85.2	332	63 NE	6	J		
23	86.0	252	74 NW	3	J		
24	88.3	48	87 NW	7	J		
25	88.6	352	84 NE	3	J	CLAY	6" Thick

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203.

Date 3/15/95

Detail Line D ; Bearing 126° ; Plunge 0

Location NW RIDGE UPPER ROAD

Page 1 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	0	336	83SW	30.0	V/FLT	QTZ	4" QTZ VEIN/FAULT
2	0	49	65 NW	3	J	—	
3	1	46	84SE	4	FB	—	FLOW BANDING (FB)
4	1	46	84SE	4	J	—	
5	1	79	38 NW	1	J	—	
6	2,2	71	89 NW	1	J	—	
7	2.9	358	90	3	V	QTZ	1/2" WIDE
8	2.9	49	4	0.5	J	—	
9	3.5	26	87 SE	3.0	FB	—	
10	6.1	45	86 SE	3.0	J	—	
11	6.2	55	4	1	J		Joint Set are every 4-6" (over 4')
12	8.3	342	84SW	8	V	QTZ	1/2" WIDE
13	11	340	28SW	3	J	—	
14	12.4	52	88 NW	5	J	—	
15	12.6	83	78 NW	4	J		
16	13.6	71	82 SE	4	J		
17	13.6	75	26 SE	2.5	J		
18	15.0	86	86 SE	4	J		
19	15.4	351	78SW	6	J		
20	16.0	139	20 SE	2	J		
21	16.6	56	79NW	5	J		
22	18.0	19	90	8	J		
23	18.2	316	34NE	3	J		
24	20.4	11	86 SE	2.5	J		
25	20.4	296	54NE	1	J		

203.

Date 3/15/95

Detail Line D ; Bearing 126 ; Plunge 0°

Location NW RIDGE UPPER ROAD

Page 2 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	20.6	358	86SW	1	J	—	
2	20.6	100	73NE	1	J	—	
3	21.5	328	32SW	3	J	—	
4	21.7	328	26SW	1	J	—	
5	22.8	8°	84NW	6	J	QTZ	1/4" WIDE
6	22.8	72°	88SE	6	J	—	
7	23.2	336	64SW	1	J	—	
8	24.2	6°	86SE	4	J	—	
9	24.2	302	84SW	3	J	—	
10	25.6	354	73SW	6	J	—	
11	26.0	338	28SW	2	J	—	
12	26.6	66	72NW	1	J	—	
13	27.1	71	74NW	3	J	—	
14	28.6	321	46SW	3	J	—	
15	28.9	20	46NW	2	J	—	
16	29.0	38	23SE	1	J	—	
17	29.0	106	73NE	2	J	—	
18	31.2	343	75NE	3	J	—	
19	31.6	346	87SW	5	J	—	
20	32.0	58	72. SE	6	J	—	
21	32.2	342	82NE	5	J	QTZ	1/2 inch WIDE
22	32.2	118	72NE	11	J	—	
23	32.6	352	63NE	2	J		
24	32.8	352	77NE	1	J		
25	33.0	63	83SE	3	J		

203.

Date 3/16/95

Detail Line: D ; Bearing 126 ; Plunge 0°

Location NW RIDGE UPPER ROAD

Page 3 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	34.3	64	64 SE	1	J	—	
2	34.3	326	48 SW	2	J	—	
3	34.8	85	87 SE	2	J	—	
4	38.0	346	39 SW	6	J	—	
5	38.4	349	43 SW	6	J	—	
6	38.6	53	73 SE	1	J	—	
7	39.0	75	82 NW	6	J	—	TIGHT
8	39.4	56	67 SE	3	J	—	
9	41.4	78	88 SE	5	J	—	TIGHT
10	41.7	347	71 NE	4	J	—	
11	42.0	323	36 SW	2	J	—	
12	42.7	66	88 SE	4	J	—	
13	43.7	356	60 NE	2	J	—	
14	44.0	82	87 SE	2.5	J	—	
15	44.8	357	81 NE	2	J	—	
16	45.0	8	90	2	J	—	
17	45.6	342	77 NE	3	FB	—	FLOW BANDING
18	46.5	55	74 SE	3	J	—	
19	47.4	60	32 SE	1	J	—	
20	47.4	331	70 NE	4	J	—	TIGHT
21	48.5	328	54 SW	3	J	—	
22	48.7	74	73 SE	1	J	—	
23	49.0	342	35 SW	1	J	—	
24	49.6	356	25 NE	2	J	—	
25	51.1	70	88 NW	3.5	J	—	

Date 3/16/94

Detail Line D ; Bearing 126 ; Plunge 0°

Location NW RIDGE UPPER ROAD Page 4 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	52.3	98	83SW	3	J	—	
2	53.0	70	78NE	2	J	—	
3	54.8	344	85SW	3	J	—	
4	56.0	78	71NE	6	J	—	
5	56.0	346	84NE	8	J	—	
6	56.9	40	44SE	2	J	—	
7	56.9	40	90	2	J	—	
8	57.0	84	76NE	3	J	—	
9	57.5	344	73NE	3	J	—	
10	57.5	8	70SW	1	J	—	
11	58.4	331	35SW	2	J	—	
12	59.0	71	86SE	2	J	—	
13	59.0	102	64SW	1	J	—	
14	59.2	356	80	3	FB	—	FLOW BANDING
15	59.8	54	72NW	1	J	—	
16	59.9	81	77NW	2	J	—	
17	60.5	345	71SW	3	J	—	
18	61.1	86	78NW	2	J	—	
19	61.1	311	43SW	2	J	—	
20	61.1	109	79SW	1	J	—	
21	61.9	304	54NE	3	J	—	
22	62.4	8	34SE	2	J	—	
23	63.0	54	62NW	2	J	—	
24	63.9	46	73NW	2	J	—	
25	64.3	50	67NW	2	J	—	

203.

Date 5/9/95 JES

Detail Line E ; Bearing ; Plunge 1

Location Top of Queen Ester Page 1 of

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	Qtz Vein 0-2 1/2	345°	76°NE	6'	2 1/2 Qtz	wide Vein	Bend @ 30.4' 0-44': @ 11° plunge; Bear = 29 - @ ; Bear =
2	2 1/2	57°	74°NW	1'	J	None Tight	
3	3	41°	80°NW	10'	1" wide Qtz Vein		
4	5	341°	78°NE	4'	J	Qtz	1/8" filling
5	5 1/2	57°	66°SE	2'	J	Tight	
6	8 1/2	31°	84°NW	3	J	Tight	
7	8 3/4	296°	88°NE	1/2	J	Tight	
8	9	22°	90°	10'	J	Tight	
9	11.4	329°	72°NE	13'	Vein	6"	Banded Qtz vein
10	11.7	46°	86°NW	3'	J	Tight	
11	13	28°	78°NW	1'	J	Tight	
12	12.7	36°	72°SE	7'	J	Tight	
13	12.8	357°	80°SW	1'	J	Tight	
14	15	53°	78°SE	3'	J	Tight	
15	17.5	112°	29°NE	2'	J	1/16" Qtz filling	
16	18.8	316°	76°NE	3'	J	Tight	
17	20	66°	67°SE	3'	J	Tight	
18	22.2	350°	49°NE	1'	J	Tight	
19	22.3	119°	78°NE	1.5'	J	Tight	
20	26.7	323°	50°NE	8'	J	Qtz	1" filling
21	28.8	2°	87°SE	1'	J	Tight	
22	29	126°	85°NE	2'	J	Tight	
23	30	49°	77°SE	3'	J	Tight	
24	31.2	131°	84°NE	1.5'	J	Tight	
25	32.7	75°	58°NE	2'	J	Tight	

No offsets measured from Tape to structure. Tape distance taken at right angle to outcrop terminous of structure.

203.

Date 5/9/95

Detail Line E; Bearing ______; Plunge ______

Location Top of Dunn Ester Page 2 of ____

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	33'	144°	54°SW	1.5'	J	Tight	5 Joints in this Joint Se w/ 4" separating.
2	35.2'	89°	63°NW	0.5'	J	Tight	
3	36.3	59°	90°	2.5	J	Tight	
4	36.5	348°	52°NE	1'	J	Tight	
5	37.6	49°	84°NW	2'	J	Tight	
6	38.3	55°	88°NW	½'	J	Tight	
7	38.5	314°	89°SW	½'	J	Tight	
8	41.2	64°	81°NW	½'	J	Tight	
9	43.6	73°	88°SE	2	J	Tight	
10	46	322°	88°NE	8'	J	Tight	+44' @ 331° Bear, 11° plunge
11	47	88°	78°NW	8'	J	Tight	
12	48	330°	84°NE	5'	J	Tight	
13	50.6	71°	86°NW	7' +	J	Tight	
14	50.8	7°	74°SE	1'	J	Tight	
15	50.8	330°	57°SW	1'	J	Tight	
16	52	69°	81°NW	3'	J	Tight	
17	52.2	354°	86°NE	7'	Qtz 6"	Vein wide	
18	55.3	59°	83°NW	2.5'	J	Tight	
19	57	101°	65°NE	2'	J	Tight	
20	58.5	332°	87°NE	2'	J	Tight	
21	58.5	346°	51°NE	3'	J	Tight	
22	59.8	73°	80°NW	3'	J	Tight	
23	61	340°	81°NE	3.5'	J	Tight	
24	61.9	77°	87°NW	3	J	Tight	
25	61.9	356°	51°NE	4	J	Tight	

203.

Date 5/9/85

Detail Line E ; Bearing ; Plunge

Location Top of Queen Ester Page 3 of

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	61.9	341°	81° NE	3'	J	Tight	
2	63.4	71°	79° SE	3'	J	Tight	
3	65.5	45°	62° SE	1'	J	Tight	
4	669	92°	78° SW	3'	J	Tight	
5	66.9	322°	40° SE	2'	J	Tight	
6	67.5	32°	34° NE	3'	J	Tight	
7	68.4	341°	46° NE	8'	J	Tight	1/2 Qtz filling
8	68.4	344°	85° NE	2'	J	Tight	
9	69.1	55°	83° NW	2'	J	Tight	
10	71.1	326°	87° NE	6'	J	Tight	
11	71.1	88°	86° NW	2'	J	Tight	
12	71.4	74°	59° SE	4'	J	Tight	
13	74.6	320°	88° NE	1.5'	J	Tight	
14	76.2	49°	59° NW	1'	J	Tight	
15	76.7	351°	35° SW	1.5'	J	Tight	
16	76.7	353°	42° NE	1.5'	J	Tight	
17	78.2	12°	90°	12'	J	6" filled w/highly Vuggy Qtz	
18	79.3	330°	74° NE	6'	J	1/2" Qtz filling	
19	81.2	35°	80° NW	9'	J	Tight	1/4" Qtz stringer
20	81.7	310°	35° SW	3'	J	Tight	
21	84.6	68°	86° NW	2'	J	Tight	
22	86	96°	86° NE	15'	J	Tight	Very Prominent in Road cut
23	90.4	18°	56° SE	3'	J	1/4" Qtz filling	
24	92.7	18°	88° SE	6'	J	Tight	
25	94.4	98°	66° NE	5'	J	Tight	

203.

Date 5/9/95

Detail Line B ; Bearing ; Plunge

Location Top of Queen Ester

Page 4 of

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	98.2	19°	68°NW	8'	J	1/2" Vuggy Qtz	
2	98.7	72°	69°SE	2.5'	J	Tight	
3	102.7	314°	69°NE	2'	J	Tight	
4	103.5	49°	78°NW	10'	J	Tight	
5	107.3	102°	82°NE	6'	J	Tight	
6	108.5	350°	74°NE	16'	Vuggy 6"	Qtz vein	
7	108.6	308°	39°SW	1'	J	Tight	Joint set, repeats every 12" X 4"
8	109.6	346°	68°NE	5'	J	Tight	
9	110.8	298°	44°SW	2.5'	J	Tight	
10	113	21°	68°SE	1'	J	Tight	Sample F tag
11	113.9	46°	84°NW	15'	J	Tight	
12	116.0	5°	54°SE	2'	J	Tight	
13	117.8	34°	67°NW	4'	J	Tight	
14	119.9	349°	74°NE	15'	Prominent Qtz	Vein (12")	Nearing Black Area
15	ORE ZONE						
16	153.6	99°	77°NE	20'	J	Tight	
17	171	18°	85°NW	20'	J	Tight	Sample I Tag
18	171.9	93°	70°NE	3'	J	"	
19	173	353°	87°NE	3'	J	Tight	
20	173.4	99°	74°NE	5'	J	"	
21	175.4	16°	82°NW	12'	J	"	
22	173.8	353°	26°SW	1'	J	"	
23	177.4	94°	85°NE	20'	J	"	
24	178.5	350°	82°NE	20'	J	"	
25	179.5	84°	86°SW	20'	J	"	

203.

Above Markowitz

Date 5/10/95

Detail Line F ; Bearing S40°E ; Plunge 0

Location STELZNER, TOP OF ROAD, (END) Page 1 of 4

JED = Not. EO = Int

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	0	S30°W	81°SE	1'	J	0	End of Road
2	0	N41°W	43°SW	1'	J	Tight	Joint set of 3 separated 3" spacing
3	1.3	S71°W	76°NW	1'	J	Tight	
4	2.0	N63°W	76°NE	2'	J	Tight	
5	2.3	N34°E	85°NW	1.5'	J	Tight	
6	2.7	N51°E	58°NW	2'	J	"	
7	3	N42°W	75°NE	2'	J	"	
8	4	N46°E	69°NW	1.5'	J	"	
9	4	N38°W	61°SW	1'	FB	Tight	Flow Banding = FB
10	4.5	N17°E	80°NW	1'	J	"	1" Qtz filling
11	4.5	N48°W	76°SW	2'	J	"	
12	5.6	N28°E	66°NW	2'	J	"	
13	6.2	N49°E	70°NW	1'	J	"	
14	6.2	N69°W	74°SW	1'	J	"	
15	6.6	N69°W	36°NE	1'	J	"	
16	7	N52°E	81°NW	1'	J	"	
17	7.2	N37°E	87°NW	1'	J	"	with 1/4" Qtz filling
18	7.3	N66°W	72°SW	2.5'	J	"	
19	7.6	N76°W	84°NE	2'	J	"	
20	8	N61°W	57°NE	0.5'	J	"	
21	8.2	N77°E	55°NW	0.5'	J	"	
22	9.1	N34°E	76°NW	0.5'	J	"	
23	9.5	N9°W	74°NE	1.5'	J	"	1/32" Qtz filling
24	9.9	N12°W	68°NE	1'	J	"	1/8" Qtz filling
25	10.1	N71°E	78°NW	1'	J	"	

203.

Date 5/10/95

Detail Line P ; Bearing ; Plunge

Location Stulzner, Top Of Road

Page 2 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
							S 40°E Line Bearing
1	10.8	N30°W	84°NE	1'	J	Tight	
2	10.5	N79°E	68°NW	1.5'	J	"	
3	10.6	N12°W	80°NE	1.5'	QS	"	Quartz stringer (1/4")
4	11.1	N48°W	86°SW	1'	J	Tight	
5	11.4	N4°E	26°SE	1'	J	"	
6	11.4	N36°W	77°SW	1'	J	"	
7	11.4	N61°E	71°NW	0.5'	J	"	
8	11.4	N72°W	82°SW	1'	J	"	
9	11.8	N56°E	76°NW	1.5'	J	"	
10	12.6	N61°W	88°SW	2'	J	"	
11	14	N54°E	90°	1.5'	J	"	
12	14.4	N61°W	85°SW	1'	J	"	
13							Colluvium
14	17	N77°W	81°SW	2.5'	J	Tight	
15	18.6	N75°W	54°NE	1'	J	"	
16	18.6	N14°E	83°NW	0.5'	J	"	
17	19.5	N26°W	72°SE	2'	J	"	
18	19.8	N57°W	32°SW	1.5	J	"	
19	22.2	N18°W	74°NE	1'	J	"	1/2" Qtz Vein filling
20	22.6	N46°W	71°SW	1'	J	"	
21	23.3	N54°E	90°	1.5'	J	"	
22	23.3	N34°W	65°NE	2	J	"	
23	24	N14°W	47°SW	0.5'	J	"	
24	24.5	N51°W	84°SW	4	J	"	
25	25.1	N49°W	41°SW	1.5'	FB	"	Flow Banding

203.

Date 5/20/95

Detail Line F; Bearing ; Plunge

Location Stulzive, Top of Road

Page 3 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	26.8	N82°E	83°SW	2	J	Tight	S40°E Line Bearing
2	26	N26°W	47°NE	1.5"	J	"	
3	26.1	N30°E	84°NW	2'	J	"	
4	26.5	N10°W	68°NE	2'	J	"	
5	27.7	N33°E	40°SE	1'	J	"	
6	27-7	N54°W	84°SW	4'	J	"	
7	28	N79°W	83°SW	2'	J	"	
8	28.2	N51°E	86°NW	1'	J	"	
9	29.5	N63°W	90°	3'	J	"	
10	29.5	N20°E	86°NW	0.5'	J	"	
11	30.3	N42°E	84°NW	1'	J	"	
12	30.7	N18°E	90°	1'	J	"	
13	32-3	N68°W	80°NE	2.5'	J	"	
14	32.3	N56°W	43°NE	2'	J	"	
15	32.7	N44°W	52°SW	1'	J	"	
16	32-8	N51°E	66°SE	1.5'	J	"	
17	33-6	N74°W	82°SW	2.5'	J	"	
18	33-6	N11°E	51°SE	1'	J	"	
19	34.2	N64°E	49°NW	0.5'	J	"	
20	34.3	N10°W	88°NE	2'	J	"	
21	34.7	N74°W	86°SW	2'	J	"	
22	34.7	N25°W	84°SW	0.5'	J	"	
23	35.3	N64°W	83°NE	0.5'	J	"	
24	35-3	N69°W	44°SW	2'	J	"	
25	35-3	N39°W	51°NE	1.5'	J	"	

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Date 5/10/95

Detail Line F ; Bearing ; Plunge

Location Stulzner, Top Of Road Page 4 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	36	N23°W	90°	3'	J	Tight	
2	37.8	N90°E	83°N	0.5'	J	"	
3							colluvium
4	41.5	N85°E	90°	1.5'	J	Tight	
5	41.6	N9°W	87°NE	0.5'	J	Tight	
6	41.7	N82°E	90°	0.5'	J	"	
7	42.7	N86°W	78°SW	1'	J	"	
8	43.3	N50°W	49°SW	4'	B		Bedding Contact (root flo. banding
18" Qtz Vein 9	Colluvium to 60.0 feet (44-60) 60	N24°E	83NW	2'	QV	18"	+44 feet New Line Bearing = S28°E
10	61.4	N32°W	82°SW	1'	J	Tight	
11	61.4	N41°W	52°NE	1'	J	"	
12	62.3	N29°E	86°SE	2'	J	"	
13	62.5	N69°W	83°SW	3'	J	"	
14	63.6	N46°W	36°NE	1.5'	J	"	
15	64.2	N5°W	90°	4'	J	"	1/4" Qtz Vein
16	65	N90°E	78°S	2'	SZ	Gouge	3" Gouge in shear Zone
17	67	N67°W	88°SW	0.5'	J	Tight	
18	68.3	N18°W	57°NE	1'	J	"	Followed by 17' Colluvium
19	85.8	N61°W	64°NE	1'	J	"	
20	86.3	N18°E	82°SE	1.5'	J	"	
21	86.8	N81°W	67°NE	0.5'	J	"	
22	88.2	N71°W	86°NE	0.5'	J	"	
23	88.2	N49°E	14°SE	1'	J	"	
24	88.4	N16°E	77°NW	1'	J	"	
25	89.0	N61°W	83°SW	3'	J	"	
	90.5	N66°E	67°NW	2'	J	"	

"G"

203.

Date 9-14-95

Starts @ DH* ___
Detail Line DH. 8n· 7 ft. from tie; Bearing S 30° W; Plunge -3° NE

Location ___ Page 1 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	2	N5°W	59 NE	2.8'	J	–	rough surface
2	3	N5° E	NW E 37 ~~SW~~	1.5'	J	–	flat surface
3	4	N74°E	~~SE~~ E 83 ~~SW~~	1.2'	J	–	rough surface
4	5	N50°E	SE E -89 ~~SW~~	1.2'	J	"	" "
5	5	N78°E	SE E -65 ~~SW~~	1.8'	J	–	flat surface
6	6	N89°E	-90°	.5'	J	–	rough surface
7	6	N15°E	SE E -71° ~~SW~~	2.8	J	–	rough sfc.
8	7	N72°E	-55NW	1.1	J	–	flat sfc.
9	9	N45°E	-85°NW	2.1	J	–	" "
10	9	N21°E	NW E -21° ~~SE~~	1.1	J	–	" "
11	9	N23°E	SE E -53° ~~SW~~	4.2	J	–	rough surface
12	10	N10°W	-28°NE	.7	J	–	flat
13	10	N47°W	-31 SW	.3	J	–	"
14	10	N55°W	-66°SW	.8	J	–	"
15	10	N28°W	-10°NE	1.0	J	–	"
16	11	N64°E	-70°NW	.9	J	–	"
17	11	N50°E	NW -84° ~~SE~~ E	.8	J	–	"
18	11	N45°E	-26 ~~SE~~ E	.9	J	–	"
19	11	N45°W	-12°NE	1.0	J	–	"
20	13	N68°E	-83°SE	3.5	J =	–	"
21	13	N20°W	-90°	3.1	J	–	rough surface
22	13	N5°W	-10°NE	2.2	J	–	" "
23	13	E-W	-57°N	.3	J	–	" "
24	15	N45°W	-72°SE	2.2	J	–	" "
25	16	N32°E	-32°SE	4.1	J	–	flat surface

203 6"

Date 9-14-95

Detail Line 6 ; Bearing S 30° W ; Plunge -3° NE

Location

Page 2 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	16	N15°W	-13° NE	1.2	J	-	flat surf.
2	17	N72°E	-85 NW	1.8	J	-	rough surface
3	18	N45°E	-31° SE	1.0	J	-	" surf.
4	20	N83E	-85 NW	1.3	J	-	flat
5	20	N72 W	-72 NW	1.5	J	-	
6	20	N5 E	-62 SE	.4	J	-	flat
7	21	N50E	-50 SE	.9	J	-	"
8	21	N50E	-82 NW	.8	J	-	"
9	22	N70E	-84 SE	1.2	J	-	rough surface
10	23	N53E	-55 SE	1.5	J	-	flat surf.
11	23	N20E	-76 NW	.9	J	-	"
12	23	N38E	-40 SE	.8	J	-	"
13	24	N33E	-35 SE	1.6	J	-	"
14	25	N77E	-90°	2.5	J	-	"
15	29	N20 E	-44 SE	7.5	J	-	rough surface
16	26'	N75E	-88 SE	4.5	J	-	"
17	28'	N41E	-45 SE	3.8	J	-	flat
18	30'	N75E	-79 SE	2.0	J	-	"
19	30'	N-S	-22° E	.5	J	-	"
20	30'	N44E	-45 SE	6.0	J	-	Rough surface
21	33'	N64°E	-82 NW	2.5	J	-	"
22	31'	N27W	-62 SW	1.5	J	-	flat surface
23	31'	N16W	-43 SW	2.8	J	-	"
24	33'	N40E	-40 SE	4.4	J	-	rough surface
25	35'	N85E	-51 SE	5.0	J	-	"

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Detail Line 6 ; Bearing ; Plunge

Date 9/14/95

Location

Page 3 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	40	N40E	-45SE	9.0'	J	-	rough undulating surface
2	40	N66E	-53NW	1.0	J	-	flat surface
3	43	N43W	-65NE	1.8	J	Q, CA	flat surface
4	43	N40E	-63SE	2.0	J	-	rough undul. surf.
5	46	N40E	-78SE	2.8	J	-	"
6	46	N29E	-43SE	4.5	J	-	rough, undul. surf.
7	48	N51E	-83SE	2.2	J	-	flat surface
8	49	N13E	-29SE	5.8	J	-	rough, undulating surface
9	52	N52E	-82SE	3.2	J	-	flat surface
10	52	N30E	-37SE	5.8	J	-	rough, undulating surface
11	53	N55W	-40SW	1.2	J	-	rough surface
12	51	N2°E	-80° NW E	1.5	J	-	"
13	54	N60°W	-63NE	8.5	FA	gouge(¼"	4' wide FA zone, parallel fine's in FW, 2"- 6" apart, to 58° along trace
14	60	N57°W	-76SW	1.5	J	—	rough surface
15	61	N10E	-80 NW E	.9	J	-	" "
16	65	N74W	-85NE	2.0	FA	CA, Q	thin FA undulating surface
17	66	N75E	-82SE	2.0	FA	CA, Q	thin FA
18	68	N45W	-73NE	3.0	FA	CA, Q.	thin FA
19	68	N60E	-60SE	4.2	J	-	rough undulating surface
20	69	N75E	-50NW	3.8	FRAC	CA, Q	thin fracture
21	70	N87W	-82NE	1.3	J	-	flat surface
22	71	N78W	-70SW	1.8	J	-	" "
23	69	N74E	-50NW	3.4	J	—	" "
24	75	N80E	-87SE	3.2	J	-	rough surface
25	76	N70E	-74SE	2.2	J		" "

76

203. 7' 4"

Date 9-14-95

Detail Line G ; Bearing ; Plunge

Location ; Page 4 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	77	N20E	-34SE	1.4	J	–	flat surface
2	77	N64E	-78SE	.6	J	–	" "
3	77	N10E	NW -48 ~~SE~~ E	.8	J	–	" "
4	82	N75W	-82NE	2.0	J	–	" "
5	78	N62W	-88NE	2.0	J	–	X " " from 78'-102' Bearing = N43°E Plunge = -2°NE
6	108	N28E	-53SE	1.3	J	–	X from 102'—143' Bearing = N52E plunge = -2°NE
7	109	N65E	-84SE	1.5	J	–	Flat surface
8	108	N38W	-35NE	1.1	J	–	" "
9	112	N2E	-27SE	1.5	J	–	" " tight
10	112	N5E	-75 ~~SW~~ NWE	1.0	J	–	" " "
11	112	N78W	-90°	2.2	J	–	" " "
12	115	N84E	-70SE	2.5	J	–	rough undulating surface
13	116	N77E	-33SE	1.2	J	–	flat surface
14	11.	N85E	-86SE	5.5	J	–	" "
15	120	N80E	-90°	4'	J	–	
16	145	N30W	-45NE	1.0	J	–	from 143'-156' BEARING = N70°E PLUNGE = -3°NE
17	145	N82E	-83SE	1.4	J	–	flat surface
18	145	N5E	-64 ~~SW~~ NWE	.5	J	–	"
19	151	N20E	-86SE	2.5	J	–	"
20	151	N68W	-82NE	2.5	J	–	"
21	151	N37W	-65SW	1.2	J	–	rough surface
22	153	N13E	-63SE	2.5	J	–	flat surface
23	155	N15E	-72SE	2.7	J	–	"
24	155	N88E	-83SE	1.5	J	–	"
25	156	N15E	-17SW E	1.0	J	-	"

203.

Detail Line "H"; Bearing Ⓐ 315° 0'-38' Ⓑ 348° 38'-89'; Plunge Ⓐ 0 Ⓑ +3°

Date 9-17-95

Location West Side of ridge

Page 1 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	10	80°	-90°	8'	Frac.	½" Q	
2	12	175°	-88°NE	4'	"	1½" Q	
3	12	95°	-90°	3'	Frac.	—	
4	17	255°	-75°NW	6'	"	Q	multiple thin, parallel frac's.
5	17	340°	SW W -75°	4'	"	½" Q	
6	18	355	SW W -78 ~~SE~~	4'	"	¼" Q	
7	19	348	SW W -78 ~~SE~~	5'	"	⅛" Q	
8	20	230	-68NW	6'	FA	Q, gouge	
9	21	346	-90°	2'	Frac.	Q	
10	22	95°	NE E -82	3'	FA	Gouge	
11	25	304°	-90°	2'	Frac.	—	
12	25	286	-77NE	2'	Frac.	¼" Q	
13	27	354°	-85E	1½'	"	—	
14	29'	352°	-82°E	4'	"	—	
15	29	35°	-1.8 SE	0.5'	J	—	Tight
16	29	225°	-69NW	1'	J	—	"
17	29	109°	NE E -75 ~~NW~~	1'	J	—	"
18	32'	96°	-82NW	4'	Frac	—	Tight frac's w/ Q (~⅛")
19	34'	355°	SW E -86 ~~NW~~	1.5'	frac.	Q	
20	34'	345°	NE E -89 ~~NW~~	1.5'	"	"	
21	34'	25°	-70°	2'	"	"	
22	39'	347°	-83NE	1.5'	"	½" Q	LINE SEGMENT "B" 348°, +3° 38' → 89'
23	39'	44°	-69NW	2.5	"	—	
24	47'	356°	-88E	2.5	"	½" Q	
25	47'	245°	-90°	2.5'	"	—	multiple thin, parallel frac's.

From center of Big White Rock @ intersection 195' @ 270° to start of Line.

Line segment "A". ST. 315° PLUNGE 0° .0' — 38'

Rx = flowbanded rhyolite, bd. generally striking N-S, dipping 45-70°E

203. "H"

Detail Line H ; Bearing Ⓑ 348° 38-89' Ⓒ 348° 89-140 ; Plunge Ⓑ +3° Ⓒ -14°

Date 9-17-95

Location

Page 2 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	50'	279 ~~279°~~	-86NE	3'	Frac	—	
2	50'	356°	-80E	3½'	"	—	
3	53'	30°	-12NW	1'	"	—	
4	53'	169°	-88E	1.5'	"	—	
5	54'	245°	-87°NW	1.2'	J	—	Tight
6	57'	288	-85NE	4'	Frac	—	
7	59'	3°	-90°	3.5'	"	—	
8	59'	75°	-70SE	4'	Frac	Q	
9	61'	73°	-83NW	5½'	"	—	
10	61'	348	-74SW	3'	"	—	
11	70'	15-° 15	-79NW	1.5'	"	Q	
12	70'	183°	-87W	1.5'	"	1" Q	
13	76'	94°	-85°S	25'	FA	Gouge, Brx	Fx ~12" wide, multiple thin, ∥ frac's.
14	82'	345	-70 ~~NW~~ E	1.2'	Fc	QTZ	
15	82'	55°	-90°	2.2'	Fc	—	
16	82'	155	-84NE	6'	FC	2" Q	
17	88'	343°	-74NE	2'	FC	½" Q	
18	88	60°	-64NW	3½'	FC	—	
19	89	307	-85NE	2'	"	—	
20	89	351	-86E	4'	"	—	
21	89	170	-83 ~~NW~~ SW E	4'	VEIN	6" Q	
22	95	170	-89 ~~NW~~ SW E	4.5'	"	2" Q	Line Segment "C" 89' - End
23	93	163	-67SW	1.4	Frac	—	AZ=348°, Plunge = -14°
24	93	168	-77NE	2.8	frac	—	
25	104	246	-80SE				

203.

Date 9-18-95

Detail Line "H" ; Bearing 348° ; Plunge -14°

Location

Page 3 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	106	348	-86 SW	3.5'	VEIN	5" Q	
2	107	349	-79SW	7.5'	"	1" Q	
3	110	272	-90	2.5	frac	–	} multiple // frac's & some rock
4	109	274	-81 ~~NE~~ ~~SE~~ SW	6'	"	–	shattering btwn. these frac. surfaces
5	112	300	-17SW	2'	"	–	
6	113	286	-16SW	3'	"	–	
7	114	283	-18SW	.8'	"	–	
8	114	350	-90	1'	"	Q	
9	114	270	-78S	2'	"	1/4" Q	
10	116	344	-88NE	13'	Vein	1/2" Q	
11	116	342	-86SW	1.5'	"	2" Q	
12	116	75	-75NW	2.5	"	1" Q	
13	116	79	-78NW	2'	frac	–	
14	117	290	-25SW	.9	"	–	
15	118	115	-16SW	.8'	"	–	
16	125	84	-83NW	3'	frac	–	
17	127	355	-90°	4'	Vein	4' Q	
18	130	352	-90	2'	"	3" Q	
19	130	130	-19NE	1.4'	J	–	
20	130	192	-72SE	.9'	J=	–	
21	130	167	-76NE	1.5	J	–	
22	131	300	-72SW	1.5	frac	–	
23	131	351	-80SW	1.5	"	–	
24	132	88	-78NW	2'	"	–	
25	133	276	-77SW	3'	"	local Q	

203.

Detail Line "H" ; Bearing 348° ; Plunge -14°

Date 9-18-95

Location

Page 4 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	140	336	-80NE	3.5'	VEIN	Q	
2	140	252	-76NW	.8	Frac	—	
3	141	106	-57SW	3.2	"	—	
4	143	343	-74NE	3.5	"	½":Q	
5	143	37	-64SE	.9	"	Q	
6	143	233	-52SE	1.4	"	½" Q	
7	156	90°	-70N	3'	FA	3" FA Brx	
8	159	148°	-55SW	3.5'	FC	Q	
9	170'	305'	-14NE	.8'	FC	Q	
10	170	120	-80NE	1.8'	J	—	
11	169	35	-62SE	.8'	J	-	Tight
12	169	60	-62NW	1.2	J	—	"
13	169	323	-90°	1'	J	-	"
14	168	82	-85SE E	1.8'	FRAC	—	
15	171	270	-68N	1.8	FA	FA Brx,Q	
16	173	5°	-10NW	1.5	FRAC	—	
17	173	163	-87NE	2'	"	-	
18	173	325	-87SW	1.5'	"	-	
19	176	15	-52NW	5.5'	"	—	
20	176	125	-23SW	1.8	"	—	
21	178	70	-72NW	4.5	"	1¼" Q	
22	179	302	-86NE	3.5'	"	Q	
23	181	200	-48NW	2.5	J	—	
24	185'	352°	-78NE	1.8'	FRAC	—	
25	188'	325°	-68SW	5'	FRAC	Q	

203. I

Date 10-3-95

Detail Line QUARTZ LATITE Bearing 250°; Plunge +8°

Location 9620E 8693N 3283ELEV Page 1 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	1	348°	-84°NE	10'	FA	Q, gouge, hem	NOTE: Line begins @ DH GQ-165
2	3	348°	-74°SW	12'	FA	Q, FA Brx	
3	5	341°	-75NE	2'	FA	Brx, hem	
4	5	136°	-81 NE	2.5'	J	hem	
5	6	346°	-77NE	4'	FA	Brx hem	
6	7	180°	-86 W	3.5'	J	hem	
7	7	346°	-72°SW	4.5'	J	hem	
8	8	317°	-88NE	4.8'	J	hem.	
9	9	63°	-87NW	1.8'	J	–	tight
10	10	46°	-70NW	3.5'	J	hem	
11	10	139°	-74SW	1.8'	J	"	
12	11	46°	-87NW	3.5'	J	–	
13	11	52°	-78NW	3.2	J	hem	
14	13	306°	-64SW	4.5	J	hem, MnO	
15	13	219°	-86NW	.8'	J	" "	
16	14	155°	-73 SW	.5'	J	" "	
17	14'	125°	-87SW	.8'	J	" "	
18	16	137	-86 SW	3'	FA	Brx; Q	
19	17	230°	-87NW	1'	J	hem, MnO	
20	17	226°	-88NW	1.2'	J =	–	
21	17	140°	-89 SW	2'	J	–	
22	19	29.7°	-84°NE	4'	J	clay	
23	19	190°	-41°NW	1.1	J	"	
24	20	108°	-66°SW	6.5'	J	"	
25	20	53°	-41 NW	2.2	J	hem, MnO	

203. " "

Date 10-3-95

Detail Line J ; Bearing ; Plunge

Location

Page 2 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	23	155	-76°SW	.5'	J	—	
2	24	170	-83SW	4'	J	hem	
3	24	173	-87NE	4'	FA	Brx	
4	25	340	-76SW	3.5'	FA	gouge	
5	25	174	-85NE	1.8'	J	—	
6	26	68	-74NW	1.5	J	hem, MnO	
7	27	345	-86NE	1'	J	" "	
8	27	280	-87NE	2.1	J	clay	
9	28	180	-66W	1.8	J	"	
10	28	4	-24SE	1.5	J	—	tight
11	29	176	-71SW	1	J	—	"
12	29	265	-88NW	.8	J	clay	
13	30	2	-26NW	.3	J	—	tight
14	31	118	-87NE	.9	J	—	
15	32	349	-38NE	.5	J	—	tight
16	33	340	-58NE	.5	J	—	"
17	36	345	-42NE	5'	FA	Brx, hem	
18	49	321	-86NE	6.5'	J	hem	
19	49	4	-54SE	1.9	J	hem	
20	49	70	-51NW	4'	J	"	
21	53	307	-80NE	1'	J	"	
22	53	72	-88NW	1'	J	"	
23	56	350	-37NE	2'	J	"	
24	56	283	-49NE	1.5'	J	"	
25	57	209	-73SE	2.3	J	"	

203. " "

Date 10-3-95

Detail Line I; Bearing ; Plunge

Location

Page 3 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	58	0	-61 E	2.5	J	hem	
2	58	309	-82SW	2.8	J	"	
3	60	315	-69SW	2-5	J	"	
4	60	5	-32SE	4'	J	"	
5	60	45	-85NW	2.8'	J	"	
6	66	338	-64SE	.7	J	"	
7	66	270	-60N	.4	J	"	
8	68	79	-88NW	2.5	J	"	
9	68	160	-62NE	1.2	J	"	
10	72	4	-82NW	1.2	J	"	
11	72	10	-45SE	2	J	"	
12	72	52	-54NW	1.8	J	"	
13	75	6	-66SE	2	J	"	
14	75	324	-57SW	1	J	"	
15	77	345	-52SE	2	J	hem, MnO	
16	77	40	-88NW	3.8	J	" "	
17	77	309	-72SW	1.5	J	" "	
18	79	47	-77SE	1.2	J	" "	
19	79	56	-75NW	1	J	" "	
20	79	350	-47SW	1.8	J	" "	
21	104	282	-86NE	4.5	J	hem, MnO	
22	105	60	-81NW	5.5	J	" "	
23	105	4	-53SE	4	J	" "	
24	111	136	-67NE	2	J	" "	
25	111	79	-90	2	J	" "	

203. " "

Date 10-3-95

Detail Line I ; Bearing ; Plunge

Location Page 4 of 4

No.	Tape Distance	Strike	Dip	Trace Length	Fracture Type	Fracture Filling	Remarks
1	117	260	-64NW	2	√	FeOx stain	
2	118	157	-88SW	.8	√	"	
3	118	232	-48NW	1.2	√	"	
4	120	202	-76NW	3	√	"	
5	120	146	-81NE	2.5	√	", clay	
6	122	303	-90	.8	√	"	
7	122	41	-56NW	1.5	√	"	
8	124	94	-72NE	2	√	"	
9	125	201	-85NW	2.5	√	"	
10	125	199	-62SE	1	√	"	
11	129	125	-48NE	4	√	"	
12	129	22	-86NW	5	√	"	
13	129	150	-24SW	1.5	√	"	
14	131	163	-18SW	.5	√	"	
15	131	125	-55NE	2	√	"	
16	131	14	-82NW	3.5	√	1/4" Q	
17	133	128	-69NE	1.2	√	FeOx stain	
18	133	185	-86NW	1.1	√	"	
19	133	88	-44SE	1.1	√	"	
20	136	349	-19SW	.5	√	"	
21	136	118	-67NE	1.5	√	.	
22	136	46	-87NW	1.5	√	"	
23	139	84	-88SE	1.1	√	"	
24	139	1	-70NW	1.8	√	"	
25	139	337	-54NE	5.5	√	"	

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December 11, 1995

EARTHQUAKE STABILITY SUPPLEMENT

SOLEDAD MOUNTAIN PROJECT, SLOPE STABILITY ANALYSIS

by

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

The site largest maximum-credible site acceleration of 0.055 g will not be sufficient to induce failure of any of the planned 55° design slope angles on Soledad Mountain. This is true for both the highwalls along the Ultimate Pit Boundary and the pitwalls within the interconnected pits inside the Ultimate Pit Boundary. In fact, pitwall slope angles of 63.4° (two vertical to one horizontal) could resist the additional down-dip thrust from the maximum credible earthquake without triggering a slope failure. The earthquake slope stability analyses conservatively assumed not only the maximum credible earthquake but that the acceleration from that event was directed in the most adverse possible direction, parallel to the potential sliding surfaces. Table 1 presents the lowest-possible limiting equilibrium factors of safety for the planned pit highwalls, critically oriented with respect adverse to fracture orientations, with the maximum individual slope height and when subjected to the maximum credible earthquake. The relatively minor impact of the maximum credible earthquake on the calculated factors of safety for the conservative application of the earthquake acceleration can be seen by comparing Table 1 with Table 2, for the same conditions without the maximum credible earthquake acceleration applied to the slopes.

The planned pit slopes and geologic conditions are unchanged from those presented in the "Soledad Mountain Project, Slope Stability Analysis", November 8, 1995. The Tertiary rock types present in the area of the planned pit remain the Quartz Latite Porphyry (Tql), the Middle Pyroclastic Unit (Tmp), the Aphanitic Rhyolite (Tr), the Upper Pyroclastic Unit (Tup) and the Rhyolite Porphyry (Trp).

Table 1. Relative stability of planned slopes under maximum credible earthquake acceleration.

Location Information				Slope Height (ft)	Slope Angle (°)	Factor of Safety @ Confidence Level		
Side of Pit	Structural Domain	Rock Type	Slope Ident.			80%	98%	99.9%
East	11	Tup	1	800	63.4°	Failure paths >		
					55°	possible slopes		
	12	Tmp	2	850	63.4°	1.84	1.75	1.74
					55°	3.63	3.54	3.54
	1	Tql	3	400	63.4°	2.34	2.23	2.23
					55°	2.35	2.24	2.24
North	2	Tr	4	550	63.4°	2.32	2.21	2.21
					55°	2.66	2.56	2.56
Northwest	5	Tmp	10	240	63.4°	5.01	4.92	4.92
					55°	11.33	11.25	11.25
			11	180	63.4°	No failure path		
					55°			
			12	220	63.4°	6.68	6.43	6.42
					55°	8.28	8.03	8.02
West	8	Trp	9	650	63.4°	Failure paths >		
					55°	possible slopes		
South			8	1100	63.4°	Failure paths <		
					55°	residual friction		
	10	Trp	7	780	63.4°	Failure paths <		
					55°	residual friction		
			6	700	63.4°	No failure path		
					55°			
	11	Trp	5	600	63.4°	Failure paths >		
					55°	possible slopes		

Table 2. Relative stability of planned slopes, without maximum credible earthquake acceleration.

	Location Information					Factor of Safety @ Confidence Level		
Side of Pit	Structural Domain	Rock Type	Slope Ident.	Slope Height (ft)	Slope Angle (°)	80%	98%	99.9%
East	11	Tup	1	800	63.4°	Failure paths >		
					55°	possible slopes		
	12	Tmp	2	850	63.4°	1.97	1.87	1.87
					55°	3.89	3.80	3.79
	1	Tql	3	400	63.4°	2.69	2.56	2.56
					55°	2.69	2.57	2.57
North	2	Tr	4	550	63.4°	2.53	2.42	2.42
					55°	2.91	2.80	2.80
Northwest	5	Tmp	10	240	63.4°	5.37	5.28	5.27
					55°	12.19	12.09	12.09
			11	180	63.4°	No failure path		
					55°			
			12	220	63.4°	7.30	7.02	7.01
					55°	9.05	8.78	8.77
West	8	Trp	9	650	63.4°	Failure paths >		
					55°	possible slopes		
South			8	1100	63.4°	Failure paths <		
					55°	residual friction		
	10	Trp	7	780	63.4°	Failure paths <		
					55°	residual friction		
			6	700	63.4°	No failure path		
					55°			
	11	Trp	5	600	63.4°	Failure paths >		
					55°	possible slopes		

INTRODUCTION

The following analysis of planned 55° pitwall slope angles was undertaken to evaluate their stability when the acceleration from the maximum credible earthquake is applied to the potentially unstable planned slopes of the Soledad Mountain Project. The Soledad Mountain Project involves mining the interconnected orebodies shown on Figure 1. The Ultimate Pit Boundary is shown on Figure 2. Figure 2 also indicates the structural domains, areas of consistent geologic structure, defined during the geologic work preceding preparation of the "Soledad Mountain Project, Slope Stability Analysis", November 8, 1995 report. Figure 3 presents the location of critical slopes within the Ultimate Pit Boundary as defined in the November 8, 1995 report.

The potentially unstable slopes were identified and their stability analyzed under gravitational loading in the "Soledad Mountain Project, Slope Stability Analysis" report, November 8, 1995. This report adds the force developed by the maximum credible earthquake derived site acceleration to the gravitational thrust acting down the adverse structures mapped in the area of the planned Ultimate Pit Boundary and highwalls inside the planned Ultimate Pit Boundary. Adverse fractures are those which either dip out of the planned pitwalls or join with another fracture to form a wedge of rock plunging out of a planned pitwall. Figure 4 shows the plane shear and wedge failure modes analyzed. The limiting equilibrium method was used to calculate the factors of safety between the potential driving thrust and resistance to sliding. The resistance to sliding, frictional and cohesive, along an adverse fracture orientation is not affected by earthquake acceleration if the acceleration is parallel to the daylighted fracture. Any other earthquake acceleration direction reduces the down-dip thrust component.

The "Soledad Mountain Project, Slope Stability Analysis" report, November 8, 1995 presented the method of calculating the resistance to sliding when an adversely oriented fracture set is present in one of the critical slopes. The only adjustment made in this report is the addition of the earthquake produced thrust to the gravitational thrust component.

Figure 1. Interconnected planned pits within Ultimate Pit Boundary.

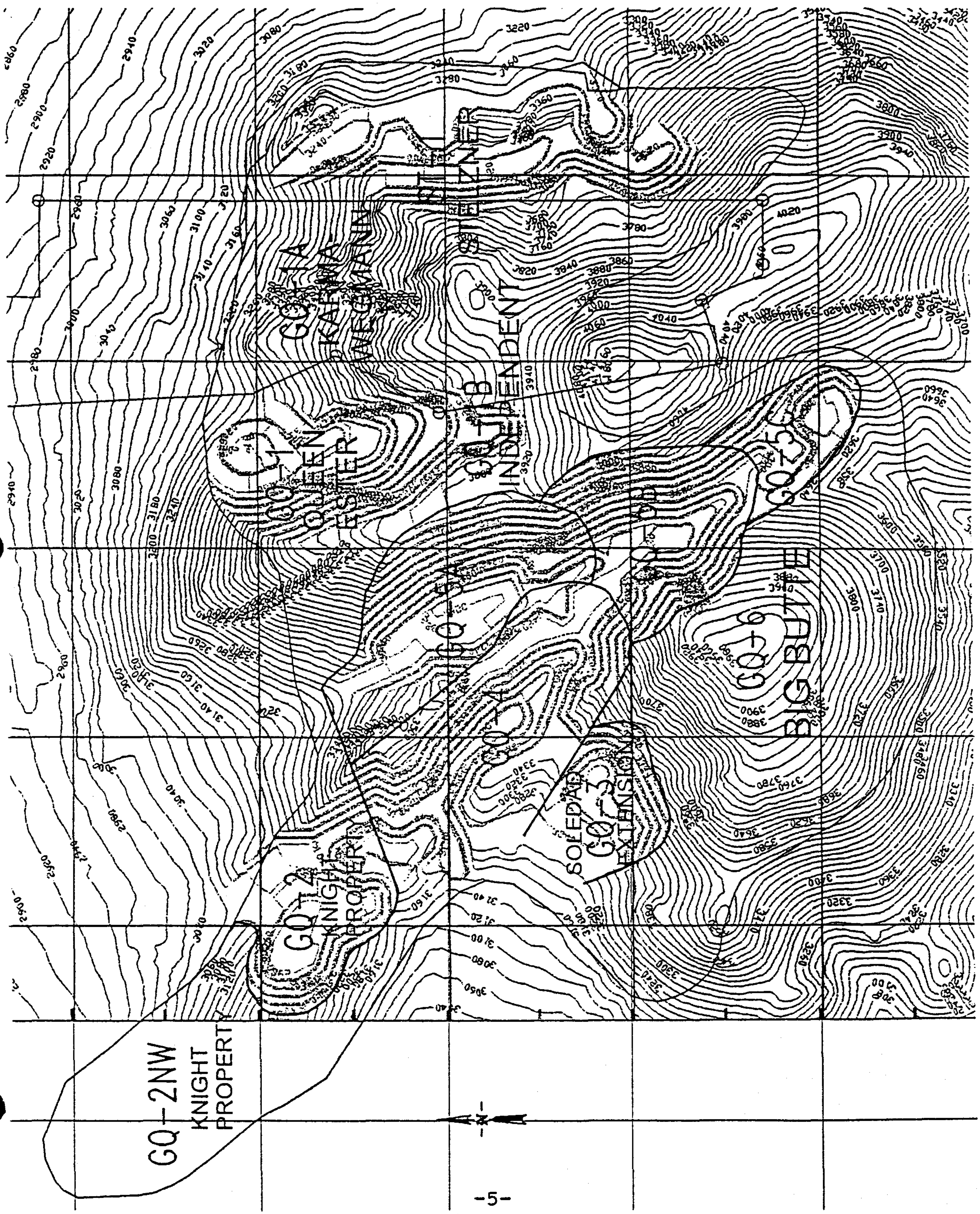


Figure 2. Structural domains for Soledad Mountain Project.

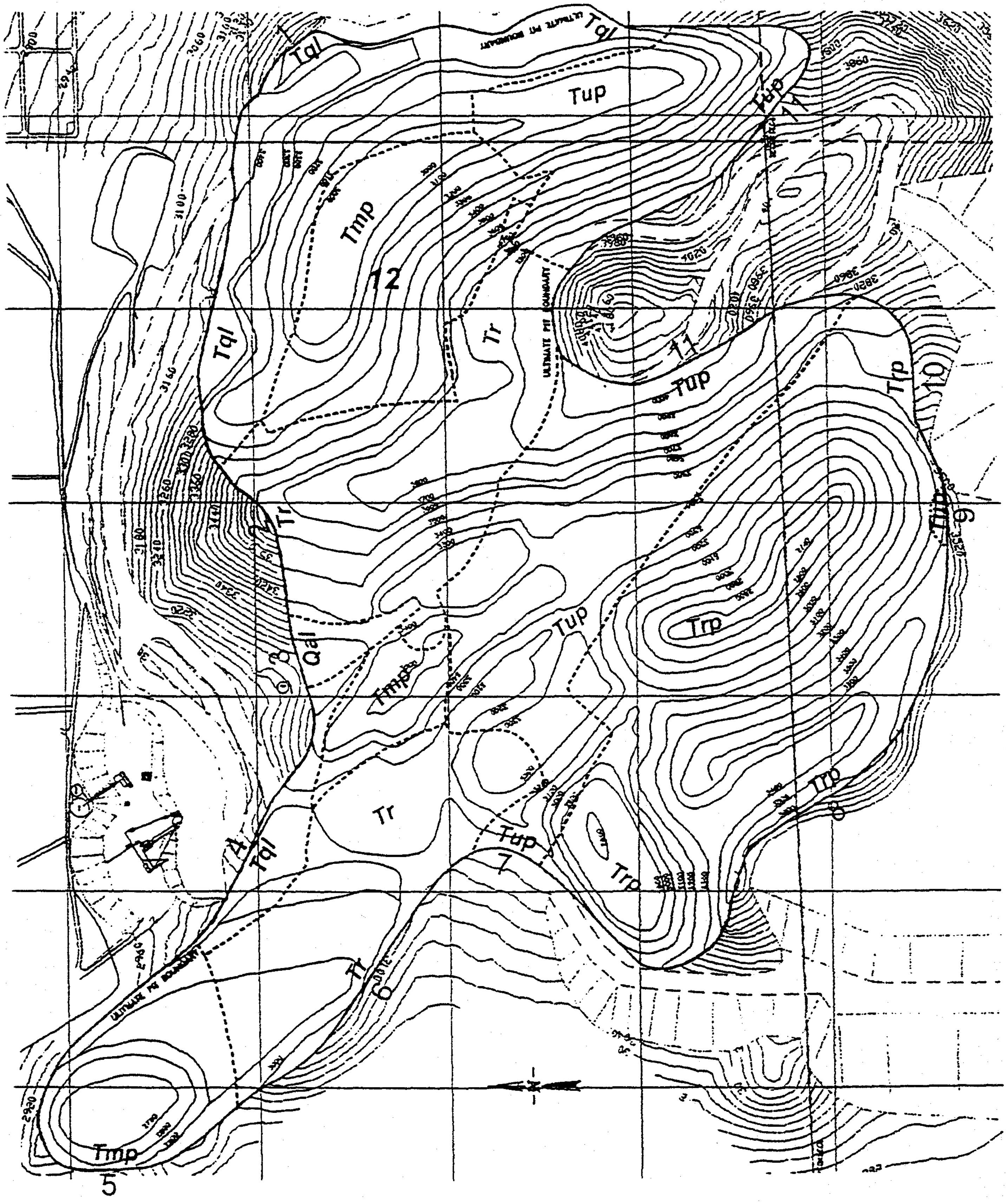


Figure 3. Critical, worst-case highwalls for Soledad Mountain Project.

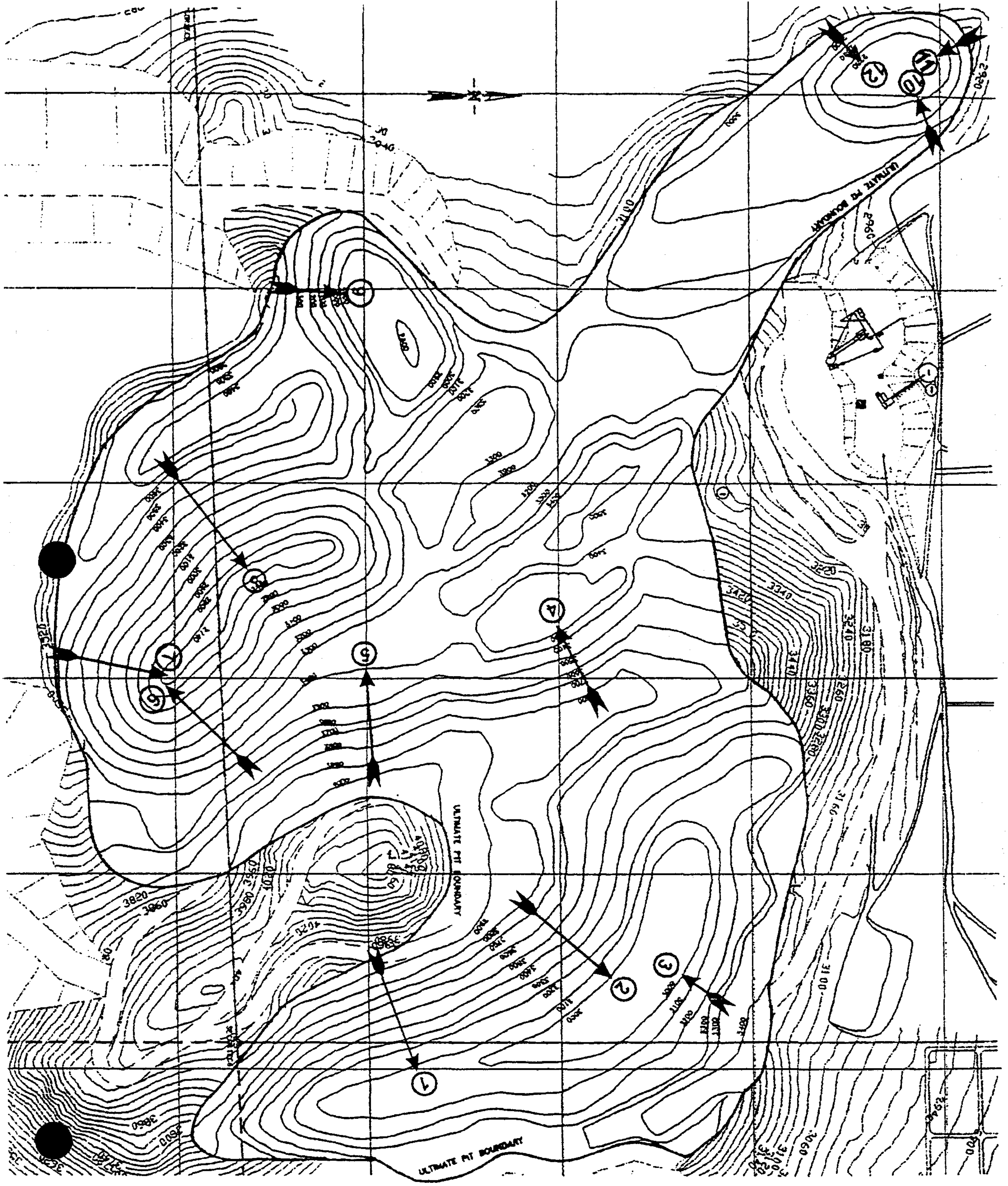
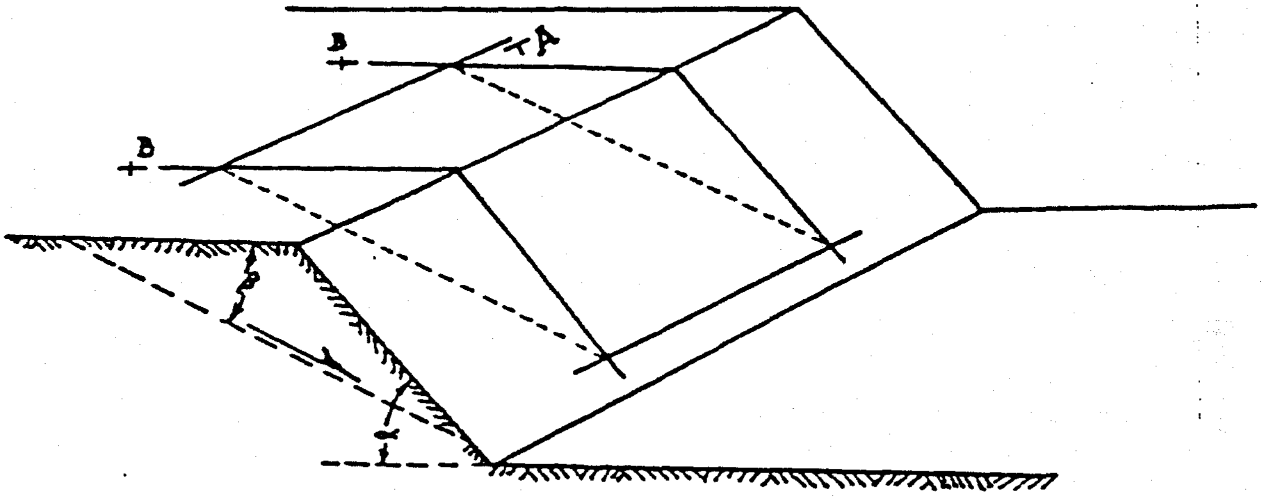
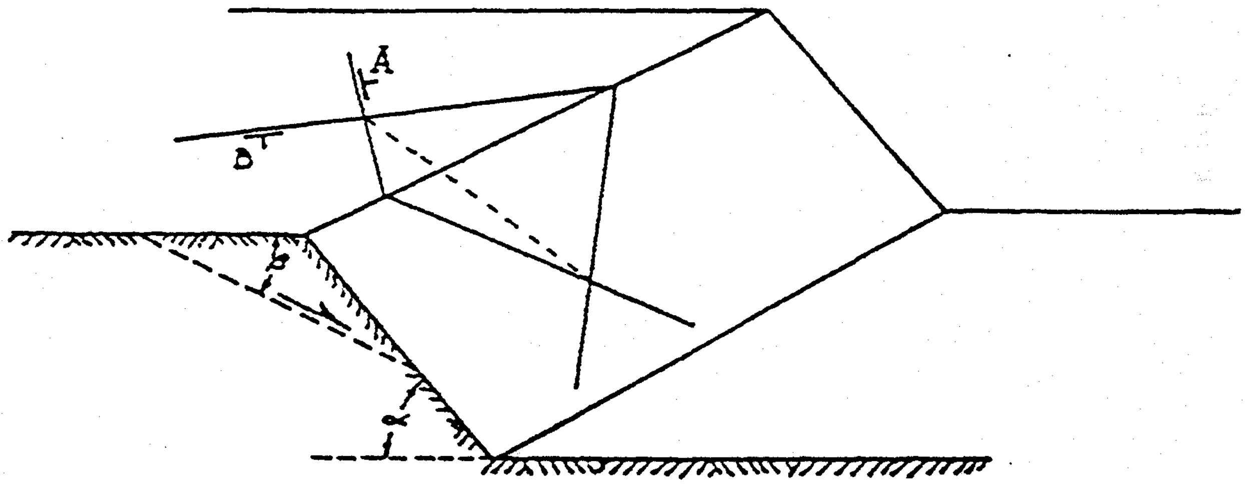


Figure 4. Potential plane and wedge shear failure modes.



Isometric sketch of failure geometry for daylighted plane shear fracture dipping into pit, showing end release fractures.



Isometric sketch of failure geometry for daylighted wedge shear condition, intersection of two fractures plunging into pit.

LIMITING EQUILIBRIUM SLOPE STABILITY ANALYSIS

Daylighted fracture, or joint, sets are potentially subject to plane shear sliding failure whenever the fracture is flatter than the slope angle and steeper than the angle of surface friction of the rock type involved. The wedge formed by two fracture sets is subject to sliding failure when the plunge of their line of intersection plunges flatter than the slope angle, is daylighted, and steeper than the angle of surface friction of the rock type involved. Wedge failures are less common than plane shear failures, possibly because there is more area to shear across each unit of the highwall face. The critical pitwall identified on Figure 3 by the number 3 (Structural Domain 1, rock type Tql) is primarily at risk because of the potential of plane shear sliding along a daylighted fracture. The critical slope highwall identified by number 2 (Structural Domain 12, rock type Tmp) is at risk for plane shear failure. However, a potential wedge shear failure present in the same critical slope has a lower factor of safety. Wedge shear provides the only potential failure mode for the critical highwalls identified by the numbers 4 (Structural Domain 2, rock type Tr), 10 and 12 (Structural Domain 5, rock type Tmp).

PLANE SHEAR SLOPE ANALYSIS

Table 3 presents the limiting equilibrium plane shear factors of safety for the potentially adverse daylighted N20°W striking and 22°SW dipping fracture set in Structural Domain 1 and critical Ultimate Pit Boundary slope 3, as shown on Figure 3. Critical slope 3 is 400 feet high and has a planned 55° overall slope angle. These factors of safety include the maximum credible earthquake acceleration of 0.055 g provided by WZI, Inc. in their letter of December 7, 1995. The following example calculation should explain the calculation of the factor of safety for the dry slope condition, with a one-dimensional estimate of intact rock along the fracture controlled potentially adverse plane shear failure path, subjected to the maximum credible earthquake acceleration.

Weight of potential sliding block - 10730 tons/foot of wall

Gravitational (weight) thrust component = $10730(\mathrm{Sin}22^{\circ}) = 4020\frac{\mathrm{To}}{\mathrm{ft}}$

Down-dip earthquake thrust component = $10730(0.055) = 590\frac{\mathrm{Ton}}{\mathrm{ft}}$

Total thrust to produce sliding = 4020 + 590 = $4610\frac{\mathrm{Ton}}{\mathrm{ft}}$

Total resistance to sliding = 10830 $\frac{\mathrm{Ton}}{\mathrm{ft}}$ (see November 8, 1995 report)

Factor of safety without maximum credible earthquake =

$$\frac{\text{Sliding Resistance}}{\text{Gravitational Thrust}} = \frac{10830}{4020}$$

Factor of safety with maximum credible earthquake =

$$\frac{\text{Sliding Resistance}}{\text{Gravitational Thrust +Earthquake Thrust}} = \frac{10830}{4020+590} = .$$

Table 3. Factors of safety for potentially hazardous plane shear joint set striking N20°W and dipping 22°SW, Domain 1 (Detail Line I), for Ultimate Pit Boundary at GQ-1A (Karma-Wegmann) Pit, under maximum credible earthquake loading.

Quartz Latite Porphyry, overall slope height - 400 ft.

FACTORS OF SAFETY

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level 80%	98%	99.9%	Confidence Level 80%	98%	99.9%
63.4	2.34	2.23	2.23	2.76	2.71	2.71
55	2.35	2.24	2.24	2.77	2.71	2.71

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level 80%	98%	99.9%	Confidence Level 80%	98%	99.9%
63.4	1.48	1.41	1.41	1.75	1.71	1.71
55	1.48	1.41	1.41	1.76	1.72	1.72

Table 3 also provides factors of safety for fully saturated slopes and for 2-dimensional estimates of intact rock. Figure 5 indicates the fully saturated slope condition examined and the how the pore pressure induced hydraulic uplift force was calculated. The hydraulic uplift force would, if present reduce the normal force acting on the fracture controlled potential failure plane. Reduction of the normal force reduces the frictional resistance to sliding in proportion to the uplift force. The essentially dry condition of the underground workings inspected below the planned pit indicates that the Soledad Mountain Project pit slopes will be dry. Table 3 indicates that the potentially adverse daylighted fracture set just examined should be stable even if the slope were fully saturated when subjected to the maximum credible earthquake.

Plane shear slope failure is possible along potentially adverse fracture orientations in Structural Domain 12 (critical interior slope 2) and in Structural Domain 5 (critical Ultimate Pit Boundary slope 10 and critical Ultimate Pit Boundary slope 12). Table 4 presents the factors of safety for earthquake loading added to the gravitational thrust along the potentially hazardous fracture set that strikes N13°W and dips 51°SW. The factors of safety are for dry and saturated slope hydraulic conditions and for 1-dimensional and 2-dimensional intact rock estimates. Table 5 presents the factors of safety for earthquake loading added to the gravitational thrust along the potentially hazardous fracture set that strikes N50°W and dips 37°SW. Table 6 presents the factors of safety for earthquake loading added to the gravitational thrust along the potentially hazardous fracture set that strikes N13°W and dips 51°NE. The factors of safety are for dry and saturated slope hydraulic conditions and for 1-dimensional and 2-dimensional intact rock estimates.

The decrease in the plane shear factors of safety resulting from the application of the maximum credible site acceleration of 0.055 g does not indicate instability for any of the critical pitwalls potentially at risk for sliding along daylighted fracture sets. This is true, regardless of the hydraulic pore pressure that could possibly develop in any of the pitwalls. It is, however, unlikely that significant pore pressure will be present or will develop in the pitwalls.

Figure 5. Geometric and hydraulic uplift conditions related to calculation of limiting equilibrium slope stability.

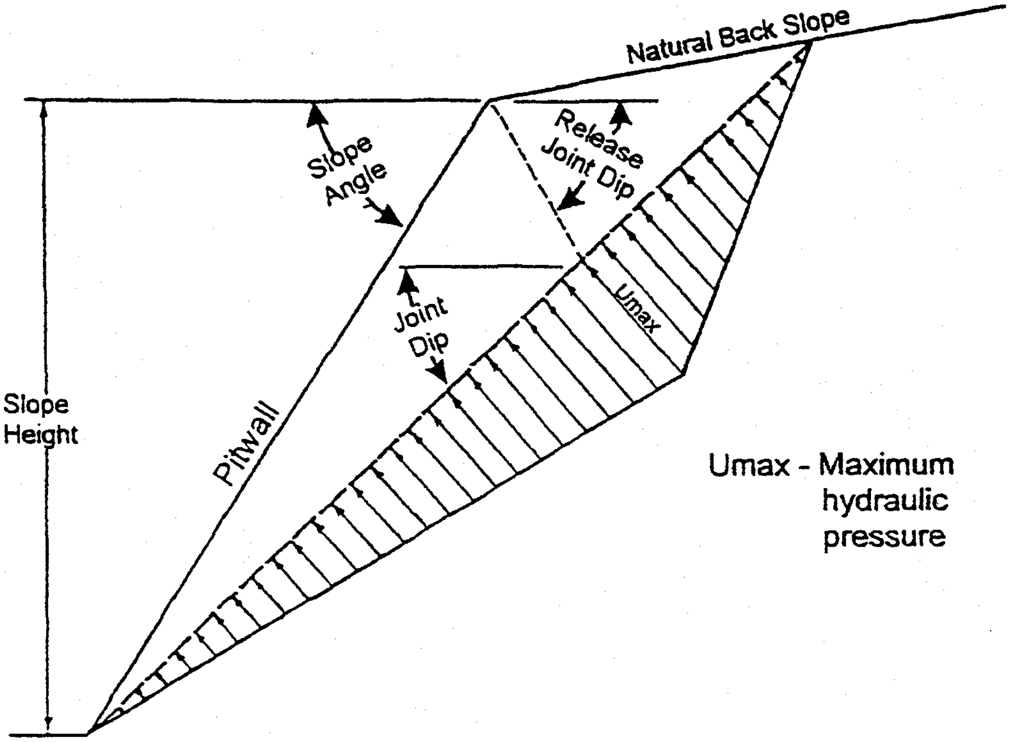


Table 4. Factors of safety for potentially hazardous plane shear joint set striking N13°W and dipping 51°SW, Domain 12 (Detail Lines E + F), on northeast facing pitwall, Domain 12 (Detail Lines E + F), for inside the Ultimate Pit at GQ-1A (Karma-Wegmann) and GQ-1B (Independent) Pits, under maximum credible earthquake loading.

Middle Pyroclastic Unit, overall slope height - 850 ft.

FACTORS OF SAFETY

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	2.23	2.20	2.20	3.78	3.75	3.75
55	5.35	5.32	5.32	9.66	9.63	9.63

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	2.02	2.00	2.00	3.56	3.54	3.54
55	5.14	5.12	5.12	9.43	9.42	9.42

Table 5. Factors of safety for potentially hazardous plane shear joint set striking N50°W and dipping 37°SW, Domain 5 (Detail Lines E + F), for Ultimate Pit Boundary at GQ-2NW Pit (Knight Property) under maximum credible earthquake loading.

Middle Pyroclastic Unit, overall slope height - 240 ft.

FACTORS OF SAFETY

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope	Confidence Level			Confidence Level		
Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	7.25	7.02	7.02	12.59	12.43	12.43
55	9.00	8.82	8.82	15.95	15.80	15.80

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope	Confidence Level			Confidence Level		
Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	6.67	6.59	6.59	12.03	11.96	11.96
55	8.48	8.40	8.40	15.41	15.33	15.33

Table 6. Factors of safety for potentially hazardous plane shear joint set striking N13°W and dipping 51°NE Domain 5 (Detail Lines E + F), for Ultimate Pit Boundary at GQ-2NW Pit (Knight Property) under maximum credible earthquake loading.

Middle Pyroclastic Unit, overall slope height - 220 ft.

FACTORS OF SAFETY

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	7.15	7.12	7.12	13.04	13.01	13.01
55	19.25	19.22	19.22	35.82	35.78	35.78

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	6.94	6.92	6.92	12.79	13.80	12.80
55	19.04	19.02	19.02	35.59	35.57	35.57

WEDGE SHEAR SLOPE ANALYSIS

The potential wedge shear sliding hazards present at the Soledad Mountain Project were analyzed by first determining the bearings, plunges and dihedral angles of potentially hazardous wedge intersections formed by significant fractures sets defined during the detail line mapping described in the November 8, 1995 base report. The same limiting condition criteria govern the development of wedge shear slope failures as do plane shear sliding, i.e. plunge of the line of intersection must be less than the slope face angle and greater than the residual friction angle for the rock type.

Table 7 lists the potentially adverse wedge intersections that were determined from the fracture sets detected in the fracture orientation data mapped along Detail Lines E + F, Domain 5 on the Ultimate Pit Boundary. Table 8 lists the potentially adverse wedge intersection that was determined from the fracture sets detected in the fracture orientation data mapped along Detail Line A, Domain 2, on the Ultimate Pit Boundary. Table 9 lists the potentially adverse wedge intersection that was determined from the fracture sets detected in the fracture orientation data mapped along Detail Lines E + F, Domain 12, a critical slope inside the Ultimate Pit Boundary. These tables indicate the fracture sets producing the potentially adverse wedges and the bearing, plunge and dihedral angle for each of the potentially adverse wedges.

Table 10 provides the calculated factors of safety for the two potentially adverse wedges identified in Structural Domain 5. The driving forces for slope failure along these wedges are the combination of the thrust from the gravitational force for the rock above the worst-case wedge passing through the toe of the slopes plus the maximum credible earthquake acting on the masses. The adverse wedge that bears S21°W is a potential hazard to Critical Slope 10 on Figure 3. The adverse wedge that bears N75°E is a potential hazard to Critical Slope 12 on Figure 3. The addition of the earthquake driving force decreases the factors of safety, but not significantly.

Table 11 provides the calculated factors of safety for the potentially adverse wedge identified in Structural Domain 2. The driving forces for slope failure along this wedge are the combination of the thrust from the gravitational force for the rock above the worst-case wedge passing through the toe of the slope plus the maximum credible earthquake acting on the masses. The adverse wedge bears S36°W is a potential hazard to Critical Slope 4 on Figure 3. Again, the addition of the earthquake driving force decreases the factors of safety, but not significantly.

Table 7. Potentially hazardous wedge intersections at Ultimate Pit Boundary along GQ-2NW Pit (Knight Property), Domain 5 (Detail Lines E + F), Middle Pyroclastic Unit.

Joints Involved	Joint Orientations in Order				Dihedral Angle	Bearing	Plunge
	Strike	Dip	Strike	Dip			
B - D	N50°W	37°SW	N17°E	83°NW	109°	S21°W	36°
G - H	N82°W	73°NE	N13°W	51°NE	116°	N75°E	50°

Table 8. Potentially hazardous wedge intersection inside Ultimate Pit Boundary, Domain 2 along GQ-5A Pit ; Detail Line A; Aphanitic Rhyolite.

Joints Involved	Joint Orientations in Order				Dihedral Angle	Bearing	Plunge
	Strike	Dip	Strike	Dip			
A - B	N80°W	38°SW	N03°E	53°NW	123°	S36°W	36°

Table 9. Potentially hazardous wedge intersection inside Ultimate Pit Boundary, Domain 12 in area of GQ-1 Pit (Queen Ester) and GQ-1B Pit (Independent); Detail Lines E + F; Middle Pyroclastic Unit.

Joints Involved	Joint Orientations in Order				Dihedral Angle	Bearing	Plunge
	Strike	Dip	Strike	Dip			
G - H	N82°W	73°NE	N13°W	51°NE	116°	N75°E	50°

Table 10. Factors of safety for potentially hazardous wedge intersections, Domain 5 (Detail Lines E + F), for Ultimate Pit Boundary at GQ-2NW Pit (Knight Property) under maximum credible earthquake loading.

Wedge G - H FACTORS OF SAFETY

Middle Pyroclastic Unit, overall slope height - 240 ft.

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	5.01	4.92	4.92	9.03	8.94	8.94
55	11.33	11.25	11.25	21.05	21.05	21.05

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	4.78	4.72	7.72	8.78	8.73	8.73
55	11.10	11.04	11.04	20.81	20.75	20.75

Wedge B - D FACTORS OF SAFETY

Middle Pyroclastic Unit, overall slope height - 220 ft.

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	6.68	6.43	6.42	11.56	11.33	11.32
55	8.28	8.03	8.02	14.58	14.36	14.35

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	6.02	5.91	5.90	10.88	10.77	10.77
55	7.63	7.51	7.51	13.91	13.80	13.80

Table 11. Factors of safety for potentially hazardous wedge intersections, Domain 2 (Detail Line A), for Ultimate Pit Boundary at GQ-5A Pit, under maximum credible earthquake loading.

Wedge A - B FACTORS OF SAFETY

Middle Pyroclastic Unit, overall slope height - 550 ft.

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	2.32	2.21	2.21	3.43	3.34	3.34
55	2.66	2.56	2.56	4.05	3.96	3.96

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
Slope Angle (°)	Confidence Level			Confidence Level		
	80%	98%	99.9%	80%	98%	99.9%
63.4	1.71	1.66	1.66	2.73	2.68	2.68
55	2.06	2.01	2.01	3.34	3.30	3.30

Table 12 provides the calculated factors of safety for the potentially adverse wedge identified in Structural Domain 12. The driving forces for slope failure along this wedge are the combination of the thrust from the gravitational force for the rock above the worst-case wedge passing through the toe of the slope plus the maximum credible earthquake acting on that mass. The adverse wedge bears N75°E is a potential hazard to Critical Slope 2 on Figure 3. Again, the addition of the earthquake driving force decreases the factors of safety, but not significantly.

The decrease in the wedge shear factors of safety resulting from the application of the maximum credible site acceleration of 0.055 g does not indicate instability for any of the critical pitwalls potentially at risk for sliding along the wedge formed be intersecting daylighted fracture sets. This is true, regardless of the hydraulic pore pressure that could possibly develop in any of the pitwalls. It is, however, unlikely that significant pore pressure will be present or will develop in the pitwalls.

Table 12. Factors of safety for potentially hazardous wedge intersection on northeast facing pitwall, Domain 12 (Detail Lines E + F), for a highwall inside the Ultimate Pit Boundary at GQ-1 (Queen Ester) and GQ-1B (Independent) Pits, under maximum credible earthquake loading.

Wedge G - H FACTORS OF SAFETY

Middle Pyroclastic Unit, overall slope height - 850 ft.

Dry Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	1.84	1.75	1.74	2.99	2.91	2.90
55	3.63	3.54	3.54	6.40	6.32	6.32

Saturated Slope	1-Dimensional Intact			2-Dimensional Intact		
	Confidence Level			Confidence Level		
Slope Angle (°)	80%	98%	99.9%	80%	98%	99.9%
63.4	1.60	1.55	1.55	2.74	2.69	2.69
55	3.40	3.34	3.34	6.16	6.11	6.11

SUMMARY AND CONCLUSIONS

The 55° overall highwall slope angles planned for the Soledad Mountain Project will not be at risk of failing under the additional forces from the maximum credible site acceleration of 0.055 g. This is true for both the highwalls along the Ultimate Pit Boundary and the pitwalls within the interconnected pits inside the Ultimate Pit Boundary. In fact, pitwall slope angles of 63.4° (two vertical to one horizontal) could resist the additional down-dip thrust from the maximum credible earthquake without triggering a slope failure.

The earthquake slope stability analyses conservatively assumed not only the maximum credible earthquake but that the acceleration from that event was directed in the most adverse possible direction, parallel to the potential sliding surfaces. This conservative application of the maximum credible earthquake acceleration resulted in relatively minor reductions in the calculated factors of safety obtained previously with only the gravitational driving forces, presented in the "Soledad Mountain Project, Slope Stability Analysis", November 8, 1995 report.

JOHN F. ABEL, JR.
MINING ENGINEER

310 LOOKOUT VIEW COURT
GOLDEN, CO 80401
303-279-4901
FAX 278-8163

July 24, 1996

Tony Casagranda
Golden Queen Mining Co., Inc.
P.O. Box 878, Suite #4
Rosamond, CA 93560-0878

Dear Tony:

Table 1 enclosed provide the factors of safety for the critical pit slopes calculated for the modified maximum credible earthquake acceleration of 0.297G. Table 2 is a copy of the calculated factors of safety for the critical pit slopes without any earthquake acceleration.

The "Soledad Mountain Project, Slope Stability Analysis" report, November 8, 1995 presented the method of calculating the resistance to sliding when an adversely oriented fracture set is present in one of the critical slopes. The only adjustment made in this report is the addition of the earthquake produced thrust to the gravitational thrust component.

These factors of safety are extremely conservative and should be considered worst case, because:

1) The earthquake acceleration is assumed to be directed up either the dip of the potential joint controlled failure plane or plunge of the potential joint controlled wedge intersection. The new information that the acceleration is directed along a strike of N45E/S45W would result in only a component of the acceleration acting on any failure plane or intersection direction not oriented in that direction.

2) The proportion of stronger intact rock along a potential failure plane, or planes, was based on a one-dimensional approximation. The conservatism of this assumption is based on the fact that no joint continues indefinitely in any direction.

Table 1. Relative stability of planned dry slopes under maximum credible (0.297G) earthquake acceleration.

Location Information				Slope	Slope	Factor of Safety @ Confidence Level		
Side of Pit	Structural Domain	Rock Type	Slope Ident.	Height (ft)	Angle (°)	80%	98%	99.9%
East	11	Tup	1	800	63.4°	Failure paths >		
					55°	possible slopes		
	12	Tmp	2	850	63.4°	1.42	1.35	1.35
					55°	2.81	2.74	2.74
	1	Tql	3	400	63.4°	1.50	1.43	1.43
					55°	1.50	1.43	1.43
North	2	Tr	4	550	63.4°	1.68	1.61	1.61
					55°	1.93	1.86	1.86
Northwest	5	Tmp	10	240	63.4°	3.87	3.80	3.80
					55°	6.71	6.57	6.57
			11	180	63.4°	No failure path		
					55°			
			12	220	63.4°	4.85	4.67	4.66
					55°	6.01	5.83	5.82
West	8	Trp	9	650	63.4°	Failure paths >		
					55°	possible slopes		
South			8	1100	63.4°	Failure paths <		
					55°	residual friction		
	10	Trp	7	780	63.4°	Failure paths <		
					55°	residual friction		
			6	700	63.4°	No failure path		
					55°			
	11	Trp	5	600	63.4°	Failure paths >		
					55°	possible slopes		

Table 2. Relative stability of planned dry slopes, without earthquake acceleration.

	Location Information					Factor of Safety @ Confidence Level		
Side of Pit	Structural Domain	Rock Type	Slope Ident.	Slope Height (ft)	Slope Angle (°)	80%	98%	99.9%
East	11	Tup	1	800	63.4°	Failure paths >		
					55°	possible slopes		
	12	Tmp	2	850	63.4°	1.97	1.87	1.87
					55°	3.89	3.80	3.79
	1	Tql	3	400	63.4°	2.69	2.56	2.56
					55°	2.69	2.57	2.57
North	2	Tr	4	550	63.4°	2.53	2.42	2.42
					55°	2.91	2.80	2.80
Northwest	5	Tmp	10	240	63.4°	5.37	5.28	5.27
					55°	12.19	12.09	12.09
			11	180	63.4°	No failure path		
					55°			
			12	220	63.4°	7.30	7.02	7.01
					55°	9.05	8.78	8.77
West	8	Trp	9	650	63.4°	Failure paths >		
					55°	possible slopes		
South			8	1100	63.4°	Failure paths <		
					55°	residual friction		
	10	Trp	7	780	63.4°	Failure paths <		
					55°	residual friction		
			6	700	63.4°	No failure path		
					55°			
	11	Trp	5	600	63.4°	Failure paths >		
					55°	possible slopes		

I hope this fulfills your requirements.

Sincerely,

John F. Abel, Jr.

John F. Abel, Jr.
Colorado P.E. 5642

Reviewed by:

The Glasgow Engineering Group, Inc.

REGISTERED PROFESSIONAL ENGINEER
DON ANDREW POLLER
Sept 6, 1996
No. C-32075
Exp. 8-23-97
CIVIL
STATE OF CALIFORNIA

THE GLASGOW ENGINEERING GROUP, Inc.
7393 South Everett Ct. Phone No. (303) 904-4614
Littleton, Colorado 80123 Fax No. (303) 979-8166

August 29, 1996

Mr. Tony Casagranda
Golden Queen Mining Company, Inc.
P.O. Box 878
Rosamond, California 93560-0878

Re: Soledad Mountain Project Pit Slope Stability Review

Dear Tony,

The open pit slope stability study by Mr. John F. Abel, Ph.D. for the Soledad Mountain Project has been reviewed by the Glasgow Engineering Group, Inc. (Glasgow Engineering). The review was conducted by Mr. Don A. Poulter, P.E., of Glasgow Engineering. Mr. Poulter is a qualified Registered Professional Engineer in the State of California. This review was completed as requested by Golden Queen Mining Company, Inc. (GQMC) and in full knowledge of Mr. Abel. The reports by Mr. Abel listed below were presented for review by Glasgow Engineering.

November 8, 1995 -	"Soledad Mountain Project, Slope Stability Analysis";
December 11, 1995 -	"Earthquake Stability Supplement, Soledad Mountain Project,Slope Stability Analysis";
July 24, 1996 -	Letter Report supplement to report of December 11, 1995; and

Letter correspondence to Mr. Abel (with attached WZI report dated June 11, 1996) for which the July 24, 1996 letter report is based upon.

It is my opinion that the stability analyses presented by Mr. John F. Abel, Jr. (State of Colorado P.E. No. 5642) represent the anticipated stability of the proposed open pit at the Soledad Mountain Project. This is based upon the findings of my review and understanding of the above referenced data and reports, and my knowledge of the project. It is my recommendation that joint and fracture patterns in the pit wall be recorded as the pit is developed and compared with the data used in the analyses. In the event that data different from that used in the analyses is collected from the exposed pit slopes, the pit slope stability should be re-evaluated using the field data.

Thank you for this opportunity to work with you on the Soledad Mountain Project. If you should have any questions regarding our review or the contents of this letter, please call me.

Sincerely,
The Glasgow Engineering Group, Inc.

Don A Poulter

Don A. Poulter, P.E.
President

THE GLASGOW ENGINEERING GROUP, INC.
7393 South Everett Ct.
Littleton, Colorado 80123 Phone No. (303) 904-4614

October 25, 1996

Mr. Tony Casagranda
Golden Queen Mining Corporation
2997 Desert Street, Suite 4
Rosamond, California 93560-0878

Re: Slope Stability Evaluation for the Soledad Mountain Project Mine Overburden Disposal Piles

Dear Tony:

We have completed the slope stability evaluation for the mine overburden disposal piles currently proposed for the Soledad Mountain Project. The scope of this study was to re-evaluate the stability of the overburden disposal piles with respect to the updated seismic data provided by WZI, Inc. The layout shown in Figure 1 was provided by Golden Queen Mining Company, Inc. (GQMC). Other data provided by GQMC included design data from the pit slope stability study conducted for GQMC by Dr. John Abel and the seismicity report for the project area. A summary of the evaluation, findings, and recommendations are presented in this letter report.

Slope stability analyses were performed for critical sections at three locations as shown on Figure 1. The selection of these locations was based on existing topography, the proposed configurations of overburden piles and geologic foundation conditions. Cross sections of the overburden piles at these locations were modeled as end-dumped material with reclaimed slopes at the close of the project. It is understood that the slope of the working faces will be at about 1.5H:1V (horizontal to vertical) and will be reclaimed to an overall slope of 1.8H:1V as shown in Figures 2 through 7. Sections A-A' and C-C' include benches as shown in plan view of the disposal area. Both static and psuedostatic seismic loading conditions were included in the slope stability analyses.

The overburden pile stability of the three section locations shown in Figure 1 was evaluated using limit equilibrium methods with the aid of XSTABL. XSTABL is a two-dimensional limit equilibrium slope stability computer program developed at Purdue University. Both circular and wedge shaped failure surfaces were analyzed under static and pseudostatic earthquake loading conditions. Analyses were performed using the Bishop method for circular failure surfaces and the Janbu method for wedge shaped surfaces. Wedge shaped surfaces through the overburden and/or foundation materials near the overburden/foundation contact were considered. The stability of these slopes under earthquake conditions was analyzed using psuedostatic procedures where an additional out of slope inertial force equal to some fraction of the anticipated peak horizontal bedrock acceleration is included in the horizontal direction when performing the analysis. For these analyses, a horizontal inertial force equal to one-half of the magnitude of the anticipated peak horizontal bedrock acceleration was used as an estimate of the effects of earthquake motions on stability. Topographic amplification of the peak bedrock acceleration was not considered necessary for this evaluation. The characteristics of the waste rock piles do not warrant such an analysis. The only potential effect such an occurrence would have on the waste pile would possibly be some sloughing of the crest line. Acceleration at the base of the pile would not substantially change or impact the mass stability of the waste pile.

Shear strength parameters and material properties used in the slope stability analyses are summarized in Table 1. These strength parameters were based on typical values for waste rock material, and data from the mine slope stability study. Foundation material properties were based on data from the mine slope stability study and foundation explorations in other areas of the project. The values selected for use in this evaluation are considered to be conservative, but within the range of values expected for the types of material to be encountered, and for end-dump placement of the waste rock. The estimated peak horizontal ground acceleration for this project was 0.4g. The estimated ground acceleration was multiplied by a factor of 0.5 to calculate the psuedostatic coefficient for this evaluation, as mentioned above. This factoring of the peak bedrock acceleration is recommended for slope stability evaluations using pseudostatic procedures.

The foundation in the vicinity of sections A-A' and B-B' appears to consist of deposits of alluvial fill and bedrock. The foundation in the vicinity of section C-C' appears to consist of only bedrock. Based on the available borehole data provided by GQMC, the ground water level is approximately 200 feet below the waste piles and have no impact on the stability of the waste rock piles.

Results of the slope stability analyses are summarized in Table 2. The critical failure surfaces for both static and pseudo-static loading conditions at each of the three locations are shown on Figures 2 through 7. These results show that the waste piles reclaimed at 1.8H:1V overall slopes will be stable under static conditions and earthquake loading conditions as modeled in the analyses. The slope face during operation will be at the angle of repose of the material. These slopes should be stable under static loading conditions. Some sloughing of the slope face will probably occur in the event of seismic loading at the site. Once the waste piles are being constructed and can be observed, these evaluations may be reviewed to determine whether or not the waste piles may remain at the angle of repose upon closure of the site.

The estimated factors of safety are believed to be conservative based on the input parameters used in the analyses and that only 'short-term' conditions were considered in the model. With time, the overburden materials will settle and consolidate under self-weight loading conditions. This will result in a more dense mass of material which in turn will exhibit an increase in the shear strength parameters (particularly in the internal friction parameter(∅)). Often times, upon consolidation, the overburden mass will also exhibit significant cohesive properties as vertical or near vertical slopes result at the working face when excavating the material. Also, in end-dumped overburden piles such as those proposed for the Soledad Mountain Project, segregation of particle sizes occurs as the material slides down the face of the pile. This results in coarse, blocky material in the base of the pile with particle sizes decreasing up the slope. The shear strength parameter base of the overburden pile is, therefore, usually significantly higher (plus 40° ∅) than the upper portion of the overburden pile. This in turn results in a more stable overburden pile than that modeled in this evaluation.

Considering the above information and results of the waste rock slope stability evaluation summarized in this letter report, it is my professional opinion and judgment that the proposed waste rock piles will be stable under short term and long term conditions, with respect to deep seated failures in the overburden pile. In the event the seismicity of the project area is revised to a more active region or the overburden materials of different properties and shear strength parameters from those described for this evaluation, the stability results, findings, and recommendations contained in this letter report may not be valid for representing the stability of the proposed overburden piles.

We appreciate having the opportunity to work with you on this project and hope this addresses your needs. If you have any comments or questions regarding these analyses, please do not hesitate to call.

Sincerely,

The Glasgow Engineering Group, Inc.

Don A. Poulter
President

Don Andrew Poulter
Oct 25, 1996
No. C-32075
Exp. 8/23/97

DAP:mfb
Enclosures

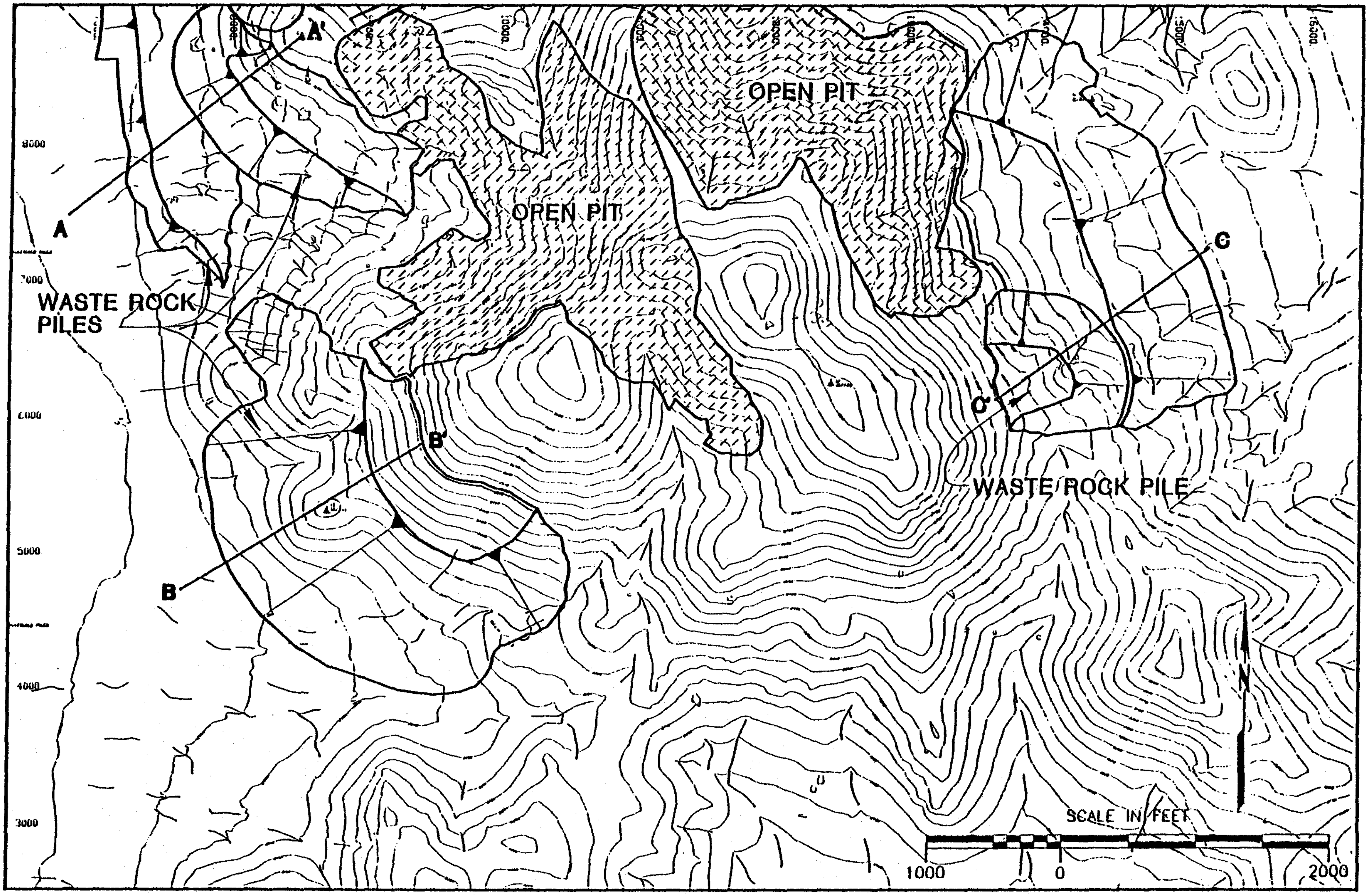
r:\q:\17-650\glasgow

Table 1 - Summary of Material and Shear Strength Parameters

MATERIAL TYPE	MOIST UNIT WEIGHT (lb/f^3)	SATURATED UNIT WEIGHT (lb/f^3)	FRICTION ANGLE (degrees)	COHESION (psf)
Waste Rock	120	125	37	500
Bedrock	150	150	45	1000
Alluvial Fill (Sections A and B)	95	100	30	0

Table 2 - Summary of Results of Stability Analyses for 1.8 : 1 Slopes (H :V)

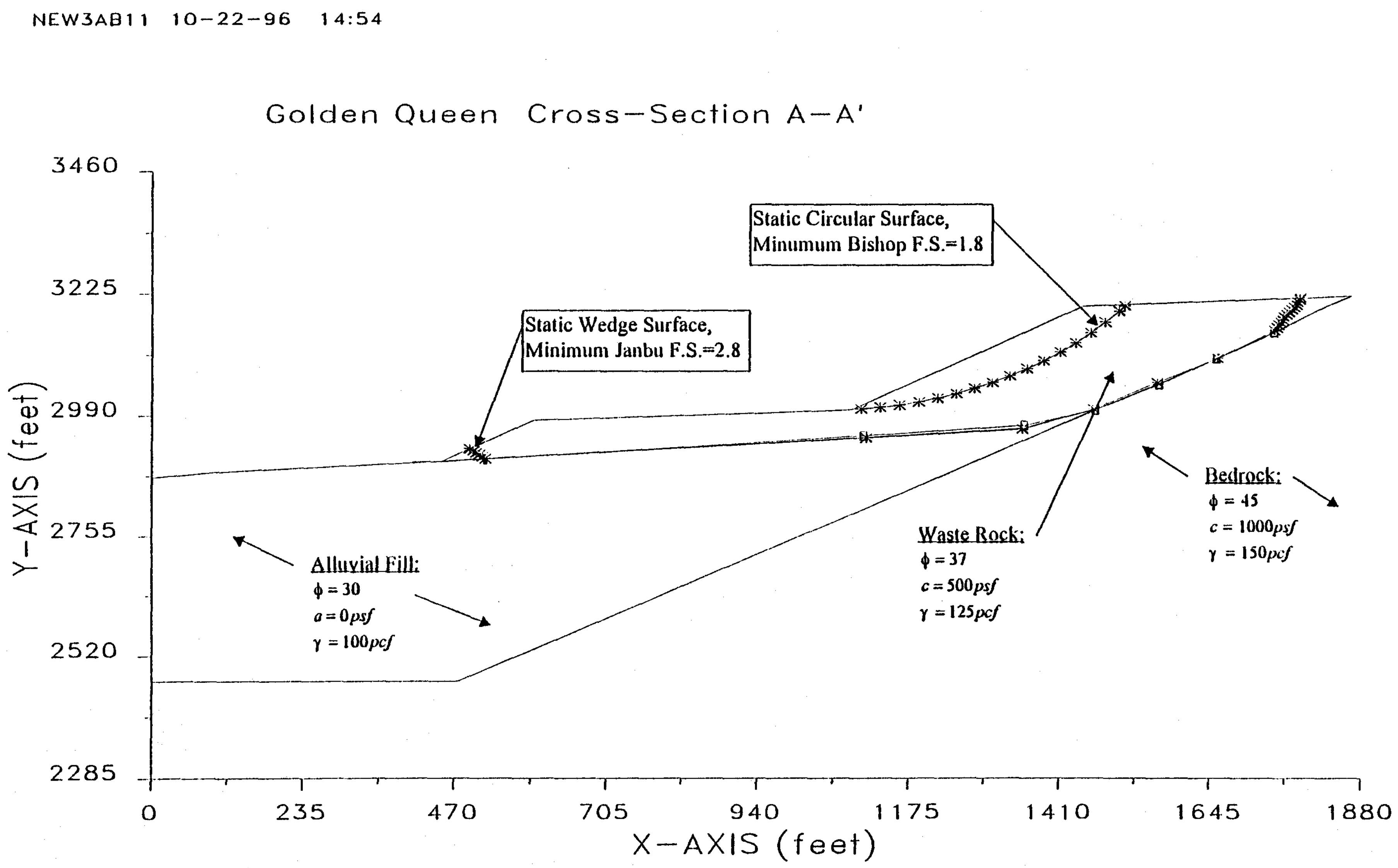
SECTION	Static Factor of Safety		Seismic Factor of Safety (at $K_H = 0.20g$)	
	Circular Surface	Wedge-Type Surface	Circular Surface	Wedge-Type Surface
A-A' at 1.8 to 1 Inter-bench Slope	1.8	2.8	1.2	1.5
B-B' at 1.8 to 1 Overall Slope	1.7	1.8	1.1	1.2
C-C' at 1.8 to 1 Inter-bench Slope	1.9	2.4	1.2	1.5
Minimum Acceptable Factor of Safety	1.3	1.3	1.1	1.1



Golden Queen Mining Co.
2997 Desert St. Suite 4
Rosamond, CA 93560-0878

FIGURE 1
LOCATION OF STABILITY SECTIONS

Date:	OCT. 1996
Project:	01701
File:	17-650\XSTAB



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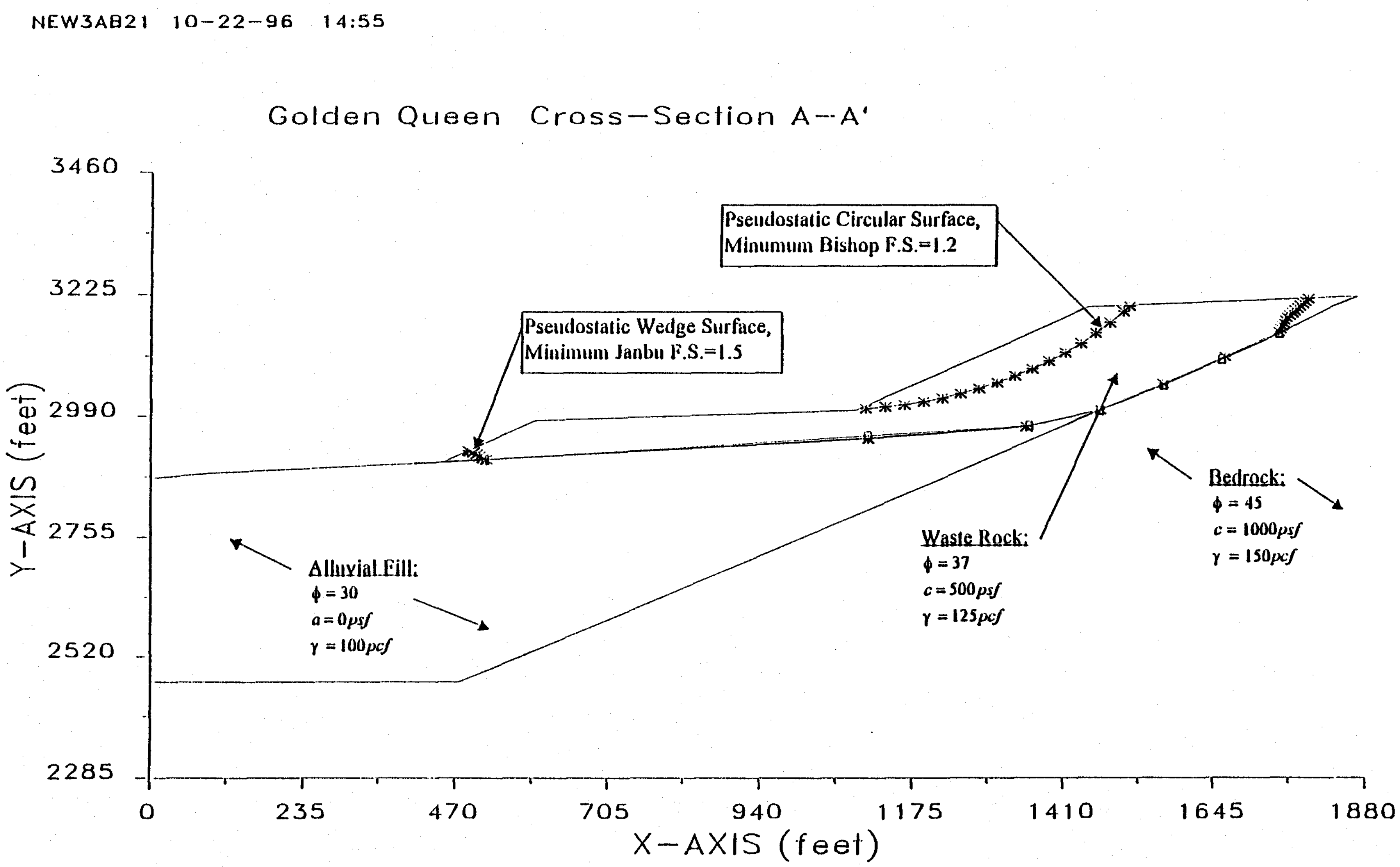
2997 Desert St., Suite 4
Rosamond, CA 93560-0878

FIGURE 2
WASTE ROCK SECTION A-A'
Static Analyses with 1.8 : 1 Side Slopes

Date: October 1996

Project: 01701

File: 17-650\stbfig2.doc



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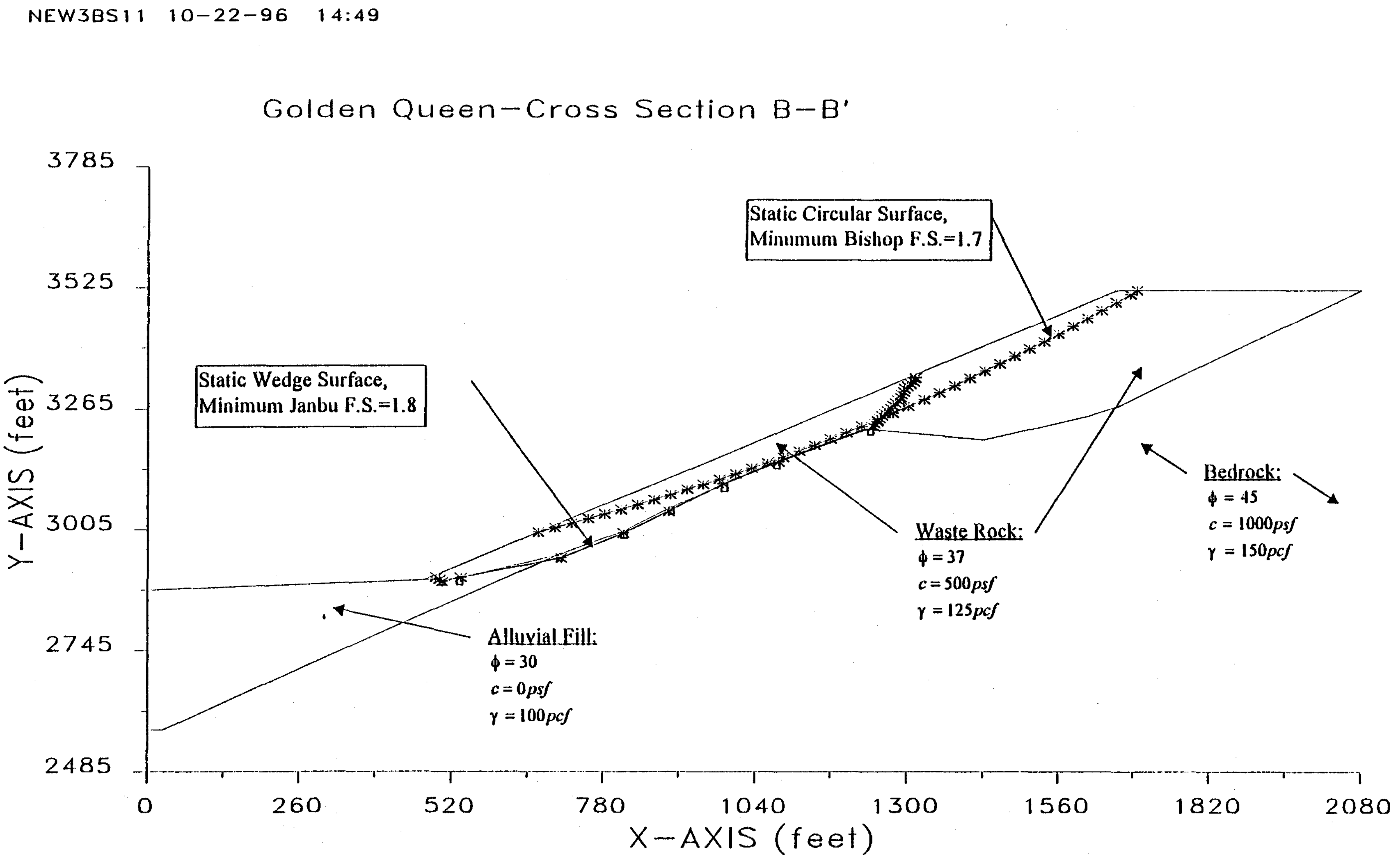
Rosamond, CA 93560-0878

FIGURE 3
WASTE ROCK SECTION A-A'
Pseudostatic Analyses with K_h=0.2g, 1.8 : 1 Side Slopes

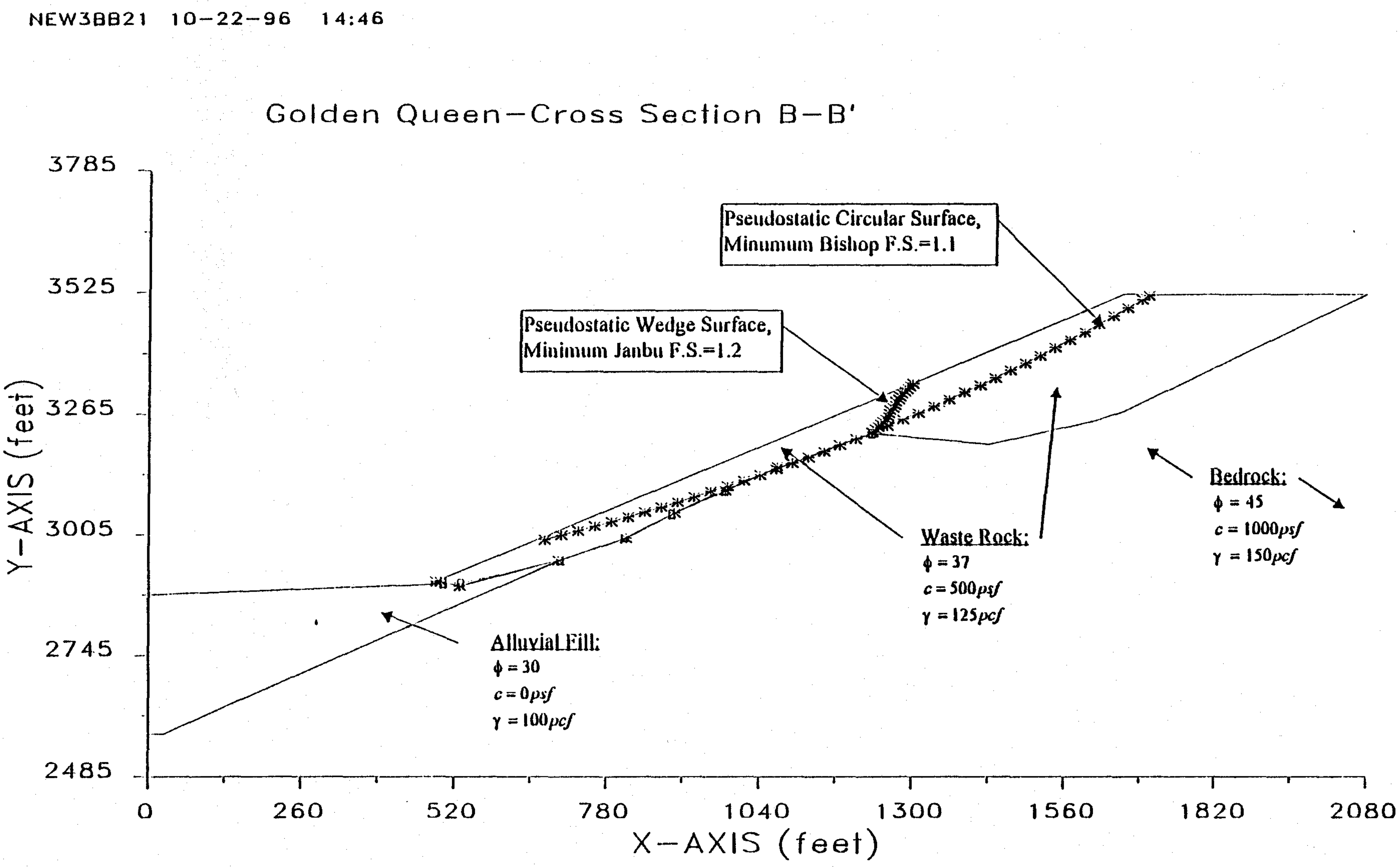
Date: October 1996
Project: 01701
File: 17-650\stbfig3.doc



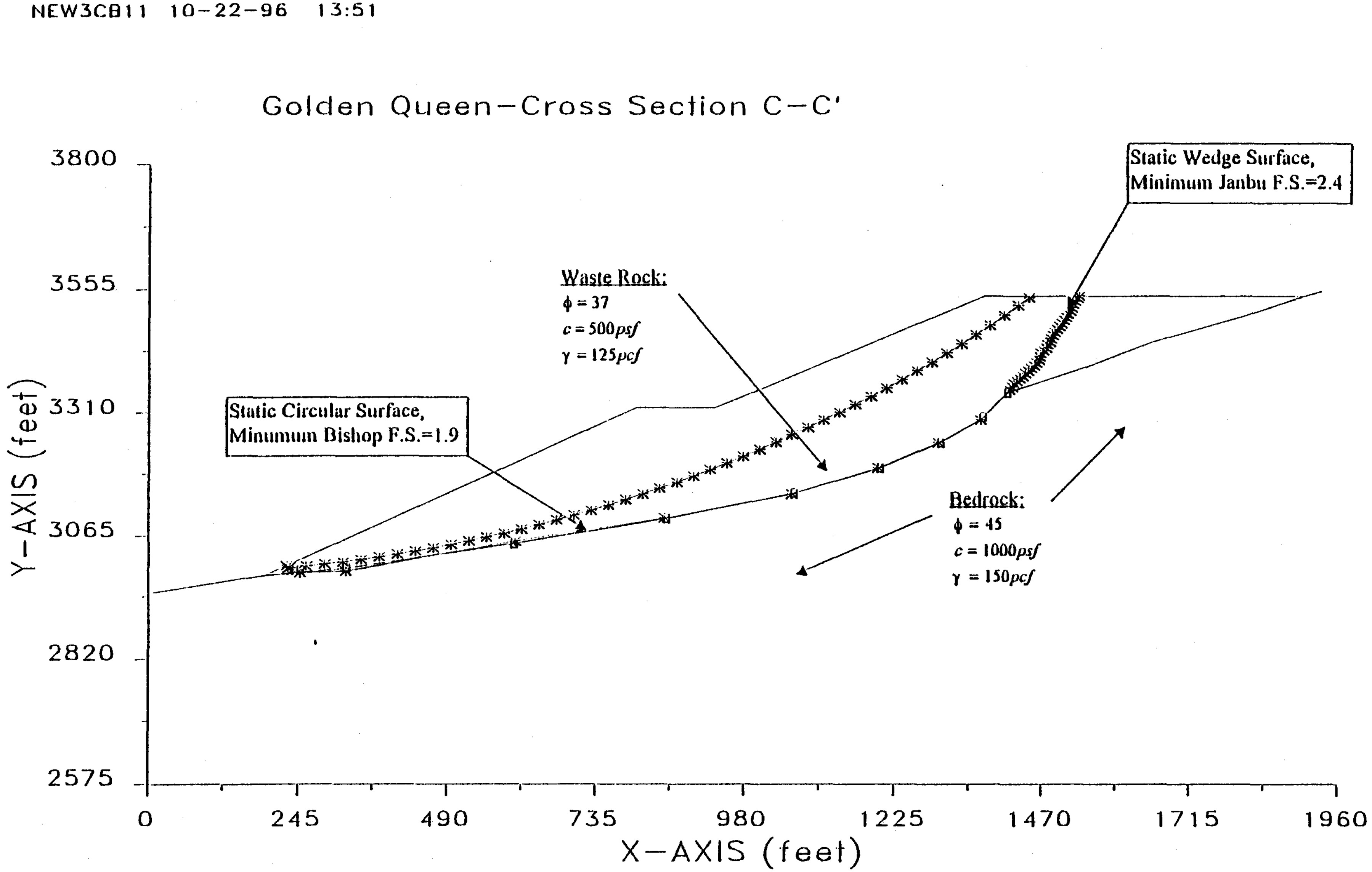
Golden Queen Mining Co.
2997 Desert St., Suite 4
Rosamond, CA 93560-0878

FIGURE 4
WASTE ROCK SECTION B-B'
Static Analyses with 1.8 : 1 Side Slopes

Date: October 1996
Project: 01701
File: 17-650\stbfig4.doc



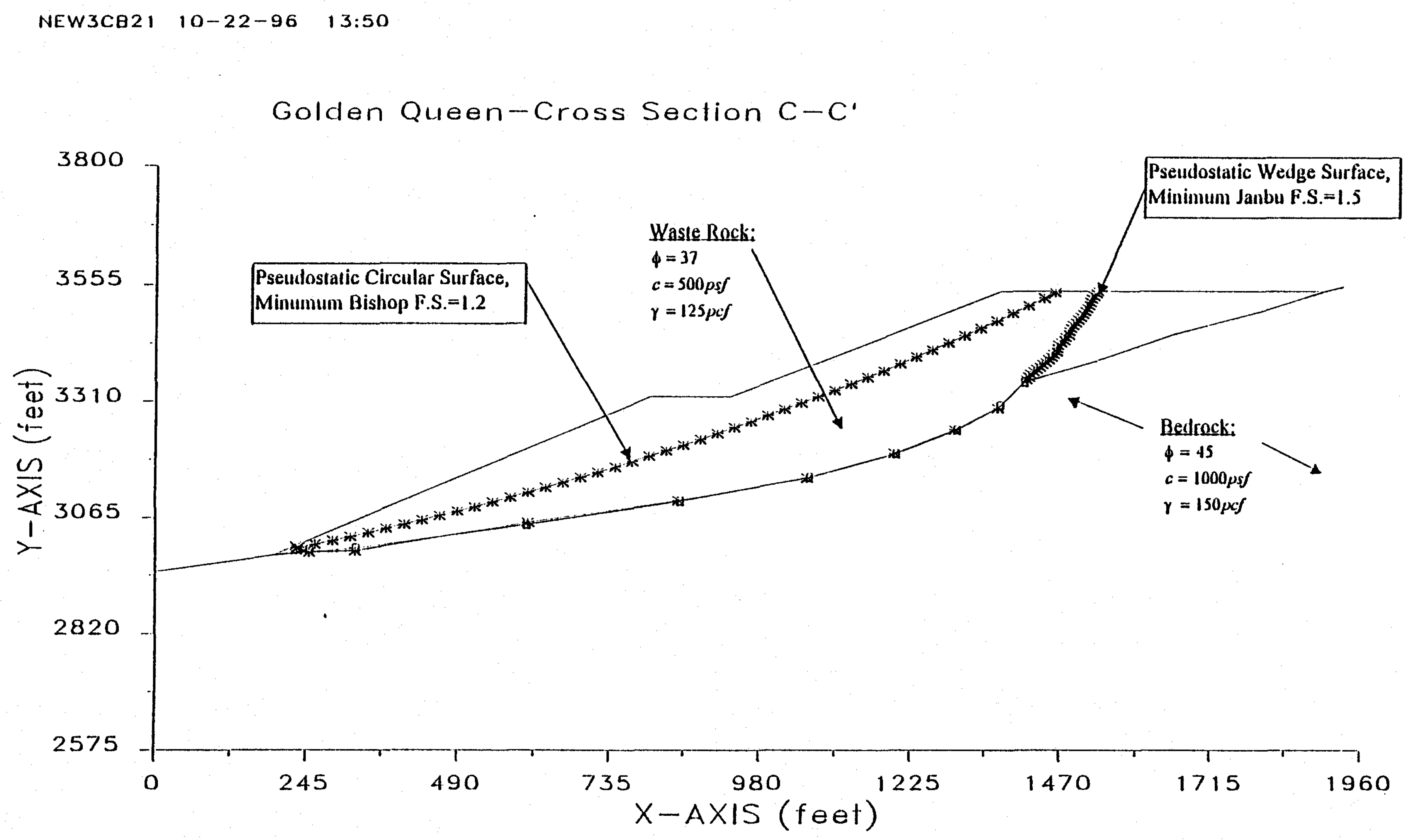
Golden Queen Mining Co. **2997 Desert St., Suite 4** **Rosamond, CA 93560-0878**	FIGURE 5 WASTE ROCK SECTION B-B' Pseudostatic Analyses with K_h=0.2g, 1.8 : 1 Side Slopes	Date: October 1996 Project: 01701 File: 17-650\stbfig5.doc



Golden Queen Mining Co.
2997 Desert St., Suite 4
Rosamond, CA 93560-0878

FIGURE 6
WASTE ROCK SECTION C-C'
Static Analyses with 1.8 : 1 Side Slopes

Date: October 1996
Project: 01701
File: 17-650\stbfig6.doc



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2997 Desert St., Suite 4
Rosamond, CA 93560-0878

FIGURE 7
WASTE ROCK SECTION C-C'
Pseudostatic Analyses with K_H=0.2g, 1.8 : 1 Side Slopes

Date: October 1996
Project: 01701
File: 17-650\stbfig7.doc

DEC 09 1996

THE GLASGOW ENGINEERING GROUP, Inc.
7393 South Everett Court
Littleton, Colorado 80123
Phone No. (303) 904-4614
Fax No. (303) 979-1833

December 5, 1996
Project No. 00704

Golden Queen Mining Company, Inc.
11847 Gempen Street
Mojave, California 93501

Attention: Mr. Tony Casagranda

Re: **Pit Slope Seismic Stability**

Dear Tony:

An evaluation of the potential influence of topographic amplification of seismic forces on the stability of the pit slopes has been made per your request. The evaluation included the review of the geotechnical data and pit slope stability analyses presented in the reports by Mr. John Abel, Jr. dated November 11, 1995, December 11, 1995 and July 24, 1996.

Topographic amplification of seismic forces is not likely to have an impact on the stability of the pit slopes during the operations of the Soledad Mountain Project. Based on the data presented in the above referenced reports, there are no critical slopes or joint patterns that control the slope stability in any area of the pit. The estimated factors of safety (FOS) against slope failures presented in the above referenced analyses are sufficiently conservative such that moderate increases in forces contributing to slope movement (such as amplified ground accelerations) would not adversely impact the stability of the pit slopes. This does not preclude the occurrence of raveling of loose slope materials during a seismic event that results in ground motions at the site.

It is recommended that the slope stability input parameters be checked as the pit is developed and joint and fracture are exposed in the pit walls. Should these or any other occurrence be adversely different from the data used in the analyses, the pit slope stability should be re-evaluated using the new data. Also, the pit slope stability should be checked in the event the seismicity of the region is updated to show potentially stronger ground motions at the site.

If you should have any questions or require additional information concerning the contents and opinions presented in this letter, please call me.

Sincerely,
The Glasgow Engineering Group, Inc.

Don A. Poulter, P.E.
President

REGISTERED PROFESSIONAL ENGINEER
DON ANDREW POULTER
Dec 5, 1996
No. C-32075
Exp. 8-23-97
CIVIL
STATE OF CALIFORNIA

[illegible]
DEC 0[illegible] 1996

Attachment D

COUNTY OF KERN

RECLAMATION AND REVEGETATION PROCEDURES FOR SOLEDAD MOUNTAIN PROJECT

Prepared for:
Kern County Planning Department

Submitted by:
Golden Queen Mining Company, Inc.

Prepared by:
Bamberg Associates
Samuel A. Bamberg, Ph.D.
Reclamation Specialist

January, 1996

Revised December, 1996

Revised March, 1997

TABLE OF CONTENTS

1.0 INTRODUCTION

This plan presents reclamation details for the Soledad Mountain Project, a proposed gold mine on Soledad Mountain in Kern County, California. The project is operated by Golden Queen Mining Company, Inc. (GQMC). The plan is in compliance with Kern County requirements (FORM A175.PDS, 8/93) and the California Surface Mining and Reclamation Act of 1975 (SMARA), as amended. It will also address specific site-related reclamation concerns expressed by the Bureau of Land Management (BLM) and Kern County Planning Department during the scoping process. This is an individual document prepared specifically for the Soledad Mountain Project as proposed in the EIS/EIR. Reclamation standards are now required by SMARA 1975 (1993 Statues, and promulgated as DMG Note 26, Revised January 1994, and amended February 1994). This plan meets the California Code of Regulations, Article 9, Reclamation Standards.

The techniques were prepared to comply with the requirements of the California Regional Water Quality Control Board. This reclamation plan focuses on the procedures involved in establishing a productive ecosystem through revegetation and wildlife habitat development, and achieving visual compatibility with the surrounding landscape. Visual impacts will be mitigated by breaking up straight lines and establishing vegetation and habitats. This is a working document and a practical approach to reclamation in this area of the Mojave Desert with low, unpredictable rainfall. The recommended methods and criteria form the basis for construction and operational procedures for reclamation enhancement at the mine closure.

The Site Drainage Plan will include the on-site roads, crushing site, process plant site, maintenance site, office site, overburden material piles and site drainage. Portions of the crushing, process, maintenance and office site will involve engineered fill. These areas are part of the detailed project design engineering which is currently in progress and will be available at a later date to supplement the information presented in this document.

Bamberg Associates, which prepared these procedures, has recently conducted revegetation testing programs at several desert mining locations in California, forming the basis for several procedures proposed here. The natural revegetation that has already occurred on previously disturbed portions of the Soledad project site also served as a basis for determining the plant species and topographic features necessary for successful reclamation. The testing programs and observations of this natural revegetation have been used also as a basis for reclamation techniques, seed sources and plant species selection, and topographic modification. Techniques and alternatives for reclamation of altered terrain left after mining and ore processing are also discussed in this plan.

The Reclamation Procedures are intended to address pertinent issues relating to successful reclamation implementation by GQMC at the Soledad Mountain Project. This report provides coordination procedures for the final decommissioning process at mine closure.

Two bonds are required, one for reclamation held by Kern County, and the other for Closure and Post-Closure maintenance that is intended to cover the cost of the physical closure and decommissioning procedures held by the Lahontan RWQCB. The bond for reclamation will be held by Kern County under SMARA, and relates to the interim reclamation as revegetation testing for this mine site, and reclamation costs for the mining project.

The cost estimate for closure and post closure maintenance will be contained in the report of waste discharge document.

2.0 PROJECT OVERVIEW

The Soledad Mountain Project is located in Kern County, California, on the western edge of the Mojave Desert. The project involves open-pit mining of gold-bearing ore, development of overburden piles, and beneficiation by heap leaching processes. The components of the Soledad project are shown in Figure 2.1.

Of the total project area of 1,600 acres, the total disturbance acreage for the Soledad Mountain Project is estimated to be approximately 930 acres. See Table 2.1 for a breakdown of disturbance acreage by project component. Not all of the permitted land is projected to be disturbed, and not all disturbed land will be revegetated. The proposed acres to be revegetated are estimated at 419 acres, and are less than the disturbed acreage due to steep slopes in the open pits and overburden piles.

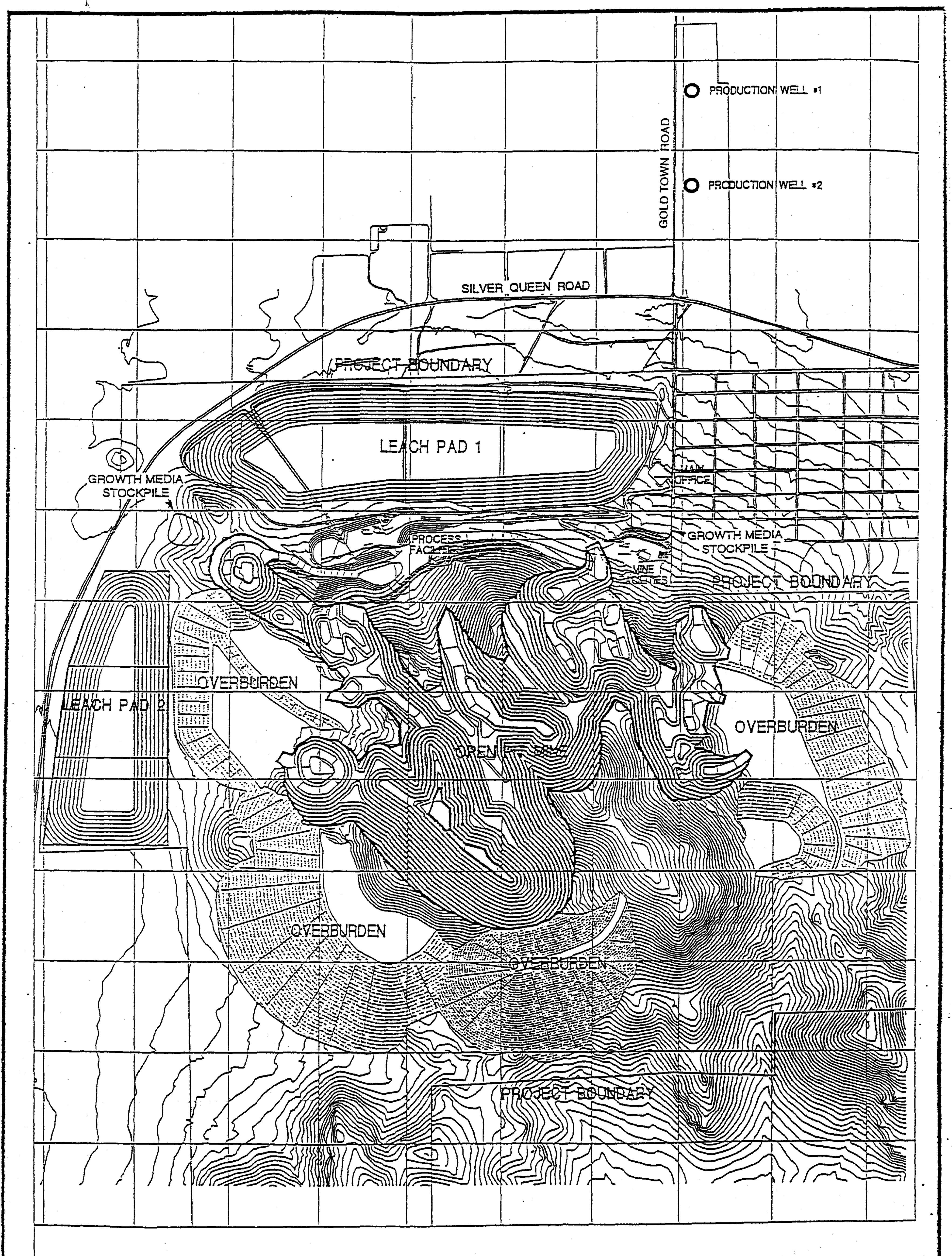
Approximately 215 acres of the project area have been previously disturbed as a result of the historic mining, milling, and exploration activities (see Figure 2.2). Therefore, of the 930 acres total disturbance, the new disturbance includes approximately 715 acres. Any previously disturbed land outside the project area and within the property boundary will be reclaimed where it is feasible to do so.

Due to the harsh desert conditions on the site, normal reclamation and revegetation methods utilized in more temperate climates will not succeed. Recent revegetation testing programs more appropriate for this desert climate were designed to test techniques for reclamation in the California Deserts. Results of these testing programs are described in Appendix A.

TABLE 2.1

Project Component Acreages

Project Component Area	Acres Disturbed	Acres Reclaimed	Growth Media (cubic yards)	Acres Active Revegetation	Acres Natural Revegetation
Heap leach					
North pad	166	166	79,000	166	-
West pad	77	77	37,000	77	-
Overburden pile					
Northwest	73	73	15,000	32	41
Southwest	92	92	8,000	17	75
South	86	86	1,000	2	84
East	93	93	12,000	26	67
Facilities and Roads	69	69	22,000	46	23
Open pit	265	44	21,000	44	-
Growth media stockpiles					
East	6	6	3,000	6	-
West	3	3	2,000	3	-
TOTALS	**930**	**709**	**200,000**	**419**	**290**



Golden Queen
MINING CO. INC.

SOLEDAD MTN. PROJECT
PROJECT COMPONENTS AND MINE AREA DISTURBANCE

FIGURE 2.1

APPENDIX A

RESULTS OF REVEGETATION TESTING PROGRAMS IN THE CALIFORNIA DESERTS

A.1 Introduction

Bamberg Associates has conducted revegetation testing programs at other mining sites in the California deserts starting in 1989 and continuing through 1995. These programs are current and monitoring is proceeding. Two of these mines are in the Sonoran Desert, and one is in the Mojave Desert near the current project. The results from these programs has confirmed that revegetation of disturbed mine sites in this area can be successful. The revegetation programs utilized the following techniques:

1) Microtopographic control of surface runoff into moisture catchment basins.
2) Transplanting and seeding the basins using locally collected plants, seeds, and stripped soils.
3) Establishing "garden spots" as source of plant material for continued revegetation.

The success of the above programs depended on years with abundant and appropriately spaced rainfall, such as the growing seasons of winter/spring in 1991/92, 1992/93, and spring of 1995. Full scale implementation of the reclamation program is presently beginning at several mining sites.

A.2 Revegetation Testing on Other Mine Sites

Bamberg Associates has conducted revegetation testing programs for the past five years (1989 through 1995) at several different sites in the Mojave and Sonoran Desert regions (Bamberg, et al, 1994; Bamberg and Hanne, 1995). These programs concentrated on the following aspects:

1) an intensive local seed collection program,
2) setting up seeding test plots in moisture catchment basins constructed on mine rock overburden piles and spent heap leach pads,

3) transplanting plant specimens on mine rock overburden piles dumps and reclaimed roads,

4) planning for grading and revegetation testing on the leach heap, overburden piles and roads and facilities at the mine sites.

Monitoring of the garden plots and transplants for revegetation success has been conducted at the beginning and end of each growing season (November/December and April/May). In general, the revegetation testing program and activities started in 1989/90 were extremely successful during 1992, 1993, and 1995. The main reason for this success was the record rainfalls during these years that were appropriately spaced and fell at optimum times for plant germination and growth. The testing program was designed to take advantage of rain and runoff by forming catchment basins that retain moisture, and then seeding and transplanting those places where the moisture collects. The catchment basins were successful and collected sufficient moisture resulting in seed germination in the seeded plots, luxuriant plant growth, and survival of transplants.

The seed collection program depended on adequate flowering and setting of seeds by the local vegetation, both abundant in 1992, and continued into 1993 and again in 1995 through the spring growing period. Sufficient moisture already existed in the soil to allow continued plant germination and growth during the early part of 1993 and 1995. This seed production also requires ample rainfall and moisture retention. Sufficient common plant seeds were collected during the spring and early summer seasons to carry out full scale seeding during final reclamation. The seeded plots, seed collection program, and transplanting programs have continued during the testing programs.

Test plots were set up on tops of mine rock overburden piles at two mines, and on the surface on 3 heap leach pads at one other mine. Portions of the program, such as seed collection and transplanting, have also been conducted at all three mines. The following sections highlight the setup and results of the revegetation testing programs:

Test plots

Test plots have been set up on overburden piles and spent heap leach pads: the test plots were set up in two areas within different mine overburden substrate conditions. One area was smoothed with a dozer and compacted by truck traffic and the other area had loose end-dumped mine overburden rock. Plots were also established on spent leach pads. Three types of seeding and transplant plots were established on overburden piles and heap leach pads (plus associated access roads):

1) double tear-drop shaped water catchment basins of 4,000 to 5,000 square feet on the compacted top portion of one overburden pile,

(2) half-moon crescent shaped catchment basins of 4,000 to 6,000 square feet on the entrance road and compacted western and southern portions of the second pile; and the sides of the heap leach pads,

3) irregular shaped basins in the loose end-dumped portions of two overburden piles, and the top surfaces of the heap leach pads.

All of the catchment basins collected and directed water to the 100 to 400-square-foot garden plots.

The mine rock in the test plots on one overburden pile was modified by adding combinations of amendments and treatments. Treatments included the addition of polyacrylamide (PAM) crystals as a soil moisture enhancement, ammonium nitrate as fertilizer, hay as organic mulch, and/or zeolite as a natural soil conditioner. Polyacrylamide crystals, a water-absorbing polymer, was tested by mixing it with the soil in some plots and in the transplant test plots at a rate to enhance the moisture retention capabilities of the soil. The monitoring of the amended test plots have not shown significant differences in plant germination and growth from the control plots.

Soils, as a seed source, were added from two areas: (1) desert pavement soil salvaged during construction of a heap leach pad, and (2) plots on one overburden pile were covered with soil collected from the nearby washes. The rest of the plots were seeded with locally collected native seed.

The results of the monitoring show that in these plots, germination and survival of plants has been successful. Test plots on the overburden piles were the first constructed in early winter 1989/1990, and have had the longest period of testing. These plots have received both wind-blown natural reseeding and seeding with nine species of plants collected in the area. There was excellent germination and growth observed in the all seeded plots during the April/May 1992 period. Regrowth, seed set, and additional germination from this seed occurred in 1993 and 1995 from the seeded plots. The most common plant in the plots and between berms is the adventive skeleton weed (*Eriogonum deflexum*) that is adapted to disturbed wash habitats. This plant species has reseeded from wind-blown seed. Good germination and growth was also displayed by four-wing saltbush (*Atriplex confertifolia*) seeded in December 1990. Other species that have become established are creosote bush (*Larrea divaricata*), fan-leaf (*Psathyrotes annua*) and desert-straw (*Stephanomeria pauciflora*). There were three palo verde seedlings observed in these plots, with some germination by three-awn (*Aristida*), spurge (*Euphorbia*) and a few small shrub species (*Encelia, Larrea*) scattered throughout the plots. Plants set seed in three of the past four years (1992 through 1995), and have contributed seeds to adjoining areas. A total of 37 species have been recorded in the test plots.

The trend to more complete ecosystem development was observed during the most recent monitoring in 1993 through 1995. In addition to vegetative surveys, animal habitat utilization has been recorded in the form of ant hills, rodent burrows and diggings, and plant grazing. Colonization and use of the reclaimed plots by wildlife species and insects has continued to expand. Small mammal burrows and ant nests were observed in many of the seeded plots. Vegetation has been grazed by jackrabbits, and by pack rats who are nesting in the boulders in the rough graded mine rock. Other animals noticed were birds and lizards in the spring, and evidence of a shrike using one of the transplanted ocotillo as a roost and to hang prey.

Specific area monitoring results of the test plots (from December 1993 to 1995) are summarized below. The relationship between time of establishment and other treatments and the current state of the revegetation success is included:

- The longest established (four growing seasons) of the revegetation test plots had initial slow plant and vegetation establishment because a good set of viable seeds was not available and a drought was ongoing at the time of planting. These test plots were established with a matrix of soil amendments, seeds or no seeds, and one watering or no watering. Past monitoring showed no significant effect from the soil amendments, although seed germination was enhanced by the simulated rainfall (one initial watering) in spring 1990 in some test plots. Seed germination emphasized the necessity of seeds or a good seed source for perennial plant establishment. Vegetative cover in all plots at one mine site averaged 55% (10% of this was perennial species), and cover was 22% (2% perennial) over the entire site in 1993. Perennial plants were in very good condition and some seed production was observed. Abundance of annual plants was very high.
- All of the plots for testing the best season (winter and spring) for seed planting had an average vegetative cover of 30% (0.5% of this was perennial species). The best results were from areas sown immediately after grading on fresh substrate during any time of year. Seeds remained covered in the soil and were dormant until favorable rains occurred.
- The portion of the overburden plots revegetated with transplants and wash soil as a seed source had an average vegetative cover of 40% (12% of this was perennial species) and was 15% (2% perennial) over the entire area in 1993. Perennial plants were in very good condition and some seed set was observed. Four perennial plants had seeds present, two of these also had flowers.
- On the heap leach pad reclaimed in 1992 the density of perennial shrubs and herbaceous perennials averaged 160 shrubs per acre during monitoring in spring 1995. The density of shrubs has been increasing on this site during the past two years, and the trend is for more perennials to become established as the vegetation matures. Numbers of species per plot (as a measure of diversity)

averaged 9.2 on the site, although the kinds of species differ due to the successional status of plant growth on the heap leach compared to offsite. A count of all perennial plants present in each basin that our transects crossed was recorded and included 109 perennials (12 species, mostly *Encelia farinosa* - inciensio). These species included surviving transplants of *Ferocactus cylindraceus* (barrel cactus) and *Opuntia acanthocarpa* (buckhorn cholla). The numbers and density of shrubs was more variable than total plant cover and could not be related to slope or aspect. The most conspicuous factor that may control shrub density is the lack of time for shrubs to become established on this successional vegetation type.

Transplant Program

All three revegetation programs had plant specimens transplanted from the areas to be disturbed into plots on the overburden piles and heap leach pads. The plants were dug out with a backhoe and transplanted, within a few hours, into prepared small pits. Two of the transplant programs used soil prepared with the soil amendments of PAM, zeolites, and ammonium nitrate. Immediately after planting, the pits were watered once and then again, approximately 3 hours later, to hydrate the PAM crystals. The soil amendments have not increased survival or growth of the transplants. These transplant programs were partially successful depending on the species transplanted and the age and condition of the specimen being transplanted. In one program, there was survival of 20 of the 41 plant specimens transplanted. The most successfully transplanted species in the Sonoran Desert were ocotillo with 8 out of 10 transplants surviving. Other successfully transplanted species were beavertail cactus, barrel cactus, and ironwood. The transplanting programs have been hindered by a lack of suitable plant materials due to the previous droughts, and the age and condition of the plants specimens. In the Mojave Desert, Joshua trees have been successfully transplanted.

Seed Collection and Source Program

The two sources of seed identified to date are: (1) surface soils stripped from areas to be disturbed that contain a reservoir of seeds, and (2) seed collected from native plants or from surface soils underneath shrubs in the local areas around the mine sites. The seed collection programs were fully implemented during the three years of abundant rains, the previous winters and spring of 1992 and 1993, and again in 1995. The stock of local seeds was collected for future sowing and collection will continue during the rest of the revegetation testing period. The surface soils stripped as a source of seed were from three types of areas. In the first area, soils were stripped from desert pavement surfaces on a flat bajada. This soil material was applied on the overburden rock piles in spring 1990 and contained very few seeds resulting in a low level of germination. The second area stripped was the area in a wash to be used as a borrow site for gravel. These soils were applied to overburden piles in late spring 1991. The third source was surface litter and soil underneath shrubs collected by hand. Abundant germination of many species was observed, and most annual and some perennial plants set good seeds during the growing season.

A.3 Reclamation Approach

The reclamation approach and concepts used during the revegetation test programs and ultimately for final reclamation are based on five components. These components are a direct result of the revegetation testing program as discussed above and consist of:

1. Establishing stable surface and drainage conditions that are compatible with the surrounding landscape. This will be accomplished during operations by material placement and grading, as well as after closure by final fine grading and contouring.

2. Where possible, create surface and substrate conditions conducive to seed germination, natural regeneration, and native plant establishment without

irrigation using moisture enhancement catchment basins. The soil surface will be altered through grading and the selective application of seed or appropriate soil material that will act as a seed source.

3. Collect and use seed from native plant species obtained from local and onsite sources, and transplant with locally adapted plant species into specially prepared local spots. These "garden" spots will act as loci for continued natural revegetation on the entire reclaimed site, including side slopes, berms, and pits.

4. Leave occasional slopes, particularly in the mined rock disposal areas and remnant pit slopes, as talus-like slopes to resemble the surrounding rocky hillsides. These surfaces may be recontoured for erosion and drainage control, as well as for slope stability and visual compatibility. Partial revegetation will occur through natural plant establishment from revegetated spots, as has been observed during the testing program.

5. Consider public safety through the stabilization of slopes and mined surfaces, removal and/or fencing of structures or landforms that could constitute a public hazard .

Surface stabilization must be obtained through contouring and drainage control as opposed to revegetation due to the desert climatic conditions. Vegetation cannot be established at a density that would generate slope stability through root mass and penetration. Revegetation is desirable from the standpoints of vegetation productivity, aesthetics, and wildlife habitat. Stability on natural, undisturbed slopes is provided by landform rather than vegetation, therefore, the basis for site reclamation initially lies with the physical manipulation of onsite topography for stabilization, and then with revegetation for aesthetics and wildlife habitat.

Past reclamation procedures were designed to use precipitation with surface runoff water management. The only watering of transplants was accomplished with onsite watering trucks at the initial time of transplanting. This minimal-irrigating approach to vegetation establishment is warranted in this desert climate due to the poor quality of water, to avoid irrigation-dependent plants, and the lack of significant success with other irrigation studies in these isolated desert habitats. Chances increase for long term successful revegetation if plants germinate naturally and survive without artificial watering.

A.4 Reclamation Standards

Based on the revegetation testing and subsequent monitoring, the reclamation standards recommended use a combination of reclamation activities and revegetation results. The standards for activities are based on the successful techniques used during recent revegetation testing programs at other desert mining sites. Since successful reclamation has been demonstrated to depend on a combination of surface preparation that takes advantage of natural precipitation and an adequate seed source, a dual approach to reclamation standards is considered necessary. The germination and subsequent growth of plants to produce vegetative cover (the plant cover standard) is then dependent on ensuing rainfall.

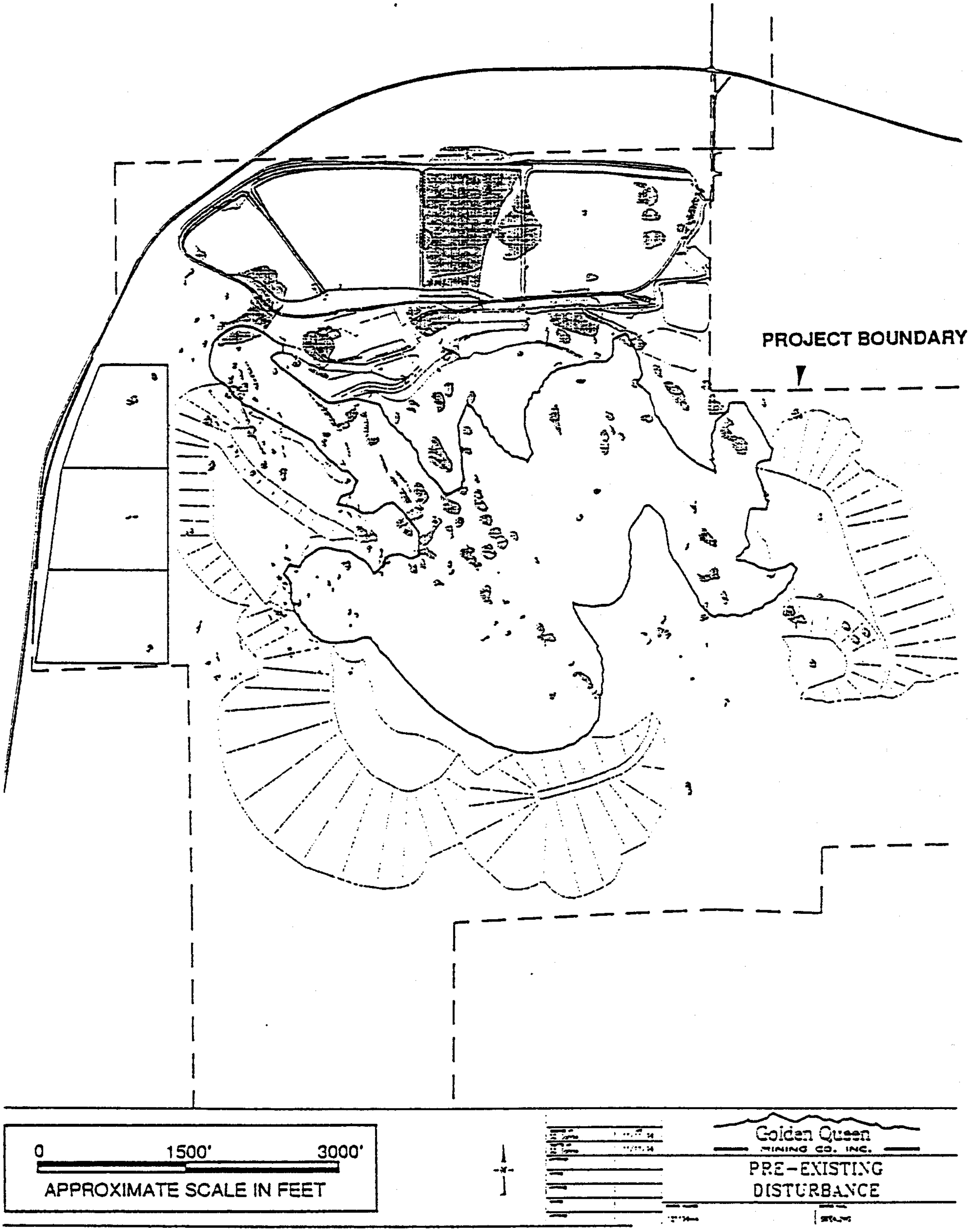
The reclamation activities include: (1) rough grading for drainage control, erosion control, and surface stability, and (2) fine contouring for surface configuration and water catchment basins. The revegetation standards will be based on a percentage of the vegetation cover present on corresponding adjacent vegetation types. The existing vegetation cover will be determined using a vegetation/topographic correlation method. The reclamation activities that will be performed, including rough and fine grading, need to be field determined at the time of closure. The bond period for this portion of the reclamation activities should be set to conclude a period for satisfactory completion of these activities.

The revegetation standard can be determined using a sampling protocol that has been developed for sampling vegetation cover and patterns in relationship to topographic, soils, and erosional factors. The topography and soils on the reclaimed site will be complex and disturbed, and the vegetation established will be in a successional status, not uniform, and composed partly of hardy and pioneer species that may differ from natural vegetation. The specific type of sampling for determining the relationship of vegetation patterns to soils and topography should be conducted on relatively undisturbed areas in the vicinity of the mine site. The purpose of monitoring and sampling is to determine the vegetative cover, densities, and patterns of vegetation in the specific location of a mine in California as a guide to conditions to be expected on the reclaimed site.

The method proposed and used during the revegetation testing program at current mine sites uses linear coupled transects. These are linear plots (typically 2 x 10 meters in size, or longer in the desert) laid end to end and oriented parallel to or across environmental gradients. A 30 meter steel tape will be stretched between markers. Lines of transects generally are run for 500 meters or more depending on the ecological scale of vegetation in relationship to topographic parameters. The general areas to be surveyed are the slopes, flats, and near the mine that will not be disturbed by mining. Vegetative, topographic, erosional, and soil parameters are to be recorded in each plot. The transects are analyzed for the cover, dominant species, type of vegetation, and amounts of bare areas as they relate to topography, soils, and erosional features. The linear transects can be run from randomly selected located points near the mine. Similar linear transects should be measured on the reclaimed site using an analogous systematic random location method. An attempt will be made to have approximately the same number of samples on the reclaimed sites and on the adjacent areas.

The parameters in the transects to be estimated or measured for vegetation are percent cover by species, and numbers of shrubs and perennials by species. Topographic features recorded will be slope and aspect; soils and surface features will be types of substrate and percentage rock; and erosion features will be depths and width of drainages, and amounts of aggradation and degradation (erosional status) of surfaces. The number of samples will depend on the heterogeneity of the linear plots being surveyed. Sample adequacy for the number of factors being measured are generally not of concern, but a large number of samples is required for multiple regression analysis. The results of the transects will be analyzed for: (1) the vegetative types, percentage cover, and sizes of area with low vegetative cover; (2) the percentage and types of topographic slopes; (3) the percentage and types of soil; and (4) types and amounts of erosional features. The parameters will be developed using statistical means and standard deviations. The correlation coefficients between these four sets of parameters can be determined for application toward developing the range to be used in the standards, if needed.

The results of the analysis will then be applied as a standard on the reclaimed areas at the proposed mine site. It is proposed that the standard for the reclaimed surfaces be set at a percentage of cover and density of the similar adjacent vegetation measured in comparable areas. It is recommended that the monitoring and bond period for revegetation be set at a maximum of 5 years, or earlier if adequate rains occur and plant germination and growth equal the criteria standard.



LEGEND

▨ AREAS OF PREVIOUS DISTURBANCE

GOLDEN QUEEN MINING COMPANY INC.
Soledad Mountain Project

PREVIOUS DISTURBANCE

DATE 11/96		FIGURE	2.2

3.0 SITE CHARACTERISTICS

The Soledad Project is located on Soledad Mountain approximately five miles southwest of Mojave, California. This is 70 miles northeast of Los Angeles on the western edge of the Mojave Desert. Soledad Mountain is an isolated, roughly circular volcanic peak approximately three miles in diameter. The mountain rises out of the alluvial flats in northwestern Antelope Valley southeast of the Tehachapi Mountains. Elevations on the mountain range from 2800 feet at the base to 4190 feet at the highest peak. The slopes are steep with rock outcrops. Residual weathered rock and soil lie below the outcrops. Alluvial slopes and flats surround the mountain on all sides except for the northeast where there are low hills and ridges with a former operating gold mine.

The climate is typical for the Mojave Desert with hot, dry summers and cool winters. Temperatures range from 70 to 105 degrees Fahrenheit in the summer and 27 to 60 degrees in the winter. The average precipitation is approximately five inches per year with the majority of the rainfall occurring in the winter months from frontal storms. With increasing elevations on Soledad Mountain, the temperatures are cooler and rainfall and snow increases.

The desert climate and dry substrate conditions influence the soil and biological resources. Soils are generally skeletal rocky or pebbly loams on the slopes, and sandy loams on the alluvial fans and flats. Soils consist of weathered residual substrates on the mountain grading into undifferentiated alluvium around the base of the mountain. The mountain is characterized by rock outcrops and rocky soils with predominantly desert shrub-grass species that have been altered by frequent burning, grazing by sheep, recreation, and mine related disturbance. The vegetation is a creosote/burrobush type on the flats and alluvial slopes below and surrounding the mountain. Vegetation on the mountain slopes consists of an altered shrub/grass. Wildlife is fairly diverse, however, animal populations have a low density, a high diversity, and activity is seasonal.

Previous disturbance on the mountain is from historic mining activities, previous and more recent exploration, burning, and increased human activity. Groups of people use the area for recreational vehicle activities and target practice for firearms. The two activities which have had the most influence on biological and soil resources are the mining/exploration and the repeated fires which have highly altered the vegetation.

As part of a separate Biological and Soil Resources Evaluation by Bamberg Associates, 1996, stand surveys were completed in 1990 and 1995. The results for the two surveys were very different due to variations in moisture and growing conditions. In 1990, the mixed shrub community on the mountain slopes consisted mainly of annual grasses with a cover value of 10% due to fire. In areas protected from fire, two shrubs dominated with a cover value of 49%. In 1995, in the same area, cover values were estimated at 80% with extremely variable vegetation. Tables showing the survey results are contained in the Biological and Soil Resources Evaluation.

4.0 RECLAMATION APPROACH

The basis for the revegetation approach and techniques presented in this plan is from observations of natural revegetation occurring near the Soledad site, as well as from the ongoing revegetation testing programs at other mines as presented in Appendix A.

4.1 Reclamation techniques

The results from the testing programs have confirmed that revegetation of disturbed mine sites in this area can be successful. The revegetation programs utilized the following techniques:

1) Microtopographic control of surface runoff into moisture catchment basins.
2) Transplanting and seeding the basins using locally collected plants, seeds, and stripped soils.
3) Establishing "garden spots" as source of plant material for continued revegetation.

The success of the testing programs depended on years with abundant and appropriately spaced rainfall. Full scale implementation of the reclamation program is presently beginning at several mining sites. These testing results and start up of implementation are the basis for the following components utilized in this Soledad plan:

1) The Soledad site will be revegetated by establishing surface drainage control and small catchment basins capable of sustaining vegetation without artificial irrigation.
2) Seeds will be collected from nearby areas for revegetation.
3) A reclamation standard for vegetation parameters on the reclaimed surfaces will be established by appropriate sampling of adjacent vegetation types and habitats. The goal is a productive self-sustaining ecosystem given the conditions on the reclaimed site.

4) Wildlife habitat and open space will, once again, be the primary land use objective.

Previously disturbed areas outside the project component boundaries will not be reclaimed. Approximately 419 acres (45%) of the areas to be disturbed during the current proposed mining can be reclaimed (refer to Table 2.1). Portions of the project site will not benefit from a revegetation effort due to the steep slopes, poor topographic conditions, and harsh, desert climate with poor soil substrate conditions.

The reclamation approach and concepts are based on five components. These components are a direct result of the revegetation testing program (Appendix A) and consist of:

1. Establishing stable surface and drainage conditions that are compatible with the surrounding landscape. This will be accomplished during operations by material placement and grading, as well as after closure by final fine grading and contouring (see Section 6.1).

2. Where possible, creating surface and substrate conditions conducive to seed germination, natural regeneration, and native plant establishment without irrigation using moisture enhancement catchment basins. The soil surface will be altered through grading and the selective application of seed or appropriate soil material that will act as a seed source (see Section 6.2 and 6.3).

3. Collecting and using seed from native plant species obtained from local and onsite sources, and transplanting with locally adapted plant species into specially prepared spots. These "garden" spots will act as loci for continued natural revegetation on the entire reclaimed site, including side slopes, berms, and pits (see Section 6.4 and 6.5).

4. Leaving occasional slopes, particularly in the overburden pile areas and remnant pit slopes, as talus-like slopes to resemble the surrounding rocky hillsides. The horizontal surfaces of the overburden piles ~~may~~ will be recontoured for erosion and drainage control, as well as for revegetation and visual compatibility. Partial revegetation will occur through natural plant establishment from revegetated spots, as has been observed during the testing program (see Sections 7.1 and 7.2).

5. Considering public safety through the stabilization of spent ore heap slopes and removal and/or fencing of structures or landforms that could constitute a public hazard (see Section 7.3 and 7.4).

Surface stabilization must be obtained through contouring and drainage control as opposed to revegetation due to the desert climatic conditions. Vegetation cannot be established at a density that would generate slope stability through root mass and penetration. Revegetation is desirable from the standpoints of vegetation productivity, aesthetics, and wildlife habitat. Stability on natural, undisturbed slopes is provided by landform rather than vegetation, therefore, the basis for site reclamation initially lies with the physical manipulation of onsite topography for stabilization, and then with revegetation for aesthetics and wildlife habitat.

Post reclamation procedures are designed to use precipitation with surface runoff water management. This minimal-irrigating approach to vegetation establishment is warranted in this desert climate due to the poor quality of water, necessity of avoiding irrigation-dependent plants, and the lack of significant success with other irrigation studies in these isolated desert habitats. Chances increase for long term successful revegetation if plants germinate naturally and survive without artificial watering.

The use of containerized seedlings is not recommended for the mine revegetation. The seedlings may not have the right characteristics (genotype) for survival on the mine substrates. Watering is generally required for a period of time, up to two years. When watering is discontinued, plant survival is compromised. Water quality is a problem due to high mineral contents that can form crusts after a short period of irrigation. Propagation of containerized seedling is expensive and requires the extra use of resources. The better alternative is to set up the proper substrate and moisture conditions for seed germination and growth by enhancing natural processes of vegetation succession. Plants that germinate and grow from seed without horticultural or artificial means have a greater chance of long term success. However, the use of transplants of site indigenous species will be included in test plots to determine the chance of their successful use.

4.2 Reclamation Results and Standards

Reclamation activity consists of two stages. The first stage involves the reclamation activities of physical preparation of the surfaces and seeding. The second stage is after a period of vegetation establishment. Final bond release will be based on revegetation standards.

For the first stage, the reclamation activities include: (1) Removal of building structures and equipment, (2) testing of soils, (3) heap leach pile neutralization (the bond for this to be covered by a separate agreement with the Regional Water Quality Control Board), (4) rough grading for drainage control, erosion control, and surface stability, (5) fine contouring for surface configuration and water catchment basins, (6) seeding and vegetation establishment, (7) fencing and (8) administrative activity. The reclamation activities that will be performed, including rough and fine grading, will need to be field determined at the time of closure. A final engineering design will be prepared based on the final surface configuration when the mine is closed. GQMC will commit to providing this final plan and costing. After satisfactory completion of these activities, the bond for the first stage will be released.

The second stage of reclamation involves evaluation of revegetation success determined during a monitoring period. The vegetative cover (the plant cover standard) is dependent on subsequent climatic conditions, particularly the ensuing rainfall amounts and patterns.

The revegetation success will be dependent on the results of seed germination, and plant growth and establishment. These standards proposed are a percentage of the vegetation parameters based on corresponding adjacent vegetation types, or on vegetation that has been successful on disturbed land in revegetation testing.

The vegetation standards will be determined using a sampling protocol that has been developed for sampling vegetation and topographic variables on reclaimed lands. The topography and soils on the reclaimed site will be complex and disturbed, and the vegetation established will be in a successional status. The vegetation will not be uniform, and composed partly of seeded species, but also hardy and pioneer species that may differ from natural vegetation. Soledad Mountain has habitats and vegetation that have been mined, burned, and grazed in the past, and is not a pristine area. The vegetation that has established on historic mining was observed to differ from the relatively natural vegetation in species composition and cover.

The vegetation cover in existence at nearby areas at the time of revegetation will be determined using a linear transect monitoring method. This specific type of sampling for determining the relationship of vegetation patterns to soils and topography will be conducted on relatively undisturbed areas in the vicinity of the mine site. The purpose of this sampling is to determine the vegetative cover, densities, and patterns of vegetation in this specific region of California during the climatic conditions at the time of reclamation as a guide to conditions to be expected on the reclaimed site.

The method proposed uses linear coupled transects (see also Appendix A). These are linear plots (typically 2 x 10 meters in size, or longer in the desert) laid end to end and oriented parallel to or across environmental gradients. A 30 meter steel tape will be stretched between markers, and variables recorded for each 10 meter plot. Vegetative, topographic, erosional, and soil variables will be recorded in each plot. The transects will be analyzed for the cover, dominant species, type of vegetation, and amounts of bare areas as they relate to topography, soils, and erosional features. Previous vegetation sampling on Soledad Mountain has measured perennial vegetation cover from less than

1% to about 40% in years of low precipitation, and up to 80% cover in years of abundant moisture. This cover is highly dependent on seasonal rainfall, and the 80% cover is a maximum following three years of abundant rainfall.

At the time of sampling for bond release, concurrent and comparable monitoring will be conducted in the same year on undisturbed sites on the mountain and in the reclaimed areas. The linear transects will be run from located points on the mountain. The general areas to be surveyed will be the slopes or flats on portions of Soledad Mountain that will not be disturbed by mining. Similar linear transects will be measured on the reclaimed site using an analogous systematic random location method. Approximately the same number of plots will be sampled on the reclaimed sites and on the adjacent areas.

The biotic variables in the transects to be estimated or measured for vegetation are percent cover by species, and numbers of shrubs and perennials by species. The abiotic and topographic features recorded will be slope and aspect; surface features will be types of substrate and percentage rock; and erosion features of depths and width of drainages. The number of samples will depend on the heterogeneity of the linear plots being surveyed. Sample adequacy for the number of factors being measured are generally computed based on statistical validity. The results of the transects will be analyzed for: (1) the vegetative parameters of percentage cover, density and diversity; (2) the percentage and types of topographic slopes; (3) the percentage and types of soil; and (4) types and amounts of erosional features. The parameters will be developed using statistical means and standard deviations.

The results of the analysis will then be applied as a standard on the reclaimed areas at the proposed mine site. It is proposed that the standard for the reclaimed surfaces be set at 35 percent of the vegetative cover (amount of surface covered by perennial plant canopies), 20 percent of the density (number of perennial plants per unit area) and 30 percent of diversity (number of different species of perennials in a sample area). These standards will be compared to similar adjacent vegetation measured in comparable Soledad Mountain areas either in undisturbed vegetation, or as compared to a reclaim vegetation standard. These standards may change as a result of current and future monitoring. The results of the field sampling procedures will be documented prior to completing the final reclamation at Soledad, and can be repeated during the monitoring stage. It is recommended that the monitoring and bond period for revegetation be set at 5 years, or less if adequate rains occur and plant germination and growth equal the standards. Golden Queen acknowledges that monitoring will need to be performed until performance standards are met.

5.0 RECLAMATION SCHEDULING

The schedule for revegetation plots, interim and final reclamation will depend on the construction, operation, and closure of the mining facilities. This schedule will be developed after detailed engineering and operational plans are finalized, but will be periodically reviewed as mining progresses. Interim reclamation plots or areas can be established after several years into a project when disturbed surfaces are available that will not be further disturbed or otherwise used. Monitoring will be conducted on the reclamation plots and final reclamation areas during the appropriate seasons (generally twice a year during the first two years, and annually thereafter). Maintenance activities for test plots during mining and reclaimed areas after closure will also depend on current activities and the effects of weather patterns.

6.0 GENERAL RECLAMATION PROCEDURES

This section will first describe the general and specific procedures recommended for reclamation at the Soledad project, then will describe how these procedures will be implemented in Section 7.0. The purpose of the reclamation planning and test plots is to establish the most practical methods for natural revegetation and seeding with minimal use of equipment and materials given the conditions on the project site.

The goal of this reclamation program is to return the disturbed area of the mine site to a stable, self-sufficient ecosystem. For this reason, irrigation is not recommended because of the dry desert climate. Plants grown under irrigation practices will not survive when the irrigation is discontinued. This non-irrigating vegetation establishment is also warranted in this desert climate because of the poor quality of water and lack of long-term success at other, climatically similar, mine sites. In addition, locally collected and native plant species seeds will be sown. If native and adapted plants germinate in a specific site and survive, there is a significantly better chance for long term successful revegetation at that site. The procedures that will be set up at the areas to be reclaimed are: (1) set up and grade the area surface configuration for drainages and water collection, (2) collect local seed in the vicinity of the proposed mine, and (3) seed the plots.

6.1 Grading the Areas

The initial rough grading will blend edges of overburden piles and reduce the grade of the leach heap pads before final grading for catchment basins. Potential drainage and erosion processes will be important considerations in the design for shape and size of the basins.

Previous experience has shown that basins of about 4000 to 5000 square feet in this desert climate provide sufficient moisture collection to support garden spots of about 400 square feet. Garden spots are the lowest area in the basin were water saturates the soil, and this is the area where seeds will be sown and initial plant growth will be encouraged. The shape of the catchment basin can vary from crescents on slopes to coupled doubleended ovals on flatter tops of mined rock piles. The mine overburden piles have surface and subsoil conditions similar to surfaces that will be encountered on the other disturbed areas such as roads, facilities, and leach heaps. These will be compacted surfaces of mixed rock substrates with varying amount of actual soil or highly weathered materials other than coarse alluvium.

6.2 Surface Preparation

Most of the surfaces of the fine graded water catchment basins will be left in a rough condition. Compacted surfaces may be loosened by ripping. This will enhance seed catchment and water retention and also prevent erosion channels from forming during the subsequent storm events and runoff.

A seeding or transplant plot will be established in the lowest point of the catchment basin or in depressions where water will collect in chiseled compacted ground or rough graded rock overburden piles. These plots can be of any shape, but should be about 100 to 400 square feet in size. These plots can be constructed either by dozing or by digging a depression with a front end loader and piling the excavated material as a low ridge to the west (up wind) side of the depression. The low ridge acts as a wind barrier to the prevailing strong north and west winds. The seed mixture or transplant material is placed in the depression immediately after basin and plot construction when the soil surface is loose and seeds will lodge.

Other surface preparation procedures that will potentially be used are: (1) deep chiseling of large compacted surfaces such as haul roads or heavily traveled routes, bone yards, and former shop and facilities areas, and (2) dozing of mounds, berms of haul roads, and any dumped material other than mine overburden rock. Grading and contouring along the minor washes will slow and redirect runoff to enhance plant survival. This surface water management will consist of construction of berms above catchment basins.

6.3 Soil Salvage, Placement and Amendments

The soils and surface material on Soledad Mountain were evaluated as a plant growth medium and source of seed. Soledad Mountain was formed as a result of volcanic activity and, therefore, the parent material and soils are of volcanic origin. The principal rock substrates are of three general types:

1) two kinds of rhyolites (flow and intruded)
2) pyroclastic debris, tuffs, and breccias
3) quartz alunites and latites

The soils formed from these substrates vary from weathered rock outcrop to deeper droughty skeletal soil with a clay loam to sandy loam texture. Soil development has been slow and profile development incomplete or non-existent. The soil surfaces are fairly stable, however, in some places they are old and weathered. Although the slopes on the Soledad Mountain are steep, there is little evidence of slope or soil instability in the form of slides, soil creep or solifluction lobes. The reasons for this are unknown, however is most likely related to the weathering of these soils producing a clay content that binds soil and rock particles into a stable mass. In this dry climate, the soil does not become saturated enough to move on the bedrock which is rough and without bedding planes.

Based on experience at other revegetation testing areas, it is likely that large portions of the reclaimed surface will consist of uncovered mined rock material which weathers into soil substrates containing fines. During final reclamation, pockets in which plants can become established will be interspersed at varying intervals within the contoured basins. In addition, scattered vegetation will become established within a short time depending on local climatic conditions (rainfall events), softening the visual disparity with surrounding areas. Although mined rock overburden material may not, in the foreseeable future support the same type of vegetation which currently exists on upland slopes, it is anticipated that these areas will probably support a greater vegetative cover than do the rock outcrop and adjacent alluvial fans that currently occupy large portions of the site.

Recent testing of revegetation on salvaged desert soils indicate that the salvaged and stockpiled soils are not a better growth medium than the prepared surfaces of overburden piles and heap leach materials. The weathered desert soils are generally poor and lack sufficient nutrients to support revegetation when used as a plant growth medium. The overburden and leach materials are a good source of nutrients, and have appropriate textures for desert plants.

The availability of suitable soil material is limited due to past mining on Soledad Mountain and the large amounts of rock rubble and outcrop. The lack of soil material will not negatively impact the primary goal of reclamation, which is surface and subsurface stabilization, subsequent revegetation, and the re-establishment of a stable area capable of productive land uses (vegetation and wildlife habitat) after the completion of operations. Generally topsoil is nonexistent on the lower slopes and alluvial fans in the project area due to poor soil development. However soil materials up to 0.5 feet in depth can be selected and salvaged from the leach pad area and lower portions of the overburden piles areas, where suitable, as sources of seed. This salvaged material is referred to as growth media. Growth media with suitable texture will be used in localized areas as a source of seed. The growth media will be extracted from areas within the project site prior to disturbance by mining or operations.

The availability and amounts of growth media of suitable substrate material are estimated based on the areas to be disturbed and percentage of previously disturbed soils. It is estimated that 200,000 cubic yards of suitable growth media can be salvaged from the leach pads and flatter portions of the overburden pile areas. This material will be used during final reclamation by spreading in selected areas to a depth of 2 inches. This plant growth media will be spread as a thin layer using a front end loader, after the soil is transported from the stockpiles to the area to be spread using haul trucks. As summarized in Table 2.1, more than enough growth media is available in the estimate of 200,000 cubic yards.

In general, soil amendments have not proved to be necessary or effective in this desert climate in promoting or enhancing plant growth. The revegetation test program included testing soil amendments of fertilizer, a soil conditioner, water retention crystals, and an organic mulch. The results of adding soil amendments have either been neutral or inconclusive to date in the testing program due to the extreme and variable growing conditions during the past several seasons. Based on the results to date, using soil amendments are not recommended. The use of soil amendments is costly and time consuming, and does not enhance vegetation growth and productivity. It is estimated that most plots, up to 90%, will have good germination and plant growth using moisture catchment and plot establishment techniques alone, provided a good seed source is used and rains occur. These techniques should be adequate for most revegetation purposes without additional soil amendments.

The lowest area within each catchment will be formed into garden spots of about 400 square feet by roughing the surface if compacted by equipment passes. Salvaged soils will be placed first in these spots, and then distributed over other areas, as available. These garden spots will be more heavily seeded to provide an area for quick seed germination and plant growth. These spots can then act as centers for seed production and dispersal in subsequent years. They can also be used as locations for transplanted plant specimens to ensure good survival and growth after replanting.

6.4 Collecting Seed Sources

In general, locally adapted seeds are available from two sources: these are: (1) seeds in surface soils salvaged during construction of heap leach and portions of the overburden piles, and (2) seeds hand collected from plants and soils on and in the vicinity of the mine.

Seeds in surface soils have been observed in surface plant debris and organic matter under shrubs and in wind-rowed furrows in undisturbed vegetation around the base of the mountain. Suitable locations that have abundant, viable appearing, seeds of several plant species that grow in relatively undisturbed vegetation will be determined by inspection.

This source of locally collected seed in surface soils typically will contain viable seeds from up to 25 species of native perennial shrubs, perennial forbs, and annuals. This information is based on previous tests in similar desert conditions. In addition, long-lived seeds of a variety of annual plants were also noted to germinate after sowing under favorable rain and temperature conditions during subsequent growing seasons. There are very few weeds or undesirable seeds in the collections, provided the seed is collected from soils in undisturbed native vegetation.

Seeds can be collected from plants into bags and from underneath shrubs using hand implements such as shovels, trowels, or simply hand scooping the surface materials (no more than the top one-half inch) containing the seeds and placing in large paper bags. The collected material may at times contain a large percentage of plant litter and organic matter mixed with the seed. However, a large volume of this seed containing material can be quickly collected offsetting the low percentage of viable seed. A sufficient volume of seed materials can be collected in a short period of time to sow the areas needing revegetation. In 1995, approximately 55 bushels of seeds containing enough seed to sow an estimated 780 acres were collected at a nearby mine in the Mojave Desert.

This method of seed collection by hand does not unduly disturb the native vegetation community since the seeds are not collected all in one place, nor from a single surface. This method of seed collection can be used to build up a sufficient reservoir of seeds during those favorable years with good set and production. Most of the seed will remain viable during the short period of time that the seed is stored, generally from a few days up to several years. Seeds of some desert plants are known to remain viable for long periods of time (decades) under favorable conditions. It is not necessary that all seeds of all plants species survive in order to establish good germination, vegetative growth, and productivity during reclamation.

The disturbed surfaces on the mine of overburden piles, spent ore heaps, and roads and facilities do not resemble natural habitats now present on Soledad Mountain. These surfaces do not simulate alluvial fans, mountain slopes or rock outcrops with weathered mature surfaces, but are an atypical substrate. The approach to seeding these disturbed surfaces is to collect available seed from a variety of native species, seed with this mixture, and allow the successful genotype of the native species to germinate and grow. There is no known treatment or seed mix to anticipate what species will successfully germinate and colonize the reclaimed surfaces. Some local species are successful in germinating and growing on the disturbed surfaces, others will not grow until the vegetation and soil has matured, or other unknown specific site factors are present. Therefore, specific seed mixtures for certain slopes and exposures have not been established. It is possible that test plots will aid in determining a more specific seed mixture for different areas on the project site. General seed mixtures for slopes (mixed upland shrub) and flats (shrub scrub) as defined in Figure 4-1 of the Biological and Soil Resources Evaluation Report are shown in Table 6.1.

6.5 Sowing Seed

The seeds will be immediately sown or growth media applied (the same day or within a few days) onto the roughened soil surfaces prepared for revegetation. The garden spots will be sown first at a heavier rate than the rest of the prepared catchment basins. Depending on the amount (volume) of seed collected, other portions of the basins will be lightly sown with seed or spread with growth media.

Seed will be hand broadcast or will be applied using hand-held spreaders. The seed application rate is estimated at approximately seven to eight pounds per acre. The rate of sowing will be adjusted, by volume, depending on the visible seeds present. Generally, about one-half cup of seed containing material per catchment basin was sufficient in past trials using this method. As mentioned earlier, seed will be sown immediately following the fine grading of the basins while the soil surface is loose. Plant growth media will be spread to an average depth of two inches on most areas. Subsequent rains and weathering processes cover the seed and prevent washing and blowing.

Experience with seeding trials at other windy mine sites has demonstrated that seeds sown directly onto freshly graded and roughed surfaces are quickly covered and are not blown any distance. The seeds are sown by hand in shallow basins behind berms (or ridges and furrows) that also protect seeds.

TABLE 6.1

Preliminary Plant Seed Mixture for Revegetation

Shrubs		Rate of Application*	
		Slopes	Flats
Acamptopappus sphaerocephalus	goldenhead	5	5
Ambrosia dumosa	burrobush	5	20
Atriplex confertifolia	shad scale	1	5
Atriplex polycarpa	cattle spinach	3	3
Chrysothamnus nauseous	rubber rabbitbrush	10	5
Encelia virginensis	acton encelia	5	10
Ericameria cooperi	goldenbush	1	2
Eriogonum fasciculatum	California buckwheat	5	5
Eriogonum plumatella	flat-top buckwheat	2	2
Grayia spinosa	spiny hop-sage	10	1
Hymenoclea salsola	cheesebush	2	1
Krascheninnikovia lanata	winter fat	10	1
Larrea tridentata	creosote bush	20	25
Xylorhiza tortifolia	mojave-aster	5	5
Grasses			
Poa secunda	bluegrass	5	1
Pleuraphis rigida	big galleta grass	1	2
Trisetum canescens	trisetum	2	1
Herbaceous Perennials and Annuals		7	4
Camissonia brevipes	evening primrose	+	+
Chaenactis fremontii	Fremont's pincushion	+	+
Dalea mollis	soft indigo	+	+
Eriogonum trichopes	little trumpet	+	+
Lupinus brevicaulis	sand lupine	+	+
Malacothrix californica	desert dandelion	+	+
Phacelia glandulifera	tackstem phacelia	+	+
Platystemon californicus	cream cups	+	+
Salvia carduacea	thistle sage	+	+

* Rate is an estimated percentage of total seed by volume and reflects relative abundance of plant species.

+ Rate for herbaceous species is variable depending on seed availability.

7.0 RECLAMATION IMPLEMENTATION

The open pit and associated mining activities at the Golden Queen Project will result in four main areas of disturbance: (1) overburden pile areas, (2) mining open pit(s), (3) spent ore heap, and (4) facilities and access and haul roads. The open pit will receive a minimum of reclamation, as will the sides of the overburden piles. The following sections outline specific reclamation considerations for each of these disturbance areas at the project site.

For the purposes of this document, closure is defined as "the activities necessary to eliminate any groundwater hazards (heap rinsing and detoxification, plant decommissioning, pond removal, etc.)" and reclamation is defined as "the physical activities (heap recontouring, plant/facility removal, access road recontouring, site revegetation, etc.) necessary to rehabilitate the site (see Appendix A). A closure and post-closure plan will be developed that describes the physical aspects of closure implementation. This document details reclamation and revegetation plans. As previously mentioned, due to the harsh nature of the desert environment and unsuitable substrates, only areas suitable for revegetation will be attempted (See map of areas in Figure 1). Many areas (steep slopes, south facing slopes, rock outcrops etc.) are not conducive to revegetation. Therefore, not all of the areas listed as "disturbed" will be revegetated.

7.1 Overburden Piles

The overburden piles will have surfaces and subsoil conditions similar to mine pits, roads, facilities, and leach heaps. These will be surfaces of mixed rock substrates with little developed soils or highly weathered materials other than coarse alluvium. Revegetation testing on similar sites conducted to date showed that the top horizontal surface of the mined overburden rock piles has two types of surface conditions. The first is loose end dumped material with undulating surfaces that result from dumping mine overburden rock without dozing or grading. The second is hard packed surfaces left from haul truck traffic and dozing. Rough surfaces will be smoothed and configured into shallow basins constructed with irregular outlines of about 4000 to 5000 square feet. After ripping the compacted hard surfaces in the flat portions, similar basins will be constructed with a dozer and grader. The configured surfaces will be sown with seed or spread with growth media. Revegetation of overburden pile side slopes after recontouring is not proposed because such slopes are not conducive to active revegetation in the harsh desert environment. Natural revegetation will occur within a period of several years.

7.2 Mining Open-Pit

At the end of mining operations, in-pit diversions constructed during mining to divert surface runoff from the upstream catchment area will be breached. The natural drainage upstream of the pits will be reestablished so that runoff will enter the pits at the low point of the pit rims. Standing water will collect in the pit bottoms and some active revegetation will be conducted for wildlife habitat. Blasting of pit slopes and high walls is not needed for reclamation.

Flat benches remaining along pit walls after mining are rough surfaces providing for the anchoring of seed and soil materials available through natural processes. However, management and mine health and safety supervision recommend that these surfaces be left alone on pit wall faces due to safety considerations. These pit walls will be avoided during final reclamation. Surface material will be left in a loose, rough condition to aid in moisture retention, decrease wind erosion losses, and encourage establishment of seedlings in small surface crevices. In addition, it is expected that over time some natural encroachment of native species (i.e. creosote bush, burrobush, inciensio, cactus, and buckwheats) adapted to rock outcrop habitats already existing on Soledad Mountain will occur in isolated groupings. Areas along the perimeter of the pit will be fenced for safety. A portion of the pit haul road and flat service areas (estimated at 10% will be ripped and revegetated.

7.3 Spent Ore Heap

The spent ore heap will be rough graded and contoured to reduce slopes and blend with surrounding topography. Graded surfaces will be formed into catchments basins and seeded. It is not anticipated that fertilizer or soil amendments will be needed. The goal of reclamation in the heap leach area will be the creation of contoured, active and naturally revegetated areas that blend unobtrusively into the gentle slopes surrounding the leach site. Heap detoxification and recontouring will be accomplished as described in the closure plan.

Outslopes will be regraded after detoxification is complete. The liners will be pulled and covered. Outslopes will be graded to a final 2.5H:1V slope, so that the sharp contours of the heap will be appreciably softened and the graded material will extend outward far enough to obliterate the upslope perimeter berm that prevents surface water run on to the heap during active operations. Drainage on and around the heap will direct runoff for reclamation and revegetation enhancement. In addition to regrading the heap outslopes, the haul road ramps over the interceptor ditches will be removed. This will include the removal of any culverts required during operations and will allow the reestablishment of free-flowing drainage in this area.

Stabilization of the post-closure heap landform will be achieved through the regrading and slope reduction discussed in preceding paragraphs. Given the final 2.5H:1V slope configuration, the spent ore of the heap will be stable. For the aesthetics of the project from visible points on nearby roads, some mounding of the top of the heap will be included during regrading activities. This will serve a dual purpose: (1) small scale reduction of visual contrast with surrounding landforms and (2) creation of microsite hollows and depressions for revegetation purposes.

After recontouring, microsite hollows and garden spots will be selectively formed on the top and slopes of the heap. Revegetation will then proceed in the manner described in Section 6.4 and 6.5. It is likely that seeding of the entire heap surface would be ineffective; rather, selective seeding will be in the garden spots, with light seeding of the overall heap. The overall goal of revegetation on the heap, as well as on other project site disturbances, will be a productive vegetation cover for habitats and to allow a mature ecosystem to develop.

7.4 Facilities, Access and Haul Roads

The decommissioned and salvaged facilities sites such as offices, shops, laydown, and boneyard sites will be ripped, contoured, and seeded as described in Section 6. After decisions have been made as to which roads will be abandoned and reclaimed, culverts will be removed and the roads will be graded for sloping and drainage reestablishment. Decisions regarding road reclamation will be consistent with the approved end use of the road. Safety berms and ditches will be graded and filled to create contours that blend with the landscape. The compacted surfaces of the roads will be ripped, and water catchment basins established were possible.

Revegetation will be by direct seeding and by covering portions of the surface with growth media as a seed source, as available. The haul road corridors will receive some natural reseeding from nearby undisturbed vegetation. Other roads on the property will be reclaimed in conjunction with the mine dumps and pit areas.

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

Attachment E

SITE DRAINAGE PLAN

THE GLASGOW ENGINEERING GROUP, INC.
7393 South Everett Court
Littleton, Colorado 80123
Phone No. (303) 904-4614
FAX No. (303) 979-8166

May 23, 1997
Proj. No. 00704

Mr. Tony Casagranda
Golden Queen Mining Corporation
11847 Gempen Street
Mojave, California 93501

Re: Soledad Mountain Project
Response to Kern County Planning Department Office Memorandum Dated May 16, 1997

Dear Tony,

We have completed our review of the Kern County Planning Department's comments and concerns presented in their office memorandum dated May 16, 1997. Our responses to these comments and concerns presented in the memorandum are presented below. These responses are based on discussions with you and a telephone conversation with Mr. Aaron Leicht of the Planning Department. The item number of each response corresponds with the order of comments in the memorandum.

1. The grading plan has been revised to show minimum drainage slopes to be 1%.

2. Drainage channel cross sections shown in the plans have been set to minimize the width of the channels and areas of disturbance. The channels will be maintained as necessary during operation to prevent erosion and breaching of the channels. In areas of natural alluvial ground, the side slopes will be flattened to 2H:1V. Upon closure of the project area, the drainage channels remaining in place or newly constructed will have side slopes suitable foe revegetation except those cut into rock.

3. The intent of the design was for the ponds to be constructed in cut. Detail 11 on Drawing No. 6 has been revised to further show the pond storage area to be below the natural ground surface. It is understood that freeboard for the overflow spillway may be obtained by construction of a berm around the pond. The spillway channel is to be properly armored to prevent scouring in the event of a discharge.

4. The storm water pond volumes have been checked and revised to the volumes calculated by the HEC-1 model for the 100 yr, 24-hr storm event. The design runoff volumes for the storm water ponds were previously estimated from the average initial and final flow rates for the design storm event. Drainage areas B4A and B4B drain to the East pond and B3A through E drain to the West pond. The adjusted volumes for the ponds are 338,000 cubic feet and 409,000 cubic feet in the West and East ponds respectively. The depth and width of each of the ponds has been corrected in the table in Detail 11 on Drawing No. 6.

5. The typical section in Detail 11 on Drawing No. 6 show the spillway to be cut into natural ground. The channel from the pond will be directed to the nearest existing/natural drainage channel. Actual alignment of the spillway and overflow channel will be determined as part of the field layout and construction of the pond.

6. A signed and stamped letter of the Soledad Mountain Project Grading Plan layout and Design Summary - Revision 1, dated March 30, 1997, is enclosed with this letter.

I believe the above responses address the concerns and comments presented in the Kern County Planning Department's memorandum dated May 16, 1997. The revised drawings showing the corrections and revisions noted above are enclosed with this letter. If you should have any questions or require additional information concerning the drainage plan layout and design criteria, please call me.

Sincerely,
THE GLASGOW ENGINEERING GROUP, INC.
Don A Poulter
Don A. Poulter, P.E.
President

Enclosures:
1 letter
2 sets of 5 drawings

THE GLASGOW ENGINEERING GROUP, INC.
7393 South Everett Court
Littleton, Colorado 80123
Phone No. (303) 904-4614
FAX No. (303) 979-8166

March 20, 1997

Mr. Tony Casagranda
Golden Queen Mining Corporation
11847 Gempen Street
Mojave, California 93501

Re: Soledad Mountain Project Grading Plan Layout and Design Criteria Summary - Revision No. 1

Dear Tony:

This letter presents a revised summary of the design criteria and layout for run-off control for the Soledad Mountain Project site facilities. The intent of this grading plan is to provide the basis for the application and approval of the Kern County Grading Permit. Furthermore, it will serve as the general elevation control for plan layouts and hardstand elevations to be constructed for the project. Final grade elevations and site runoff from these facilities should be set to comply with this grading plan.

Details for specific items requiring spill control and containment have not been included in this plan. Such details will be specific to each facility and dependent upon detailed engineering of the facility. Therefore, for purposes of this plan, the following are assumed to be incorporated into final facility designs.

1. Direct precipitation into the fuel storage areas will be contained within the storage facility or routed to a lined containment pond as outlined in Titles 22 and 23 of the California Code of Regulations (CCR) for these areas.
2. Surface runoff from ready-line areas shall be contained on site as outlined in Titles 22 and 23 of the CCR for these areas.
3. Solvents, grease, fuels and other such discharges from the maintenance, truck shop, and vehicle wash areas shall be contained and disposed as provided in Titles 22 and 23 of the CCR for these materials.
4. Hazardous waste and chemical storage facility areas will be sloped to divert runoff away from the storage area. The storage facilities will be designed for containment of direct precipitation and spills as outlined in Titles 22 and 23 of the CCR.

The primary design objectives used to develop the drainage plan and ditch routing for the Soledad Mountain Project are as follows:

1. Segregate runoff from disturbed and undisturbed areas to the extent practical;
2. Collect and contain direct precipitation onto the agglomerator area, conveyor corridor, and solution tanks area and route it to the leach pad;
3. Route ditches from disturbed area to sediment containment ponds designed for zero discharge of runoff for storms up to the 100-yr., 24-hr design event;
4. Route surface runoff from mine waste overburden piles into the mine pit; and

5. Use best management practices as applicable to reduce and control erosion.

For design purposes, peak flows in main storm water collection and diversion ditches were estimated for the 24-hour duration storm event with a 100-yr. return period. The total precipitation for this design event was estimated to be 3.6 inches based on project design data provided by the Golden Queen Mining Company. Peak flows and corresponding flow depths were calculated using the HEC1 computer program and the following assumed watershed characteristics.

Assumptions used in development of the grading plan were:

1. All undisturbed areas have little to no soil or vegetation cover. Therefore the hydrologic condition is poor.
2. Volcanic rock is the primary material in undisturbed areas of the contributing watersheds. Volcanic outcrops cover most of the steeply sloped undisturbed areas.
3. Any cover soil in disturbed areas will be removed and stockpiled for later use as growth media.
4. Haul roads and facilities areas will be constructed of common excavation material or fill from overburden volcanic rock excavated during initial pit development. This rock will be the first layer removed from the pit and is assumed to be relatively broken up and weathered.
5. Although constructed from overburden rock, haul roads and facilities areas will be relatively impervious due to weathering and mechanical breakdown of the rock and compaction from mine traffic.
6. Overburden rock is assumed to have properties represented by hydrologic group A.
7. Watershed areas will change over the life of the project as the pit, waste rock disposal, and heap leach pad areas, and haul roads are developed over the life of the project. The determination of watershed areas used in the design layouts and runoff calculations are discussed below.

Based on these assumptions, the surface conditions in the contributing watersheds were assumed to have hydrologic properties represented by the curve numbers listed below.

Material and Location	CN
1. Volcanic Rock covering slopes	98
2. Volcanic Overburden in Rock Dump	63
3. Volcanic Overburden on Facilities Areas	95
4. Volcanic Overburden on Haul Roads	95

Diversion ditches were sized based upon the flow depths corresponding to the estimated peak flows. Channel depths were sized by adding 0.5 feet of freeboard to the peak flow depths and rounding the resulting depth up to the nearest 0.5 foot-increment.

The contributing watersheds for the diversion ditches in the plant and leach pad area will be changing continually over the life of the mine due to the development of the heap leach pad and mine pit. Using the watershed configurations as they will exist at project start-up would significantly overestimate the runoff during the life of the mine. Conversely, using the final watershed configuration after the heap leach pad mine pit have been completely developed would result in the underestimation of flows during operations.

Two design considerations were used to account for the changing watershed configurations in the mine pit and heap leach pad areas during operations. One consideration was to estimate the peak flows to the ditches for both the initial and ultimate watershed configurations and use the average of these two flows for design of the ditches. The other consideration was to divert runoff from the slope above the leach pad and plant areas into the mine pit at the southwest end of the leach pad. This area represents the area of greatest change in runoff quantities over the life of the project. The mine pit at the southwest end of the heap leach pad will be developed during the beginning of operations and can be used to receive the runoff from the ditch. This diversion ditch into the pit will carry significantly reduced flows as the main mine pit is developed over the life of the project. As a result of separating this runoff from the plant and heap leach pad facilities, the change in watershed areas in these areas over the life of the project is greatly reduced. Therefore, the impact to the diversion ditch designs through the plant area and around the heap leach pad is less significant.

It was found to be impractical to segregate and divert runoff from undisturbed areas from the runoff of disturbed areas due to the close proximity of the project facilities to one another and the minimal drainage area above the facilities. As a result, the drainage plan and ditch routing are designed to contain all storm water runoff within the property rather than routing the ditches to merge with the area existing drainage patterns at the project boundaries. This will be accomplished as follows. The leach pad area is designed to contain all direct precipitation onto it, the conveyor corridor, solution tank pad, and the agglomerator area. All other drainage from disturbed areas will discharge into the mine pit or into sediment containment ponds located at the property boundaries.

The sediment containment ponds are designed to contain the estimated volume of runoff from the 100-yr., 24-hr design storm event. An emergency spillway is sized to pass the peak flow of the 100-yr., 24-hr storm in the event of a back-to-back occurrence of the design storm.

Water collected in the sediment containment ponds will be dissipated through evaporation or used as a process water supply. Sediment will be removed as necessary to maintain the design storage capacity. The sediments will be deposited in the leach pad area or waste rock piles.

The drainage areas for the waste rock piles will continually increase as each area is developed to its design capacity. Therefore, the diversion ditches for each area was designed for the final configuration of the waste rock piles. Runoff from precipitation was only considered for the top surface of the piles. As discussed below, runoff from the slopes and from infiltration through the waste rock piles existing the toe areas was determined to be very unlikely to occur.

1. Average annual and storm event precipitation in the project area are insufficient to increase and sustain the moisture content of the waste rock that would result in filtration (seepage) of excess moisture through the waste rock.
2. In general, the moisture content of the waste rock would be 10% (by weight) or greater for filtration of precipitation to occur through the waste rock. The waste rock will be excavated and placed at a natural moisture content of about 3%. This 7% increase in moisture content represents about 1.7 inches of precipitation per foot of depth of waste rock. Due to evaporation, the near surface material are usually moisture deficient and will retain the infiltrated precipitation.
3. The top surface of the waste rock piles will be compacted from equipment traffic which will promote runoff and further reduce infiltration.
4. There are no occurrences of surface waters or springs in the areas of the waste rock piles. Therefore, discharge of water from the toe areas of the waste rock piles is not of concern for this project.
5. Observation of existing waste rock piles in the area of recently operated and historic mines in the project area found no signs of precipitation infiltration and from the toe of the waste piles.

If you should have any questions or require additional information concerning the drainage plan layout and design criteria, please call me.

Sincerely,
THE GLASGOW ENGINEERING GROUP, INC.

Don A Poulter

Don A. Poulter, P.E.
President

REGISTERED PROFESSIONAL ENGINEER
DONALD ANDREW POULTER
Don A Poulter
May 24, 1997
No. C-32075
Exp. 8-13-97
CIVIL
STATE OF CALIFORNIA

SITE DRAINAGE PLAN

EXHIBITS

GRADING PLAN

FOR THE

SOLEDAD MOUNTAIN PROJECT
HEAP LEACH FACILITIES

MOJAVE, CALIFORNIA

PREPARED FOR

Golden Queen Mining Company, Inc.

11847 Gempen Street
Mojave, California 93501

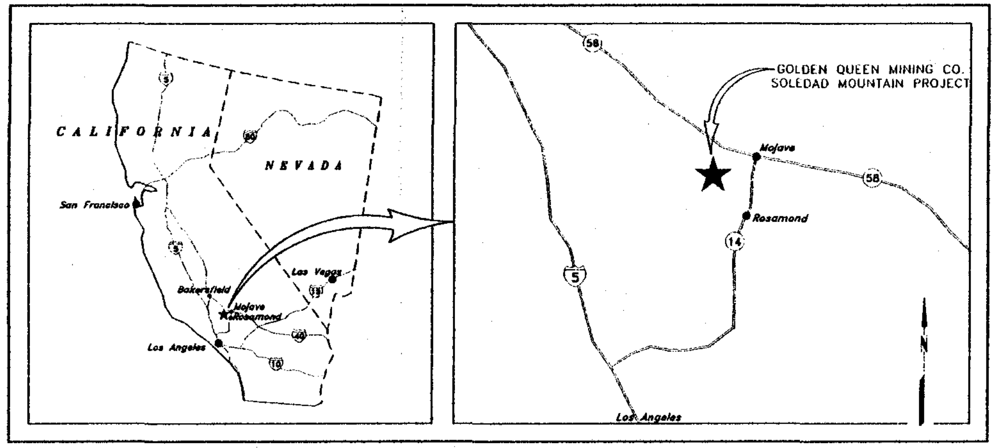
PREPARED BY

The Glasgow Engineering Group, Inc.

7393 South Everett Court
Littleton, Colorado 80123
(303) 904-4614

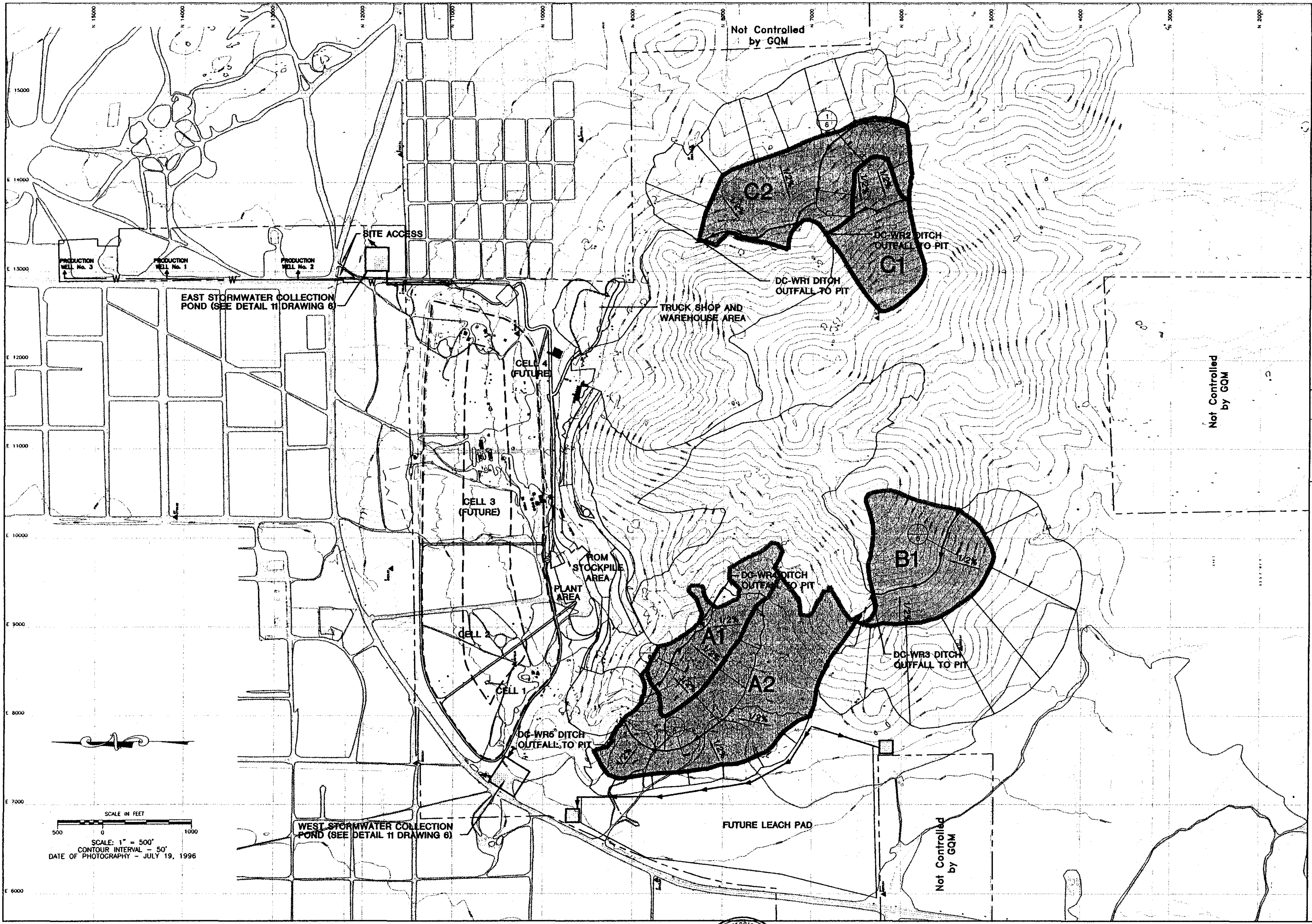
No. C-32075
Exp. 8-13-97

GENERAL LOCATION MAP



INDEX OF DRAWINGS

DRAWING No.	TITLE	REVISION
1	TITLE DRAWING AND GENERAL LOCATION	–
2	SITE PLAN	A
3	GRADING PLAN LEACH PAD AND PLANT AREA	A
4	GRADING PLAN PROCESS AREA	A
5	GRADING PLAN TRUCK SHOP AND WAREHOUSE	A
6	TYPICAL DETAILS	A
7	PLANT AREA WATERSHED DELINEATION	B
8	MINE OVERBURDEN DISPOSAL PILE WATERSHED DELINEATION	B



LEGEND

- 3600 EXISTING INDEX CONTOUR (50 FT INTERVAL)
- EXISTING FENCE LINE
- EXISTING DIRT ROAD
- EXISTING PAVED ROAD
- EXISTING WATER FEATURES
- EXISTING PROPERTY BOUNDARY (APPROXIMATE)
- EXISTING RETAINING WALL
- EXISTING VEGETATION
- EXISTING BUILDING FEATURES
- • EXISTING POWERPOLE
- EXISTING TANKS
- ▲ HORIZONTAL AND VERTICAL CONTROL
- MINE ADIT
- MINE PROSPECT
- ■ MINE SHAFT

- PROPOSED CONSTRUCTION
- ▲WSW #1 WATER SUPPLY WELL AND DESIGNATION
- WATER SUPPLY LINE
- DITCH
- ▨ WATERSHED CONTRIBUTING TO FLOW OF DITCH INDICATED

OVERBURDEN PILE CHANNEL I.D.	PEAK FLOW (CFS)	SIDE SLOPE (H: V)	BOTTOM WIDTH (FT)	MINIMUM CHANNEL DEPTH (FT)	MINIMUM BOTTOM SLOPE (%)
DC-WR1	61	1:1	0	4.5	0.25
DC-WR2	55	1:1	0	4.5	0.25
DC-WR3	85	1:1	0	5.0	0.25
DC-WR4	15	1:1	0	3.0	0.25
DC-WR5	90	1:1	0	5.0	0.25

REVISIONS

No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE
B	WATERSHED DELINEATION				4/97

REVISIONS

No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE

No. C-32075
Exp 9-13-97
DON A. POULTER, P.E.

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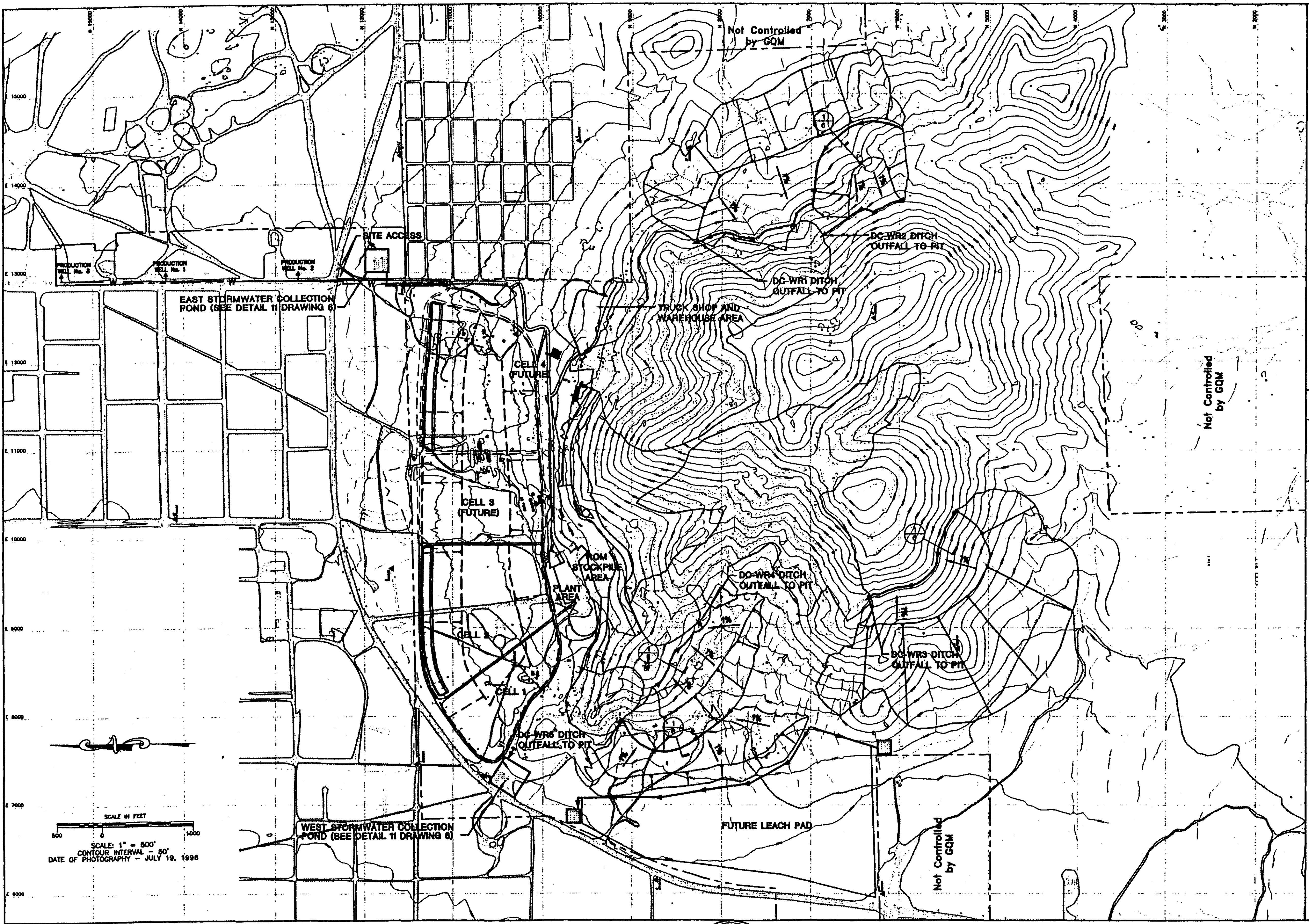
PREPARED FOR
Golden Queen Mining Company, Inc.
11847 GEMPEN STREET
MOJAVE, CA 93501

TITLE
MINE OVERBURDEN DISPOSAL PILE WATERSHED DELINEATION.

PROJECT	17-650	DATE	APRIL 1997	DRAWING	REVISION
SCALE	1" = 500'	ACAD FILE	17650WSR	8	B



LEGEND

EXISTING INDEX CONTOUR (50 FT INTERVAL)
EXISTING FENCE LINE
EXISTING DIRT ROAD
EXISTING PAVED ROAD
EXISTING WATER FEATURES
EXISTING PROPERTY BOUNDARY (APPROXIMATE)
EXISTING RETAINING WALL
EXISTING VEGETATION
EXISTING BUILDING FEATURES
EXISTING POWERPOLE
EXISTING TANKS
HORIZONTAL AND VERTICAL CONTROL
MINE ADIT
MINE PROSPECT
MINE SHAFT

PROPOSED CONSTRUCTION
▲WSW #1 WATER SUPPLY WELL AND DESIGNATION
WATER SUPPLY LINE
DITCH

☐ MINE PIT
☐ MINE OVERBURDEN DISPOSAL PILE
☐ LEACH PAD AND PLANT AREA

OVERBURDEN PILE CHANNEL I.D.	PEAK FLOW (CFS)	SIDE SLOPE (H:V)	BOTTOM WIDTH (FT)	MINIMUM CHANNEL DEPTH (FT)	MINIMUM BOTTOM SLOPE (%)
DC-WR1	61	1:1	0	4.5	0.25
DC-WR2	55	1:1	0	4.5	0.25
DC-WR3	85	1:1	0	5.0	0.25
DC-WR4	15	1:1	0	3.0	0.25
DC-WR5	90	1:1	0	5.0	0.25

REVISIONS

No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE
A	FINAL DRAFT GRADING REPORT				12/96
B	REVISED GRADE SLOPES FROM 1/2% TO 1%				5/97

REVISIONS

No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE

No. C-32075
Exp. 8/13/97

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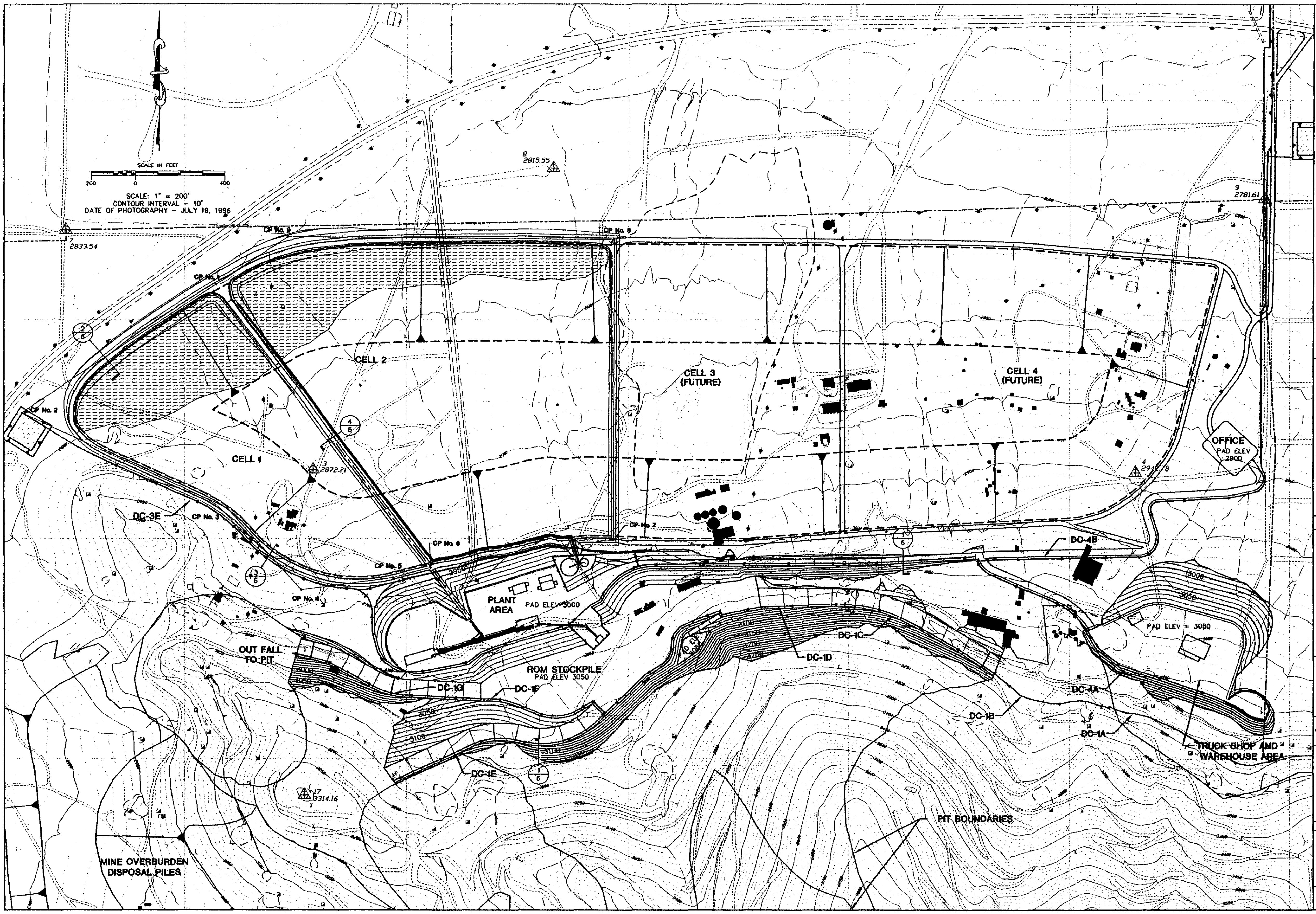
PREPARED FOR

Golden Queen Mining Company, Inc.
11847 GEMPEN STREET
MOJAVE, CA 93501

TITLE

SITE PLAN

PROJECT	17-850	DATE	DEC 1996	DRAWING	REVISION
SCALE	1" = 500'	ACAD FILE	176500SP	2	B



LEGEND

3600	EXISTING INDEX CONTOUR (50 FT INTERVAL)
	EXISTING INTERMEDIATE CONTOUR (10 FT INTERVAL)
	EXISTING FENCE LINE
	EXISTING DIRT ROAD
	EXISTING PAVED ROAD
	EXISTING WATER FEATURES
	EXISTING PROPERTY BOUNDARY
▭	EXISTING BUILDING FEATURES
■	EXISTING BUILDING FEATURES (SEE NOTE 1)
■	EXISTING FOUNDATION RUINS (SEE NOTE 2)
•	EXISTING POWERPOLE
⊕	EXISTING TANKS
▲	HORIZONTAL AND VERTICAL CONTROL
	MINE ADIT
x	MINE PROSPECT
■	MINE SHAFT
3600	PROPOSED INDEX CONTOUR (50 FT INTERVAL)
	PROPOSED INTERMEDIATE CONTOUR (10 FT INTERVAL
	PROPOSED HAUL ROAD
	PROPOSED PIT BOUNDARY
▭	PROPOSED BUILDING FEATURE
	PROPOSED RETAINING WALL
	WATER SUPPLY LINE
	WATER SUPPLY LINE STUB
	DITCH

NOTES

1. EXISTING BUILDINGS AND STRUCTURES TO BE DEMOLISHED AND HAULED TO A CLASSIFIED WASTE DUMP PER LOCAL REGULATIONS.
2. CONCRETE FOUNDATION AND FLOOR SLAB RUINS TO BE BURIED AT A DESIGNATED ON SITE LOCATION APPROVED BY OWNER.
3. SHAFTS AND EXPLORATION PITS TO BE SEALED PER SPECIFICATIONS FOR LEACH PAD CONSTRUCTION.
4. LEACH PAD CELLS DESIGNED AS SELF CONTAINED UNITS WITH NO RUNOFF EXITING THE PAD AREA.

CONTROL POINTS

ID	EASTING	NORTHING
CP No. 1	8140.43	11163.27
CP No. 2	7267.87	10574.61
CP No. 3	8190.57	10138.24
CP No. 4	8526.12	9767.06
CP No. 5	8941.42	9822.15
CP No. 6	9109.34	9867.84
CP No. 7	9934.66	9993.76
CP No. 8	9934.89	11367.86
CP No. 9	8463.20	11381.01

CHANNEL I.D.	PEAK FLOW (CFS)	SIDE SLOPE (H: V)	BOTTOM WIDTH (FT)	MINIMUM CHANNEL DEPTH (FT)	MIN SLOPE (%)
DC-1A	44	1:1	1.5	2.5	1.0
DC-1B	133.5	1:1	1.5	4.0	1.0
DC-1C	161	1:1	1.5	3.0	5.0
DC-1D	359.5	1:1	2.5	5.0	1.0
DC-1E	103	1:1	1.5	2.5	5.0
DC-1F	445	1:1	4.0	5.0	1.0
DC-1G	445	1:1	2.5	3.5	8.0
DC-2	-	1:1	1.5	2.0	0.25
DC-3A	22	1:1	1.5	2.0	1.0
DC-3B	5	1:1	1.5	2.0	0.25
DC-3C	13	1:1	1.5	2.0	0.25
DC-3D	38	1:1	1.5	3.0	0.25
DC-3E	68	1:1	2.0	3.5	0.25
DC-4A	50	1:1	1.5	3.0	0.50
DC-4B	58	1:1	1.5	3.5	0.50

REVISIONS

No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE
A	FINAL DRAFT GRADING REPORT				12/96

REVISIONS

No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE

No. C-32075

PREPARED BY

The Glasgow Engineering Group Inc.
7393 South Everett Court
Littleton, CO 80123
(303) 904-4614

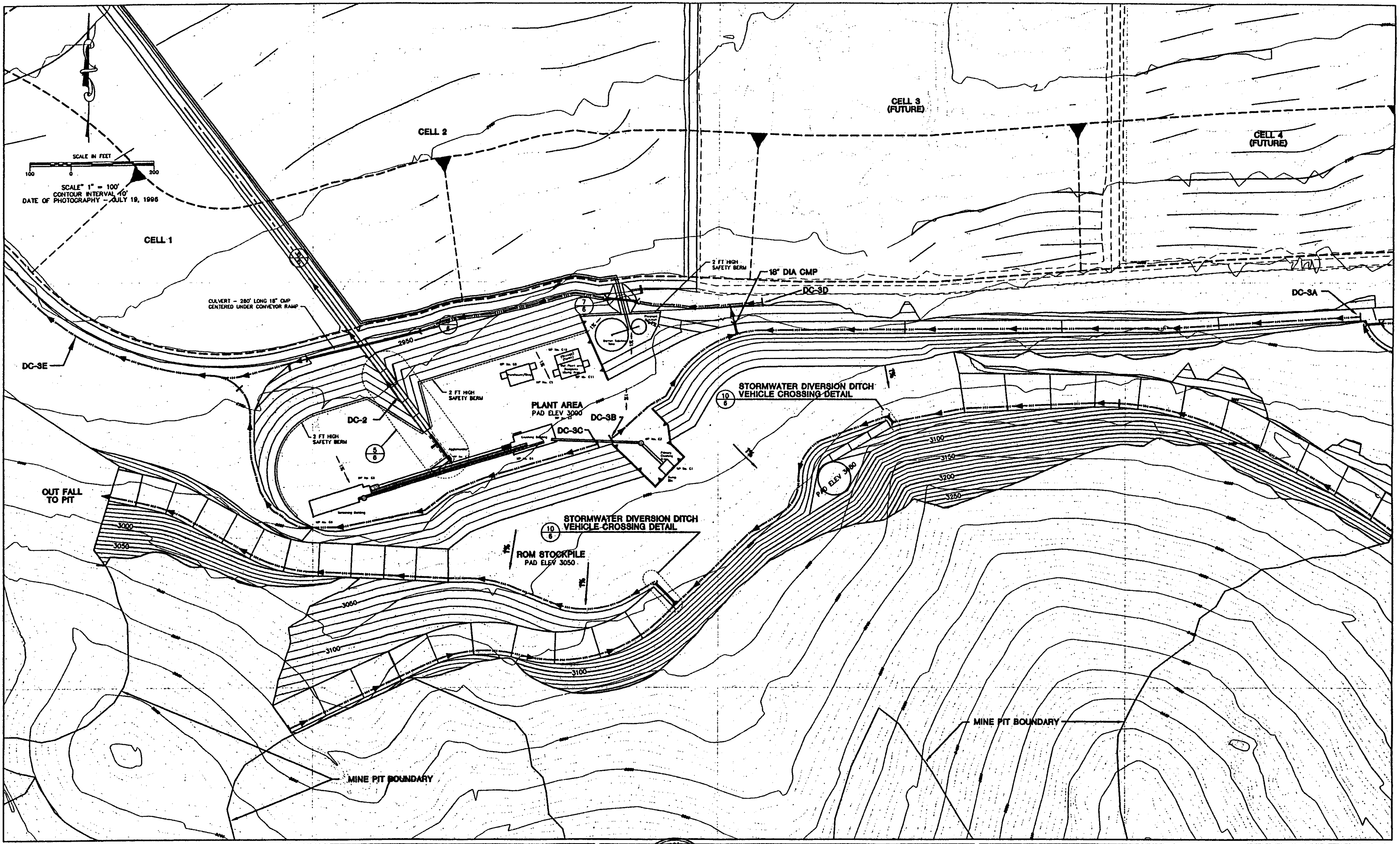
PREPARED FOR

Golden Queen Mining Company, Inc.
11847 GEMPEN STREET
MOJAVE, CA 93501

TITLE

GRADING PLAN LEACH PAD AND PLANT AREA

PROJECT:	17-650	DATE:	DEC 1996	DRAWING	REVISION
SCALE:	1" = 200'	ACAD FILE:	17650LPG	3	A



REVISIONS

No	DESCRIPTION	BY	CHKD.	APPROVED	DATE
A	FINAL DRAFT GRADING REPORT				12/96
B	REVISED GRADE SLOPES FROM 1/2% TO 1%				5/97

REVISIONS

No	DESCRIPTION	BY	CHKD.	APPROVED	DATE

No. C-32075
Exp 8-12-97
DON A. FOSTER, P.E.

PREPARED BY

The Glasgow Engineering Group Inc.
7393 South Everett Court
Littleton, CO 80123
(303) 904-4614

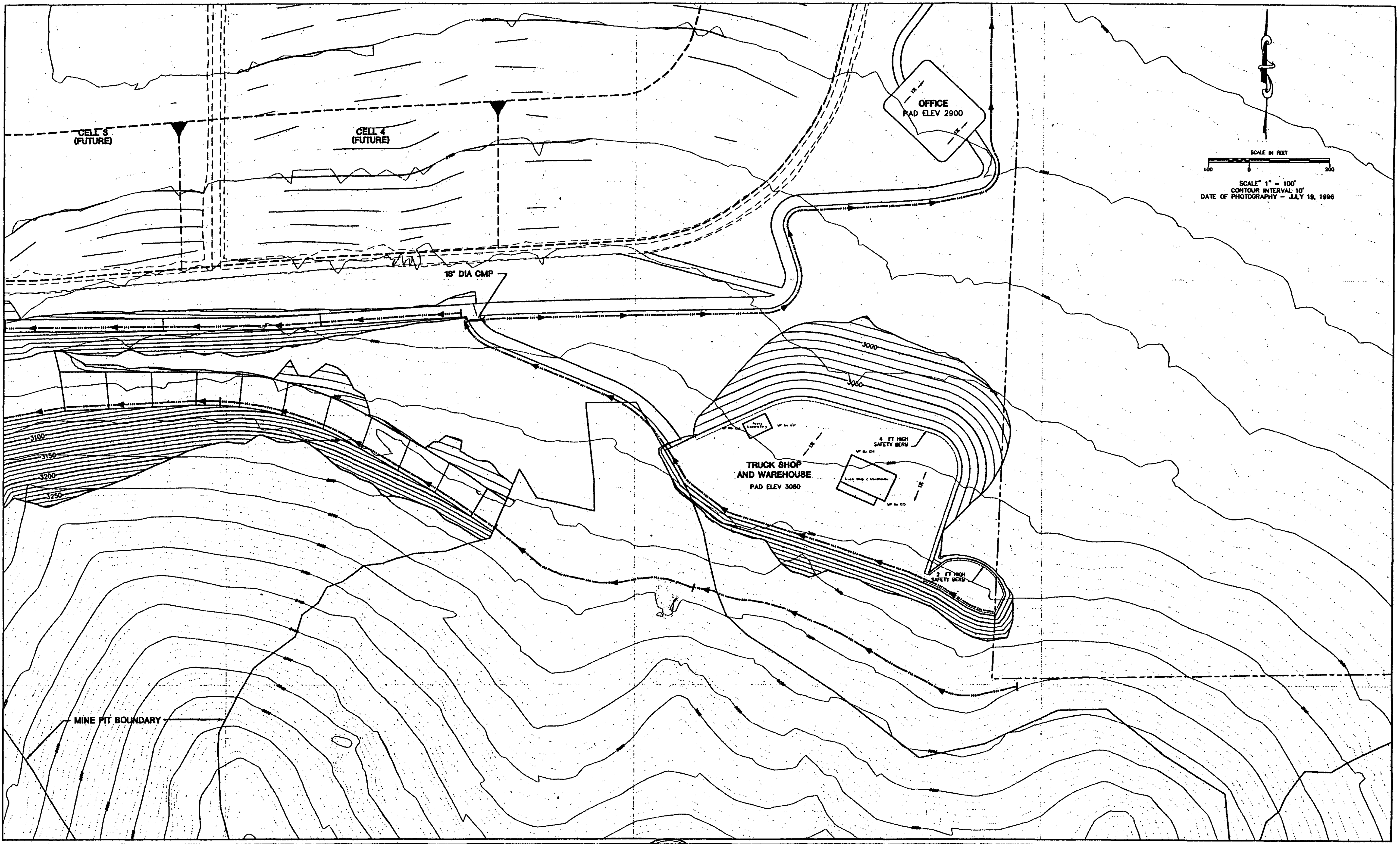
PREPARED FOR

Golden Queen Mining Company, Inc.
11847 GEMPEN STREET
MOJAVE, CA 93501

TITLE

GRADING PLAN PROCESS AREA

PROJECT	17-650	DATE	DEC 1996	DRAWING	REVISION
SCALE	1" = 100'	ACAD FILE	17650PGP	4	B



REVISIONS

No	DESCRIPTION	BY	CHKD.	APPROVED	DATE
A	FINAL DRAFT GRADING REPORT				12/96
B	REVISED GRADE SLOPES FROM 1/2% TO 1%				5/97

REVISIONS

No	DESCRIPTION	BY	CHKD.	APPROVED	DATE

DON ANDREW POULSEN
No. C-32075

PREPARED BY

The Glasgow Engineering Group Inc.
7393 South Everett Court
Littleton, CO 80123
(303) 904-4614

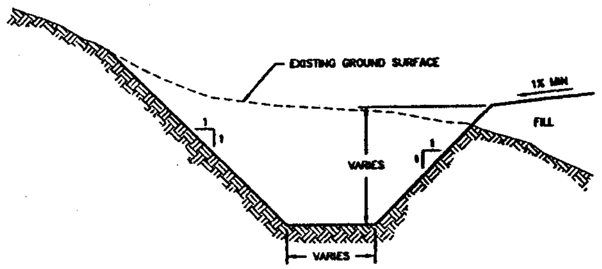
PREPARED FOR

Golden Queen Mining Company, Inc.
11847 GEMPEN STREET
MOJAVE, CA 93501

TITLE

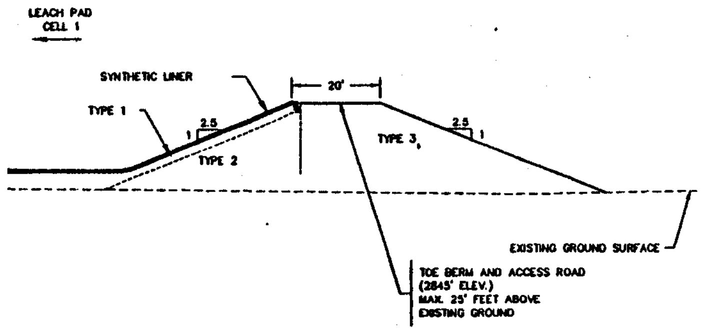
GRADING PLAN TRUCK SHOP AND WAREHOUSE

PROJECT: 17-650
SCALE: 1" = 100'
DATE: DEC 1996
ACAD FILE: 17650TSW
DRAWING: 5
REVISION: B



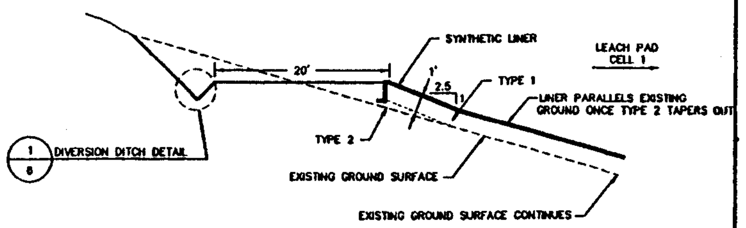
① DIVERSION DITCH DETAIL

NOT TO SCALE



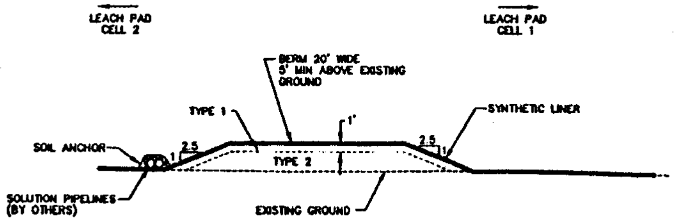
② TOE BERM DETAIL

NOT TO SCALE



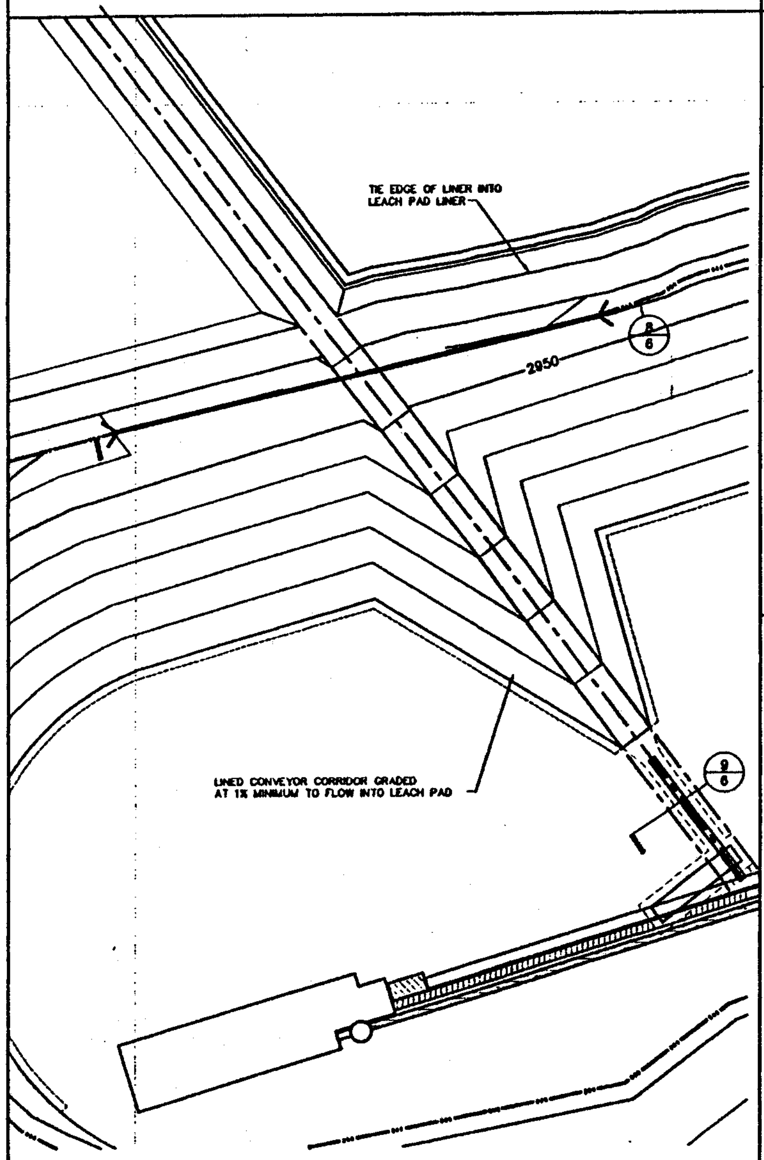
③ PERIMETER BERM DETAIL

NOT TO SCALE



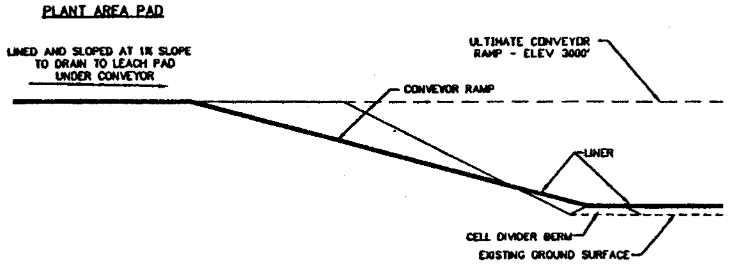
④ CELL DIVIDER BERM DETAIL

NOT TO SCALE



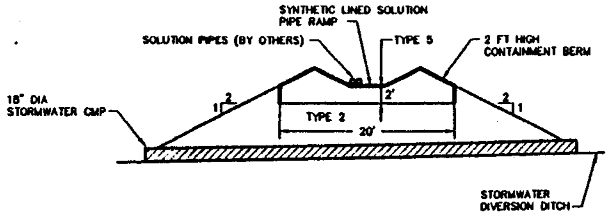
⑤ LINED CONVEYOR RAMP DETAIL

SCALE: 1" = 60'



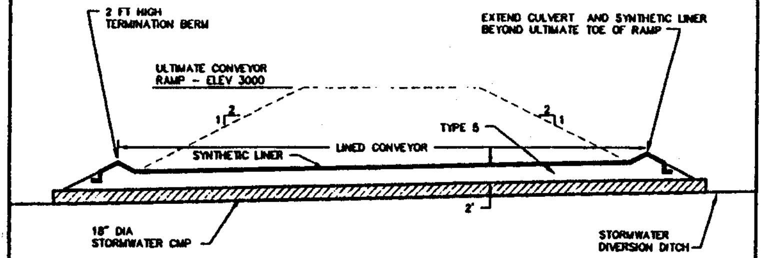
⑥ CONVEYOR RAMP PROFILE DETAIL

NOT TO SCALE



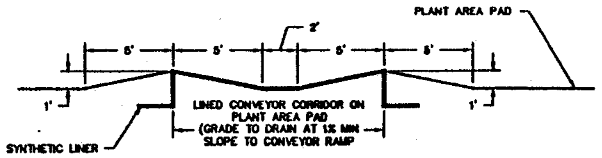
⑦ SOLUTION PIPE RAMP DETAIL

NOT TO SCALE



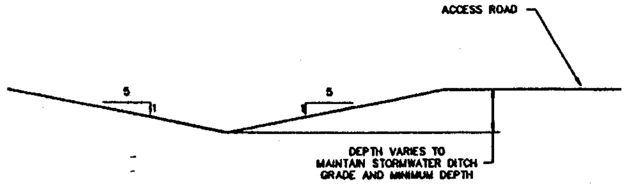
⑧ CONVEYOR RAMP DETAIL

NOT TO SCALE



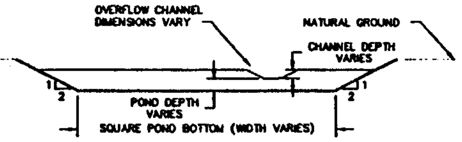
⑨ PLANT AREA CONVEYOR CORRIDOR DETAIL

NOT TO SCALE

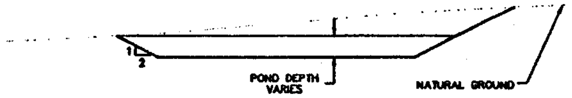


⑩ STORMWATER DIVERSION DITCH – VEHICLE CROSSING DETAIL

NOT TO SCALE



CROSS-SECTION A-A'



CROSS-SECTION B-B'

⑪ STORMWATER COLLECTION PONDS DETAIL

NOT TO SCALE

NOTE: SPILLWAY CHANNEL TO BE ARMORED AS NECESSARY FOR EROSION PROTECTION. TYPE AND EXTENT OF ARMOR SUBJECT TO GROUND CONDITIONS EXPOSED UPON CONSTRUCTION.

	STORMWATER COLLECTION POND				OVERFLOW CHANNEL			
No.	DESIGN STORAGE CAPACITY (CUBIC FEET)	ACTUAL STORAGE CAPACITY (CUBIC FEET)	POND DEPTH (FT)	POND BOTTOM WIDTH (FT)	CHANNEL BOTTOM WIDTH (FT)	CHANNEL DEPTH (FT)	SIDE SLOPES (H:V)	MINIMUM BOTTOM SLOPE (%)
WEST	320,000	338,000	15	120	20	2.0	2:1	0.25
EAST	382,000	409,000	15	135	20	2.0	2:1	0.25

REVISIONS

No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE
A	FINAL DRAFT GRADING REPORT				12/96
B	REVISED DETAIL 11, GRADE CHANGES FROM 1/2% TO 1%				5/97

REVISIONS

No.	DESCRIPTION	BY	CHKD.	APPROVED	DATE

No. C-32075

PREPARED BY

The Glasgow Engineering Group Inc.
7393 South Everett Court
Littleton, CO 80123
(303) 904-4614

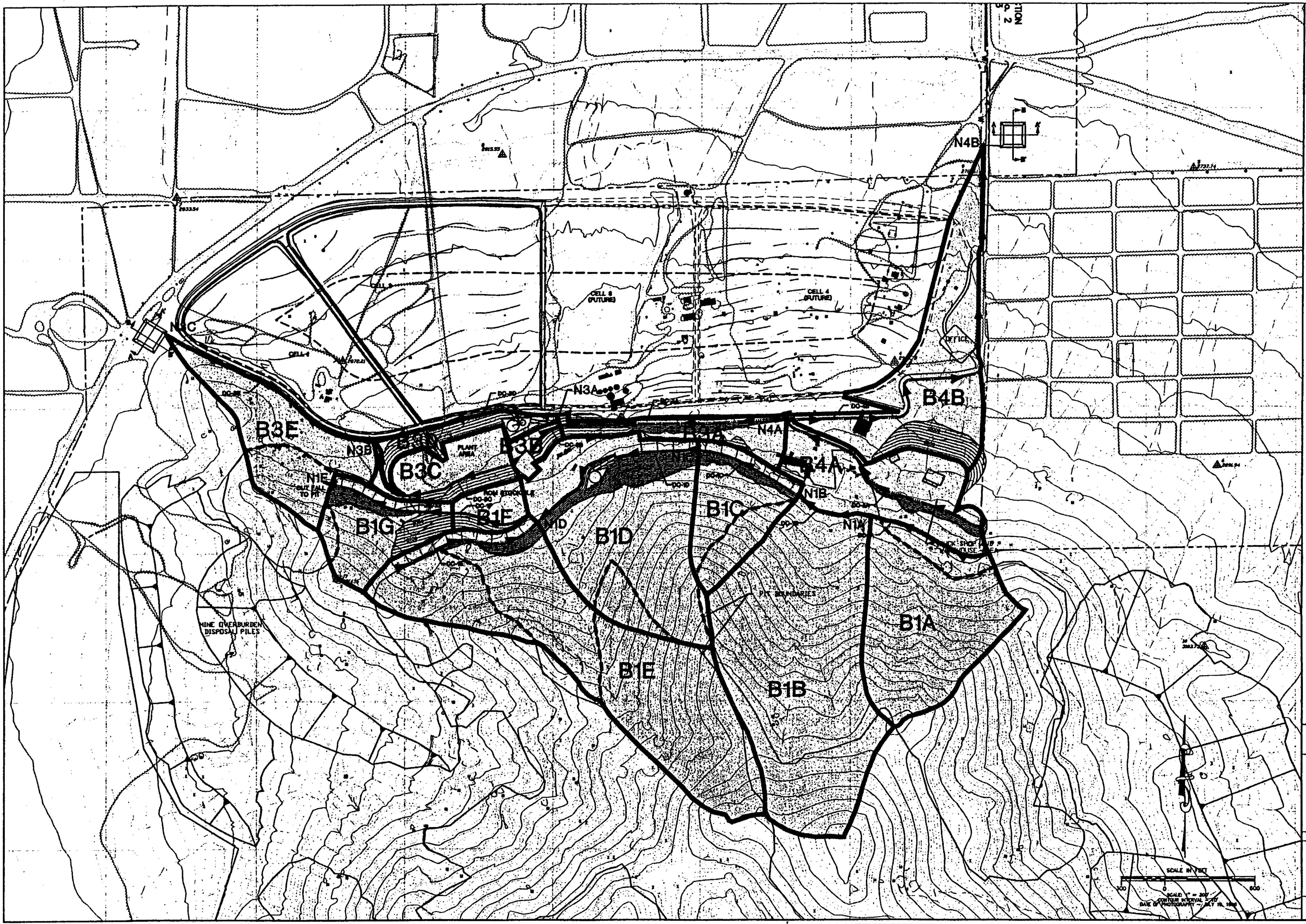
PREPARED FOR

Golden Queen Mining Company, Inc.
11847 GEMPEN STREET
MOJAVE, CA 93501

TITLE

TYPICAL DETAILS

PROJECT: 17-650
DATE: DEC 1996
SCALE: AS SHOWN
CAD FILE: 17650DET
DRAWING: 6
REVISION: B



LEGEND

- EXISTING INDEX CONTOUR (50 FT INTERVAL)
- EXISTING INTERMEDIATE CONTOUR (10 FT INTERVAL)
- EXISTING FENCE LINE
- EXISTING DIRT ROAD
- EXISTING PAVED ROAD
- EXISTING WATER FEATURES
- EXISTING PROPERTY BOUNDARY
- EXISTING BUILDING FEATURES
- EXISTING BUILDING FEATURES (SEE NOTE 1)
- EXISTING FOUNDATION RUINS (SEE NOTE 2)
- EXISTING POWERPOLE
- EXISTING TANKS
- HORIZONTAL AND VERTICAL CONTROL
- MINE ADIT
- MINE PROSPECT
- MINE SHAFT
- 3600 PROPOSED INDEX CONTOUR (50 FT INTERVAL)
- PROPOSED INTERMEDIATE CONTOUR (10 FT INTERVAL)
- PROPOSED HAUL ROAD
- PROPOSED PIT BOUNDARY
- PROPOSED BUILDING FEATURE
- WATER SUPPLY LINE
- WATER SUPPLY LINE STUB
- DITCH
- WATERSHED CONTRIBUTING TO FLOW OF DITCH INDICATED (INITIAL START OF MINING)
- WATERSHED BOUNDARY (FINAL END OF MINING) (B1A, B1B, B1C, B1D, B1E, B1G, B3E)
- N4A ● NODE AND ID

CHANNEL I.D.	PEAK FLOW (CFS)	SIDE SLOPE (H:V)	BOTTOM WIDTH (FT)	MINIMUM CHANNEL DEPTH (FT)	MIN SLOPE (%)
DC-1A	44	1:1	1.5	2.5	1.0
DC-1B	133.5	1:1	1.5	4.0	1.0
DC-1C	161	1:1	1.5	3.0	5.0
DC-1D	359.5	1:1	2.5	5.0	1.0
DC-1E	103	1:1	1.5	2.5	5.0
DC-1F	445	1:1	4.0	5.0	1.0
DC-1G	445	1:1	2.5	3.5	8.0
DC-2	-	1:1	1.5	2.0	0.25
DC-3A	22	1:1	1.5	2.0	1.0
DC-3B	5	1:1	1.5	2.0	0.25
DC-3C	13	1:1	1.5	2.0	0.25
DC-3D	38	1:1	1.5	3.0	0.25
DC-3E	68	1:1	2.0	3.5	0.25
DC-4A	50	1:1	1.5	3.0	0.50
DC-4B	58	1:1	1.5	3.5	0.50

REVISIONS

No	DESCRIPTION	BY	CHKD.	APPROVED	DATE
B	WATERSHED DELINEATION				4/97
C	REVISED NODE N4A, ADDED POND CROSS-SECTIONS				5/97

REVISIONS

No	DESCRIPTION	BY	CHKD.	APPROVED	DATE

No. C-32075
Exp 6-1-97
May 24 1997

PREPARED BY

The Glasgow Engineering Group Inc.
7393 South Everett Court
Littleton, CO 80123
(303) 904-4614

PREPARED FOR

Golden Queen Mining Company, Inc.
11847 GEMPEN STREET
MOJAVE, CA 93501

TITLE

PLANT AREA WATERSHED DELINEATION

PROJECT	17-650	DATE	APRIL 1997	DRAWING	REVISION
SCALE	1" = 300'	ACAD FILE	17650PAW	7	C

APPENDIX

```
1***************************************                     ***************************************
 *                                     *                     *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1) *                     *   U.S. ARMY CORPS OF ENGINEERS      *
 *              MAY   1991             *                     *   HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.0.1E           *                     *         609 SECOND STREET           *
 *                                     *                     *      DAVIS, CALIFORNIA 95616        *
 * RUN DATE  12/23/96  TIME  12:07:32  *                     *          (916) 551-1748             *
 *                                     *                     *                                     *
***************************************                     ***************************************



                              X     X  XXXXXXX   XXXXX          X
                              X     X  X        X     X        XX
                              X     X  X        X               X
                              XXXXXXX  XXXX     X       XXXXX   X
                              X     X  X        X               X
                              X     X  X        X     X         X
                              X     X  XXXXXXX   XXXXX         XXX



           THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

           THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
           THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
           NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
           DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
           KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                             HEC-1 INPUT                                                    PAGE  1

          LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1          ID    Project:  Golden Queen - Soledad Mountain Project
            2          ID    Input Filename P:\17-650\hec1\hecrun4f.ihl
            3          ID    100 YR. 24 HOUR STORM
    *** FREE ***
                       *DIAGRAM
            4          IT       1       0       0    1440       0       0
            5          IN      15       0       0
            6          IO       5       0

            7          KK     B1A
            8          KM   RUNOFF FROM  BASIN B101
            9          KO       0       0       0       0      21
           10          PB     3.6
           11          PC  0.0000  0.0030  0.0050  0.0080  0.0110  0.0130  0.0160  0.0190  0.0220  0.0250
           12          PC  0.0280  0.0310  0.0340  0.0370  0.0410  0.0440  0.0480  0.0510  0.0550  0.0580
           13          PC  0.0620  0.0660  0.0700  0.0740  0.0790  0.0830  0.0880  0.0920  0.0970  0.1020
           14          PC  0.1080  0.1130  0.1190  0.1250  0.1310  0.1380  0.1450  0.1530  0.1610  0.1700
           15          PC  0.1800  0.1900  0.2020  0.2160  0.2350  0.2570  0.2900  0.4000  0.6600  0.7100
           16          PC  0.7350  0.7560  0.7720  0.7880  0.8000  0.8100  0.8200  0.8300  0.8390  0.8470
           17          PC  0.8550  0.8620  0.8690  0.8750  0.8810  0.8870  0.8920  0.8980  0.9030  0.9080
           18          PC  0.9120  0.9170  0.9210  0.9260  0.9300  0.9340  0.9380  0.9420  0.9450  0.9490
           19          PC  0.9520  0.9560  0.9590  0.9630  0.9660  0.9690  0.9720  0.9750  0.9780  0.9810
           20          PC  0.9840  0.9870  0.9890  0.9920  0.9950  0.9970  1.0000
           21          BA  0.0021
           22          LS       0      98
           23          UD   0.077
                       *

           24          KK   ROUTEFROM NODE N1A TO N1B
```

```
   25          RD     532  0.0025    0.02       0    TRAP       0       1
               *

   26          KK     B1B
   27          BA    0.01
   28          LS       0      98
   29          UD   0.182
               *

   30          KK COMBINEHYDROGRAPHS
   31          HC       2
               *

   32          KK   ROUTEFROM NODE N1B TO N1C
   33          RD     730  0.0025    0.02       0    TRAP       0       1
               *

   34          KK     B1C
   35          BA  0.0109
   36          LS       0      98
   37          UD   0.039
               *
1                                     HEC-1 INPUT                                        PAGE  2

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


   38          KK COMBINEHYDROGRAPHS
   39          HC       2
               *

   40          KK   ROUTEFROM NODE N1C TO N1D
   41          RD    1230  0.0025    0.02       0    TRAP       0       1
               *

   42          KK     B1D
   43          BA  0.0404
   44          LS       0      97
   45          UD   0.070
               *

   46          KK     B1E
   47          BA  0.0224
   48          LS       0      98
   49          UD   0.073
               *

   50          KK COMBINEHYDROGRAPHS
   51          HC       3
               *

   52          KK   ROUTEFROM NODE N1E TO N1F
   53          RD    1415  0.0025    0.02       0    TRAP       0       1
               *

   54          KK     B1F
   55          BA  0.0198
   56          LS       0      96
   57          UD   0.065
               *

   58          KK COMBINEHYDROGRAPHS
   59          HC       2
               *

   60          KK     B3A
   61          BA  0.0102
```

```
  62          LS       0      95
  63          UD   0.125
              *

  64          KK     83B
  65          BA  0.0026
  66          LS       0      95
  67          UD   0.200
              *
```

```
 LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

  68          KK COMBINEHYDROGRAPHS
  69          HC       2
              *

  70          KK   ROUTEFROM NODE N3A TO N3B
  71          RD    1225  0.0025    0.02       0    TRAP       0       1
              *

  72          KK     83C
  73          BA  0.0101
  74          LS       0      95
  75          UD   0.434
              *

  76          KK     83D
  77          BA  0.0067
  78          LS       0      95
  79          UD   0.181
              *

  80          KK COMBINEHYDROGRAPHS
  81          HC       3
              *

  82          KK   ROUTEFROM NODE N3B TO N3C
  83          RD    1465  0.0025    0.02       0    TRAP       0       1
              *

  84          KK     83E
  85          BA  0.0142
  86          LS       0      98
  87          UD   0.121
              *

  88          KK COMBINEHYDROGRAPHS
  89          HC       2
              *

  90          KK     84A
  91          BA  0.0228
  92          LS       0      95
  93          UD   0.111
              *

  94          KK   ROUTEFROM NODE N4A TO N4B
  95          RD    3065  0.0025    0.02       0    TRAP       0       1
              *

  96          KK     84B
  97          BA  0.0319
  98          LS       0      95
  99          UD   0.871
              *
```

```
           LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


             100           KK COMBINEHYDROGRAPHS
             101           HC        2
                           *
             102           ZZ
1
                  SCHEMATIC DIAGRAM OF STREAM NETWORK
  INPUT
   LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

    NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

       7         B1A
                   V
                   V
      24       ROUTE
                   .
                   .
      26           .         B1B
                   .           .
                   .           .
      30     COMBINE............
                   V
                   V
      32       ROUTE
                   .
                   .
      34           .         B1C
                   .           .
                   .           .
      38     COMBINE............
                   V
                   V
      40       ROUTE
                   .
                   .
      42           .         B1D
                   .           .
                   .           .
      46           .           .         B1E
                   .           .           .
                   .           .           .
      50     COMBINE........................
                   V
                   V
      52       ROUTE
                   .
                   .
      54           .         B1F
                   .           .
                   .           .
      58     COMBINE............
                   .
                   .
      60           .         B3A
                   .           .
                   .           .
      64           .           .         B3B
                   .           .           .
                   .           .           .
      68           .     COMBINE............
                   .           V
                   .           V
```

```
70           .       ROUTE
             .           .
72           .           .        83C
             .           .          .
76           .           .          .           83D
             .           .          .           .
80           .     COMBINE.......................
             .           V
             .           V
82           .       ROUTE
             .           .
84           .           .        83E
             .           .          .
88           .     COMBINE...........
             .           .
90           .           .        84A
             .           .          V
             .           .          V
94           .           .        ROUTE
             .           .          .
96           .           .          .           84B
             .           .          .           .
100          .           .      COMBINE............

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                    ****************************************
 *                                       *                    *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *   U.S. ARMY CORPS OF ENGINEERS       *
 *              MAY   1991               *                    *   HYDROLOGIC ENGINEERING CENTER      *
 *          VERSION 4.0.1E               *                    *        609 SECOND STREET             *
 *                                       *                    *      DAVIS, CALIFORNIA 95616         *
 * RUN DATE  12/23/96  TIME  12:07:02    *                    *          (916) 551-1748              *
 *                                       *                    *                                      *
 ****************************************                     ****************************************



                    Project:  Golden Queen - Soledad Mountain Project
                    Input Filename P:\17-650\hec1\hecrun4f.ih1
                    100 YR. 24 HOUR STORM

  6 IO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

    IT        HYDROGRAPH TIME DATA
                    NMIN           1  MINUTES IN COMPUTATION INTERVAL
                   IDATE     1     0  STARTING DATE
                   ITIME        0000  STARTING TIME
                      NQ        1440  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE     1     0  ENDING DATE
                  NDTIME        2359  ENDING TIME
                   ICENT          19  CENTURY MARK

              COMPUTATION INTERVAL    0.02 HOURS
                   TOTAL TIME BASE   23.98 HOURS
```

```
  ENGLISH UNITS
       DRAINAGE AREA          SQUARE MILES
       PRECIPITATION DEPTH    INCHES
       LENGTH, ELEVATION      FEET
       FLOW                   CUBIC FEET PER SECOND
       STORAGE VOLUME         ACRE-FEET
       SURFACE AREA           ACRES
       TEMPERATURE            DEGREES FAHRENHEIT

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

          **************
          *            *
 7 KK     *      81A   *
          *            *
          **************

 9 KO         OUTPUT CONTROL VARIABLES
                   IPRNT          5  PRINT CONTROL
                   IPLOT          0  PLOT CONTROL
                   QSCAL         0.  HYDROGRAPH PLOT SCALE
                   IPNCH          0  PUNCH COMPUTED HYDROGRAPH
                    IOUT         21  SAVE HYDROGRAPH ON THIS UNIT
                   ISAV1          1  FIRST ORDINATE PUNCHED OR SAVED
                   ISAV2       1440  LAST ORDINATE PUNCHED OR SAVED
                  TIMINT      0.017  TIME INTERVAL IN HOURS

I
                                                RUNOFF SUMMARY
                                          FLOW IN CUBIC FEET PER SECOND
                                        TIME IN HOURS,  AREA IN SQUARE MILES

                                          PEAK   TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD     BASIN    MAXIMUM    TIME OF
             OPERATION      STATION       FLOW    PEAK                                          AREA      STAGE    MAX STAGE
 +                                                           6-HOUR      24-HOUR     72-HOUR

             HYDROGRAPH AT
DC-1A                          81A          5.    12.00        1.          0.          0.        0.00

             ROUTED TO
 +                           ROUTE          5.    12.03        1.          0.          0.        0.00

             HYDROGRAPH AT
 +                             81B         20.    12.07        3.          1.          1.        0.01

             2 COMBINED AT
DC-1B                      COMBINE         25.    12.07        3.          1.          1.        0.01

             ROUTED TO
 +                           ROUTE         24.    12.10        3.          1.          1.        0.01

             HYDROGRAPH AT
 +                             81C         26.    12.00        3.          1.          1.        0.01

DC-1C        2 COMBINED AT
 +                         COMBINE         46.    12.00        6.          2.          2.        0.02

             ROUTED TO
 +                           ROUTE         44.    12.05        6.          2.          2.        0.02

             HYDROGRAPH AT
 +                             81D         95.    12.00       11.          4.          4.        0.04
```

```
DC-1E HYDROGRAPH AT
                    81E        53.   12.00        6.       2.       2.     0.02
DC-1D 3 COMBINED AT
                COMBINE       190.   12.00       23.       8.       8.     0.09
      ROUTED TO
+                 ROUTE       185.   12.03       23.       8.       8.     0.09
      HYDROGRAPH AT
+                   81F        46.   12.00        5.       2.       2.     0.02
DC-1F 2 COMBINED AT
                COMBINE       229.   12.02       28.       9.       9.     0.11
      HYDROGRAPH AT
DC-3A               83A        22.   12.03        3.       1.       1.     0.01
      HYDROGRAPH AT
DC-3B               83B         5.   12.08        1.       0.       0.     0.00
      2 COMBINED AT
+               COMBINE        26.   12.03        3.       1.       1.     0.01
      ROUTED TO
+                 ROUTE        25.   12.10        3.       1.       1.     0.01
      HYDROGRAPH AT
DC-3C               83C   38   13.   12.30        3.       1.       1.     0.01
      HYDROGRAPH AT
DC-3D               83D        13.   12.07        2.       1.       1.     0.01
      3 COMBINED AT
+               COMBINE        48.   12.10        7.       2.       2.     0.03
      ROUTED TO
+                 ROUTE        46.   12.18        7.       2.       2.     0.03
      HYDROGRAPH AT
+                   83E        32.   12.03        4.       1.       1.     0.01
      2 COMBINED AT
DC-3E           COMBINE        68.   12.08       11.       4.       4.     0.04
      HYDROGRAPH AT
DC-4A               84A        50.   12.02        6.       2.       2.     0.02
      ROUTED TO
+                 ROUTE        46.   12.15        6.       2.       2.     0.02
      HYDROGRAPH AT
+                   84B        26.   12.73        8.       3.       3.     0.03
      2 COMBINED AT
DC-4B           COMBINE        58.   12.17       14.       4.       4.     0.05

                    SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                        (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                             INTERPOLATED TO
                                                          COMPUTATION INTERVAL
 ISTAQ   ELEMENT     DT      PEAK    TIME TO   VOLUME     DT     PEAK   TIME TO    VOLUME
                                       PEAK                               PEAK

                    (MIN)   (CFS)     (MIN)     (IN)    (MIN)   (CFS)    (MIN)      (IN)

 ROUTE   MANE        1.00    4.89    722.00     3.36     1.00    4.89   722.00      3.36
```

```
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3766E+00 EXCESS=0.0000E+00 OUTFLOW=0.3759E+00 BASIN STORAGE=0.8828E-03 PERCENT ERROR=  -0.1

            ROUTE  MANE        1.00     24.43    726.00       3.35       1.00     24.43    726.00         3.35

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2166E+01 EXCESS=0.0000E+00 OUTFLOW=0.2163E+01 BASIN STORAGE=0.4010E-02 PERCENT ERROR=   0.0

            ROUTE  MANE        1.00     43.98    723.00       3.35       1.00     43.98    723.00         3.35

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4119E+01 EXCESS=0.0000E+00 OUTFLOW=0.4111E+01 BASIN STORAGE=0.1137E-01 PERCENT ERROR=  -0.1

            ROUTE  MANE        1.00    184.90    722.00       3.30       1.00    184.90    722.00         3.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1513E+02 EXCESS=0.0000E+00 OUTFLOW=0.1509E+02 BASIN STORAGE=0.3642E-01 PERCENT ERROR=   0.0

            ROUTE  MANE        1.00     25.39    726.00       3.02       1.00     25.39    726.00         3.02

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2069E+01 EXCESS=0.0000E+00 OUTFLOW=0.2063E+01 BASIN STORAGE=0.7009E-02 PERCENT ERROR=  -0.1

            ROUTE  MANE        1.00     46.39    731.00       3.01       1.00     46.39    731.00         3.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4770E+01 EXCESS=0.0000E+00 OUTFLOW=0.4759E+01 BASIN STORAGE=0.1543E-01 PERCENT ERROR=  -0.1

            ROUTE  MANE        1.00     45.65    729.00       3.01       1.00     45.65    729.00         3.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3686E+01 EXCESS=0.0000E+00 OUTFLOW=0.3664E+01 BASIN STORAGE=0.2628E-01 PERCENT ERROR=  -0.1


*** NORMAL END OF HEC-1 ***
```

```
1*****************************************                   *****************************************
*                                       *                   *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                   *   U.S. ARMY CORPS OF ENGINEERS        *
*             MAY  1991                 *                   *   HYDROLOGIC ENGINEERING CENTER       *
*           VERSION 4.0.1E              *                   *        609 SECOND STREET              *
*                                       *                   *     DAVIS, CALIFORNIA 95616           *
* RUN DATE  12/23/96  TIME  11:59:52    *                   *         (916) 551-1748                *
*                                       *                   *                                       *
*****************************************                   *****************************************



                              X     X  XXXXXXX   XXXXX         X
                              X     X  X        X     X       XX
                              X     X  X        X              X
                              XXXXXXX  XXXX     X      XXXXX   X
                              X     X  X        X              X
                              X     X  X        X     X        X
                              X     X  XXXXXXX   XXXXX        XXX



        THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

        THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
        THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
        NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
        DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
        KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM


1                                             HEC-1 INPUT                                              PAGE  1

         LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            1          ID   Project:  Golden Queen - Soledad Mountain Project
            2          ID   Input Filename P:\17-650\hec1\hecrun4.ih1
            3          ID   100 YR, 24 HOUR STORM
 *** FREE ***
                       *DIAGRAM
            4          IT       1       0       0    1440       0       0
            5          IN      15       0       0
            6          IO       5       0

            7          KK     B1A
            8          XM   RUNOFF FROM  BASIN B101
            9          KO       0       0       0       0      21
           10          PB     3.6
           11          PC  0.0000  0.0030  0.0050  0.0080  0.0110  0.0130  0.0160  0.0190  0.0220  0.0250
           12          PC  0.0280  0.0310  0.0340  0.0370  0.0410  0.0440  0.0480  0.0510  0.0550  0.0580
           13          PC  0.0620  0.0660  0.0700  0.0740  0.0790  0.0830  0.0880  0.0920  0.0970  0.1020
           14          PC  0.1080  0.1130  0.1190  0.1250  0.1310  0.1380  0.1450  0.1530  0.1610  0.1700
           15          PC  0.1800  0.1900  0.2020  0.2160  0.2350  0.2570  0.2900  0.4000  0.6600  0.7100
           16          PC  0.7350  0.7560  0.7720  0.7880  0.8000  0.8100  0.8200  0.8300  0.8390  0.8470
           17          PC  0.8550  0.8620  0.8690  0.8750  0.8810  0.8870  0.8920  0.8980  0.9030  0.9080
           18          PC  0.9120  0.9170  0.9210  0.9260  0.9300  0.9340  0.9380  0.9420  0.9450  0.9490
           19          PC  0.9520  0.9560  0.9590  0.9630  0.9660  0.9690  0.9720  0.9750  0.9780  0.9810
           20          PC  0.9840  0.9870  0.9890  0.9920  0.9950  0.9970  1.0000
           21          BA  0.0347
           22          LS       0      98
           23          UD   0.060
                       *

           24          KK   ROUTEFROM NODE N1A TO N1B
```

```
   25          RD     532  0.0025    0.02        0     TRAP        0       1
               *

   26          KK     B1B
   27          BA  0.0668
   28          LS       0       98
   29          UD   0.058
               *

   30          KK COMBINEHYDROGRAPHS
   31          HC       2
               *

   32          KK   ROUTEFROM NODE N1B TO N1C
   33          RD     730  0.0025    0.02        0     TRAP        0       1
               *

   34          KK     B1C
   35          BA  0.0150
   36          LS       0       98
   37          UD   0.040
               *
1                                       HEC-1 INPUT                                            PAGE  2

 LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

   38          KK COMBINEHYDROGRAPHS
   39          HC       2
               *

   40          KK   ROUTEFROM NODE N1C TO N1D
   41          RD    1230  0.0025    0.02        0     TRAP        0       1
               *

   42          KK     B1D
   43          BA  0.0456
   44          LS       0       97
   45          UD   0.070
               *

   46          KK     B1E
   47          BA  0.0677
   48          LS       0       98
   49          UD   0.116
               *

   50          KK COMBINEHYDROGRAPHS
   51          HC       3
               *

   52          KK   ROUTEFROM NODE N1E TO N1F
   53          RD    1415  0.0025    0.02        0     TRAP        0       1
               *

   54          KK     B1F
   55          BA  0.0677
   56          LS       0       96
   57          UD   0.065
               *

   58          KK COMBINEHYDROGRAPHS
   59          HC       2
               *

   60          KK     B3A
   61          BA  0.0102
```

```
          62            LS       0       95
          63            UD   0.125
                        *

          64            KK     83B
          65            BA  0.0026
          66            LS       0       95
          67            UD   0.200
                        *
1                                             HEC-1 INPUT                                            PAGE  3

        LINE            ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


          68            KK COMBINEHYDROGRAPHS
          69            HC       2
                        *

          70            KK   ROUTEFROM NODE N3A TO N3B
          71            RD    1225  0.0025    0.02       0    TRAP       0       1
                        *

          72            KK     83C
          73            BA  0.0101
          74            LS       0       95
          75            UD   0.434
                        *

          76            KK     83D
          77            BA  0.0067
          78            LS       0       95
          79            UD   0.181
                        *

          80            KK COMBINEHYDROGRAPHS
          81            HC       3
                        *

          82            KK   ROUTEFROM NODE N3B TO N3C
          83            RD    1465  0.0025    0.02       0    TRAP       0       1
                        *

          84            KK     83E
          85            BA  0.0142
          86            LS       0       98
          87            UD   0.121
                        *

          88            KK COMBINEHYDROGRAPHS
          89            HC       2
                        *

          90            KK     84A
          91            BA  0.0228
          92            LS       0       95
          93            UD   0.111
                        *

          94            KK   ROUTEFROM NODE N4A TO N4B
          95            RD    3065  0.0025    0.02       0    TRAP       0       1
                        *

          96            KK     84B
          97            BA  0.0319
          98            LS       0       95
          99            UD   0.871
                        *
```

```
          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10


            100          KK COMBINE HYDROGRAPHS
            101          HC       2
                         *
            102          ZZ
1
                 SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING         (--->) DIVERSION OR PUMP FLOW

   NO.      (.) CONNECTOR       (<---) RETURN OF DIVERTED OR PUMPED FLOW

      7        B1A
                 V
                 V
     24      ROUTE
                 .
                 .
     26          .         B1B
                 .           .
                 .           .
     30    COMBINE............
                 V
                 V
     32      ROUTE
                 .
                 .
     34          .         B1C
                 .           .
                 .           .
     38    COMBINE............
                 V
                 V
     40      ROUTE
                 .
                 .
     42          .         B1D
                 .           .
                 .           .
     46          .           .         B1E
                 .           .           .
                 .           .           .
     50    COMBINE........................
                 V
                 V
     52      ROUTE
                 .
                 .
     54          .         B1F
                 .           .
                 .           .
     58    COMBINE............
                 .
                 .
     60          .         B3A
                 .           .
                 .           .
     64          .           .         B3B
                 .           .           .
                 .           .           .
     68          .     COMBINE............
                 .           V
                 .           V
```

```
70             .      ROUTE
               .          .
               .          .
72             .          .        83C
               .          .          .
               .          .          .
76             .          .          .        830
               .          .          .          .
               .          .          .          .
80             .    COMBINE......................
               .          V
               .          V
82             .      ROUTE
               .          .
               .          .
84             .          .        83E
               .          .          .
               .          .          .
88             .    COMBINE...........
               .          .
               .          .
90             .          .        84A
               .          .          V
               .          .          V
94             .          .      ROUTE
               .          .          .
               .          .          .
96             .          .          .        848
               .          .          .          .
               .          .          .          .
100            .          .    COMBINE...........

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1***************************************                                      ***************************************
 *                                     *                                      *                                     *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                     *    U.S. ARMY CORPS OF ENGINEERS     *
 *             MAY   1991              *                                      *    HYDROLOGIC ENGINEERING CENTER    *
 *           VERSION 4.0.1E            *                                      *          609 SECOND STREET          *
 *                                     *                                      *       DAVIS, CALIFORNIA 95616       *
 * RUN DATE  12/23/96  TIME  11:59:52  *                                      *           (916) 551-1748            *
 *                                     *                                      *                                     *
 ***************************************                                      ***************************************



                           Project:  Golden Queen - Soledad Mountain Project
                           Input Filename P:\17-650\hec1\hecrun4.ih1
                           100 YR. 24 HOUR STORM

  6 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          5  PRINT CONTROL
                      IPLOT          0  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN          1  MINUTES IN COMPUTATION INTERVAL
                      IDATE     1    0  STARTING DATE
                      ITIME       0000  STARTING TIME
                         NQ       1440  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1    0  ENDING DATE
                     NDTIME       2359  ENDING TIME
                      ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL    0.02 HOURS
                     TOTAL TIME BASE   23.98 HOURS
```

```
       ENGLISH UNITS
            DRAINAGE AREA          SQUARE MILES
            PRECIPITATION DEPTH    INCHES
            LENGTH, ELEVATION      FEET
            FLOW                   CUBIC FEET PER SECOND
            STORAGE VOLUME         ACRE-FEET
            SURFACE AREA           ACRES
            TEMPERATURE            DEGREES FAHRENHEIT

*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

               ***************
               *             *
   7 KK        *     B1A     *
               *             *
               ***************

   9 KO           OUTPUT CONTROL VARIABLES
                        IPRNT           5  PRINT CONTROL
                        IPLOT           0  PLOT CONTROL
                        QSCAL          0.  HYDROGRAPH PLOT SCALE
                        IPNCH           0  PUNCH COMPUTED HYDROGRAPH
                         IOUT          21  SAVE HYDROGRAPH ON THIS UNIT
                        ISAV1           1  FIRST ORDINATE PUNCHED OR SAVED
                        ISAV2        1440  LAST ORDINATE PUNCHED OR SAVED
                       TIMINT       0.017  TIME INTERVAL IN HOURS

1
                                                    RUNOFF SUMMARY
                                               FLOW IN CUBIC FEET PER SECOND
                                            TIME IN HOURS,  AREA IN SQUARE MILES

                                        PEAK    TIME OF    AVERAGE FLOW FOR MAXIMUM PERIOD      BASIN    MAXIMUM    TIME OF
            OPERATION        STATION    FLOW     PEAK                                           AREA     STAGE     MAX STAGE
   *                                                      6-HOUR      24-HOUR      72-HOUR

            HYDROGRAPH AT
 DC-1A                          B1A     |83.|    12.00        9.          3.           3.        0.03

            ROUTED TO
   *                           ROUTE      82.    12.00        9.          3.           3.        0.03

            HYDROGRAPH AT
   *                            B1B      160.    12.00       18.          6.           6.        0.07

            2 COMBINED AT
 DC-1B                       COMBINE   |242.|    12.00       27.          9.           9.        0.10

            ROUTED TO
   *                           ROUTE     240.    12.00       27.          9.           9.        0.10

            HYDROGRAPH AT
   *                            B1C       36.    12.00        4.          1.           1.        0.01

            2 COMBINED AT
 DC-1C                       COMBINE   |276.|    12.00       31.         11.          11.        0.12

            ROUTED TO
   *                           ROUTE     270.    12.02       31.         11.          11.        0.12

            HYDROGRAPH AT
   *                            B1D      107.    12.00       12.          4.           4.        0.05
```

```
         HYDROGRAPH AT
DC-1E                      B1E        153.   12.02        18.       6.       6.     0.07
         3 COMBINED AT
DC-1D                    COMBINE      529.   12.02        62.      21.      21.     0.23
         ROUTED TO
+                          ROUTE      514.   12.05        62.      21.      21.     0.23
         HYDROGRAPH AT
+                          B1F        158.   12.00        18.       6.       6.     0.07
         2 COMBINED AT
DC-1F                    COMBINE      661.   12.02        79.      26.      26.     0.30
         HYDROGRAPH AT
DC-3A                      B3A         22.   12.03         3.       1.       1.     0.01
         HYDROGRAPH AT
DC-3B                      B3B          5.   12.08         1.       0.       0.     0.00
         2 COMBINED AT
+                        COMBINE       26.   12.03         3.       1.       1.     0.01
         ROUTED TO
+                          ROUTE       25    12.10         3.       1.       1.     0.01
         HYDROGRAPH AT
DC-3C                      B3C         13    12.30         3.       1.       1.     0.01
                          B3C=
         HYDROGRAPH AT
DC-3D                      B3D         13.   12.07         2.       1.       1.     0.01
         3 COMBINED AT
+                        COMBINE       48.   12.10         7.       2.       2.     0.03
         ROUTED TO
+                          ROUTE       46.   12.18         7.       2.       2.     0.03
         HYDROGRAPH AT
+                          B3E         32.   12.03         4.       1.       1.     0.01
         2 COMBINED AT
DC-3E                    COMBINE       68.   12.08        11.       4.       4.     0.04
         HYDROGRAPH AT
DC-4A                      B4A         50.   12.02         6.       2.       2.     0.02
         ROUTED TO
+                          ROUTE       46.   12.15         6.       2.       2.     0.02
         HYDROGRAPH AT
+                          B4B         26.   12.73         8.       3.       3.     0.03
         2 COMBINED AT
DC-4B                    COMBINE       58.   12.17        14.       4.       4.     0.05

                          SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                               (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                       INTERPOLATED TO
                                                                    COMPUTATION INTERVAL
      ISTAQ   ELEMENT     DT      PEAK    TIME TO   VOLUME     DT      PEAK   TIME TO    VOLUME
                                            PEAK                                PEAK

                         (MIN)    (CFS)    (MIN)     (IN)     (MIN)   (CFS)    (MIN)      (IN)

      ROUTE   MANE       1.00     82.37   720.00     3.36     1.00    82.37   720.00      3.36
```

```
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6224E+01 EXCESS=0.0000E+00 OUTFLOW=0.6215E+01 BASIN STORAGE=0.7375E-02 PERCENT ERROR=   0.0

            ROUTE  MANE        1.00     239.90    720.00      3.36      1.00    239.90    720.00        3.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1820E+02 EXCESS=0.0000E+00 OUTFLOW=0.1817E+02 BASIN STORAGE=0.2232E-01 PERCENT ERROR=   0.0

            ROUTE  MANE        1.00     269.96    721.00      3.35      1.00    269.96    721.00        3.35

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2086E+02 EXCESS=0.0000E+00 OUTFLOW=0.2082E+02 BASIN STORAGE=0.3882E-01 PERCENT ERROR=   0.0

            ROUTE  MANE        1.00     513.76    723.00      3.33      1.00    513.76    723.00        3.33

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4085E+02 EXCESS=0.0000E+00 OUTFLOW=0.4078E+02 BASIN STORAGE=0.7136E-01 PERCENT ERROR=   0.0

            ROUTE  MANE        1.00      25.39    726.00      3.02      1.00     25.39    726.00        3.02

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2069E+01 EXCESS=0.0000E+00 OUTFLOW=0.2063E+01 BASIN STORAGE=0.7009E-02 PERCENT ERROR=  -0.1

            ROUTE  MANE        1.00      46.39    731.00      3.01      1.00     46.39    731.00        3.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4770E+01 EXCESS=0.0000E+00 OUTFLOW=0.4759E+01 BASIN STORAGE=0.1543E-01 PERCENT ERROR=  -0.1

            ROUTE  MANE        1.00      45.65    729.00      3.01      1.00     45.65    729.00        3.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3686E+01 EXCESS=0.0000E+00 OUTFLOW=0.3664E+01 BASIN STORAGE=0.2628E-01 PERCENT ERROR=  -0.1


*** NORMAL END OF HEC-1 ***
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