NRC'd w/ttr ltr dtd 9/21/94

**SUMMARY OF THE JULY 27, 1994,
U. S. NUCLEAR REGULATORY COMMISSION/U.S. DEPARTMENT OF ENERGY
TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY**

Staff from the Nuclear Regulatory Commission met with representatives of the Department of Energy (DOE) to discuss items of mutual concern regarding design, the design control process, the architectural document hierarchy and the imminent start-up of tunnel boring at DOE's Exploratory Studies Facility (ESF) at Yucca Mountain. Representatives of the State of Nevada (NV) and the NV Nuclear Waste Task Force attended the meeting. The Affected Units of Local Government had been notified of the meeting, but did not attend. Also in attendance were representatives of the DOE Civilian Radioactive Waste Management System Management and Operating Contractor, and the Nuclear Waste Technical Review Board. Attachment 1 is an attendance list. Copies of presenters' handouts are included as Attachment 2. A copy of the agreements reached by the NRC staff and the representatives of DOE is Attachment 3.

Among the topics discussed at the meeting was DOE's response to the March 30, 1994, NRC letter on the ESF design and design control process. The DOE response is contained in the handout (See Attachment 2) titled: "DOE-NRC Technical Meeting on the Exploratory Studies Facility Introduction." The NRC staff will review this information and discuss its response with DOE at the next ESF Technical Meeting, which is scheduled for November 8, 1994.

In response to a request from the NRC staff, DOE made a presentation to stress the distinction between design stages and design phases in the repository program. A design stage corresponds to the major stages of facility design, eg. Title I, Title II, Advanced Conceptual Design, License Application Design, Procurement and Construction Design and Title III or As-Built Design. Design phases correspond to the phased approach to ESF design that are captured in sequential design packages, eg. Package 1A, 1B, 2A, 2B, 2C, etc. The DOE explained what type of information was expected to be available at each design stage. Several questions regarding the relationship of design stages to other parts of the repository program were asked by the meeting participants. These included questions on: the completion of analyses of alternatives relative to the design phases, the relationship of design activities to the schedules of activities associated with DOE's proposed program approach, and the relationship of the Title II design to development of the Environmental Impact Statement. The participants agreed that these questions would be discussed further at the November ESF meeting.

The evolution of the ESF Q-List was also discussed. Of particular interest is the fact that, as part of its commitment to worker safety, DOE is expanding the ESF Q-List. The Q-List will now include structures, systems, and components important to fire protection, physical protection, and occupational exposure, even if they do not otherwise affect safety or waste isolation. The NRC staff believes that this shows an appropriate understanding of the importance of making the grading process a fully-integrated part of the repository program.

1028

9410060314 940921
PDR WASTE
WM-11 PDR

During the discussion of ESF Design and Construction Progress, DOE stated that the tunnel boring machine was scheduled to begin operations on August 8, 1994. The NRC staff then asked some questions regarding two June 21, 1994 staff letters discussing pneumatic pathways concerns which might be impacted by tunnel boring activities. In one of the June 21, 1994, letters, the staff closed Site Characterization Analysis comment 123 open items on the pneumatic testing issue. In the other the staff asked for further information on how the DOE was addressing a concern raised by the State of Nevada, and had requested further information as to why DOE believes this was not a concern. The NRC staff believes that its questions related to hydrochemical testing and the NV concern regarding characterization of pneumatic pathways should be addressed before TBM start-up. DOE agreed to address these concerns in a telecon, prior to August 8, 1994, and to provide a follow up response in writing.

At the conclusion of the meeting, the NRC project manager and a representative of DOE agreed that three commitments had been made at this meeting and produced and signed Attachment 3, listing those commitments.

Mark S. Delligatti, Project Manager
High-Level Waste & Uranium Recovery
Projects Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission

Christian E. Einberg
Regulatory Integration Branch
Office of Civilian Radioactive
Waste Management
U.S. Department of Energy

ATTENDANCE

NRC/DOE ESF MEETING JULY 27, 1994

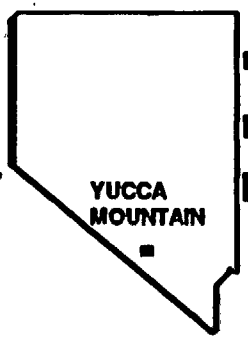
NAME	ORG.	Phone
MARK DELLIGATTI	NRC/DWM	415-6620
JIM REPLOGLE	DOE/YMP/ESF	702 794 7929
WILLIAM BOYLE	DOE/YMSCO/AMSP	702 794 7595
KEITH. LOBO	SAIC/PE	702 794 1929
Robin N. Datta	M&O/WCFS	702 794-1832
JOHN H. PYE	M&O/M-K	702-794-5330.
Shiann-Jang Chern	NRC/DWM	301-415-6613
Thomas Bierstedt	DOE/YMSCO	702-794-7590
TOM GEER	M&O/DUKE	702/794-7868
Thomas Rogers	M&O/WCFS	202/488-2320
Chris Einberg	DOE	(202)586-8869
RAM B. MURTHY	DOE	202-586-1239
Baker Ibrahim	DWM	301. 415-6651
Steve Nesbit	M&O/Duke	702-794-1910
JIM YORK	Weston	202-646-6650
Steve Frishman	State of NV Nuclear Waste Task Force	702/687-3744
Judy Treichel		702-248-1171
NORMAN T. SIMMS	M&O/DUKE	702-794-7314
Joe Holonich	NRC/DWM	301 415 6643

ATTENDANCE

NAME	ORG	Phone
JOHN TRAPP	NRC	301-415-8063
R. McFARLAND	NWTRB	703/235 4423
APRIL GIL	US DOE/YMSCO	(702) 794-7622
Mike Bell	NRC/ENGB	301-415-7286
Keith McConnell	NRC/ENGB	301-415-7289
Mysore Nataraja	NRC/ENGB	301-415-6695
JACK SPRAUL	NRC/QA	301-415-6715

U.S. DEPARTMENT OF ENERGY

OCRWM



YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

DOE-NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

DESIGN AND CONSTRUCTION PROGRESS

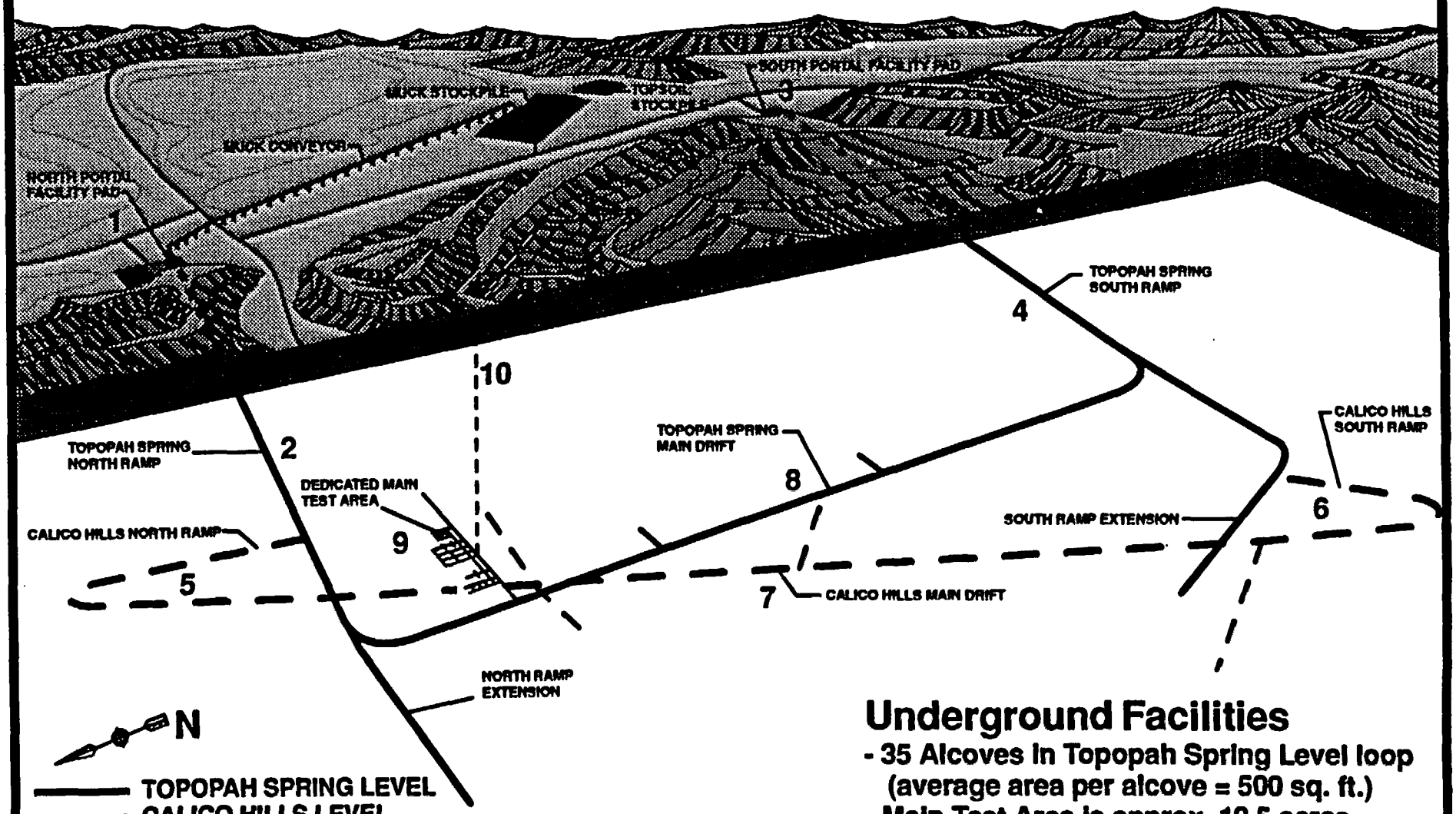
PRESENTED BY:
JAMES M. REPLOGLE

JULY 27, 1994
ROCKVILLE, MD

PRESENTATION PARAMETERS

- **ESF design and construction progress information is based on projected budgets of:**
  - **FY94 = $55M**
  - **FY95 = $101M**
  - **FY96 = $114M**
  - **FY97 = $119M**
- **ESF packages are described either by configuration items (where defined) or projected scope**

EXPLORATORY STUDIES FACILITY DESIGN



Underground Facilities

- 35 Alcoves in Topopah Spring Level loop (average area per alcove = 500 sq. ft.)
- Main Test Area is approx. 18.5 acres

ESFPRP3C.CDR.XSECTNS/5-12-94

PACKAGE 1A:
NORTH PORTAL SITE PREPARATION

Configuration items:

- Tunnel Boring Machine (TBM), TBM starter tunnel, pad and access road, pad water drainage system; switchgear building, underground utilities on pad (electric, sewer, H20, firewater, waste water) rock and topsoil storage area, Test Alcove 1

Design Status

- All items complete and accepted for construction

PACKAGE 1A:
NORTH PORTAL SITE PREPARATION

Construction status:

- Complete
  - TBM starter tunnel
  - Pad and access road
  - Rock and topsoil storage area
  - Test Alcove #1
  - TBM Assembly

- In process
  - TBM Operational Readiness Review
  - Switchgear building
  - Pad water system
  - TBM launch chamber

Acceptance status: Pending

PACKAGE 1B:
NORTH PORTAL SURFACE FACILITIES AND UTILITIES

Configuration items:

- Change House building, Shop building, pad sewer system, pad electrical system, pad waste water system, pad and access road, water system, surface rail, finish grading and paving

Design Status

- All items complete and accepted for construction

PACKAGE 1B: NORTH PORTAL SURFACE FACILITIES AND UTILITIES

(CONTINUED)

Construction status:

- In process
  - Pad sewer system
  - Pad electrical system
  - Pad waste water system
  - Pad water systems
    * Potable
    * Non Potable
- Complete FY95
  - Change House building
  - Shop building
  - Pad extension
  - Explosive storage area
  - Finish grade

Acceptance status: TBD

PACKAGE 1C:
NORTH PORTAL SURFACE FACILITIES AND UTILITIES

Configuration items:

- Compressed air systems, standby power

Design Status

- In process, complete mid-FY94

Construction Status: Complete FY95

- Compressed air systems
- Standby power

Acceptance Status: TBD

PACKAGE 1D:
NORTH PORTAL SURFACE FACILITIES AND UTILITIES

Design Scope:

- Muck storage area, conveyor access road & oily water containment
- Integrated data/control system (IDCS) system description & procurement specifications
- Fuel storage system
- Remaining site lighting
- Fence grounding
- Air compressor and stand-by generator foundations

Design Status

- In 90% Review process, by July 94
- Complete expected by Sept 94

Construction Status: Start FY95 - Complete FY96

Acceptance Status: Pending

PACKAGE 2A:

Configuration Items: None. Components only

Design Status: Complete

Construction Status: Procurement only, complete FY95

Acceptance Status: Complete

PACKAGE 2B:

Configuration items:

- Mapping Gantry, locomotives, rolling stock, precast concrete inverts, ventilation system

Design Status

- 90% Design Review complete

Construction Status: Procurement only FY94

Acceptance Status: Complete

PACKAGE 2C: NORTH RAMP TO TOPOPAH SPRING LEVEL (TSL)

Configuration items:

- North Ramp Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor systems

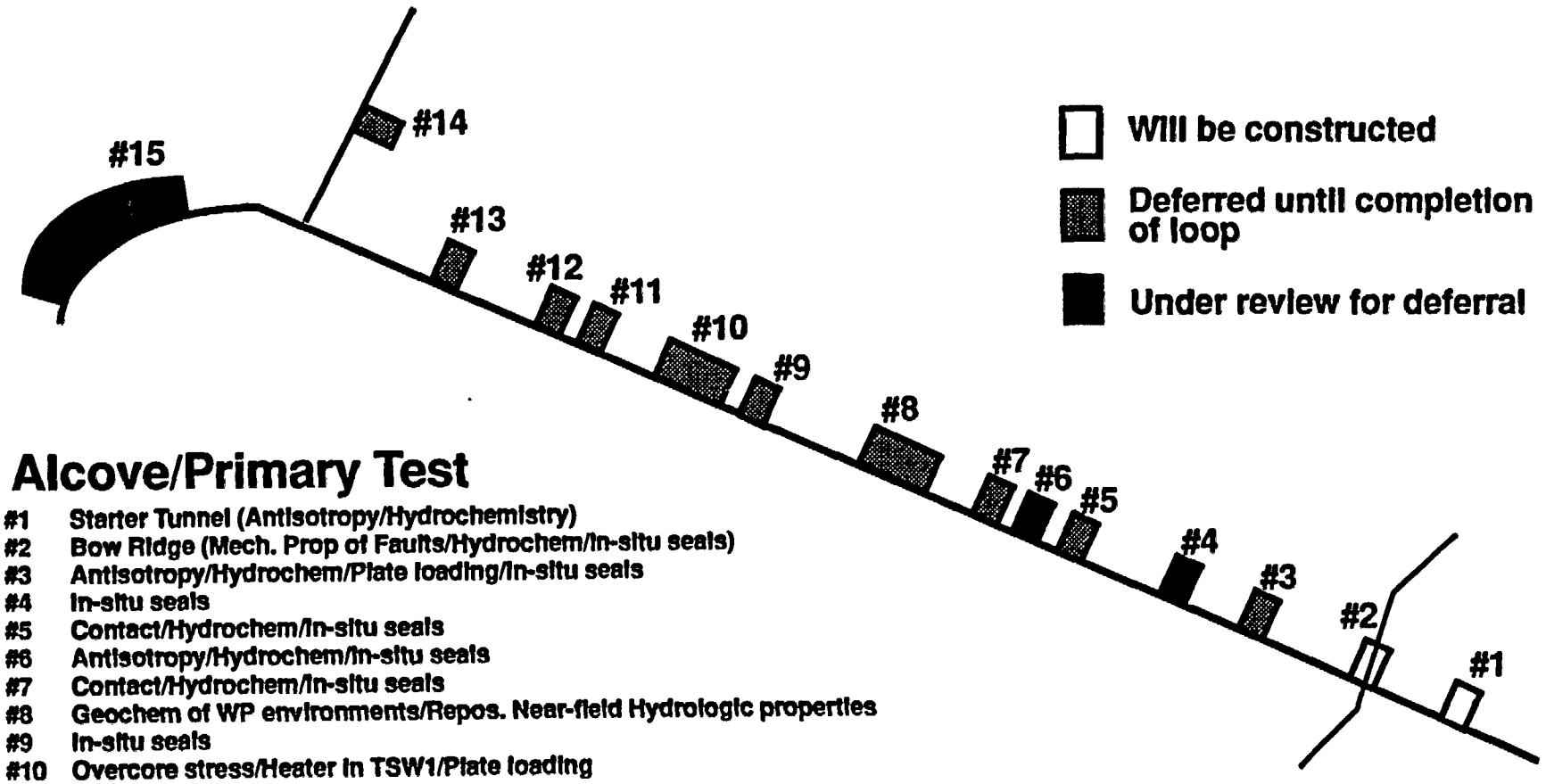
Design Status

- In review process - Complete late FY94
  90% review held May 2, 1994,
  release for construction expected
  August 1994

Construction Status: Start FY94 - Complete FY95

Acceptance Status: Pending

NORTH RAMP ALCOVE CONFIGURATION



Alcove/Primary Test

#1 Starter Tunnel (Antisotropy/Hydrochemistry)
#2 Bow Ridge (Mech. Prop of Faults/Hydrochem/In-situ seals)
#3 Antisotropy/Hydrochem/Plate loading/In-situ seals
#4 In-situ seals
#5 Contact/Hydrochem/In-situ seals
#6 Antisotropy/Hydrochem/In-situ seals
#7 Contact/Hydrochem/In-situ seals
#8 Geochem of WP environments/Repos. Near-field Hydrologic properties
#9 In-situ seals
#10 Overcore stress/Heater in TSW1/Plate loading
#11 Antisotropy/Hydrochemistry
#12 In-situ seals
#13 Hydrochem/In-situ seals
#14 Excavation effects
#15 Hydro Prop of Major Faults/Hydrochemistry

Predecisional Preliminary Draft Material

PACKAGE 3A: SOUTH PORTAL SITE PREPARATION

Design Scope:

- Pad and access roads, pad water and sewer systems, pad drainage

Design Status

- Start FY95 - Complete FY96

Construction Status: Start FY95 - Complete FY96

Acceptance Status: Pending

PACKAGE 3B: SOUTH PORTAL FACILITIES AND UTILITIES

Design Scope:

- Fan/Airlock structure, portal control building, shop building, warehouse building, pad utilities

Design Status

- Start FY95 - Complete FY95

Construction Status: Start FY95 - Complete FY96

Acceptance Status: Pending

PACKAGE 4: SOUTH RAMP TO TOPOPAH SPRING LEVEL (TSL)

Design Scope:

- South Ramp Excavation/breakthrough, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY95 - Complete FY96

Construction Status: Start FY96 - Complete early FY97

Acceptance Status: Pending

PACKAGE 5: NORTH RAMP TO CALICO HILLS LEVEL (CH)

Design Scope:

- North Ramp To Calico Hills Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY96 - Complete FY97

Construction Status: Start FY98 - Complete FY00

Acceptance Status: Pending

PACKAGE 6: SOUTH RAMP TO CALICO HILL LEVEL (CH)

Design Scope:

- South Ramp To Calico Hills Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY96 - Complete FY97

Construction Status: Start FY97 - Complete FY99

Acceptance Status: Pending

PACKAGE 7: CALICO HILL (CH) DRIFTING

Design Scope:

- Calico Hills Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY96 - Complete FY97

Construction Status: Start FY99 - Complete FY01

Acceptance Status: Pending

PACKAGE 8A: TOPOPAH SPRING LEVEL (TSL) MAIN DRIFT

Design Scope:

- TSL main drift excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY94 - Complete FY95

Construction Status: Start FY95 - Complete FY96

Acceptance Status: Pending

PACKAGE 8B: TOPOPAH SPRING LEVEL (TSL) NORTH RAMP EXTENSION

Design Scope:

- North Ramp Extension Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY95 - Complete FY96

Construction Status: Start FY97 - Complete FY98

Acceptance Status: Pending

PACKAGE 8C: TOPOPAH SPRING LEVEL (TSL) SOUTH RAMP EXTENSION

Design Scope:

- South Ramp Extension Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY95 - Complete FY96

Construction Status: Start FY97 - Complete FY98

Acceptance Status: Pending

PACKAGE 9: TOPOPAH SPRING LEVEL (TSL) MAIN TEST AREA

Design Scope:

- TSL Main Test Area Excavation, linings and ground support, subsurface electrical systems, subsurface mechanical systems, subsurface fire protection, subsurface monitoring and warning systems, subsurface conveyor system

Design Status

- Start FY95 - Complete FY96

Construction Status: Start FY96 - Complete FY98

Acceptance Status: Pending

PACKAGE 10: OPTIONAL SHAFT

Design Scope:

- Optional shaft excavation, linings and ground support, support utilities, site and pad preparation

Design Status

- Start FY97 - Complete FY98

Construction Status: Start FY98 - Complete FY00

Acceptance Status: Pending

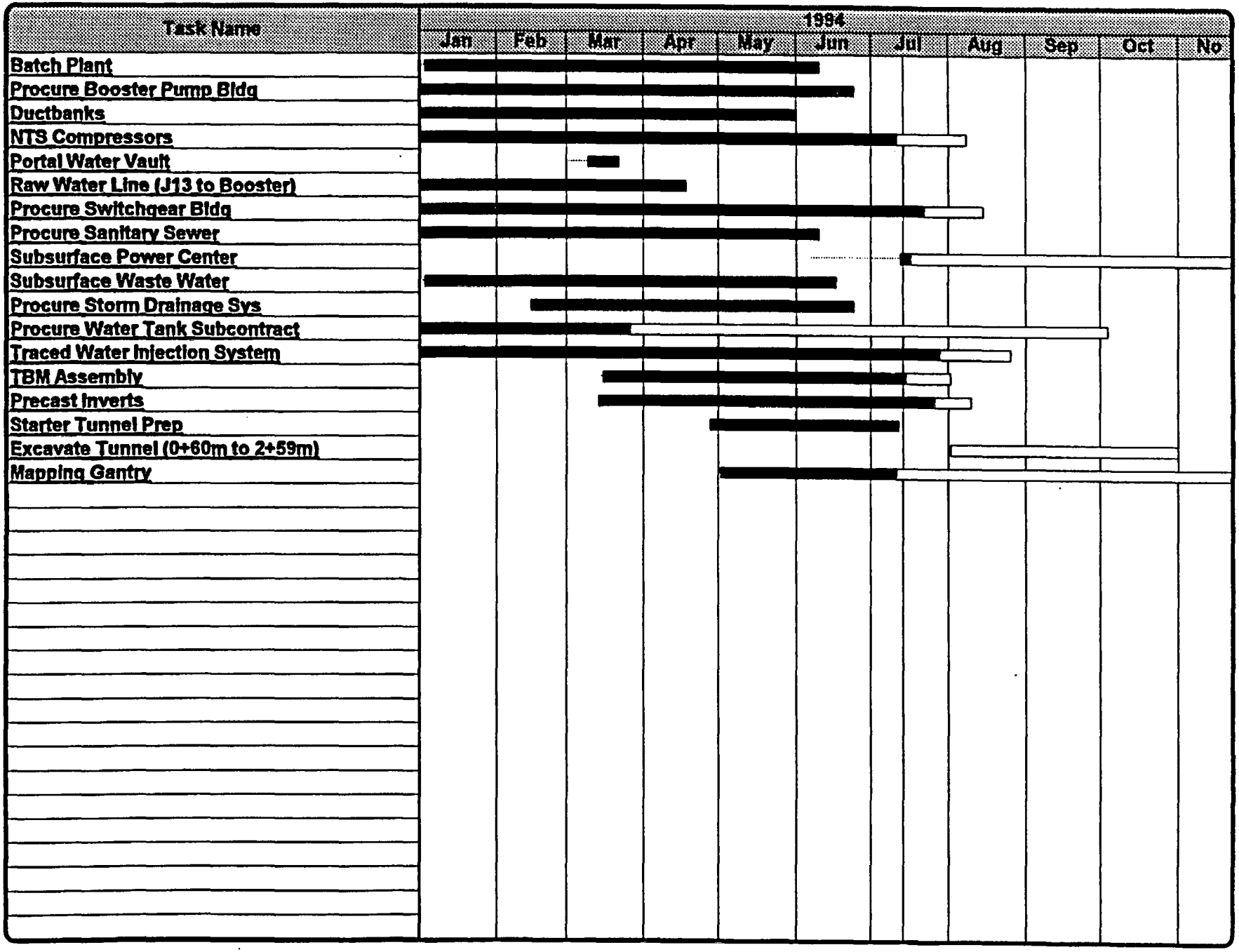
Other Near-Term ESF Design Activities

- Integrated Data Control System (IDCS)
  - 50% Review - June 7, 1994 (complete)
    90% Review - August, 1994
- Alcove design - (North Ramp test alcoves, Ghost Dance Drifts, Heater Test Drifts)
  - 50% Review - 8/1/95
- Mechanical Excavation Methods Study
  - Recommendation by end of FY1994
- Calico Hills Access Alternatives Study
  - Early FY1995 Start

North Ramp Construction Schedule

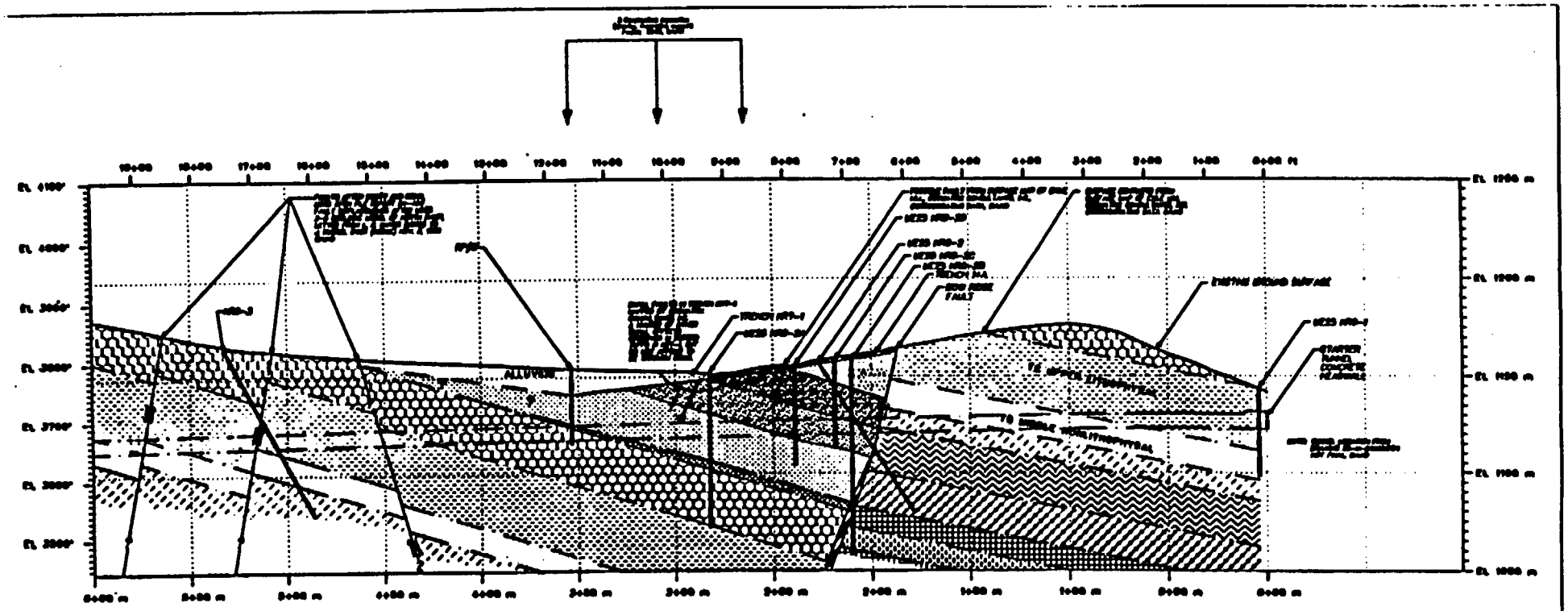
- TBM start up, testing phases are expected to begin August 8, 1994
- Initial operations can be characterized as a "Startup Testing Phase followed by a Shakedown Phase"
- Advance rate will be low during this period due to:
  - Training of operational personnel
  - Startup testing of the TBM systems
  - Encounter with Bow Ridge Fault at approximately 1+90 meters
  - Negotiation of "Rainier Mesa" material from Bow Ridge to approximately Station 2+70
  - Rail haulage of muck until conveyor installation in early to mid-1995
  - Completion of North Ramp (to 28+00) - Early FY1996

Main



Milestone △ Summary

Fixed Delay



FORMATION	MEMBER	MAJOR ZONES	CRYSTALLINITY SUBZONES	LITHOLOGIC DESCRIPTION
TIMBER MOUNTAIN TUFF	RAINIER MESA			
	?			
PAINTBRUSH TUFF				

LEGEND

CROSS SECTION CONSTRUCTED ALONG RAMP ALIGNMENT – AZIMUTH 238°

0 20 40 60 80 100m

1 : 2000

Borehole	Projected to Section along Azimuth	Ground Elevation (ft)	Elevation to Section (ft)

Notes: Boreholes projected into cross section along centerline of ramp axis.

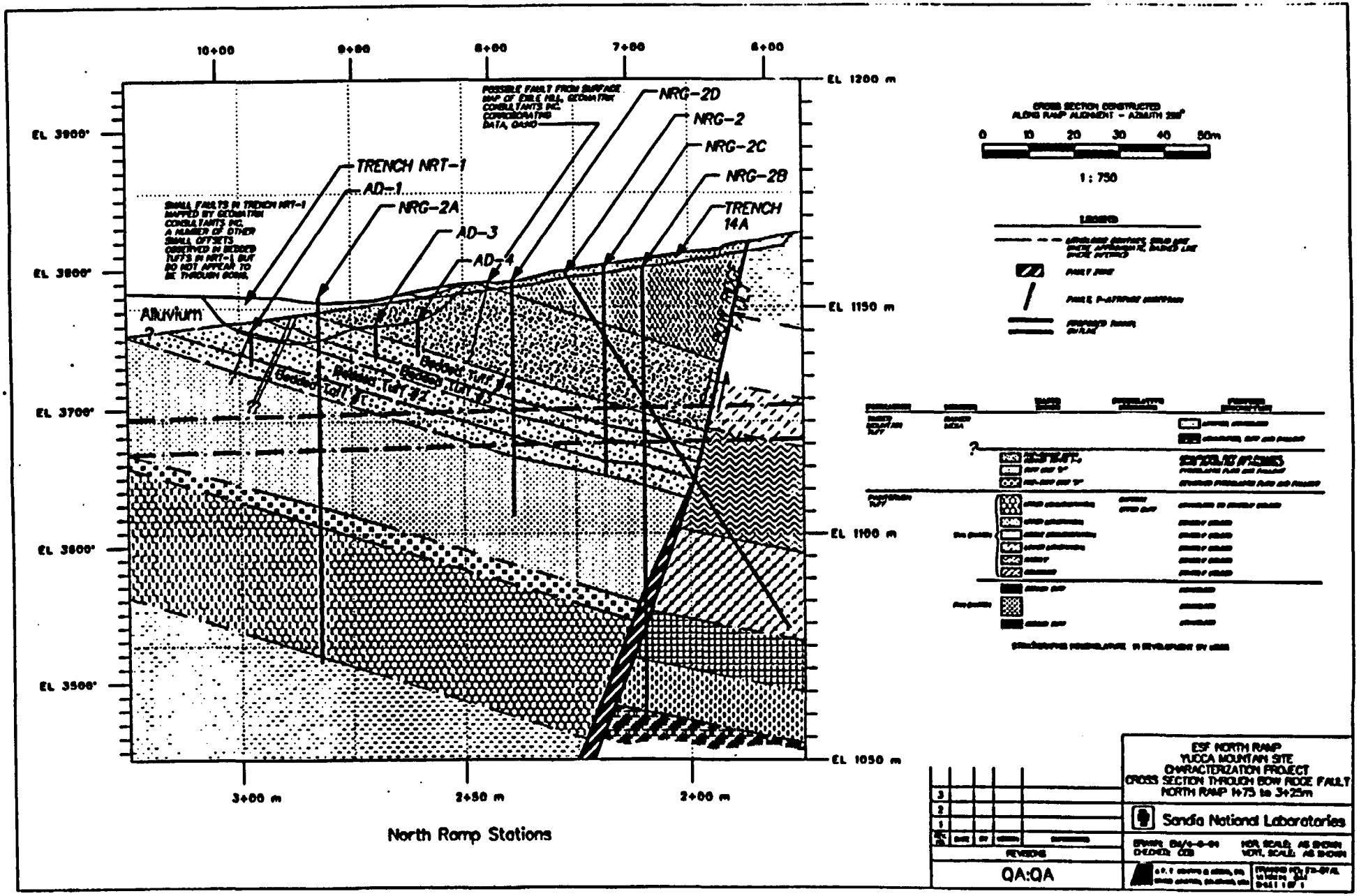
NP = Not projected

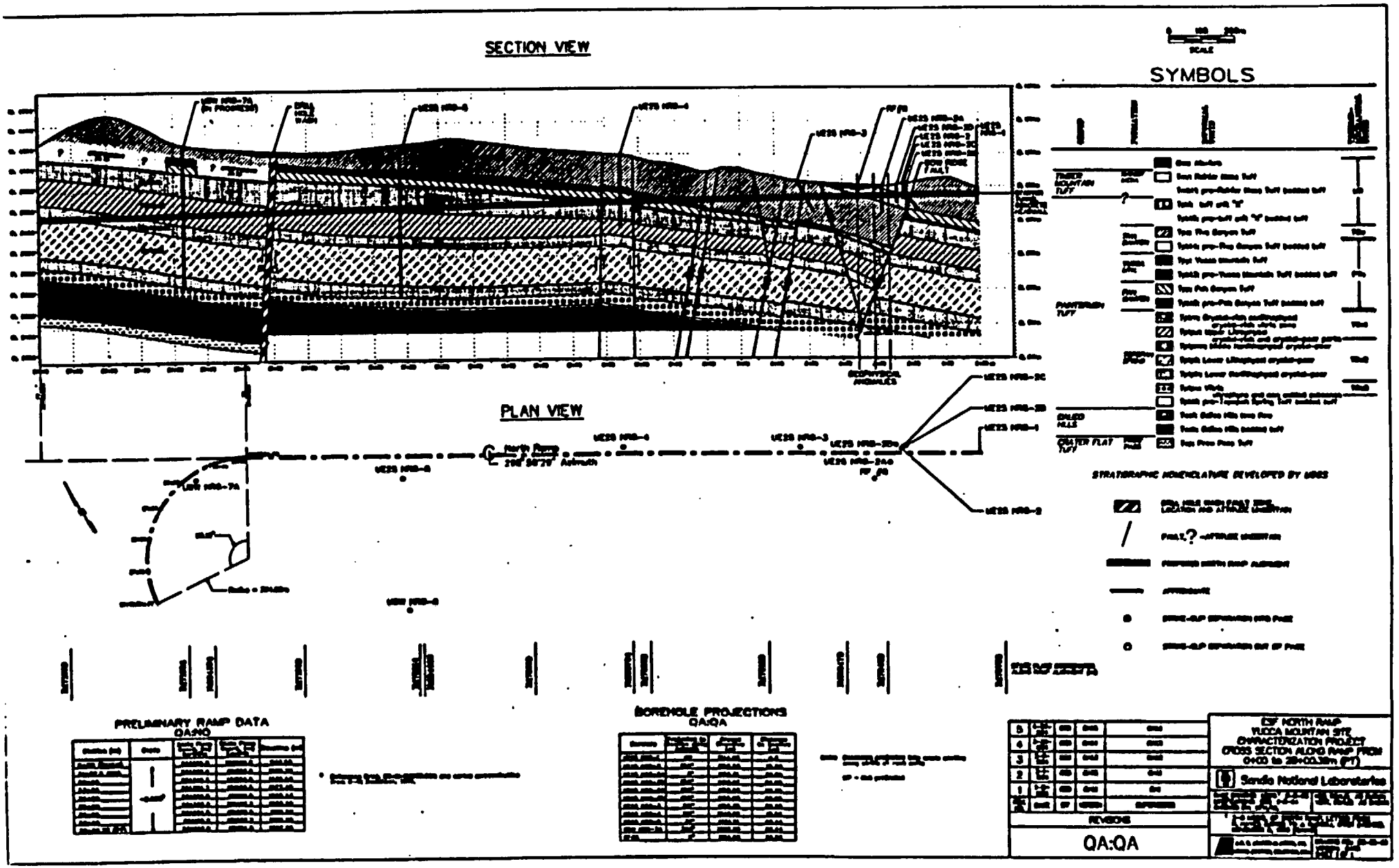
REVISIONS				
3				
2				
1				
0				

QA:QA

ESF NORTH RAMP
YUCCA MOUNTAIN SITE
CHARACTERIZATION PROJECT
CROSS SECTION THROUGH EXILE HILL
NORTH RAMP 0+00 to 6+00m

Sandia National Laboratories


10+00
9+00
8+00
7+00
6+00
EL 1200 m
EL 3900'
EL 3800'
EL 3700'
EL 3600'
EL 3500'
EL 1150 m
EL 1100 m
EL 1050 m
TRENCH NRT-1
AD-1
NRG-2A
AD-3
AD-4
NRG-2D
NRG-2
NRG-2C
NRG-2B
TRENCH 14A
Alluvium
3+00 m
2+50 m
2+00 m
North Ramp Stations
1 : 750
ESF NORTH RAMP
YUCCA MOUNTAIN SITE
CHARACTERIZATION PROJECT
CROSS SECTION THROUGH BOW RIDGE FAULT
NORTH RAMP 14+75 to 3+25m
Sandia National Laboratories
QA:QA


SECTION VIEW
SYMBOLS
PLAN VIEW
PRELIMINARY RAMP DATA
QA:NO
BOREHOLE PROJECTIONS
QA:QA
QA:QA

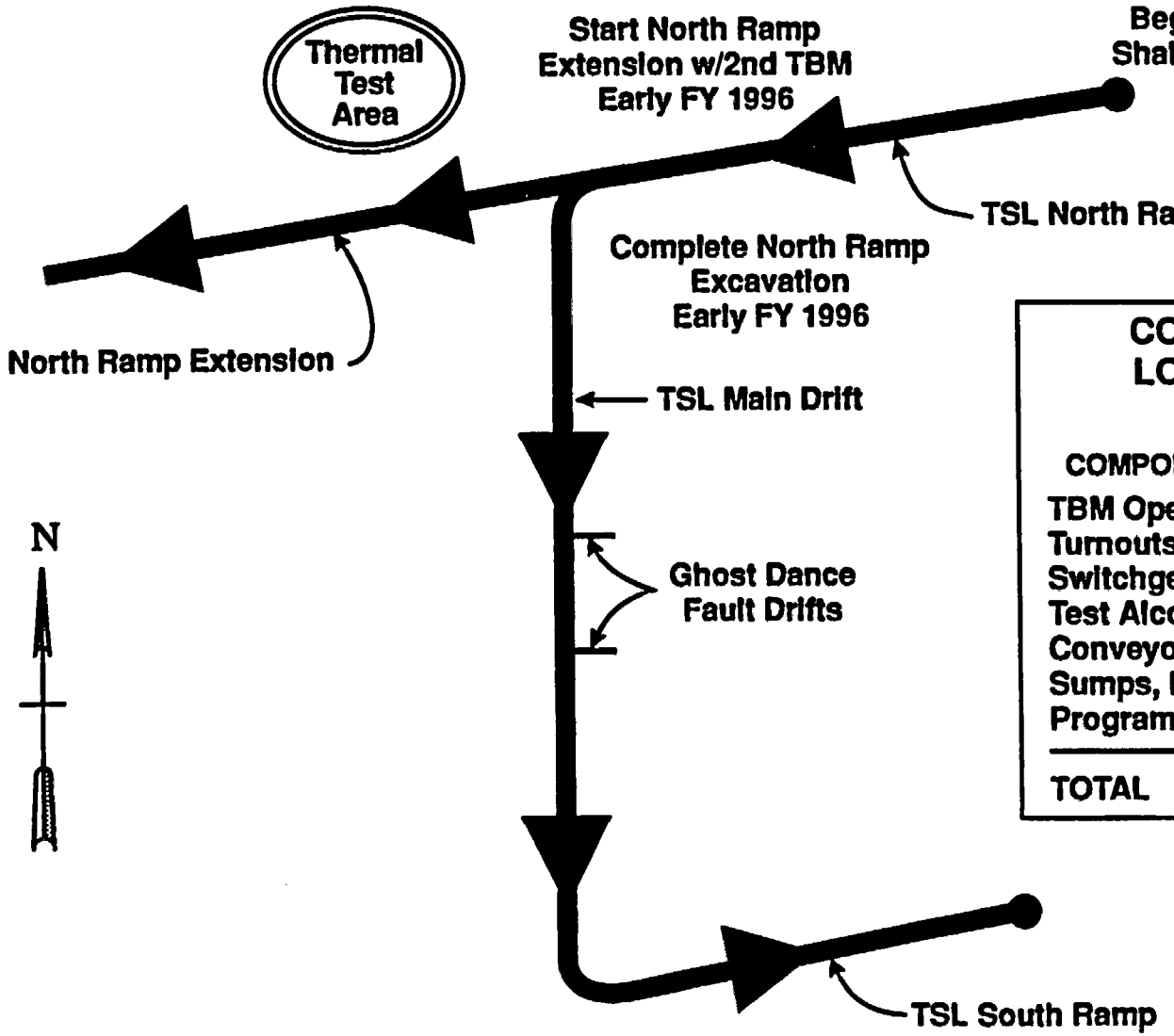
CONSTRUCTION PROGRESS PICTORIALS

Preliminary Draft Information Only

ESFD&CJR22.PM4.126/7-27-94

ESF Strategy within the Proposed Program Approach (PPA) (Scenario A)

Exploratory Studies Facility
Topopah Spring Level



COMPONENTS OF LOOP SCHEDULE

COMPONENT	DURATION (DAYS)
TBM Operation	508
Turnouts (2)	36
Switchgear Niches (14)	140
Test Alcoves (6)	47
Conveyor Install.	26
Sumps, Refuge, etc.	20
Program Delays	85
TOTAL	862

Excavation Sequence

- Complete North Ramp with 7.62 meter TBM (TBM #1) Alcoves 1 (existing), 2, 3, 4 and 5 concurrent with TBM ops.
- Acquire second TBM (lease or buy, new or used) (TBM #2) during FY 95
- Begin excavation of North Ramp Extension (NRE) with TBM #2 early FY1996
- TBM #1 proceeds with TSL Main Drift excavation in parallel with NRE excavation

Excavation Sequence

(CONTINUED)

- When TBM #1 clears Ghost Dance Fault (GDF) Drift locations, excavate GDF drifts (approximately 150-200 meters each)(Alcoves 6 & 7)
- TBM #1 resumes TSL Main Drift and proceeds toward daylight at South Portal
- TBM #2 completes NRE, goes to Calico Hills excavation (if needed)
- Heater Test drifting is done off the north side of the NRE when drift sites are cleared by TBM #2

BACKUP CHARTS

Mechanical Excavation Methods Under Consideration

- Colorado School of Mines (CSM) Alcove Machine
- Boretec CUB
- Robbins Borepak
- Wirth Continuous Mining Machine (CMM)
- TM 60 Roadheader
- USBM Radial Rock Splitter
- Plasma Blaster
- Sunburst System

Calico Hills Access Alternative Study

The CH Access Study would consider:

- **Requirements of a CH Test Program**
- **Ability to fulfill requirements using either access method**
- **Cost of Alternatives**
- **Schedule for execution**

North Ramp Construction Schedule

Schedule Variables Still to be Resolved Include:

- Schedule for acquisition & installation of muck conveyor
- Electrical equipment niches
- TBM advance rate for planning

Evolution of the MGDS Q-List

Thomas C. Geer

July 27, 1994

LV-MD-94-047

Preliminary Draft

B&W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
INTERA Inc.

JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA

Morrison Knudsen Corporation
TRW Environmental Safety Systems Inc.
Winston & Strawn
Woodward-Clyde Federal Services

QA Classification & the Q-List

- Classification applies only to permanent items
- QA classifications consistent with QARD 2.2.3A as per M&O QAP-2-3: QA-1 through QA-7
- M&O recommends changes to the Q-List to DOE
- Q-List currently controlled via AP-6.17Q
- Transitioning to revised approach with acceptance of QAP-2-3

QA Classification

- QAP-2-3 invokes QARD 2.2.3A for permanent items with a "QA function" in the permanent respository

- QA-1: Important to Radiological Safety
- QA-2: Important to Waste Isolation
- QA-3: Important to Radwaste
- QA-4: Important to Fire Protection
- QA-5: Important to Potential Interaction
- QA-6: Important to Physical Protection
- QA-7: Important to Occupational Exposure

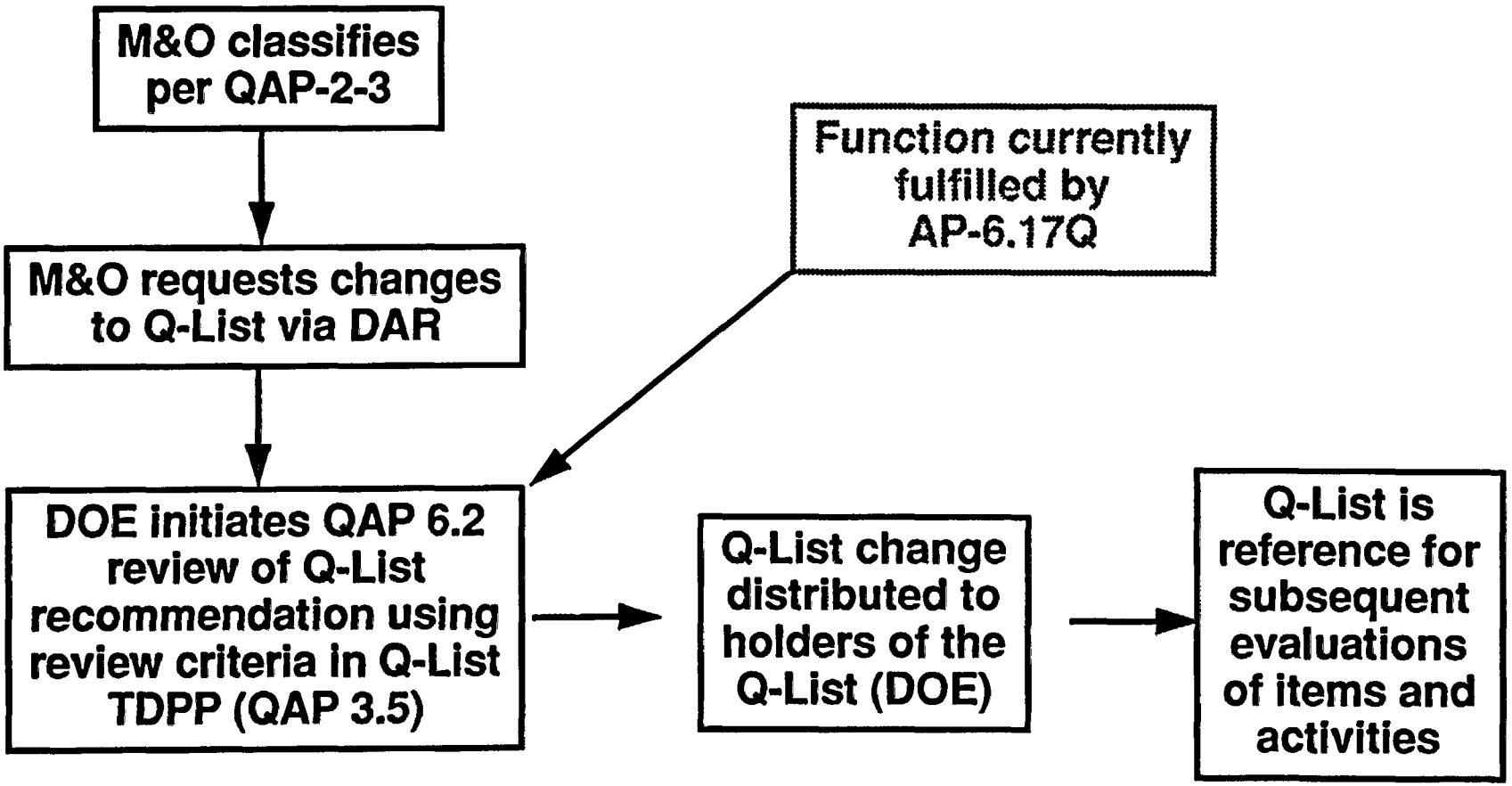
Q-List

- Contains items determined by analysis, consensus, or direct inclusion to be important
- Analyses may supersede or clarify consensus or direct inclusion
- Classification via QAP-2-3 leads to procedural recommendation to change Q-List
- Evaluation of recommendation per AP-6.17Q

Transition to QAP-2-3/Technical Document Preparation Plan

- Acceptance by OCRWM QA of QAP-2-3
- AP-6.17Q does not address all QARD criteria
- Transition will delete AP-6.17Q, recognize QAP-2-3 as procedure for doing permanent item classification
- DOE review will take place via technical review of DIEs in accordance with the Technical Document Preparation Plan (TDPP) for the Q-List
- TDPP will contain review criteria for review of DIE and associated Document Action Request for change to Q-List

Process Flow



AGENDA

U.S. NUCLEAR REGULATORY COMMISSION/U.S. DEPARTMENT OF ENERGY (DOE)

BI-MONTHLY EXPLORATORY STUDIES FACILITY (ESF) MEETING

JULY 27, 1994

ROCKVILLE, MARYLAND

8:30	Opening Remarks	DOE, NRC, State of Nevada (NV), Affect Units of Local Government (LG's)
	Action Item Status	DOE/NRC
8:45	DOE Response to NRC's 3/30/94 Letter on ESF Design and Design Control Process	DOE
9:15	Site Characterization Plan Baseline (SCPB) Relationship to Project Documents	DOE
10:00	BREAK	
10:15	M&O Design Process Improvement Plan Update	DOE
10:30	Definition of DOE Design Phases	DOE
10:45	Evolution of ESF Q-List	DOE
11:30	LUNCH	
1:00	ESF Design and Construction Progress	DOE
1:20	Drilling Program Update	DOE
1:40	Integration of Test Data into ESF Design	DOE
2:00	BREAK	
2:30	NRC Comments	NRC
	Items of Concern to State of Nevada	NV
	Items of Concern to Local Governments	LG's
	Closing Remarks	All
3:00	Adjourn	

Note: TIME WILL BE ALLOTTED FOR DISCUSSION FOLLOWING EACH AGENDA TOPIC.

Definition of

DOE Design Stages

July 27, 1994

T. C. Geer

LV-MD-94-049

Preliminary Draft

B&W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
INTERA Inc.

JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA

Morrison Knudsen Corporation
TRW Environmental Safety Systems Inc.
Winston & Strawn
Woodward-Clyde Federal Services

Presentation Outline

- Purpose
- Background
- MGDS Development Approach
- Summary

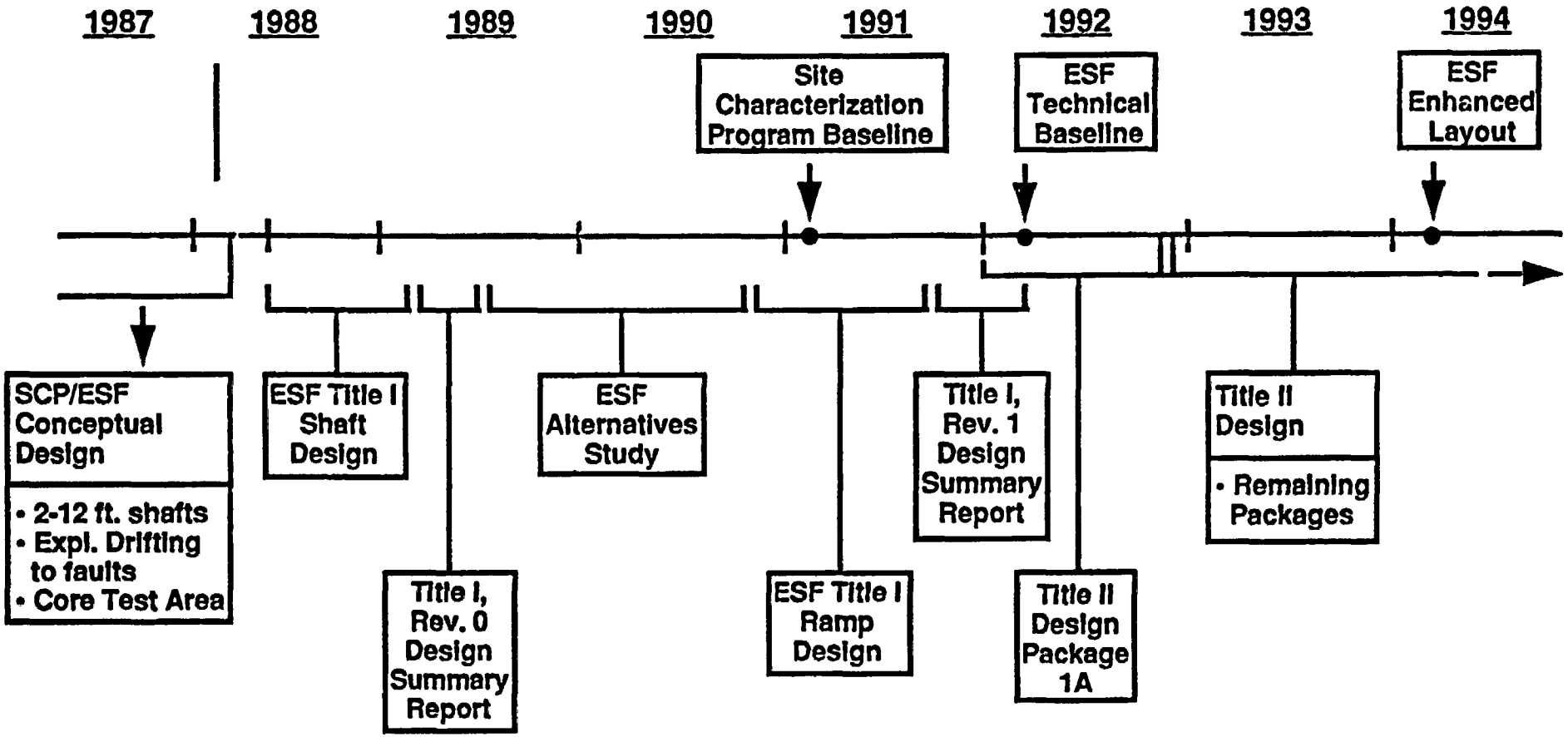
Purpose

- Describe and Define the DOE Design Stages
- Identify the Relationship of these Stages with YMP Design Activities and NRC Milestones

Background

- Many factors influence the progression through the Design Stages
  - Development of designs often requires development of portions of the design earlier than others
  - Design Studies and other factors may cause the design to re-enter a stage which had been completed

ESF Timeline Background



DOE Design Stages

- What is expected of the Conceptual Design
  - it will identify how the top level mission needs can be achieved
  - it will provide a common baseline from which all work will proceed
  - it will provide a record of major design decisions and identify design issues
  - Life Cycle Cost will be developed

DOE Design Stages

- What is expected of the Preliminary Design - Title I
  - Refined, revised technical requirements
  - Preliminary analyses, trade studies, performance predictions, etc.
  - General arrangement drawings
  - Updated Life Cycle Cost estimates

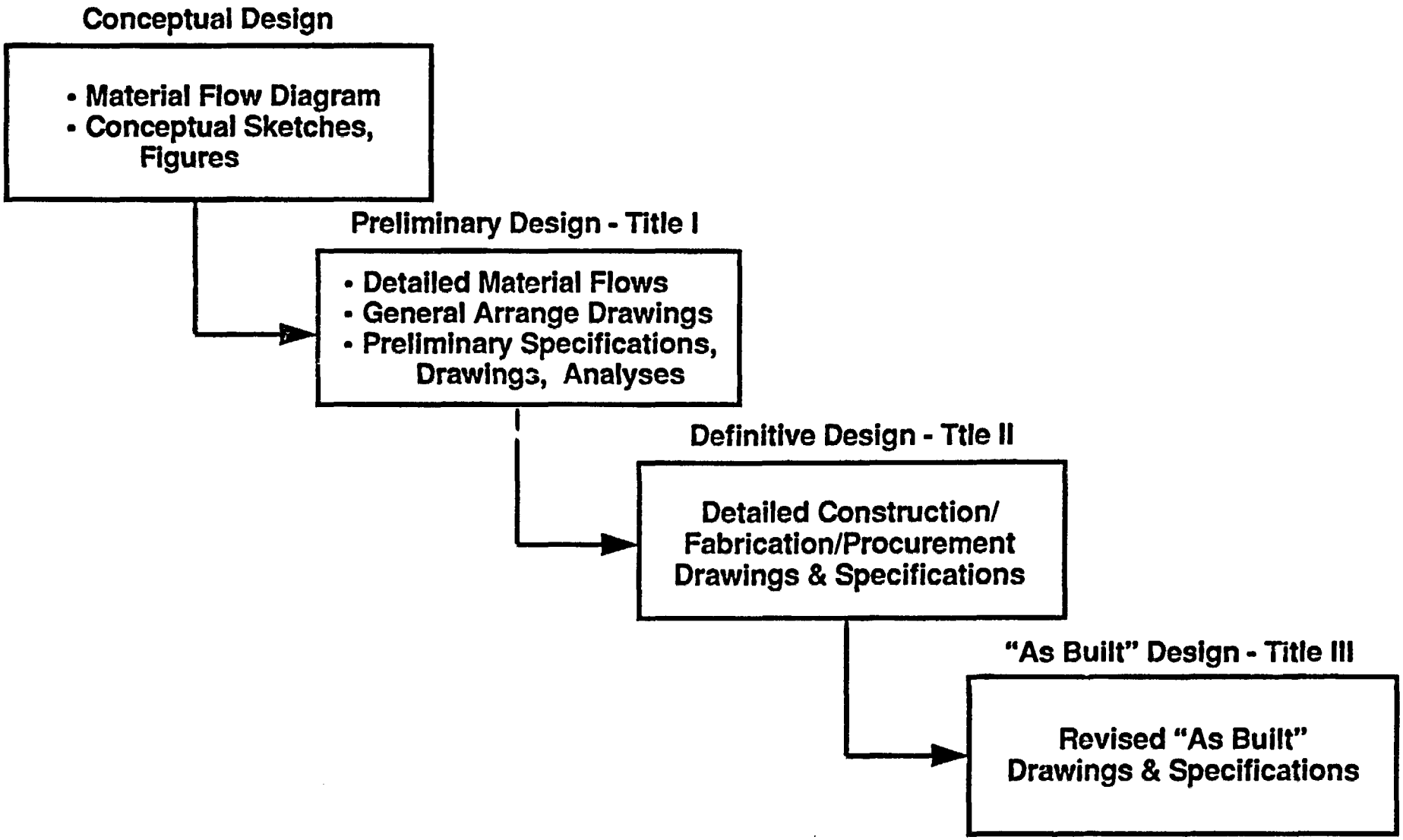
DOE Design Stages

- What is expected of the Definitive Design - Title II
  - Revised design requirements
  - Drawings and specifications in sufficient detail to permit construction, fabrication, assembly, installation and checkout of facilities and equipment
  - Updated Life Cycle Costs estimates

DOE Design Stages

- What is expected of the "As Built" Design - Title III
  - Revised drawings and specifications to reflect the "As Built" configuration of the physical system
  - Drawings and specifications maintained current through the life of the system

DOE Design Stages Flow



MGDS Development Approach

The Mission Plan (DOE/RW-0005) identifies a two-phase, four-stage approach

Phase 1 — Conceptual Design Phase

- Stage 1. Conceptual Design for the SCP
- Stage 2. Advanced Conceptual Design

Phase 2 — Title I and Title II Design

- Stage 3. License-Application Design (LAD) ~~(ACD)~~
- Stage 4. Final Procurement and Construction Design (FP & CD)

Repository/Engineered Barrier Design Stages

Conceptual Design Phase

Stage 1 Conceptual Design for the SCP

- completed and documented in the SCP - CDR (SAND 24-2691)
- basis for the Site Characterization Test Program
- Produced a Total System Life Cycle Cost estimate

Stage 2 Advanced Conceptual Design

- initiated upon completion of Conceptual Design
- will identify design related licensing issues
- will explore design alternatives as required by 10 CFR 60.21
- will consider recommendations from oversight organizations
- will utilize new data from site characterization and laboratory testing
- Firmly fix the design and refine the design criteria
- will update Total System Project baseline cost estimate

Repository/Engineered Barrier Design Stages (Continued)

Title I and Title II Design Phase

Step 3 License Application Design

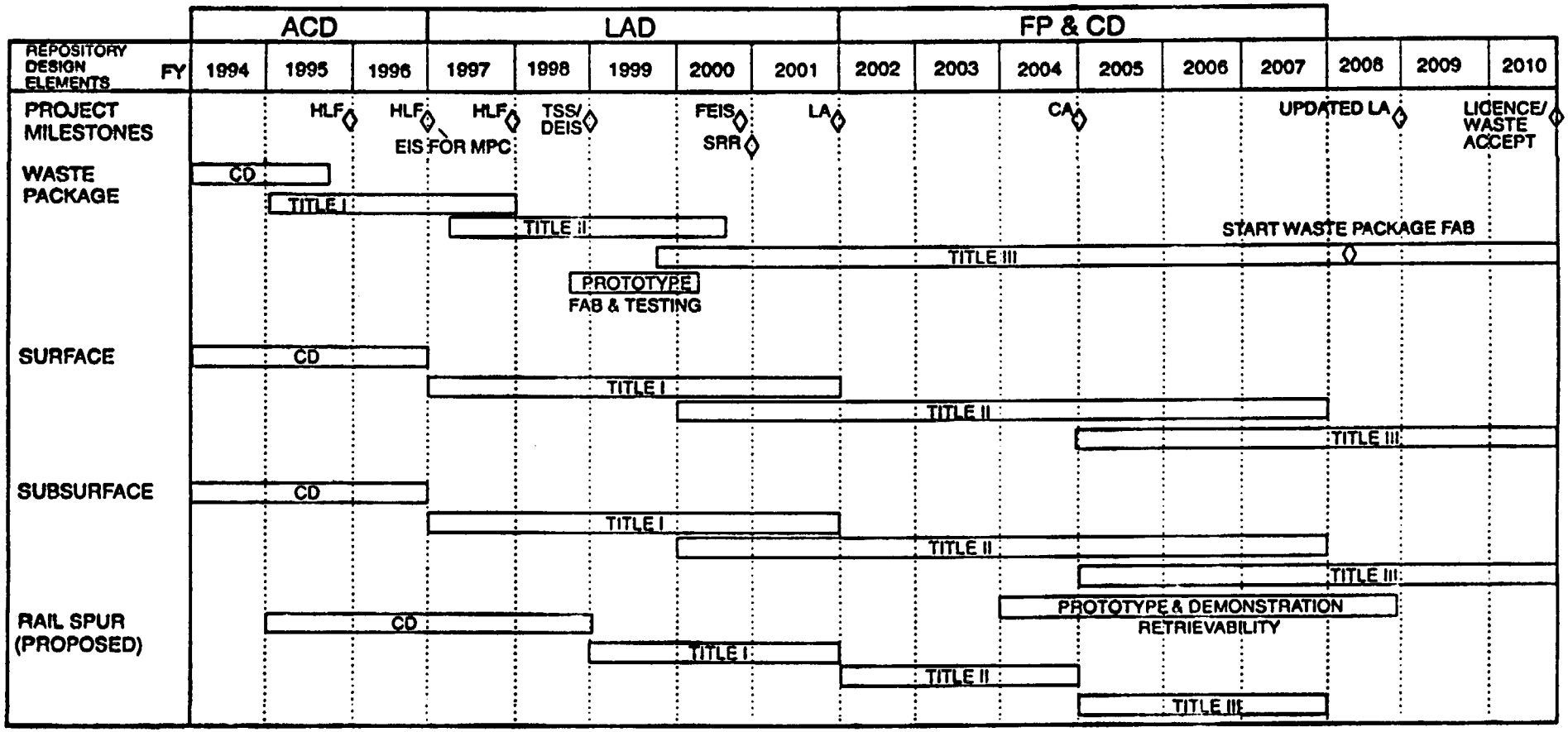
- will commence after completion of relevant ACD portions
- will provide for detailed resolution of design and licensing issues
- will demonstrate compliance with design requirements and performance objectives
- detailed safety and reliability analyses will be conducted and form the basis of the Safety Analysis Report
- will revise the Total System Life Cycle Cost

Repository/Engineered Barrier Design Stages (Continued)

Stage 4 Final Procurement and Construction Design

- will complete the design
- detailed drawings and specifications will be prepared to support procurement, fabrication and construction
- design modifications resulting from NRC interaction on the LAD and SAR will be implemented
- final procurement and construction bid packages will be prepared
- final schedule and cost estimates will be prepared and issued

Design Phases



Summary

- **Provided Answers to:**

1. To NRC request for definition of DOE Design Stages
2. The relationship of YMP design activities to DOE Design Stages and NRC milestones

M&O MGDS Design Control Improvement Plan (DCIP)

Thomas C. Geer

July 27, 1994

LV-MD-94-051

Preliminary Draft

B&W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
INTERA Inc.

JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA

Morrison Knudsen Corporation
TRW Environmental Safety Systems Inc.
Winston & Strawn
Woodward-Clyde Federal Services

M&O MGDS Design Control Improvement Plan (DCIP)

- MGDS DCIP closed out May 20, 1994
- Four Action Items Which Are Ongoing
  - All Series-3 procedures re-written to be more user friendly
  - Implementation and classroom training on all revised Series-3 procedures completed
  - Incorporate relevant RSN BFD sections for Package 1A into M&O BFD; prepare baseline change for combined BFD (FY95)
  - Revise RSN drawings, specifications, calculations for new traceability; adopt fully as M&O products (FY95)

M&O MGDS Design Control Improvement Plan (DCIP)

- Three procedures have not been completed
  - QAP-3-6 "CIs and CI Identifiers"
  - QAP-3-12 "Transmittal of Design Input"
  - QAP-3-13 "Document Identifiers"
- Implementation and classroom training are completed on all procedures that are complete
- The last two items will not be closed out until FY95

M&O Design Control Improvement Program (DCIP)

- **Purpose - Identify improvements to M&O design control process and provide uniform understanding of policy, objectives, responsibilities, procedures and requirements of the process.**
- **Objectives**
  - **Identify issues impeding effectiveness of design activities**
  - **Ensure accurate understanding of M&O design control process**
  - **Ensure effective internal training programs are in place to educate personnel**

M&O Design COntrol Improvement Program (DCIP)

- Revision 0 of the M&O DCIP was issued in March 1994
- Revision 1 is being prepared to provide enhancements and to include appropriate considerations from the recent DOE audit of the M&O QA Program
- Revision 1 is expected to be completed in August 1994

SCPB Relationship to Project Documents

July 27, 1994

Thomas C. Geer

Presentation Outline

- Purpose
- Background
- SCPB Relationship to Project Documentation
- Summary

Purpose

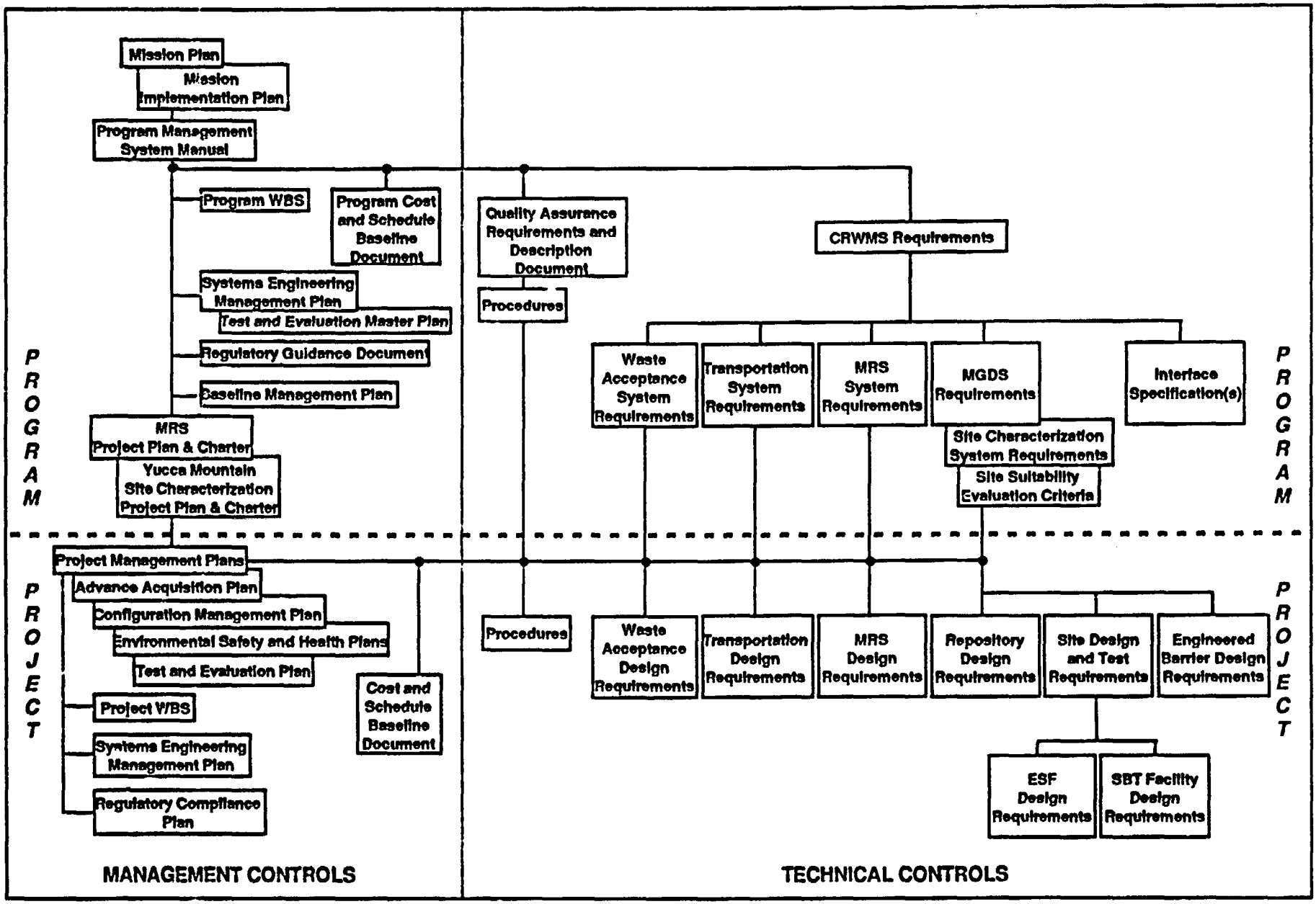
- Describe the relationship of the SCPB to the Yucca Mountain Project Technical Hierarchy Documents and Design Products (Drawings and Specifications)
- Respond to and close Action Item #12 from the prior ESF Technical Exchange

Background

MGDS Governing Documents

- There are three categories of documents that are directly relevant to the MGDS design
  1. Project Plans
  2. Technical Requirements Documents
  3. Architecture Documents
- Top level documents for categories 1 and 2 are pictured in the OCRWM Document Hierarchy

OCRWM DOCUMENT HIERARCHY



Roles of the Documents

Plans

The purpose of the plans is to provide a contract between DOE management and the engineering contractor with respect to "how" the design will be performed

Technical Requirements

The requirements documents establish the design basis for the system to direct the engineer on "what" the system must do

Architecture

The architecture documents capture the physical aspect of what the configuration items (Structures, Systems, and Components (SSCs) "look like"

What Document "Tells" the MGDS Designer What His Design Must Do?

- The YMP DRDs identify the technical performance requirements and regulatory constraints that apply to each MGDS Segment (Repository, Engineered Barrier, ESF, etc.)
- The DRDs includes those 10 CFR 60 requirements that are applicable to the particular MGDS Segment
- The designer translates the requirements into more detailed design criteria from which drawings and specifications can be prepared

SCPB Relationship to Project Documentation

The Current SCPB

- Currently the SCPB contains
  - Site Program Test Objectives
  - Performance Allocation Tables
  - 6 Repository/ESF interface drawings
  - Descriptive text for Surface/Subsurface Testing Program
- The SCPB is being revised (this FY) to
  - correct editorial errors
  - update interface drawings
  - remove performance allocation Tables (will remain CCB controlled) and Test Objectives (currently in the Site Design & Test Requirements document)

SCPB Fy 95 Revision

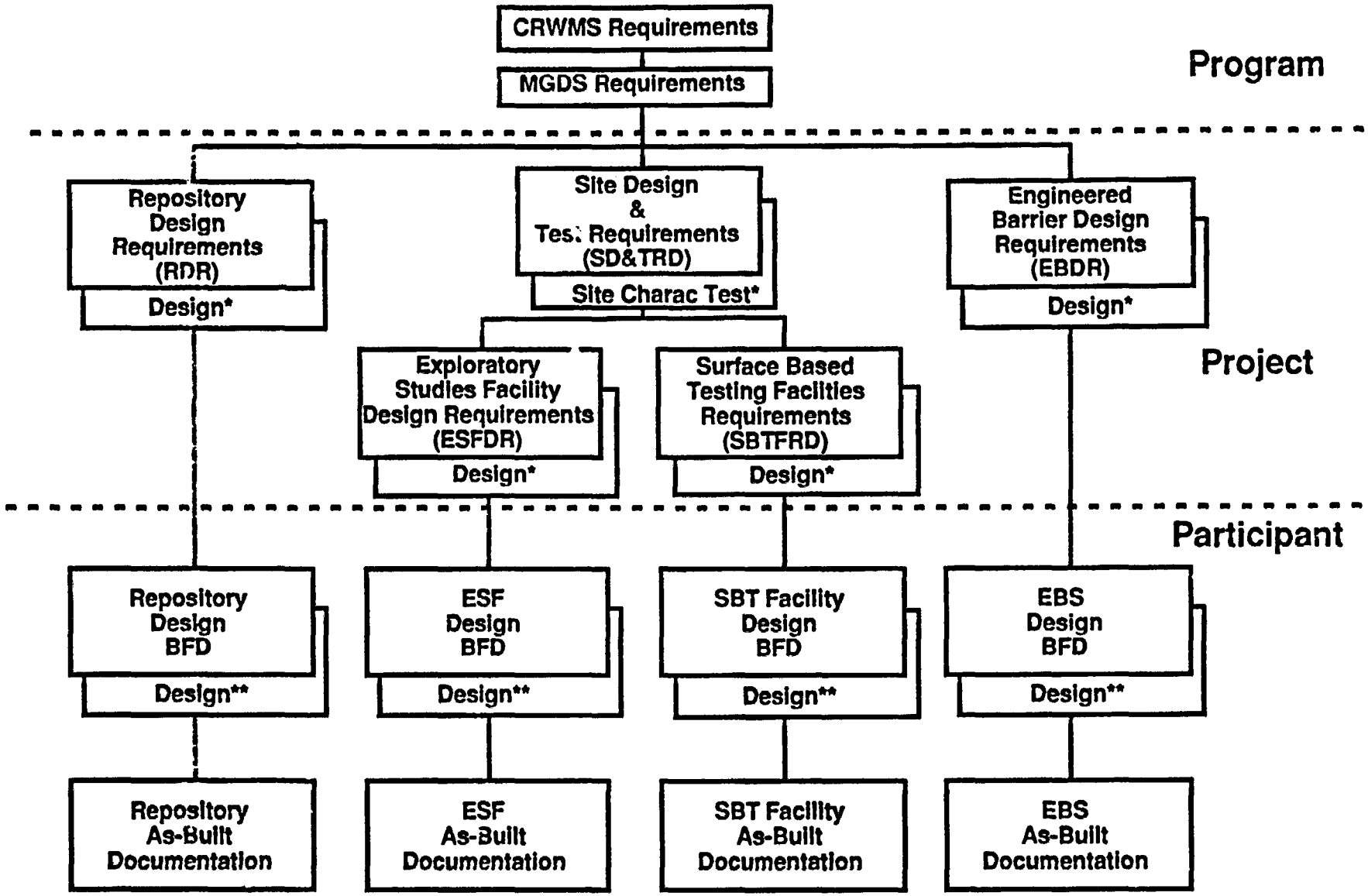
- **SCPB will be reformatted to include**
  - Concept of operations (the Repository/EBS Concept of Operations will evolve to address FCRG Chap 7 requirements)
  - High level facility descriptions (general arrangements, etc.)
  - Overview of Site Characterization Testing
  - Interfaces between Repository/Engineered Barrier System, Exploratory Studies Facility, Surface Based Testing Facilities, & Site Characterization Testing Program
  - Trace to Design Requirements Documents and participant baselines based on Configuration Items

New SCPB Role

- it will no longer be advertised as the location where all changes (changes are reported in Semi Annual Progress Report) to the SCP are captured
- it will be used by YMSCO to describe and control (CCB level II) the ESF, SBTF, Repository and Engineered Barrier System concepts and interfaces
- it will be used to describe how the ESF and SBTF are to be incorporated into the potential GROA
- it will be the source of high level MGDS descriptive information available to oversight organizations (NRC, NWTRB, etc.)
- it will be traceable to the Technical Requirements Hierarchy and the more detailed A&E designs based on Configuration Items

How the SCPB Will Be Used to Control A&E Designs

- The SCPB will identify the general configuration of all MGDS Segments (Repository, ESF, etc.)
- The MGDS designer is required to "fit" his design into the general configuration controlled in the SCPB
- The A&E Design Baselines will capture greater level of detail based on the results of the Title I (Preliminary) design and Title II (Detailed) design



* CAPTURED IN THE SCPB, CCB CONTROLLED IN THE PROJECT BASELINE (PROPOSED)
** CAPTURED IN THE PARTICIPANT CCB CONTROLLED BASELINE (PROPOSED)

Summary

Summary

- Provided Answers to:

1. Relationship of the SCPB to the Project Documents
   - Requirements: RDR, EBDR, SD&TRD, ESFDR, and SBTFRD
   - Architecture: Participant Design (ie. ESF Technical Baseline) drawings and specification
2. Purpose of SCPB document
   - Provide YMSCO control (at an appropriate level of detail) of MGDS Designs and Interfaces
   - Provide YMSCO a communication tool to keep oversight organizations informed of project progress

DOE-NRC TECHNICAL MEETING EXPLORATORY STUDIES FACILITY DESIGN AND CONSTRUCTION UPDATE

- **Opening Remarks**
  - **Welcome**
  - **Agenda for this meeting**
  - **Status of action items from previous meetings**
  - **Response to letter from Mr. Joseph J. Holonich to Mr. D. Shelor dated March 30, 1994**

DOE-NRC TECHNICAL MEETING DRAFT AGENDA
EXPLORATORY STUDIES FACILITY DESIGN AND CONSTRUCTION UPDATE

July 27,1994 Rockville, Maryland

8:30	Opening Remarks Action Item Status	DOE, NRC, State, Counties, Affected Parties
8:45	Response to NRC's 3/30/94 Letter	DOE (Replogle-YMSCO)
9:15	SCPB Relationship to Project Documents (Action Item # 12)	DOE (Geer-M&O)
10:00	BREAK	
10:15	M&O Design Process Improvement Plan Update	DOE (Geer-M&O)
10:30	Definition of DOE Design Phases	DOE (Geer-M&O))
10:45	Evolution of ESF Q-List (Action Item #14)	DOE (Geer-M&O)
11:30	LUNCH	
1:00	ESF Design and Construction Progress	DOE (Replogle-YMSCO)
1:20	Drilling Program Update	DOE (Boyle-YMSCO)
1:40	Integration of Test Data into ESF Design (Action Item #6)	DOE (Pye-M&O)
2:00	BREAK	
2:30	NRC Comments	NRC
	Items of Concern to State of Nevada	NV
	Items of Concern to Local Governments	LG
	Closing Remarks	All
3:00	Adjourn	

Note: TIME WILL BE ALLOTTED FOR DISCUSSION FOLLOWING EACH AGENDA TOPIC.

TOPICS DISCUSSED	DATES DISCUSSED	ACTION ITEMS	STATUS OF ACTION ITEMS
(1) Management of the Project Baseline	10/93, 12/93, 2/94	Yes #(2)	#(2) Open
(2) Scientific Investigation Control Process	10/93, 12/93	No	-----
(3) Design / Construction Process	10/93, 12/93, 2/94, 4/94	No	-----
(4) Design / Control Improvement Plan	10/93, 12/93, 2/94, 4/94	No	-----
(5) ESF Design Strategy	10/93, 12/93	No	-----
(6) Phased Approach to ESF Design and Construction	10/93, 12/93	No	-----
(7) Determination of Importance Evaluations	10/93, 12/93, 4/94	Yes #(3), #(5) & #(14)	#(3) Closed Out #(5) Closed Out #(14) Closed Out
(8) Document Hierarchy	10/93, 12/93, 2/94, 4/94	Yes #(1), #(12) & #(13)	#(1) Closed Out #(12) Closed Out #(13) Closed Out
(9) Proposed ESF Design Changes	10/93, 12/93, 2/94	Yes #(4) & #(9)	#(4) Closed Out #(9) Closed Out
(10) ESF Seismic Design Basis	10/93, 2/94	Yes #(7) & #(8)	#(7) Open #(8) Closed Out
(11) Consideration of Fault Displacement Hazards in Geologic Repository Design	2/94	No	-----
(12) ESF Ventilation Impact on Testing	10/93	No	-----
(13) Fire Suppression	10/93	No	-----

TOPICS DISCUSSED	DATES DISCUSSED	ACTION ITEMS	STATUS OF ACTION ITEMS
(14) Impact of Underground Diesel Emissions in ESF	10/93	No	-----
(15) Roof Bolts & Ground Control Options	10/93	No	-----
(16) Process for DOE Acceptance of ESF	12/93, 4/94	No	-----
(17) Interfaces Between Waste Package, Repository Designs and ESF	10/93	No	-----
(18) Strategy of the Drilling Program	2/94, 4/94	Yes #(6)	#(6) Closed Out
(19) New Topic Request (Test Alcoves)	2/94	Yes #(10)	#(10) Closed Out
(20) New Topic Request (Trade-Off Studies)	2/94	Yes #(11)	#(11) Closed Out
(21) Surface Based / Underground Based Test Interfaces	10/93	No	-----
(22) Tunnelling Past Bow Ridge Fault	4/94	No	-----
(23) Reportable Geologic Conditions	4/94	No	-----

From these topics that have been discussed at the Technical Exchange on October 4-5, 1993 and the ESF Technical Meetings on December 8, 1993,February 3, 1994 and April 19,1994 the following additional information was requested:

(1) It would assist the NRC staff in better understanding the ESF design process if DOE could indicate all DOE and M&O documents (e.g., implementing procedures, instructions, drawings) in a schematic or flowdown chart accompanied by a brief explanation of what each document is intended to accomplish. - 10/4-5/93 (Closed Out - Presentation "ESF Technical Baseline" given by Bob Sandifer at the April 19, 1994 meeting.)

Representatives of NRC, State of Nevada, and Clark and Nye Counties agreed that additional discussion of DOE's document hierarchy for the ESF was needed. The discussion should provide insight into how the different documents in the hierarchy are used and are related to each other. It was also suggested that DOE provide examples by following requirements through the entire design control process to illustrate how a requirement is incorporated into the design and provide an example of a design change and how that change would be dealt with in the design process. - 2/8/93 (Closed Out - Presentation "ESF Technical Baseline" given by Bob Sandifer at the April 19, 1994 meeting.)

(2) The NRC staff noted that the Site Characterization Program Baseline document, that contains the objectives and descriptions of the site characterization program, contains editorial inconsistencies and should be revised. - 12/8/93 (Open - SCPB revision #11 is in progress.)

(3) A copy of the current Q-list was requested by the NRC staff. - 12/8/93 (Closed Out - Letter with enclosures from Mr. Dwight E. Shelor of the DOE to Mr. C. William Reamer of the NRC, dated January 12, 1994)

(4) The State of Nevada representative asked for a future briefing on the decision process for the enhanced design, to include information on the rationale for, and documentation of, design decisions and who was involved in those decisions. - 12/8/93 (Closed Out - Presentation "The Enhanced ESF Layout - Rationale and Process" given by Dan McKenzie at the 2/3/94 meeting.)

(5) The State of Nevada representative requested that explanations of the Determination of Importance Evaluation (DIE) and how DIEs are integrated with the design are needed. - 2/3/94 (Closed Out - Presentation "ESF Technical Baseline" given by Bob Sandifer at the April 19, 1994 meeting.)

(6) The NRC staff agreed with the Nye County representative's comment that there appears to be no formal mechanism for integrating technical data into the design and requested additional discussion on this topic at future meetings. - 2/3/94 **(Closed Out - Presentation "Integration of Test Data into the ESF Design" given by John Pye at the July 27, 1994 meeting.)**

The Nye County representative expressed concerns about the potential impact of striking water at UZ-14 and SD-12 on the ESF design and test interference evaluations. The integration of test data into the ESF design process and test plans should be addressed at a .future ESF meeting. - 4/19/94 **(Closed Out - Presentation "Integration of Test Data into the ESF Design" given by John Pye at the July 27, 1994 meeting.)**

(7) The NRC staff stated that it does not understand the rationale for the seismic design values presented for underground permanent items. DOE agreed to provide a statement of the rationale. - 2/3/94 (Open)

(8) The NRC staff requested a copy of DOE STD 1021-92, "Natural Phenomena Hazards Performance Categorization Criteria for Structures, Systems and Components". - 2/3/94 (Closed Out - Letter with enclosures from Mr. Dwight E. Shelor of the DOE to Mr. Joseph J. Holonich of the NRC, dated May 4, 1994.)

(9) The NRC staff requested a copy of the description and rationale for the enhanced ESF design. - 2/3/94 (Closed Out - Letter with enclosures from Mr. Dwight E. Shelor of the DOE to Mr. Joseph J. Holonich of the NRC, dated May 4, 1994.)

(10) The State of Nevada representative requested that DOE explain how decisions related to test alcove locations and excavation are integrated with technical test requirements. - 2/3/94 (Closed Out - Presentation "ESF Test Alcoves" given by William Boyle at the 4/19/94 meeting.)

(11) The Clark County representative requested that DOE provide some examples of trade-off studies that were conducted. - 2/3/94 (Closed Out - A list of trade-off studies were presented at the April 19, 1994 meeting.)

(12) The NRC staff requested that the graphical presentation of the document hierarchy be simplified and illustrate how the SCPB links with the other documents. - 4/19/94 **(Closed Out - Presentation "SCPB Relationship to Project Documents" given by Tom Geer at the July 27, 1994 meeting.)**

(13) The NRC staff and Nye County representative requested a copy of the "Managed Document List". - 4/19/94 **(Closed Out - Letter with enclosures from Mr. Dwight E. Shelor of the DOE to Mr. Joseph J. Holonich of the NRC, dated June 13, 1994.)**

(14) The NRC staff requested that the process of how items are placed on the Q-list should be addressed at the next meeting. - 4/19/94 **(Closed Out - Presentation "Evolution of ESF Q-List" given by Peter Hastings at the July 29, 1994 meeting.)**

(15) The NRC staff would like to see a "Scenario A timeline" for site suitability and licensing processes. - 4/19/94 (Open)

It is DOE's understanding that the above represents the outstanding items. This does not preclude additional questions if the need arises.

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

NRC Issue

- NRC wishes to continue surveillance of the design process, and if necessary conduct their own audits to verify the effectiveness of corrective actions
  - DOE encourages the NRC to continue surveillance of the design process through the design review process, and the list of scheduled audits and surveillance given to them. Our design is done under a QA program

NRC Issue

- NRC feels there is no formal process in place to integrate SC drilling technical data into the design process
  - Technical data from the drilling program are transmitted to the DOE by interchange meetings, correspondence, reports and the YMSCO Technical Data Mangement System

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 2

- Some examples of how this data was transmitted for the 2C Package are:
  - ESF North Ramp Geology Design Analysis
  - TS North Ramp Stability Analysis
  - TS North Ramp Rock Mass Classification
  - TS North Ramp Ground Scoping
  - North Ramp Layout Calculation
- These Documents were included in the 2C Design Package

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

NRC issue

- DOE should provide a detailed action plan providing for M&O design deficiencies, root cause analysis, and verification of effectiveness of corrective actions to the plan

  - DOE considers this issue closed since they presented the improved design plan. DOE, however, agrees that additional surveillance and verification of the plan's implementation should be an on going issue

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

NRC issue

- Staff requested a formal submittal date of a controlled baseline ESF design integrated with a conceptual GROA design
  - NRC further divided the request into subsections:
    * NRC noted that 2 of the 9 referenced documents cited by DOE "that would provide an understanding of ESF design & integration with GROA conceptual design" had not been transmitted to the NRC. Therefore, "a detailed evaluation could not be performed"
    * How are these Documents integrated?
    * What is the control mechanism in place to assure design documents are integrated with study plans, etc., that discuss plans to gather information needed as input to design
    * How are the ESF construction sequenced and schedules integrated with other schedules for gathering of information needed for ESF design and testing

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

- DOE response

  - At the time of DOE's Nov 18, 1993 response, all documents but 2 have been transmitted. The two documents were subsequently transmitted on Jan 12, 1994, as "Not Readily References".

  - The documents integration will be discussed with the agenda item "SCPB relation to Project Documents"

  - The control process of how design documents are integrated were presented during the December 8, 1993 DOE-NRC meeting

  - SBT data needs are scheduled by the drilling program, once collected a technical data information form is used to transmit this data to the participants

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 6

- NRC issue - No detailed information is provided on how the integration [of ESF/GROA design documents] has been done and cites this example . . . "DOE has indicated in its response that the YM SCPB is a critical document in the identification of interrelationships between the ESF and the potential repository. However, its status can not be determined in the document hierarchy". The NRC also wants to see a clear demonstration of how the SCPB, or its replacement, is integrated with other documents in the OCRWM hierarchy

- DOE response - ESF and repository groups work together to ensure continuity. ESF design is concurrent with repository ACD, the current North Ramp design in Package 2C is consistent with repository ACD

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 7

- **DOE response** (continued)

- When approved changes to ESF and/or repository are promoted by data obtained from site characterization activities, changes are incorporated into the SCPB
  - Example

    A change request has been approved to incorporate the results of "Description and rationale for enhancement to baseline ESF configuration" into the SCPB

  - This document has been transmitted to the NRC
  - The ESF/GROA interface drawings were submitted to the NRC for analysis

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 8

- A presentation to clarify the relation of the SCPB to other program and project documents will follow as an item on the agenda of this meeting

- NRC issue

  A cursory verification was performed and numerous discrepancies were found during a spot check of the SCPB

  - DOE response
    DOE agrees, and has initiated an editorial review of the SCPB to correct inconsistencies

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 9

NRC issue

- DOE provided a Generic Scientific Investigation Control Process (GSICP) package that discussed the change control and QA process for test planning, implementation, and evaluation. NRC feels the "GSICP does not show how the control process ensures that the existing study plans are modified to account for the changes in the ESF configuration and design requirements"
  - DOE response
    At the time the NRC letter was written the NRC had study plan "Excavation investigation" which contained outdated information on ESF configuration and testing
  - The NRC March 30, 1994 letter states DOE "needs to demonstrate by example how the control process has been implemented"

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

DOE response (continued)

- The "excavation investigations" study plan provides a good example on how the control process works (although slowly)
- July 15, 1992 baseline change in ESF configuration
- August 1992, revisions of impacted study plans initiated
- May 5, 1994 updated version transmitted to NRC

From a September 16, 1993, question on the QA procedural system to provide design changes and effects to PIs for SP and data collection evaluation, DOE had stated that QAP 6.2, AP3.3Q and AP3.5Q would be used to integrate the ESF design change & SP revisions

- **NRC also notes that "DOE may need to revise the GSICP to reflect this stated control process".**
  - The third view graph presented during the GSICP presentation showed how the test planning process and the QA procedures govern and control this process

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

This view graph also made it clear that the baseline design requirements feed to study plan preparation and AP6.2Q, 3.3Q and 3.5Q are implemented when a change to the ESF baseline configuration has an impact on the specific study

NRC issue

- **NRC staff questioned how ESF design documents are integrated with study plans and plans for gathering information needed as input to design (performance assessment). NRC staff has also determined that evaluation of this process "can not be performed with the information presented by DOE "and expects that further evaluation will be necessary through audits and design package reviews".**

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 12

- **DOE response**
  - Yucca Mountain Site Characterization Plan (SCP) includes the basis for 22 Studies, outlining 42 associated test activities, which require some level of underground field implementation in the ESF
  - Each requires development, approval, and NRC review of a formal Study Plan
  - Defined objectives are included in the SCPB which provides a controlled, documented basis for all ESF testing activities
  - Each ESF test identified in the SCPB is addressed in the ESFDR Appendix B; providing test descriptions, locations, and high-level functional requirements, performance criteria, and test-related constraints on ESF facility design
  - A formal, procedural process of requesting, developing, transmitting and incorporating detailed supplemental design information and requirements is iteratively implemented between the ESF design organization and the ESF Test Coordination Office (TCO)

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 13

- **DOE response** (CONTINUED)
  - This supplemental design information provides detailed, lower-level testing requirements necessary to ensure the ESF can support all construction-phase and deferred testing activities
  - Each ESF design package is procedurally reviewed for test program compatibility prior to final design package approval and release for construction
  - ESF design process is closely integrated with procedural development of formal test planning packages, job packages, and detailed work plans
  - Test planning utilizes same requirements/constraints basis developed for facility design, and identifies any design or field changes necessary

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 14

- **DOE response** (CONTINUED)
  - All required reviews include criteria to check against pertinent SCP Study Plan(s) for consistency
  - If inconsistencies or newly defined concepts related to the design or implementation of test activities are identified, a formal revision of the Study Plan is initiated
  - Required study plan revisions must be complete prior to initiation of field activities
  - All ESF-related Study Plans and other revisions are reviewed by the TCO for design and test planning consistency
  - This carefully integrated and controlled process ensures that the SCP program of underground testing is fully and efficiently fielded in a manner consistent with NRC-reviewed Study Plans

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 15

- NRC issue

  NRC concern relates to integration of long range ESF construction sequences and schedules with other schedules of ESF gathering of information needed for ESF design and testing

  - DOE response
    This issue should be discussed at bimonthly DOE-NRC meetings and since this issue is closely tied to funding, long range plans would not provide NRC useful information

- NRC issue
  NRC feels that DOE did not directly answer how the integration process works and will continue to observe the integration of testing and ESF construction schedules

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 16

DOE response

- The ESF must interface with several different program areas. They include:
  - Repository design program
  - ESF testing program
  - Surface based testing program
  - Environmental program
- Repository design - 10CFR 60.15 requires design and construction of the ESF to be closely linked to GROA planning activities in order to limit adverse effects of the ESF on the ability of the site to isolate waste
- Title II design of the ESF and ACD of the GROA are scheduled to proceed concurrently
- The two design teams interact on a daily basis

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 17

- Official interaction occurs during design reviews and technical reports
- Members of both teams serve as reviewers of products developed by either of these teams

- **ESF testing program**
  - Communication between the testing program and the ESF occur on a daily basis
  - LANL serves as the test coordinator and provides linkage between ESF and PI's (USGS, SNL, LLNL, and LANL) who have responsibility for various ESF test programs
  - The process by which information flows from PI's to ESF, or from ESF to PI is as follows:

    1) ESFDR Appendix B for test community requirements
    2) TCO in design reviews of ESF
    3) Detailed "specs" for test planning & Job Package
    4) Integrated Schedule

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

In addition day to day coordination occurs by:

* Meeting held between the TCO and ESF
* TCO then interacts with PI's or ESF and acquires needed information
* Project letters document the actions and results under the appropriate TPO signature to close out the interactions between participants
* This letter also serves as a record of the events for the project

- Surface based testing (SBT) program

  - The SBT program is a significant source of design input data for ESF and GROA design efforts, frequent interaction is required to request and transmit information
  - Certain aspects of the SBT are closely linked to the ESF and GROA. They are:

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 19

* Deep drilling programs
* The unsaturated zone (UZ) program
* Systematic drilling (SD) program
* North/south ramp geology (NRG-SRG) soils and rock properties programs
* Data from certain trenching activities

- Design Organizations present their needs to the SBT group in letter form under authority of TPO signature
- Work conducted under Study Plan, Test Planning Package, and Job Packages
- Response to needs and data requested are transmitted to the requester in letter form under the signature of the appropriate TPO
- These letters form a project record of the action and information that has been exchanged

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 20

- SBT and ESF schedules are linked in areas of mutual interest including design data acquisition and pneumatic pathways program

- **Environmental program**

  - "Scheduled "land access and environmental compliance" application" are made to the environmental group via project procedure YAP-30.2
  - The application contains information such as location, size, nature of planned disturbance and schedule for construction
  - Pre-activity surveys are scheduled and conducted which include:
    * RAD survey
    * Cultural resources survey
    * Biological survey for endangered species (plants and animal)

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 21

- If a finding is made ESF group is informed and facilities are rerouted or replanned

- NRC issue 4

  - DOE response
    No issues were identified which require response

- NRC issue 5

NRC staff expressed concern with the process used to resolve NRC staff concerns identified during QA audits and surveillances in addition to design reviews. DOE's November 18, 1993 response was satisfactory with the NRC staff

- DOE response
  As observers the NRC staff is invited to comment on all packages and discuss these comments and potential resolutions throughout the design meeting

Response To Letter From B.J. Youngblood To D. Shelor Dated March 30, 1994

Page 22

- DOE makes a conscientious effort to respond to all observer comments

- Beginning with design Package 2C DOE/YMSCO will meet with NRC on site representatives for discussion of responses to NRC comments and will transmit these comment response packages to the NRC staff requesting NRC acknowledgments and evaluation of responses for feedback

- DOE responses for design package 2B were informally transmitted to NRC site rep on March 29, 1994; however the NRC has not acknowledged receipt of these responses to provide feedback to DOE

Civilian Radioactive Waste Management System

Management & Operating Contractor

TRW Environmental Safety Systems Inc.

DOE/NRC Technical Meeting On The Exploratory Studies Facility

July 27, 1994

INTEGRATION OF TEST DATA INTO ESF DESIGN

John H. Pye
July 27, 1994

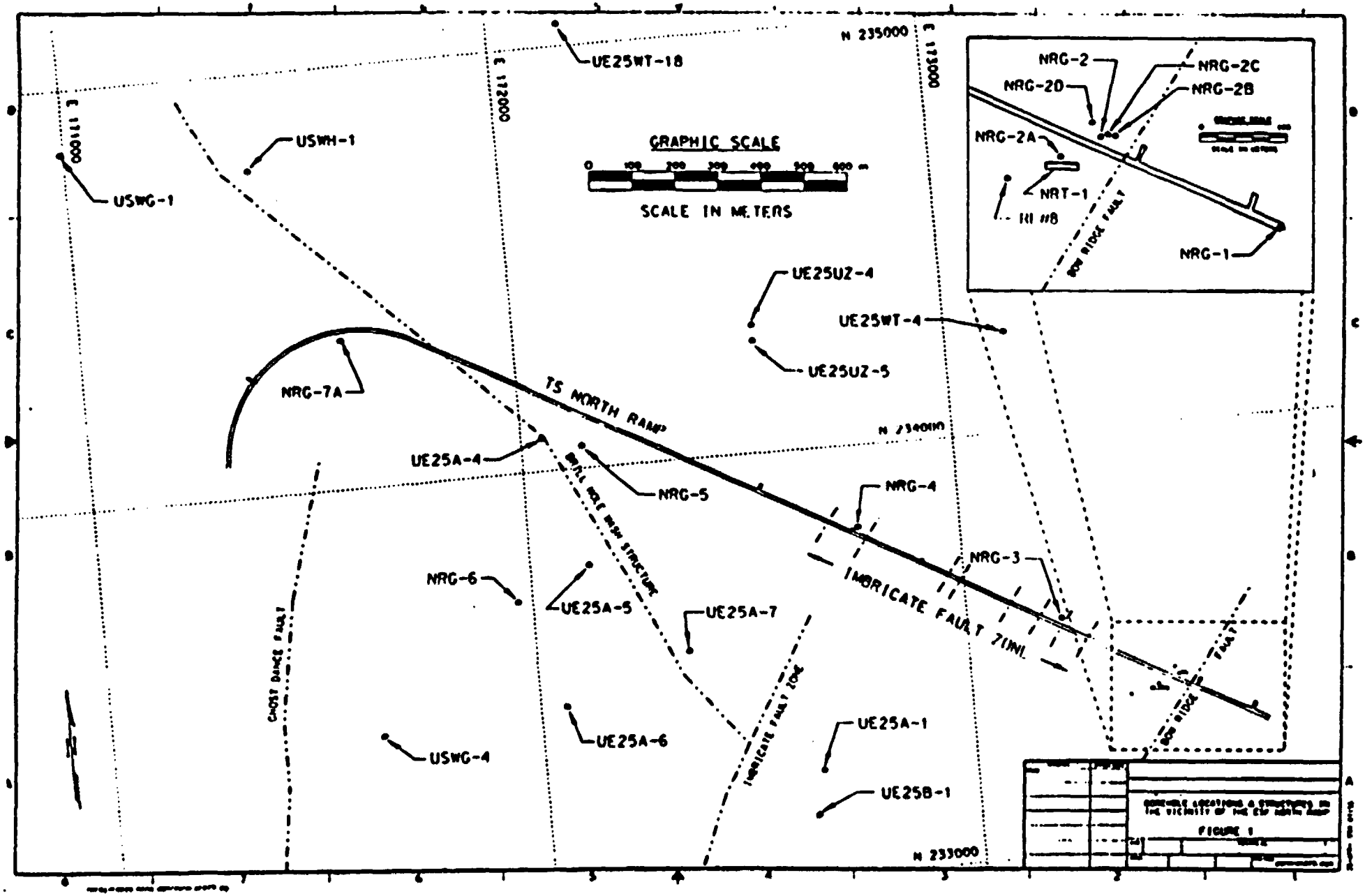
B&W Fuel Company
Duke Engineering & Services, Inc.
Fluor Daniel, Inc.
INTERA Inc.

JK Research Associates, Inc.
E. R. Johnson Associates, Inc.
Logicon RDA

Morrison Knudsen Corporation
TRW Environmental Safety Systems Inc.
Winston & Strawn
Woodward-Clyde Federal Services

DOE/NRC Technical Meeting On The Exploratory Studies Facility Integration Of Test Data Into ESF Design

- Site Data Used in the Following Design & Geotechnical Areas:
  - Geological Models
  - Empirical Estimates Rock Mass Properties
  - Laboratory Testing of Core Specimens
  - Empirical Design Methods
  - Modeling & Analysis


N 235000
E 113000
E 112000
E 111000
UE25WT-18
USWH-1
USWG-1
GRAPHIC SCALE
SCALE IN METERS
NRG-2
NRG-2C
NRG-2D
NRG-2B
NRG-2A
NRT-1
NRG-1
UE25UZ-4
UE25WT-4
UE25UZ-5
NRG-7A
TS NORTH RAMP
N 234000
UE25A-4
NRG-5
NRG-4
NRG-3
IMBRICATE FAULT ZONE
NRG-6
UE25A-5
UE25A-7
GHOST DANCE FAULT
UE25A-6
USWG-4
UE25A-1
UE25B-1
N 233000
FIGURE 1

DOE/NRC Technical Meeting On The Exploratory Studies Facility Integration Of Test Data Into ESF Design

- **Geological Modeling (LYNX System)**
  - **Volume Model of ESF Site & ESF Tunnel Alignments**
  - **Produce Profiles & Sections of Site Geology ESF Tunnels**
  - **Display Lithostratigraphic or Thermo-Mechanical Units**

DOE/NRC Technical Meeting On The Exploratory Studies Facility Integration Of Test Data Into ESF Design

- **Geological Modeling (LYNX System) (continued)**

  Used to Determine Line & Grade of North Ramp

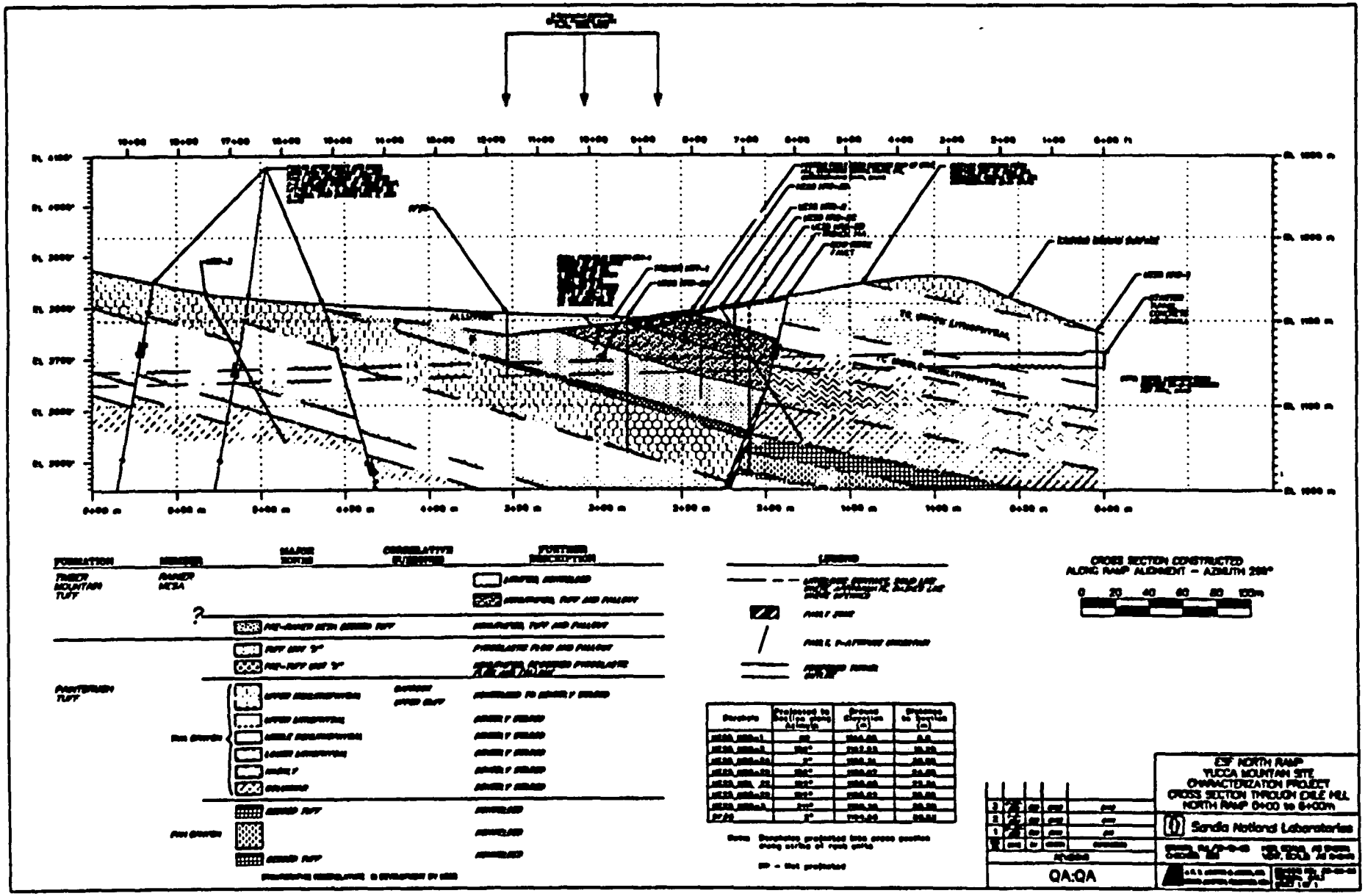
  Used to Locate Test Alcoves

  Define Physical Extent of the Thermo-Mechanical Units on TS North Ramp Alignment

DOE/NRC Technical Meeting On The Exploratory Studies Facility Integration Of Test Data Into ESF Design

- **Geological Modeling (LYNX System) (continued)**
  - **Engineering Data**
    - » **3D Coordinate System**
    - » **Database - Geotechnical**
    - » **Geostatistical Information**

Used to Develop 10 Key Cross-Sections



CROSS SECTION CONSTRUCTED
ALONG RAMP ALIGNMENT – AZIMUTH 298°

0 20 40 60 80 100m

ESF NORTH RAMP
YUCCA MOUNTAIN SITE
CHARACTERIZATION PROJECT
CROSS SECTION THROUGH DRILL HOLE
NORTH RAMP 0+00 to 6+00m

Sandia National Laboratories

QA:QA

ESF NORTH RAMP CROSS SECTION

LYNX THERMAL/MECHANICAL MODEL (G.N1, M.N1)
ENHANCED ROCK QUALITY DESIGNATION (Erqd) - 1mm = 10%

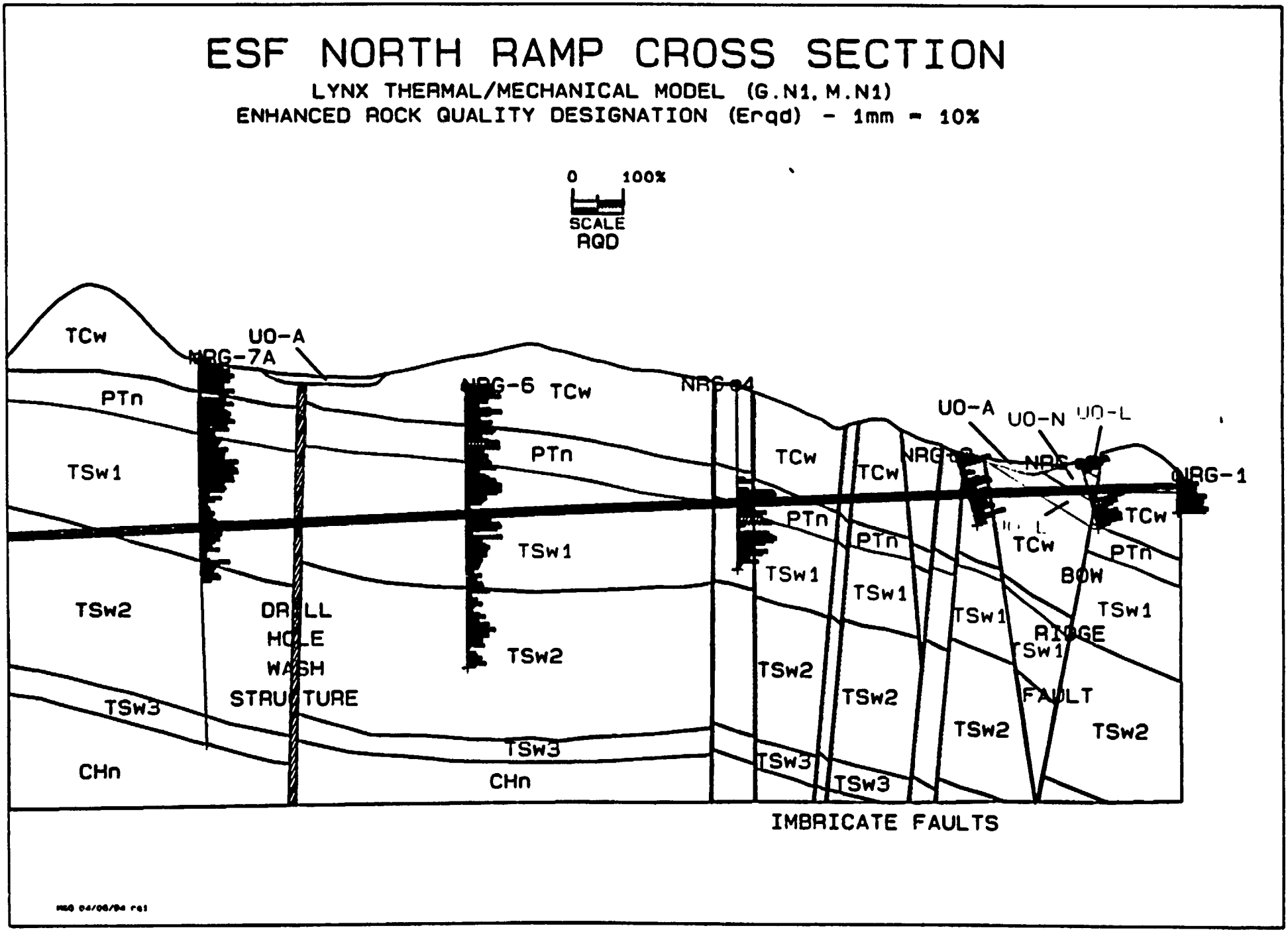


Table 2. Detailed Distances and Volumes for Thermal/Mechanical Units Encountered Along the ESF North Ramp Tunnel

FAULT BLOCK**	THERMAL/MECHANICAL UNIT OR STRUCTURE	START STA. (m)	CALC. TUNNEL DIST. (m)	ESTIMATED VOLUME (m^3)
A	TCw	0+60	136.58	6,228.5
	Bow Ridge Fault			
B	UO-N (nonlithified)	1+97	52.99	2,416.5
	UO-L (lithified)	2+50	91.94	4,193.0
	TCw	3+42	107.88	4,919.5
	Imbricate fault			
C	TCw	4+49	67.36	3,072.0
	Imbricate fault			
D	TCw	5+17	56.80	2,590.5
	Imbricate fault			
E	TCw	5+74	71.87	3,277.5
	Imbricate fault			
F	TCw	6+45	130.55	5,953.5
	Imbricate fault			
G	TCw	7+76	30.29	1,381.5
	Imbricate fault			
H	TCw	8+06	75.88	3,460.5
	PTn	8+82	128.84	5,875.5
	Imbricate fault			
I	PTn	10+11	47.02	2,144.5
	TSw1	10+58	47.78	2,179.0
	Imbricate fault			
J	PTn	*11+06	0.00	3.0
	TSw1	11+06	996.11	45,426.5
	Drill Hole Wash Structure			
K	TSw1	21+02	465.57	21,231.5
	TSw2	25+67	229.81	10,480.0
	End of North Ramp Design Pkg 2C	28+00.182	62.83	
			TOTAL VOLUME (m^3)	124,833.0

Notes: * At station 11+06 m, unit PTN occurs only in the crown of the excavation.
** Fault blocks are identified in Figure 4.

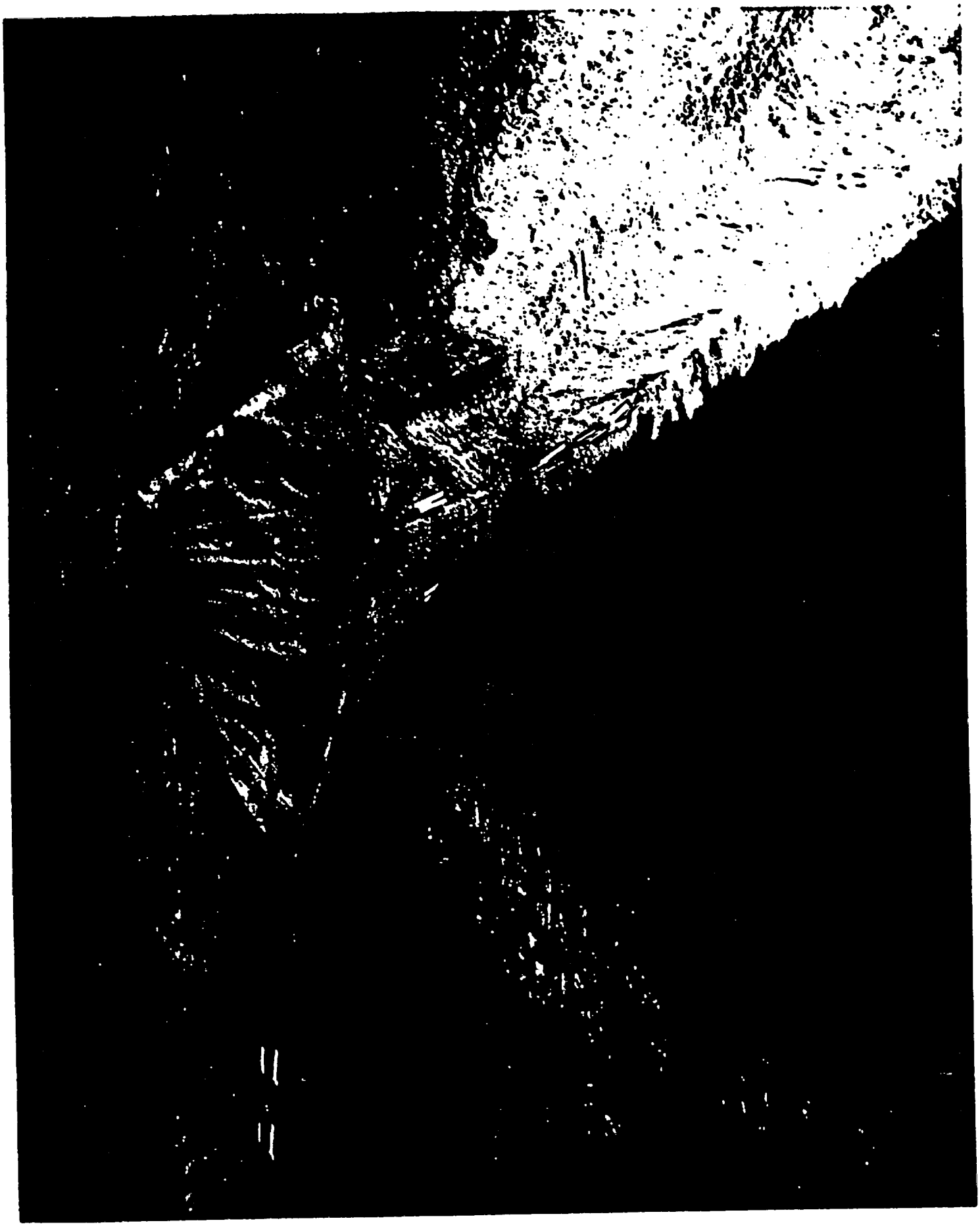
TABLE 1

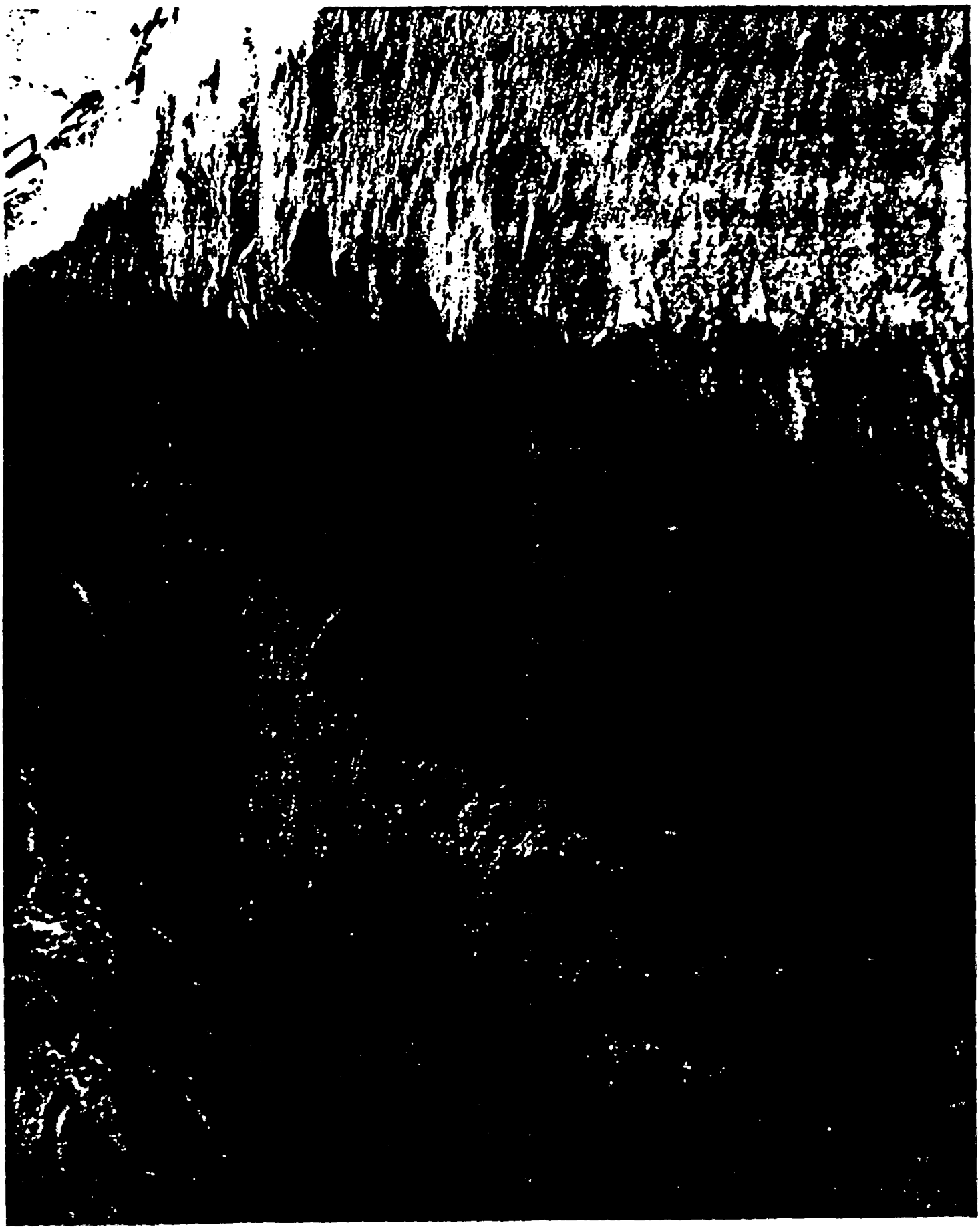
Rock and Joint Properties Used in TS North Ramp Stability Analysis

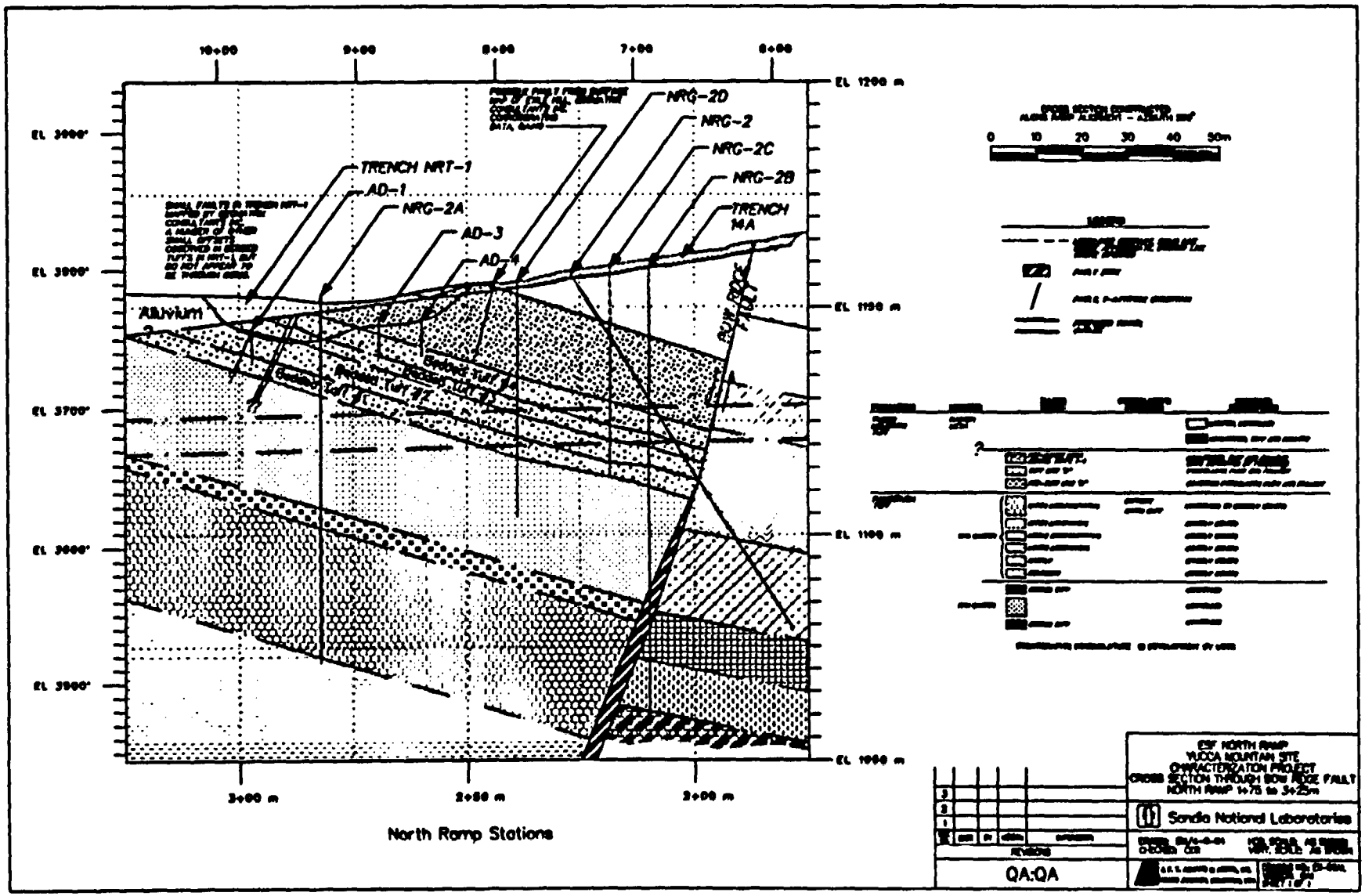
PROPERTY	TCw	PTn	TSw1	TSw2
Uniaxial Compressive Strength	122.63 MPa	7.79 MPa	58.79 MPa	161.50 MPa
Tensile Strength	10.39 MPa	1.27 MPa	6.21 MPa	10.15 MPa
Poisson's Ratio	0.21	0.21	0.24	0.20
Modulus of Elasticity	28.40 GPa	3.2 GPa	22.27 GPa	30.01 GPa
Density	2115 Kg/m^3	1268 Kg/m^3	2207 Kg/m^3	2257 Kg/m^3
Intact Rock Cohesion	1.7 MPa	0.4 MPa	1.3 MPa	2.1 MPa
Intact Rock Angle of Internal Friction	54°	17°	44°	49°
Joint Cohesion *	7.3 MPa	2.4 MPa	1.3 MPa	7.3 MPa
Joint Angle of Friction *	46°	36°	36°	46°
Joint Tensile Strength **	3.65 MPa	1.2 MPa	0.65 MPa	3.65 MPa

* The joint properties are from Table D-7, Reference 8.10.
** One half of joint cohesion is used for joint tensile strength in the analysis.

PRELIMINARY DEPENDENCIONAL DRAFT MATERIAL






10+00
9+00
8+00
7+00
6+00
EL 1200 m
EL 3900'
EL 3800'
EL 3700'
EL 3600'
EL 3500'
EL 1150 m
EL 1100 m
EL 1050 m
TRENCH NRT-1
AD-1
NRG-2A
AD-3
AD-4
NRG-2D
NRG-2
NRG-2C
NRG-2B
TRENCH MA
Alluvium
Bullfrog Tuff
Prow Pass Tuff
Tram Tuff
Bow Ridge Fault
3+00 m
2+50 m
2+00 m
North Ramp Stations
0
10
20
30
40
50m
ESF NORTH RAMP
YUCCA MOUNTAIN SITE
CHARACTERIZATION PROJECT
CROSS SECTION THROUGH BOW RIDGE FAULT
NORTH RAMP 1+75 to 3+25m
Sandia National Laboratories
QA:QA

DOE/NRC Technical Meeting On The Exploratory Studies Facility Integration Of Test Data Into ESF Design

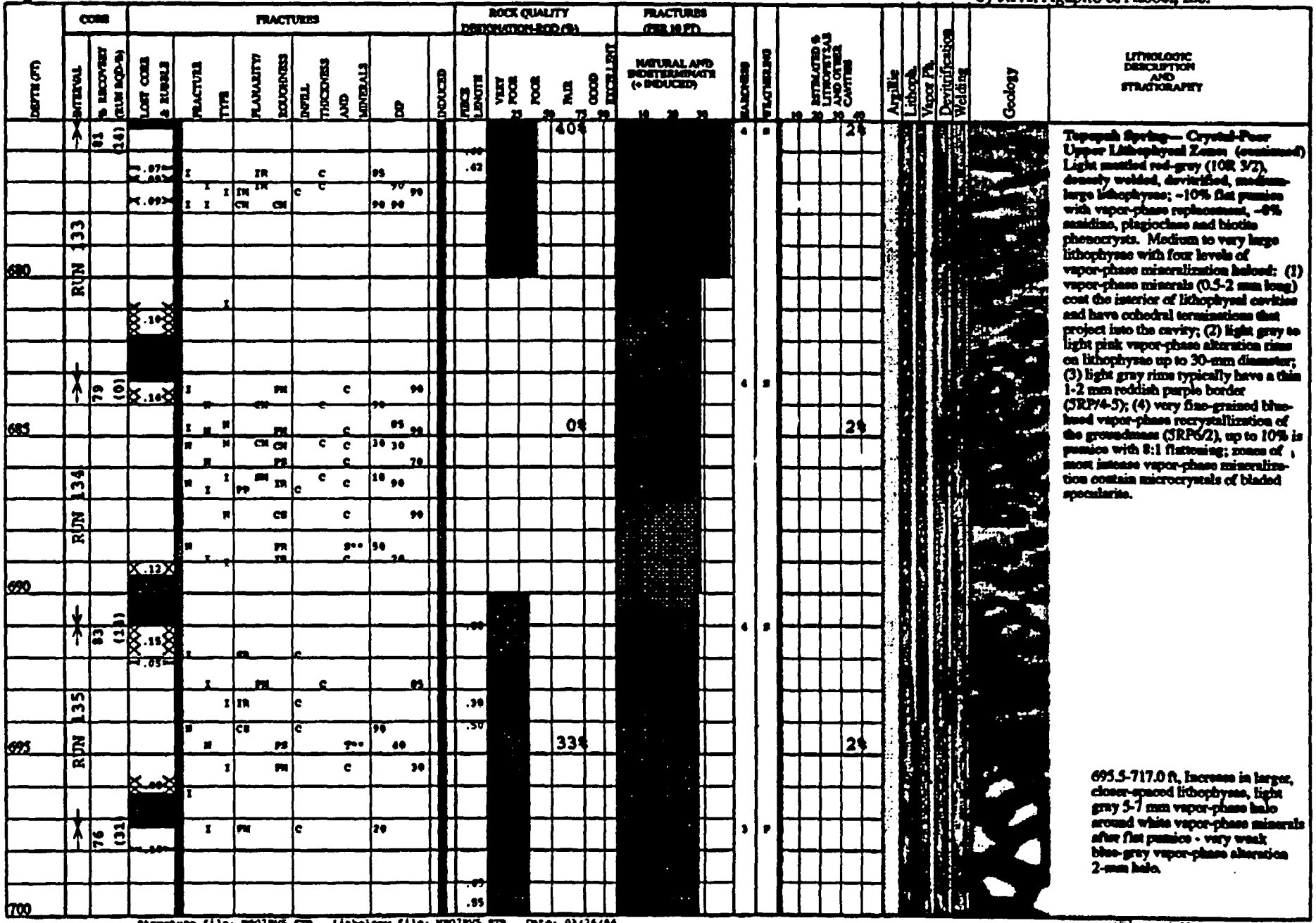
- **Empirical Design Methods**
  - **Rock Mass Quality "Q" (NGI)**
  - **Rock Mass Rating (RMR)**

  Used to Determine Range of Anticipated Tunneling Conditions

  - **Rock Support Recommendations**
  - **Develop Site Specific Ground Support Categories**

GEOLOGY AND ROCK STRUCTURE LOG

Sandia National Laboratories
by J.F.T. Agapito & Assoc., Inc.



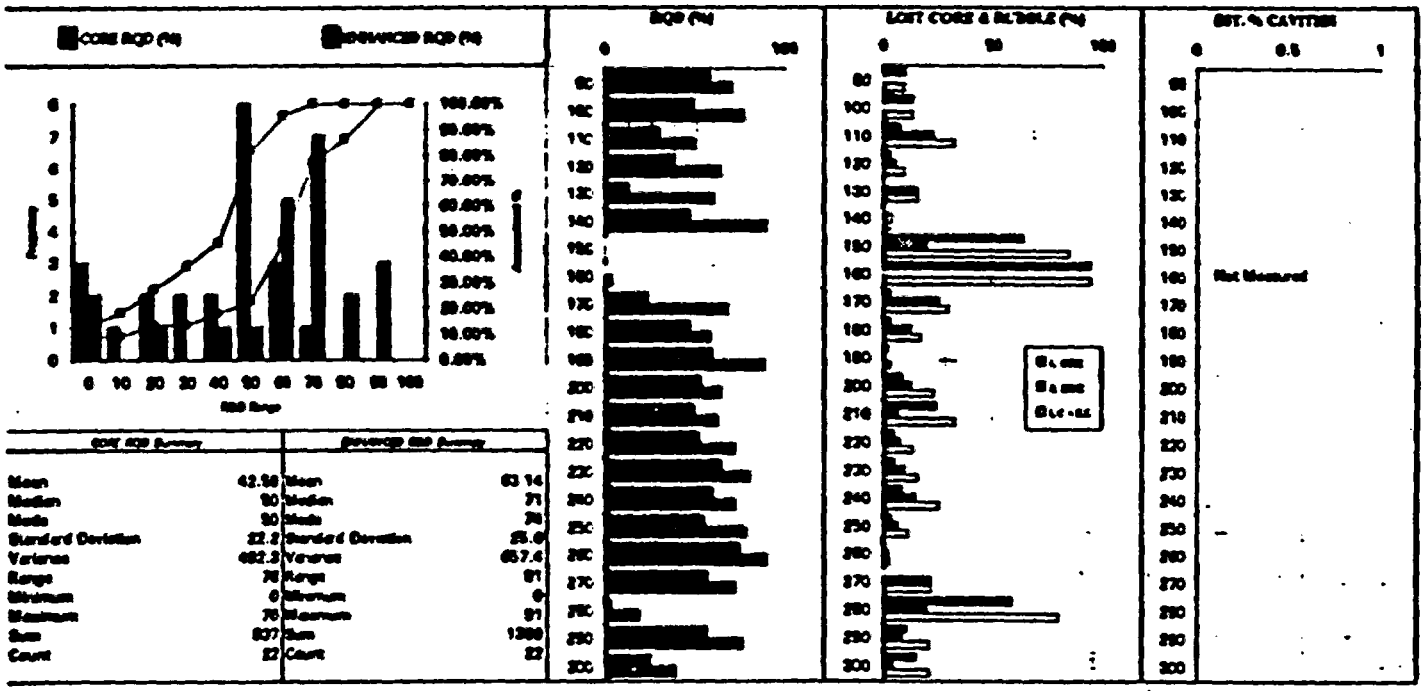
Structure file: NRG7RV5.STR Lithology file: NRG7RV5.STR Date: 03/26/96

WFlog v 4.52

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
Core Hole Structural Data Summary
Hole USW NRG-7/7A
Interval—80-300 ft, PTn Unit

BASE OF 10-FT INTERVAL	STRATIGRAPHY ZONE	THERMO-MECHANICAL UNIT	CORE RQD* %	ENHANCED RQD** %	ESTIMATED % CAVITIES	LOST CORE (ft)	BUBBLE ZONE (ft)	WELDING (5 in 10-ft interval)*** F	S	M	L	D	BOCKBURN (5 in 10-ft interval)*** 1	2	3	4	5	6	7	8	9
90	T.C. Bed Nonwelded	PTn	90	72	0	1.1				1.0	4 2 1	4 0						1.0	4.0	4.0		
100	T.C. Bed Nonwelded	PTn	80	80	0	1.5					10								8.0	4.0		
110	Bedded	PTn	80	94	0	0.0	2.6				9								1.0	3.1		
120	Y.M. Ash Flow	PTn	80	88	0	0.4	0.7				7.5								7.5			
130	Y.M. Ash Flow	PTn	94	88	0	0.0	1.7				9								9.0			
140	Y.M. Ash Flow	PTn	40	88	0	0.0	0.5		0.2	0.8									10.0			
150	Y.M. Ash Flow	PTn	0	0	0	0.4	2.1		10.0									4.8	5.2			
160	Y.M. Ash Flow	PTn	0	0	100	0.3			4.8									0.2	4.8			
170	Bedded	PTn	80	80	0	0.4	2.0		9.1										9.1			
180	P.C. Ash Flow	PTn	60	80	0	0.6	1.4		5.0										5.0			
190	P.C. Ash Flow	PTn	60	80	0	0.3	0.1		10.0										10.0			
200	P.C. Ash Flow	PTn	80	80	0	1.0	1.4		10.0										9.1	0.9		
210	P.C. Ash Flow	PTn	80	80	0	2.5	0.8		4.8										4.7	0.2		
220	P.C. Ash Flow	PTn	80	74	0	0.8	0.9		10.0										10.0			
230	P.C. Ash Flow	PTn	80	80	0	0.8	1.1		10.0									4.2	5.7			
240	P.C. Ash Flow	PTn	80	80	0	1.0	1.0		5.9									0.8	5.1			
250	P.C. Ash Flow	PTn	80	80	0	0.5	0.8		7.2	1.8									0.1			
260	P.C. Ash Flow	PTn	80	80	0	0.1	0.3		8.8	1.2									1.0	8.0		
270	T.S. U. Nonwelded	PTn	80	80	0	0.8	2.2		1.0			8.0								1.0	9.0	
280	T.S. U. Nonwelded	PTn	4	80	0	5.0	2.1					8.0									9.0	
290	T.S. U. Nonwelded	PTn	80	80	0	1.2	1.0		4.8	5.2									4.8	5.2		
300	T.S. U. Nonwelded	PTn	80	80	0	1.0	0.8	4.2	1.8					4.2					1.8			

* CORE RQD Determined from piece lengths formed by all types of fractures (C, I, II and VI).
** ENHANCED RQD Determined by filtering the effects of fractures identified as earlier induced (Type C) from the piece lengths.
*** Footage in interval may not equal 10 ft because of lost core, rubble, or omission during logging.



Figure(2) Example of Rock Structure Summary Log

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
Estimated Rock Mass Quality Indices Based on Core Log Data
Hole USW NRG-7/7A
Interval—PTn Unit, 80-300 ft

END DEPTH	STRATI-GRAPHY ZONE	THERMO-MECHANICAL UNIT	Q CLASSIFICATION SYSTEM Barton et al. (1974)										Q-CORE VALUES
			RQD** (%)	Jn*	Jr	Ja	Jw	SRF*	Q*	Jn-Core	SRF-Core	Q-Core	0.10 1.00 10.00 100.00
80	T.C. Basal Nonwelded	PTn	59	6.00	1.87	1.87	1.00	1.00	11.80	6.60	1.00	9.08	
100	T.C. Basal Nonwelded	PTn	80	6.00	4.00	1.00	1.00	1.00	25.00	6.60	1.00	30.77	
110	Bedded	PTn	31	6.00	3.00	1.00	1.00	1.00	18.60	6.60	1.00	14.31	
120	Y.M. Ash-flow	PTn	39	6.00	2.00	1.00	1.00	1.00	15.60	6.60	1.00	12.00	
130	Y.M. Ash-flow	PTn	14	9.00	1.25	2.60	1.00	1.00	0.78	6.60	1.00	1.06	
140	Y.M. Ash-flow	PTn	48	7.00	2.60	1.40	1.00	1.00	12.24	6.60	1.00	13.19	
150	Y.M. Ash-flow	PTn	0	9.00	3.00	1.37	1.00	1.00	2.43	6.60	1.00	0.34	
160	Y.M. Ash-flow	PTn	0	9.00	3.00	1.37	1.00	1.00	2.43	6.60	1.00	0.34	
170	Bedded	PTn	28	6.00	4.00	1.00	1.00	1.00	20.00	6.60	1.00	18.38	
180	P.C. Ash-flow	PTn	48	6.00	2.82	1.00	1.00	1.00	16.91	6.60	1.00	20.82	
190	P.C. Ash-flow	PTn	61	9.00	2.60	1.00	1.00	1.00	16.94	6.60	1.00	23.46	
200	P.C. Ash-flow	PTn	84	7.00	3.00	1.00	1.00	1.00	23.14	6.60	1.00	24.92	
210	P.C. Ash-flow	PTn	50	6.00	1.60	1.00	1.00	1.00	16.00	6.60	1.00	11.64	
220	P.C. Ash-flow	PTn	53	7.00	2.29	1.00	1.00	1.00	17.31	6.60	1.00	18.67	
230	P.C. Ash-flow	PTn	66	7.00	3.00	1.00	1.00	1.00	28.29	6.60	1.00	30.46	
240	P.C. Ash-flow	PTn	61	9.00	2.67	1.00	1.00	1.00	18.07	6.60	1.00	25.06	
250	P.C. Ash-flow	PTn	56	6.00	3.00	1.00	1.00	1.00	21.00	6.60	1.00	25.85	
260	P.C. Ash-flow	PTn	76	7.00	3.00	1.00	1.00	1.00	32.57	6.60	1.00	35.08	
270	T.S. U. Nonwelded	PTn	58	6.00	3.00	6.00	1.00	1.00	3.63	6.60	1.00	4.46	
280	T.S. U. Nonwelded	PTn	4	9.00	3.00	1.37	1.00	1.00	2.43	6.60	1.00	1.38	
290	T.S. U. Nonwelded	PTn	58	7.00	2.67	1.00	1.00	1.00	22.10	6.60	1.00	23.62	
300	T.S. U. Nonwelded	PTn	26	6.00	1.48	1.00	1.00	1.00	7.84	6.60	1.00	8.80	

Jn*, SRF* = interval values generated by Monte Carlo simulation; to calculate Q*.
Jn-Core, SRF-Core = average values of assumed distribution; to calculate Q-Core.
RQD**: If RQD is less than 10, the value 10 is used in the calculation of Q* as per Barton et al. (1974).
If RQD is 0, the value 1 is used in the calculation of Q-Core.

$$Q = \frac{RQD}{Jn} \times \frac{Jr}{Ja} \times \frac{Jw}{SRF}$$

Jn — Joint Set Number
Jr — Joint Roughness Number
Ja — Joint Alteration Number
Jw — Joint Water Reduction Factor
SRF — Stress Reduction Factor

[1] Barton, N., R. Lien, and J. Lunde, "Engineering Classification of Rock Masses for the Design of Tunnel Support," Rock Mechanics, 6:189-236 (Springer Verlag, 1974).
[2] Bieniawski, Z.T., "The Geomechanics Classification in Rock Engineering Applications," Proceedings, 4th International Congress on Rock Mechanics, Montreux, Switzerland, 2:41-48 (A. A. Balkema, 1979).

Figure (5) Example Q Classification System

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT
Estimated Rock Mass Quality Indices Based on Core Log Data
Hole USW NRG-7/7A
Interval—PTn Unit, 80-300 ft

END DEPTH	STRATI-GRAPHY ZONE	THERMO-MECHANICAL UNIT	RMR CLASSIFICATION SYSTEM Bieniawski (1979)						RMR VALUES
			C	RQD-I	JS	JC	JW	RMR	0.0 50.0 100.0
80	T.C. Basal Nonwelded	PTn	1	13	8	17.0	16	54.0	80
100	T.C. Basal Nonwelded	PTn	2	13	8	30.0	16	69.0	100
110	Bedded	PTn	1	8	8	28.8	16	60.8	110
120	Y.M. Ash-flow	PTn	1	8	8	23.6	16	56.6	120
130	Y.M. Ash-flow	PTn	1	3	8	12.8	16	39.8	130
140	Y.M. Ash-flow	PTn	2	8	8	23.8	16	56.8	140
150	Y.M. Ash-flow	PTn	1	3	8	27.1	16	51.1	150
160	Y.M. Ash-flow	PTn	1	3	8	27.1	16	51.1	160
170	Bedded	PTn	1	8	8	30.0	16	63.0	170
180	P.C. Ash-flow	PTn	1	8	8	27.8	16	60.8	180
190	P.C. Ash-flow	PTn	1	13	8	24.0	16	61.0	190
200	P.C. Ash-flow	PTn	1	13	8	28.8	16	65.8	200
210	P.C. Ash-flow	PTn	1	13	8	18.8	16	55.8	210
220	P.C. Ash-flow	PTn	2	13	8	22.2	16	60.2	220
230	P.C. Ash-flow	PTn	1	13	8	28.8	16	66.8	230
240	P.C. Ash-flow	PTn	1	13	8	26.8	16	62.8	240
250	P.C. Ash-flow	PTn	1	13	8	28.8	16	66.8	250
260	P.C. Ash-flow	PTn	1	17	8	28.8	16	69.8	260
270	T.S. U. Nonwelded	PTn	2	13	8	12.8	16	50.8	270
280	T.S. U. Nonwelded	PTn	1	3	8	27.1	16	54.1	280
290	T.S. U. Nonwelded	PTn	1	13	8	27.0	16	64.0	290
300	T.S.U. Nonwelded	PTn	2	8	8	19.4	16	52.4	300

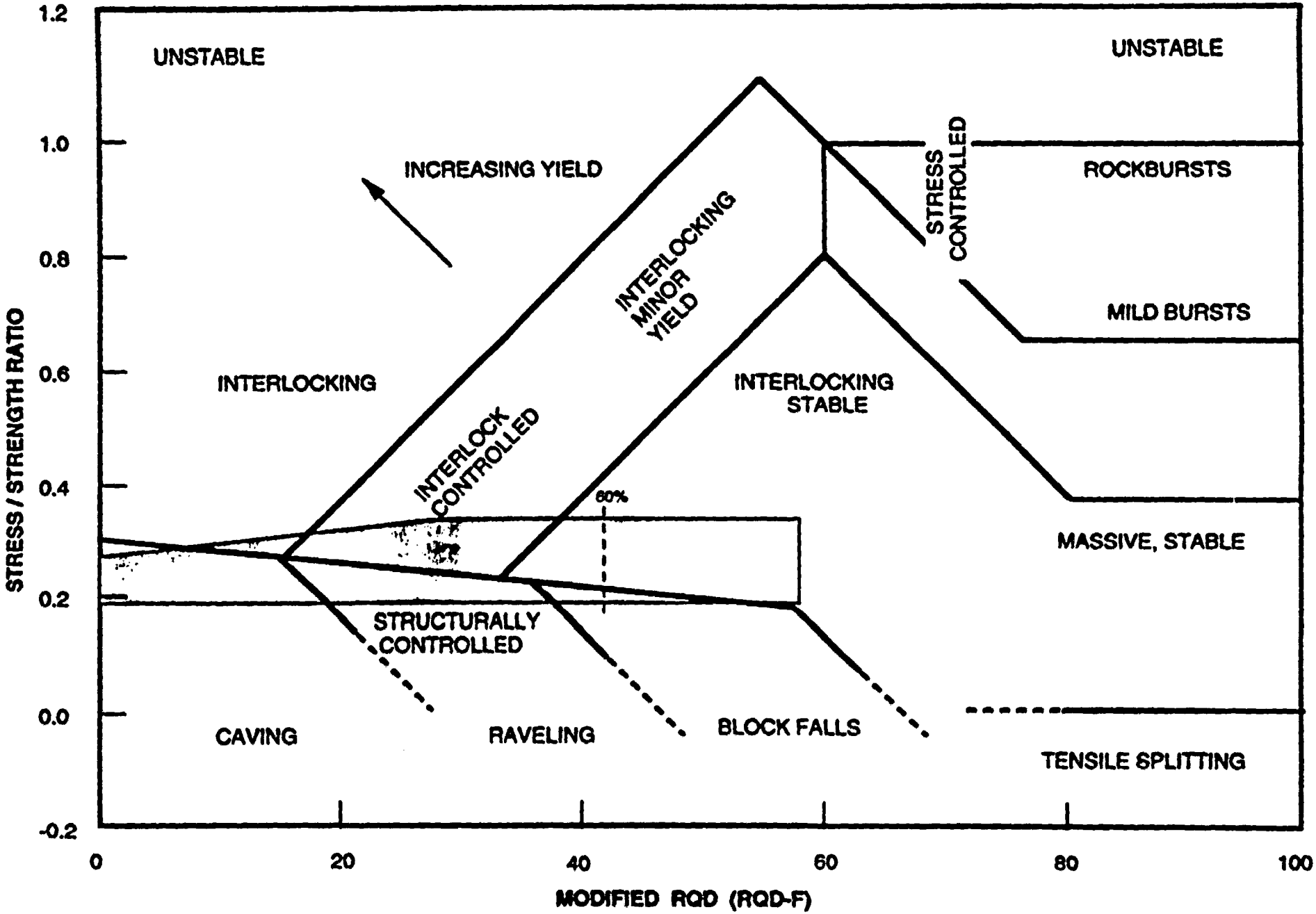
Ja*, SRF* = interval values generated by Monte Carlo simulation, to calculate Q*.
Ja-Core, SRF-Core = average values of assumed distribution, to calculate Q-Core.
RQD**: If RQD is less than 10, the value 10 is used in the calculation of Q* as per Barton et al. (1974).
If RQD is 0, the value 1 is used in the calculation of Q-Core.

RMR
C— Strength Index
RQD-I— RQD Index
JS— Joint Spacing Index
JC— Discontinuity Condition
JW— Groundwater Index

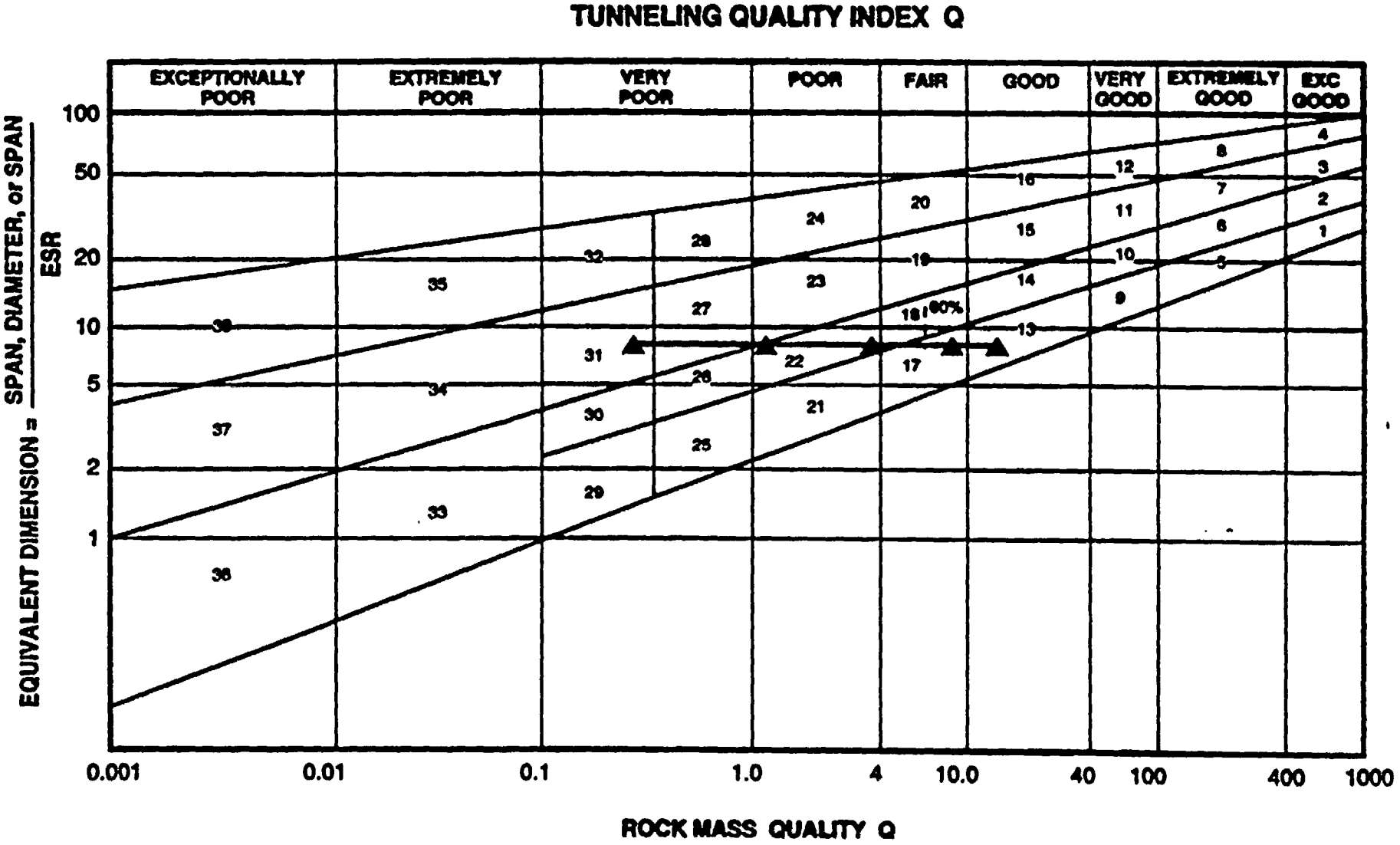
RMR = C + RQD-I + JS + JC + JW

[1] Barton, N., R. Lien, and J. Lunde, "Engineering Classification of Rock Masses for the Design of Tunnel Support," Rock Mechanics, 6:189-236 (Springer Verlag, 1974).
[2] Bieniawski, Z.T., "The Geomechanics Classification in Rock Engineering Applications," Proceedings, 4th International Congress on Rock Mechanics, Montreux, Switzerland, 2:41-48 (A. A. Balkema, 1979).

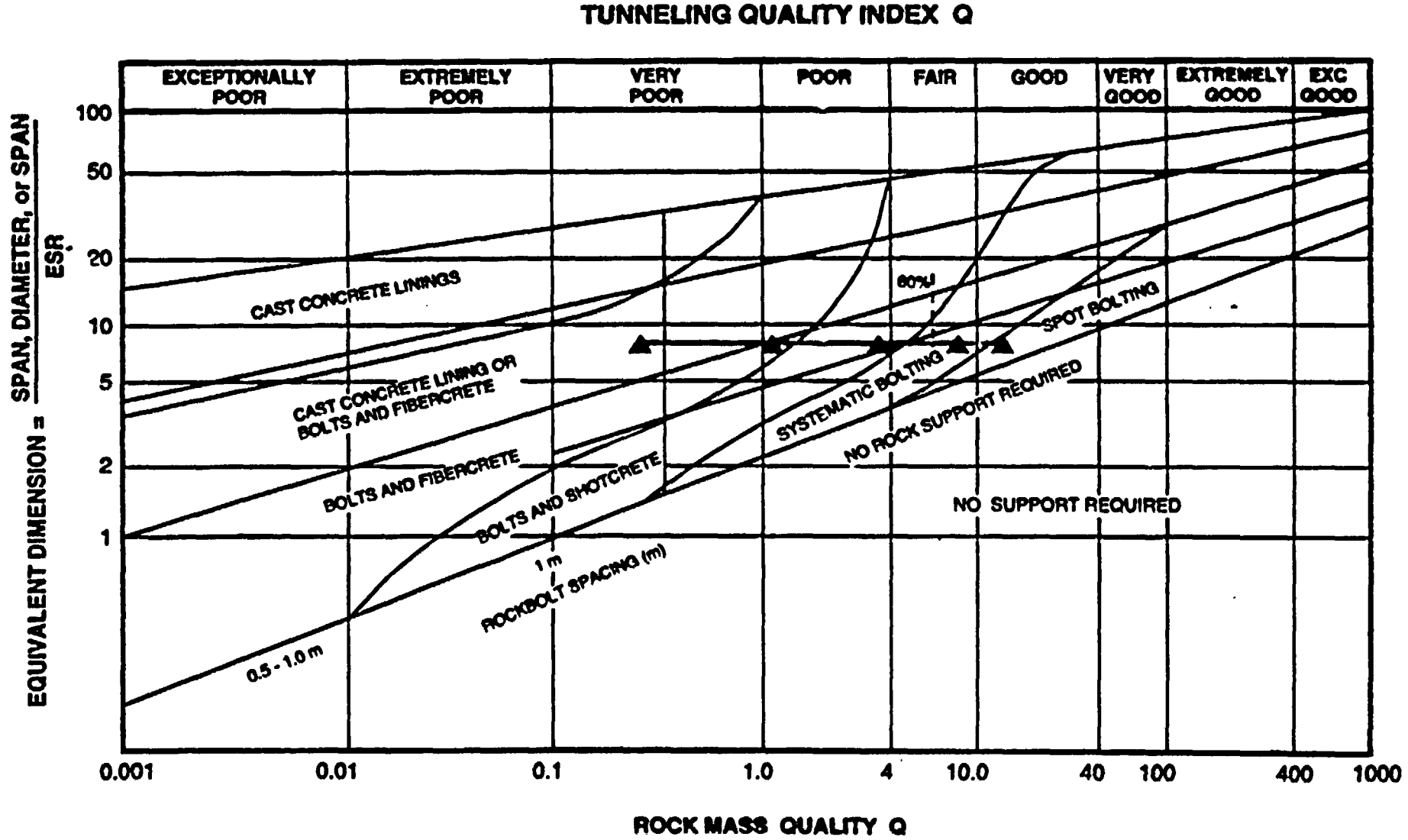
Figure(6) Example of Rock Mass Rating (RMR) Classification System



PROJECTED FAILURE MODES FOR TSw1



PROJECTED CATEGORIES OF GROUND SUPPORT FOR TSw1



PROJECTED RANGE OF GROUND SUPPORT FOR TSw1

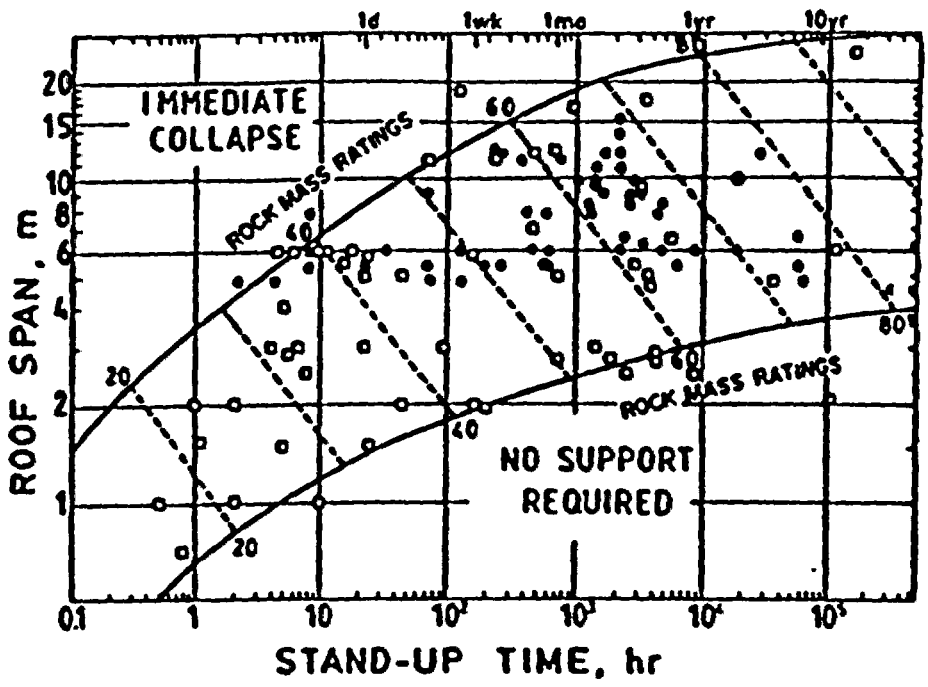


FIGURE 3 Geomechanics Classification of Rock Masses; Output for Tunneling and Mining. The Symbols Indicate Case Histories.

TABLE 5 Estimates of Q and RMR Values for TCw Unit

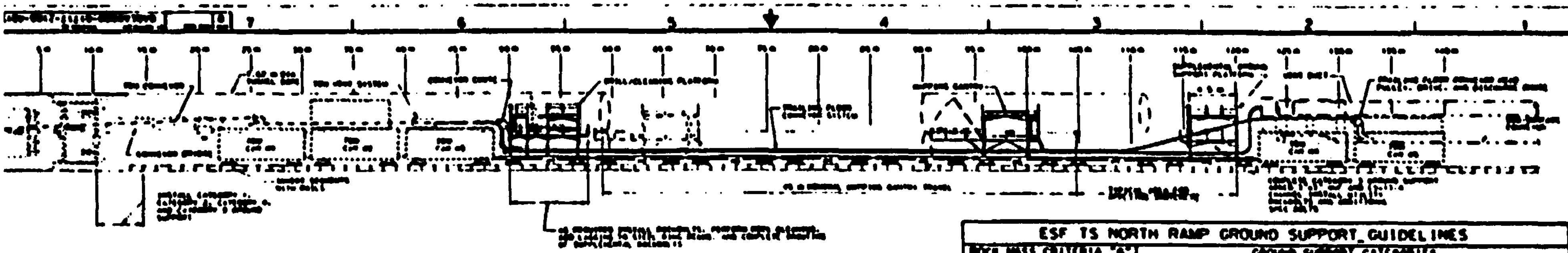
TCw UNIT	ROCK MASS QUALITY CATEGORY				
	1	2	3	4	5
Q	0.25	0.72	2.1	5.6	13.23
AVERAGE RMR	41	48	56	63	70

TABLE 6 Estimates of Q and RMR Values for PTw Unit

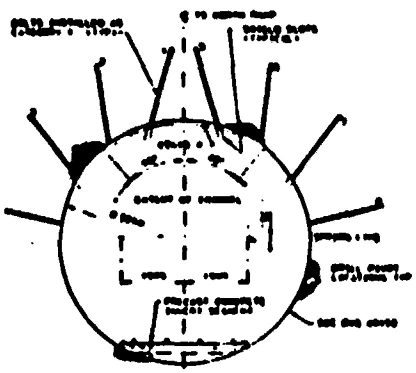
PTn UNIT	ROCK MASS QUALITY CATEGORY				
	1	2	3	4	5
Q	3.33	5.71	9.98	27	50.29
AVERAGE RMR	50	57	63	70	76

TABLE 7 Estimates of Q and RMR Values for TSw1 Unit

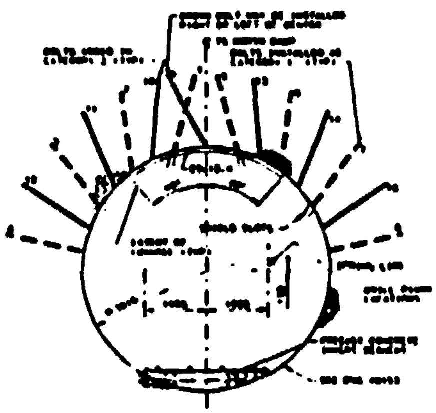
TSw1 UNIT	ROCK MASS QUALITY CATEGORY				
	1	2	3	4	5
Q	0.29	1.06	3.5	8	14.09
AVERAGE RMR	38	50	57	64	70



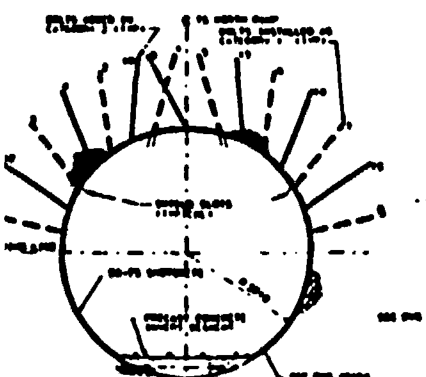
ELEVATION



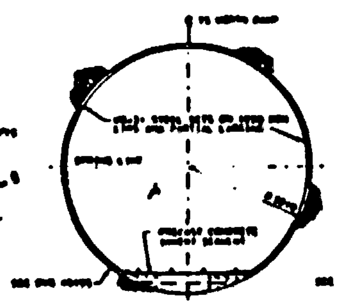
CATEGORY 1. GROUND SUPPORT



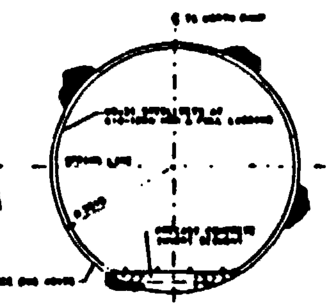
CATEGORY 2. GROUND SUPPORT



CATEGORY 3. GROUND SUPPORT



CATEGORY 4. GROUND SUPPORT



CATEGORY 5. GROUND SUPPORT

ESF TS NORTH RAMP GROUND SUPPORT GUIDELINES

ROCK MASS CRITERIA "Q"	GROUND SUPPORT CATEGORIES
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

NOTES:

GRAPHIC SCALE

DESIGN INPUTS

U.S. DEPARTMENT OF ENERGY

TS NORTH RAMP
GROUND SUPPORT MASTER
ELEVATION AND SECTIONS

PRELIMINARY

JOB TITLE : TS NORTH RAMP MOHR-COULOMB MODEL STATION 18+00 M (H/V=1) GROUND SUPPORT

FLAC (Version 3.22)

LEGEND

5/02/1994 14:34
step 4100
-1.000E+01 <x< 1.000E+01
-1.000E+01 <y< 1.000E+01

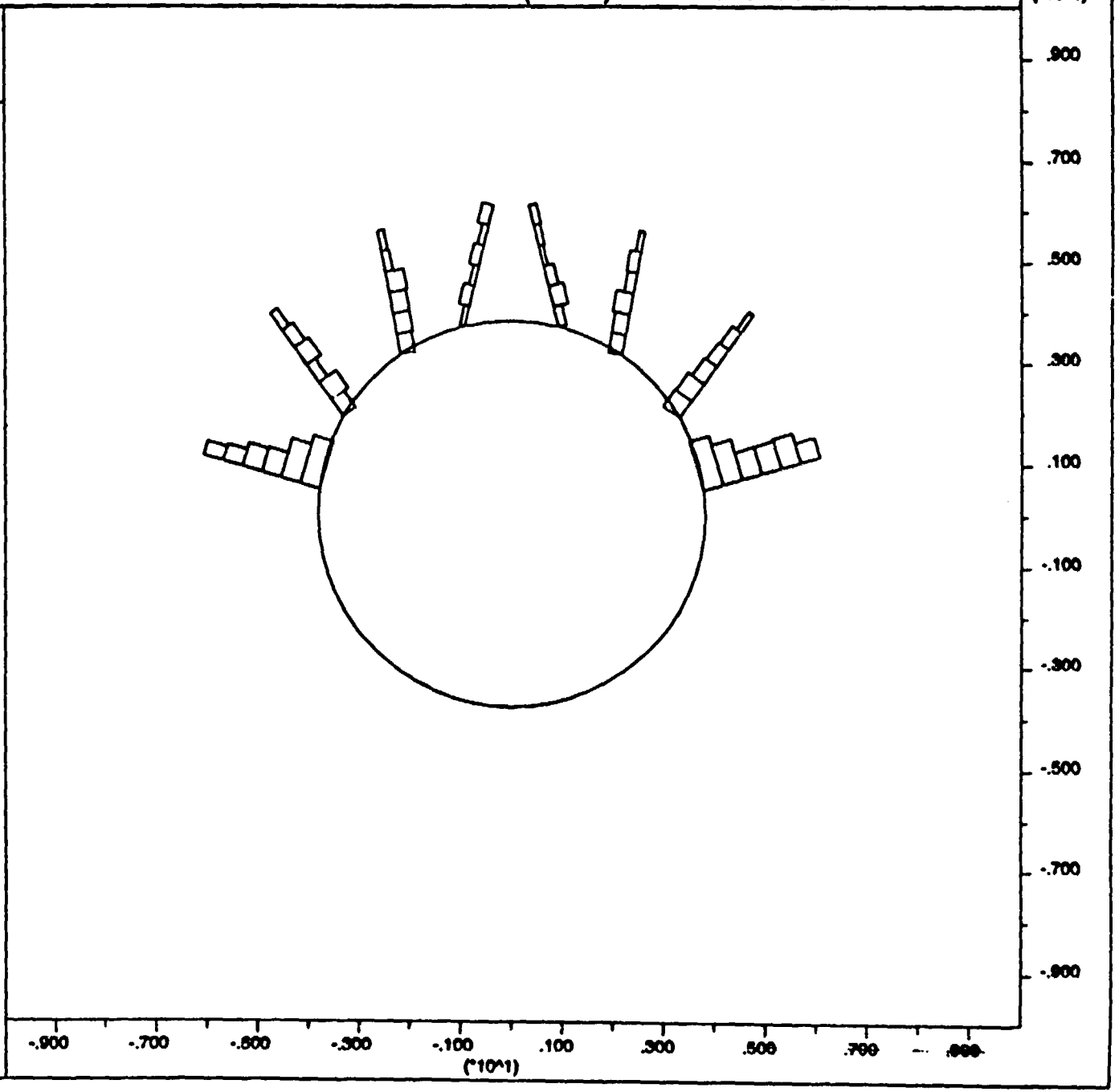
Boundary plot

0 5E 0

Axial Force on

Structure	Max. Value
Cable # 1	-7.351E+02
Cable # 2	-3.126E+02
Cable # 3	-2.748E+02
Cable # 4	-1.629E+02
Cable # 5	-7.522E+02
Cable # 6	-3.051E+02
Cable # 7	-2.567E+02
Cable # 8	-2.191E+02

CRWMS M & O



JOB TITLE : TS NORTH RAMP STATION 18+00 M (H/V=1) SEISMIC ANALYSIS

FLAC (Version 3.22)

LEGEND

5/02/1994 14:48
step 10100
-1.000E+01 <x< 1.000E+01
-1.000E+01 <y< 1.000E+01

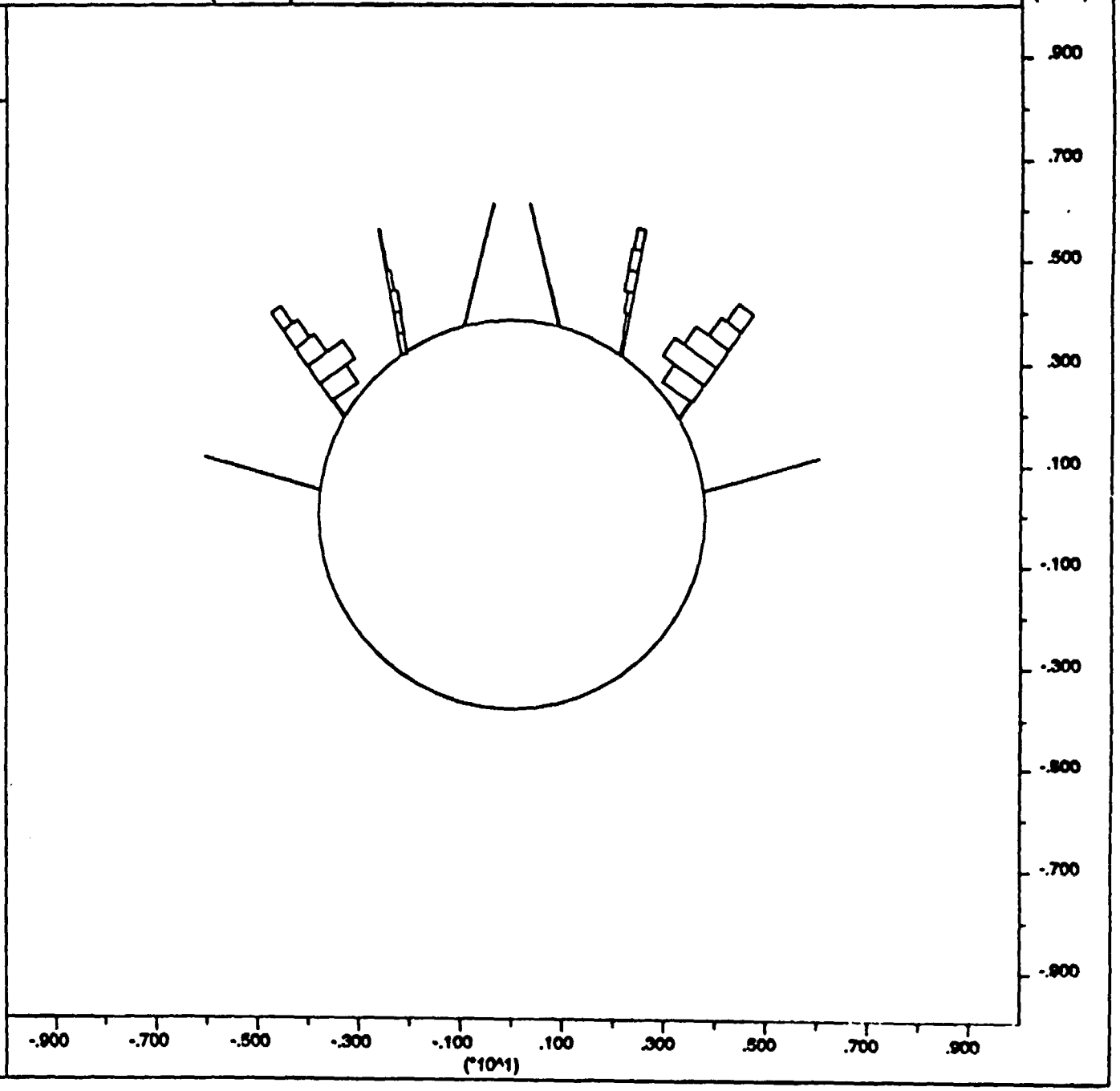
Boundary plot

0 5E 0

Axial Force on

Structure	Max. Value
Cable # 1	-1.426E+03
Cable # 2	-1.308E+05
Cable # 3	-2.303E+04
Cable # 4	-2.340E+03
Cable # 5	-1.423E+03
Cable # 6	-1.523E+05
Cable # 7	-2.925E+04
Cable # 8	-3.294E+03

CRWMS M & O



JOB TITLE : TS North Ramp Stability Analysis Station 18+00 m - Excavated & Unsupported

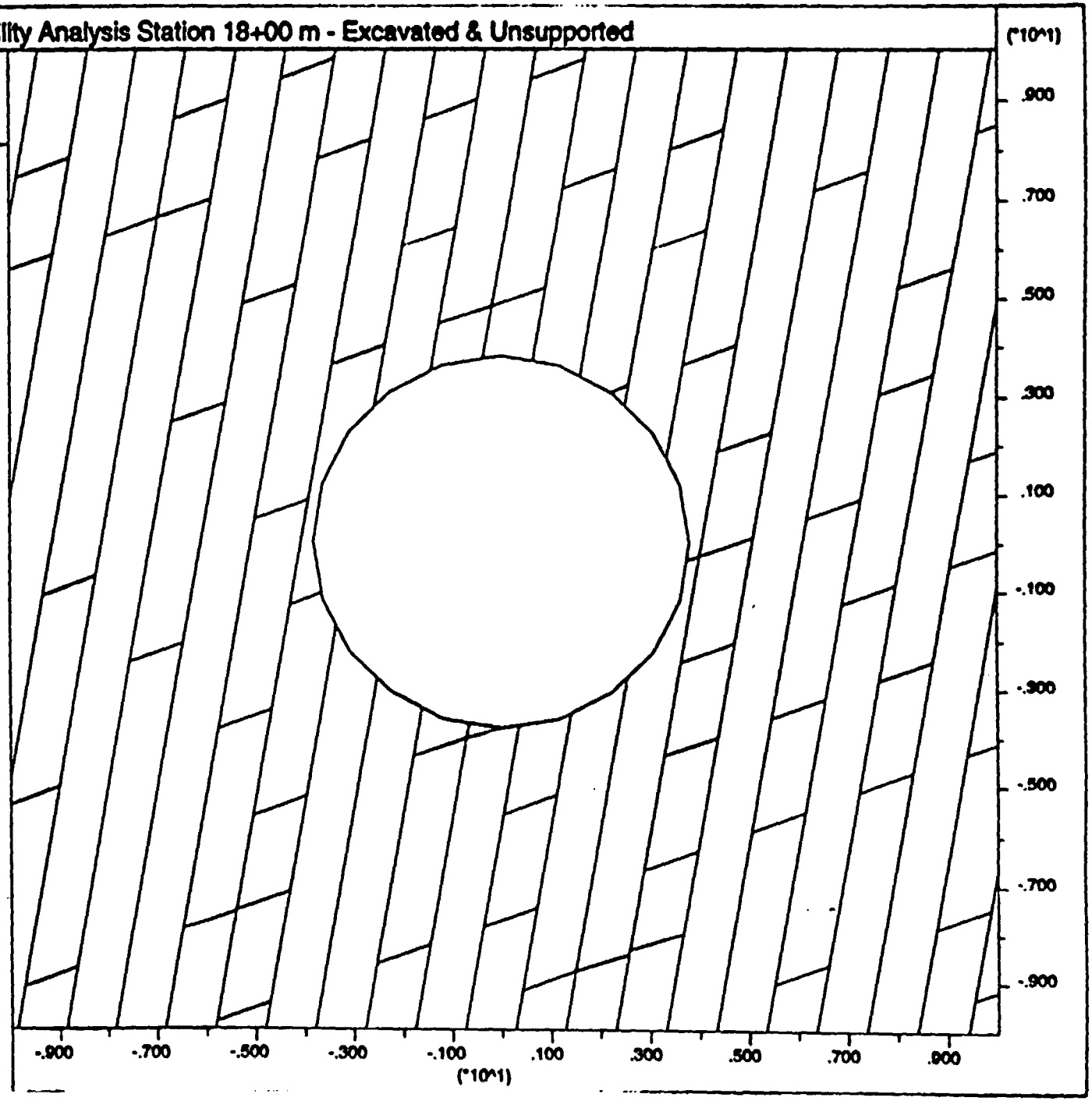
UDEC (Version 2.00)

LEGEND

5/02/1994 14:53
cycle 6000
time 1.280E+00 sec

block plot

CRWMS M & O



JOB TITLE : TS North Ramp Stability Analysis Station 18+00 m - Excavated & Unsupported

UDEC (Version 2.00)

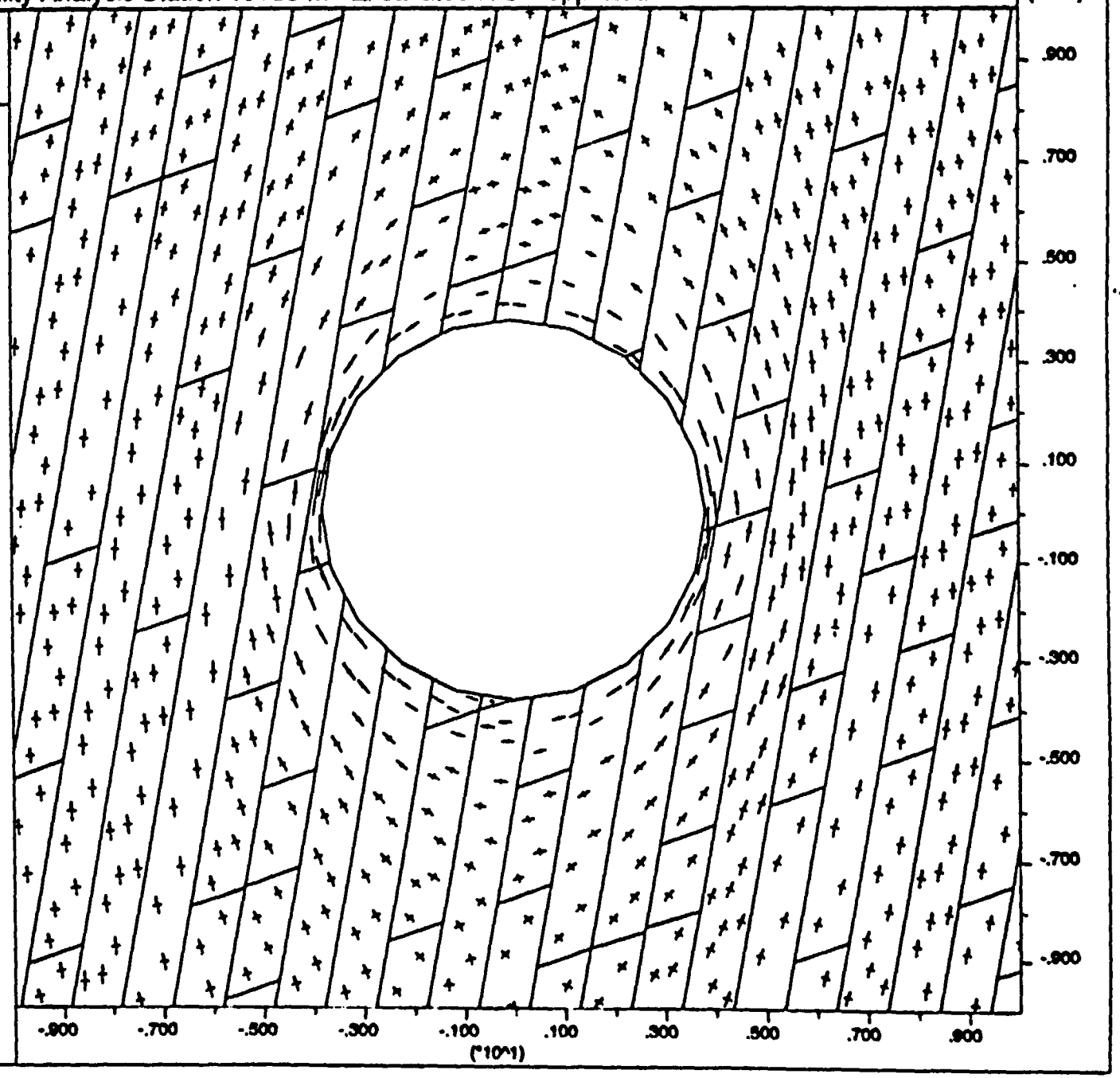
LEGEND

5/02/1994 14:57
cycle 6000
time 1.280E+00 sec

block plot
principal stresses
minimum = -1.135E+07
maximum = 5.845E+05

0 5E 7

CRWMS M & O



JOB TITLE : TS North Ramp Stability Analysis Station 18+00 m - Excavated & Unsupported

UDEC (Version 2.00)

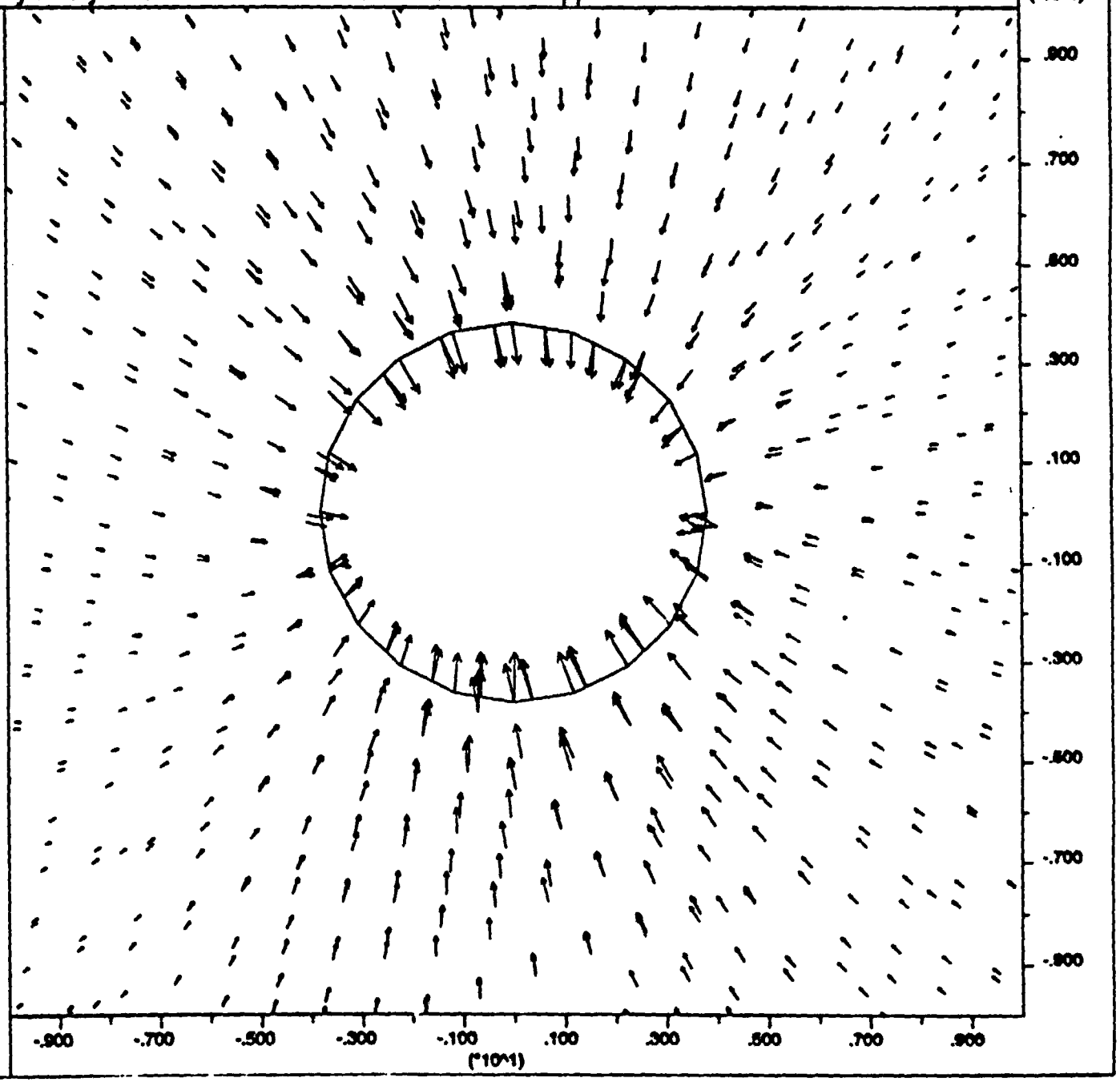
LEGEND

5/02/1994 14:58
cycle 6000
time 1.280E+00 sec

boundary plot
displacement vectors
maximum = 1.519E-03

0 5E -3

CRWMS M & O



JOB TITLE : TS North Ramp Stability Analysis Station 18+00 m - Excavated & Unsupported

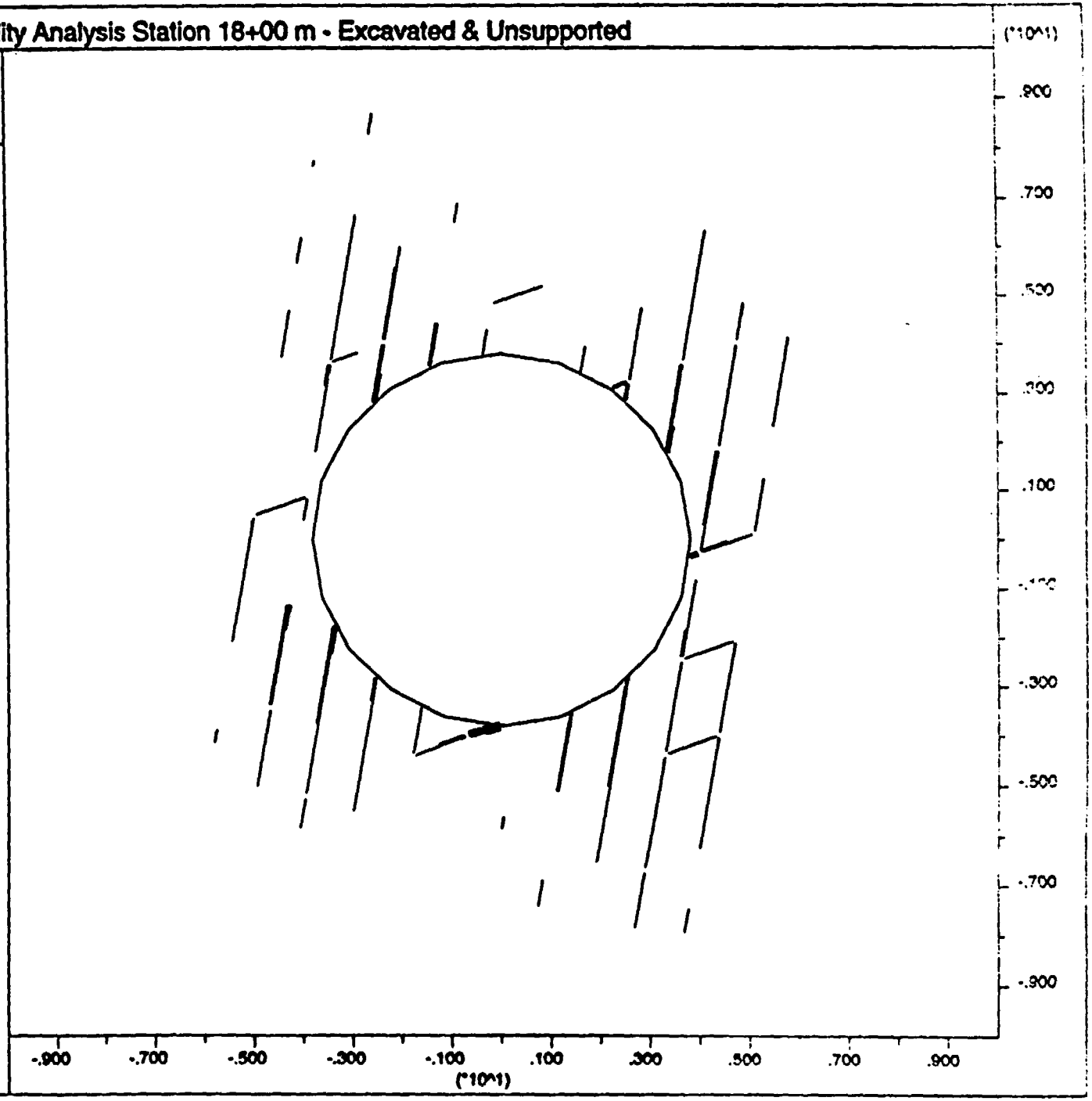
UDEC (Version 2.00)

LEGEND

5/02/1994 14:58
cycle 6000
time 1.280E+00 sec

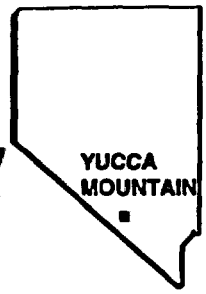
boundary plot
shear displacements on joints
max shear disp = 3.611E-04
each line thick = 7.222E-05

CRWMS M & O



U.S. DEPARTMENT OF ENERGY

OCRWM



YUCCA MOUNTAIN
SITE CHARACTERIZATION
PROJECT

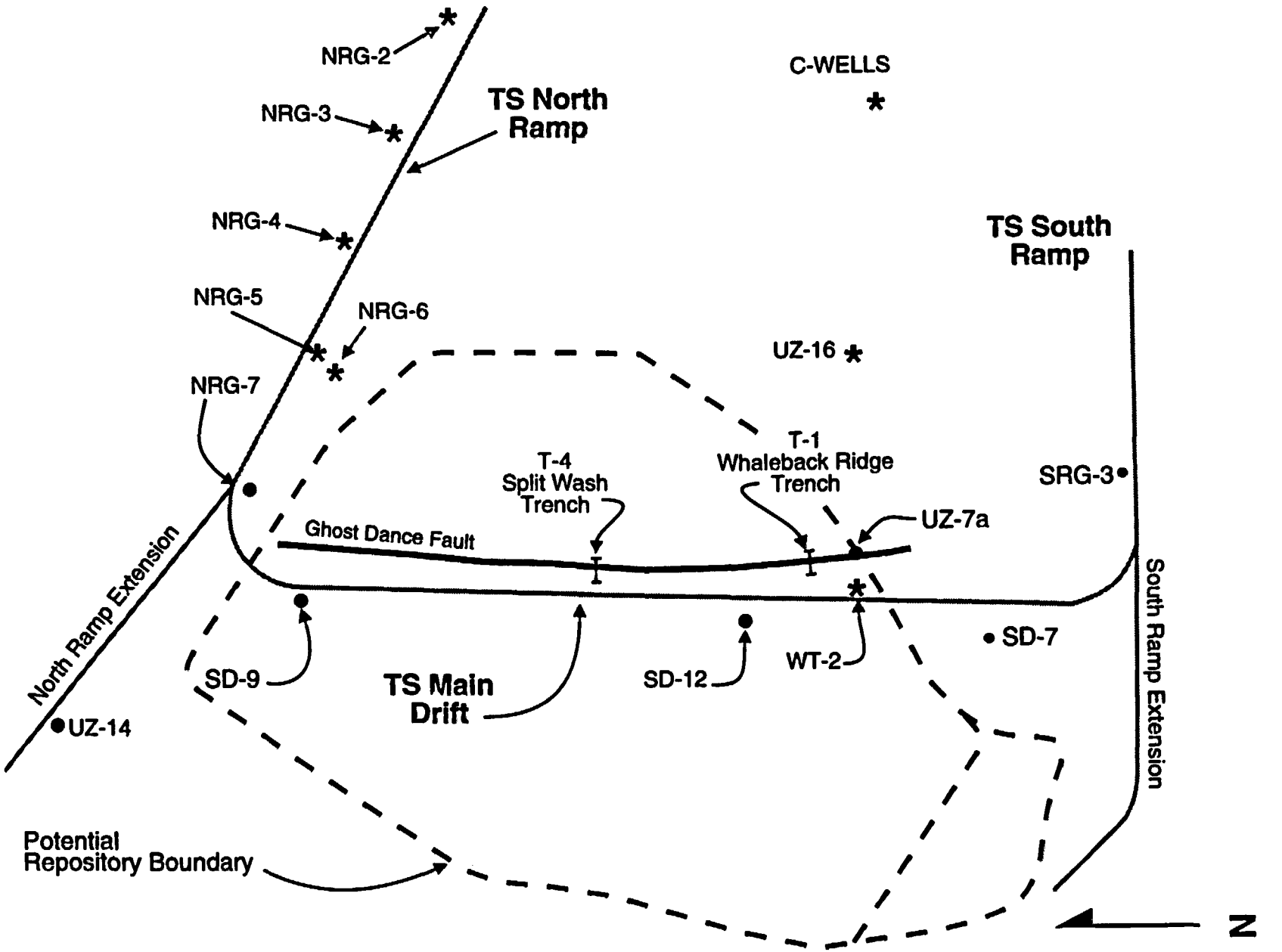
DOE-NRC TECHNICAL MEETING ON THE EXPLORATORY STUDIES FACILITY

DRILLING, SAMPLING, AND TESTING PROGRAM UPDATE

PRESENTED BY
WILLIAM J. BOYLE

JULY 27, 1994
ROCKVILLE, MD

Borehole And Trench Locations



LYOTRD7.CDR.124/12-10-93

Drilling\Sampling\Testing Program April - June 1994

UZ-14	Cored from 1616' to 2223' Depth of Water = 1885
SD-9	Cored to 1430'. Trickle at ~1350'. Standing water at ~1480' depth.
SD-12	Cored 320' to 1065'
UZ-16	Gas Testing & Air Permeability
NRG 6 and 7	Gas Testing
ESF Alcove 1	Air Permeability & Hydrochemistry Testing
Large Block Test	Finished Sawing - Continued Excavating & Sampling
Trench NRT-1	Plate Load Tests and In Situ Permeability
Ghost Dance Fault	Trenches Excavated at Split Wash & Whaleback Ridge for Dating of Fault Displacements
C-Wells	Pipeline to Spreading Basin Constructed - Spreading Basin Under Construction

Borehole Geophysical Logging

Completed April 1 - June 30, 1994

- Prototype Nuclear Magnetic Resonance logging at UE-25 UZ-16.
- Slimhole, Gyro and Video logging at USW NRG-7/7A and UE-25 NRG-2a, 2b, 2c & 2d.
- Conventional logging at USW NRG-7/7a.
- Spectral Gamma Ray logging at UE-25 NRG-2a & 2b.

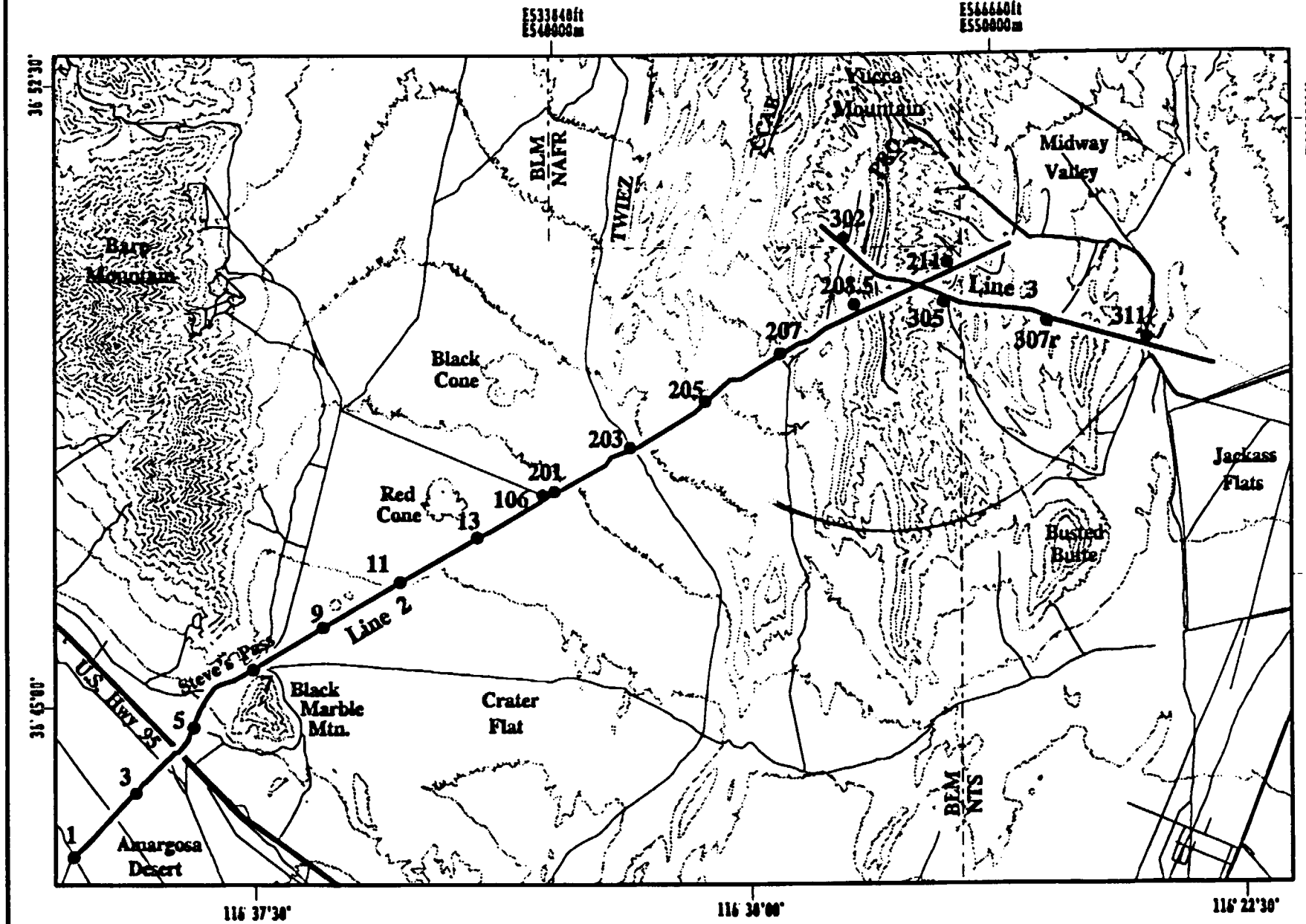
Drilling\Sampling\Testing Program
July - October 1994

SD-7	Pad Construction & Drilling
SD-9	Drilling & Sampling
SD-12	Drilling & Sampling
UZ-7A	Drilling & Sampling
NRG-7/7A and NRG-6	Air Permeability & Monitoring
ESF Alcove 1	Hydrochemistry & Air K Tests
Large Block Test	Continue Excavating & Test Preparation
Ghost Dance Fault	Map Split Wash & Whale-back Ridge Trenches
C-Wells	Complete Spreading Basin, Test Equipment, Begin Test
Stagecoach Road Fault	Drill & Sample 2 Bore-holes in the Hanging Wall to Determine Slip Rates
Regional Seismic Line	Twenty 200' Shotholes

Borehole Geophysical Logging

Planned July 1 - November 1, 1994

- **Conventional, Gyro and Video logging at the following boreholes:**
  - **USW SD-9**
  - **USW SD-12**
  - **USW UZ-14**
  - **USW UZ-7**
  - **USW SD-7**
- **Tool characterization to implement use of latest available technology.**



LEGEND

- Proposed Shothole
- Proposed Seismic Reflection Line

2 1 0 1 2 Mi

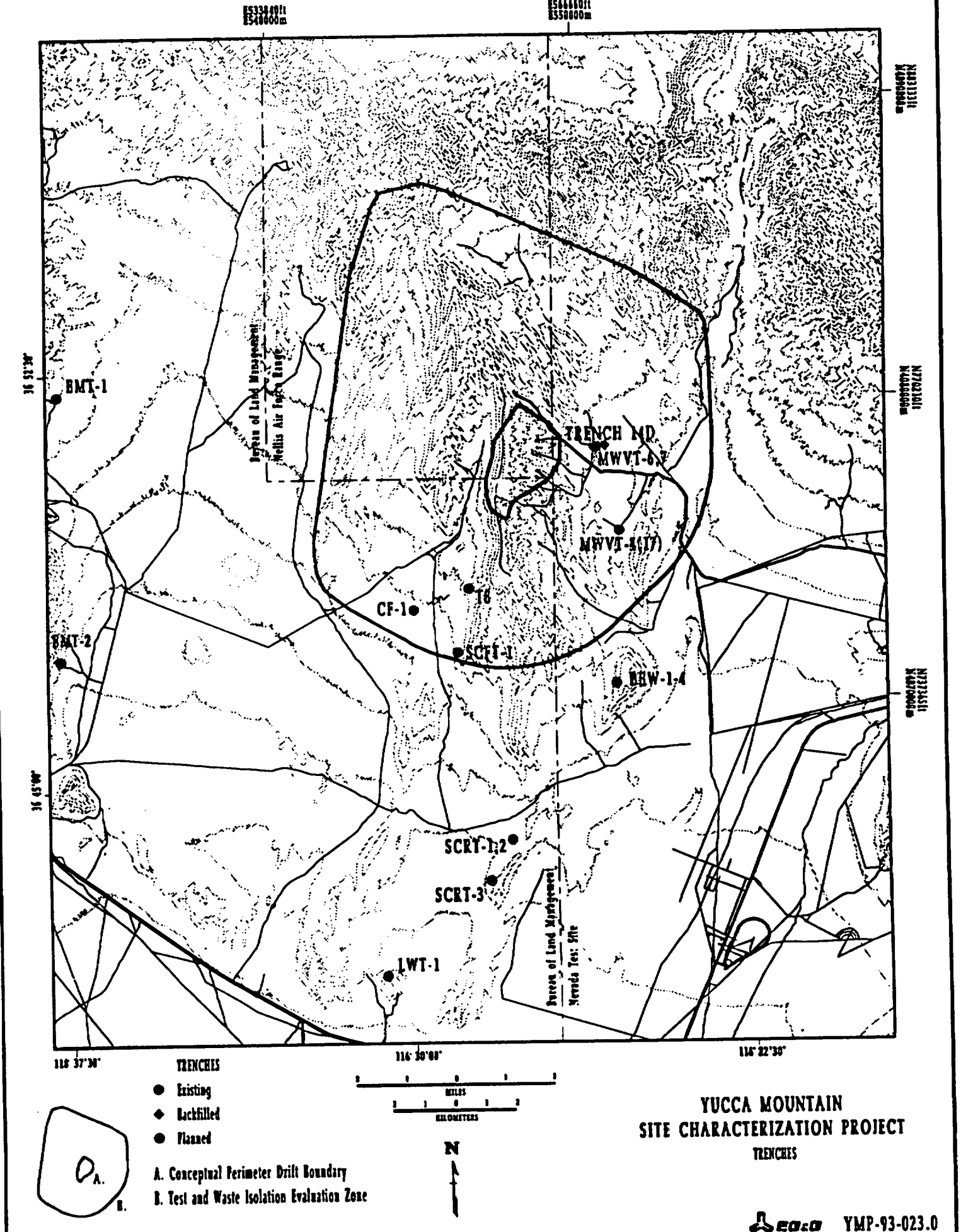
2 1 0 1 2 Km

Contour Interval 200 ft

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT PROPOSED SEISMIC REFLECTION LINES

EG&G

YMP-94-218.0


BMT-1
BAT-2
CF-1
T6
SCRT-1
RHW-1,4
TRENCH 14D
MWVT-6,7
MWVT-5(17)
SCRT-1,2
SCRT-3
LWT-1
Bureau of Land Management
Nellis Air Force Range
Bureau of Land Management
Nevada Test Site
116° 37'30"
116° 30'00"
116° 22'30"
TRENCHES
Existing
Backfilled
Planned
A. Conceptual Perimeter Drift Boundary
B. Test and Waste Isolation Evaluation Zone
N
YUCCA MOUNTAIN
SITE CHARACTERIZATION PROJECT
TRENCHES
YMP-93-023.0

Seismic Activity
April - June 1994

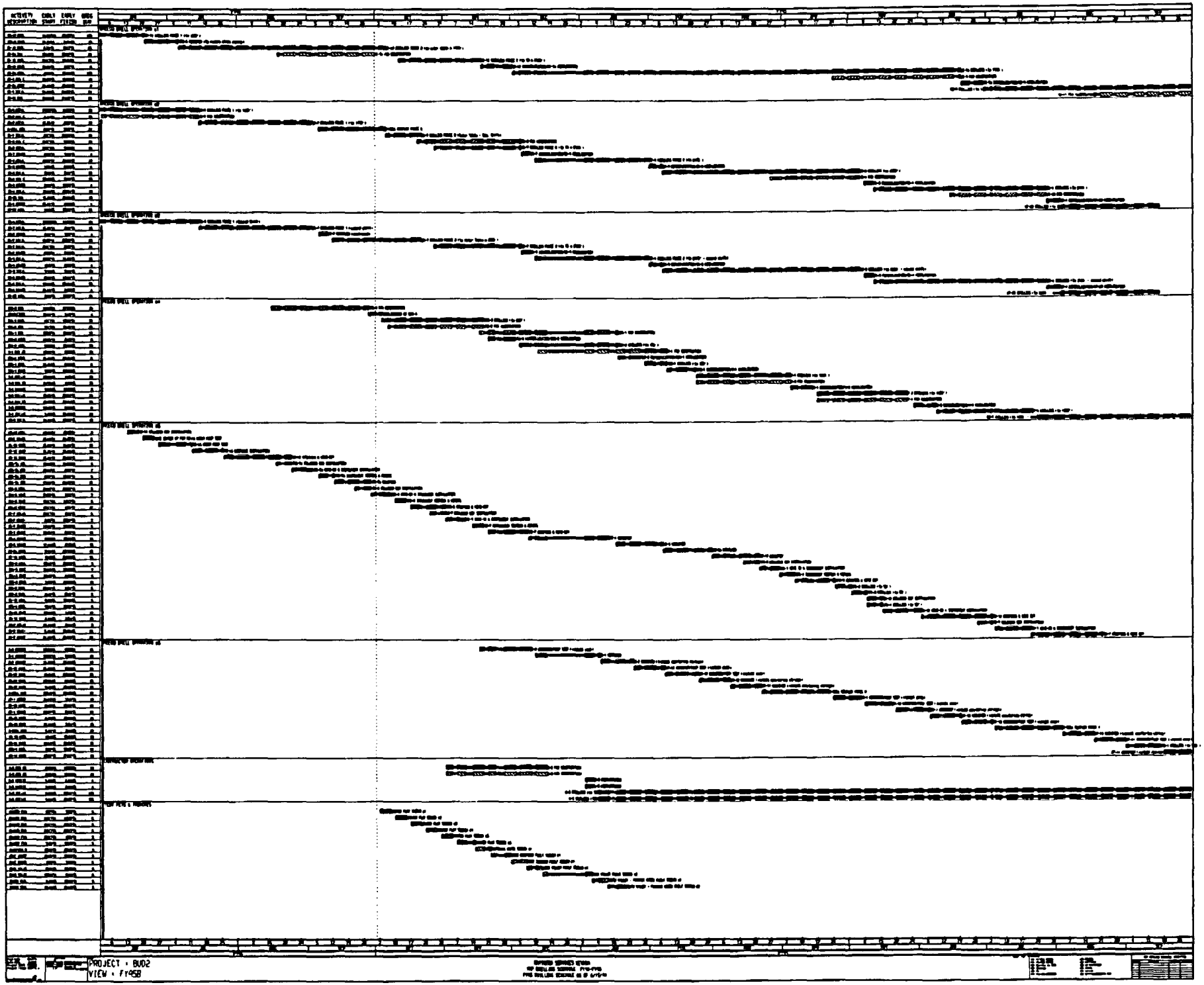
July 1, 1994

17:57 GMT

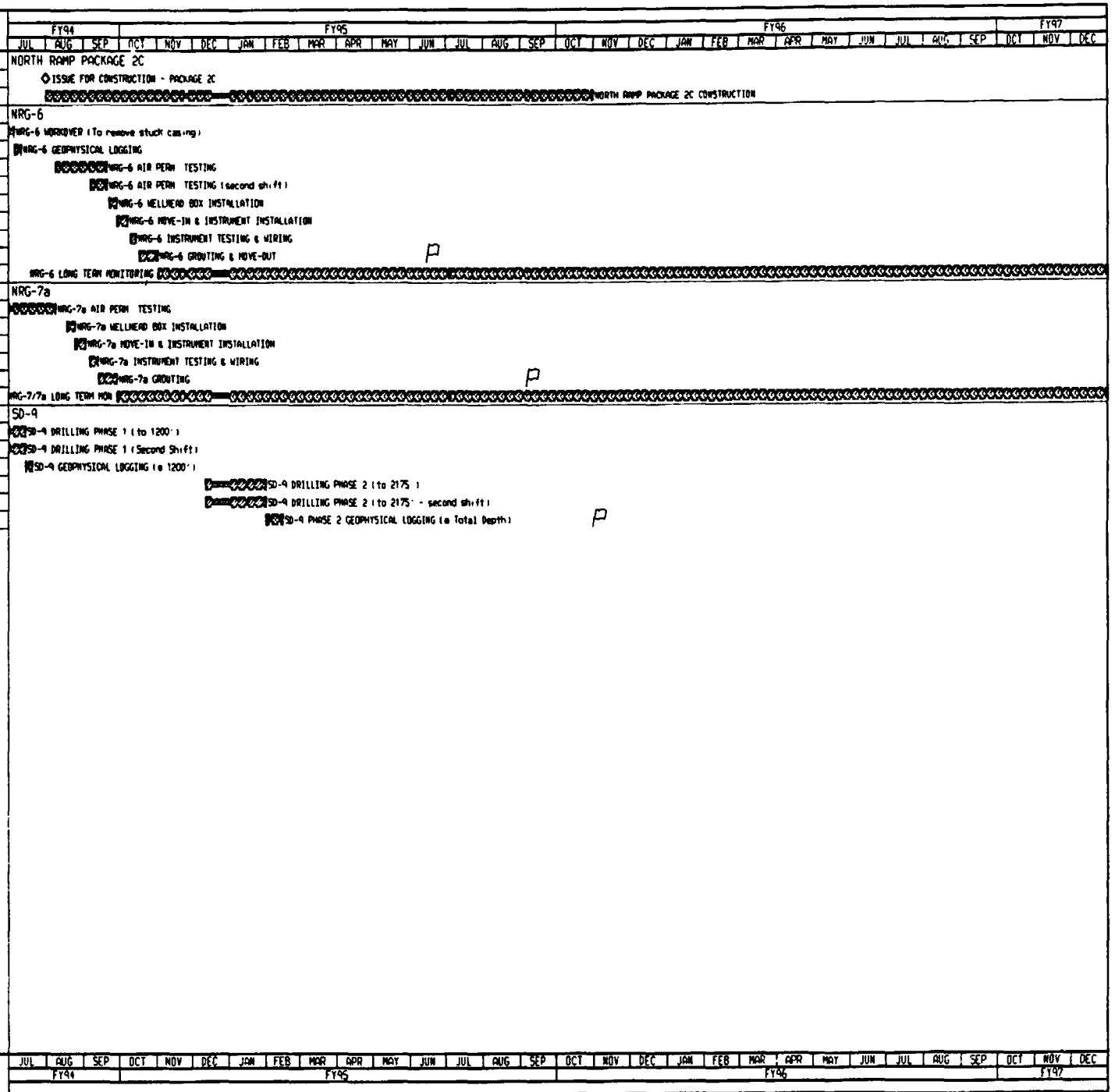
Near Epicenter of 1992 Little Skull Mountain Earthquake

Magnitude ~ 3.9

Depth - 11km



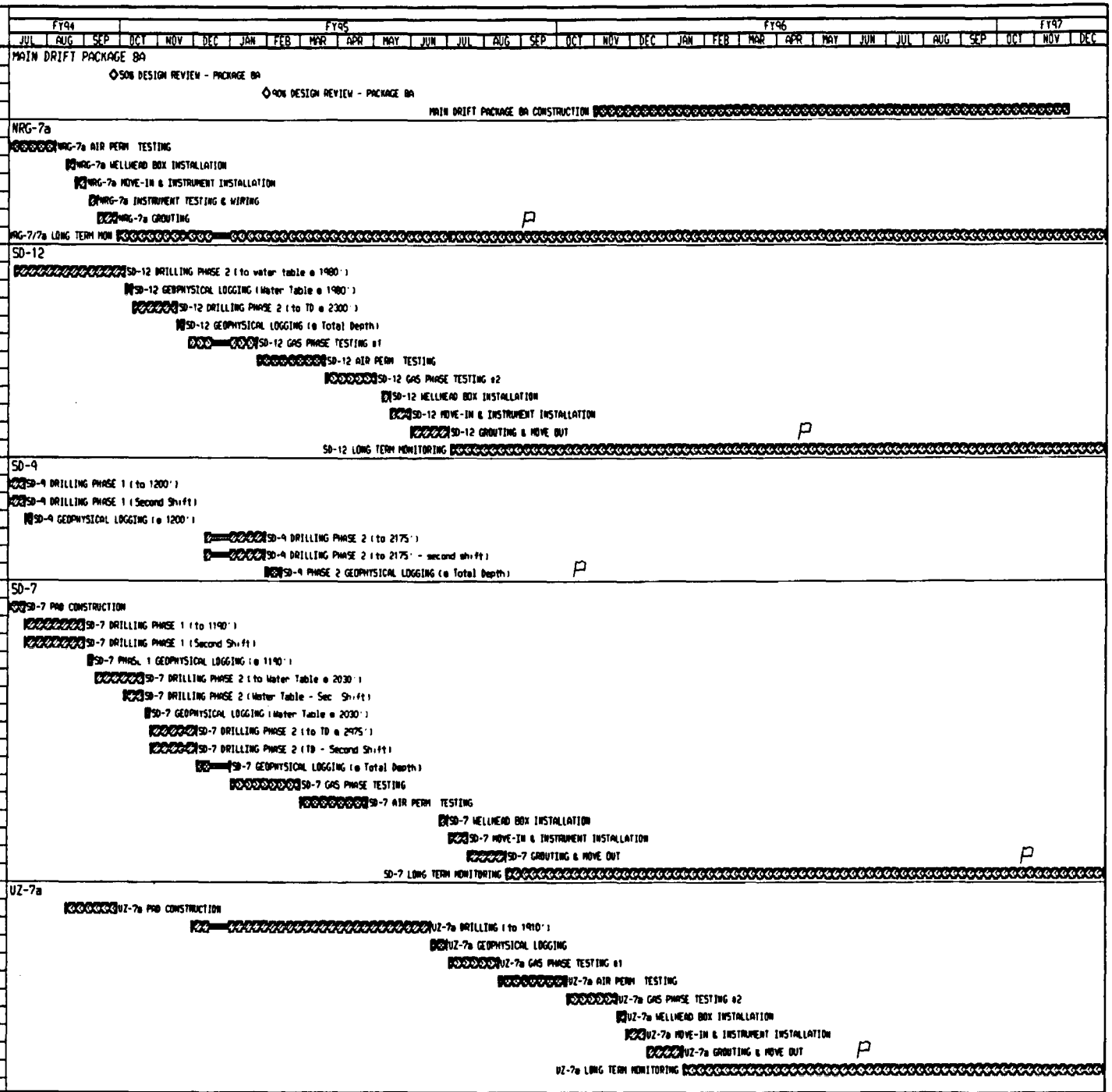
ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
ISSUE FOR CONSTRUCTION - PACKA	1AUG94	
NORTH RAMP PACKAGE 2C CONSTRUC	1AUG94	31OCT95
NRG-6 WORKOVER (To remove stuc	21JUN94	5JUL94
NRG-6 GEOPHYSICAL LOGGING	6JUL94	11JUL94
NRG-6 AIR PERM TESTING	9AUG94	20SEP94
NRG-6 AIR PERM TESTING (secon	7SEP94	20SEP94
NRG-6 WELLHEAD BOX INSTALLATIO	22SEP94	28SEP94
NRG-6 MOVE-IN & INSTRUMENT INS	29SEP94	7OCT94
NRG-6 INSTRUMENT TESTING & WIR	10OCT94	14OCT94
NRG-6 GROUTING & MOVE-OUT	17OCT94	1NOV94
NRG-6 LONG TERM MONITORING	2NOV94	28SEP98
NRG-7a AIR PERM TESTING	14JUN94A	8AUG94
NRG-7a WELLHEAD BOX INSTALLATI	10AUG94	24AUG94
NRG-7a MOVE-IN & INSTRUMENT IN	25AUG94	2SEP94
NRG-7a INSTRUMENT TESTING & WI	6SEP94	12SEP94
NRG-7a GROUTING	13SEP94	28SEP94
NRG-7/7a LONG TERM MONITORING	29SEP94	25AUG98
SD-9 DRILLING PHASE 1 (to 1200	19MAY94A	14JUL94
SD-9 DRILLING PHASE 1 (Second	23MAY94A	14JUL94
SD-9 GEOPHYSICAL LOGGING (a 12	15JUL94	20JUL94
SD-9 DRILLING PHASE 2 (to 2175	12DEC94	31JAN95
SD-9 DRILLING PHASE 2 (to 2175	12DEC94	31JAN95
SD-9 PHASE 2 GEOPHYSICAL LOGGI	1FEB95	14FEB95



RAYTHEON SERVICES NEVADA
YMP SBT ACTIVITY SCHEDULE FY93-FY95
NORTH RAMP PACKAGE 2c

P DATE OF CLOSEST TBM APPROACH TO BOREHOLE

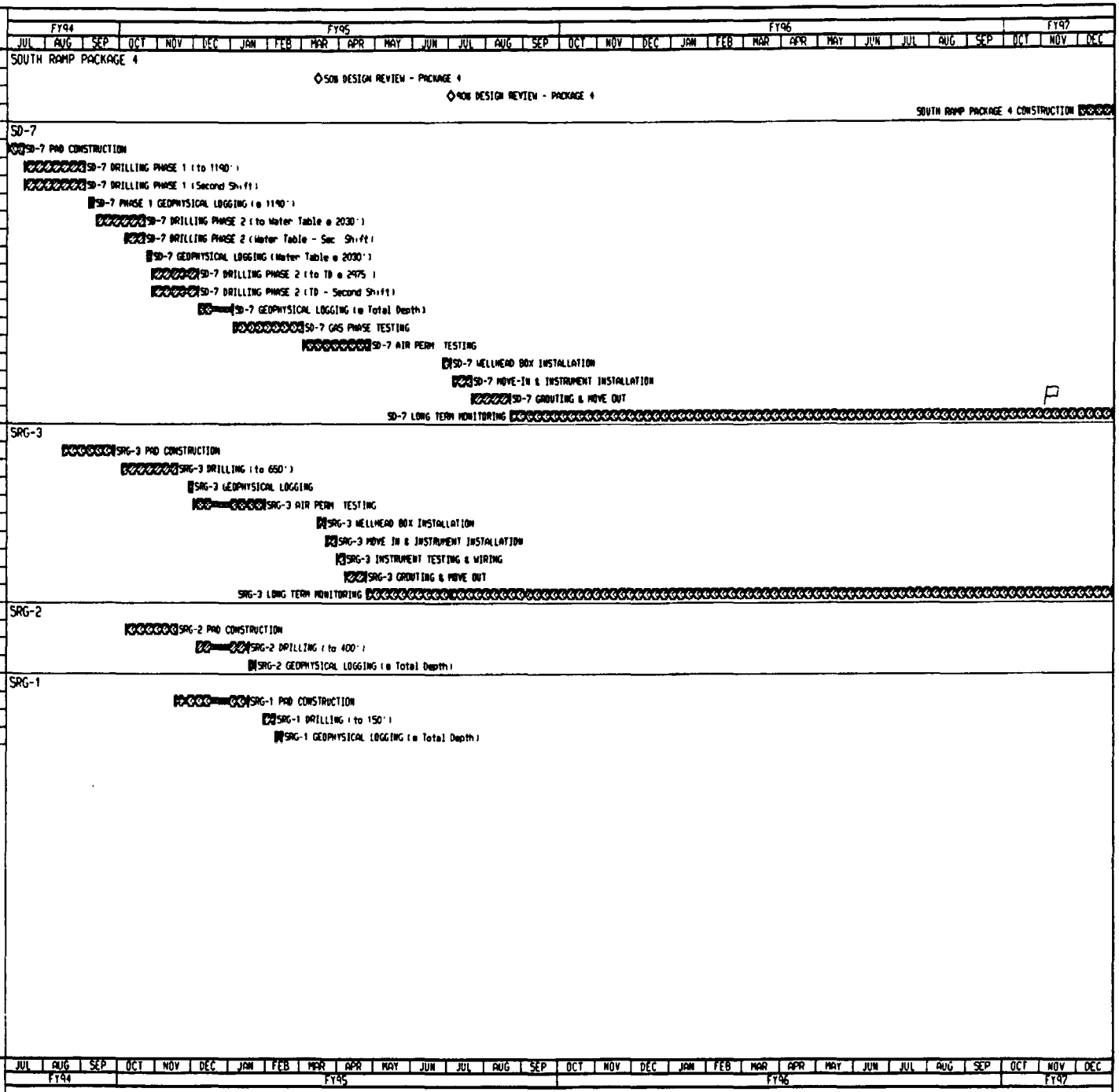
ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
50% DESIGN REVIEW - PACKAGE 8A	26SEP94	
90% DESIGN REVIEW - PACKAGE 8A	1FEB95	
MAIN DRIFT PACKAGE 8A CONSTRUC	1NOV95	29NOV96
NRG-7a AIR PERM. TESTING	14JUN94A	8AUG94
NRG-7a WELLHEAD BOX INSTALLATI	18AUG94	24AUG94
NRG-7a MOVE-IN & INSTRUMENT IN	25AUG94	2SEP94
NRG-7a INSTRUMENT TESTING & WI	6SEP94	12SEP94
NRG-7a GROUTING	13SEP94	28SEP94
NRG-7/7a LONG TERM MONITORING	29SEP94	25AUG98
SD-12 DRILLING PHASE 2 (to wat	6JUL94	5OCT94
SD-12 GEOPHYSICAL LOGGING (Wat	6OCT94	11OCT94
SD-12 DRILLING PHASE 2 (to TD	12OCT94	17NOV94
SD-12 GEOPHYSICAL LOGGING (a T	18NOV94	23NOV94
SD-12 GAS PHASE TESTING a1	28NOV94	24JAN95
SD-12 AIR PERM. TESTING	25JAN95	22MAR95
SD-12 GAS PHASE TESTING a2	23MAR95	3MAY95
SD-12 WELLHEAD BOX INSTALLATIO	9MAY95	15MAY95
SD-12 MOVE-IN & INSTRUMENT INS	16MAY95	1JUN95
SD-12 GROUTING & MOVE OUT	2JUN95	3JUL95
SD-12 LONG TERM MONITORING	5JUL95	5MAY99
SD-9 DRILLING PHASE 1 (to 1200	19MAY94A	14JUL94
SD-9 DRILLING PHASE 1 (Second	23MAY94A	14JUL94
SD-9 GEOPHYSICAL LOGGING (a 12	15JUL94	20JUL94
SD-9 DRILLING PHASE 2 (to 2175	12DEC94	31JAN95
SD-9 DRILLING PHASE 2 (to 2175	12DEC94	31JAN95
SD-9 PHASE 2 GEOPHYSICAL LOGGI	1FEB95	14FEB95
SD-7 PAD CONSTRUCTION	23JUN94	14JUL94
SD-7 DRILLING PHASE 1 (to 1190	15JUL94	25EP94
SD-7 DRILLING PHASE 1 (Second	15JUL94	25EP94
SD-7 PHASE 1 GEOPHYSICAL LOGGI	6SEP94	9SEP94
SD-7 DRILLING PHASE 2 (to Wate	12SEP94	21OCT94
SD-7 DRILLING PHASE 2 (Water T	6OCT94	21OCT94
SD-7 GEOPHYSICAL LOGGING (Wate	24OCT94	27OCT94
SD-7 DRILLING PHASE 2 (to TD a	28OCT94	5DEC94
SD-7 DRILLING PHASE 2 (TD - Se	28OCT94	5DEC94
SD-7 GEOPHYSICAL LOGGING (a To	6DEC94	3JAN95
SD-7 GAS PHASE TESTING	4JAN95	2MAR95
SD-7 AIR PERM. TESTING	3MAR95	27APR95
SD-7 WELLHEAD BOX INSTALLATION	27JUN95	3JUL95
SD-7 MOVE-IN & INSTRUMENT INST	5JUL95	20JUL95
SD-7 GROUTING & MOVE OUT	21JUL95	21AUG95
SD-7 LONG TERM MONITORING	22AUG95	22JUN99
UZ-7a PAD CONSTRUCTION	19AUG94	30SEP94
UZ-7a DRILLING (to 1910')	20DEC94	19JUN95
UZ-7a GEOPHYSICAL LOGGING	20JUN95	3JUL95
UZ-7a GAS PHASE TESTING a1	5JUL95	15AUG95
UZ-7a AIR PERM. TESTING	16AUG95	11OCT95
UZ-7a GAS PHASE TESTING a2	12OCT95	22NOV95
UZ-7a WELLHEAD BOX INSTALLATIO	23NOV95	29NOV95
UZ-7a MOVE-IN & INSTRUMENT INS	30NOV95	15DEC95
UZ-7a GROUTING & MOVE OUT	18DEC95	16JAN96
UZ-7a LONG TERM MONITORING	17JAN96	29JUN99



RAYTHEON SERVICES NEVADA
YMP SBT ACTIVITY SCHEDULE FY93-FY95
MAIN DRIFT PACKAGE 8a

P DATE OF CURRENT TDM APPROVED TO BASELINE

ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH
50% DESIGN REVIEW - PACKAGE 4	15MAR95	
90% DESIGN REVIEW - PACKAGE 4	3JUL95	
SOUTH RAMP PACKAGE 4 CONSTRUCT	20DEC96	31OCT97
SD-7 PAD CONSTRUCTION	23JUN94	14JUL94
SD-7 DRILLING PHASE 1 (to 1190	15JUL94	2SEP94
SD-7 DRILLING PHASE 1 (Second	15JUL94	2SEP94
SD-7 PHASE 1 GEOPHYSICAL LOGGI	6SEP94	9SEP94
SD-7 DRILLING PHASE 2 (to Wate	12SEP94	21OCT94
SD-7 DRILLING PHASE 2 (Water T	6OCT94	21OCT94
SD-7 GEOPHYSICAL LOGGING (Wate	24OCT94	27OCT94
SD-7 DRILLING PHASE 2 (to TD @	28OCT94	5DEC94
SD-7 DRILLING PHASE 2 (TD - Se	28OCT94	5DEC94
SD-7 GEOPHYSICAL LOGGING (@ To	6DEC94	3JAN95
SD-7 GAS PHASE TESTING	4JAN95	2MAR95
SD-7 AIR PERM TESTING	3MAR95	27APR95
SD-7 WELLHEAD BOX INSTALLATION	27JUN95	3JUL95
SD-7 MOVE-IN & INSTRUMENT INST	5JUL95	20JUL95
SD-7 GROUTING & MOVE OUT	21JUL95	21AUG95
SD-7 LONG TERM MONITORING	22AUG95	22JUN99
SRG-3 PAD CONSTRUCTION	16AUG94	27SEP94
SRG-3 DRILLING (to 650')	4OCT94	18NOV94
SRG-3 GEOPHYSICAL LOGGING	28NOV94	1DEC94
SRG-3 AIR PERM TESTING	20DEC94	30JAN95
SRG-3 WELLHEAD BOX INSTALLATIO	15MAR95	21MAR95
SRG-3 MOVE IN & INSTRUMENT INS	22MAR95	30MAR95
SRG-3 INSTRUMENT TESTING & WIR	31MAR95	6APR95
SRG-3 GROUTING & MOVE OUT	7APR95	24APR95
SRG-3 LONG TERM MONITORING	25APR95	25FEB99
SRG-2 PAD CONSTRUCTION	7OCT94	18NOV94
SRG-2 DRILLING (to 400')	5DEC94	17JAN95
SRG-2 GEOPHYSICAL LOGGING (@ T	18JAN95	23JAN95
SRG-1 PAD CONSTRUCTION	17NOV94	17JAN95
SRG-1 DRILLING (to 150')	30JAN95	8FEB95
SRG-1 GEOPHYSICAL LOGGING (@ T	9FEB95	14FEB95



RAYTHEON SERVICES NEVADA
YMP SBT ACTIVITY SCHEDULE FY93-FY95
SOUTH RAMP PACKAGE 4

P DATE OF CLOSEST YMP APPROACH TO BOREHOLE

AGREEMENTS REACHED AT THE NRC/DOE ESF MEETING

JULY 27, 1994

1. DOE Response to March 30, 1994 Youngblood/Shelor Letter.

   DOE provided responses to items in letter at ESF Meeting and will not formally transmit those responses via letter.

   NRC staff agreed to review those responses and provide feedback at the November 8, 1994 ESF Meeting.

2. Relationship of PPA to Design Phases.

   DOE agreed to further investigate and discuss at the next ESF Meeting.

3. Several questions related to the June 22, 1994 letters on issues associated with pneumatic pathways relate to TBM startup.

   DOE agrees to investigate status of responses and provide update via telephone prior to August 8th TBM startup.

7/27/94

Mark S. Delligatti, Project Manager
Division of Waste Management

US Nuclear Regulatory Commission

7/27/94

Christian E. Einberg
Regulatory Integration
Division
US Department of Energy