U.S. DEPARTMENT OF ENERGY

OCRWM

YUCCA MOUNTAIN

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT

THE EXPLORATORY STUDIES FACILITY

PRESENTED BY

CARL GERTZ

PROJECT MANAGER

937-3601

— B.Eg. to D. Dreyfus this pm

SEPTEMBER 2,

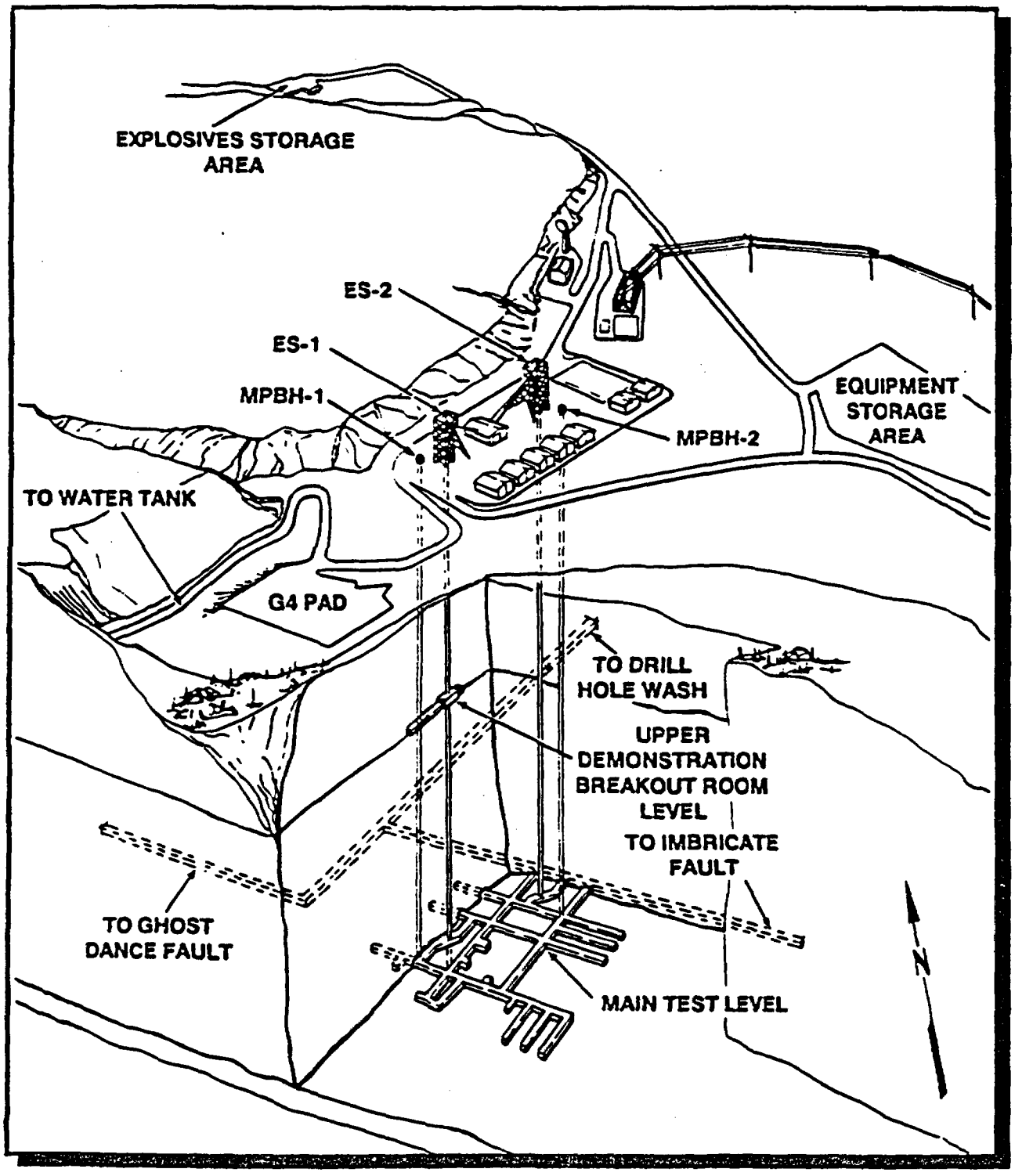
~~AUGUST 31~~, 1993

ESF.MISSION

Allow determination of the Yucca Mountain site's suitability to host a high level nuclear waste repository:

- Provide access to the potential repository horizon (Topopah Spring formation)
- Provide access to the Calico Hills formation
- Provide all required supporting facilities, both surface and underground
- Perform a comprehensive suite of testing conceived to gather physical information about the site.
- Utilize the information gained in construction and testing to support a decision on the suitability of the site

SOME ESF HISTORY



CONCEPTUAL ILLUSTRATION OF THE EXPLORATORY SHAFT FACILITY

THE TWO SHAFT CONCEPT

- Presented in the Site Characterization Plan (SCP) in December, 1988
- Was comprised of two - 12 foot diameter shafts and approximately 5,600 ft of underground drifting
- Was to be excavated by drill & blast methods

THE TWO SHAFT CONCEPT

(CONTINUED)

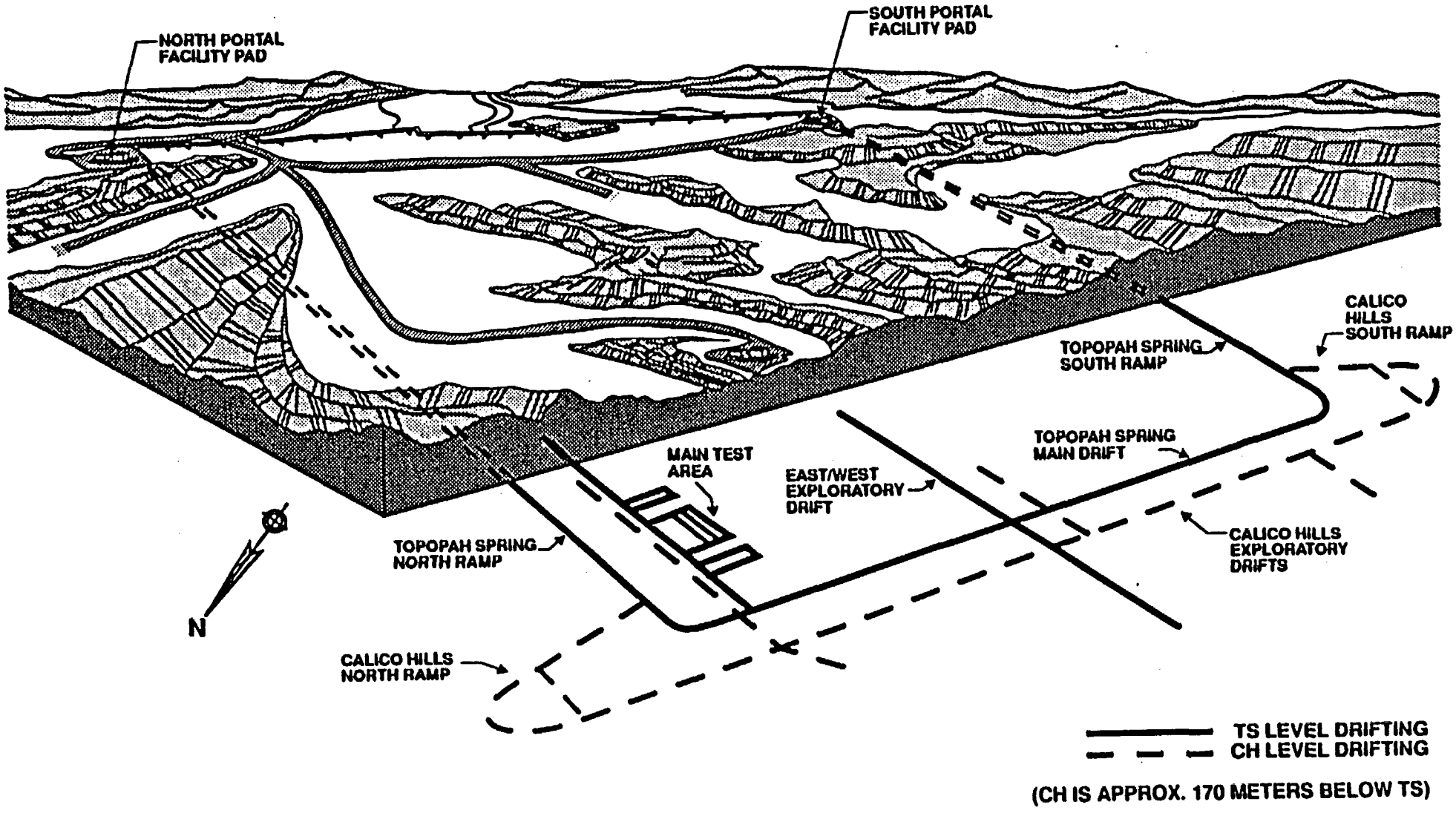
The SCP was reviewed by the Nuclear Regulatory Commission (NRC), the Nuclear Waste Technical Review Board (NWTRB), and others. Two primary comments were:

- The excavations as planned were not extensive enough, and would not provide a comprehensive look at the entire potential repository block
- Mechanical excavation would be preferable to drill & blast methods

THE EXPLORATORY STUDIES FACILITY ALTERNATIVES STUDY (ESFAS)

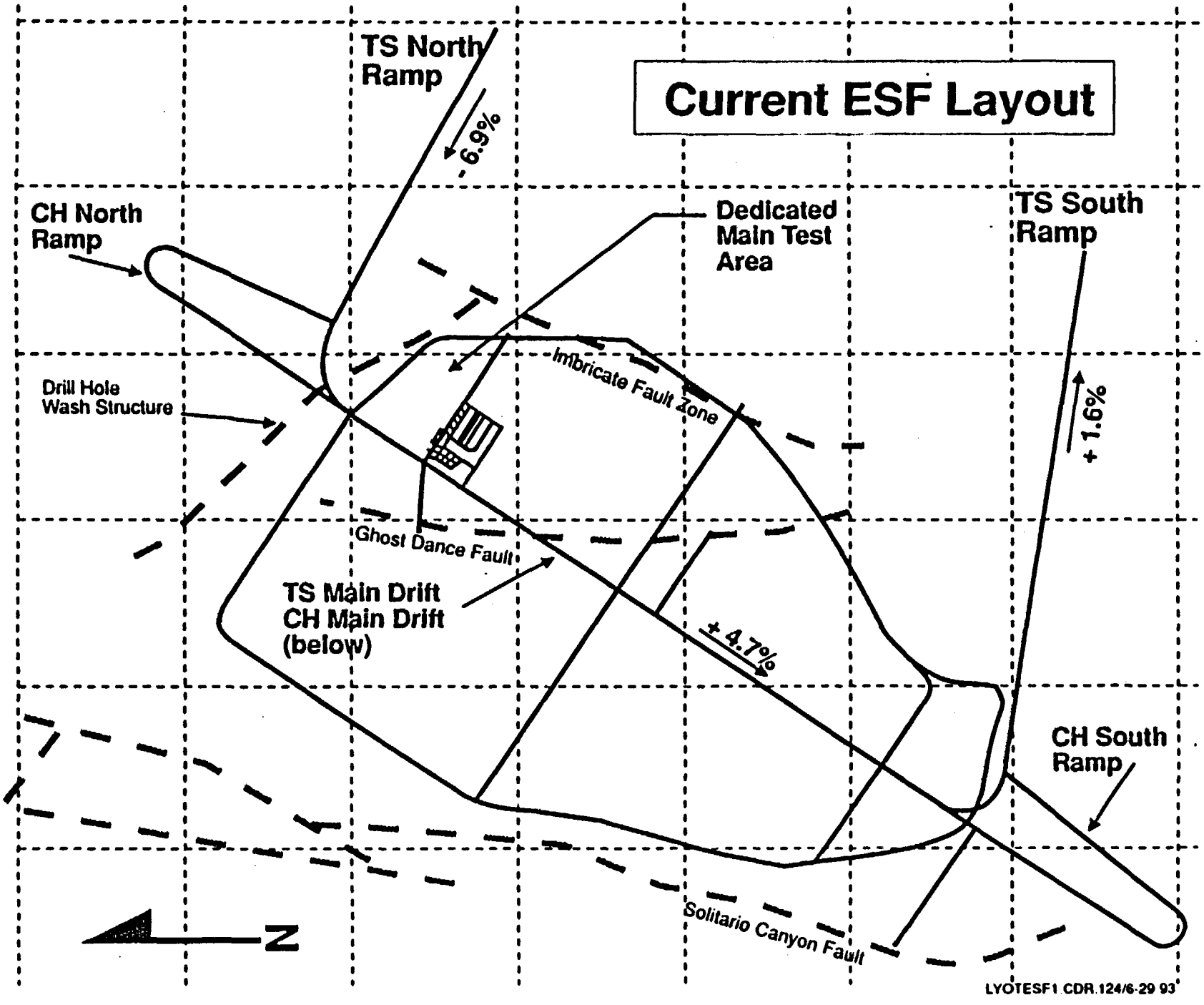
- The ESFAS was undertaken in 1990 to re-evaluate the ESF concept
- 34 different options were developed and evaluated
- Shaft access, ramp access, and combinations of both were included
- Option 30 was the preferred alternative and, with minor modifications, was chosen as the concept to be pursued in Title I design

PRELIMINARY DESIGN



(CH IS APPROX. 170 METERS BELOW TS)

ESFPRELBW.CDR XSEC/5 18 93


Current ESF Layout
TS North Ramp
-6.9%
CH North Ramp
Dedicated Main Test Area
TS South Ramp
Drill Hole Wash Structure
Imbricate Fault Zone
+1.6%
Ghost Dance Fault
TS Main Drift
CH Main Drift (below)
+4.7%
CH South Ramp
Solitario Canyon Fault
N
LYOTESF1.CDR.124/6-29 93

AN ENHANCEMENT TO THE CURRENT ESF LAYOUT HAS BEEN DEVELOPED WHICH WOULD:

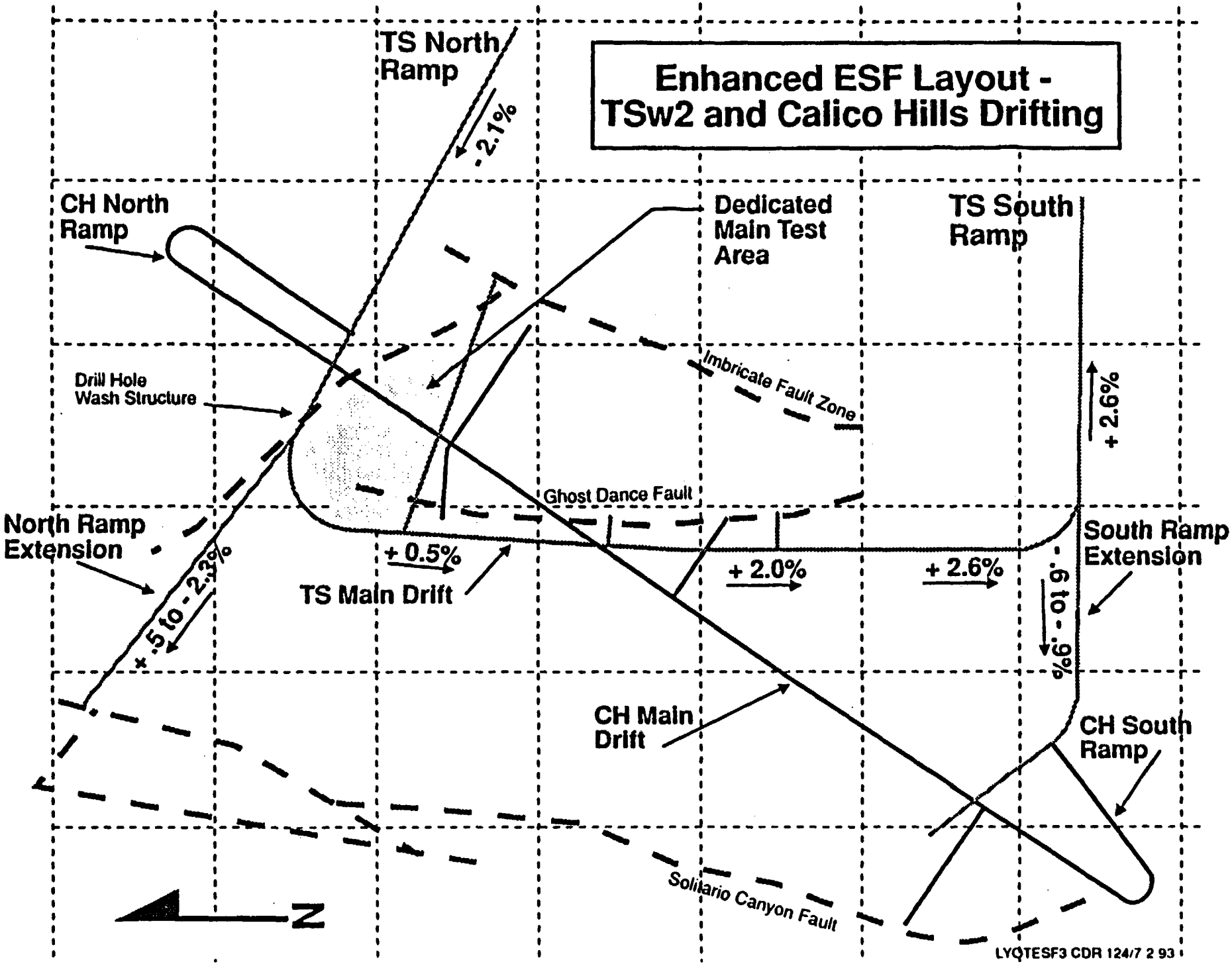
- Maintain the portal location and horizontal alignment of the North Ramp
- Result in having no grade in excess of 2.7% in the North Ramp, Main TSL drift, and South Ramp
- Preserve repository flexibility to a much greater degree than the current configuration
- Increase the distance from emplacement drifts to the water table

ENHANCEMENT

(CONTINUED)

- Better accommodate repository layouts having flat emplacement drifts, and layouts which seek to avoid having emplacement drifts cross the Ghost Dance

- Maintain the full scope of site suitability and characterization testing provided by Option 30, and significantly enhance the characterization of the Ghost Dance without affecting repository layout flexibility


Enhanced ESF Layout -
TSw2 and Calico Hills Drifting
TS North Ramp
-2.1%
CH North Ramp
Dedicated Main Test Area
TS South Ramp
Drill Hole Wash Structure
Imbricate Fault Zone
+ 2.6%
Ghost Dance Fault
North Ramp Extension
+ .5 to - 2.3%
+ 0.5%
TS Main Drift
+ 2.0%
+ 2.6%
- .6 to - .9%
South Ramp Extension
CH Main Drift
CH South Ramp
Solitario Canyon Fault
N
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ADVANTAGES TO THE ENHANCED LAYOUT

- Enhances Site Characterization ability
  - Multiple Ghost Dance Fault contacts can be made with relative ease
  - Two Solitario Canyon Fault contacts are planned instead of one
  - Ramp extensions give a good look at a large percentage of the vertical extent of the TSw2 interval
- Maximizes distance from emplacement drifts to water table

ADVANTAGES TO THE ENHANCED LAYOUT

(CONTINUED)

- Avoids emplacement drifts crossing Ghost Dance Fault
- Rail haulage for construction/operation of the ESF loop is possible
- Rail haulage option for the potential repository is maintained
- Design flexibility for the potential repository is enhanced

LONG RANGE
ESF COST & SCHEDULE DATA

OVERALL ESF SCHEDULE

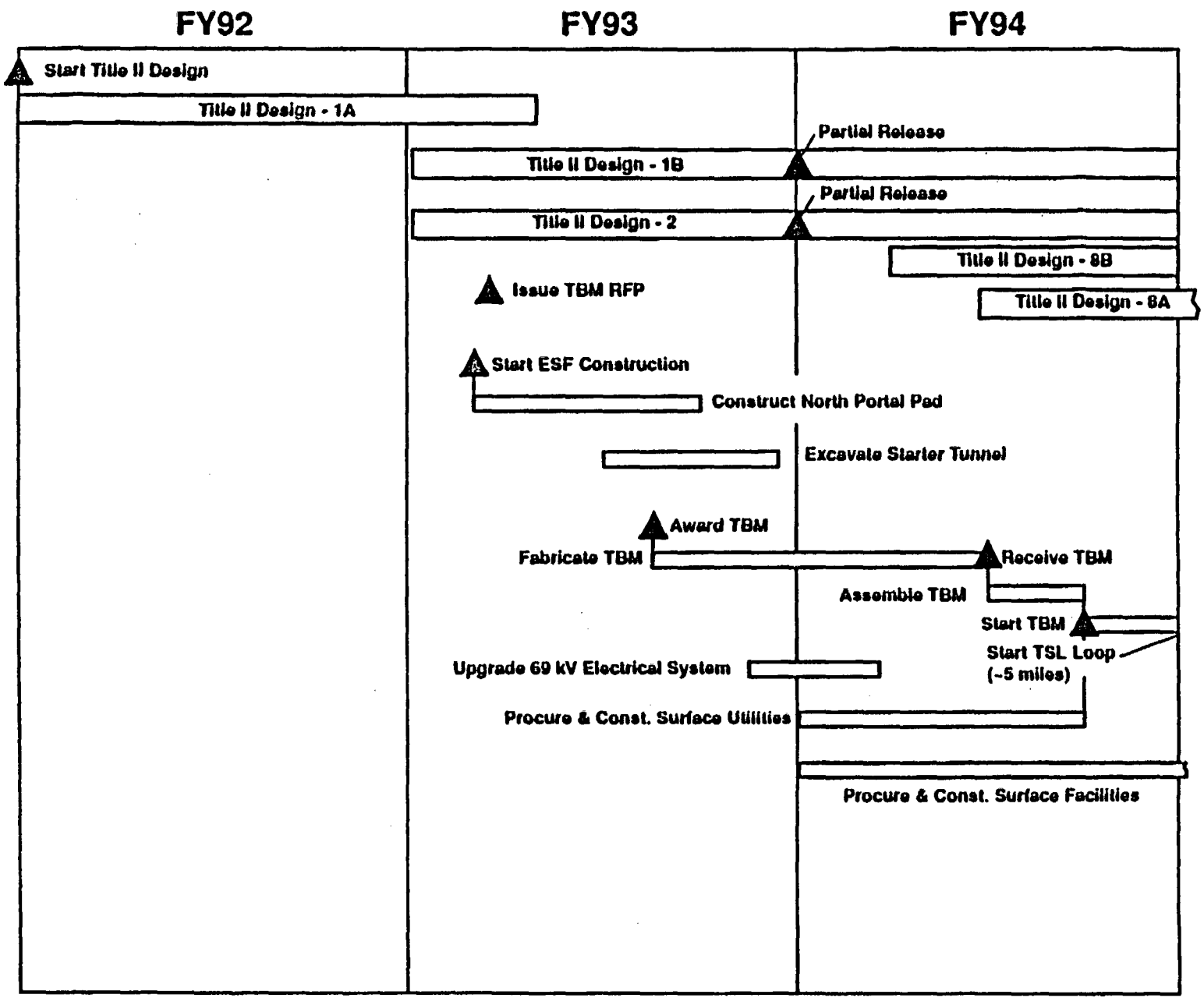
Base assumptions:

1. 1-25' TBM and 1-18' TBM

2. TBM advance rate = 114 meters/week

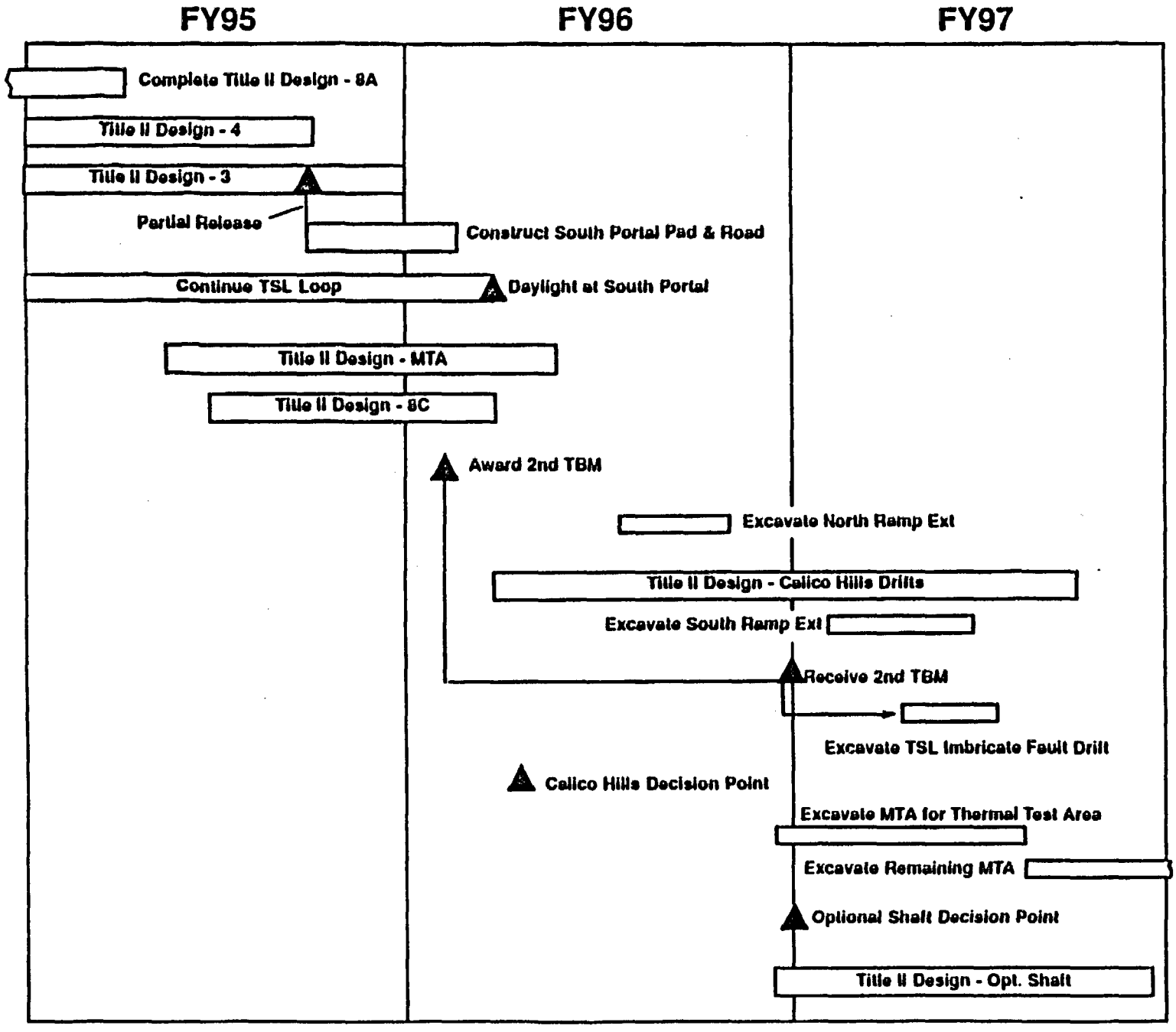
3. Funding profile
   - FY92 - $ 7M
   - FY93 - $ 48M
   - FY94 - $ 55M
   - FY95 - $ 70M
   - FY96 - $ 68M
   - FY97 - $ 110M
   - FY98 - $ 100M
   - FY99 - $ 75M
   - FY00 - $ 75M
   - FY01 - $ 20M
   - FY02 - $ 20M

OVERALL ESF SCHEDULE



OVI SFSC PM5 CPG 8 30 91

OVERALL ESF SCHEDULE



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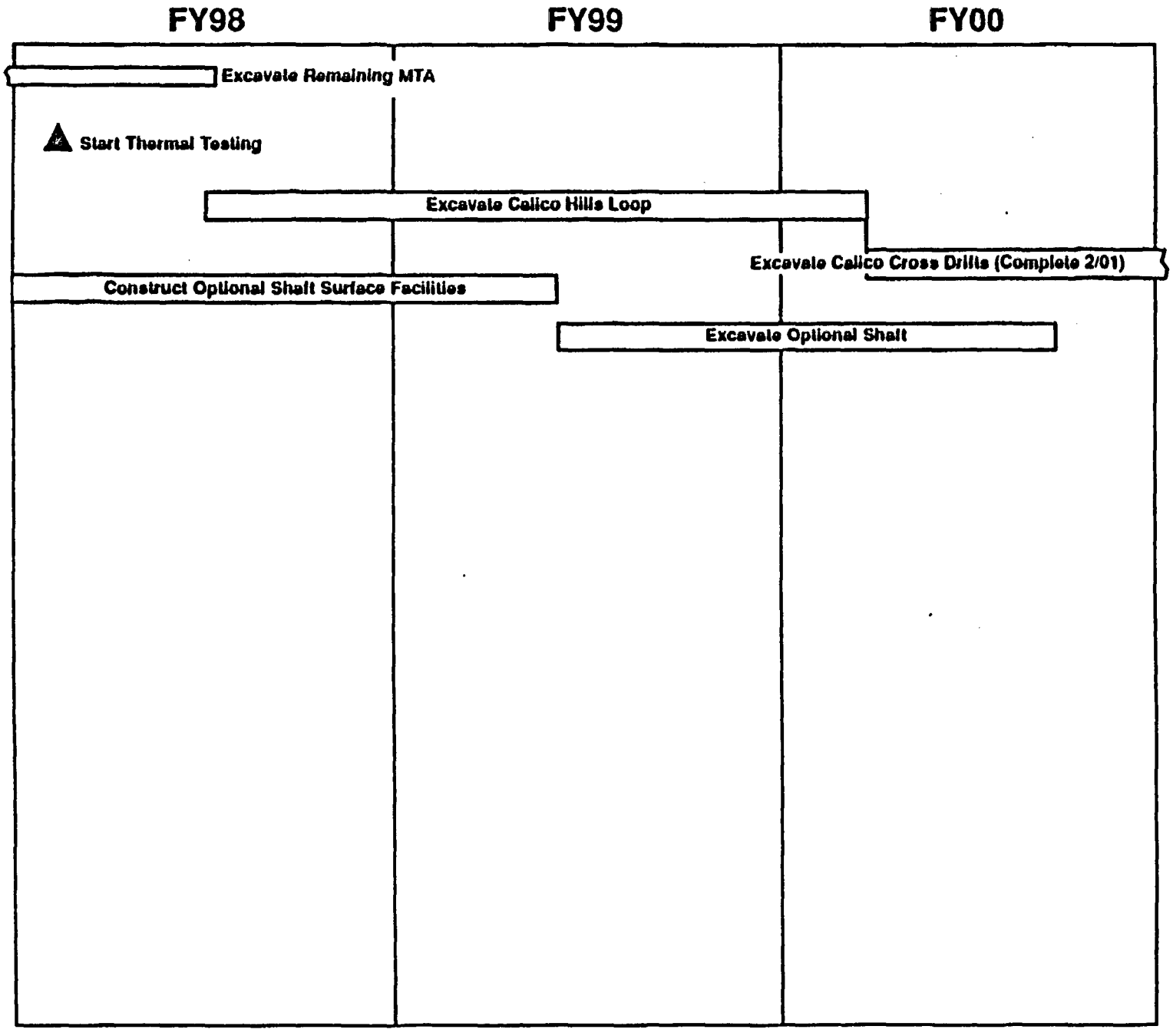
OVERALL ESF SCHEDULE



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ESF
FY94 ACTIVITIES AND BUDGETS

EXPLORATORY STUDIES FACILITY

WBS 1.2.6
FY 94 BUDGET SUMMARY

$55,000K

DESIGN ACTIVITIES

- 1.2.6.1.4; Title III; M&O; $2,484K; 16.9 FTEs

Remainder of Package 1

- 1.2.6.2.1.4; Roads & drainage; M&O; $240K; 1.5 FTEs
- 1.2.6.2.2.1; Utilities; M&O; $787K; 4.7 FTEs
- 1.2.6.3.1.1; Facilities; M&O; $673K; 4.2 FTEs

Remainder of Package 2

- 1.2.6.4.2; North Ramp; M&O; $1,148K; 9.3 FTEs

Package 8B

- 1.2.6.6.6.1.2; North Ramp Ext.; M&O; $1,608K; 12.0 FTEs

Package 8A

- 1.2.6.6.1.2; TSL Main Drift; M&O; $750K; 5.6 FTEs

IDS

- 1.2.6.8.4; IDS Design; M&O; $950K; 4.3 FTEs

CONSTRUCTION ACTIVITIES

- 1.2.6.2.1.1; Storm drains and grading; REECo; $1,505K; (14 FTEs, $300K material and equipment)
- 1.2.6.2.1.4; Muck storage and conveyor road; REECo; $170K; (5.1 FTEs, $1,270K material and equipment)
- 1.2.6.2.2.1; Pad utilities; REECo; $4,730K; (13.0 FTEs, $2,970K capital, $720K material)
- 1.2.6.2.2.4; Off pad utilities; REECo; $2,035K; (12.2 FTEs $135K capital, $863K material)
- 1.2.6.2.2.5; Electrical upgrade; REECo; $1,800K; (6 FTEs, $500K capital, $790K material)

CONSTRUCTION ACTIVITIES

(CONTINUED)

- 1.2.6.4.1; North Portal; REECo; $1,360K;
  (4.7 FTEs, $675K capital, $285K material)
- 1.2.6.4.2; North Ramp; REECo; $15,085K;
  (21 FTEs, $4,500K capital, $8,800 material)
- 1.2.6.4.4.; Construction test support; REECo; $650K;
  (5.8 FTEs, $160K capital, $0 material)
- 1.2.6.8.4.; IDS; $445K;
  (0.5 FTEs $370K capital, $10K material)

DESIGN CONTROL - RESPONSE TO NRC LETTER

RESPONSE TO NRC'S LETTER OF 8/20/93

Overview:

- The letter was not unexpected, and falls within the normal course of DOE's interactions with the NRC
- No objection was issued, and most of the deficiencies noted by the NRC were identified by DOE and reported to the NRC during normal internal reviews and audits
- We are committed to 100% compliance with All Quality Assurance requirements

RESPONSE TO SPECIFIC POINTS IN THE LETTER

- We do not believe our design process is "out of control." Each identified problem has been carefully examined and we are confident there is not compromise of our products or the public safety

- A detailed plan for process improvement has been developed and is being implemented. The plan has been informally communicated to the on-site NRC representative, and will be formally transmitted to the NRC

- DOE feels that the current ESF concept is consistent with the process described in the SCP. We believe a phased approach to ESF design and construction makes sense because this is a scientific program, and the phased approach allows the flexibility needed to accommodate new site data and new approaches to its acquisition. DOE is preparing for an upcoming Technical Exchange with the NRC to clarify this process

RESPONSE TO SPECIFIC POINTS IN THE LETTER

(CONTINUED)

- Technical Exchanges, design reviews, and the Semiannual Site Characterization Progress Reports are intended to provide NRC with timely information about changes in DOE's program
- We are evaluating these mechanisms to determine how they can be made more effective
- DOE will provide a detailed response to the NRC's letter within 90 days, as requested in the 8/20/93 letter

ESF/REPOSITORY/WASTE PACKAGE INTERACTION

INTERRELATIONSHIP OF THE ESF, REPOSITORY, AND WASTE PACKAGE

Parts of the ESF would become parts of a potential repository. 10 CFR 60 contains the following guidance:

- Exploratory activities must be conducted so as to limit adverse effects on the long-term performance of the geologic repository (10CFR60.15(c)(1))
- The number of boreholes and shafts should be limited to the extent practical (10CFR60.15(c)(2))
- To the extent practical, boreholes and shafts for characterization should be located where shafts or large unexcavated areas are planned for the repository (10CFR60.15(c)(3))
- Exploratory drilling, excavation, and testing must be planned and coordinated with the repository design (10CFR60.15(c)(4))

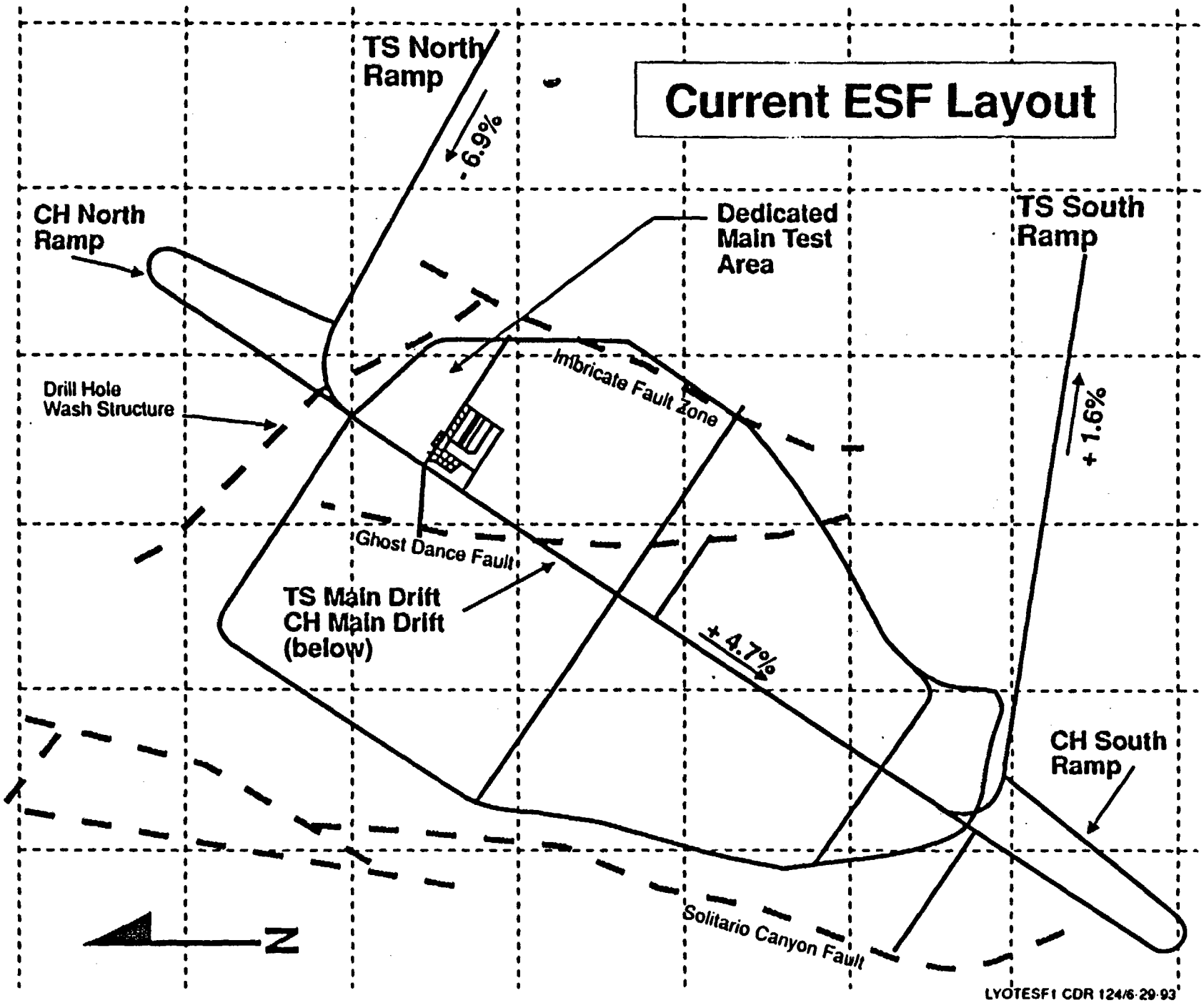
INTERRELATIONSHIP OF THE ESF, REPOSITORY, AND WASTE PACKAGE

(CONTINUED)

ESF/Repository

In addition to the regulatory considerations, the ESF will provide data for repository design and construction:

- Excavation processes used during ESF construction will be studied for their applicability to repository construction
- Thermomechanical testing in the ESF will be used to develop a thermal loading strategy for the Repository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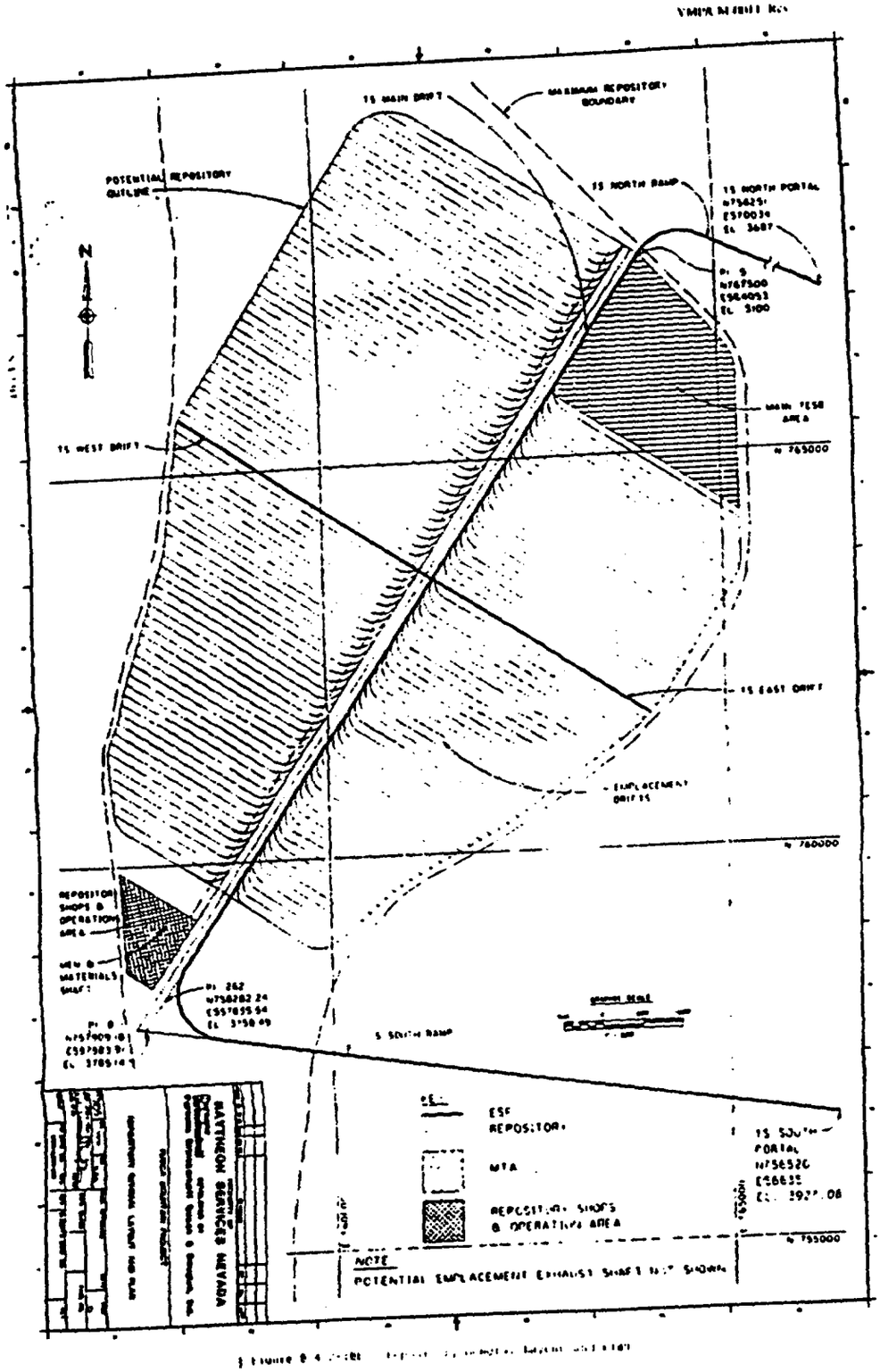
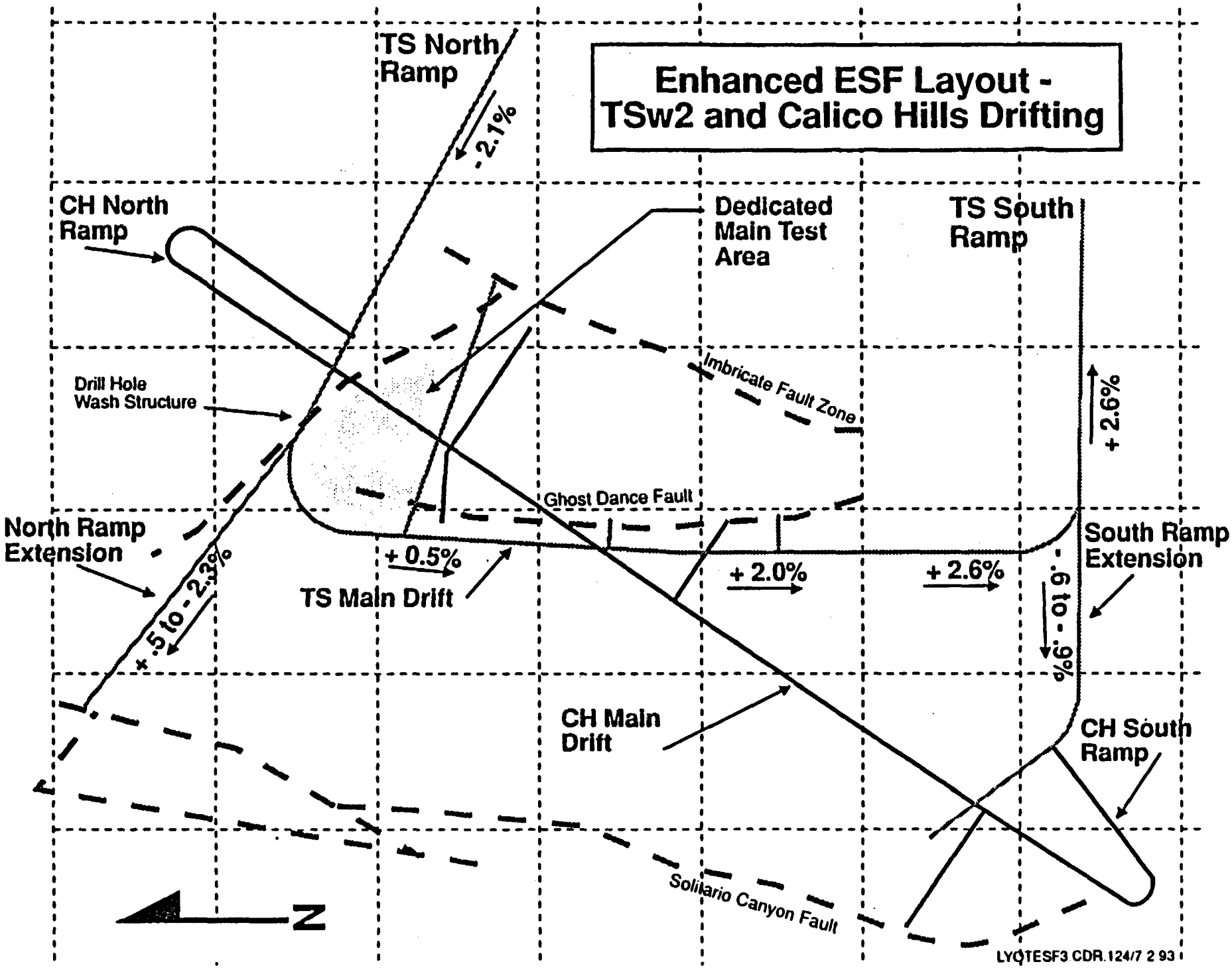
LYOTESF1 CDR 124/6-29-93


MAXIMUM REPOSITORY BOUNDARY
15 MAIN DRIFT
POTENTIAL REPOSITORY OUTLINE
15 NORTH RAMP
15 NORTH PORTAL
N
15 WEST DRIFT
N 765000
15 EAST DRIFT
EMPLACEMENT DRIFTS
N 760000
REPOSITORY SHOPS & OPERATIONS AREA
MEN & MATERIALS SHAFT
5 SOUTH RAMP
15 SOUTH PORTAL
ESF
REPOSITORY
MTA
REPOSITORY SHOPS & OPERATIONS AREA
NOTE
POTENTIAL EMPLACEMENT EXHAUST SHAFT NOT SHOWN
N 755000
BATTELLE MONTAGUE
BATTELLE SERVICES NEVADA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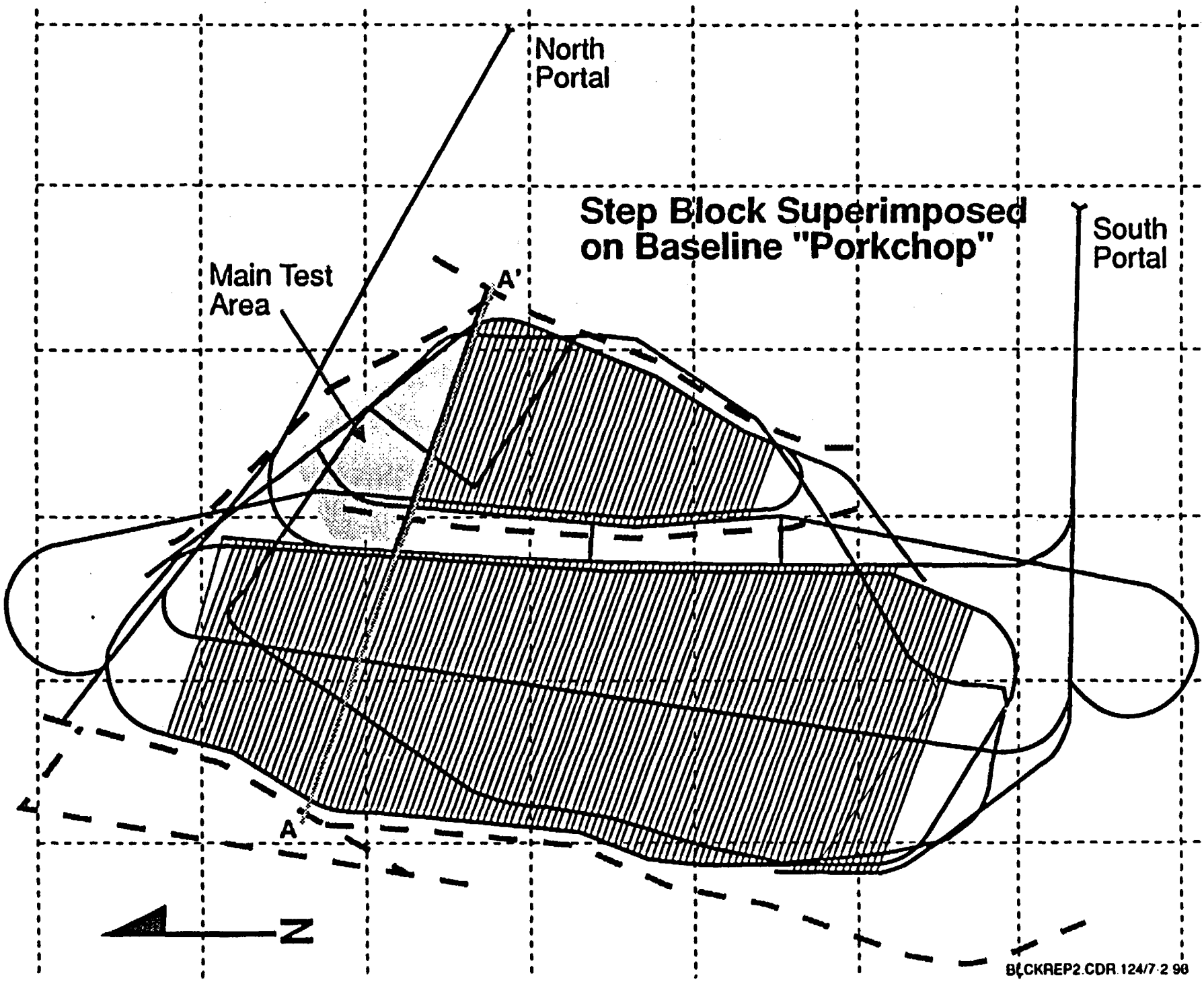
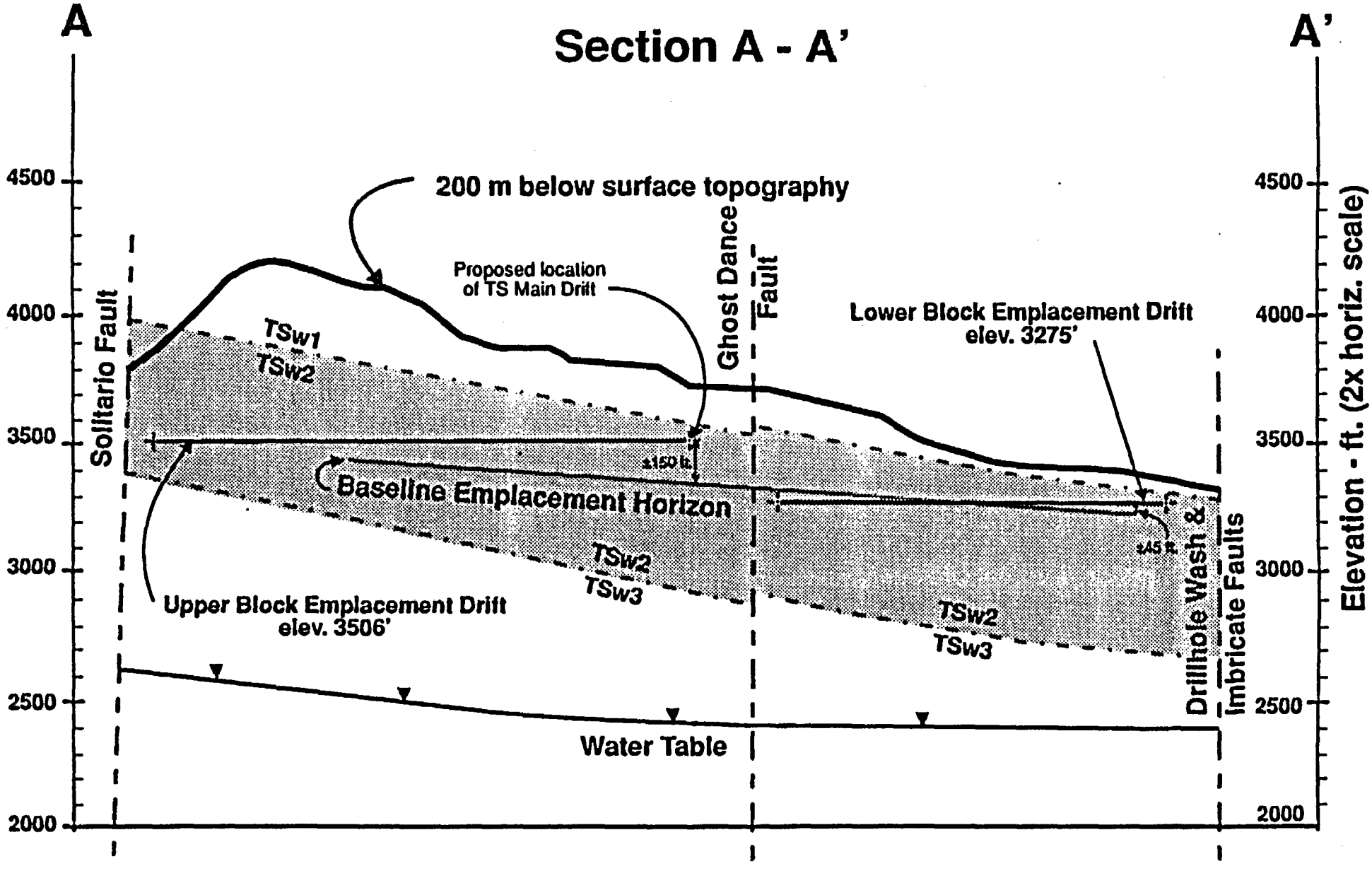

North
Portal
Step Block Superimposed
on Baseline "Porkchop"
South
Portal
Main Test
Area
A'
A
N
BLCKREP2.CDR 124/7-2 98



Note: Plane of section cuts through lowest emplacement drift in step-block layout.

SECTA-AR.CDR.124/6-29-93

INTERRELATIONSHIP OF THE ESF, REPOSITORY, AND WASTE PACKAGE

ESF - Waste Package

- Testing in the ESF will provide data for waste package design. Geochemical, Hydrochemical, and Thermomechanical data collected in the ESF will used in development of the waste package design
- No testing utilizing emplacement of radioactive materials is planned in the ESF
- ESF ramps and main drifts were sized for ESF operational needs; however, the ramp size was analyzed for its impact on potential waste handling. It was determined that the ramp size would not be a constraining factor on waste handling with the current waste package concepts being considered

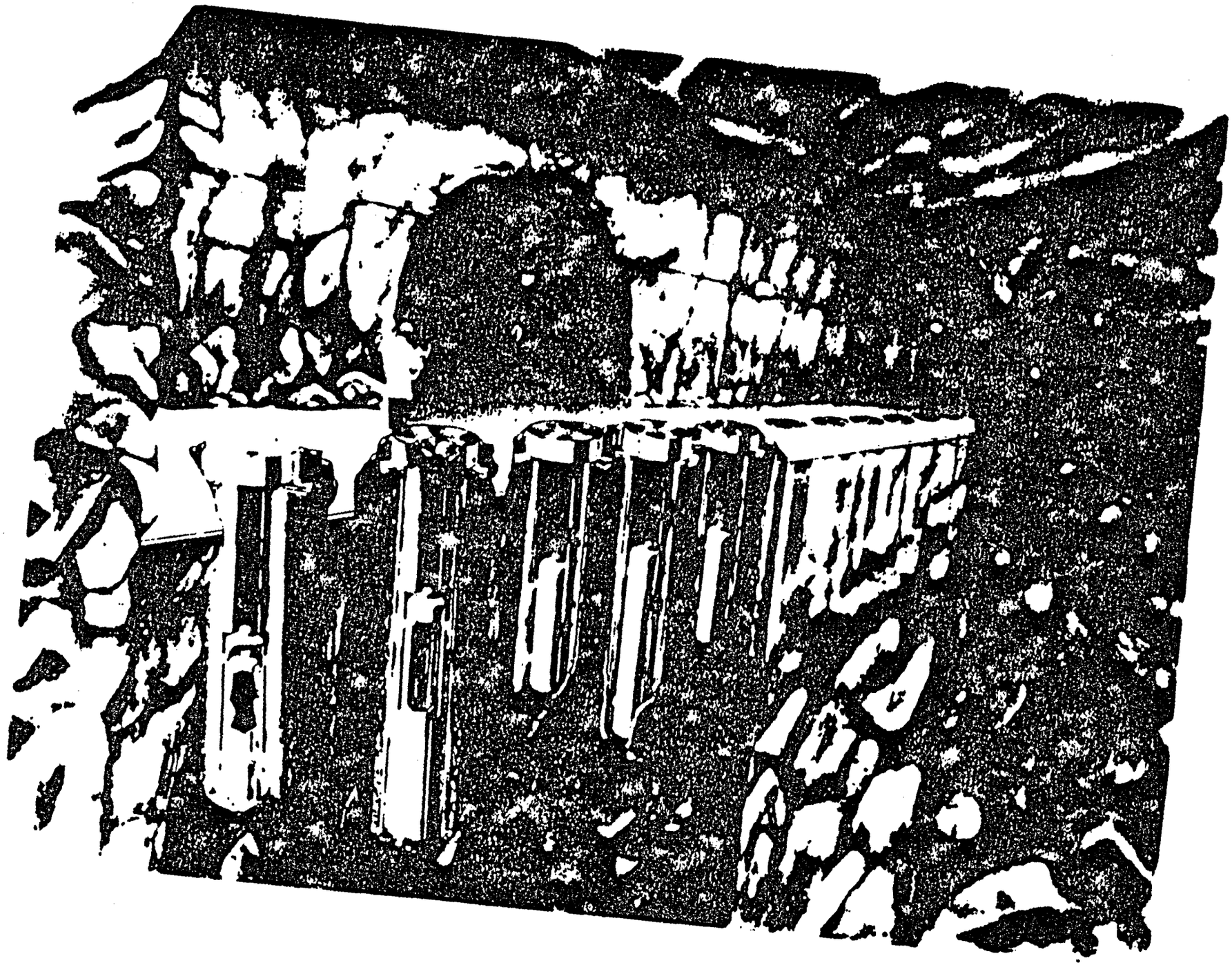
INTERRELATIONSHIP OF THE ESF, REPOSITORY, AND WASTE PACKAGE

(CONTINUED)

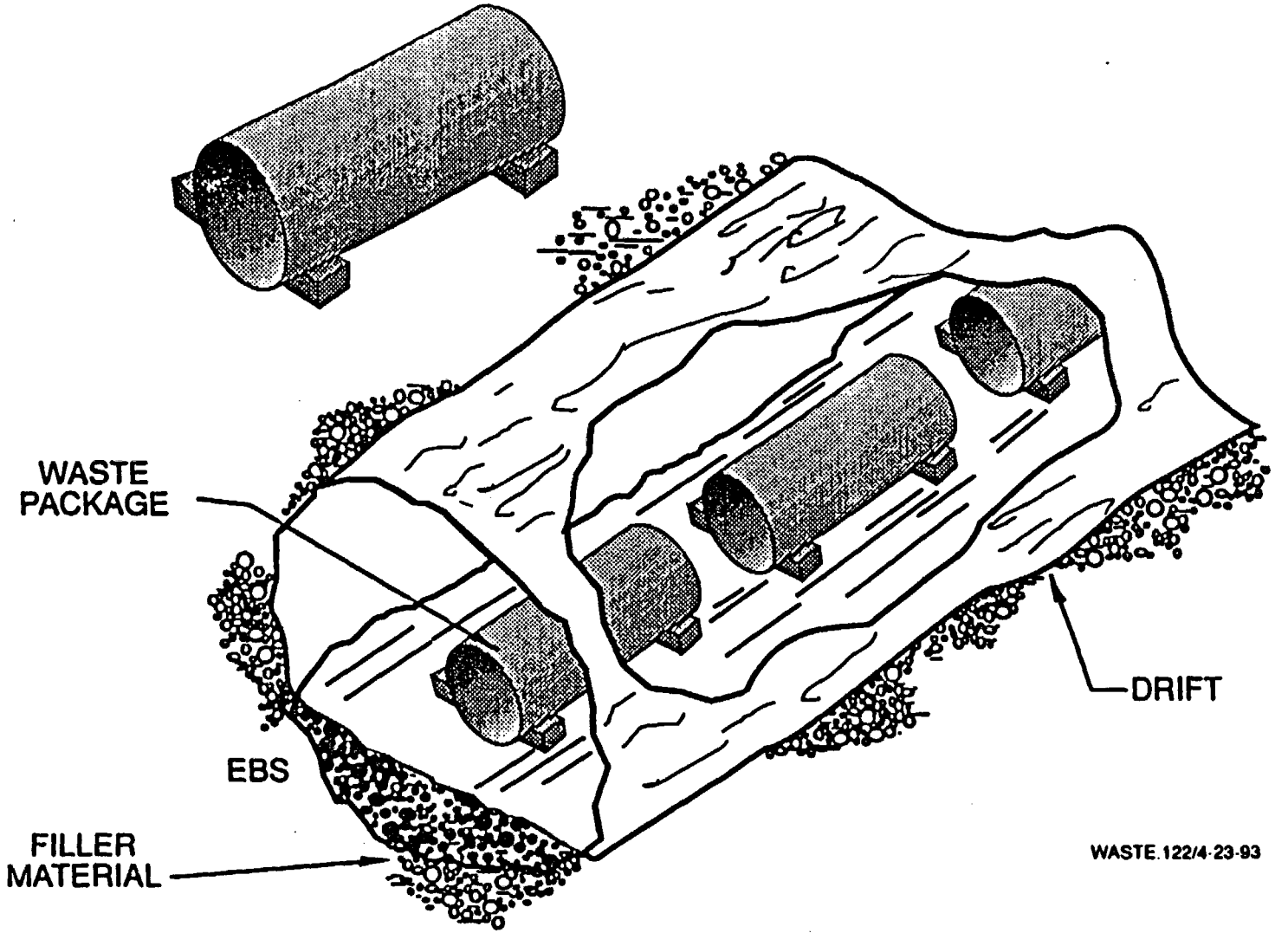
Waste Package - Repository

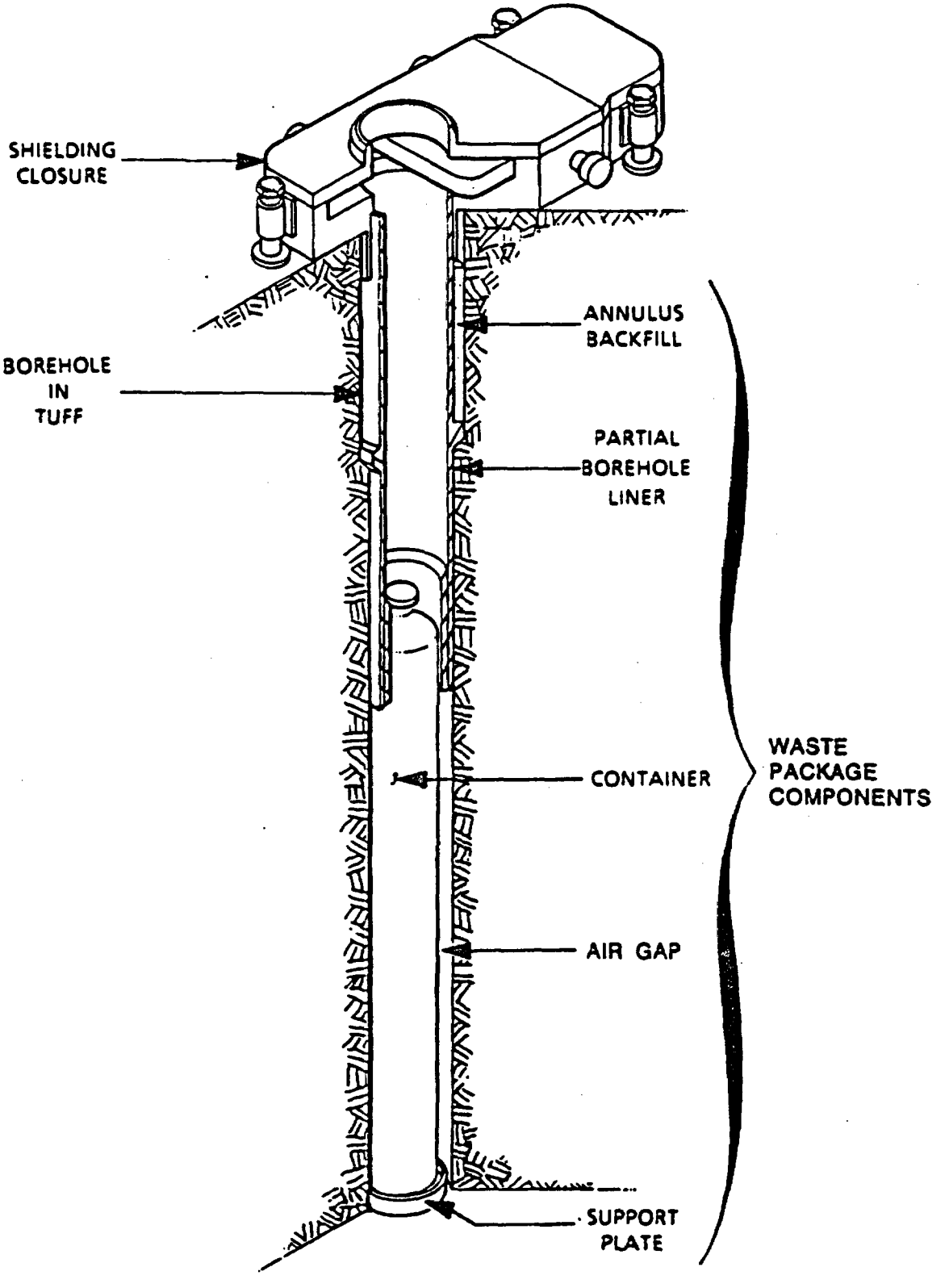
The waste package and repository designs are closely interconnected:

- Repository configuration and operations will be driven by the size of the waste package and by its thermal output
- The emplacement mode of the waste package will strongly influence repository configuration and operations
- Emplacement mode will also have an impact on the waste package configuration

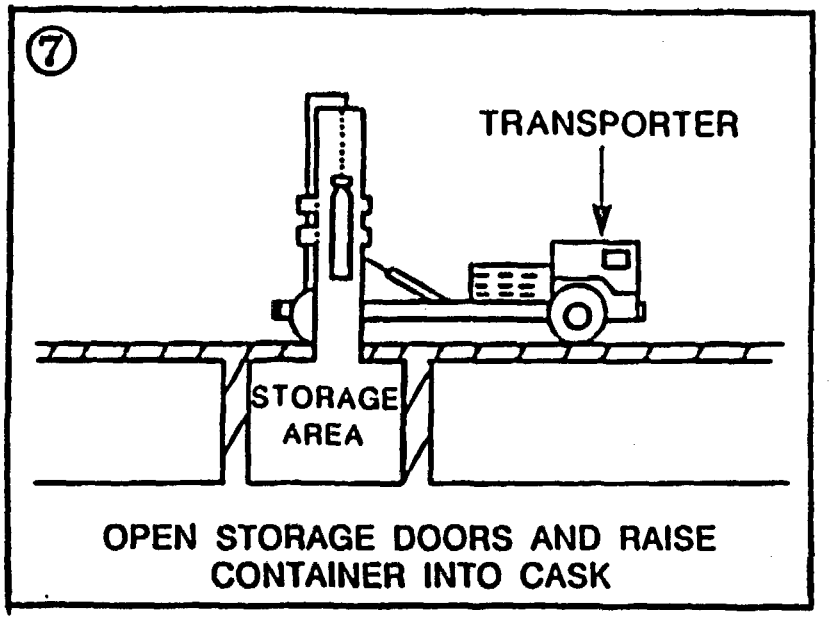


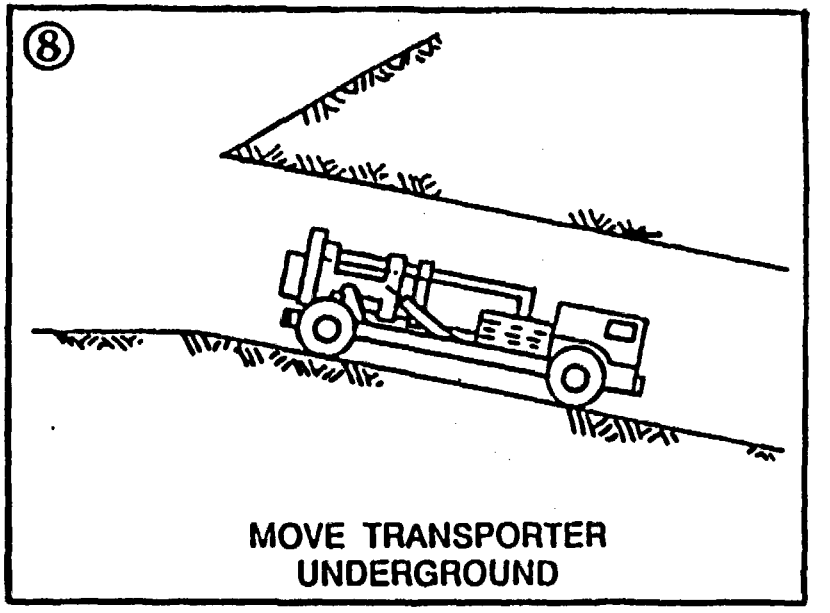
WASTE PACKAGE DRIFT EMPLACEMENT

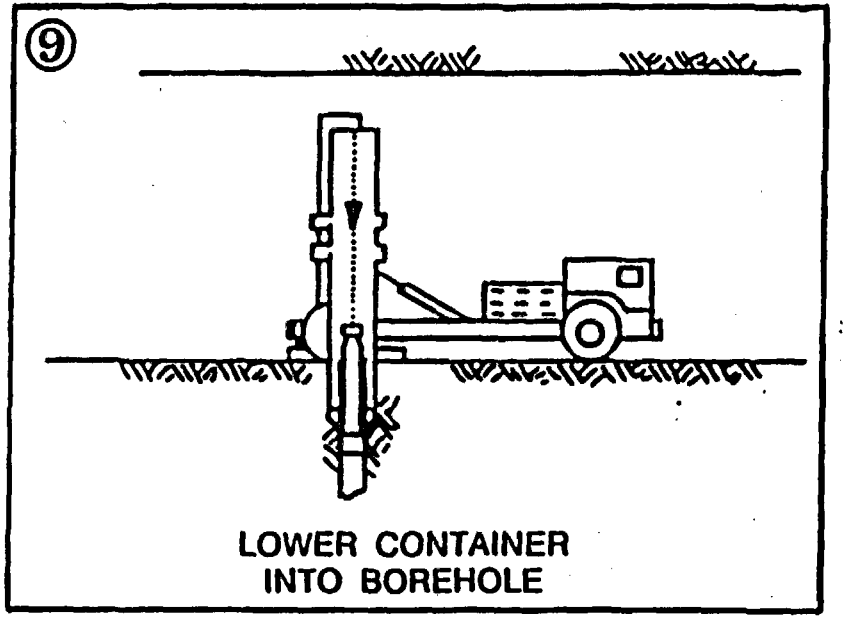




WASTE CONTAINER EMPLACED IN A VERTICAL BOREHOLE







EMPLACEMENT OF CONTAINER IN A VERTICAL EMPLACEMENT BOREHOLE