

**PRELIMINARY STUDY TO IMPROVE THE ENTRY
INTO THE CALICO HILLS FORMATION FOR SITE
CHARACTERIZATION**

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Yucca Mountain Project
Las Vegas, Nevada**

Presentation

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Introduction

- **Take an independent look at simpler methods and more cost-effective ways to develop the Calico Hills Unit (CH_n), than that which is baselined.**
- **This was a preliminary study and, therefore, nothing was optimized. For the purpose of making a conceptual cost estimate, the ramp was considered as "drill and blast development," while the CH_n was considered "roadheader development." All haulage was with trucks. A TBM and conveyor system would probably prove even more cost effective.**

Why Enhance the Present Baseline?

- **The Timing Factor**

Present Schedule:

CH South Ramp Start	7/98
CH Main Drift Start	11/98
CH Cross Cuts Complete	2/01

CH Testing - Some may start in 2000

CH Testing Complete Probably 2008

All other development on TS_w2 completed before CH. If a "show stopper" is found on CH, wasted time and money.

Why Enhance the Present Baseline, continued:

- **No connection to the Potential Repository**
 - **Option 30 selected partially for the reason that there was a 2000 feet horizontal (200 feet vertical) distance separation between the potential repository level and the CH Ramp take-off.**
 - **New Enhanced CH entry about the same elevation as potential repository.**
 - **There can never be a direct pathway of man-made opening between the two horizons if a separate access way is made.**

Why Enhance the Present Baseline, continued:

- **Reduction of Development Excavated Length to Characterize the CH**
 - **The baselined configuration is a total of 9446.4 meters (31,000 feet).**
 - **The enhanced configuration is a total of 9871 meters (32,385 feet).**
 - **The recommended entry and configuration of this report is 6273 meters (20,581 feet).**

Principal Documents Reviewed Prior to Study

- **CHRBA**
 - **Eliminated all options that did not connect with ESF**
 - **Eliminated ramps**
 - **Targets:**
 1. **Lateral facies transition from zeolitic to vitric**
 2. **Ghost Dance Fault**
 3. **Solitario Canyon Fault**
 4. **Drill Hole Wash Fault**
 5. **Bounding Structures East and Southeast**
 - **Recommendation #2 or #5**

STRATEGY NO. 2
INSIDE; S; EXTENDED DRIFTING; INTEGRATED WITH ESF

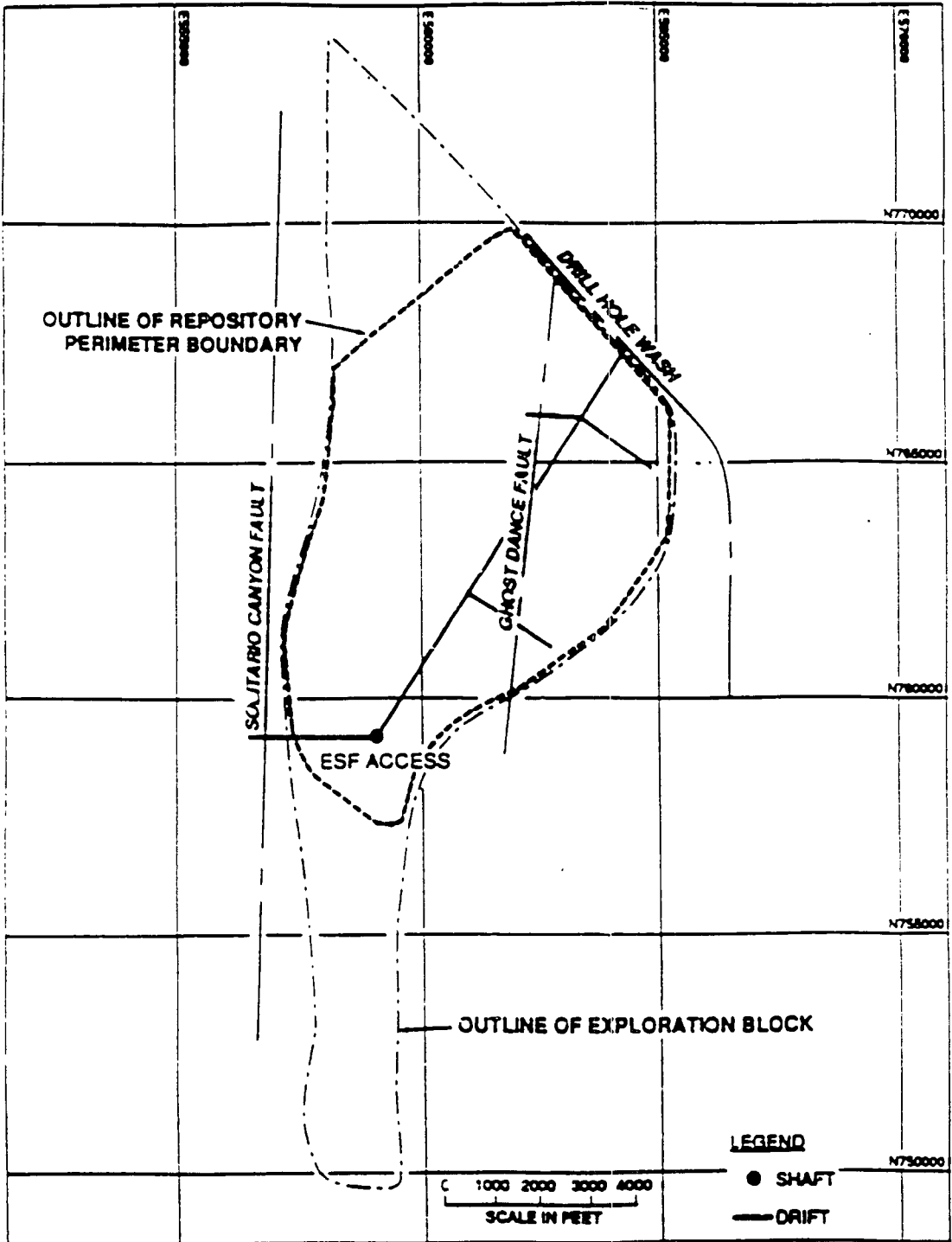
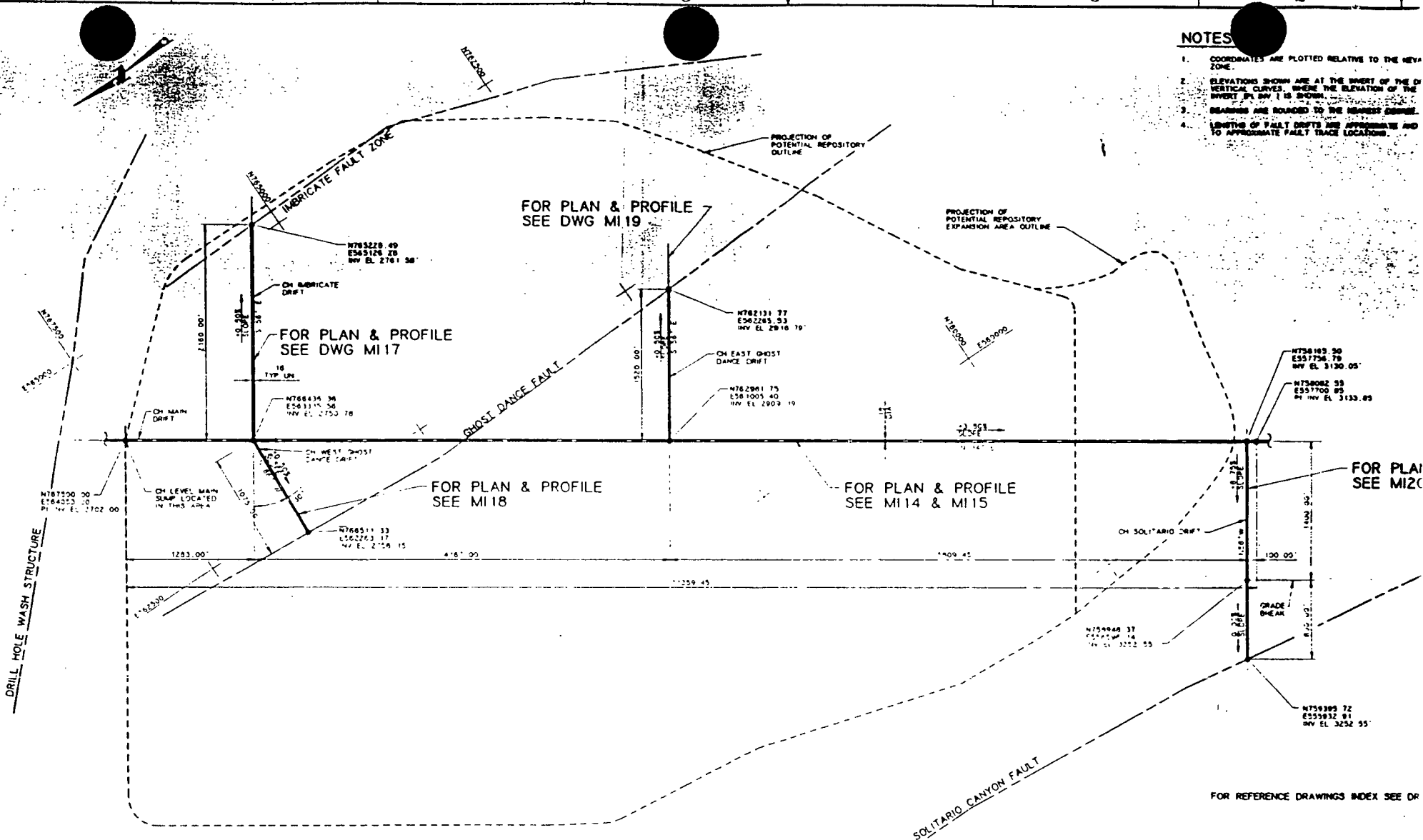


Figure 2.4-7. Sketch depicting CHn characterization Strategy 2.
 2.4-22

Principal Documents Reviewed Prior to Study continued:

- **ESFAS**
 - **Developed 17 options for characterizing the TS_w2 .**
 - **Accepted concepts from the CHRBA and doubled the options from 17 to 34 to include in every case a CH_n characterization. This increased the CH development up to 18,300 feet.**
 - **Developed a strategy for early testing of CH_n vs TS_w2 . Strong encouragement coming from NWTRB on this point.**
 - **Option 30 selected, which both isolated the take off going to the CH_n and also, was the option that had the earliest development of CH_n .**

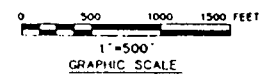
- NOTES**
1. COORDINATES ARE PLOTTED RELATIVE TO THE NEVA ZONE.
 2. ELEVATIONS SHOWN ARE AT THE INVERT OF THE DR VERTICAL CURVES WHERE THE ELEVATION OF THE INVERT IS SHOWN.
 3. BEARINGS ARE ROUNDED TO THE NEAREST DEGREE.
 4. LENGTHS OF FAULT DRIFTS ARE APPROXIMATE AND TO APPROXIMATE FAULT TRACE LOCATIONS.



CH LEVEL EXPLORATORY DRIFTS PLAN
SCALE 1"=500'

NOTES:
FAULT TRACE LOCATIONS SHOWN ARE APPROXIMATIONS BASED ON AT-DEPTH PROJECTIONS OF INFORMATION FROM SCOTT AND BOMK PRELIMINARY GEOLOGIC MAP AND SECTIONS

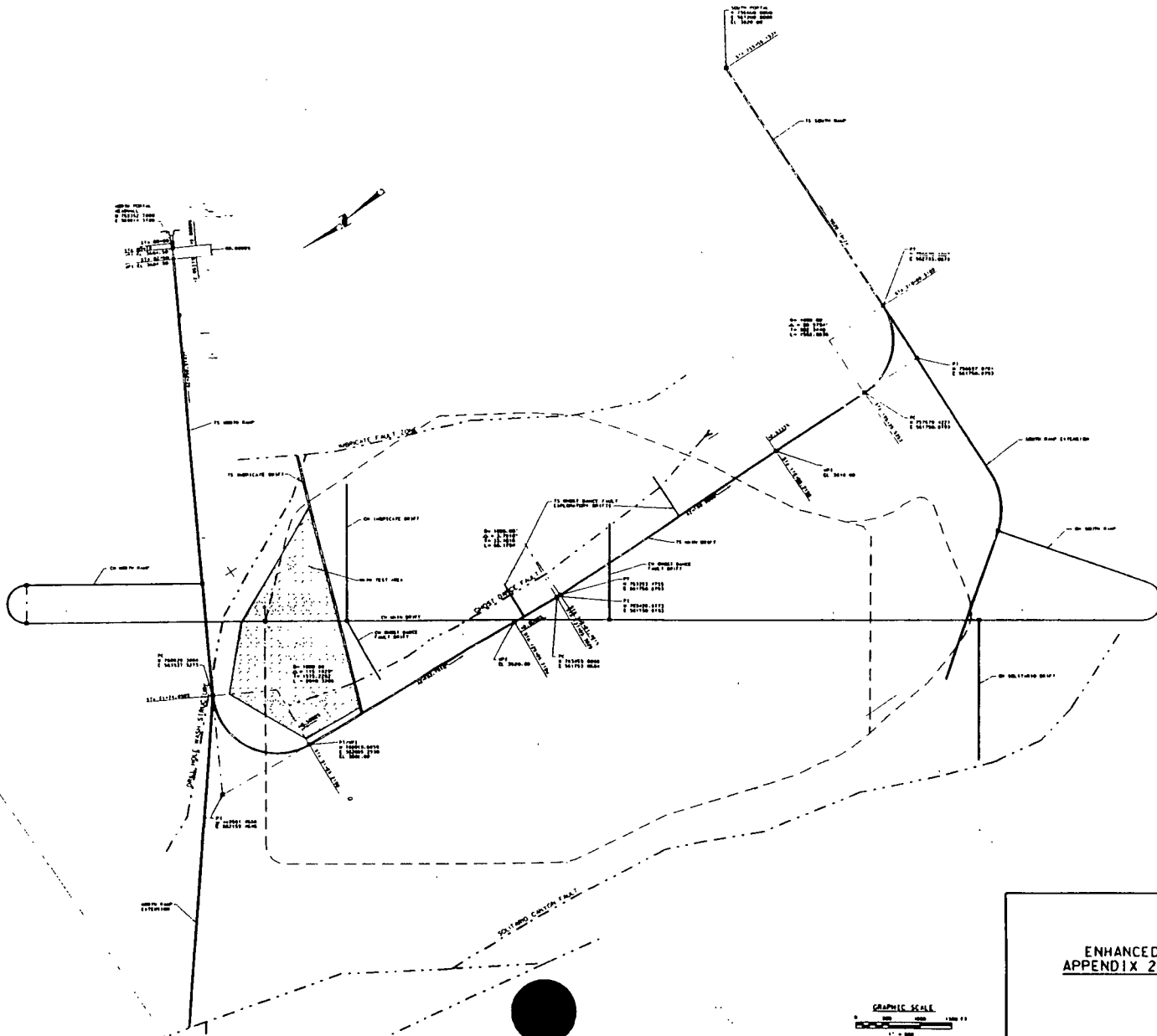
NOTE:
COORDINATES AND DIMENSIONS ARE PRELIMINARY



FOR REFERENCE DRAWINGS INDEX SEE DR

NO	DATE	REVISION	DES	DRW
U.S. DEPARTMENT OF ENERGY				
YUCCA MOUNTAIN SITE CHARACTERIZATION				
LAS VEGAS, NEVADA				
APPROVALS		Raytheon EXPLORATORY GENERAL CH LEVEL EXPLORATORY DRIFTS PLAN		
DESIGNED BY	CHKD BY			
CHECKED BY	DEC BY			
DATE SUBMITTED	BY			
VERIFICATION	N/A			
DATE	BY			
SUBMITTED BY		DATE		
APPROVED BY		DATE		

Title: Description and Rationale for Enhancement
to the Baseline ESF Configuration
Originator: D. G. McKenzie



ENHANCED ESF LAYOUT
APPENDIX 2 - FIGURE A2-1

Why Was a Separate Entry Not Considered Before?

- **All other concepts to develop and characterize the CH_n have only considered additional opening coming off of or through the potential repository level. The reason for this was that 10 CFR 60.15 (d) (2) was being followed, which states:**

"The number of exploratory boreholes and shafts shall be limited to the extent practical consistent with obtaining the information needed for site characterization."

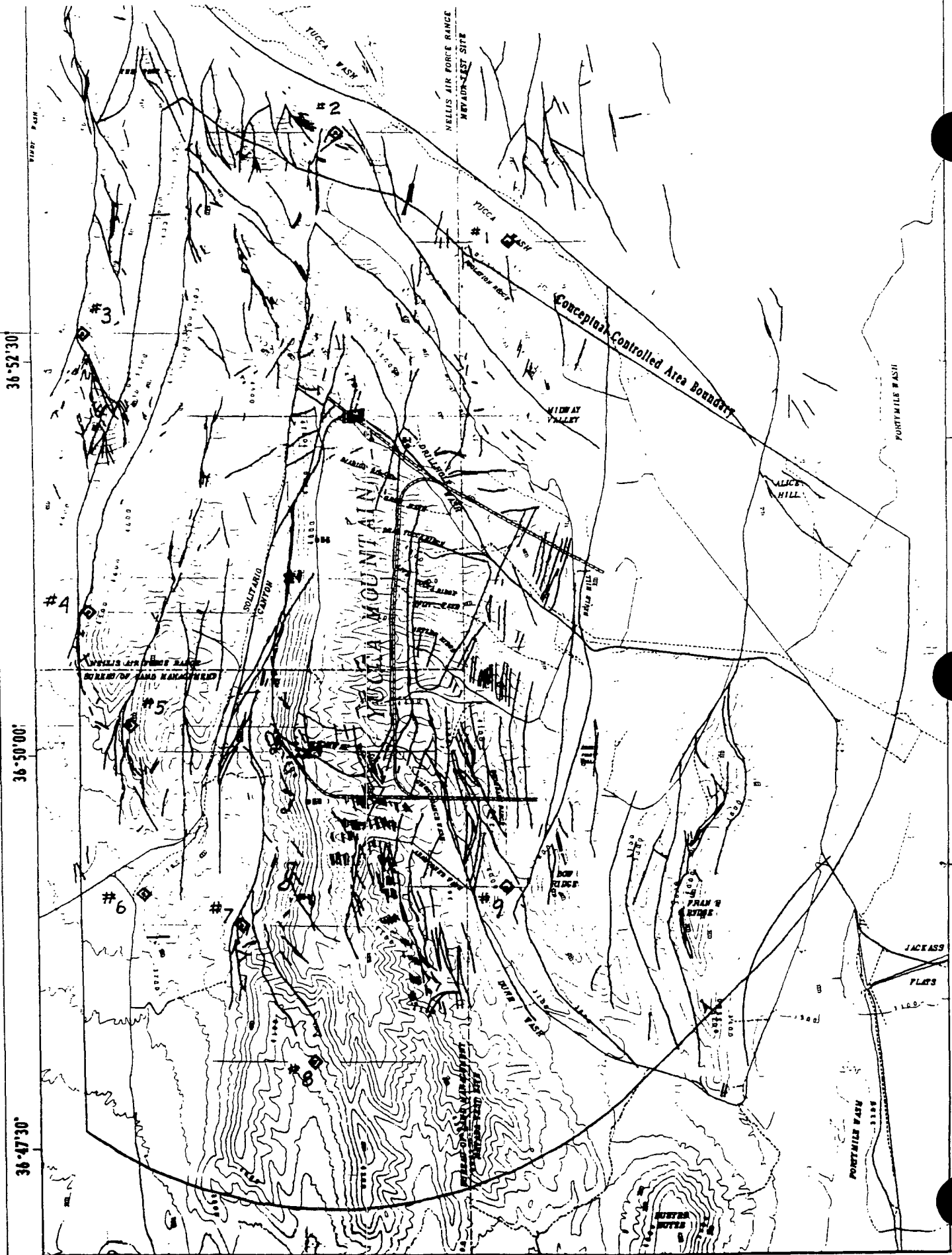
However, the way that it has been applied has had nothing to do with the practicality of the system adopted. A development system, which in no way is connected by an opening to the potential repository opening, might be much more practical and acceptable than one which creates two man-made opening connecting the repository to the Calico Hills formation.

Why Was a Separate Entry Not Considered Before, continued:

- **Furthermore, one should not consider part (d) (2), without also considering part (d) (1), which says:**

"Investigation to obtain the required information shall be conducted in such a manner as to limit adverse effects on the long term performance of the geologic repository to the extent practical."

Certainly, disconnecting the man-made opening going to the CH_n unit from the repository level is limiting any potential adverse effects more than a development scheme which has two man-made openings connecting the repository with the CH_n unit.



36°52'30"

36°50'00"

36°47'30"

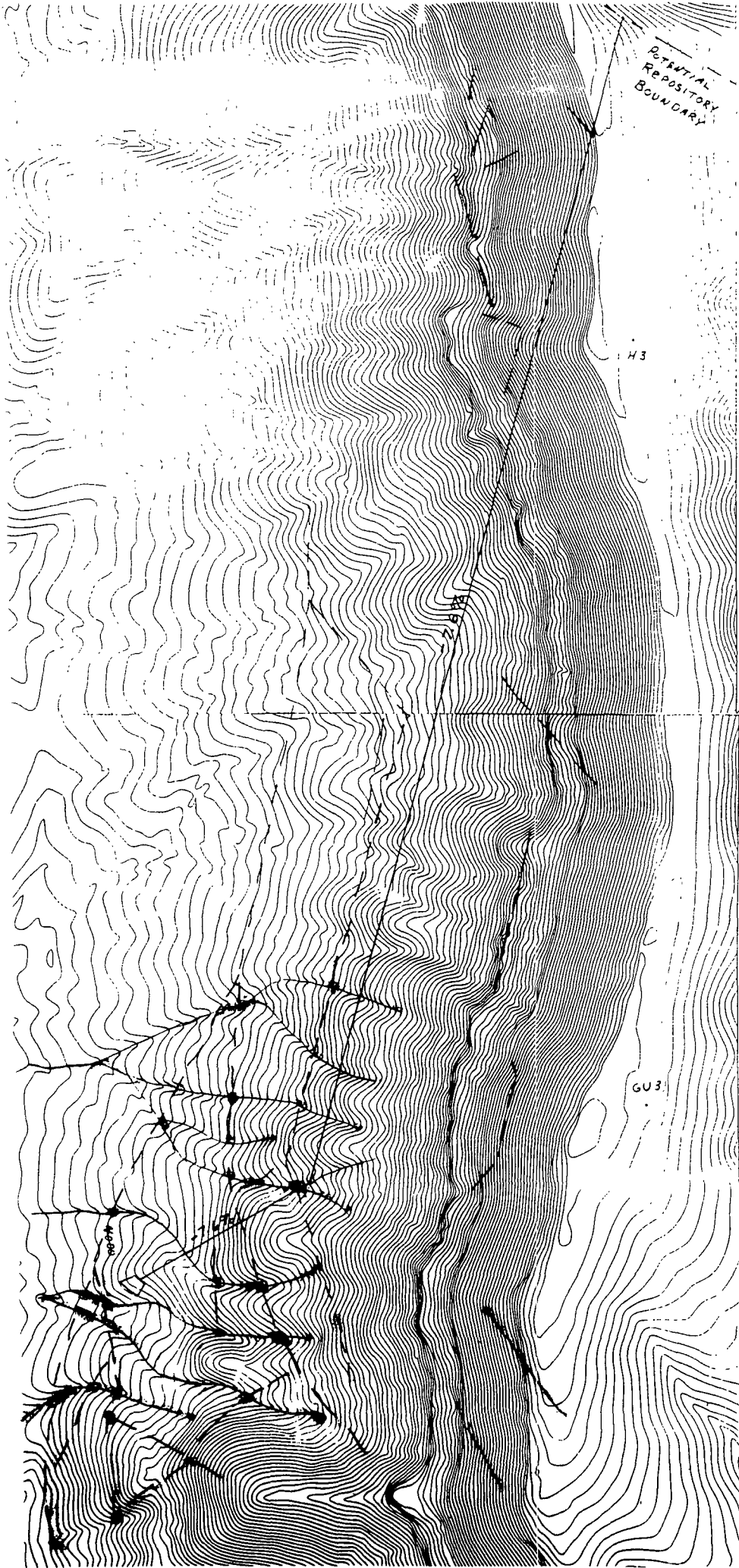
116°30'00"

116°27'30"

116°25'00"

N7702101
N4080000m

N7539501
N4075000m



N 754,750
E 559,000

N 754,750
E 559,000

**Ramp Layout
of Site 7
Ramp**

Scale: 1" = 500'

10' Contours

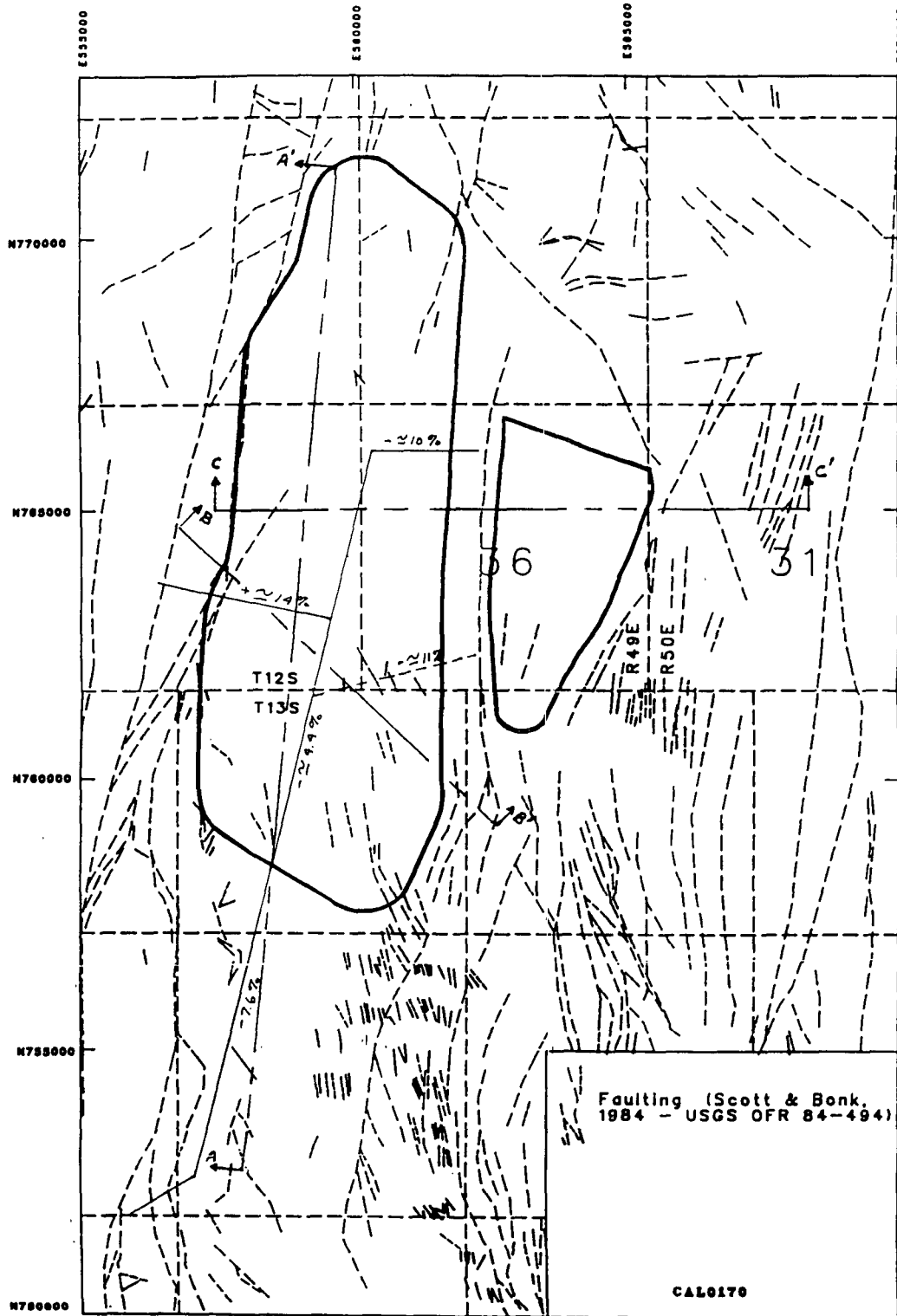
Figure 2

(After)

CALC NO.: B0000000-01717-0200-00089 Rev. 00

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Scott & Bonk Structural Map
with Emplacement Areas Shown

Figure 3

Will a Single Entry Development be Allowed?

- **What does MSHA require?**

- **30 CFR 57.11050 states:**

"Every mine shall have two or more separate, properly maintained escapeways to the surface from the lowest levels...A method of refuge shall be provided while a second opening to the surface is being provided. A second escapeway is recommended, but not required, during the exploration or development of an ore body."

- **The site characterization of the CH_n might very well be likened to the exploration of an ore body. Many test mines have never been developed beyond a single entry.**

- **What does California Administrative Code require?**

- **By there definition this development would be classified as a tunnel, not a mine.**

Will a Single Entry Development be Allowed, continued:

- **There is no mention of a second opening in their Tunnel Safety Orders.**
- **Comparison of maximum distance to escapeway portal:**
 - **Baselined case of developing the Main Test Level-7500 meters (24,600 feet)**
 - **Enhanced plan for developing the CH_n-10550 meters (34,600 feet)**
 - **Recommended Site 7 single entry for developing the CH_n-5,273 meters (17,300 feet)**

Advantages to the Recommended Development

- **It allows the CH entry to be made at any time, since starting the development does not rely on any previous development within the ESF.**
- **Since there is no connection to the ESF, which has the potential for becoming the repository, the separate entry should compare better from a performance assessment point of view.**
- **Should an accident or mine emergency occur in the CH testing area, there is far less distance to travel to the escapeway portal for the separate entry case, than there is for the development now planned for the CH level.**
- **The cost and amount of development is far less for the recommended separate entry case than it is in the baselined cases.**

CH North Ramp		1594.7 m (5232 ft.)
CH South Ramp		2269.5 m (7446 ft.)
CH Main N-S Drift		3462.2 m (11359 ft.)
CH Cross Cuts to:		2120.0 m (6955 ft.)
Imbricate Fault	658.4 m (2160 ft.)	
N. Ghost Dance Fault	327.7 m (1075 ft.)	
Mid Ghost Dance Fault	463.3 m (1520 ft.)	
Solitario Canyon Fault	<u>670.6 m (2200 ft.)</u>	
Total Development to Characterize CH _n		9446.4 m (30992 ft.)

Table I CH Development Planned in the Baseline Title I

The cost of these developments was also listed in the Title I ESF Design Summary Report and are summarized in Table 2.

North Access, CHL Excavation, Utilities & Equipment	\$29,990 K*
South Access, CHL Excavation, Utilities & Equipment	32,422 K*
Calico Hills Level	41,503 K

Total Calico Hill Development Cost (Not Shown In Report) \$103,915 K

*Contains 18 Foot TBM, Trailing Gear and Conveyor System

Table 2 Estimated Cost of CH Development in the Baseline Title I

Appendix C

Conceptual Cost Estimate Summary

	<u>Estimated Cost</u>	<u>Contingency</u>	<u>Cost with Contingency</u>
Mobilization and Demobilization	\$ 500,000	50%***	\$ 750,000
Portal and Other Surface Facilities	6,607,900	25%*	8,259,875
Underground Facilities	15,271,829	50%**	22,907,744
Contingency (Calculated)	<u>9,537,890</u>	42.62%	<u>--</u>
Total Cost with Contingency	\$31,917,619		\$31,917,619

Recommendations:

- *Site 7 be used as the Portal Site.*
- *That the ramp down to the CH_n be considered for classified as:*
 - Not important to waste isolation*
 - Not important to safety*
 - Not important to test interference*
- *That the construction of the CH Ramp be kept completely separate from the activities of the ESF (with the exception of safety-related support).*