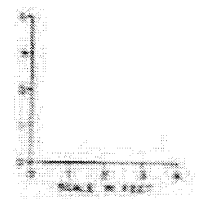


- EXPLANATION**
- FAULT ZONE: SAND, PLASTIC CLAY
SANDY MATRIX WITH AGGREGATE OF
RANDOMLY ORIENTED SILTSTONE
AND SHALE FRAGMENTS.
 - FAULT: SAND, STRONGER, COARSE, FINE
GRAINS INDICATE DIRECTION OF RELATIVE
MOVEMENT.
 - JOINT/FRACTURE PATTERN.
 - SILTYSTONE.
 - SILTYSTONE LAMINAR, DAMAGED WHERE BEDDING
PLANE CONTINUOUSLY MAPPED BUT SILTYSTONE
LITHOLOGY FINISHED OUT.
 - SHALE.
 - SHALE LAMINAR, AS LABELED.
 - BEDROCK CONCRETIONS.
 - MICRO-CRACK SAMPLE LOCATION NUMBERS GIVEN.

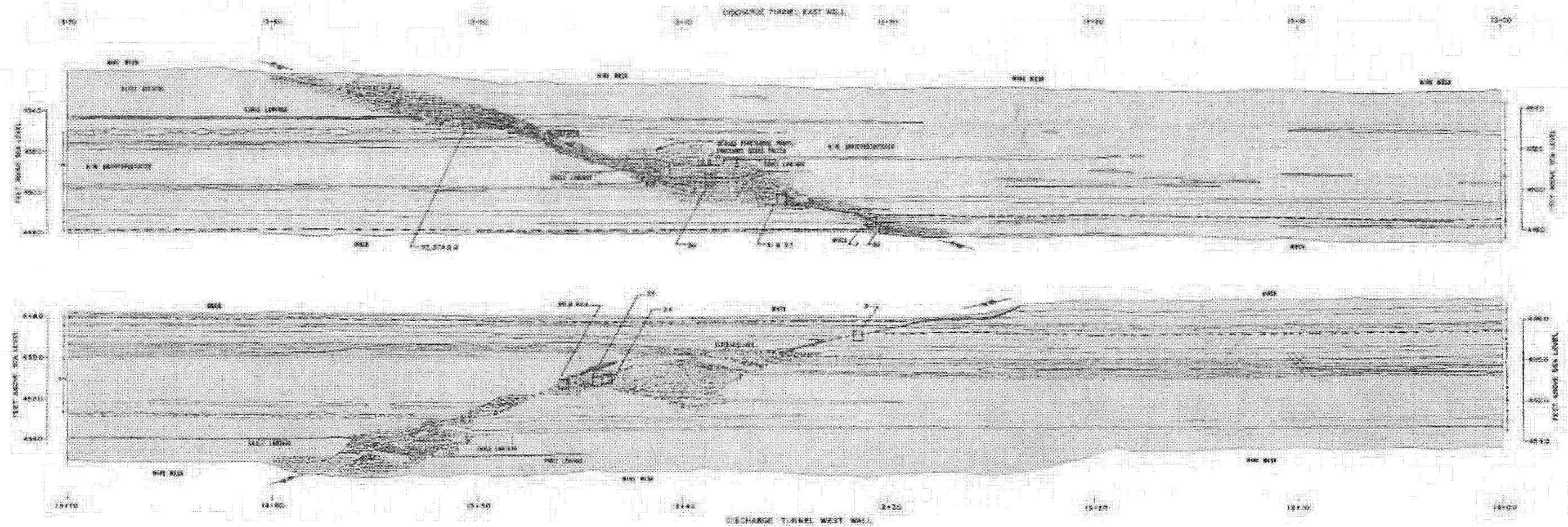


(Rev. 12 1/03)

PERRY NUCLEAR POWER PLANT

Intake Tunnel Fault Map

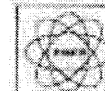
Figure 2.5-50



EXPLANATION

- FAULT SOURCE ZONE, GRAY, PLASTIC CLAY. LOOSE MATRIX WITH AGGREGATE OF RANDOMLY ORIENTED SILTSTONE AND SHALE FRAGMENTS.
- FAULT SOURCE, STRONGER 100 FT. THICK. ARROWS INDICATE DIRECTION OF RELATIVE MOVEMENT.
- JOINT/FRACTURE PATTERN.
- SILTSTONE.
- SILTSTONE LAMINAR, DASHED WHERE BEDDING PLANE CONTINUOUSLY MAPPED BUT SILTSTONE LITHOLOGY PINCHED OUT.
- SHALE.
- SHALE LAMINAR, AS CASED.
- CONCRETE CONCRETE.
- MICRO-GRAIN SAMPLE LOCATION NUMBER GIVEN.

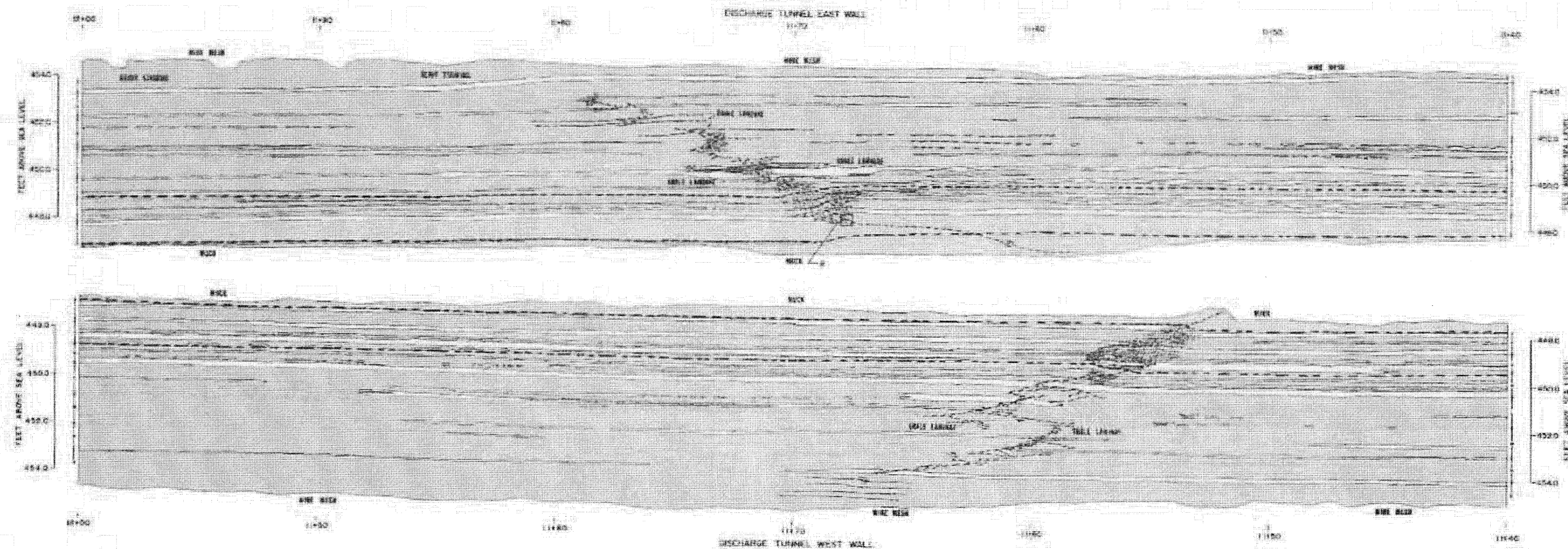
(Rev. 12 1/03)



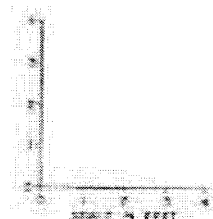
PERRY NUCLEAR POWER PLANT

Discharge Tunnel Fault Map

Figure 2.5-51



- EXPLANATION**
- FAULT ZONE. GRAY, PLASTIC CLAY MUDS WITH AGGREGATE OF RANDOMLY ORIENTED SILTSTONE AND SHALE FRAGMENTS.
 - FAULT ZONE STRINGER. 4-6 IN. THICK. ARROWS INDICATE DIRECTION OF RELATIVE MOVEMENT.
 - JOINT/FRACTURE PATTERN.
 - SILTSTONE.
 - SILTSTONE LAMINA, CARVED WHERE BEDDING PLANE CONTINUOUSLY MAPPED BUT SILTSTONE LITHOLOGY FINISHED OUT.
 - SHALE.
 - SHALE LAMINA, AS LABELED.
 - IRONSTONE CONCRETIONS.
 - MICRO-CRACK SAMPLE LOCATION. NUMBER GIVEN.

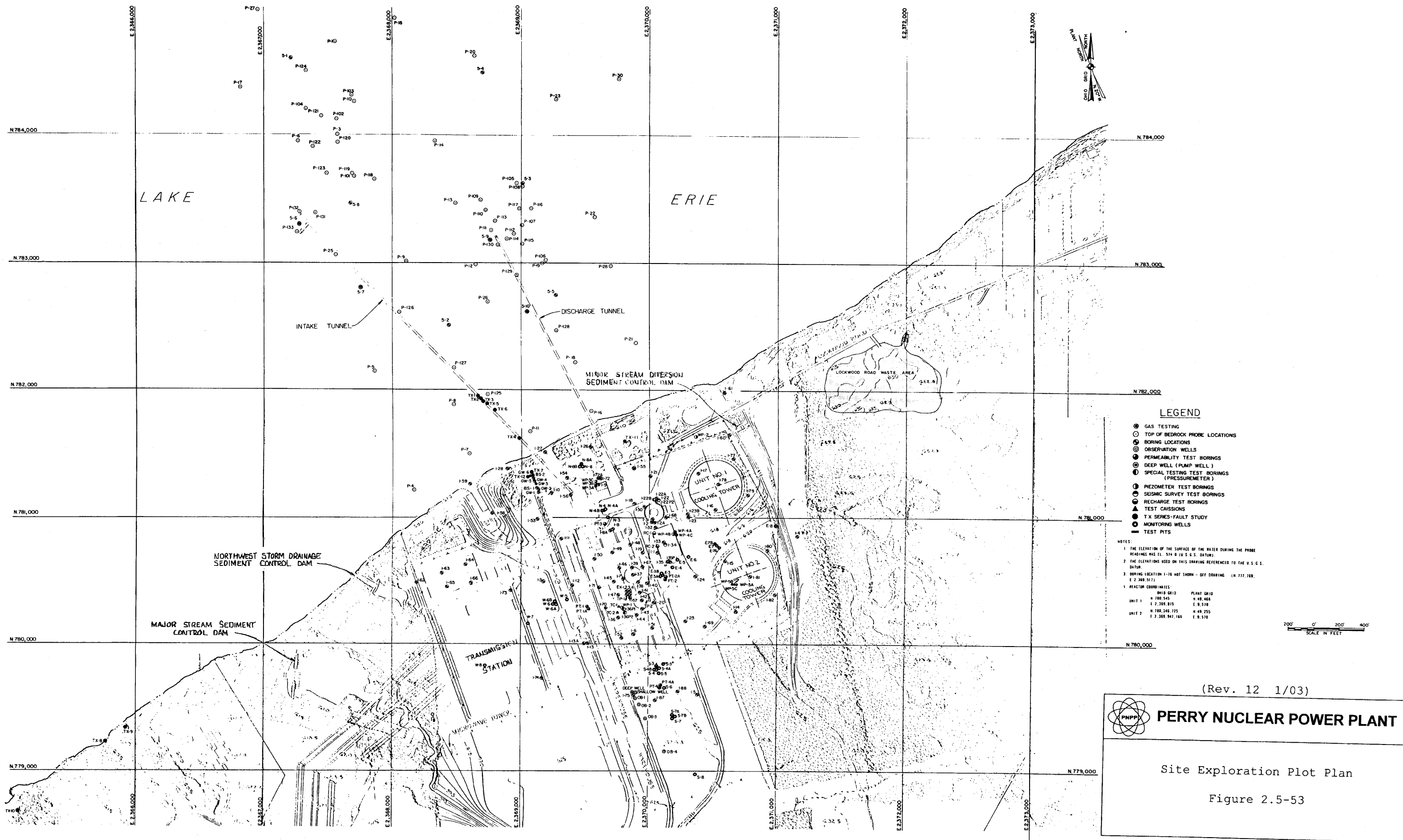


(Rev. 12-1-83)




PERRY NUCLEAR POWER PLANT

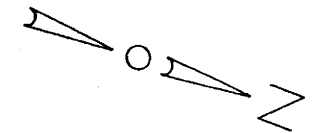
Discharge Tunnel Fracture Zone Map

Figure 2.5-52

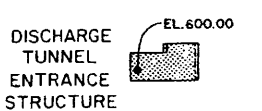
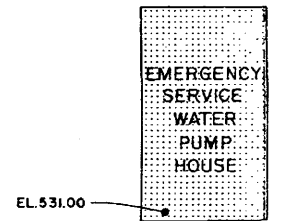
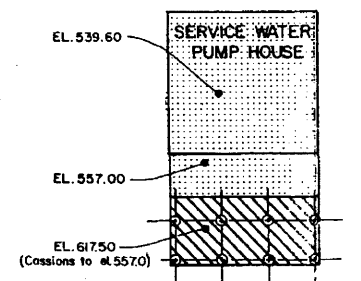
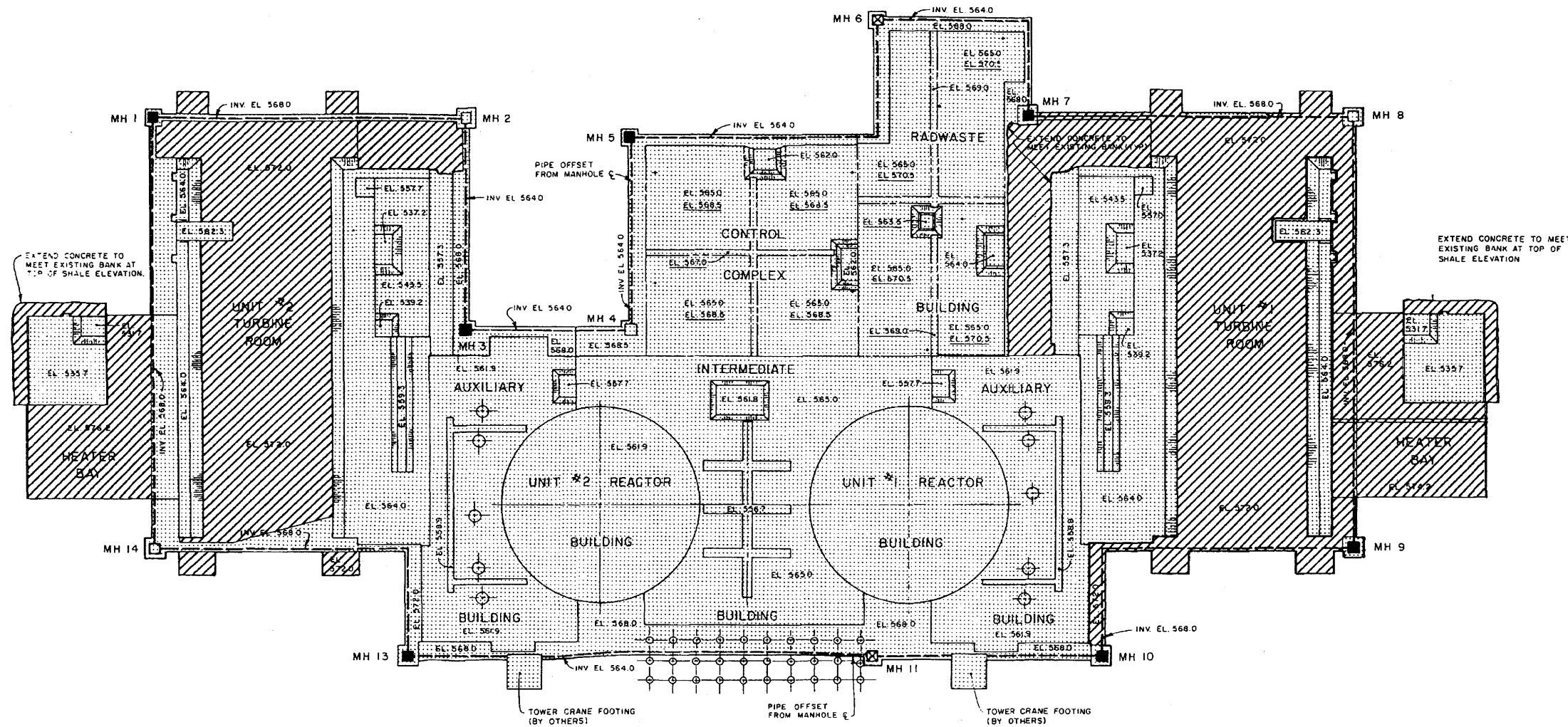


LEGEND

-  SHALE
-  LOWER TILL
-  UPPER TILL / LACUSTRINE




40 0 40 80
SCALE IN FEET



NOTE:
EACH COOLING TOWER RESTS ON 498 PILES. THE PILES ARE SEATED IN SHALE.

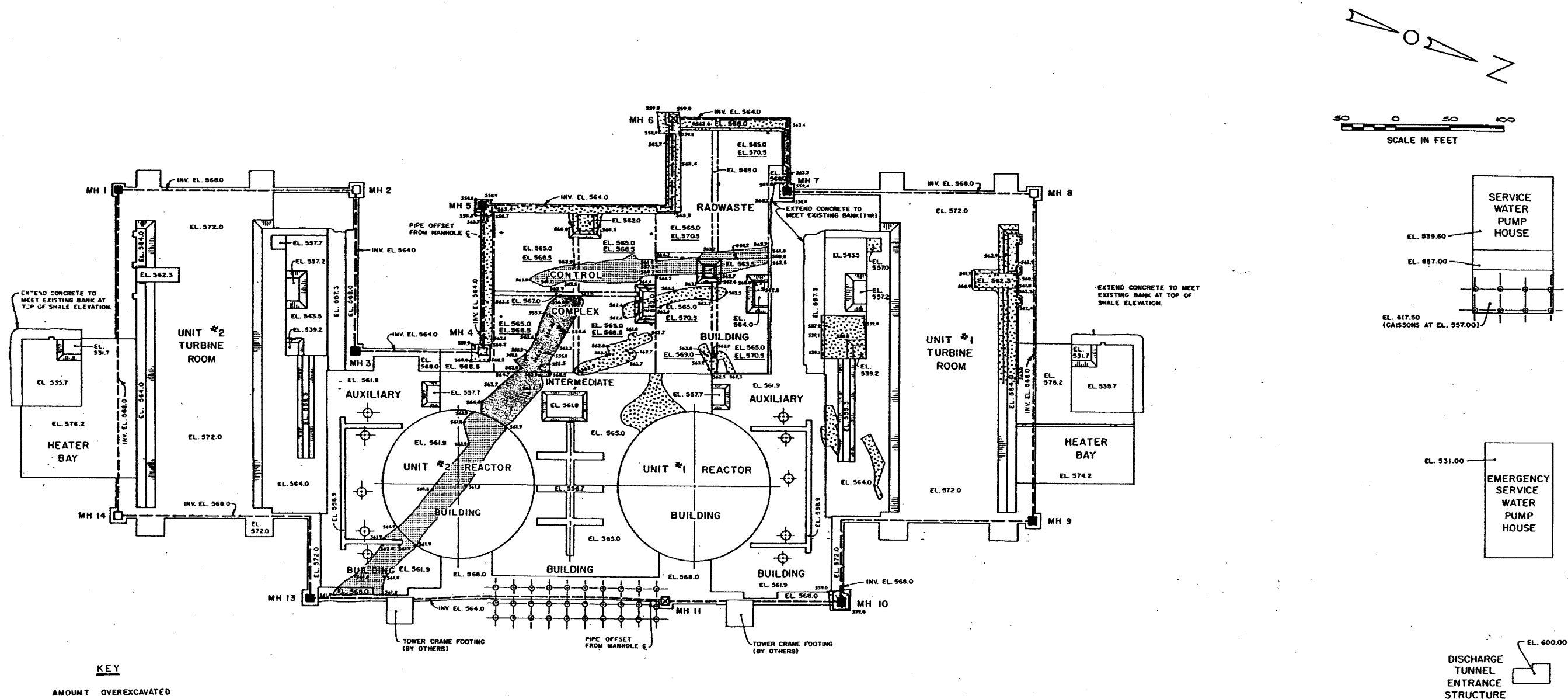
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Plant Structures Foundation
Grade Materials

Figure 2.5-54

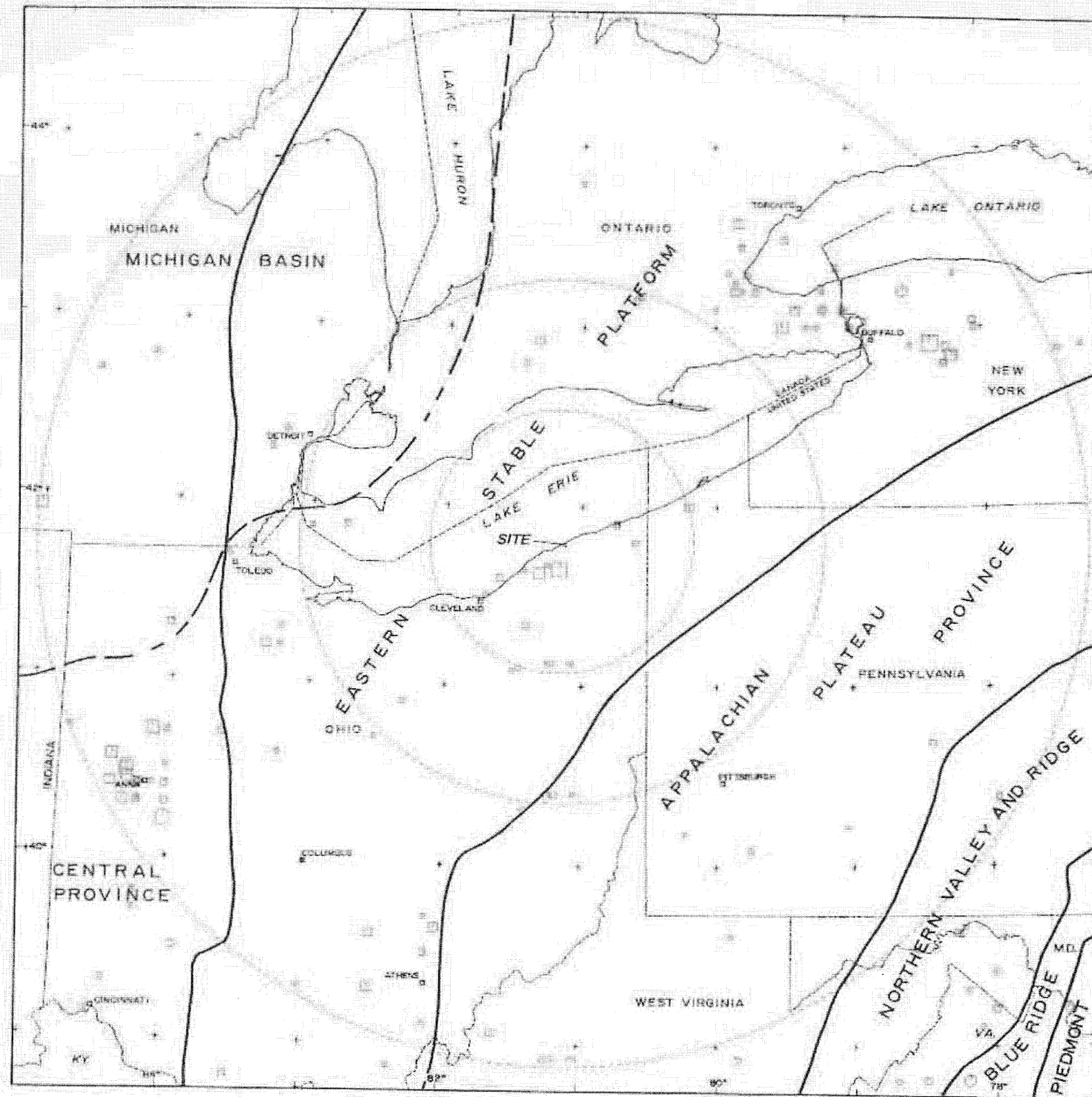


(Rev. 12 1/03)

PERRY NUCLEAR POWER PLANT

Foundation Overexcavation
Plan

Figure 2.5-55



REGIONAL TECTONIC PROVINCES


- Province Boundary
- Michigan Basin Tectonic Province Boundary constructed from Midland ASLB LBP-85-2 (72, 271)

EARTHQUAKES

TIME WINDOW BEGINNING JULY 1986, ENDING DEPT. 1991

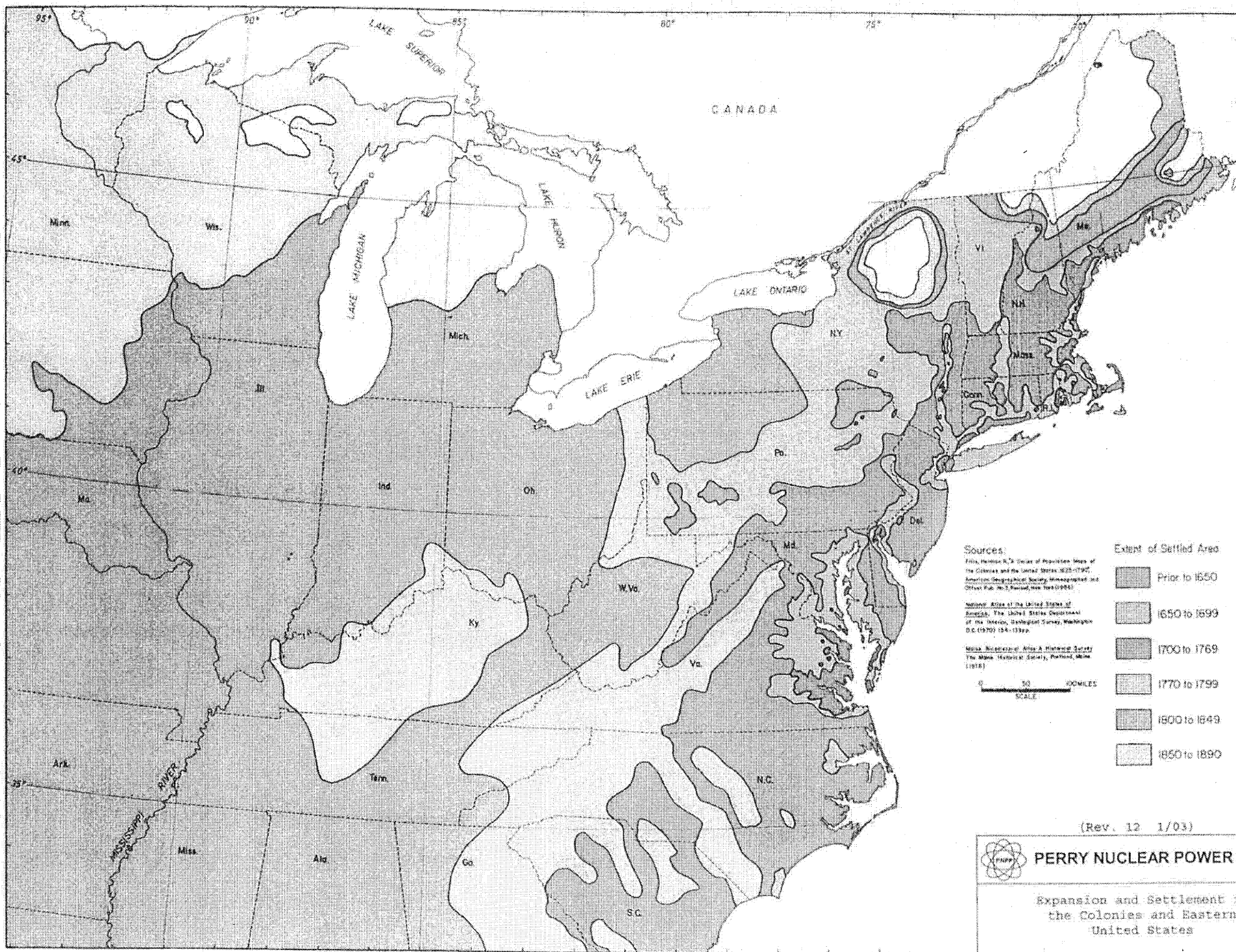
MAGNITUDE		INTENSITY	
2	3	I	III
3	4	II	IV
4	5	III	V
5	6	IV	VI
6	7	V	VII
7	8	VI	VIII

(Rev. 12 1/03)


PERRY NUCLEAR POWER PLANT

Tectonic Provinces and Earthquakes

Figure 2.3-56



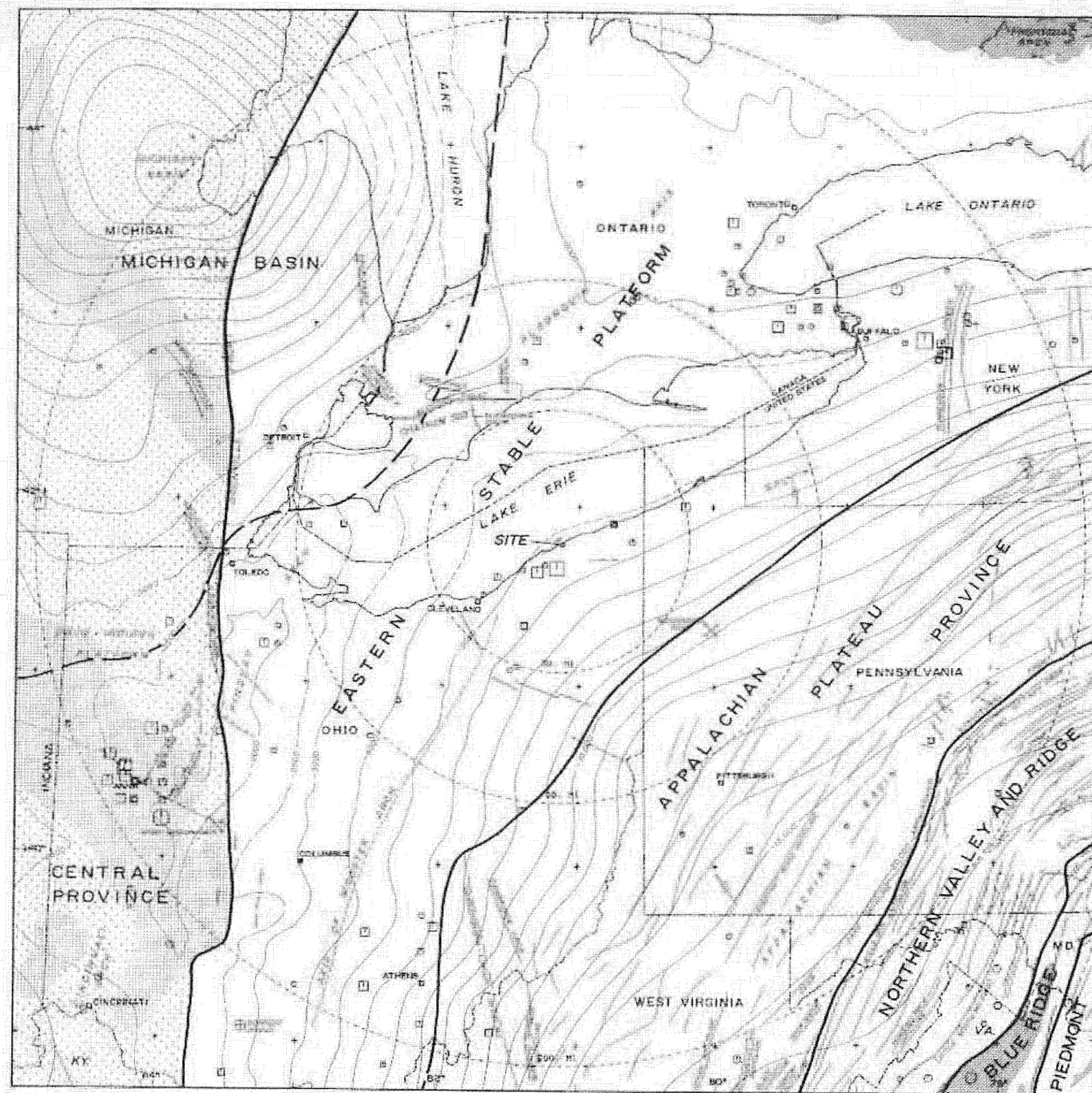
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Expansion and Settlement in
the Colonies and Eastern
United States

Figure 2.5-87



REGIONAL TECTONIC ELEMENTS

- Great Lakes Basin - Ages around 990 million years (Stable, Expanded, Non-patterned, Stable)
- Appalachian Basin - Ages around 1000 million years
- Eastern Basin - Ages around 1450 million years

Structure continues to feet from surface of Proterozoic basement surface

Thrust fault - fault on upper plate

Normal fault - fault on downthrown side

High angle fault

Anticline axis

Intensely deformed "Synorogenic" structure

(Source: geologic structure source: Smith & Woodworth, 1988; Map 198, 1975; Corbin, 1977)



REGIONAL TECTONIC PROVINCES

- Province Boundary
- Michigan Basin Tectonic Province Boundary constructed from Midland ASLB LBP-85-2 (72, 271)

EARTHQUAKES

TIME WINDOW BEGINS DEC. 1796,
ENDS SEPT. 1991

MAGNITUDE INTENSITY

2	3	4	5	III
3	4	5	6	V
4	5	6	7	VI
5	6	7	8	VII
6	7	8	9	VIII

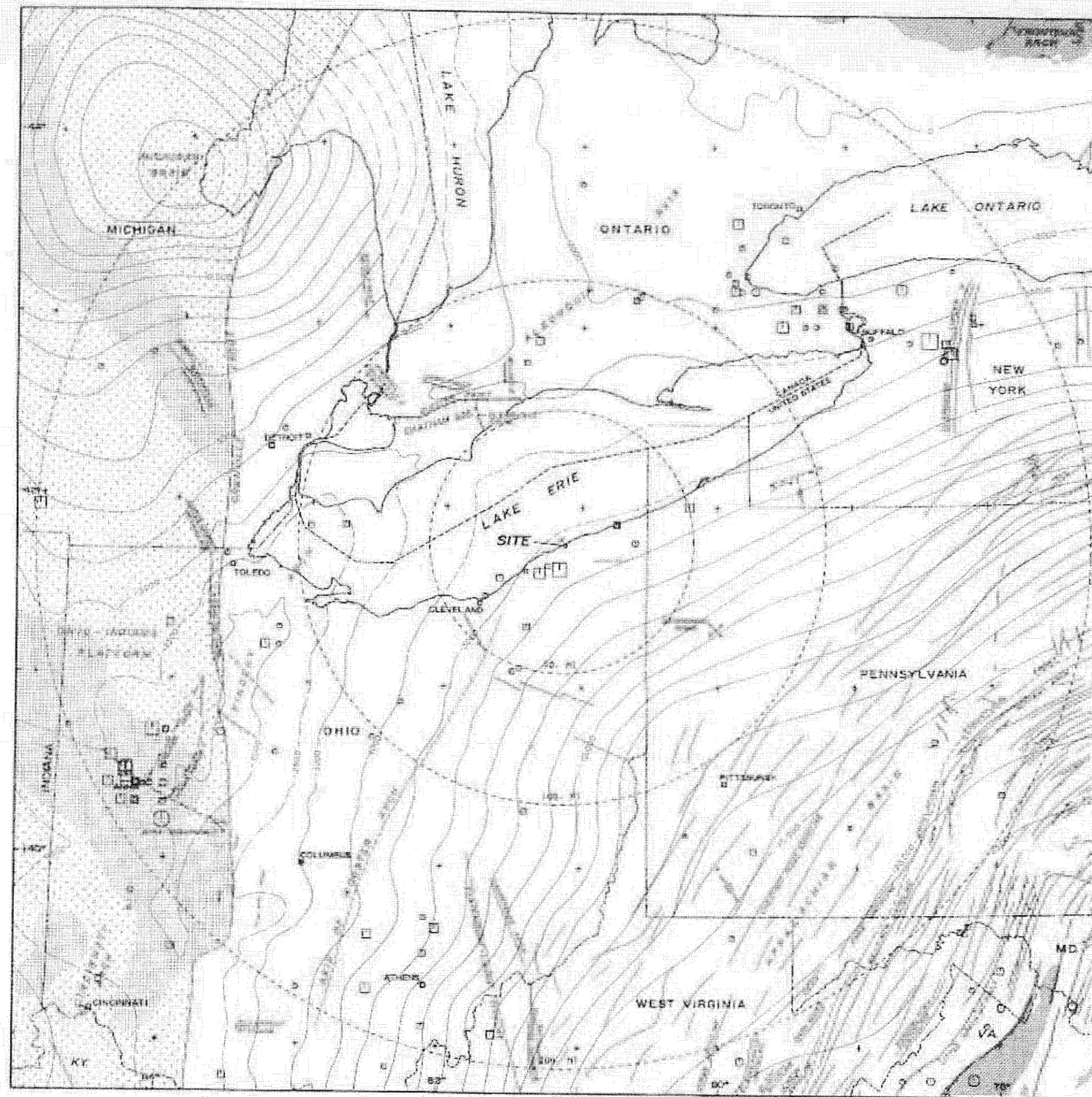
(Rev. 12 1/83)



PERRY NUCLEAR POWER PLANT

Regional Tectonics
Earthquake Tectonic Provinces

Figure 2.5-39



- REGIONAL TECTONIC ELEMENTS**
- Detroit Escarpment - Ages around 550 million years (Stippled: Escarpment; horizontal pattern: Huron-Erie Platform)
 - Huron-Erie Platform - Ages around 1100 million years
 - Ontario Escarpment - Ages around 450 million years
 - Structure introduced in last phase of the top of Precambrian basement surface
 - Thrust fault - shear on upper plate
 - Normal fault - suspended on downthrown side
 - High angle fault
 - Basal shear zone
 - Weakly deformed "Cretaceous" strata
- SPRING 1991: GEORGE L. COOPER, GEORGE L. COOPER, 1987. MODIFIED BY: NTL, 1987.



EARTHQUAKES

TIME WINDOW BEGINS DEC. 1796,
ENDS SEPT. 1991

MAGNITUDE	INTENSITY
3	III
4	V
5	VI
6	VII
	VIII

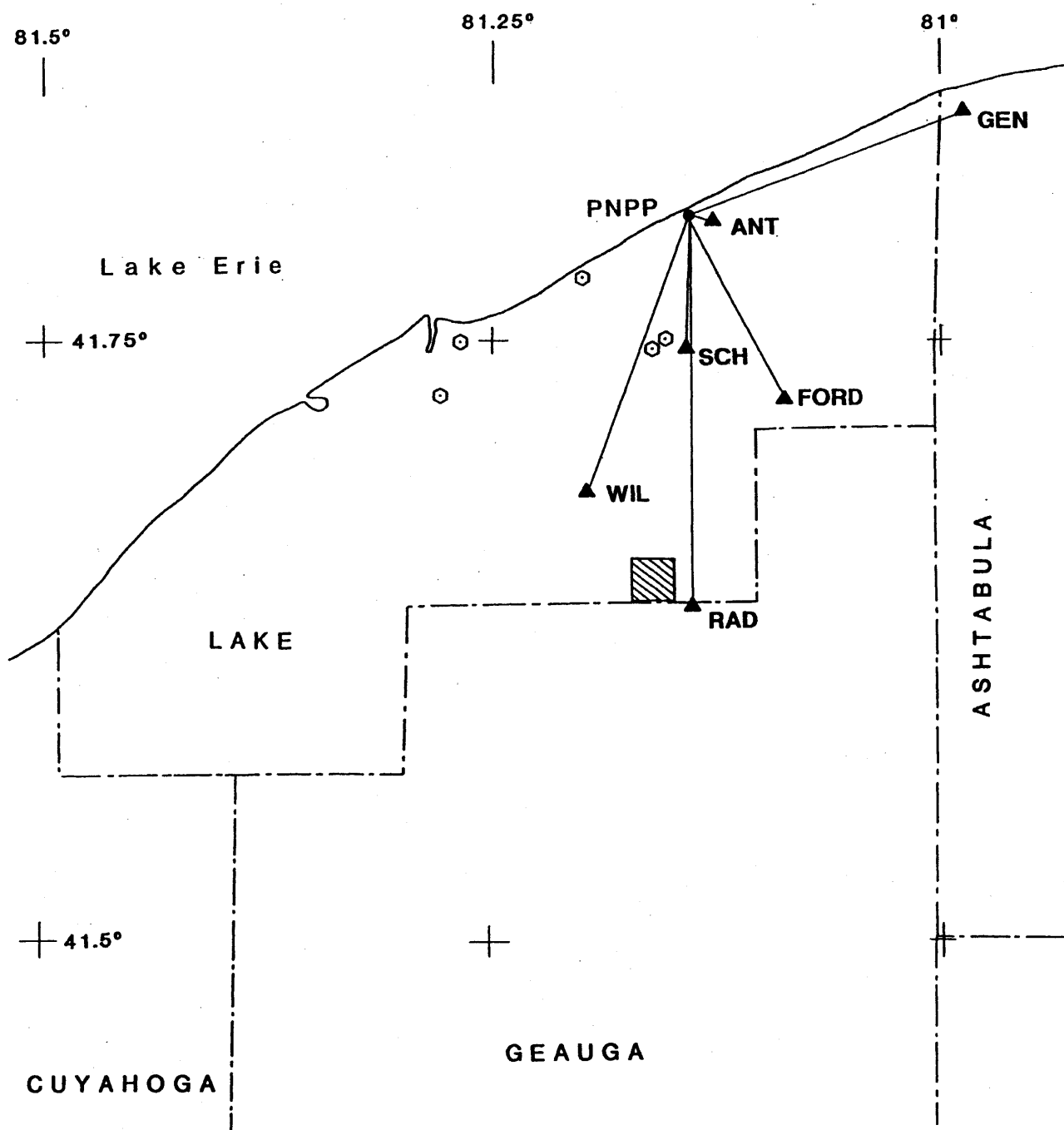
(Rev. 12 1/63)



PERRY NUCLEAR POWER PLANT

Regional Tectonics and
Earthquakes

Figure 2.3-60

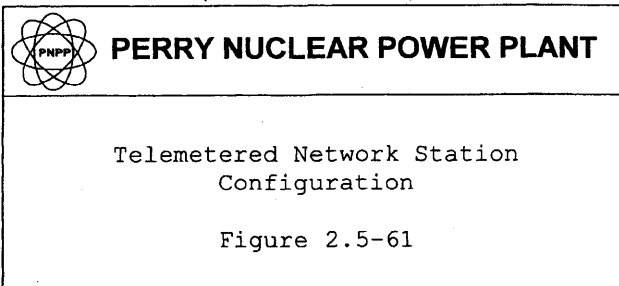


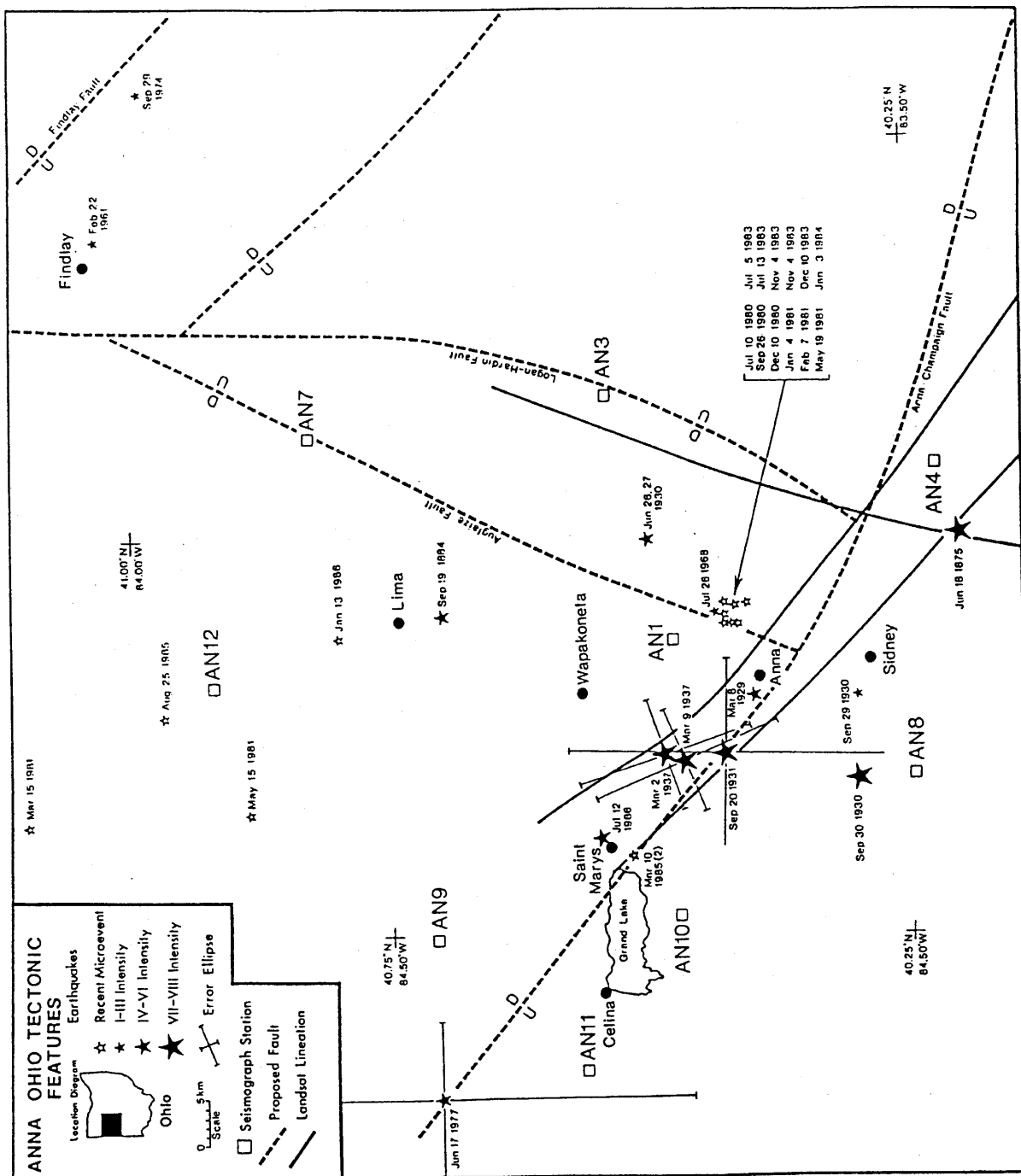
(Rev. 12 1/03)

- ▲ Station
- ⊙ Injection Well
- ▨ Epicenter of Mainshock
January 31, 1986

0 5 Miles

0 5 Km





(Source: Christensen, et al., March 1987)(2)

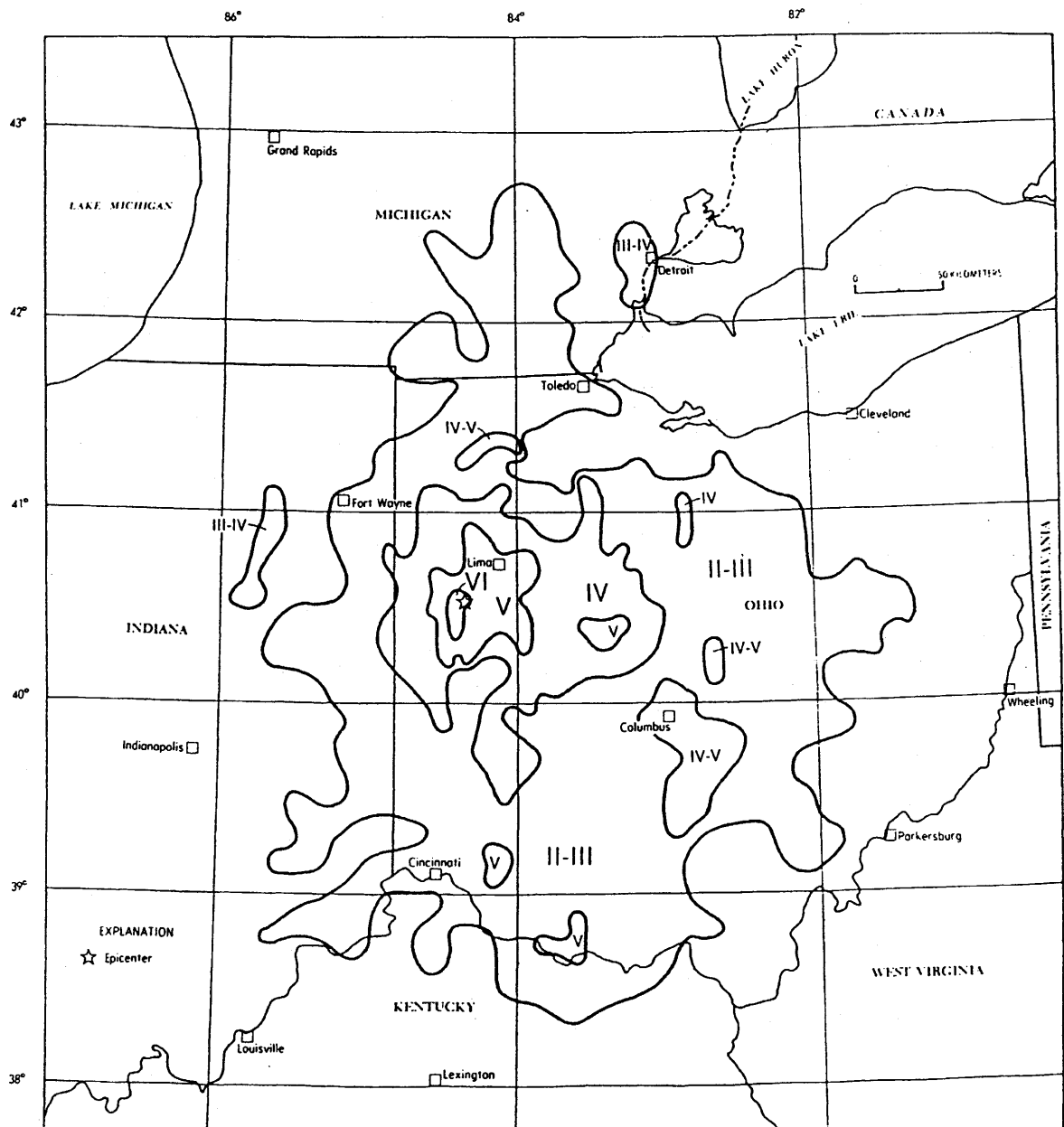
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

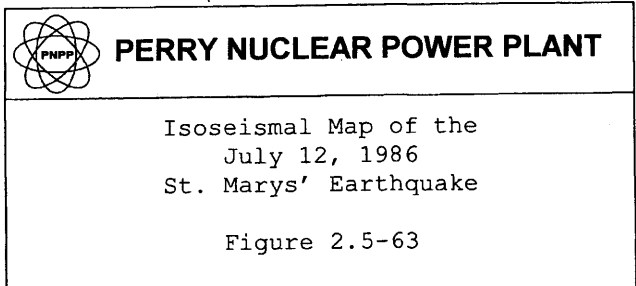
The Anna, Ohio Seismic Zone,
Historical Seismicity,
Proposed Faults, and
Observed LANDSAT Lineaments

Figure 2.5-62

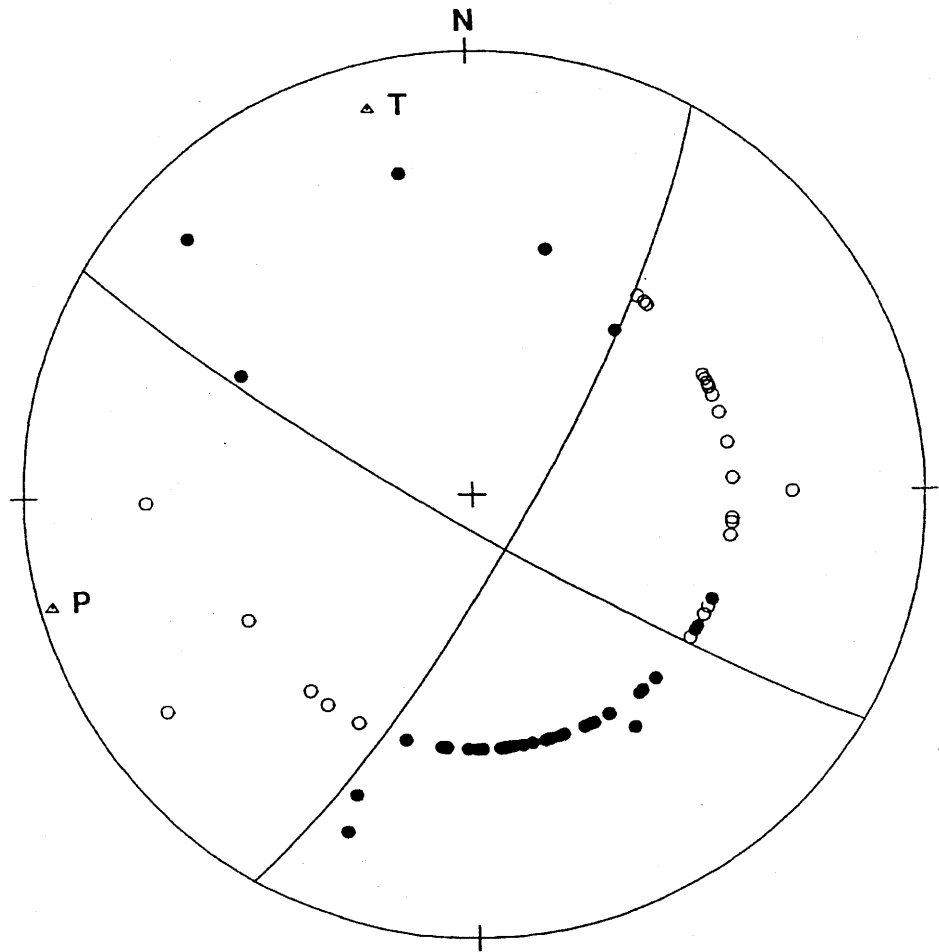


Source: C. W. Stover, U.S.G.S. in (2)

(Rev. 12 1/03)



ST MARYS EVENT
7/12/86



Focal Mechanism for the July 12, 1986, St. Marys, Ohio Earthquake. Compressional arrivals are shown as solid symbols and tensional as open symbols. The P and T axes are also shown.

(Source: Christensen, et al., March 1987) (2)

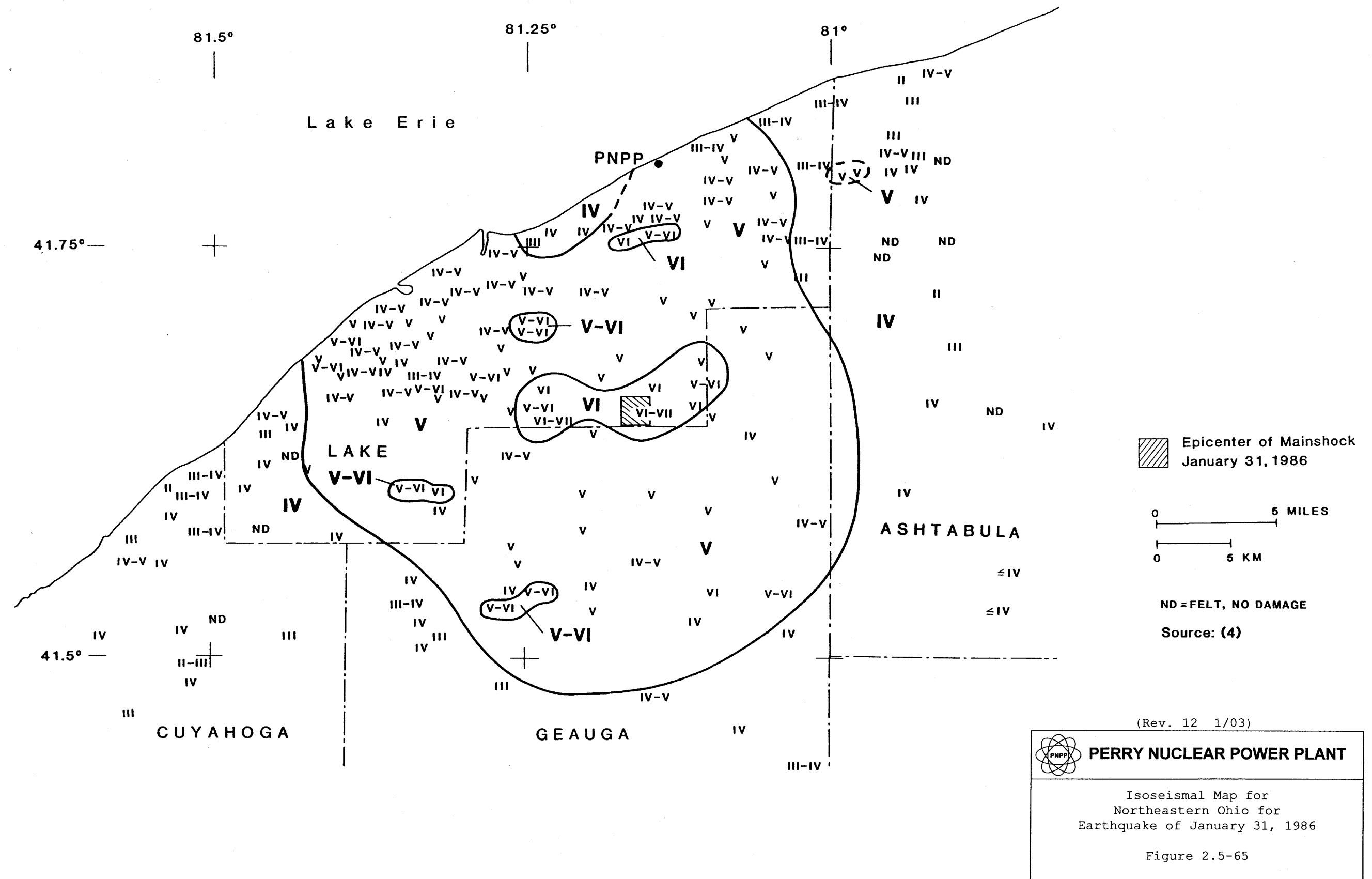
(Rev. 12 1/03)

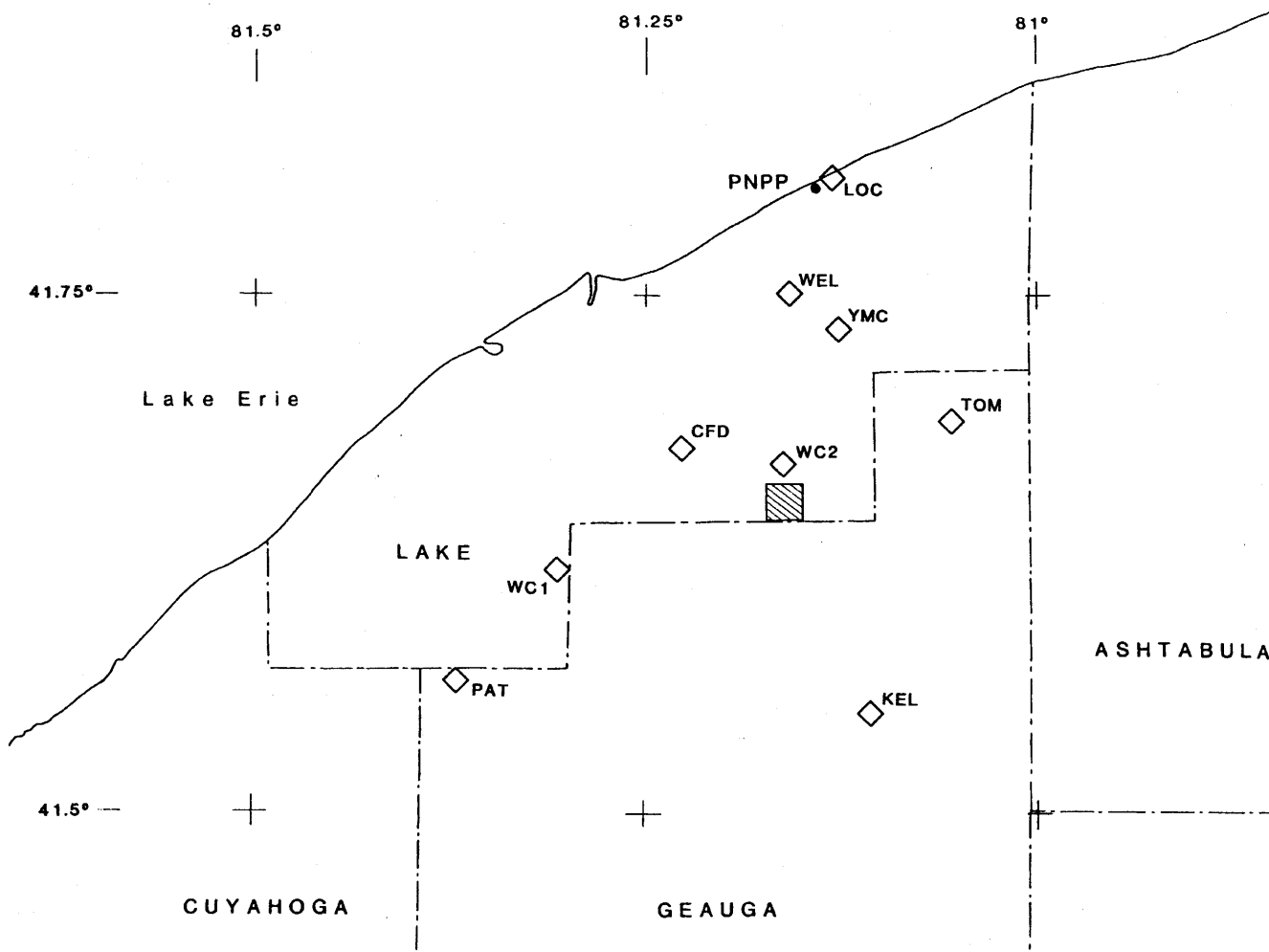



PERRY NUCLEAR POWER PLANT

Focal Mechanism for the
July 12, 1986 Earthquake

Figure 2.5-64





 Epicenter of Mainshock
January 31, 1986

0 5 MILES
0 5 KM

(Rev. 12 1/03)



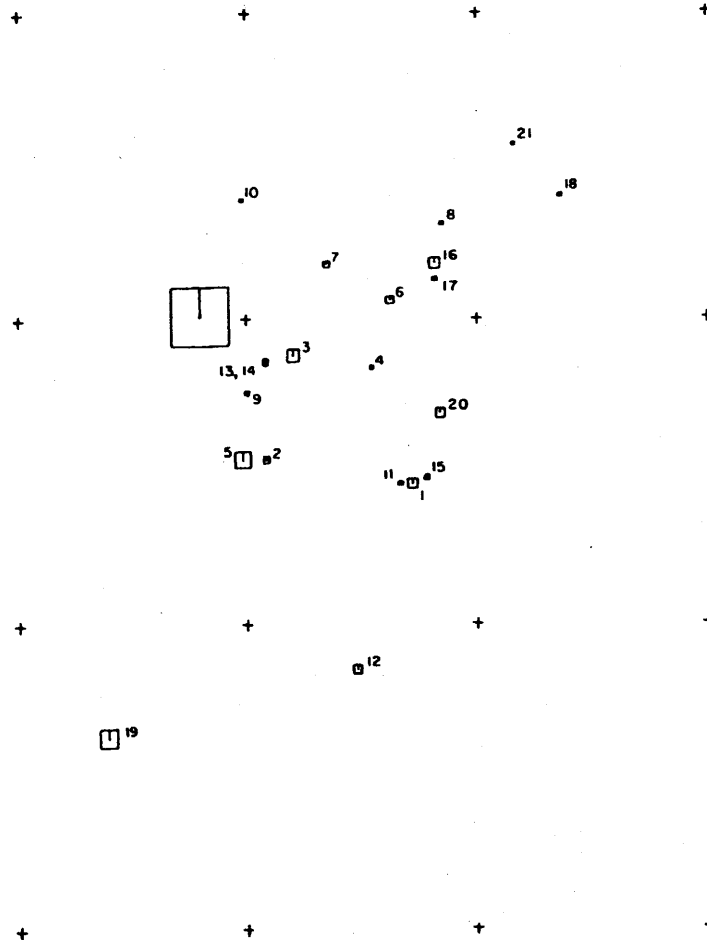
PERRY NUCLEAR POWER PLANT

Typical Portable Network
Configuration from
March to October 1986

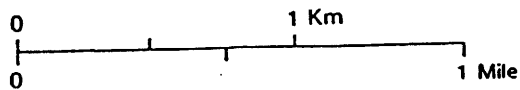
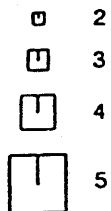
Figure 2.5-66

81.17W
+

81.14W
+ 41.67N



Magnitude



Note: See Table 2.5-18 for
identification of events.

(Rev. 12 1/03)

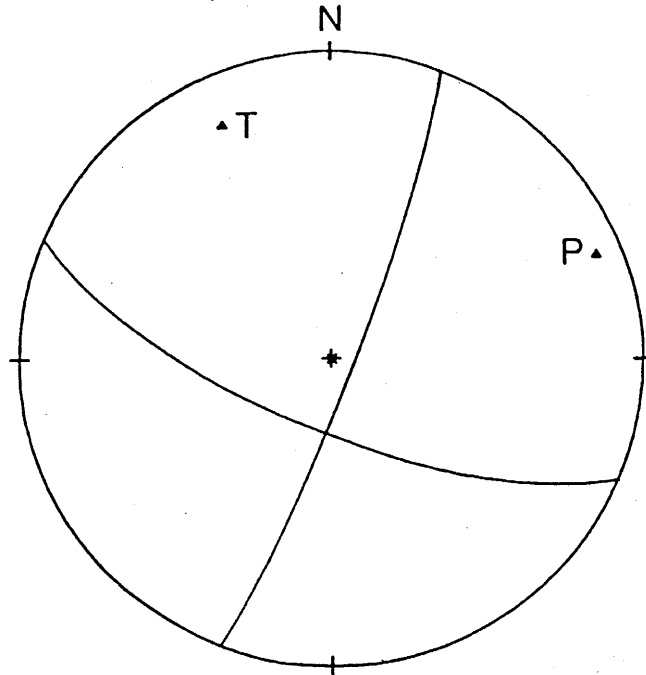


PERRY NUCLEAR POWER PLANT

January 31, 1986
Aftershock Sequence

Figure 2.5-67

PERRY EARTHQUAKE 01/31/86



Focal Mechanism for the January 31, 1986 Perry Earthquake Near Cleveland, Ohio (from the Harvard group as found in the PDE monthly listing). The compressional (P) and tensional (T) axes are shown.

(Source: Christensen, et al., March 1987) (2)

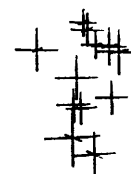
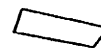
(Rev. 12 1/03)



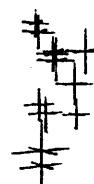
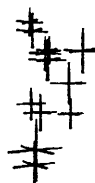
PERRY NUCLEAR POWER PLANT

Focal Mechanism for the
January 31, 1986 Earthquake

Figure 2.5-68



CENTER POINT COORDS = 41.646 -81.156
CENTER POINT ELEV = -4.5 km
VIEW POINT COORDS = 41.623 -81.070
VIEW POINT ELEV = -4.5 km
SURF. DISTANCE (km) = 8.
AZIMUTH = 110.



CENTER POINT COORDS = 41.646 -81.156
CENTER POINT ELEV = -4.5 km
VIEW POINT COORDS = 41.590 -81.200
VIEW POINT ELEV = -4.5 km
SURF. DISTANCE (km) = 7.
AZIMUTH = 211.

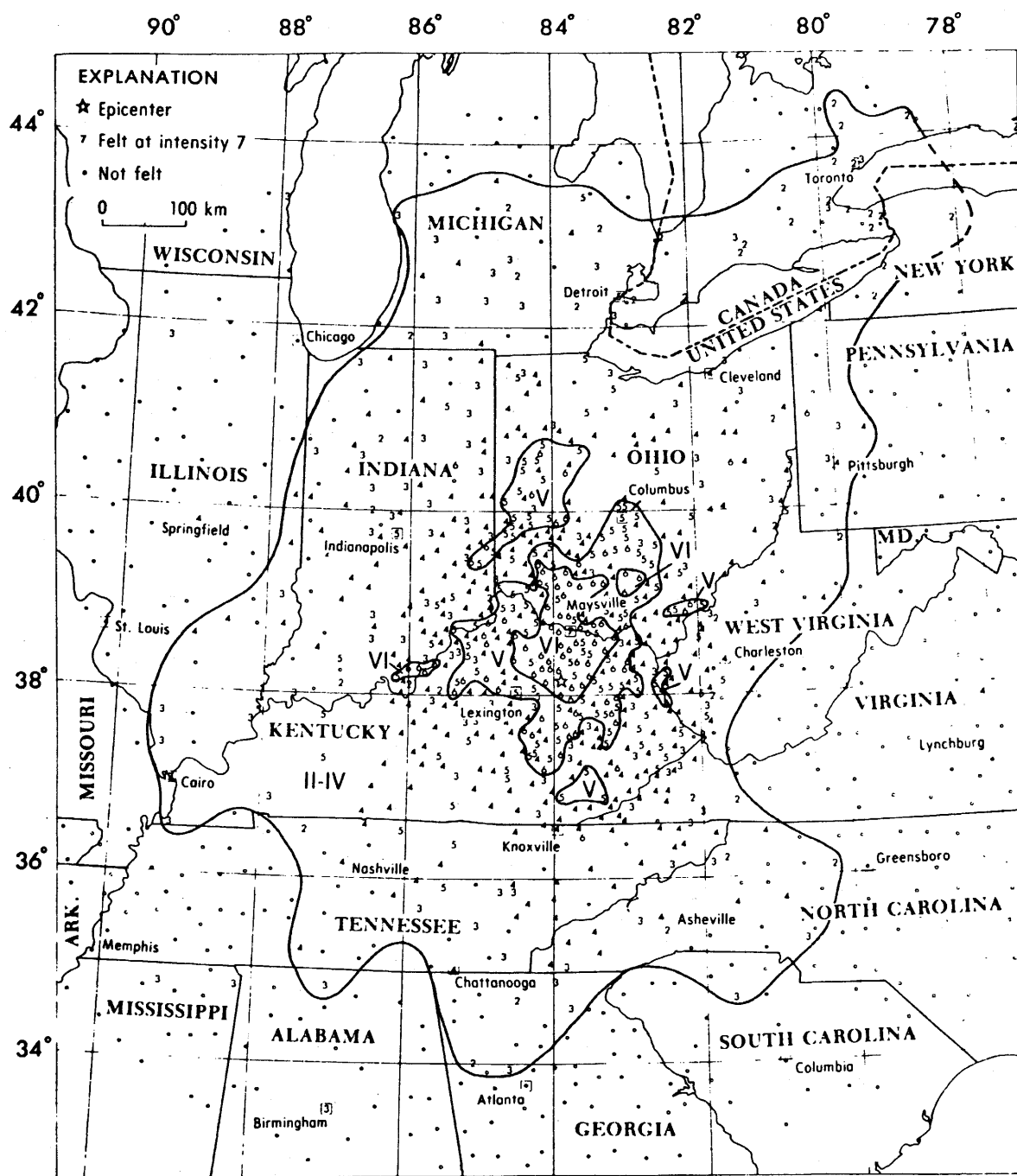
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Stereo View of the
Aftershock Sequence

Figure 2.5-69



(Source: Stover and von Hake, 1982)(276)

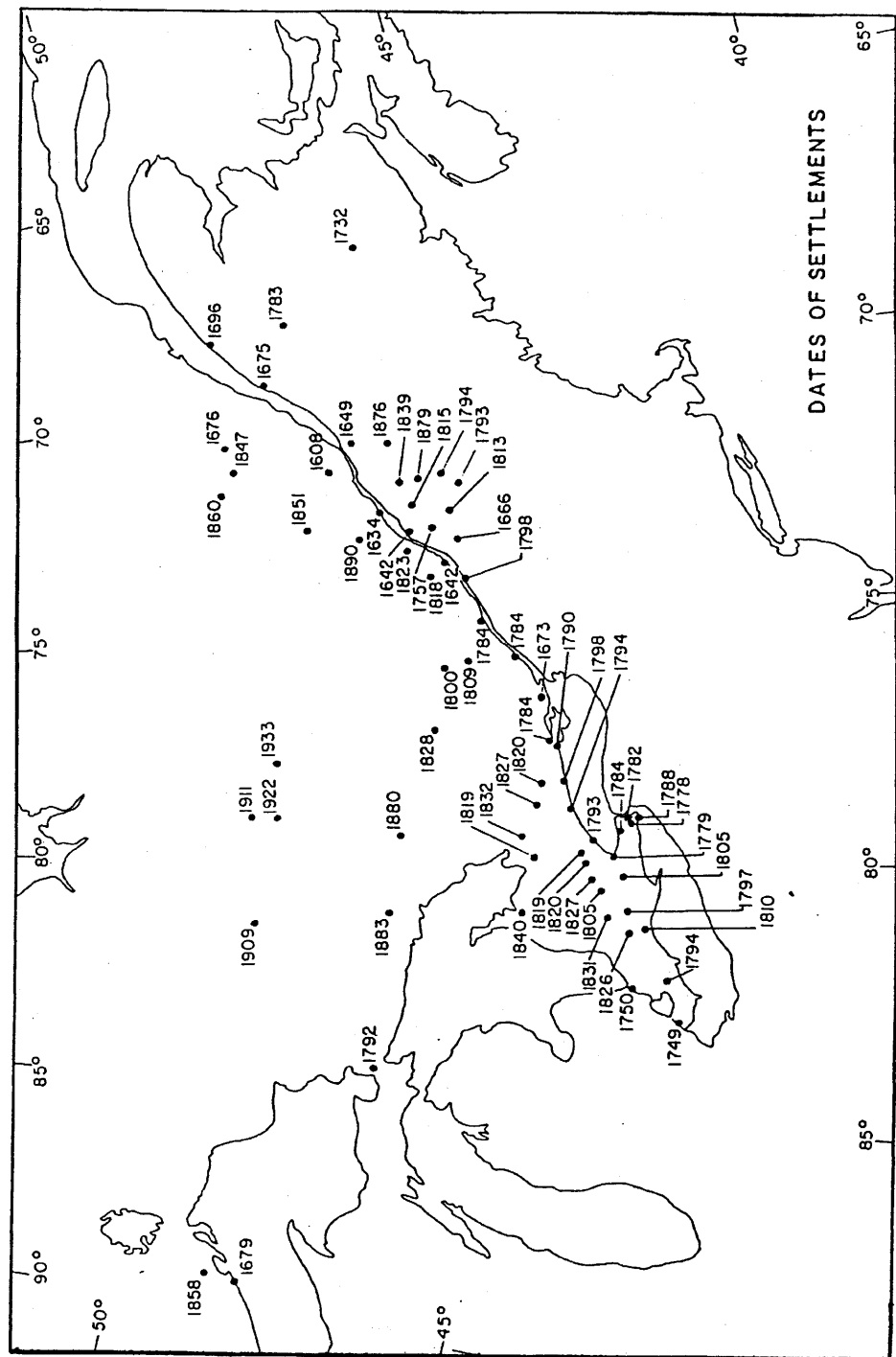
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map for the
Sharpsburg, Kentucky Earthquake
of July 27, 1980

Figure 2.5-70



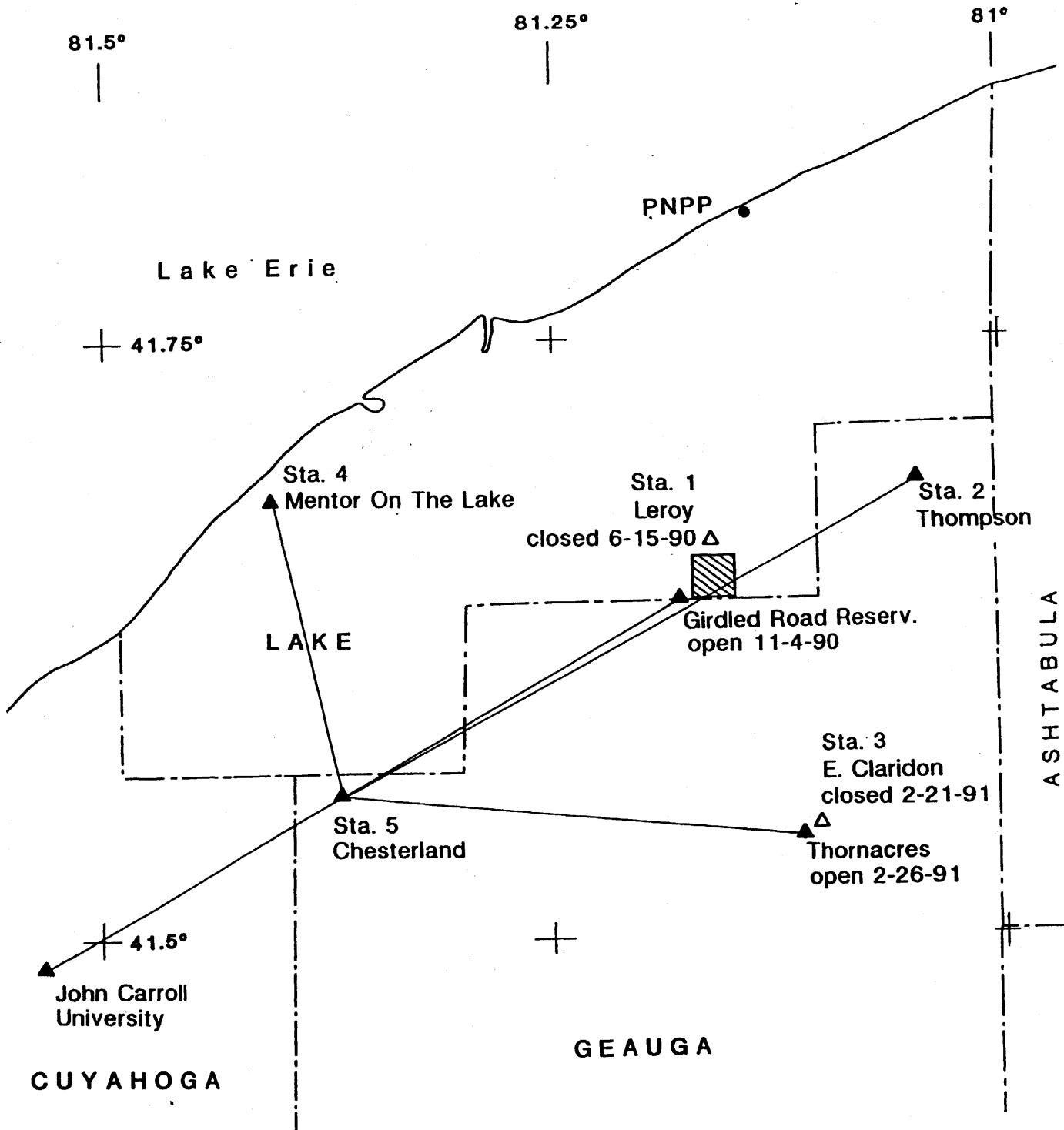
(Rev. 12 1/03)




PERRY NUCLEAR POWER PLANT

Dates of Settlement in
Eastern Canada

Figure 2.5-71

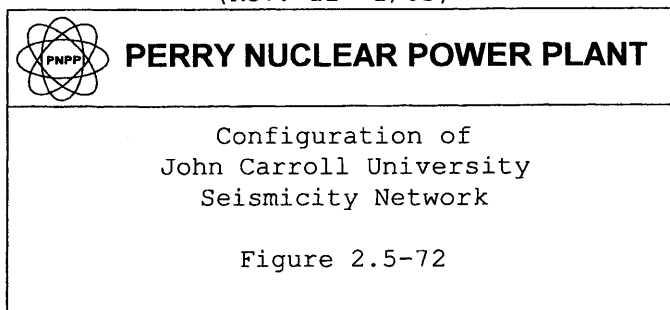


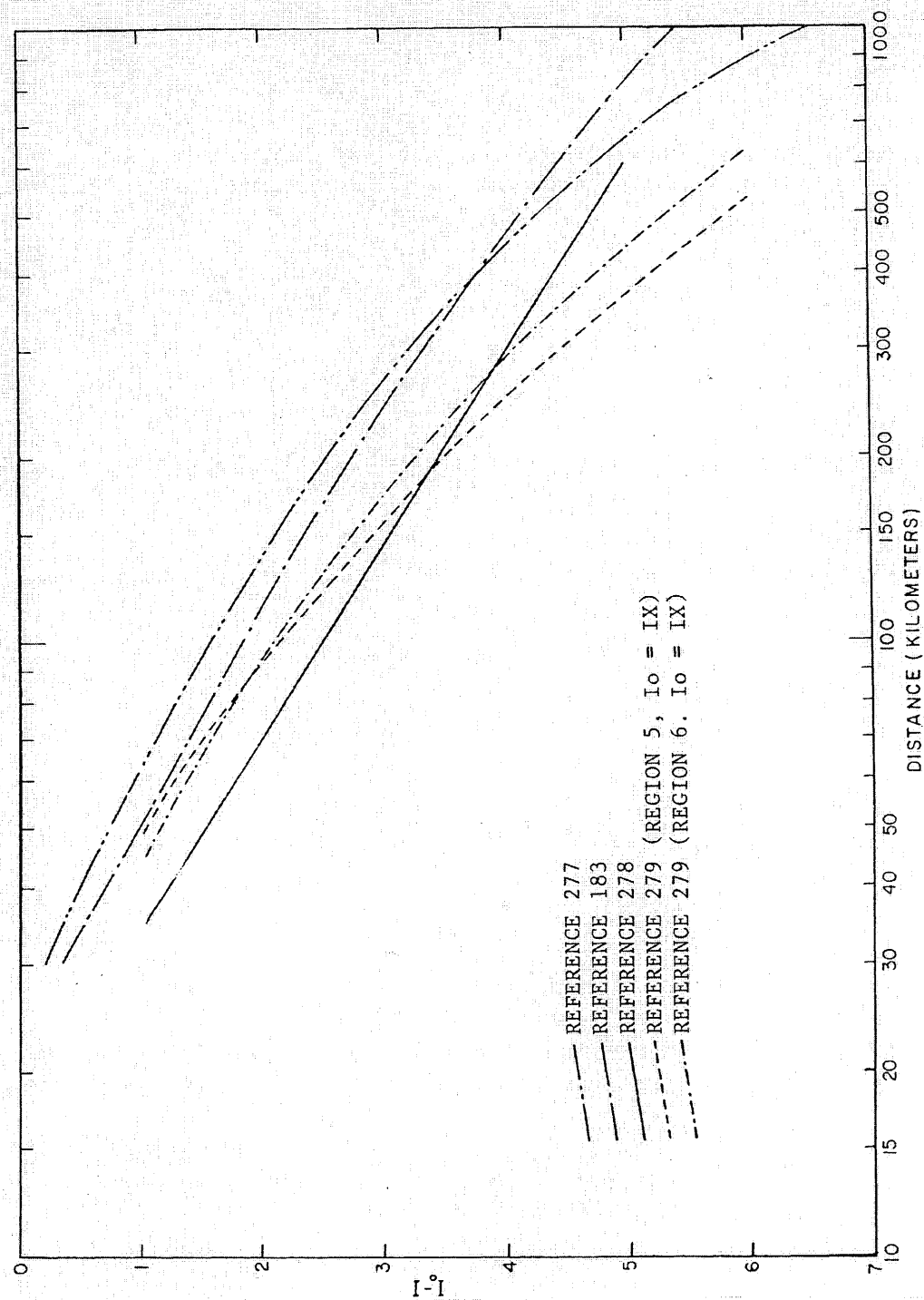
 Epicenter of Mainshock
January 31, 1986

0 5 Miles

0 5 Km

(Rev. 12 1/03)





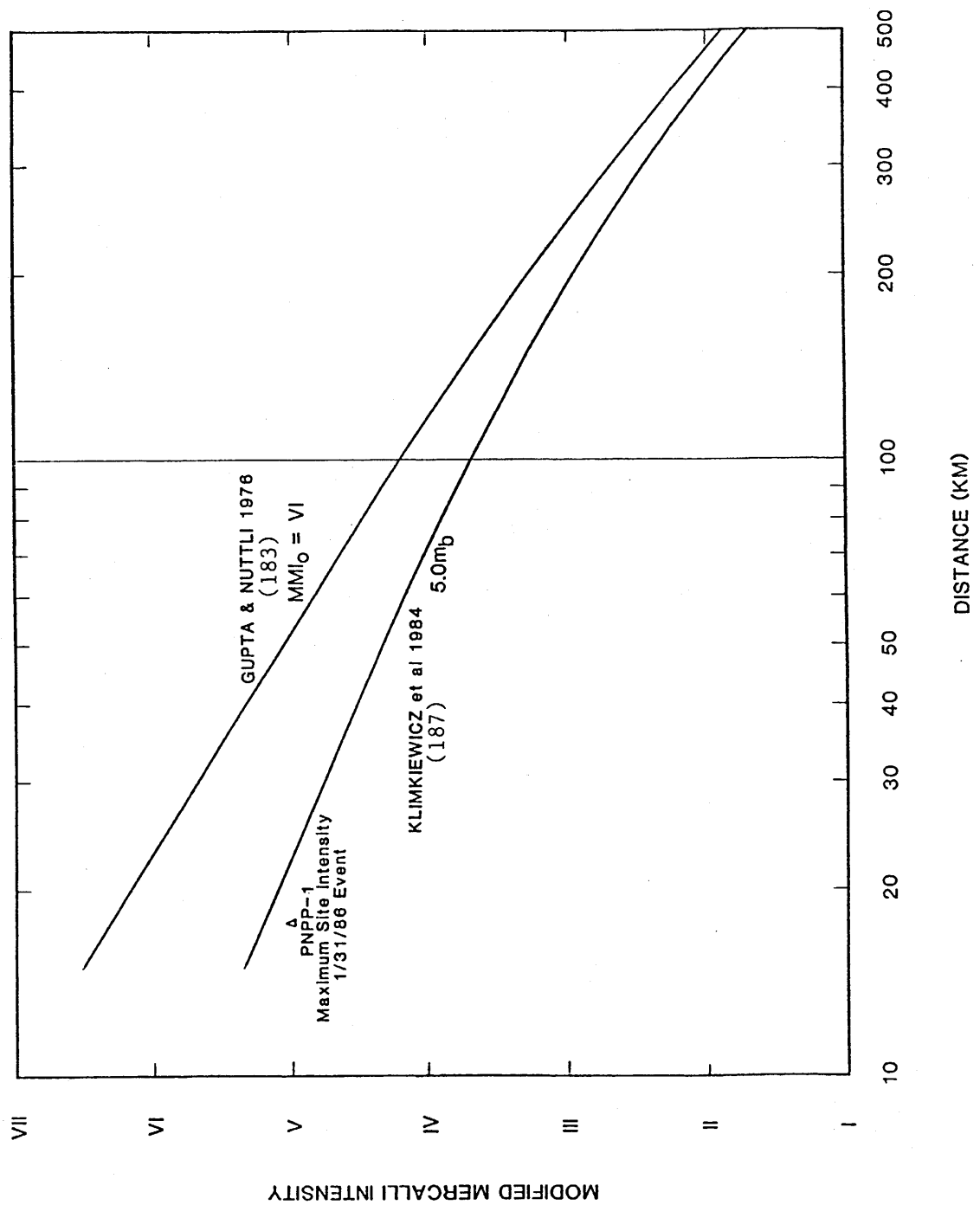
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Intensity Attenuation Curves
for Eastern North America

Figure 2.5-73



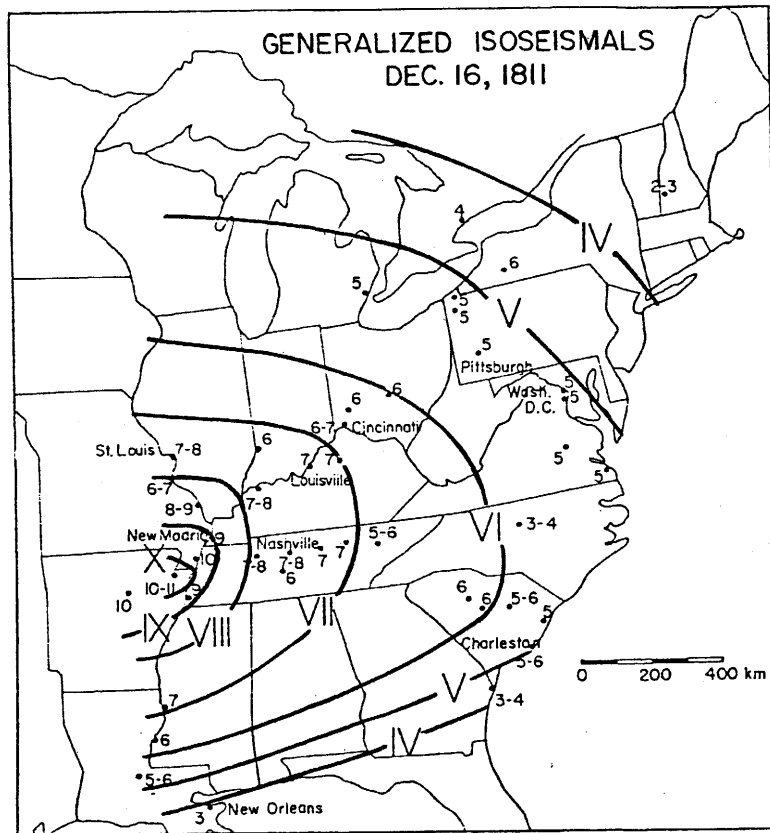
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Comparison of Attenuation
Models Used to Estimate Site
Intensities for Historical Events

Figure 2.5-74



Generalized isoseismal map of the earthquake of December 16, 1811 at 08^h15^m GMT. MM intensity values at individual points are given in Arabic numerals. The isoseisms, labeled with Roman numerals, indicate the outer bound of the region of specified intensity.

REFERENCE 280

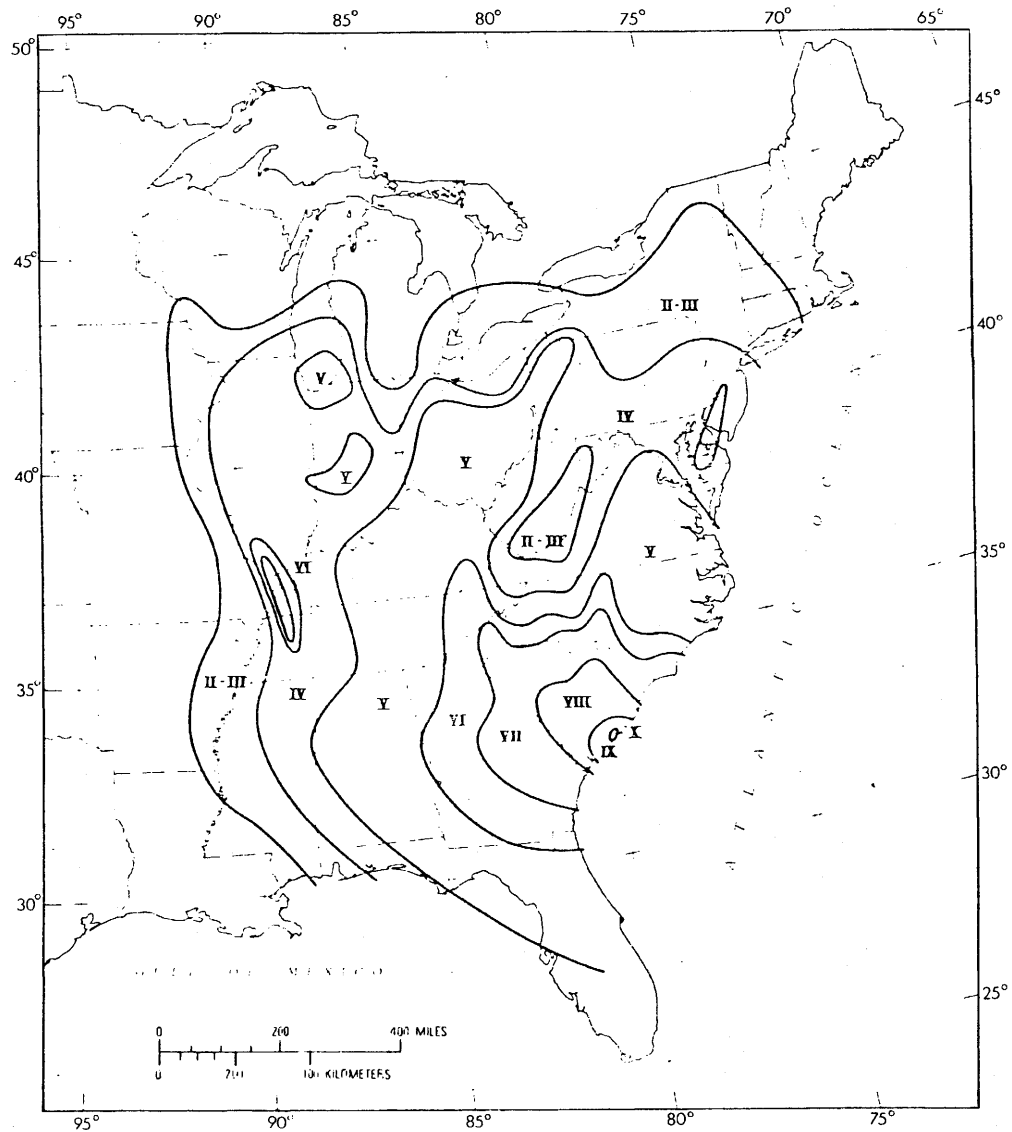
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - Mississippi
Valley Earthquake of
1811 and 1812

Figure 2.5-75



Isoseismal map of the Eastern United States contoured to show the broad regional patterns of the reported intensities for the 1886 Charleston earthquake. Contoured intensity levels are shown in Roman numerals.

REFERENCE 281

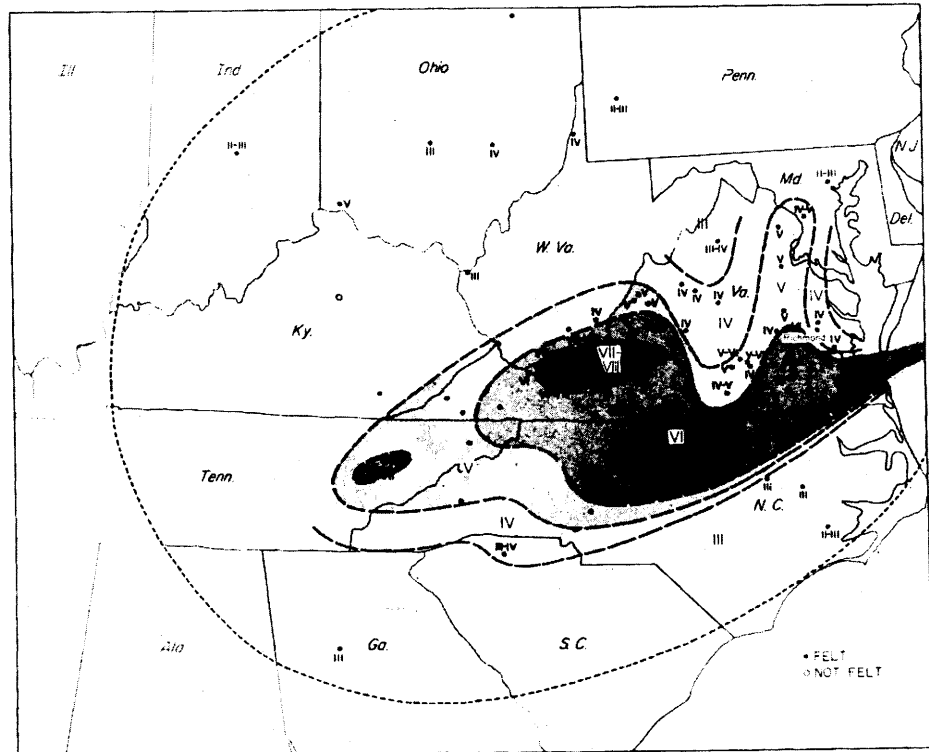
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - 1886
Charleston Earthquake

Figure 2.5-76



Earthquake of May 31, 1897

REFERENCE 150

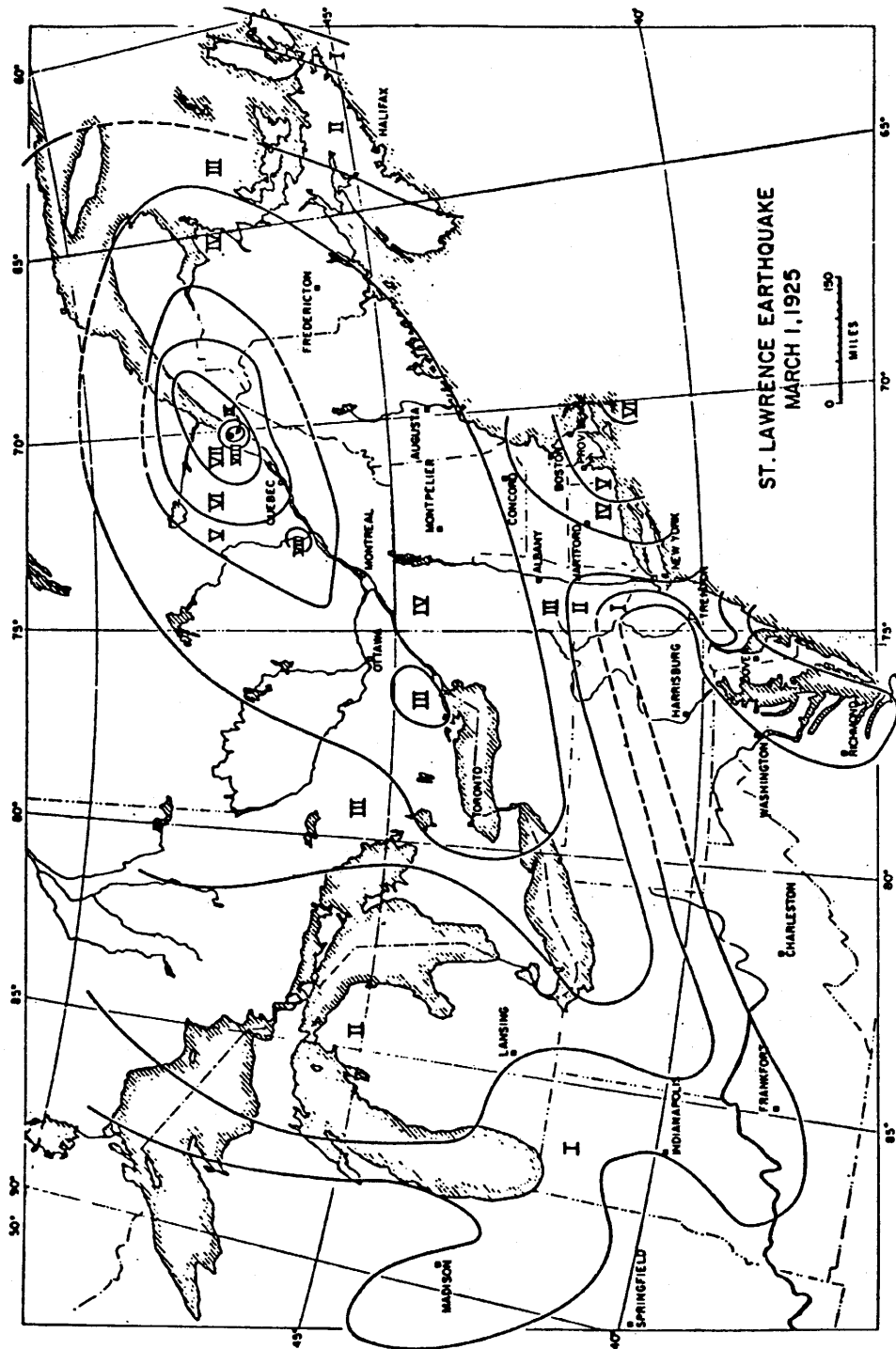
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - Virginia
Earthquake of May 31, 1897

Figure 2.5-77



REFERENCE 282

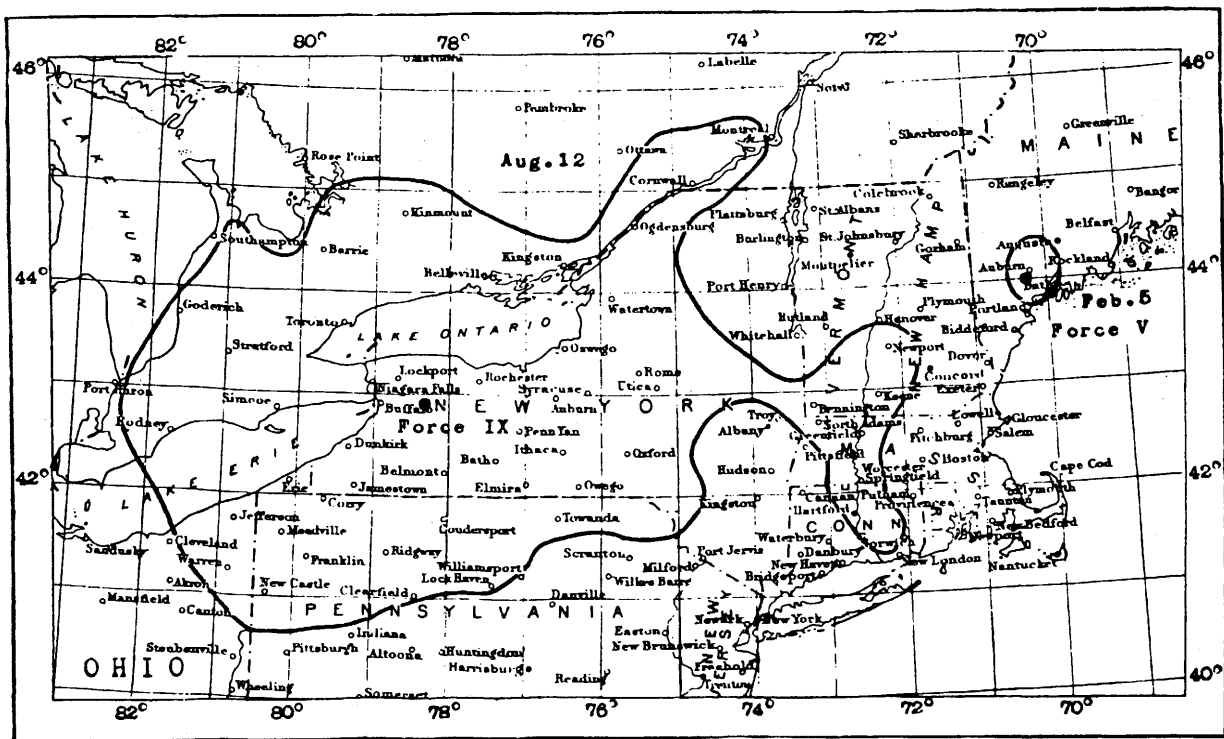
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - St. Lawrence
Earthquake, March 1, 1925

Figure 2.5-78



Areas affected by shocks of February 5 and August 12

REFERENCE 283

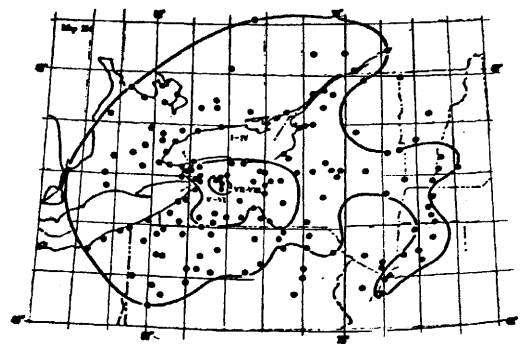
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - United States
(Eastern, Attica, New York)
Earthquakes, 1929

Figure 2.5-79



The Attica, New York, Earthquake of
August 12, 1929.

A Modification of REFERENCE 283
(Figure 3):
125,000 square miles.

REFERENCE 147

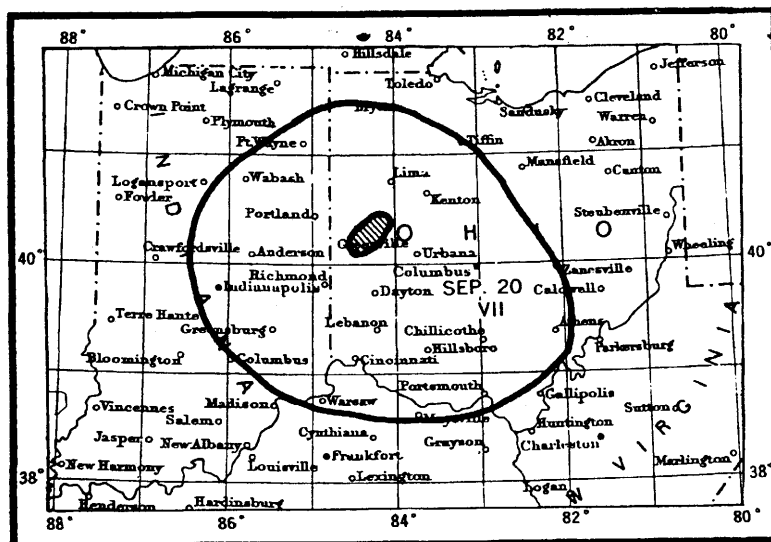
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - Attica, New York
Earthquake of August 12, 1929

Figure 2.5-80



Area affected by Anna, Ohio, shock of September 20

REFERENCE 284

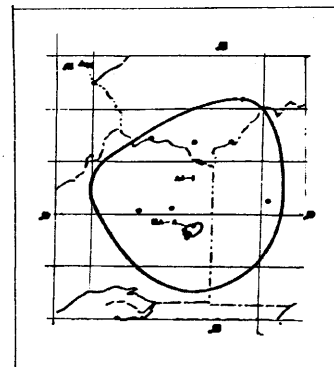
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - Area Affected by
Anna, Ohio Earthquake
September 20, 1931

Figure 2.5-81



The Anna, Ohio, Earthquake of
September, 1931.

A Modification of REFERENCE 215
(Figure 3):
45,000 square miles.

REFERENCE 147, Page 135

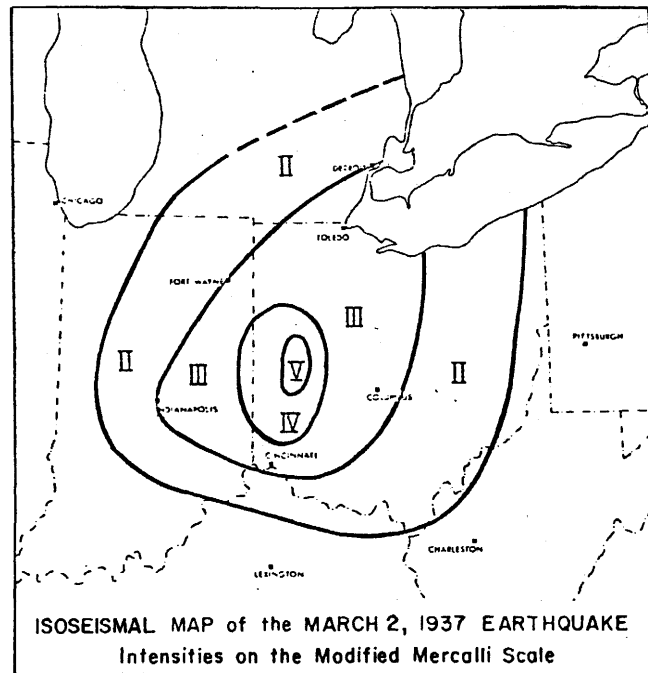
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - Area Affected by
Anna, Ohio Earthquake
September 20, 1931

Figure 2.5-82



REFERENCE 1, P.12 (AFTER REFERENCE 160)

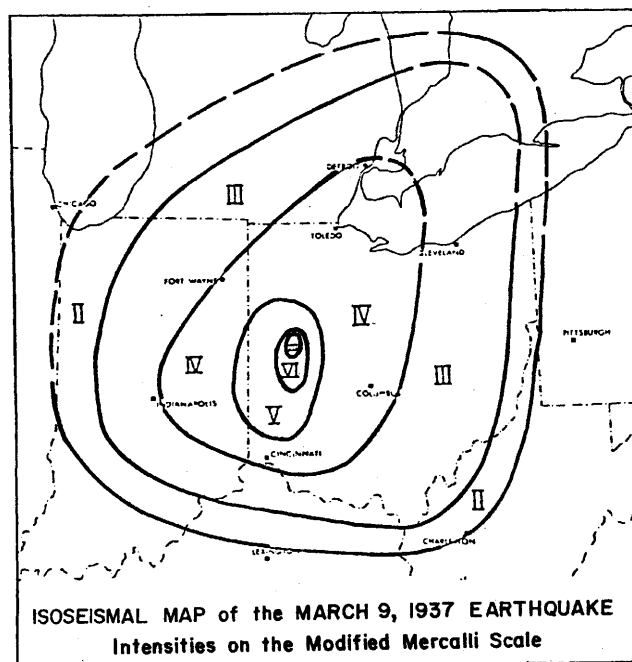
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - Area Affected by
 Anna, Ohio Earthquake,
 March 2, 1937

Figure 2.5-83



REFERENCE 285 (AFTER REFERENCE 160)

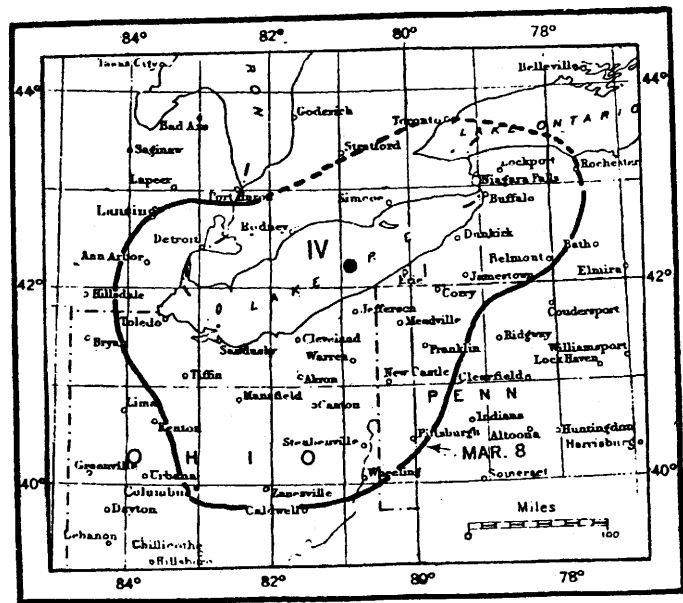
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

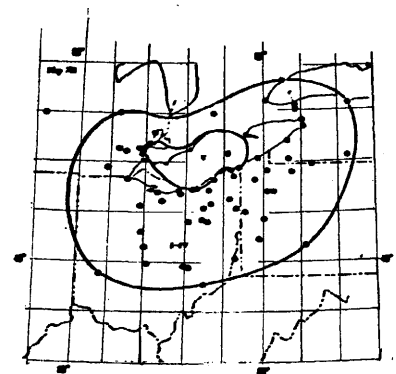
Isoseismal Map - Area Affected by
Anna, Ohio Earthquake,
March 2, 1937

Figure 2.5-84



Area affected by the Lake Erie earthquake of March 8, 1943.

REFERENCE 286



The Lake Erie Earthquake March 8, 1943.

A Modification REFERENCE 217 (Figure 4):
85,000 square miles.

REFERENCE 147, page 135.

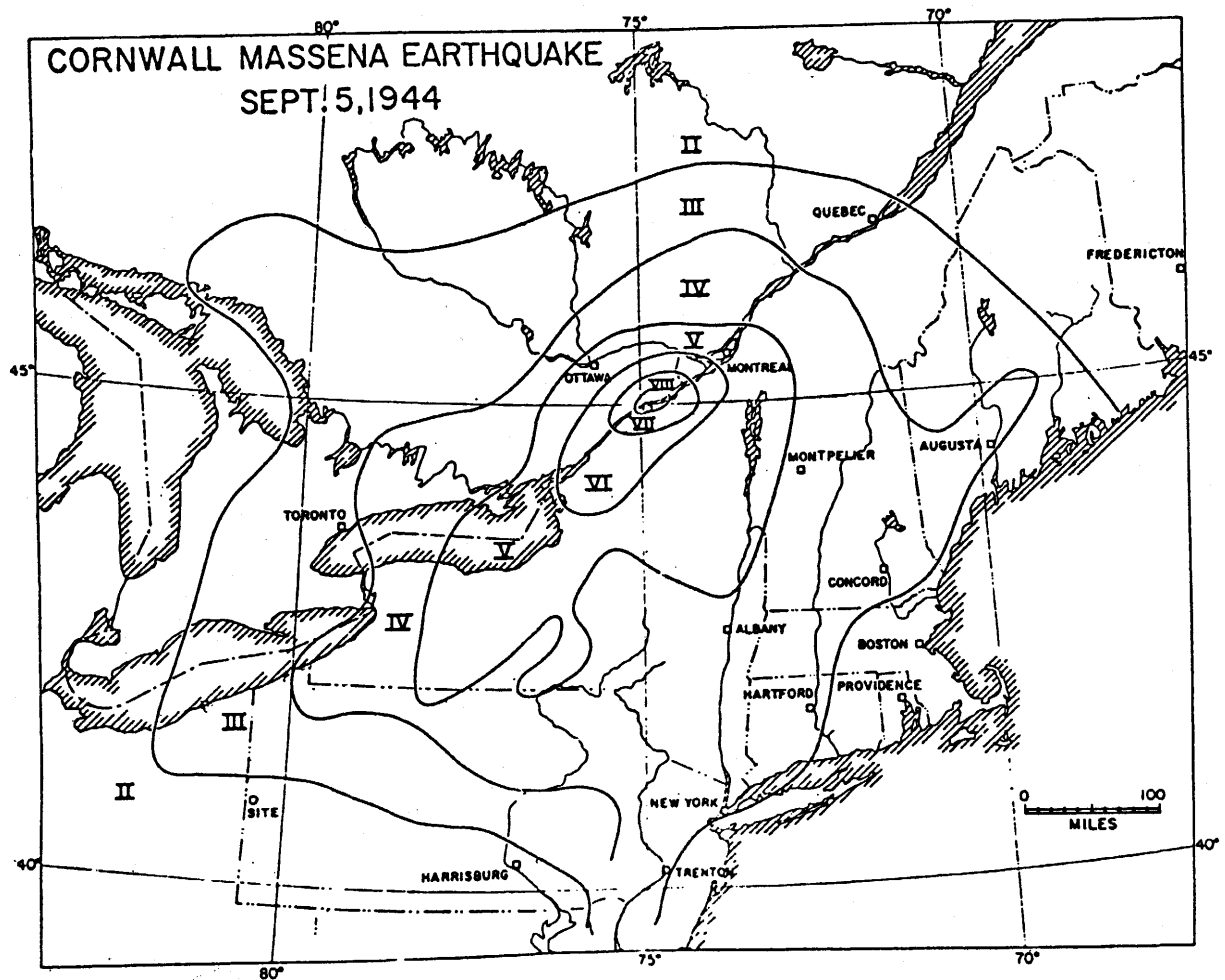
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - The Lake Erie
Earthquake of March 8, 1943

Figure 2.5-85



REFERENCE 147, page 135.

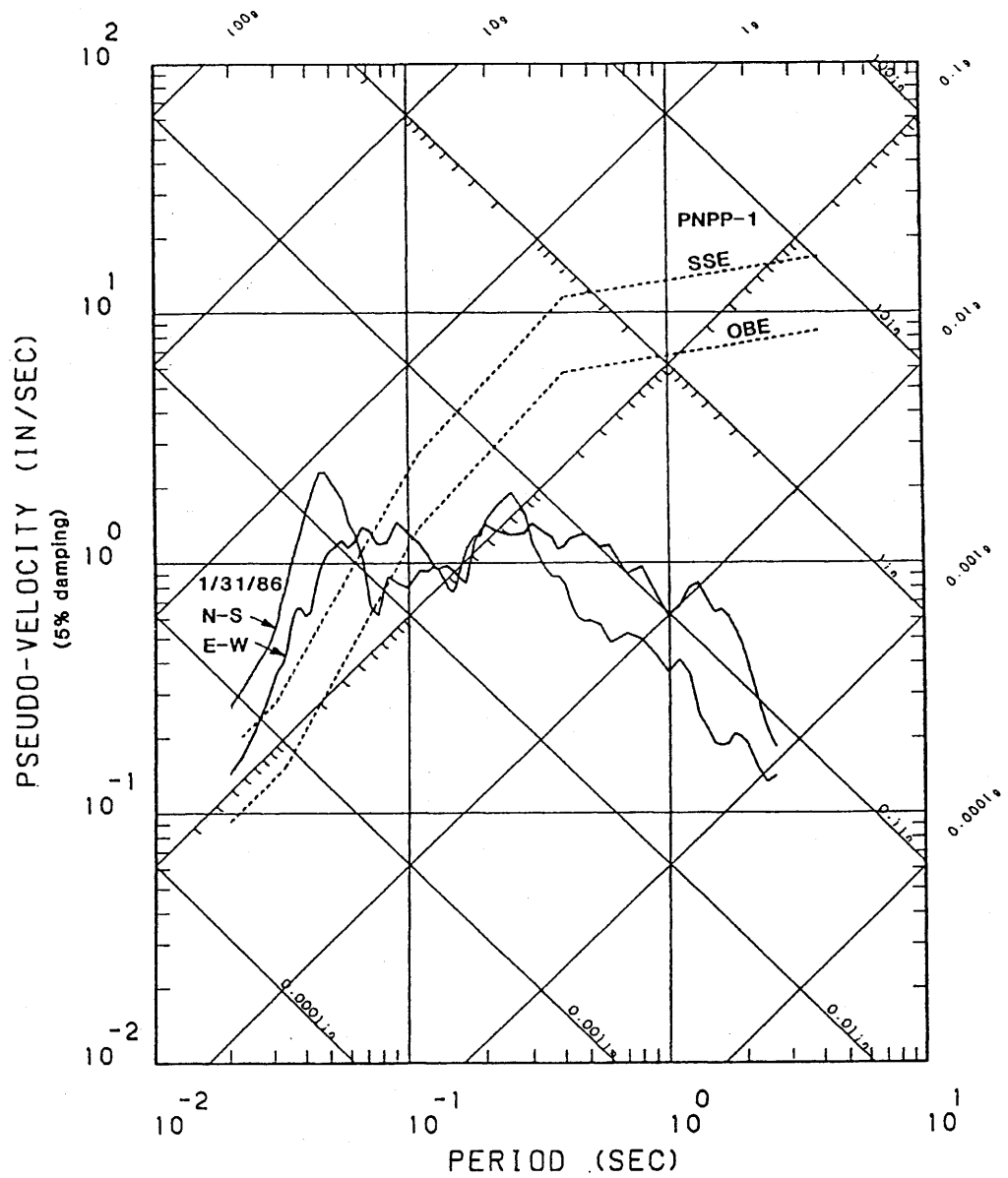
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map - Cornwall
Massena Earthquake of
September 5, 1944

Figure 2.5-86



(Rev. 12 1/03)

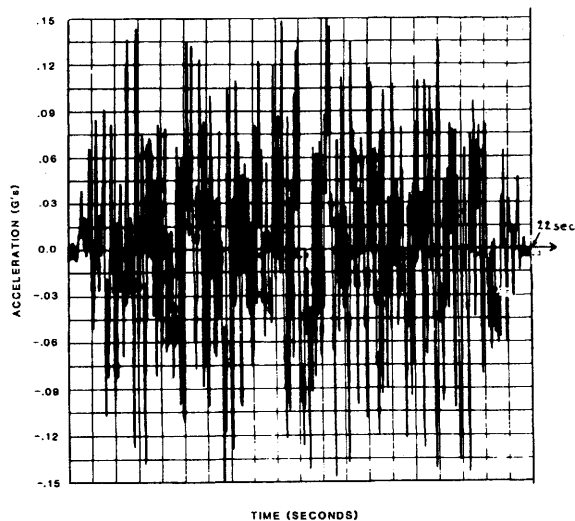


PERRY NUCLEAR POWER PLANT

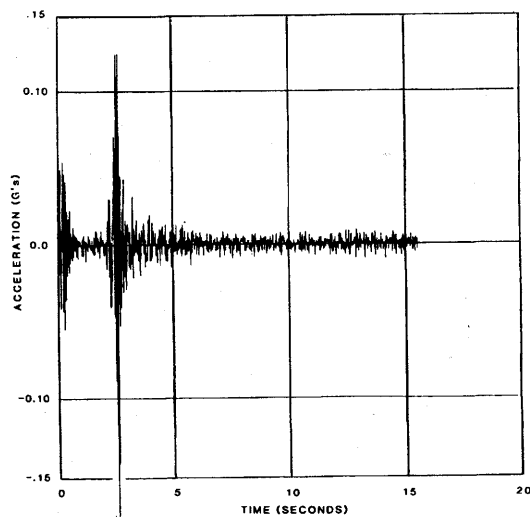
Comparison of PNPP-1 OBE and
SSE Horizontal Spectra with
January 31, 1986, Horizontal
Spectra at Reactor Foundation

Figure 2.5-88

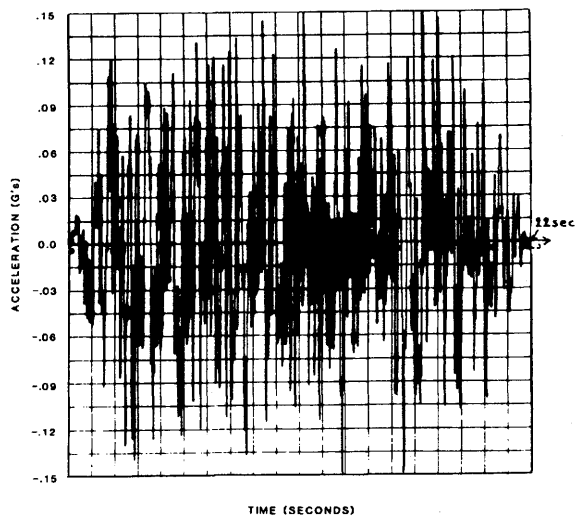
ACCELERATION TIME HISTORY MOTION - H1



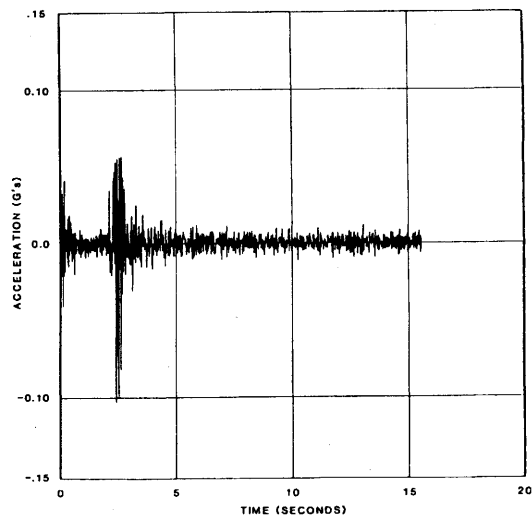
JANUARY 31, 1986 EARTHQUAKE ACCELEROGRAM
HORIZONTAL (N-S)



ACCELERATION TIME HISTORY MOTION - H2



JANUARY 31, 1986 EARTHQUAKE ACCELEROGRAM
HORIZONTAL (E-W)



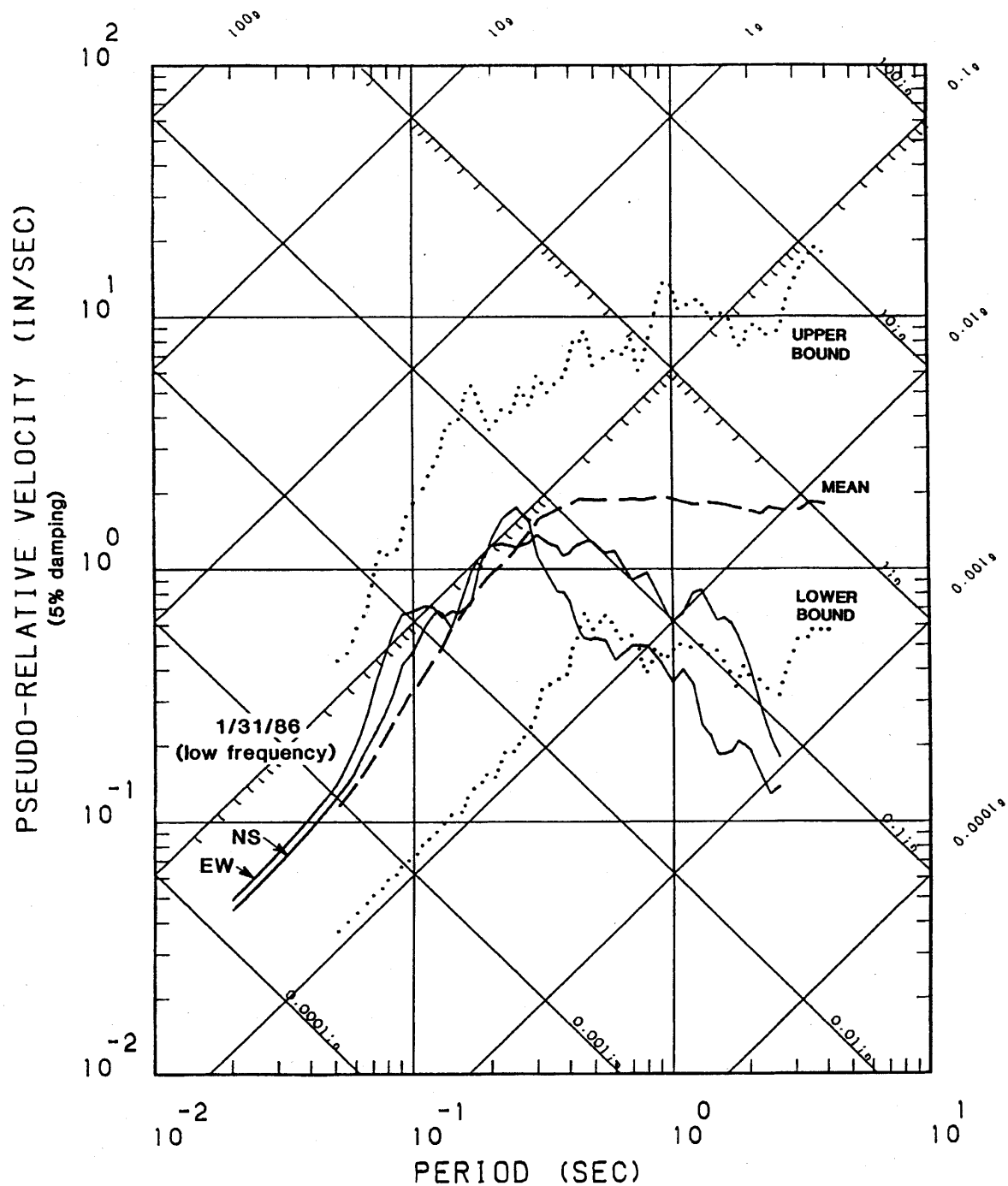
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Comparison of Design Time History -
H1 and January 31, 1986 - (N-S)
H2 and January 31, 1986 - (E-W)

Figure 2.5-89



R1651S.L10
R1651W.L10

Mean, upper and lower
bounds for V MM
after O'Brien (1980)

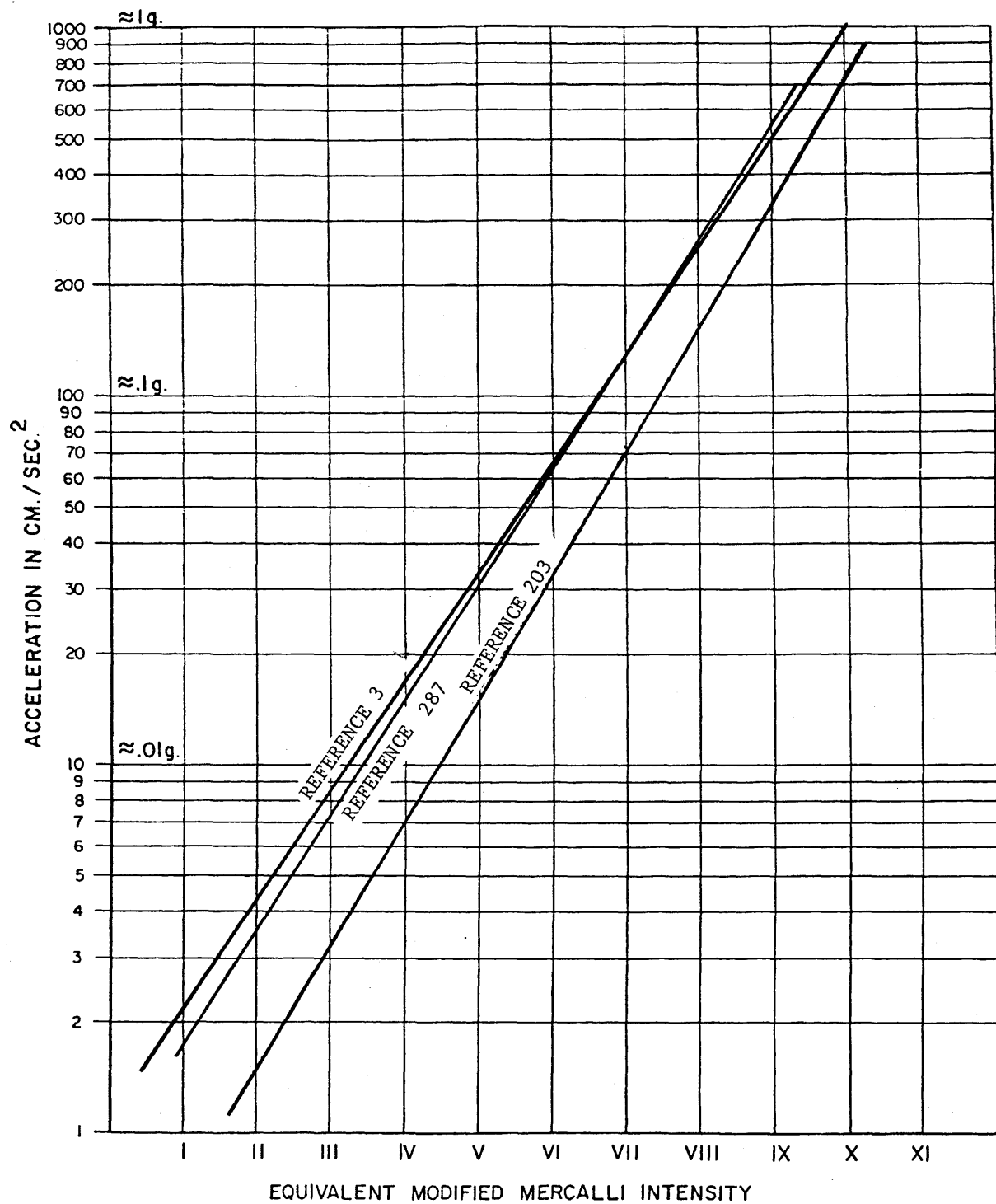
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Comparison of January 31, 1986,
Low Frequency Horizontal Response
Spectra with Response Spectra
for MM Intensity V

Figure 2.5-90



(Rev. 12 1/03)

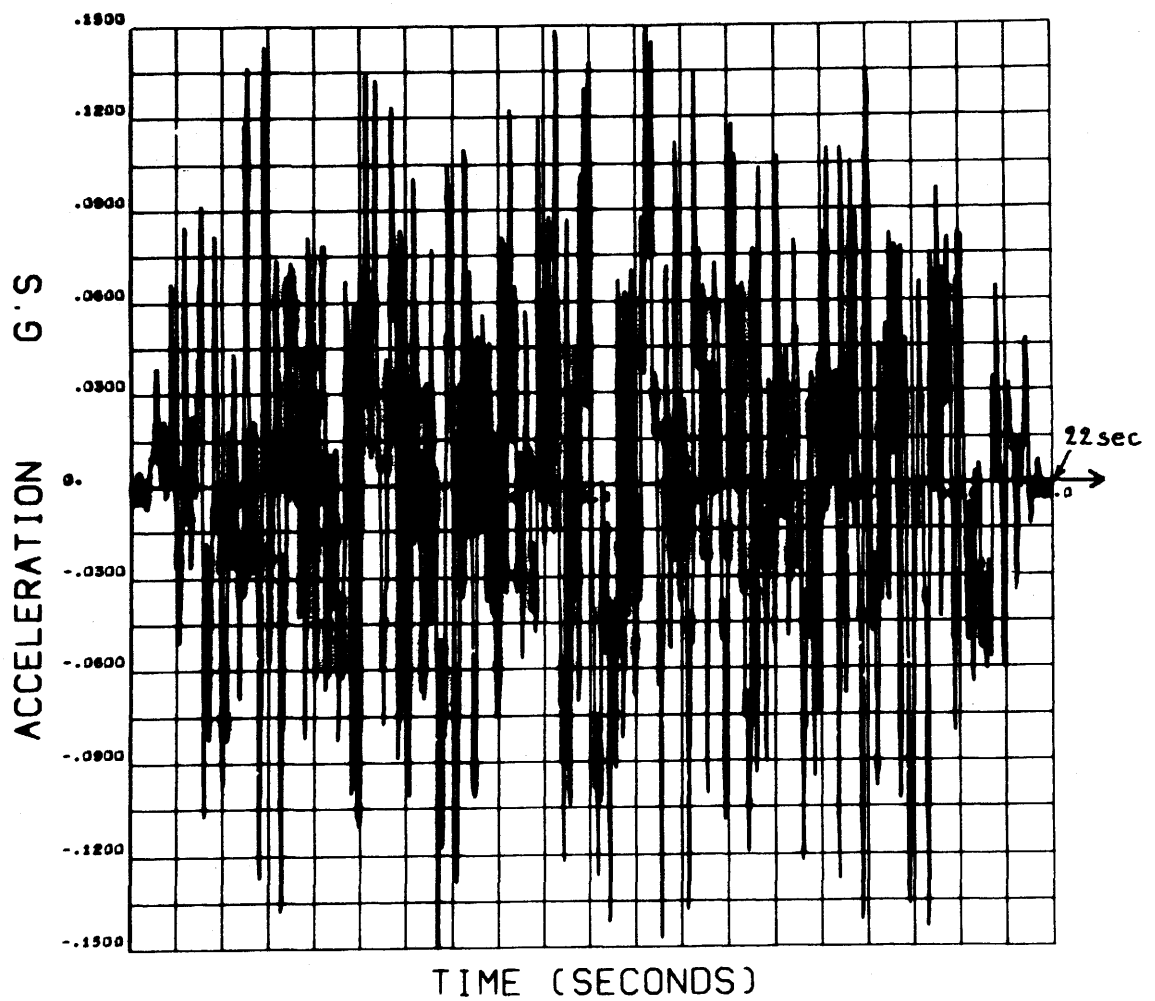


PERRY NUCLEAR POWER PLANT

Intensity Acceleration
Relationships

Figure 2.5-91

ACCELEROGRAM - H1



(Rev. 12 1/03)

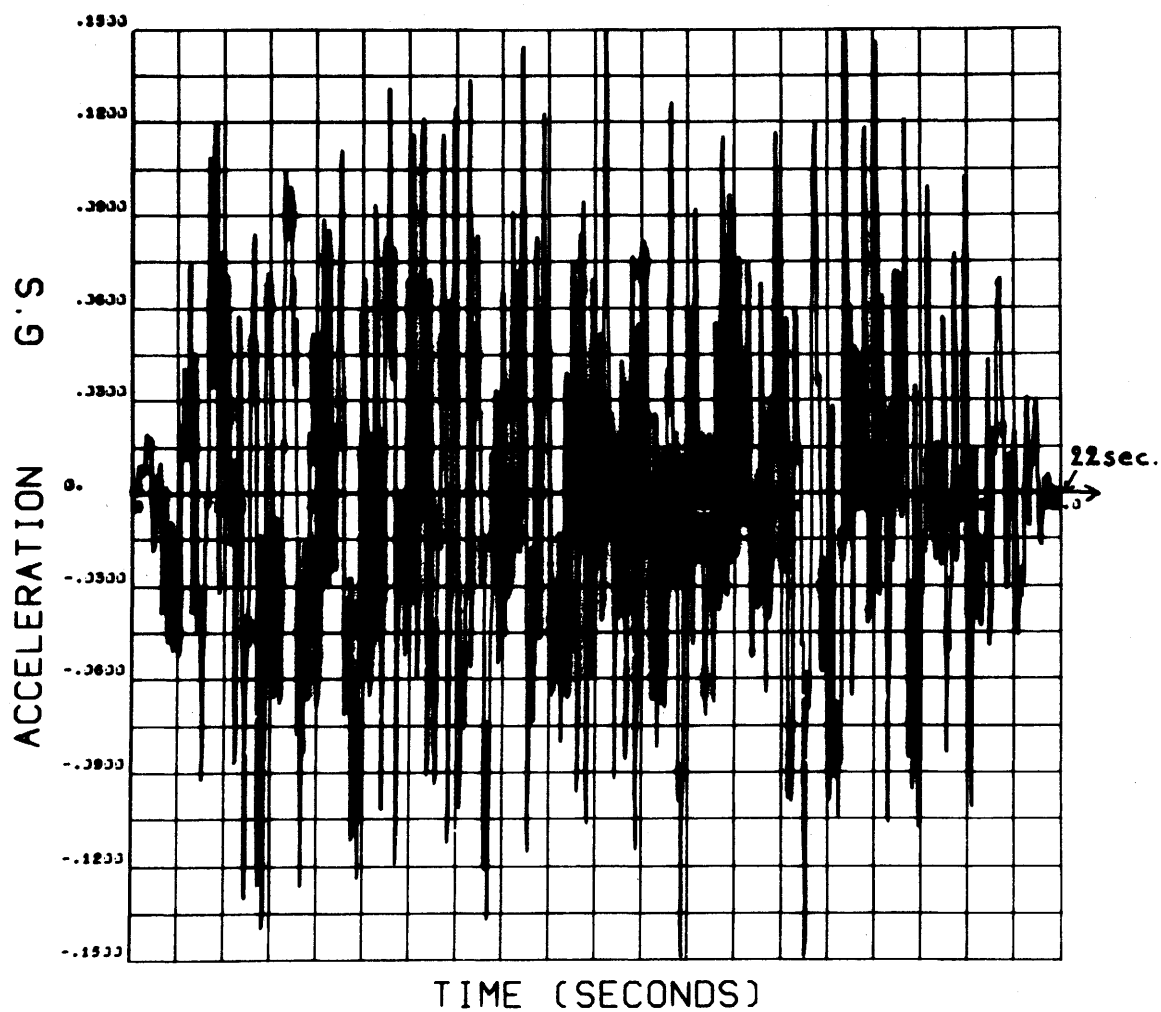


PERRY NUCLEAR POWER PLANT

Acceleration Time History -
Motion H1

Figure 2.5-92

ACCELEROGRAM - H 2



(Rev. 12 1/03)

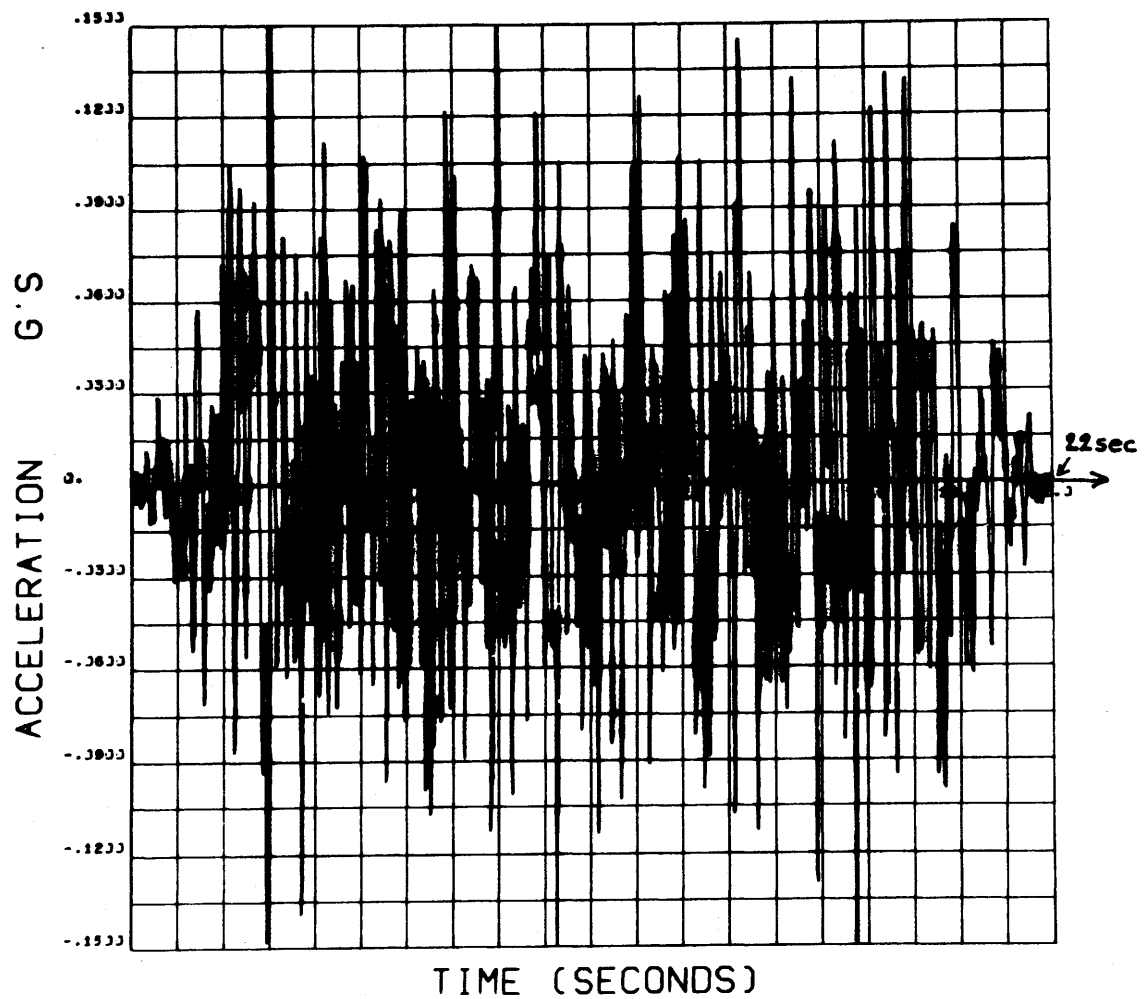


PERRY NUCLEAR POWER PLANT

Acceleration Time History -
Motion H2

Figure 2.5-93

ACCELEROGRAM - V



(Rev. 12 1/03)

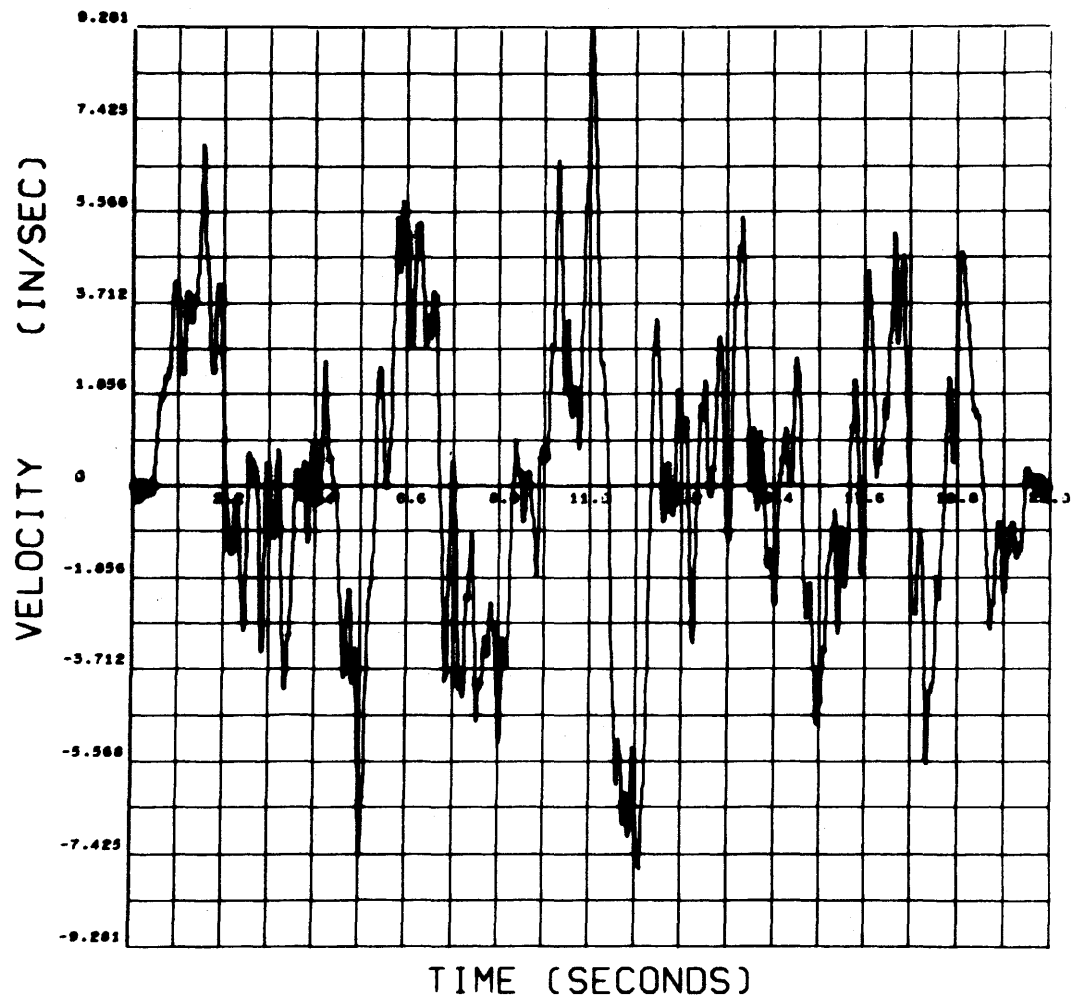


PERRY NUCLEAR POWER PLANT

Acceleration Time History -
Vertical Motion

Figure 2.5-94

VELOCITY TIME HISTORY - H 1



(Rev. 12 1/03)

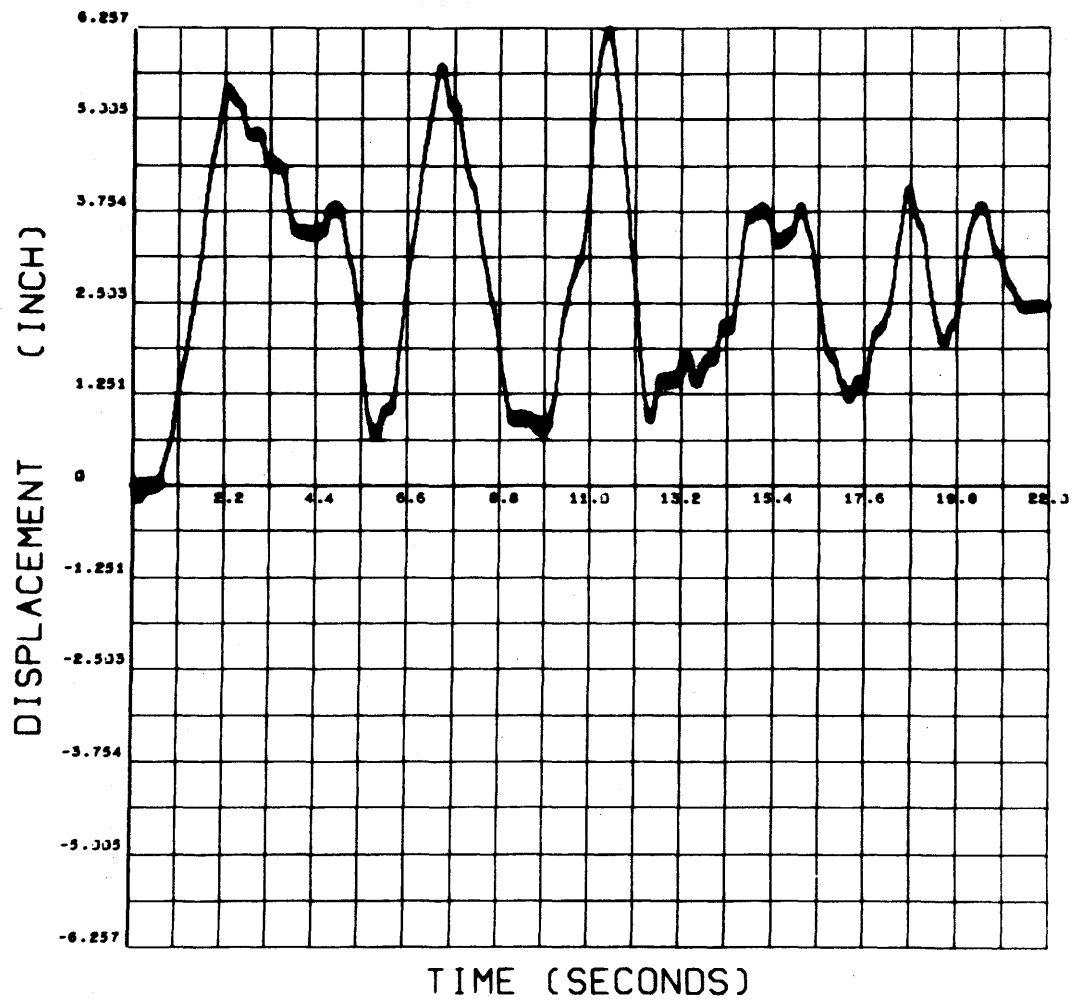


PERRY NUCLEAR POWER PLANT

Vertical Time History -
Motion H1

Figure 2.5-95

DISPLACEMENT TIME HISTORY - H1



(Rev. 12 1/03)

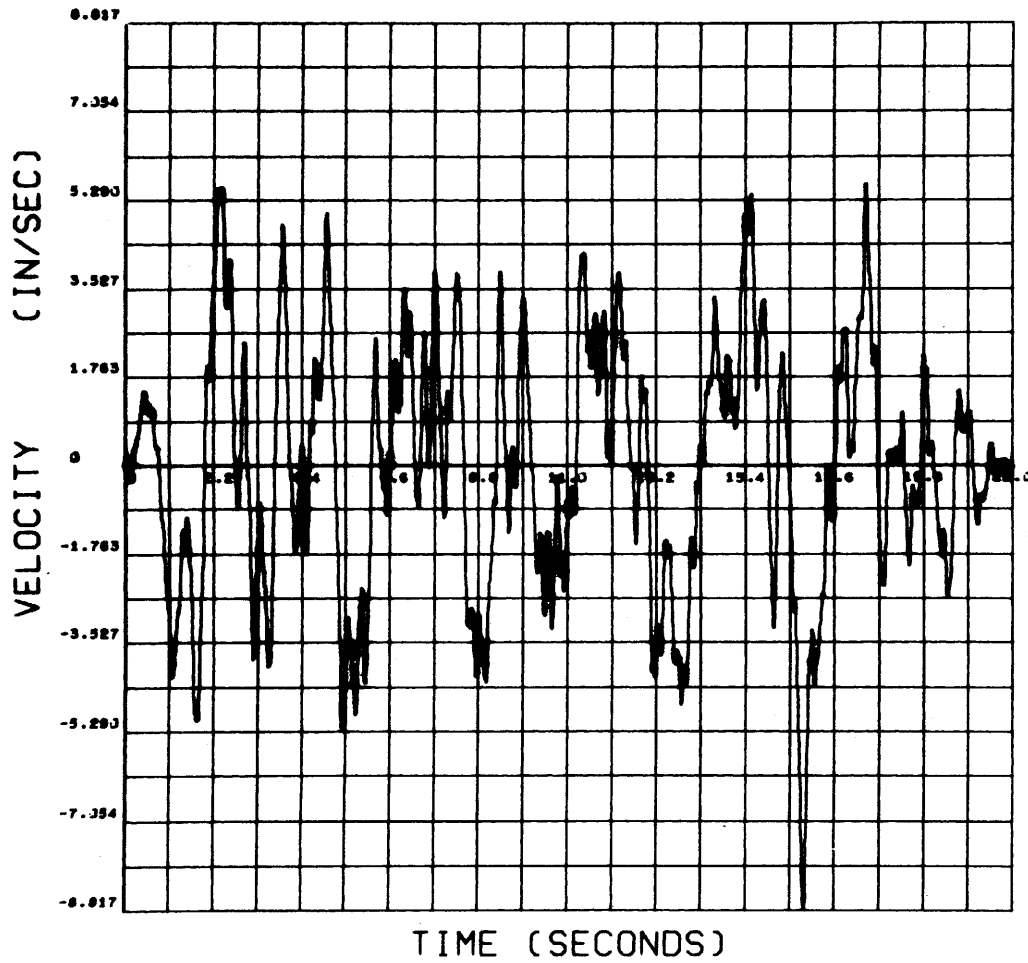


PERRY NUCLEAR POWER PLANT

Displacement Time History -
Motion H1

Figure 2.5-96

VELOCITY TIME HISTORY - H2



(Rev. 12 1/03)

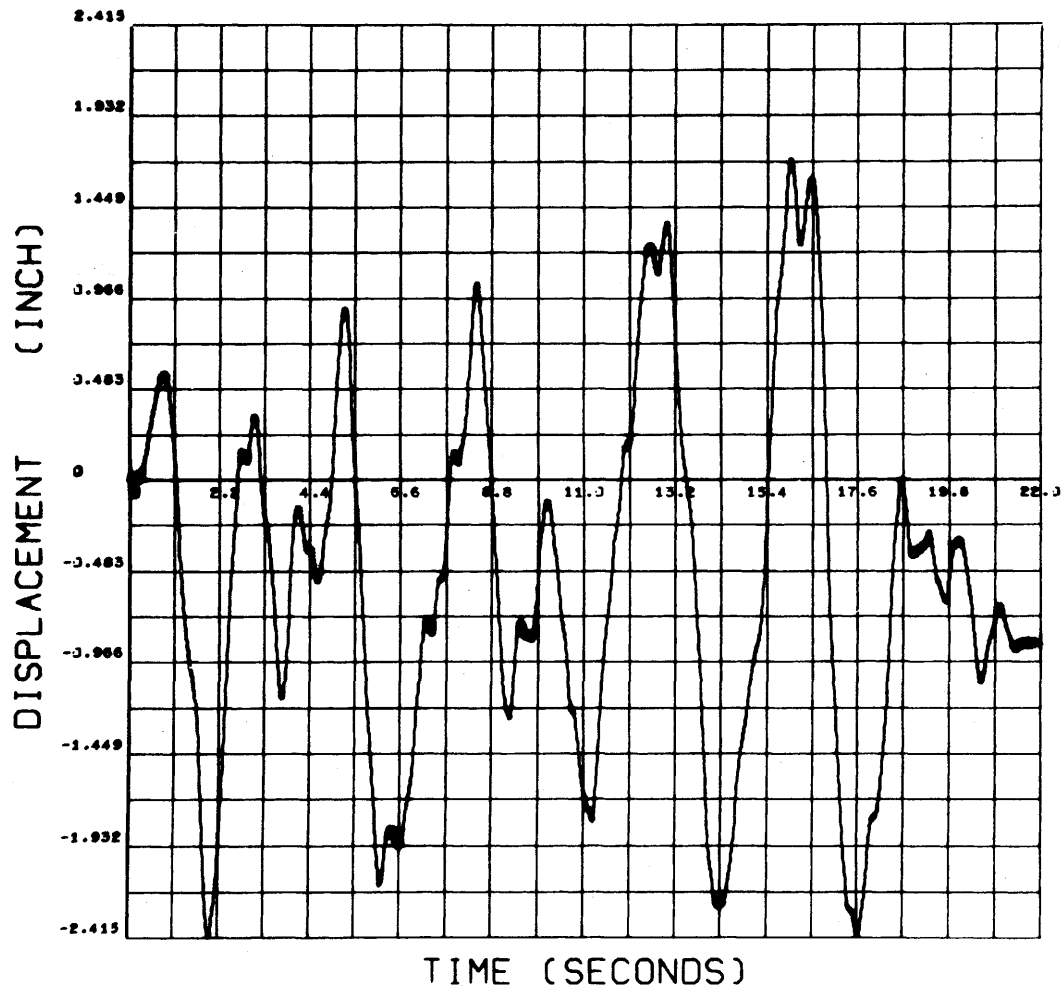


PERRY NUCLEAR POWER PLANT

Vertical Time History -
Motion H2

Figure 2.5-97

DISPLACEMENT TIME HISTORY - H2



(Rev. 12 1/03)

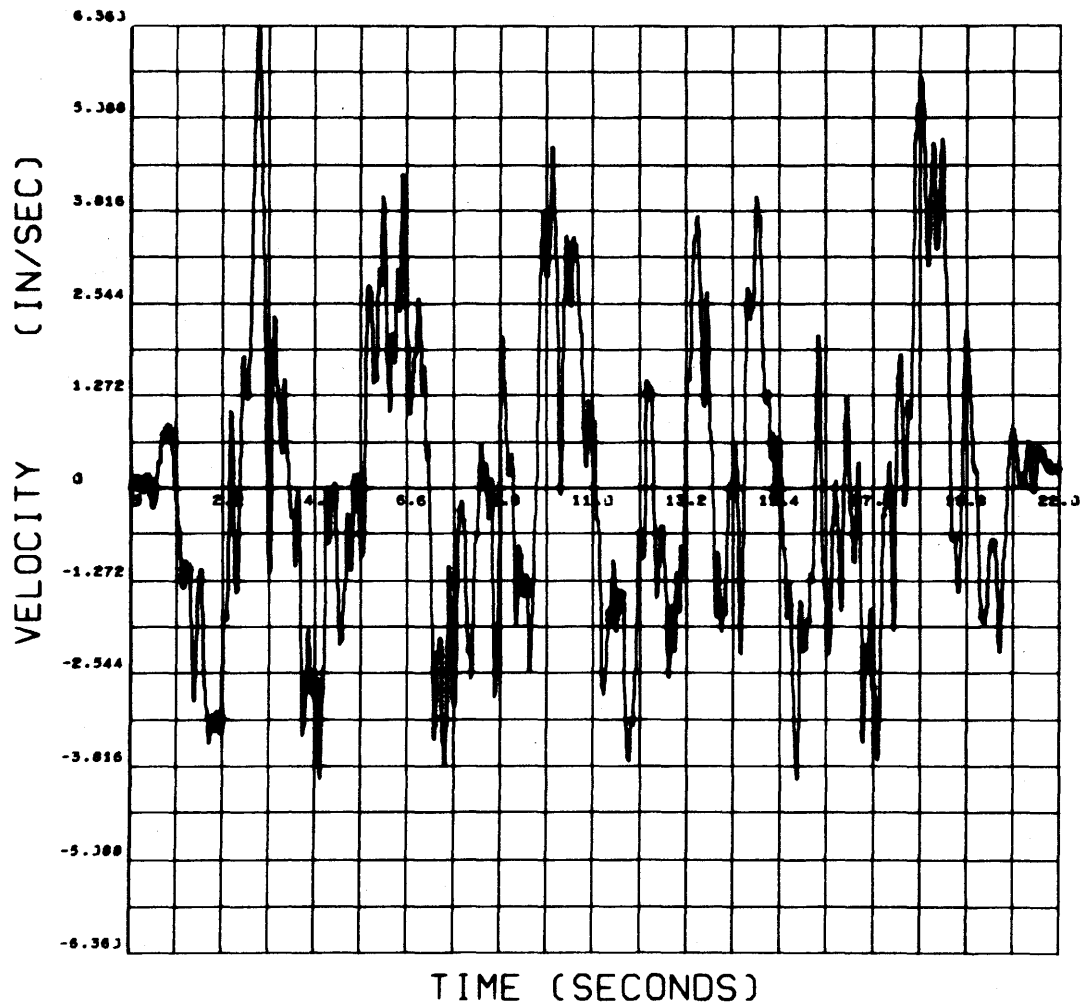


PERRY NUCLEAR POWER PLANT

Displacement Time History -
Motion H2

Figure 2.5-98

VELOCITY TIME HISTORY - V



(Rev. 12 1/03)

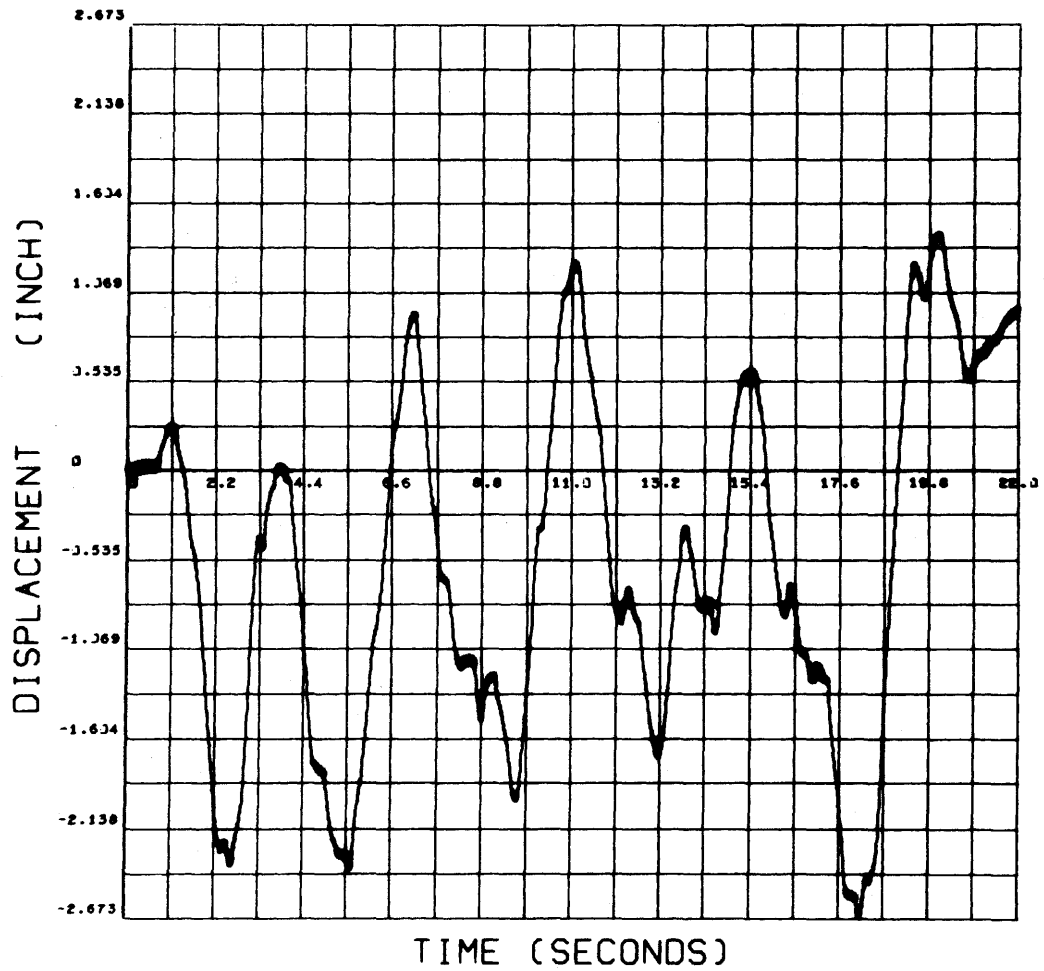


PERRY NUCLEAR POWER PLANT

Velocity Time History -
Vertical Motion

Figure 2.5-99

DISPLACEMENT TIME HISTORY - V



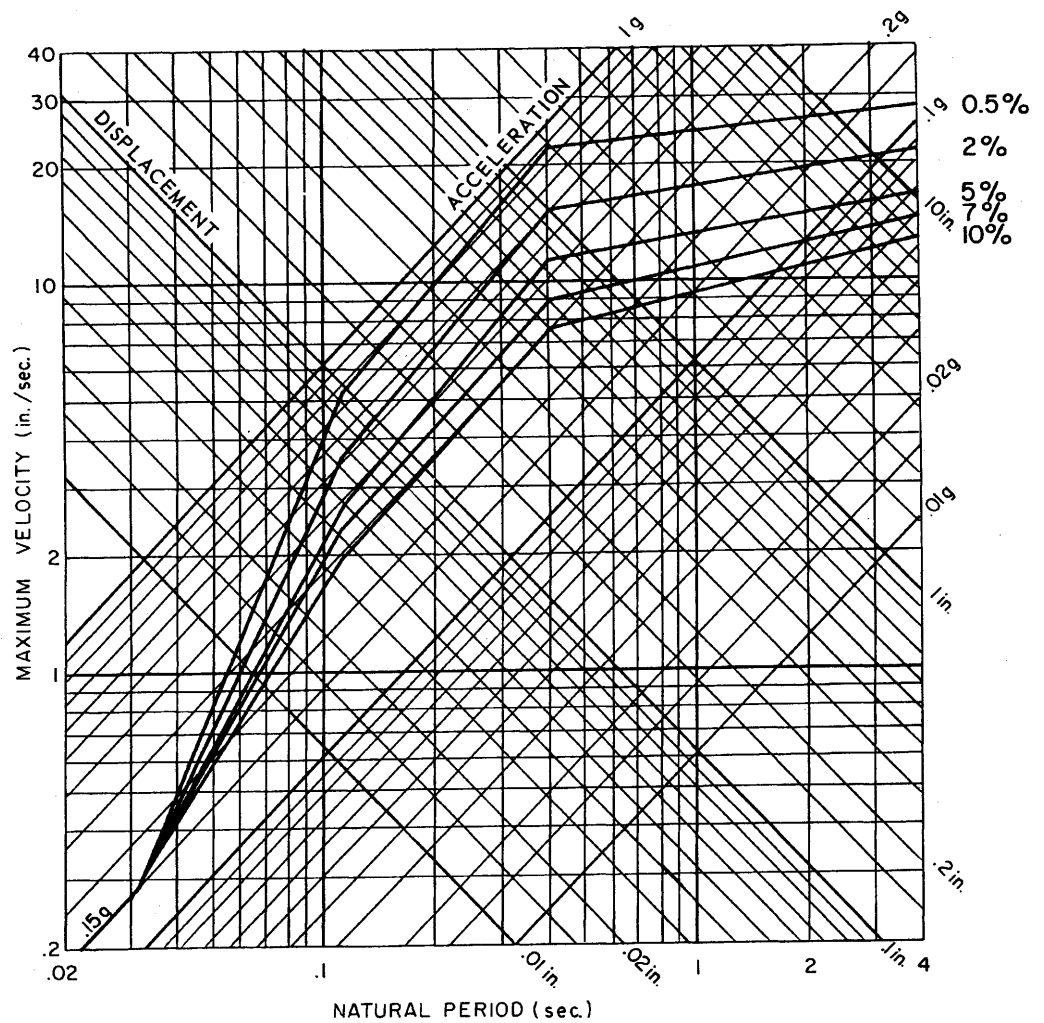
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Displacement Time History -
Vertical Motion

Figure 2.5-100



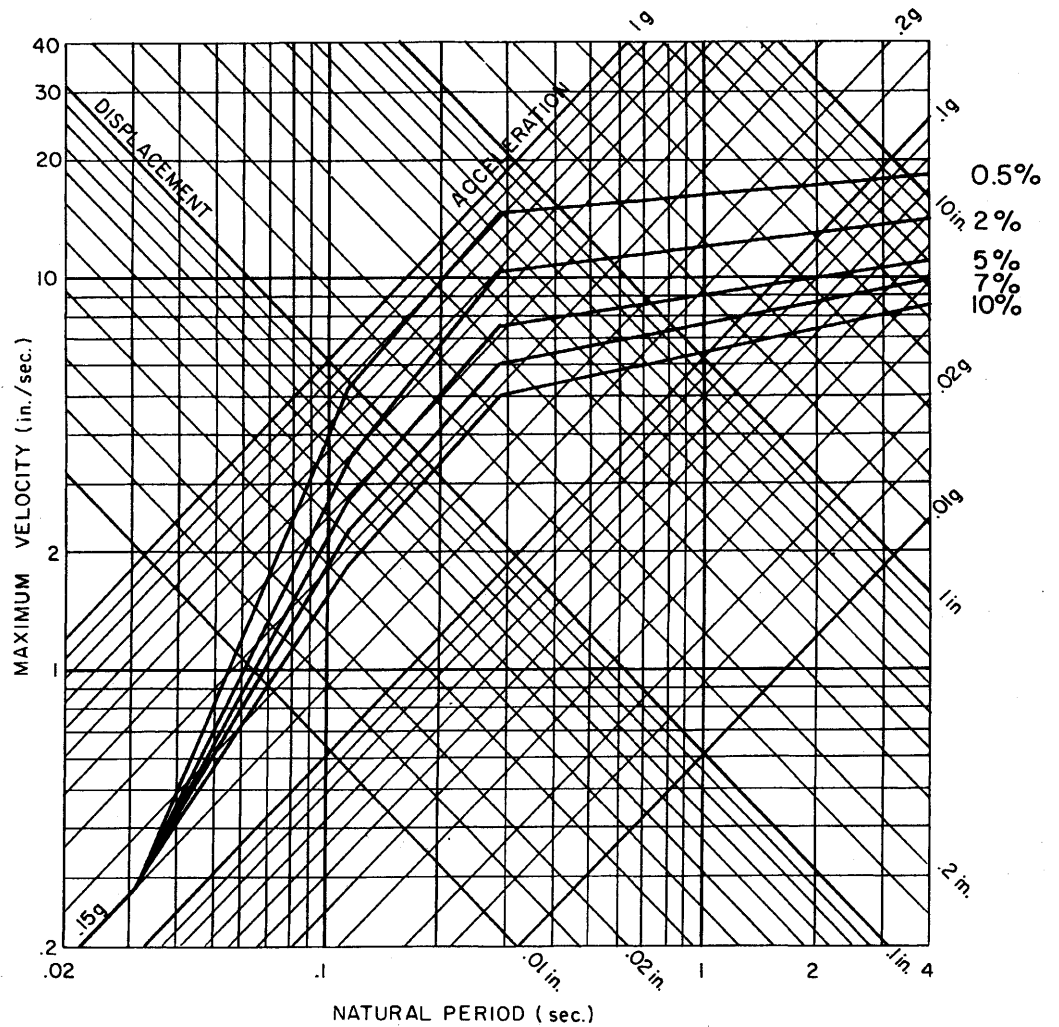
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Safe Shutdown Earthquake Design
Response Spectra -
Horizontal Motion

Figure 2.5-101



(Rev. 12 1/03)

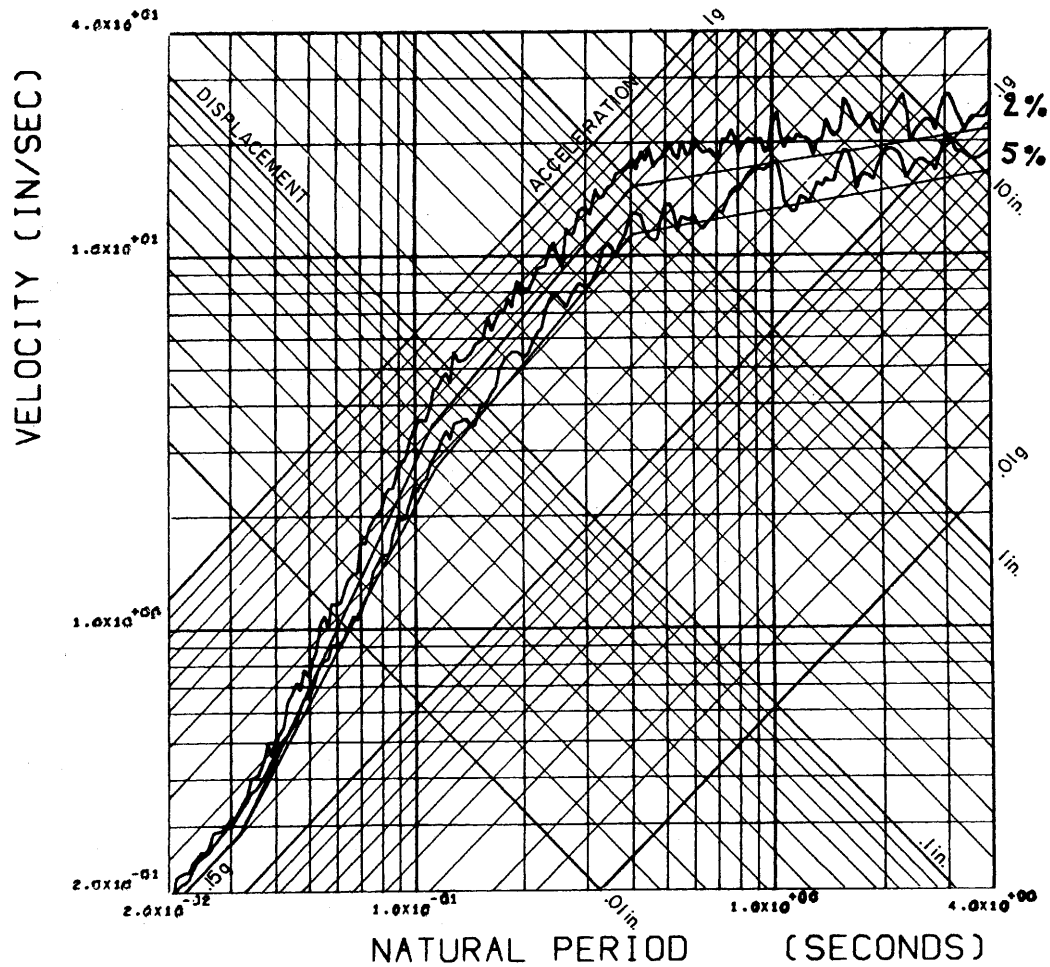


PERRY NUCLEAR POWER PLANT

Safe Shutdown Earthquake
Design Response Spectra -
Vertical Motion

Figure 2.5-102

RESPONSE SPECTRUM - H1



(Rev. 12 1/03)

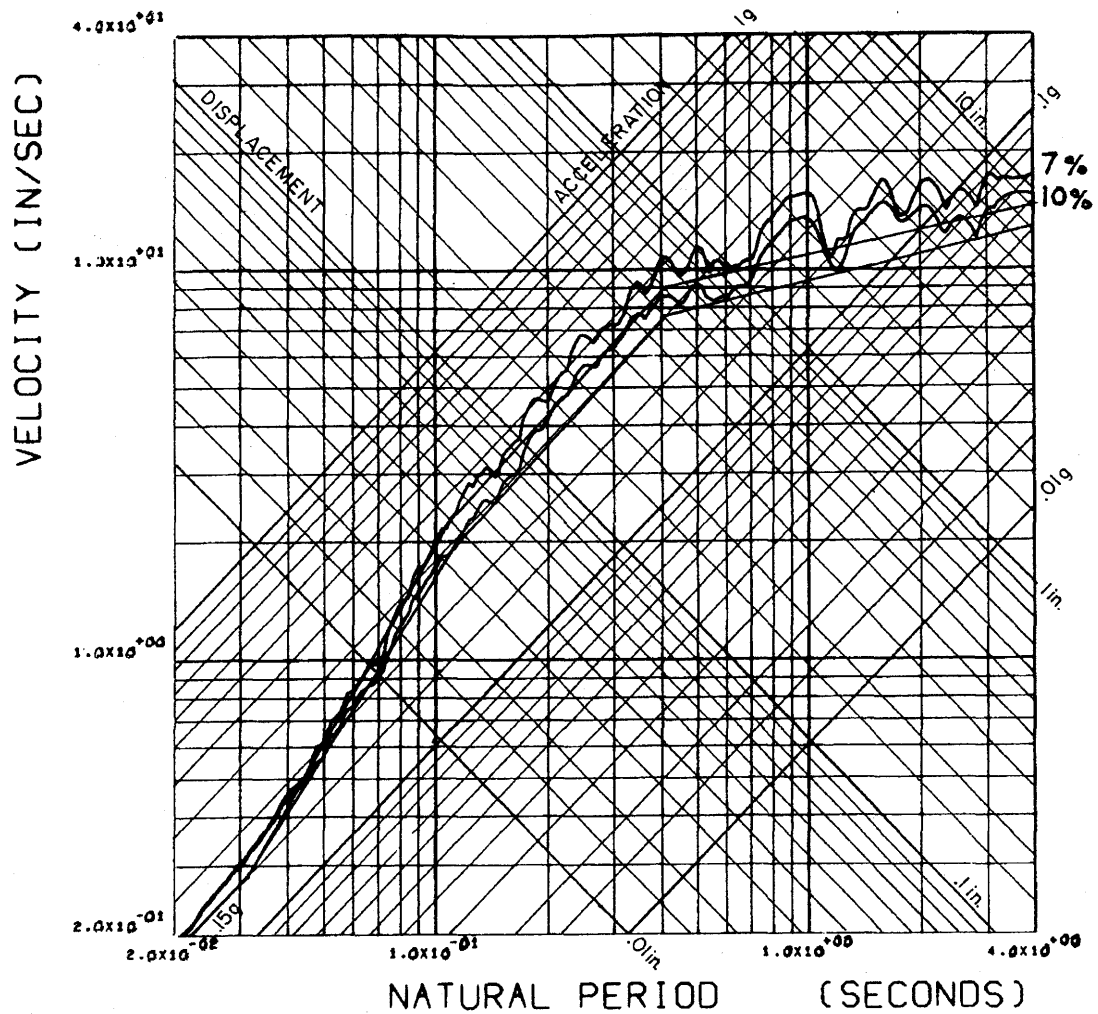


PERRY NUCLEAR POWER PLANT

Response Spectra - Horizontal
Motion H1 (2% and 5% Damping)

Figure 2.5-103

RESPONSE SPECTRUM - H1



(Rev. 12 1/03)

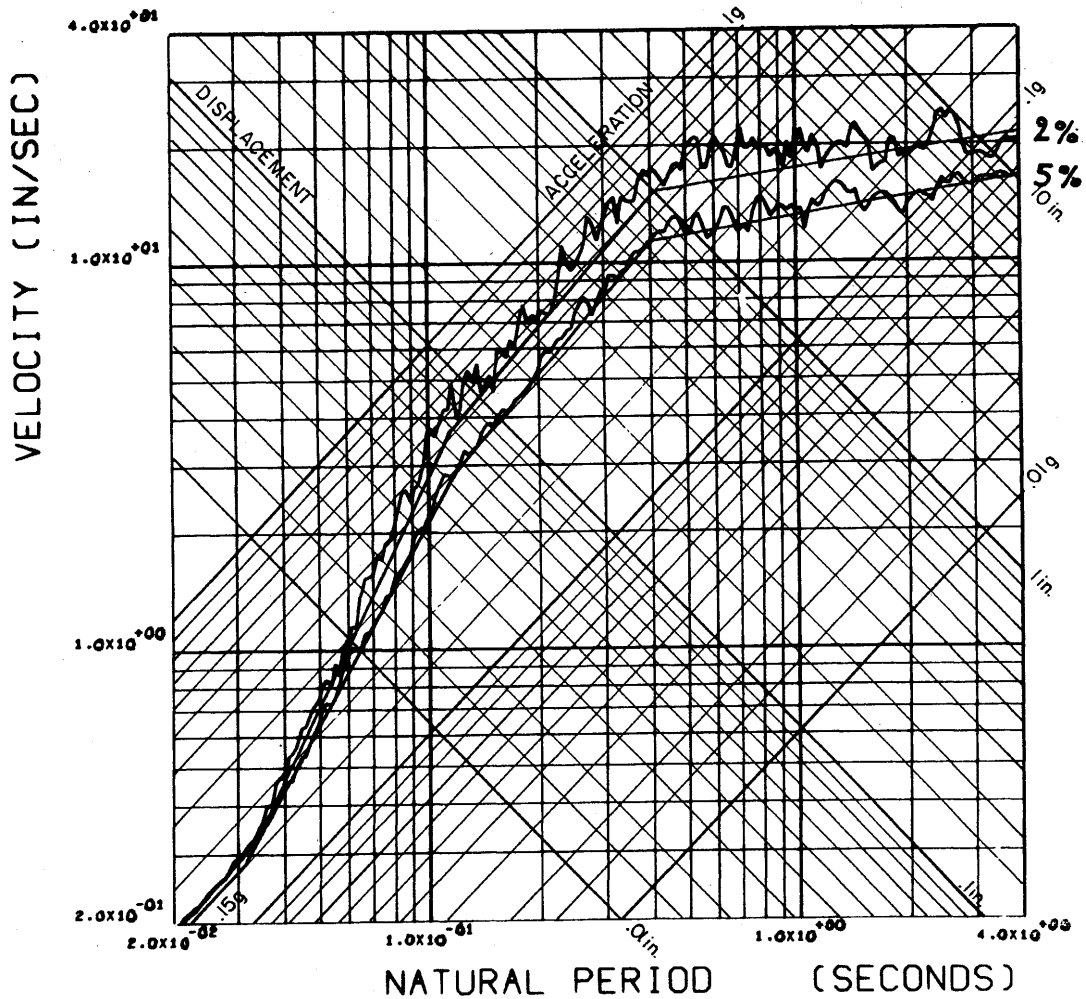


PERRY NUCLEAR POWER PLANT

Response Spectra - Horizontal
Motion H1 (7% and 10% Damping)

Figure 2.5-104

RESPONSE SPECTRUM - H2



(Rev. 12 1/03)

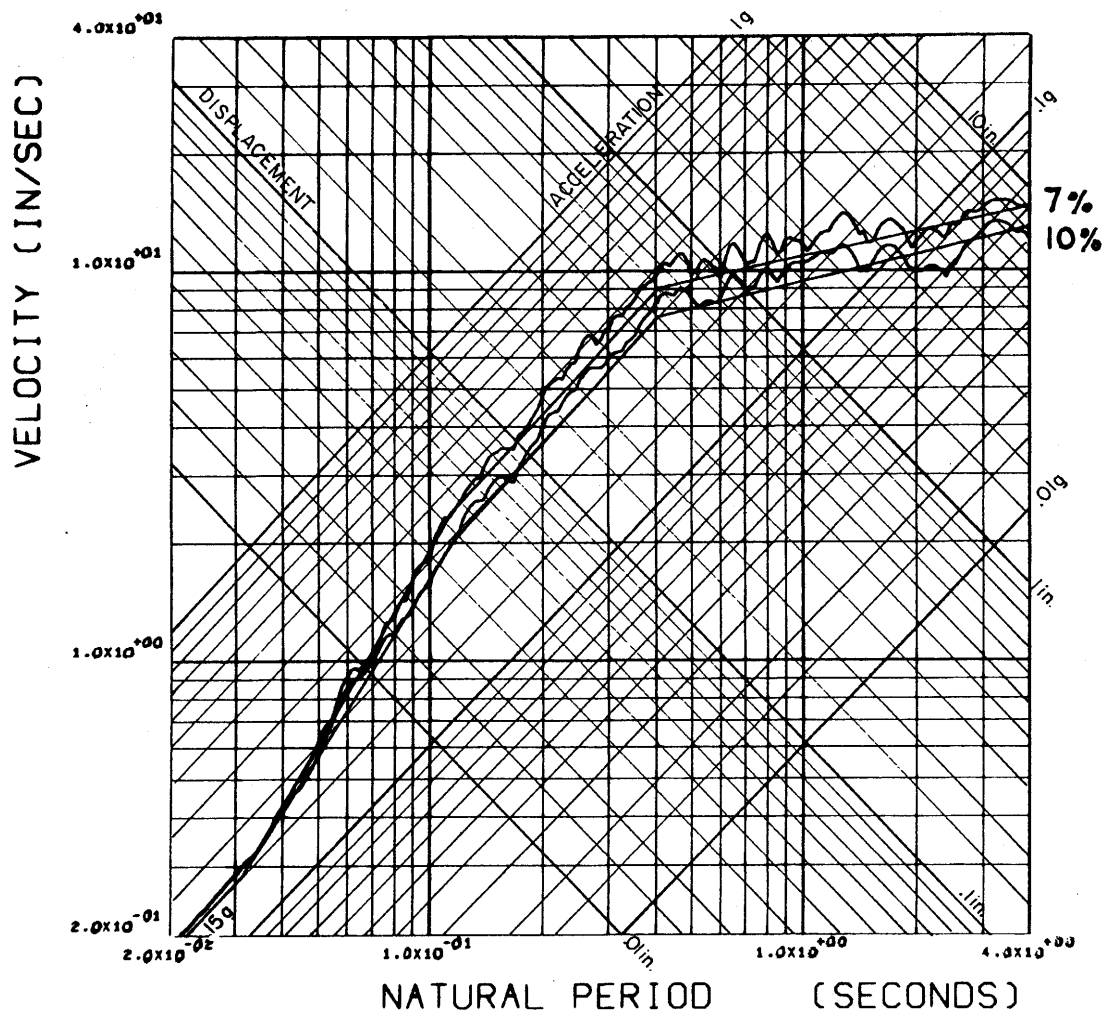


PERRY NUCLEAR POWER PLANT

Response Spectra - Horizontal
Motion H2 (2% and 5% Damping)

Figure 2.5-105

RESPONSE SPECTRUM - H2



(Rev. 12 1/03)

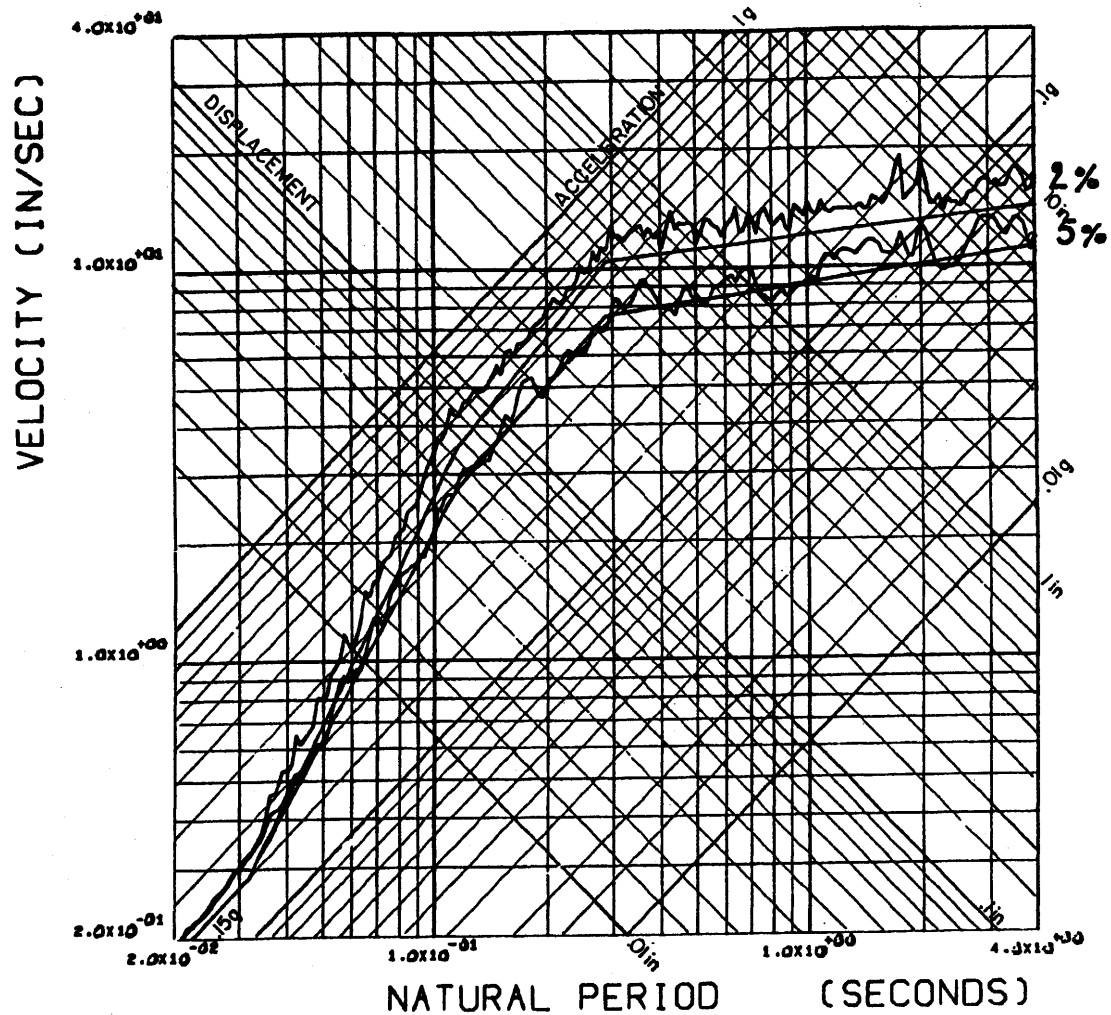


PERRY NUCLEAR POWER PLANT

Response Spectra - Horizontal
Motion H2 (7% and 10% Damping)

Figure 2.5-106

RESPONSE SPECTRUM - V



(Rev. 12 1/03)

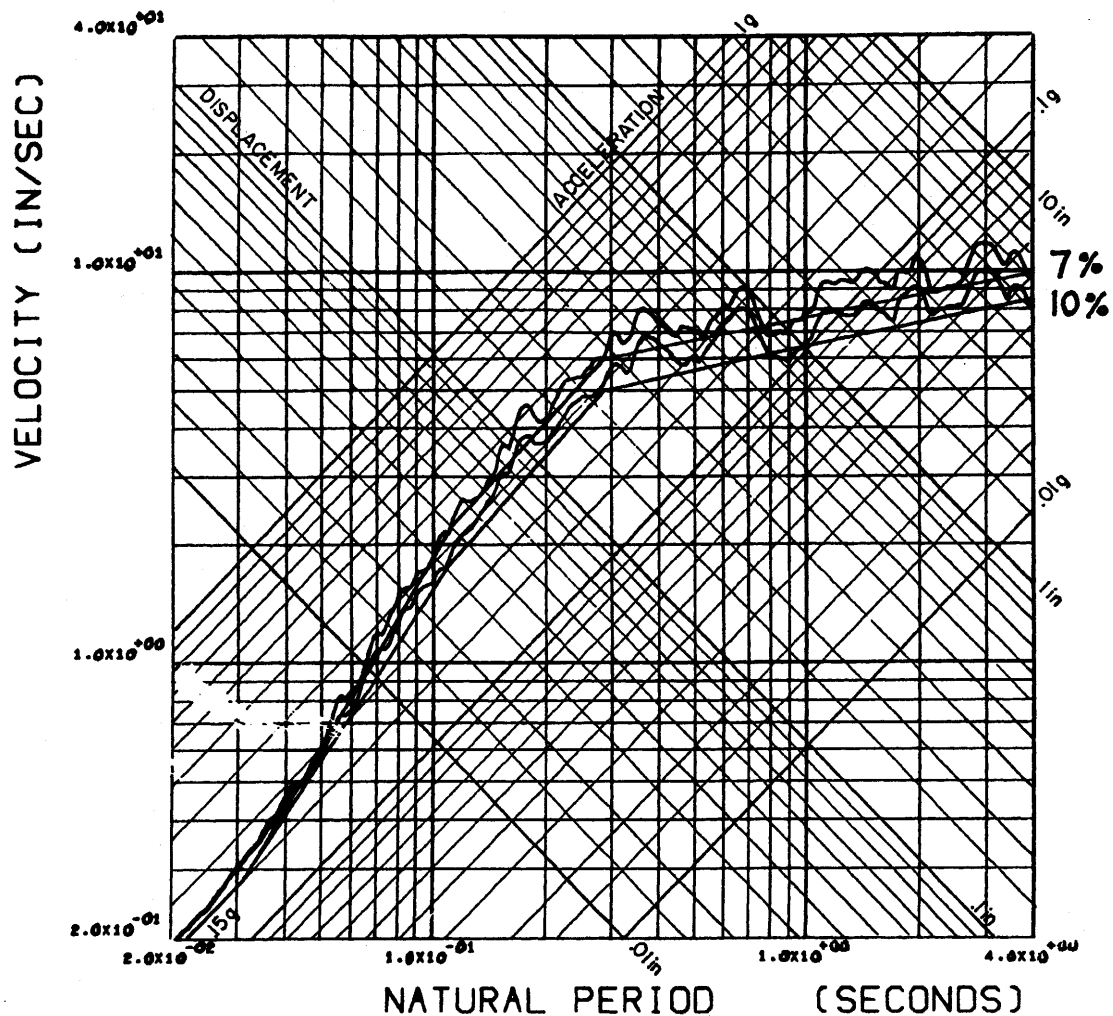


PERRY NUCLEAR POWER PLANT

Response Spectra - Vertical
Motion (2% and 5% Damping)

Figure 2.5-107

RESPONSE SPECTRUM - V



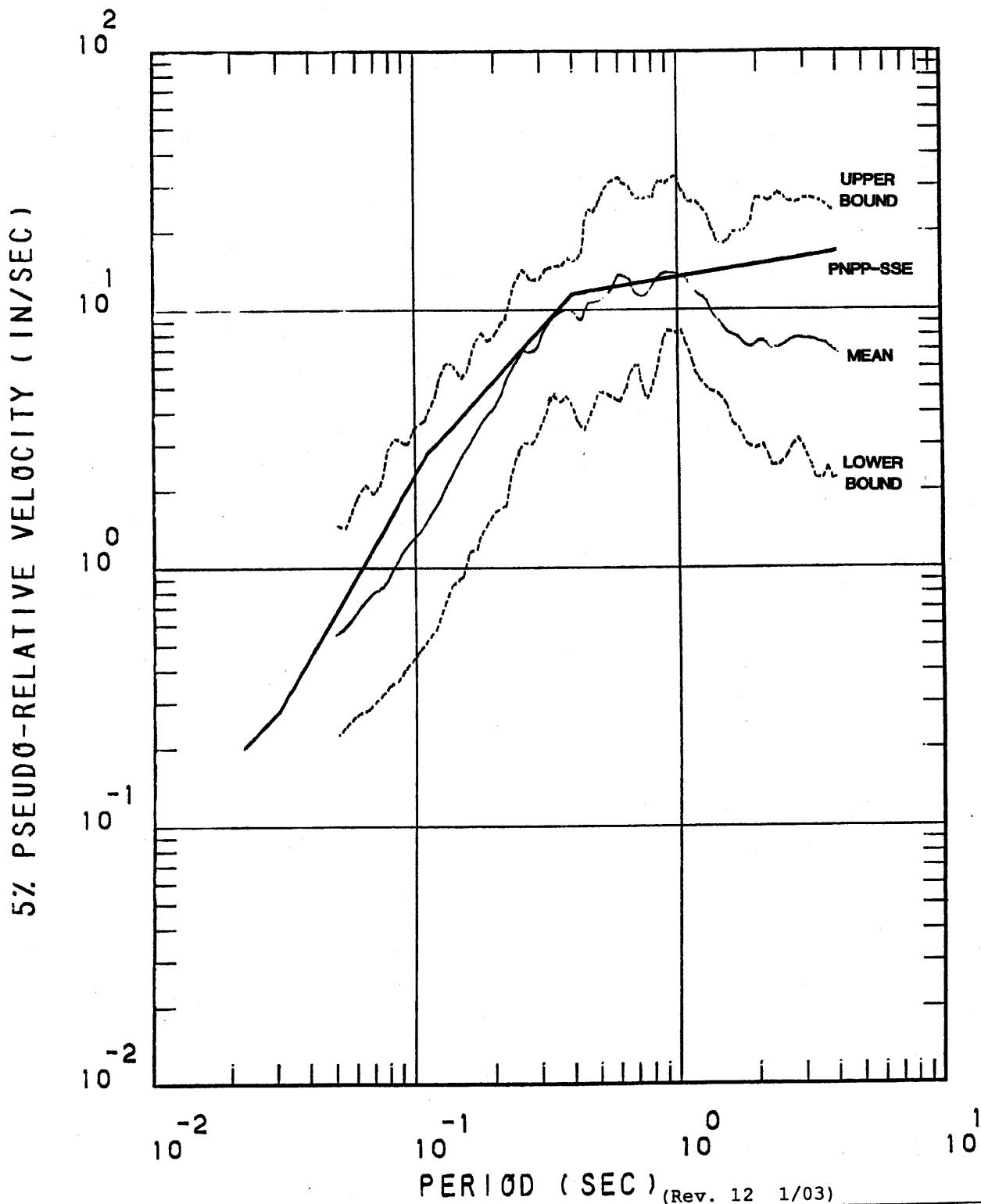
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Response Spectra - Vertical
Motion (7% and 10% Damping)

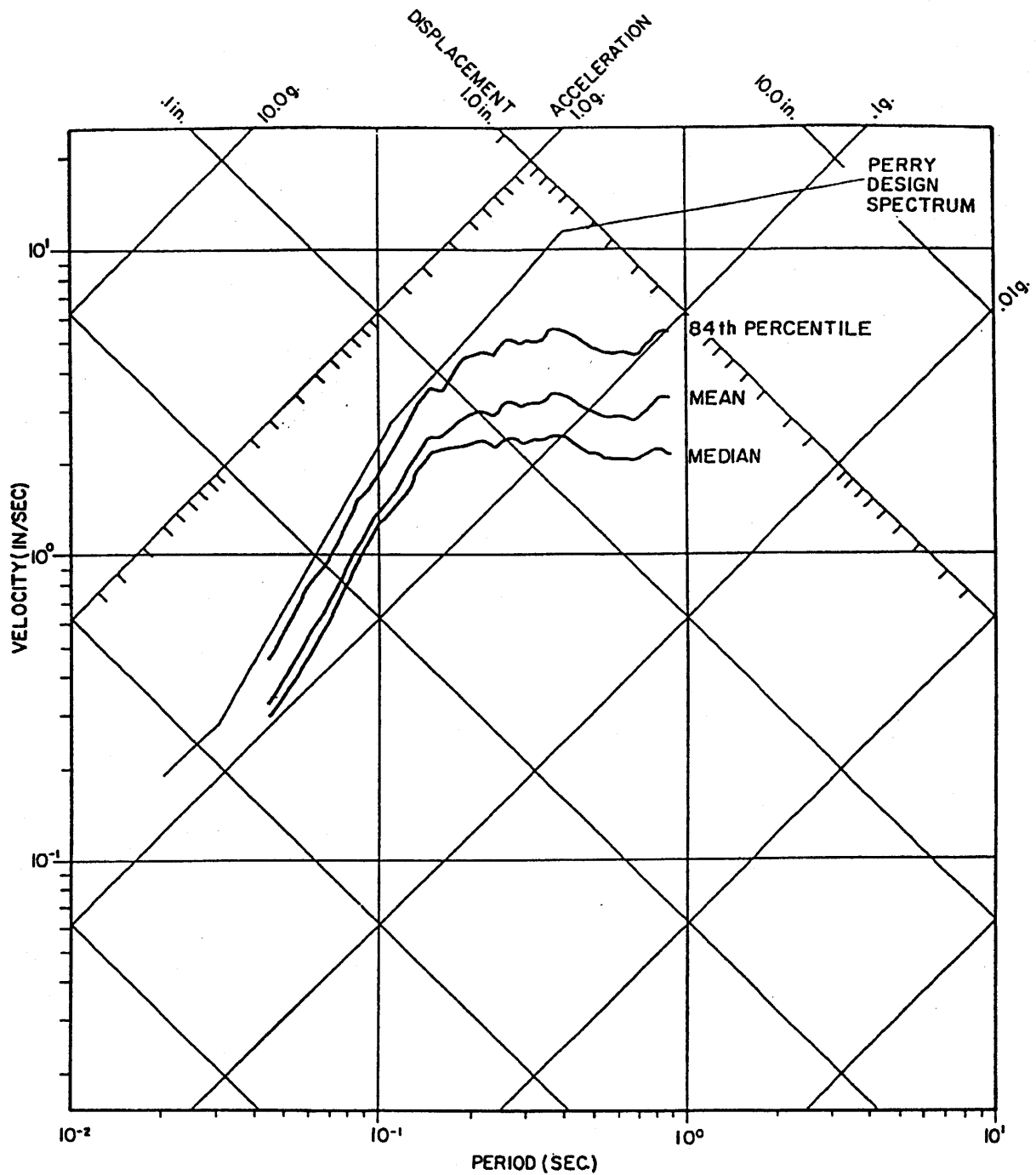
Figure 2.5-108



PERRY NUCLEAR POWER PLANT

Observed Response Spectra for
Intensity VIII Effects vs. Design
Response Spectra

Figure 2.5-109



AVERAGE MAGNITUDE OF 5.7
AVERAGE DISTANCE OF 13 KM
ROCK FOUNDATIONS
(BASIC SUBSET, MAGNITUDE RANGE
EXTENDED TO INCLUDE THREE EVENTS
WITH MAGNITUDE $M_L = 6.0, 6.0$ AND
6.1, 5% DAMPING)

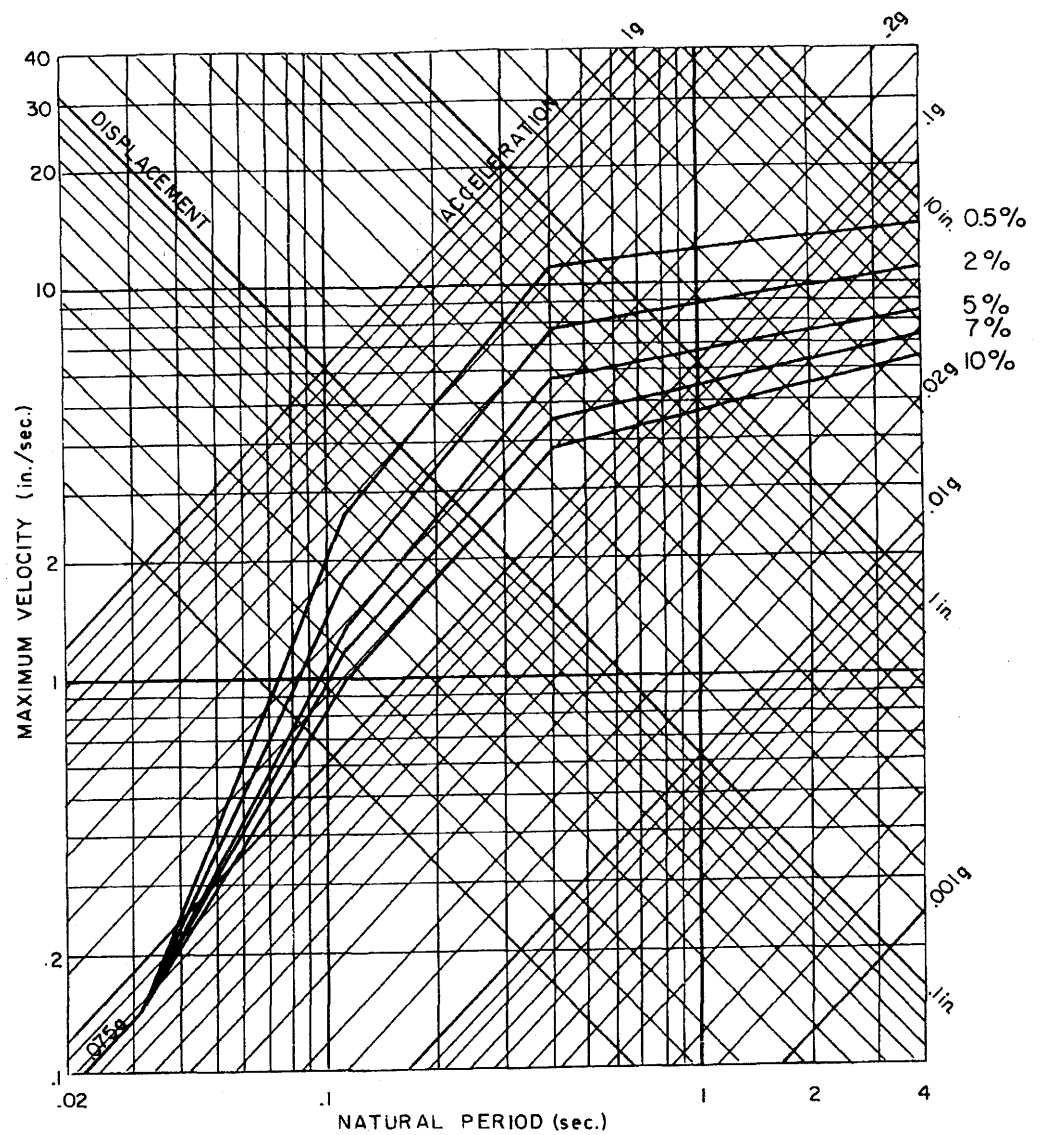
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Site Specific Response Spectra
for the Perry Site
(5% Damping)

Figure 2.5-110



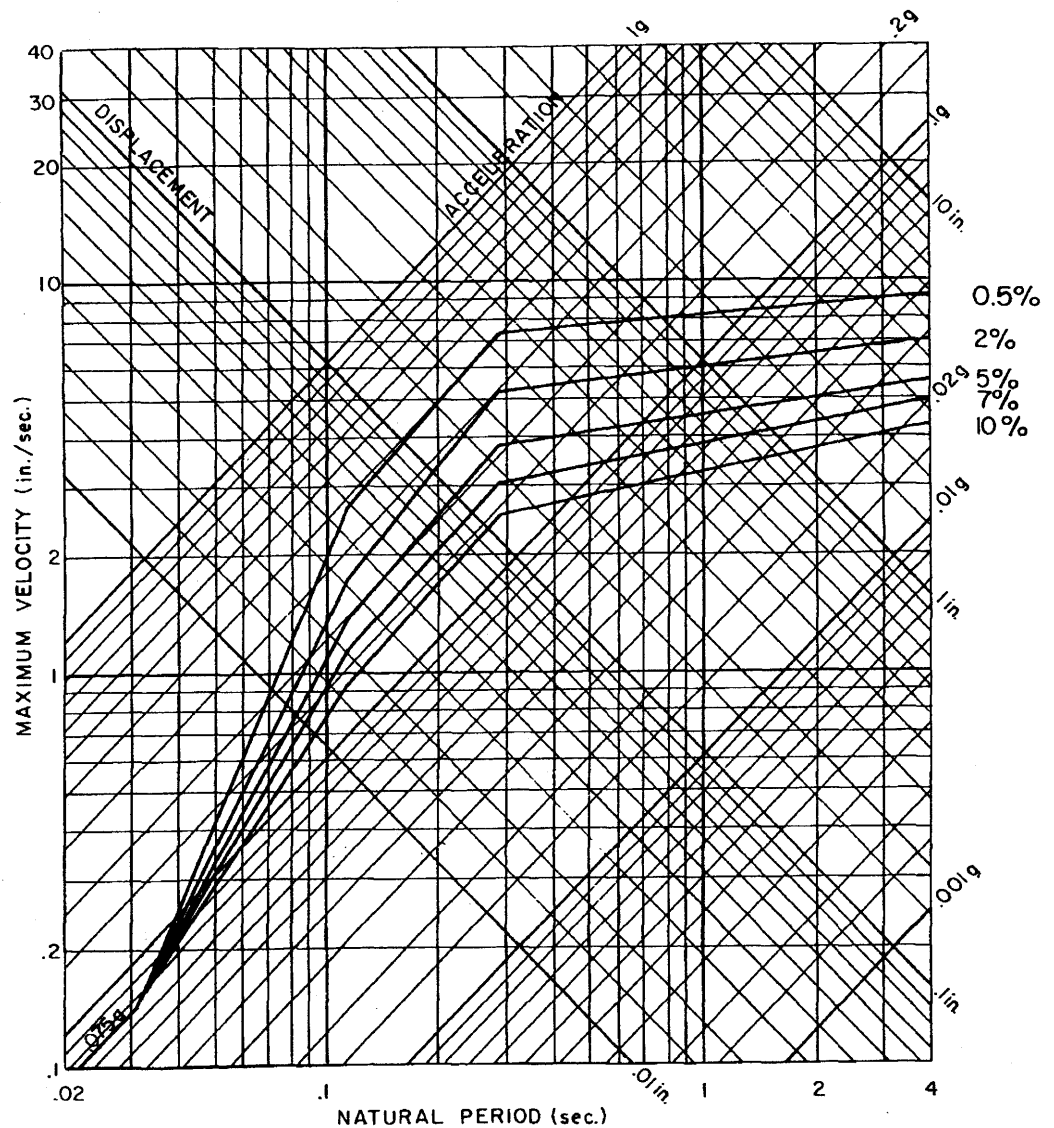
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Operating Basis Earthquake Design
Response Spectra - Horizontal
Motion

Figure 2.5-111



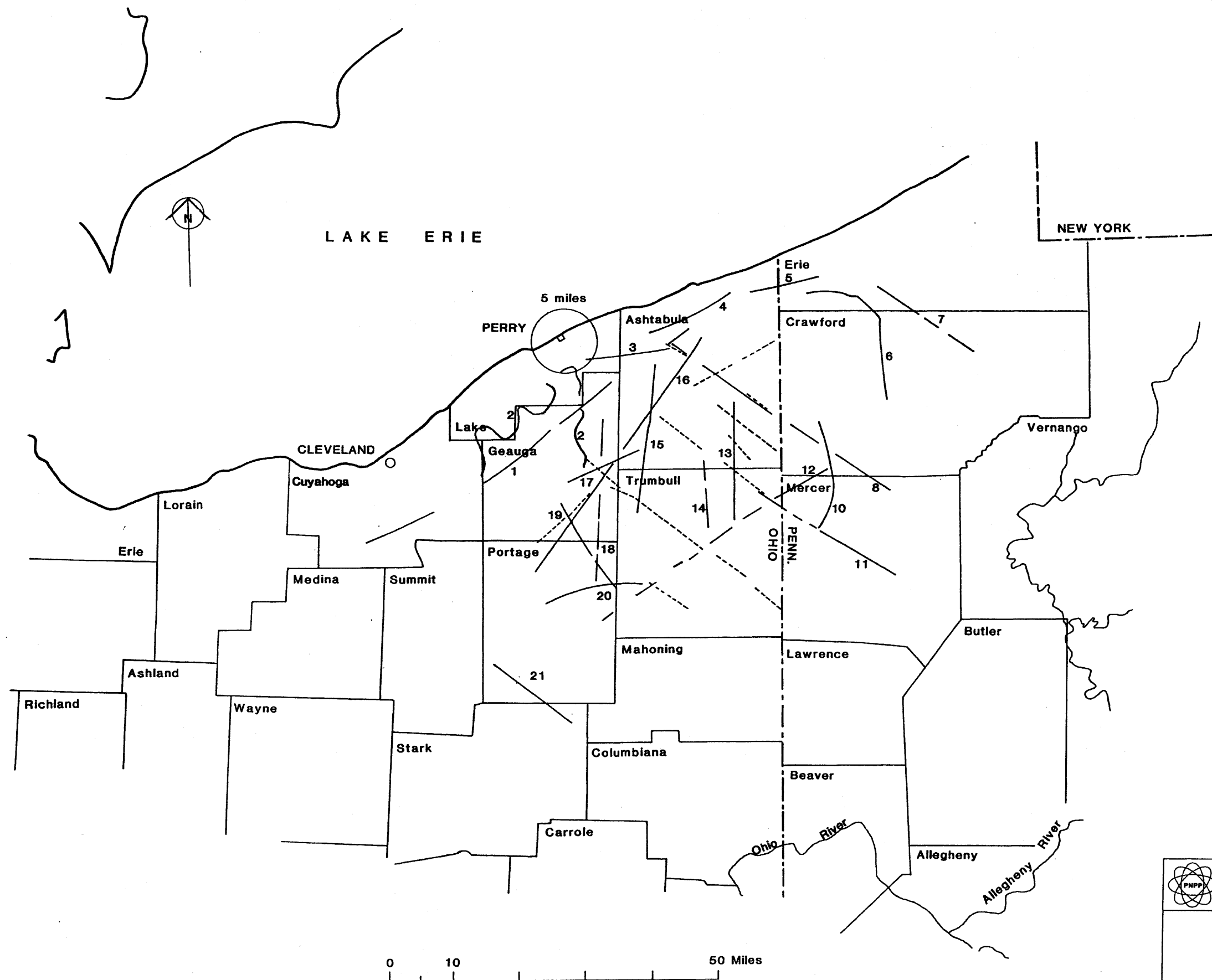
(Rev. 13 12/03)



PERRY NUCLEAR POWER PLANT

Operating Basis Earthquake Design
Response Spectra - Vertical
Motion

Figure 2.5-112

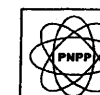


NOTE:

Numbers next to solid lineaments referred to in Section 2.5.3.2.

Dashed lineaments from Synthetic Aperture Radar Imagery, Cleveland 2° sheet, 1984.

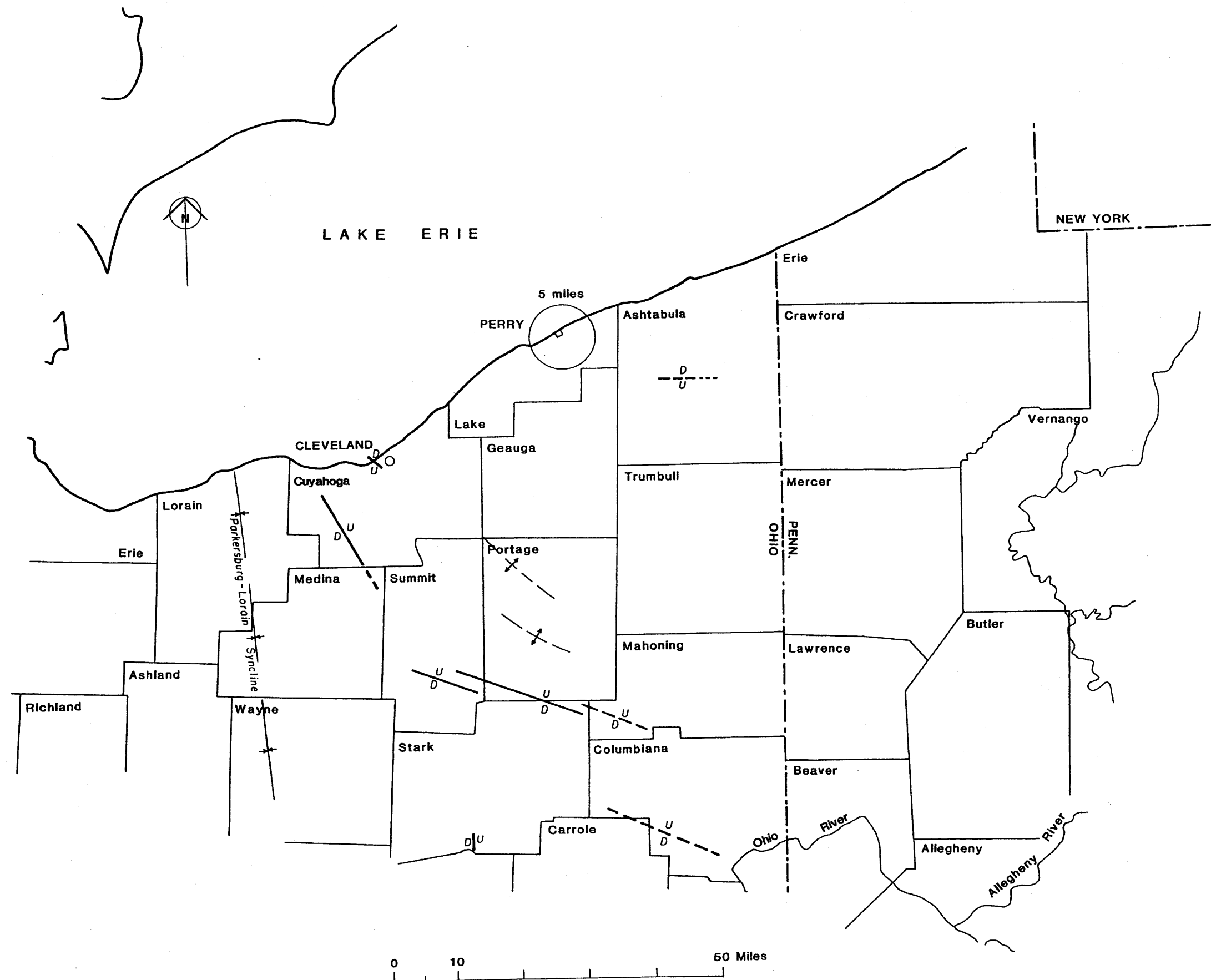
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

ERTS and SAR Lineaments

Figure 2.5-113



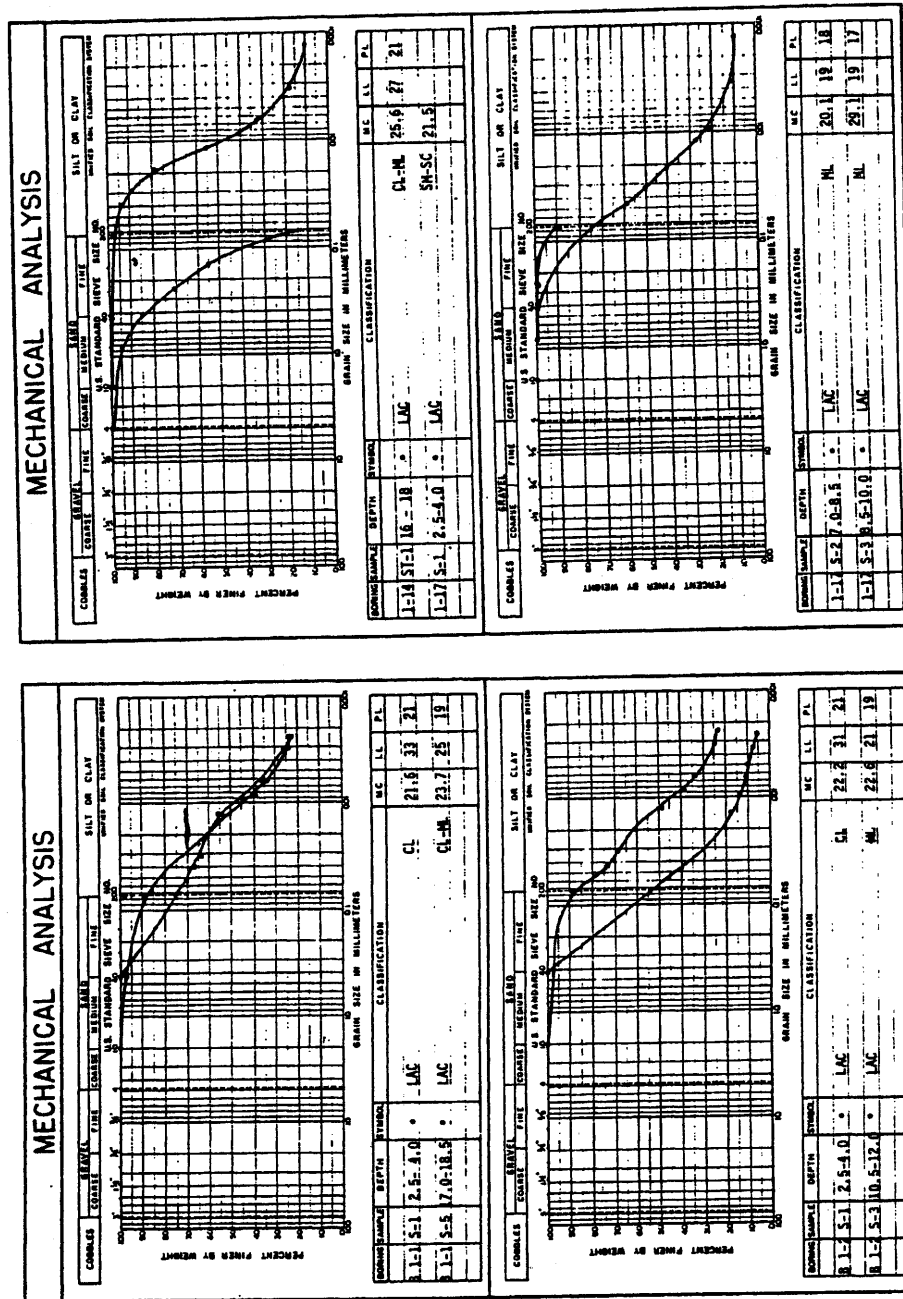
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Structure Map of Northeastern Ohio

Figure 2.5-114



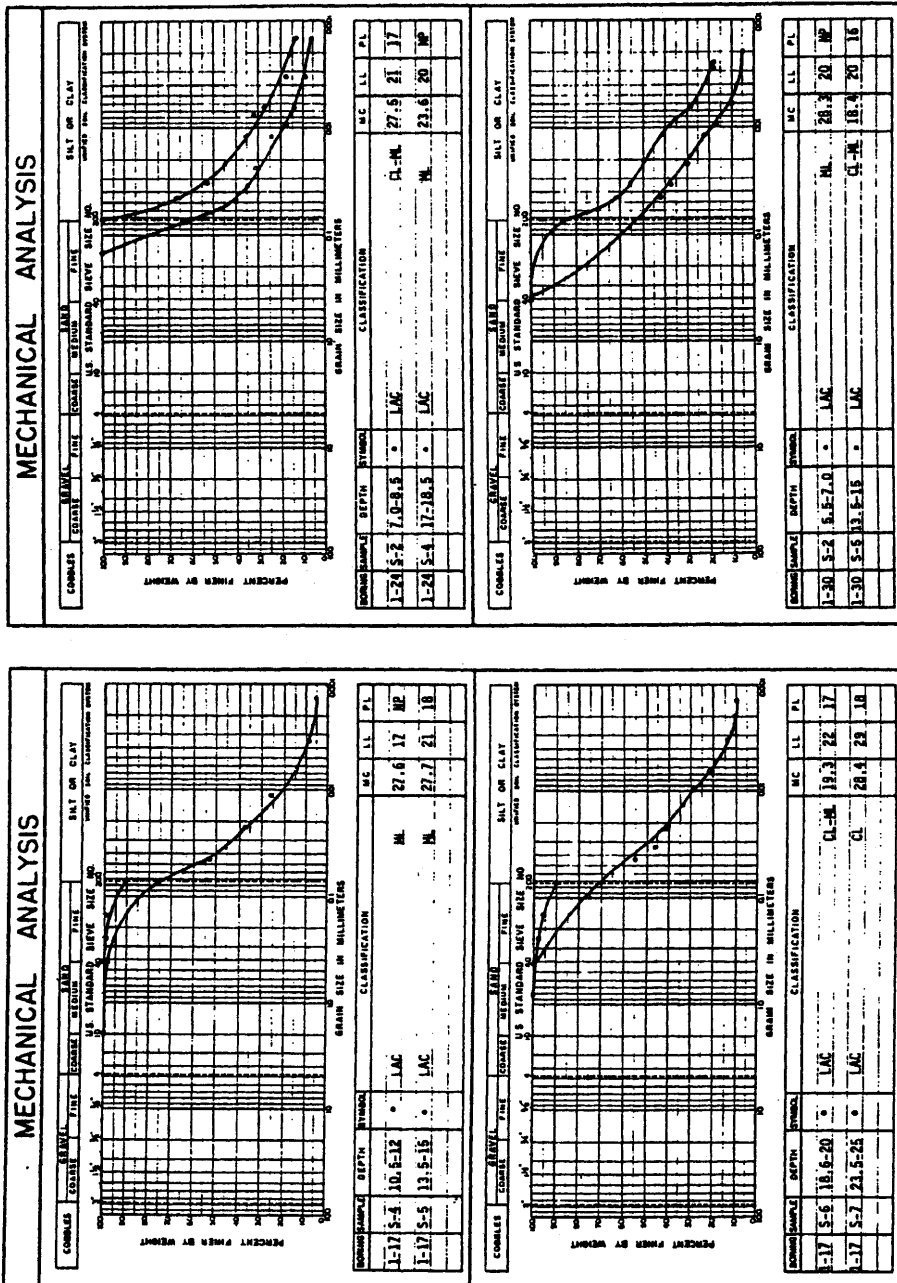
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Lacustrine Sediments

Figure 2.5-115 (Sheet 1 of 6)



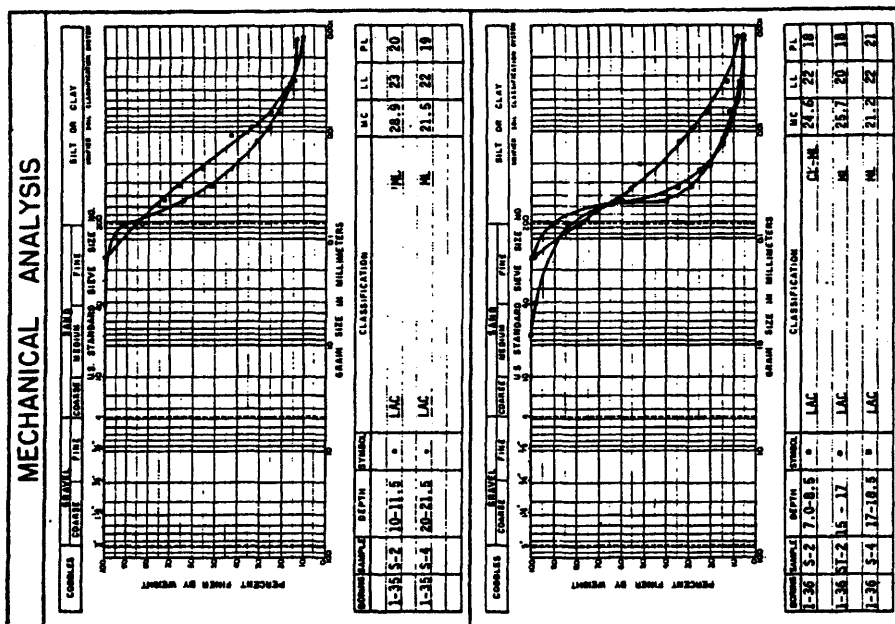
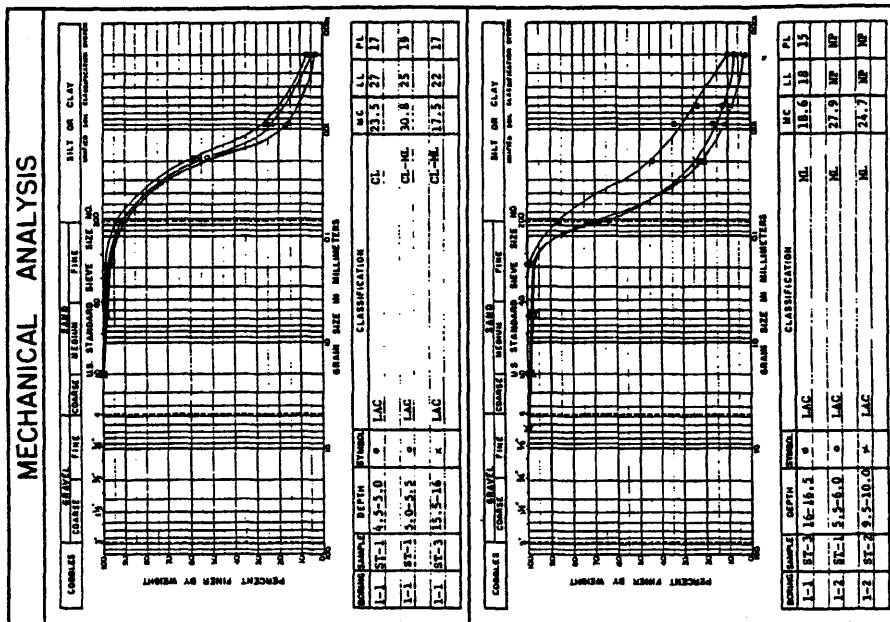
(Rev. 12-1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Lacustrine Sediments

Figure 2.5-115 (Sheet 2 of 6)



(Tested by Heron Testing Laboratories)

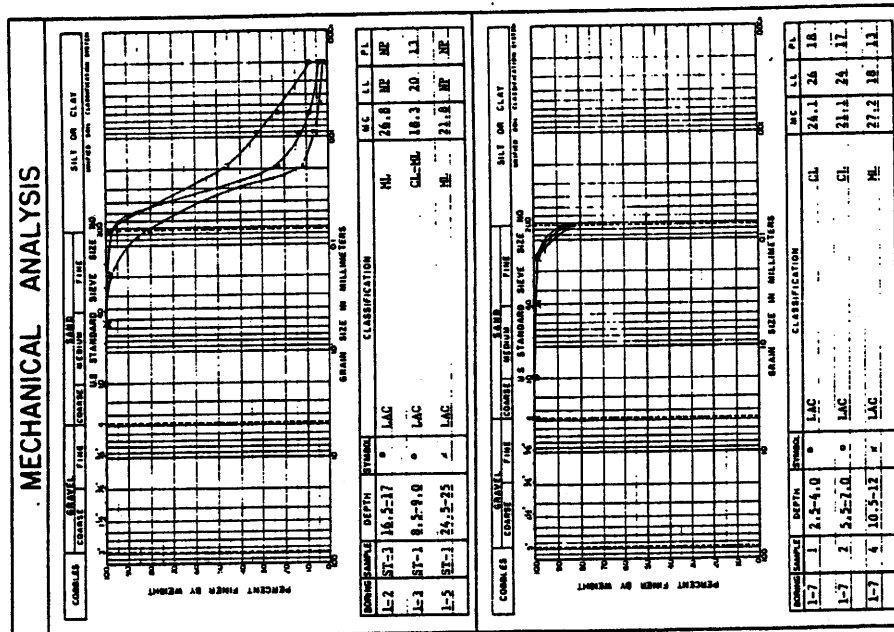
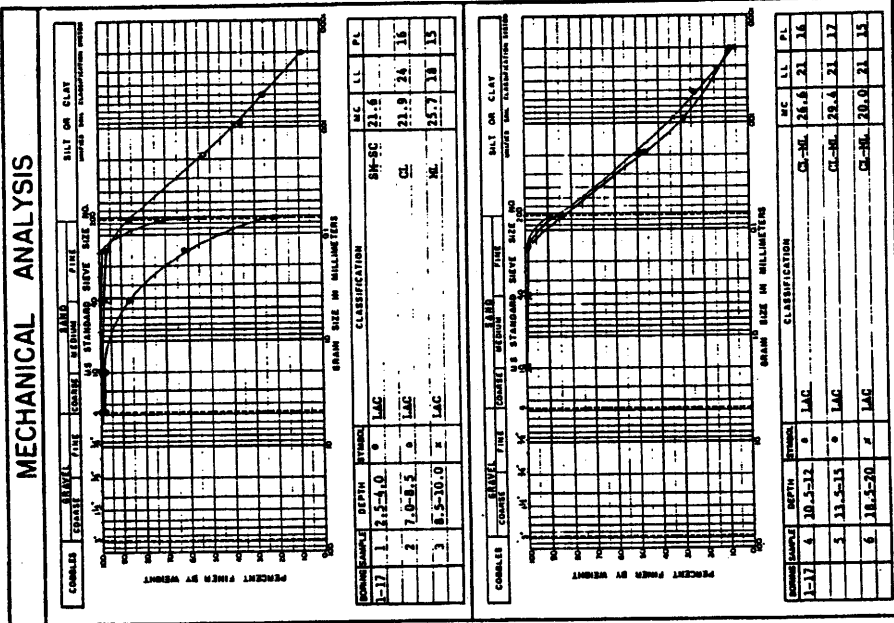
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Lacustrine Sediments

Figure 2.5-115 (Sheet 3 of 6)



(Tested by Hannon Testing Laboratories)

(Rev. 12 1/03)

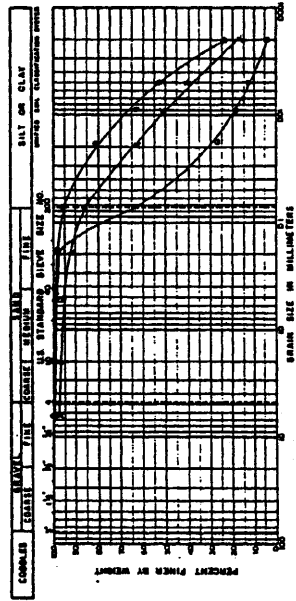


PERRY NUCLEAR POWER PLANT

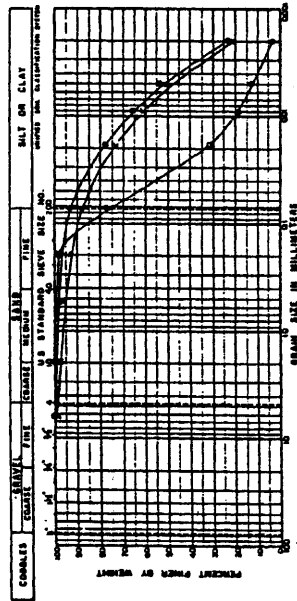
Grain Size Distribution Curves -
Lacustrine Sediments

Figure 2.5-115 (Sheet 4 of 6)

MECHANICAL ANALYSIS



DEPTH	DEPTH	STUCK	CLASSIFICATION	WC	LL	PI
1-37	8	23.5-25	0	LAC	22.3	27
					CL	
1-38	2	5.5-7.0	0	LAC	25.6	MP
					ML	
1-39	9	26.5-28	7	LAC	19.1	26
					CL	17



STRESS	CLASSIFICATION		MC	LL	PL
	BOUNDARY	DEPTH			
0	1-20	7 11.2-21	24.3	33	18
0	1-20	7 21.2-23	18.7	MP	MP
1	1-40	9 31.2-28	33.6	21	10

(Tested by Herron Testing Laboratories)

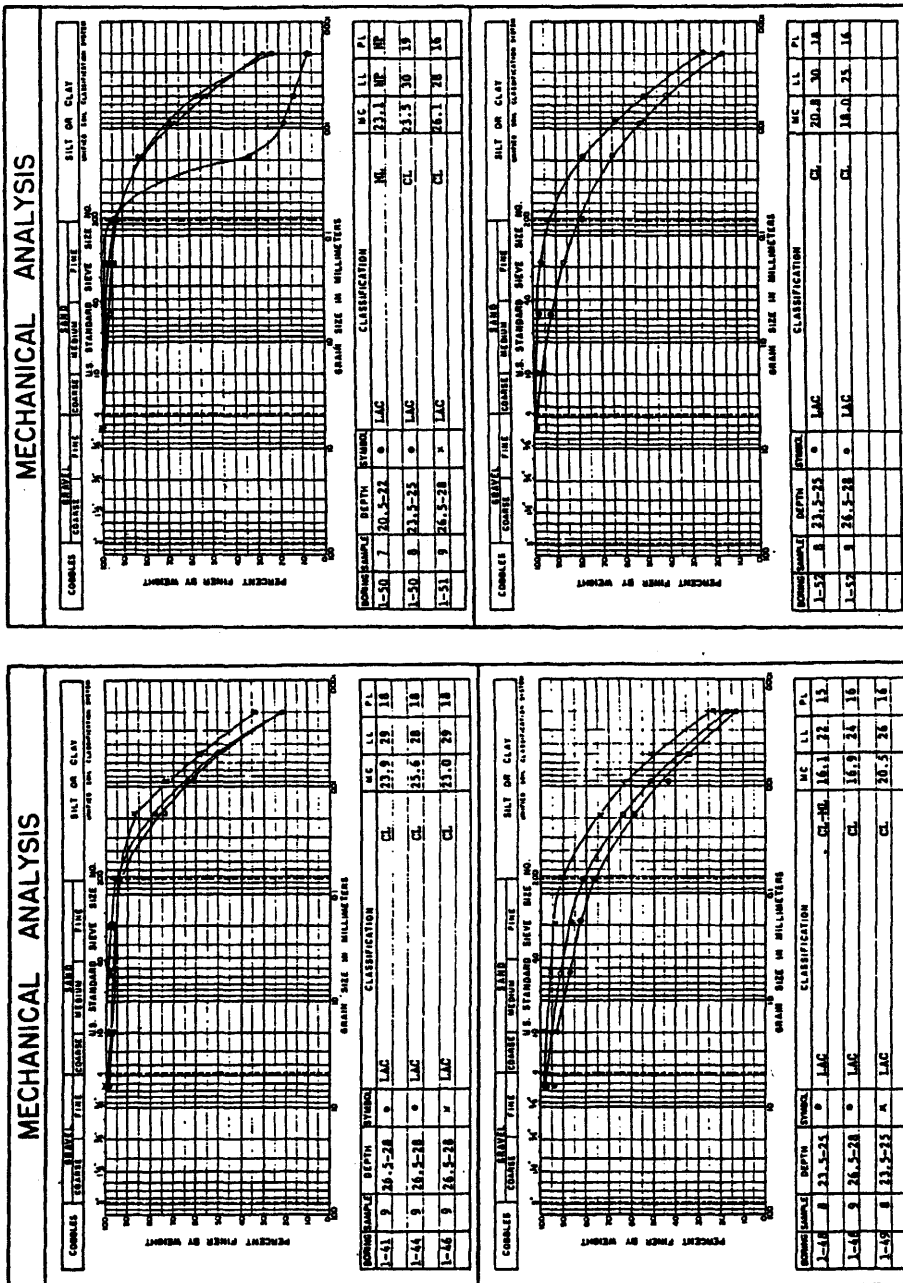
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves - Lacustrine Sediments

Figure 2.5-115 (Sheet 5 of 6)



(Tested by Heron Testing Laboratories)

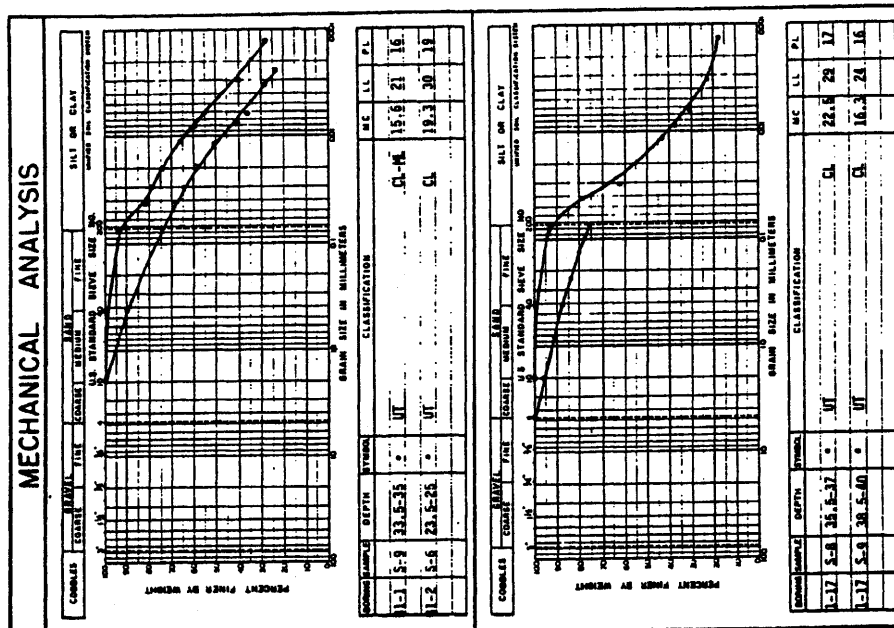
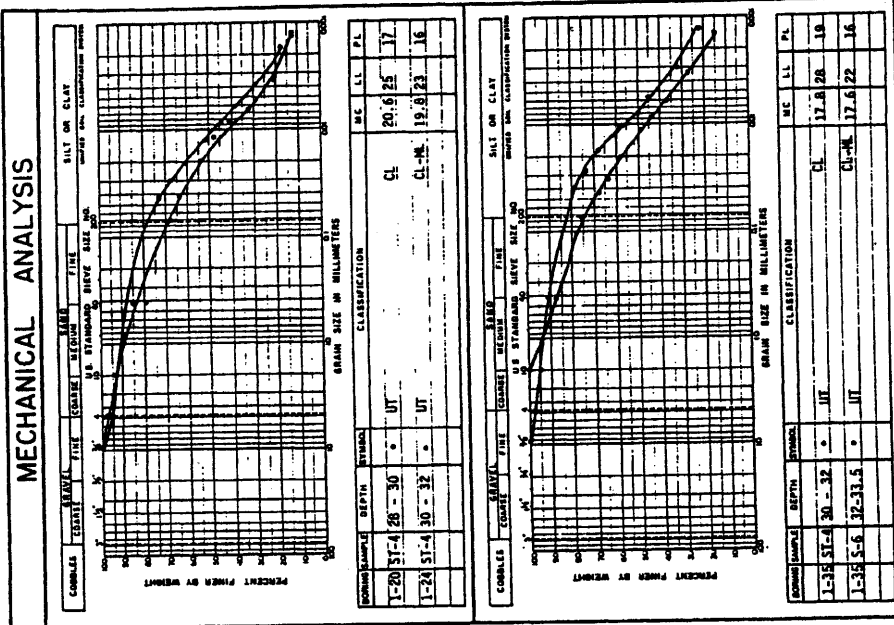
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Lacustrine Sediments

Figure 2.5-115 (Sheet 6 of 6)



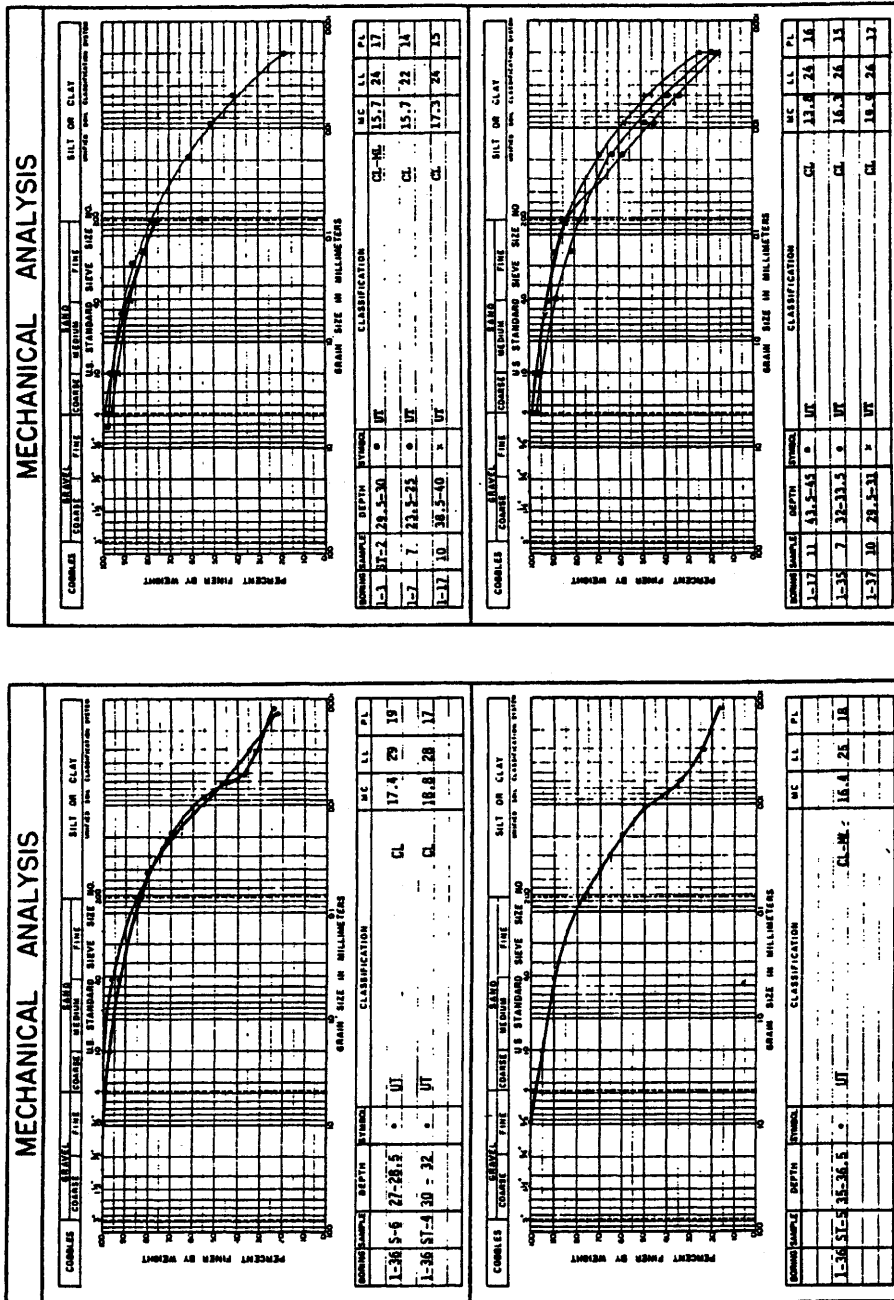
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Upper Till

Figure 2.5-116 (Sheet 1 of 5)



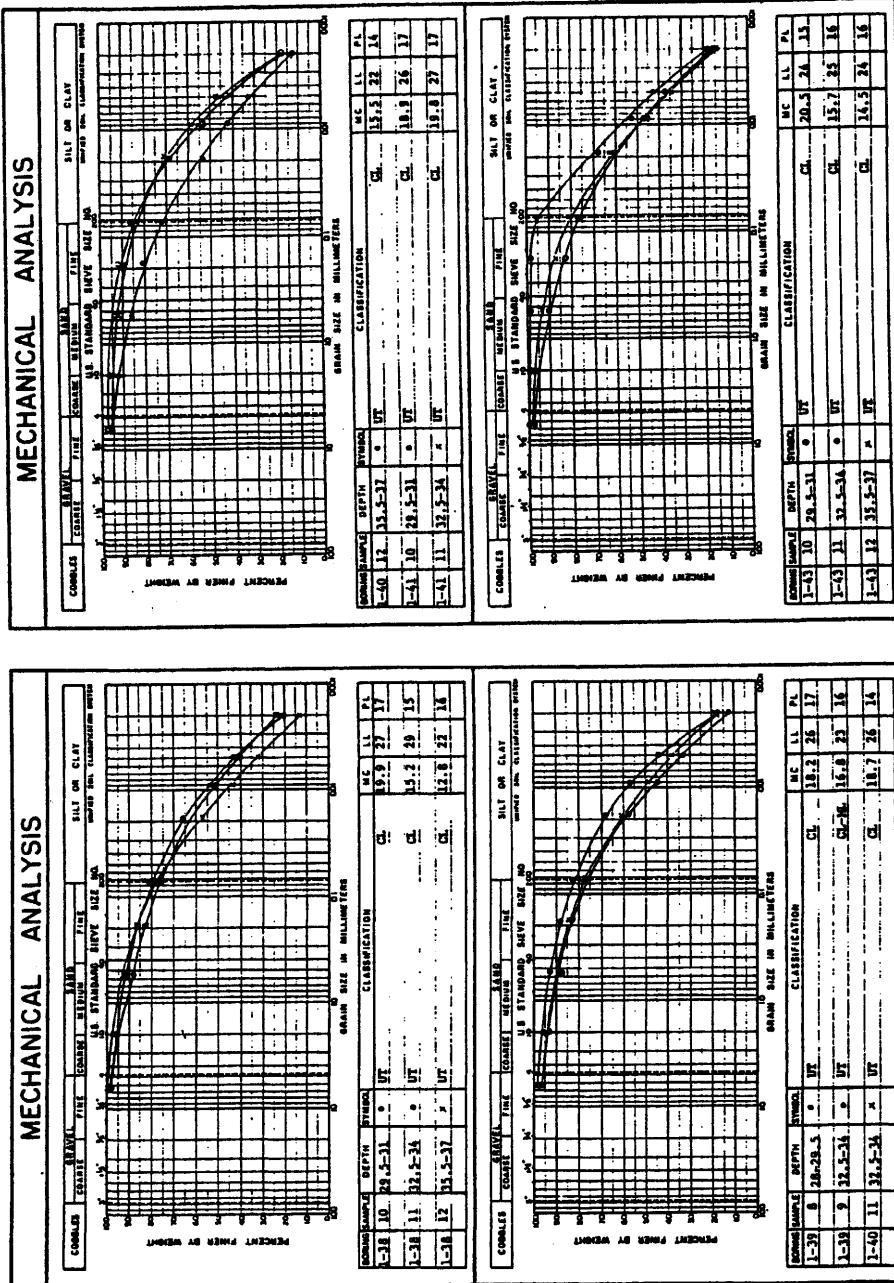
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Upper Till

Figure 2.5-116 (Sheet 2 of 5)



(Tested by Herron Testing Laboratories)

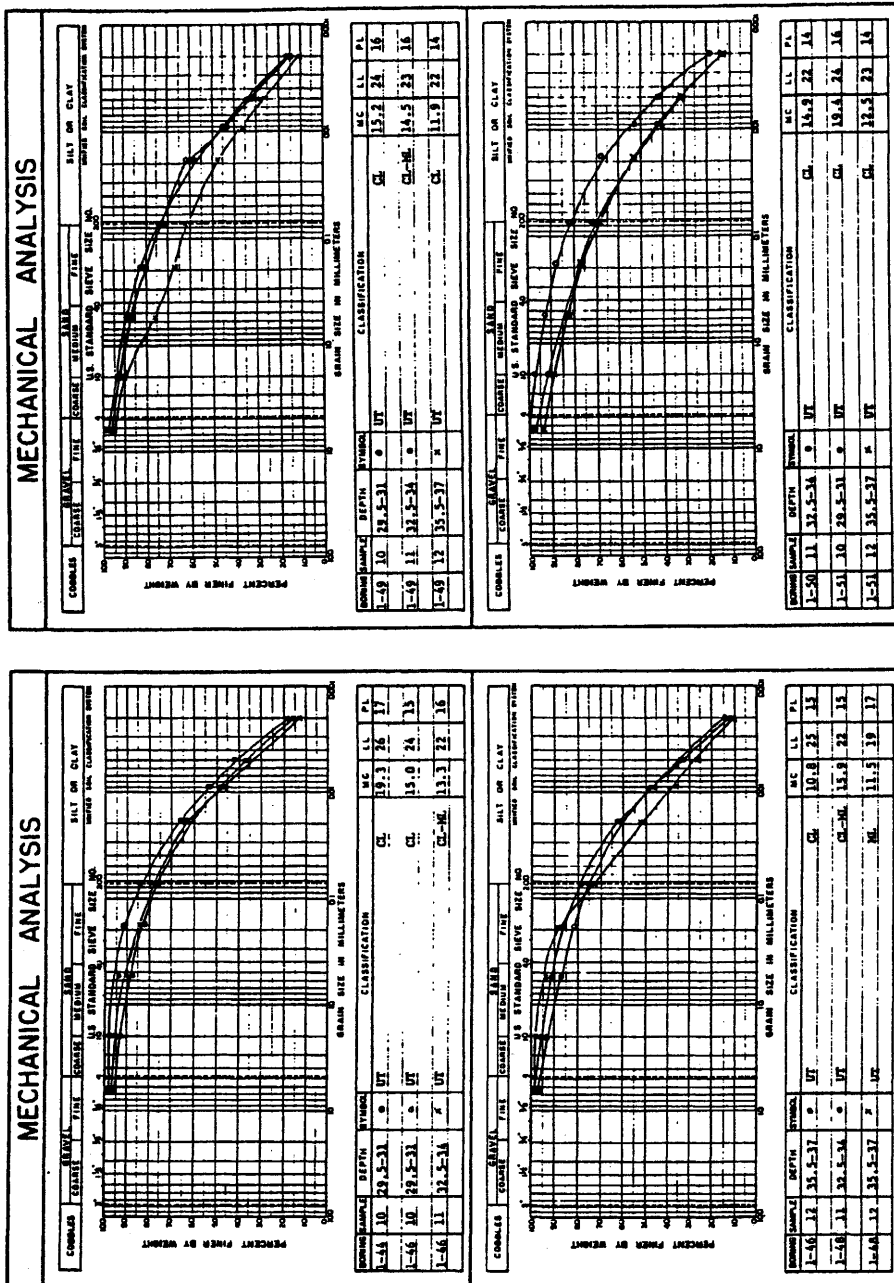
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Upper Till

Figure 2.5-116 (Sheet 3 of 5)



(Tested by Hannon Testing Laboratories)

(Rev. 12 1/03)

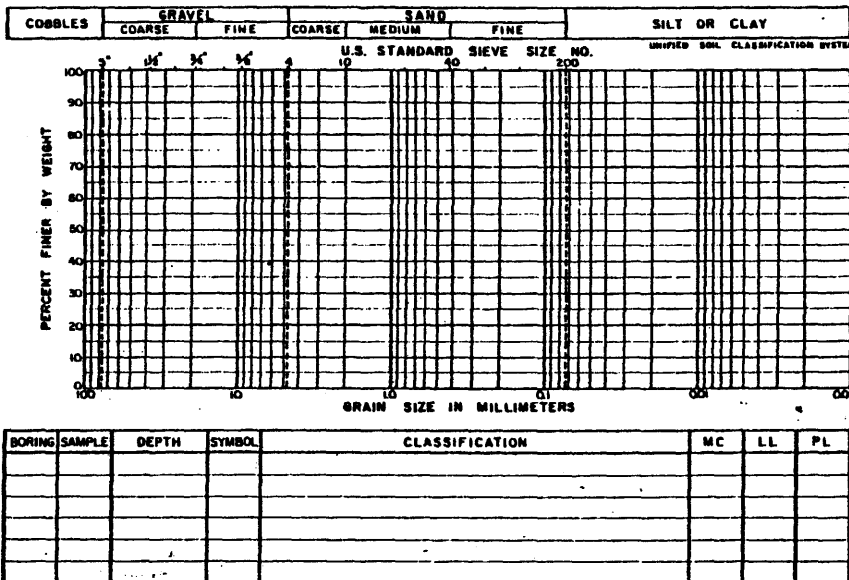
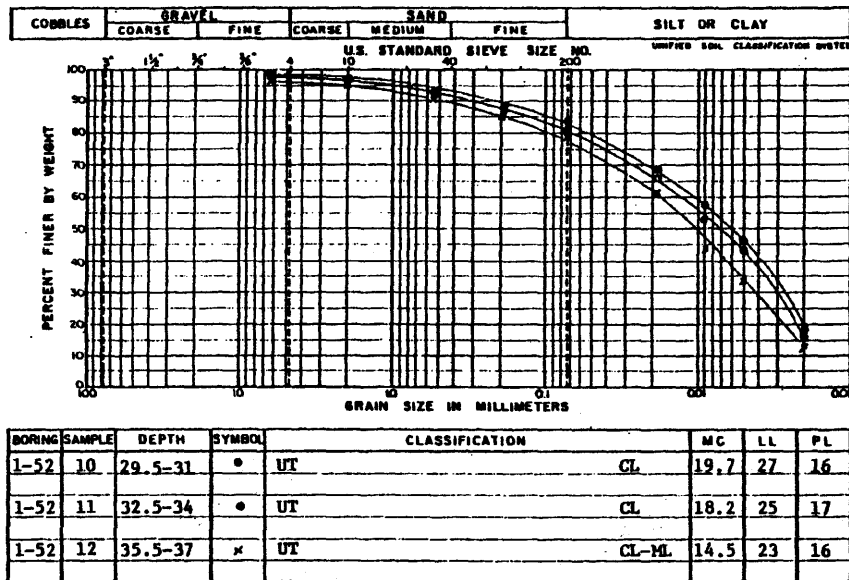


PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Upper Till

Figure 2.5-116 (Sheet 4 of 5)

MECHANICAL ANALYSIS



(Tested by Herron Testing Laboratories)

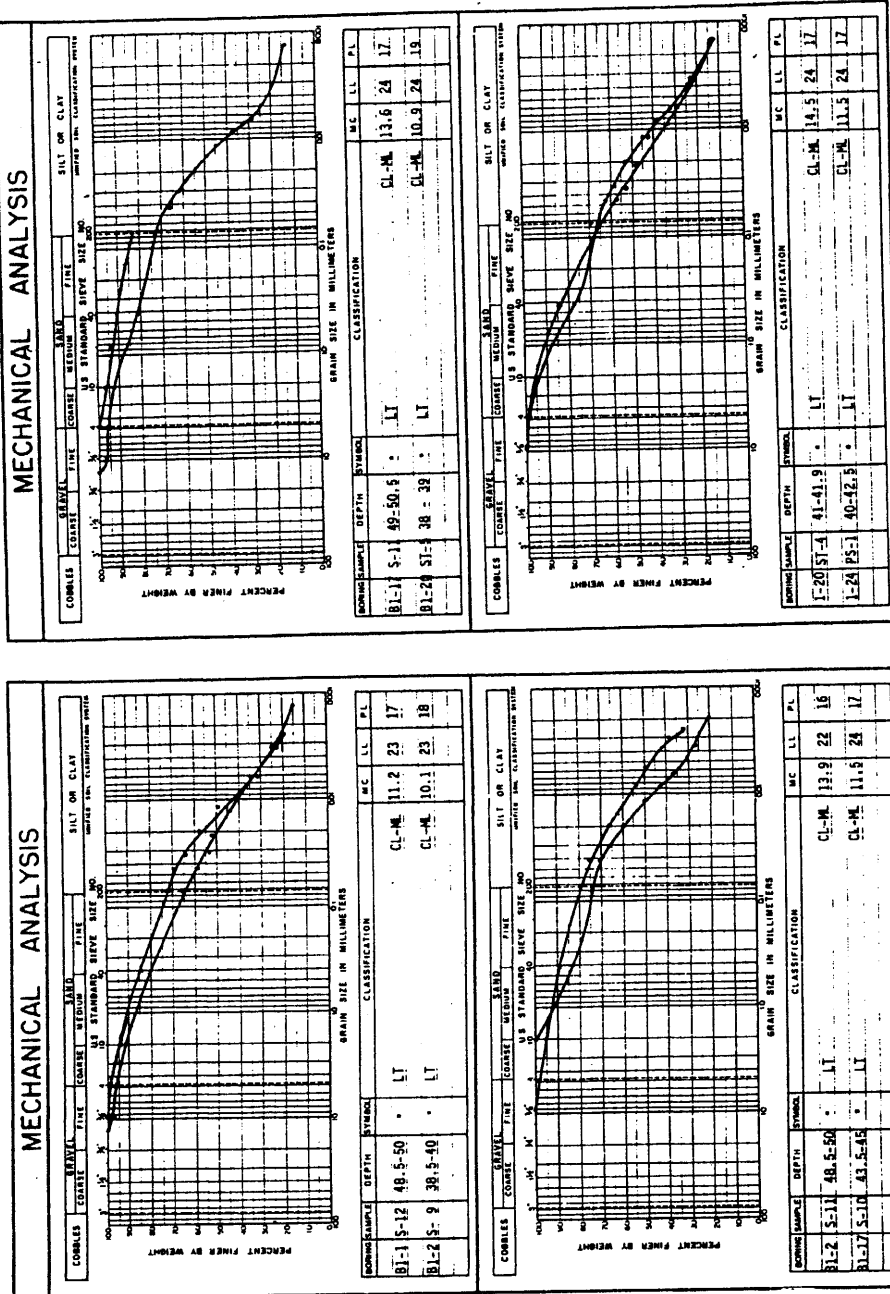
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Upper Till

Figure 2.5-116 (Sheet 5 of 5)



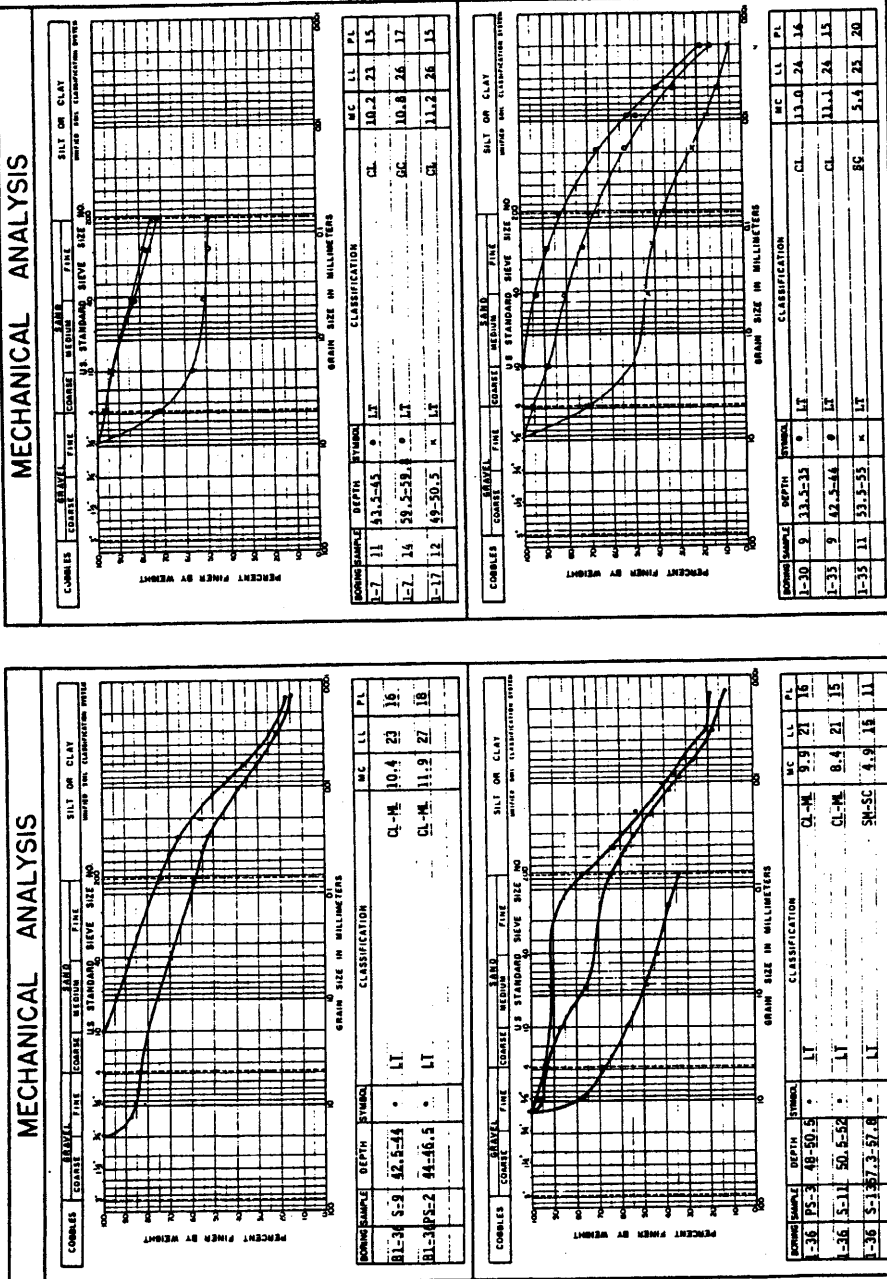
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Lower Till

Figure 2.5-117 (Sheet 1 of 6)



(Tested by Harrop Testing Laboratories)

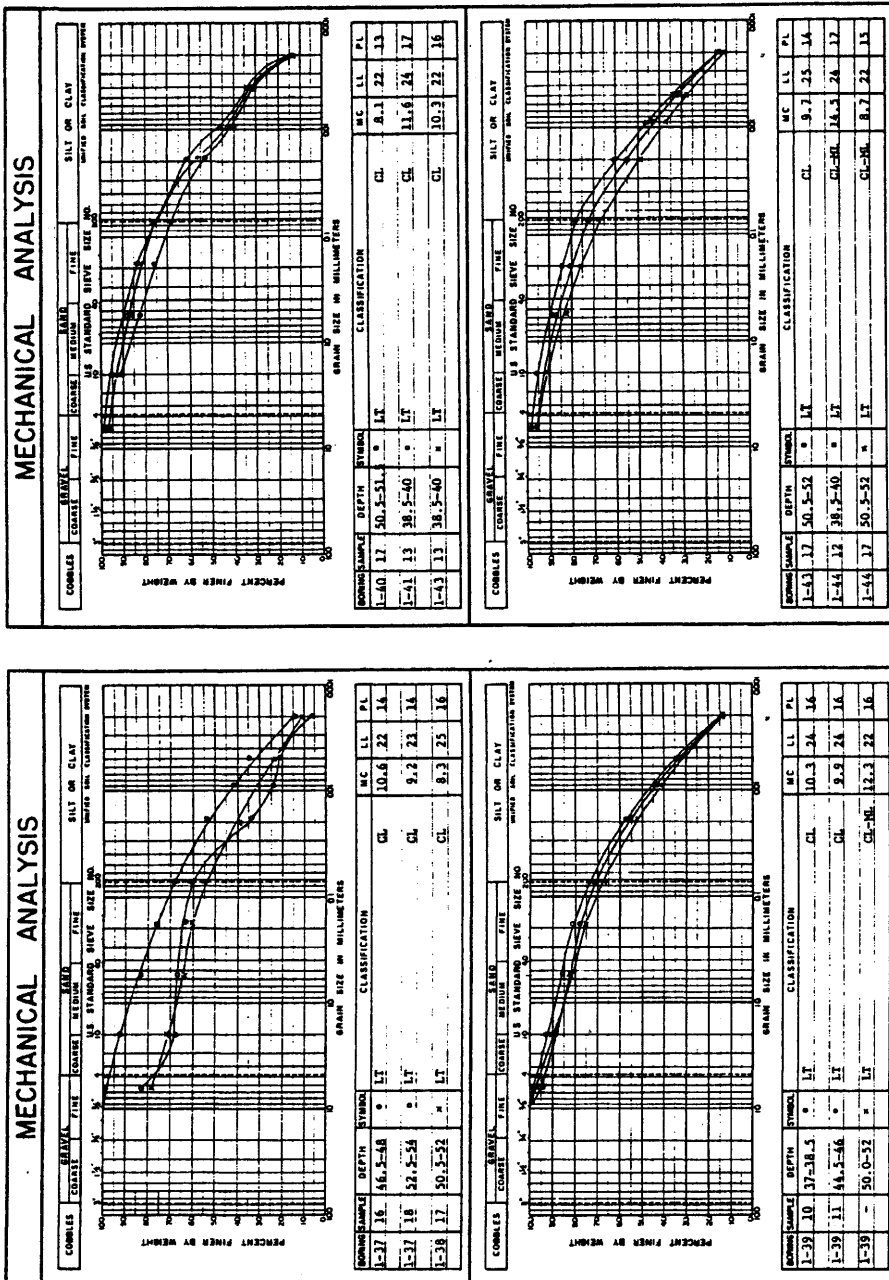
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Lower Till

Figure 2.5-117 (Sheet 3 of 6)



(Tested by Herron Testing Laboratories)

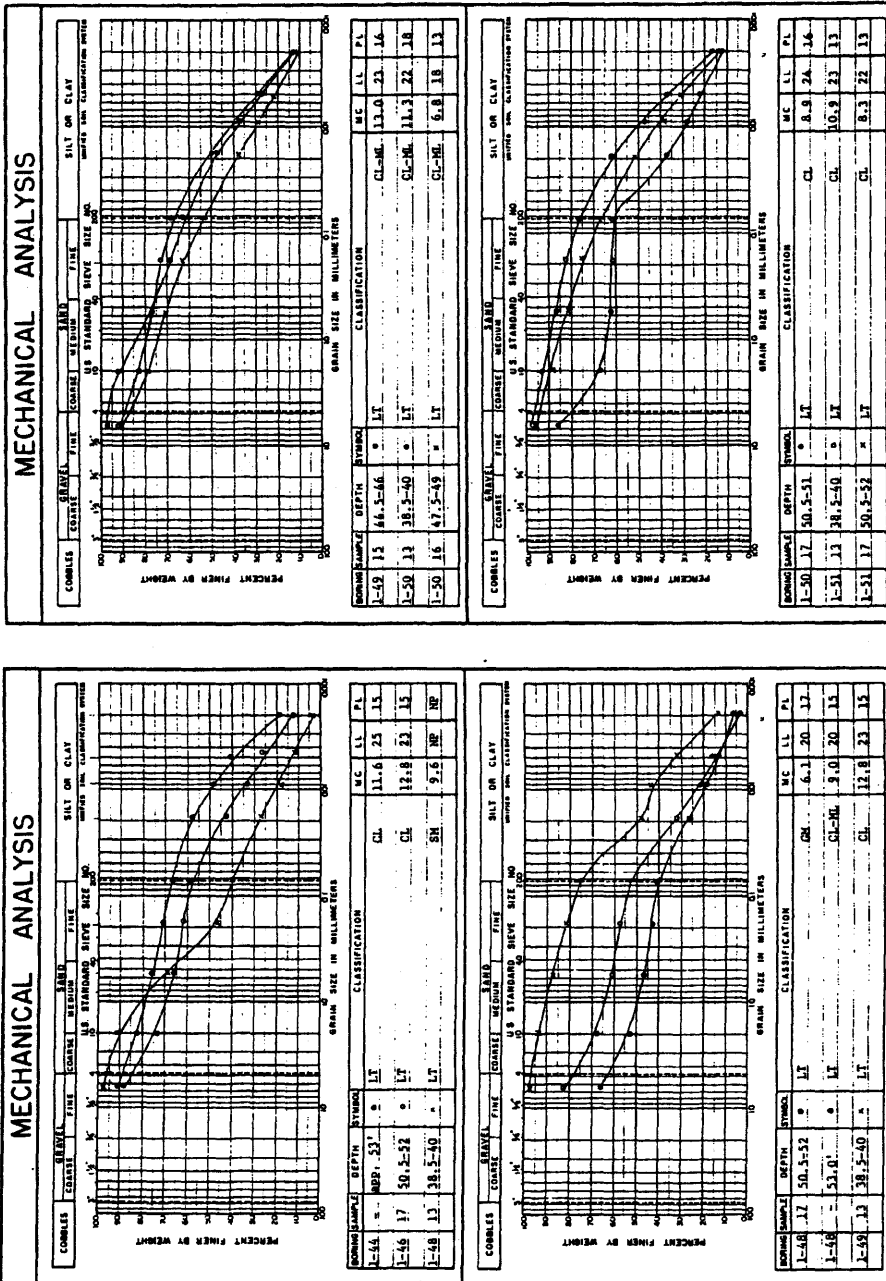
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Lower Till

Figure 2.5-117 (Sheet 4 of 6)



(Tested by Herron Testing Laboratories)

(Rev. 12 1/03)

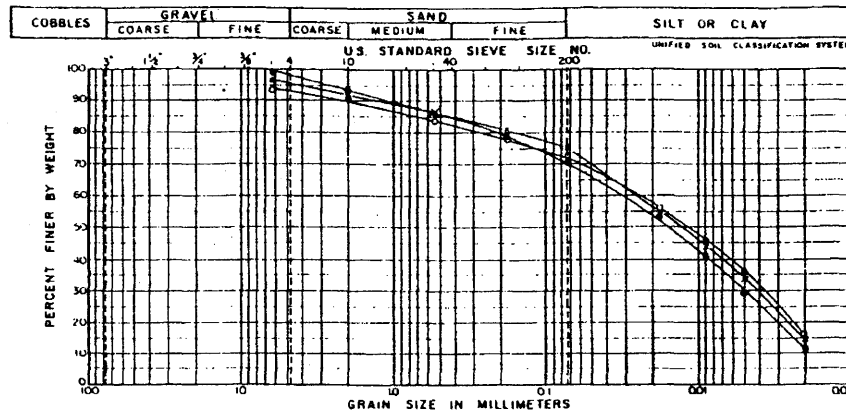


PERRY NUCLEAR POWER PLANT

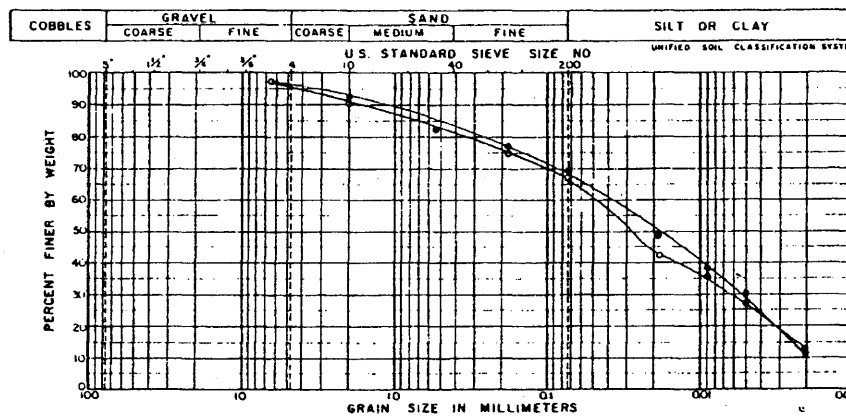
Grain Size Distribution Curves -
Lower Till

Figure 2.5-117 (Sheet 5 of 6)

MECHANICAL ANALYSIS



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
1-52	13	38.5-40	•	LT CL	11.5	23	14
1-52	14	41.5-43	°	LT CL-ML	11.9	21	15
1-52	15	44.5-46	x	LT CL	10.9	24	16



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
1-52	16	47.5-49	°	LT CL	8.0	20	12
1-52	17	50.5-52	•	LT CL	8.3	22	13

(Tested by Herron Testing Laboratories)

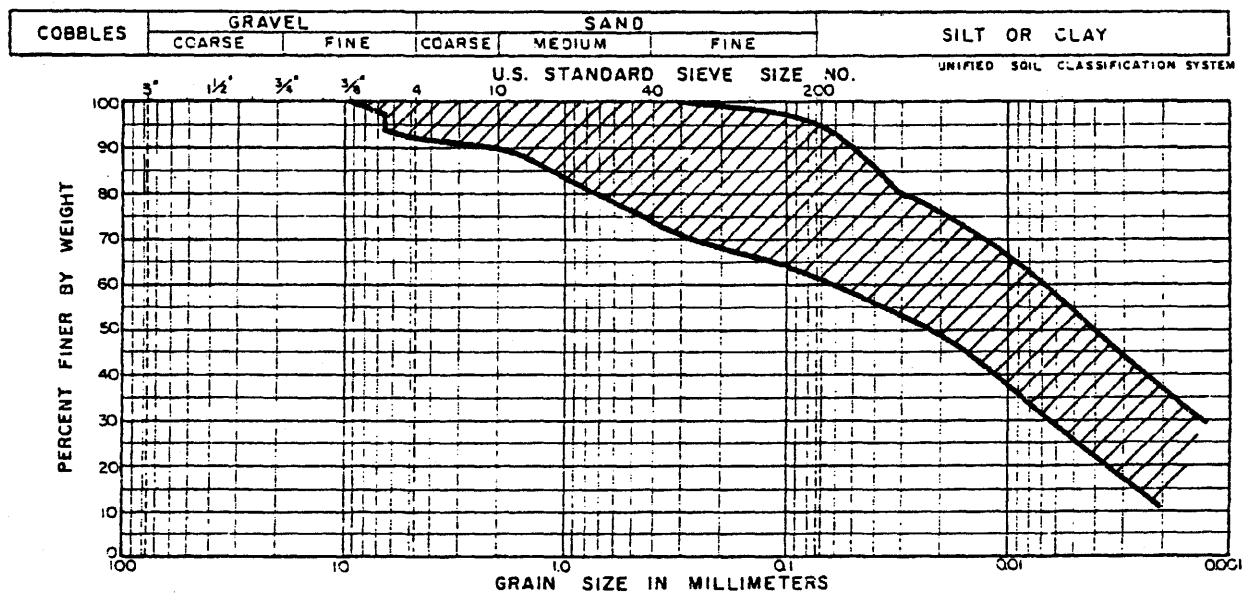
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Lower Till

Figure 2.5-117 (Sheet 6 of 6)



NOTE: RANGE REPRESENTS THE RESULTS OF 44 TESTS

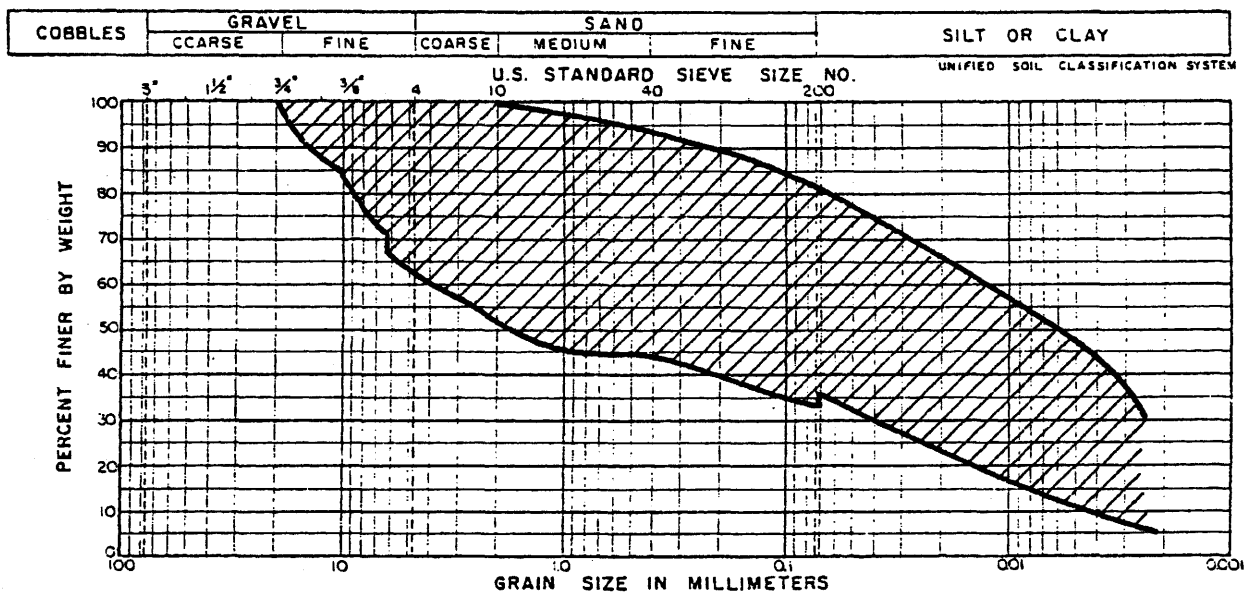
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Range of Grain Size Distribution
Test Results for Upper Till

Figure 2.5-118



NOTE: RANGE REPRESENTS THE RESULTS OF 56 TESTS

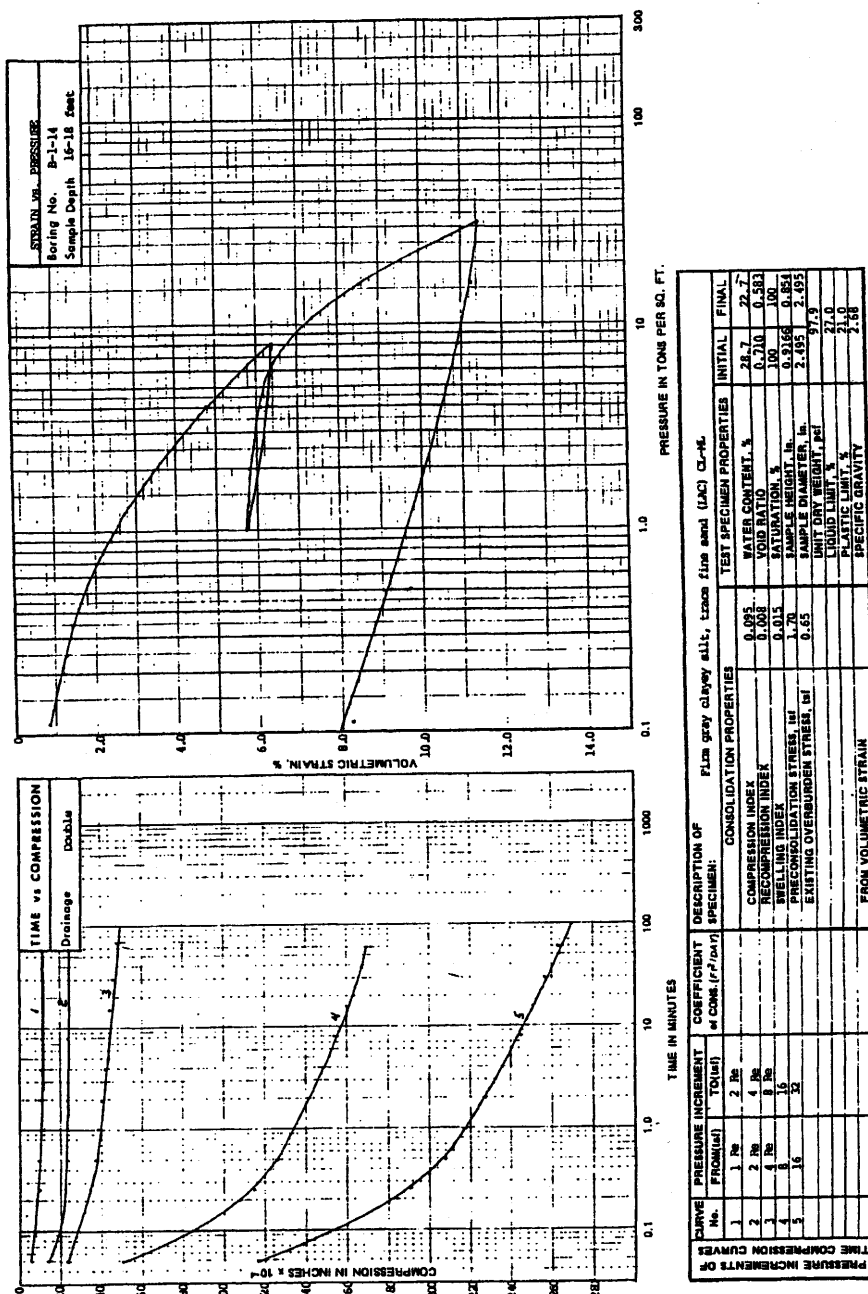
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Range of Grain Size Distribution
Test Results for Lower Till

Figure 2.5-119



CURVE No.	PRESSURE INCREMENT FROM (psi)	TIME IN MINUTES	COEFFICIENT OF CONS. (C _v)	DESCRIPTION OF SPECIMEN	CONSOLIDATION PROPERTIES		TEST SPECIMEN PROPERTIES	
					COMPRESSION INDEX	WATER CONTENT, %	VOID RATIO	INITIAL
1	1 ps	2 ps		COMPRESSION INDEX	0.095	28.7	0.710	22.7
2	2 ps	4 ps		RECONSOLIDATION INDEX	0.008	100	100	100
3	4 ps	8 ps		SWELLING INDEX	0.015	100	100	100
4	8 ps	16 ps		PRECONSOLIDATION STRESS, psi	1.70	2.495	0.851	2.495
5	16 ps	32 ps		EXISTING OVERBURDEN STRESS, psi	0.65	2.495	0.851	2.495
				UNIT WEIGHT, pcf		27.0		27.0
				PLASTIC LIMIT, %		21.0		21.0
				SPECIFIC GRAVITY		2.58		2.58
				FROM VOLUMETRIC STRAIN				

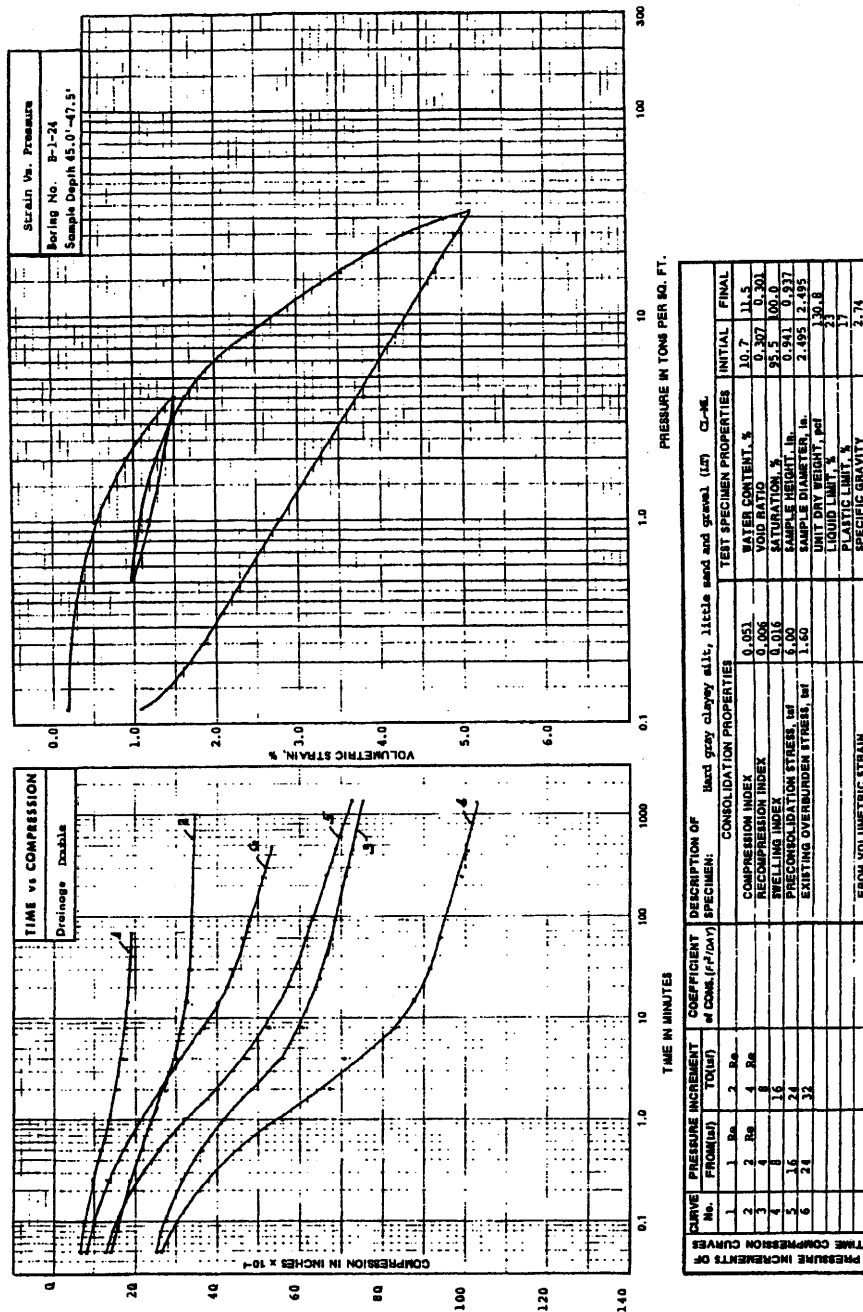
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Consolidation Test
Curves - Lacustrine Sediments

Figure 2.5-120



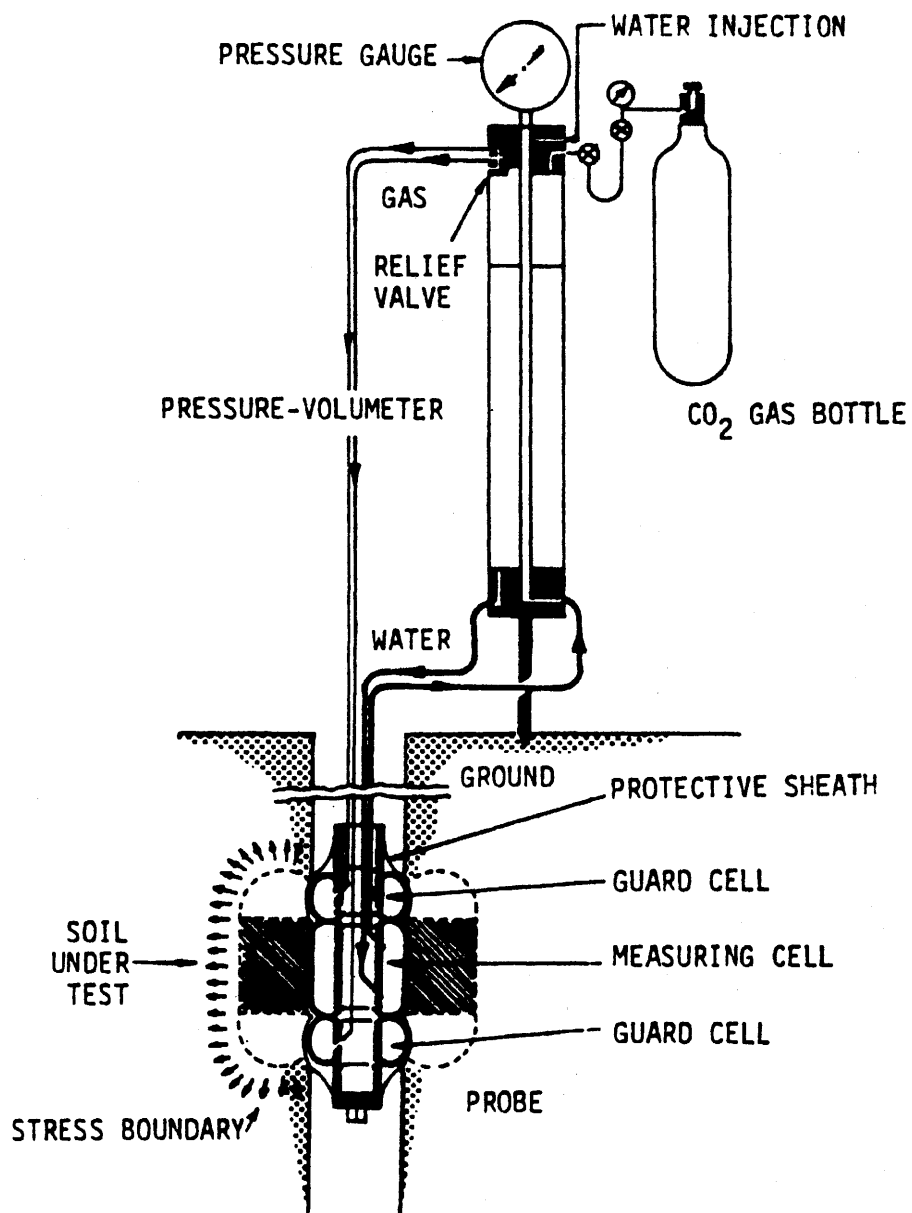
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Consolidation Test
Curves - Lower Till

Figure 2.5-122



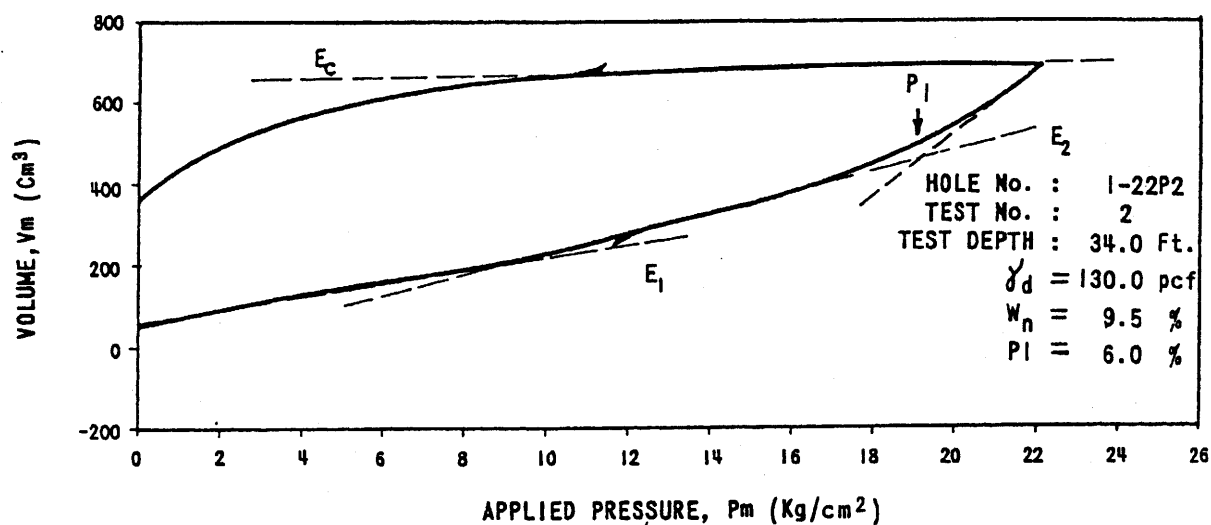
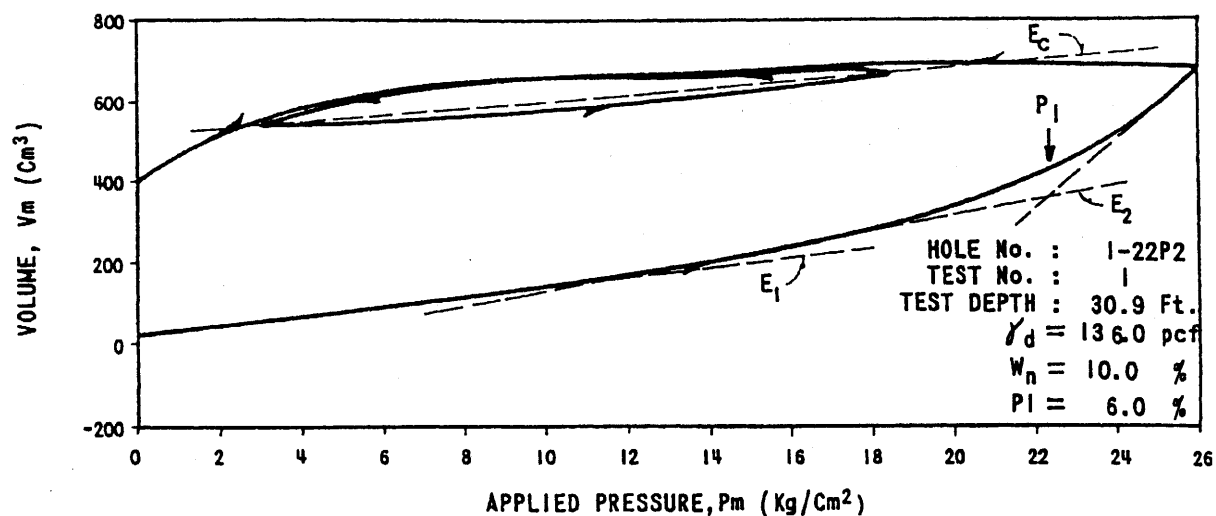
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Schematic Representation of
Pressuremeter

Figure 2.5-123



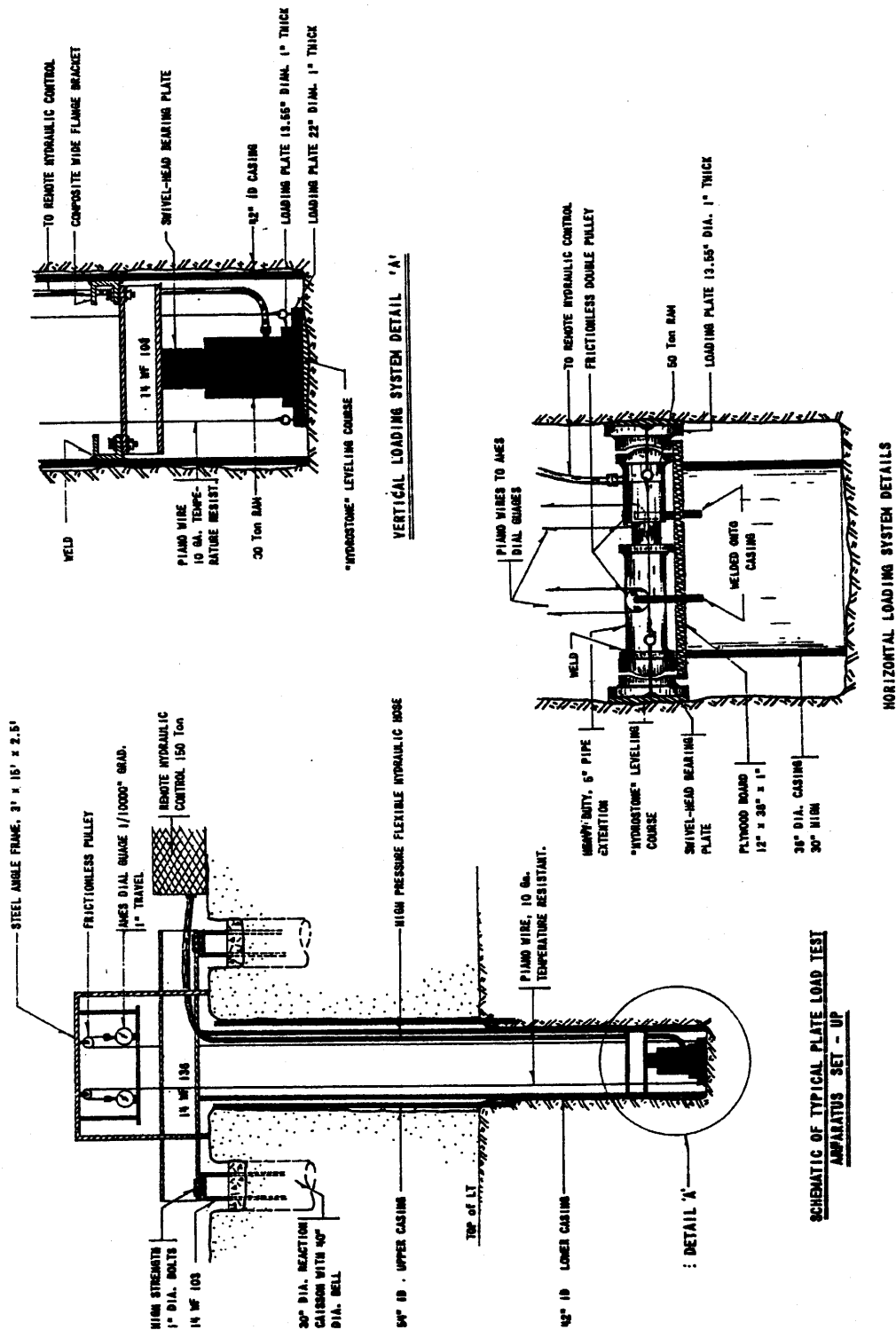
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Pressuremeter Test
Curves - Lower Till

Figure 2.5-124



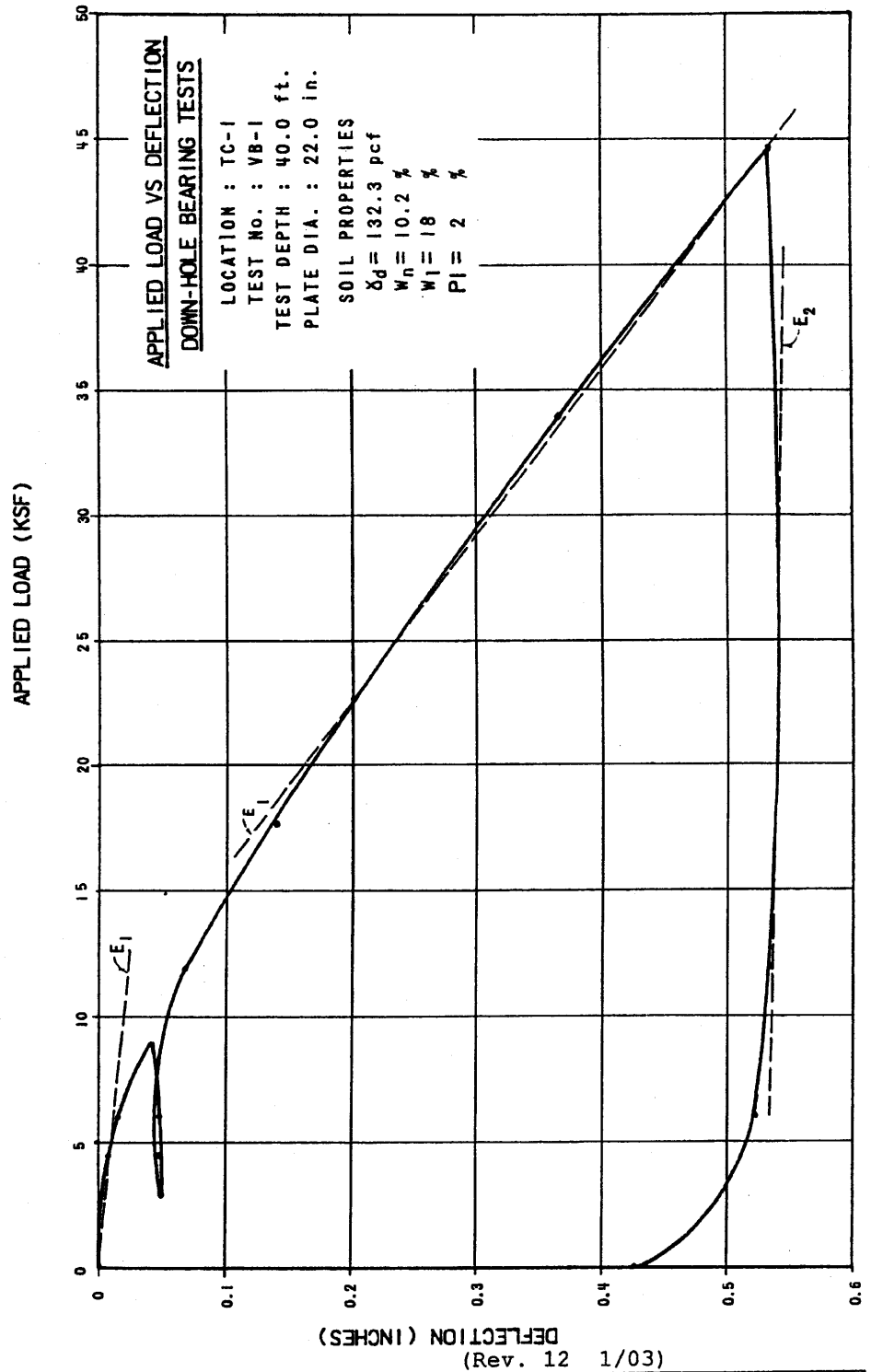
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Plate Loading Test
Configuration

Figure 2.5-125



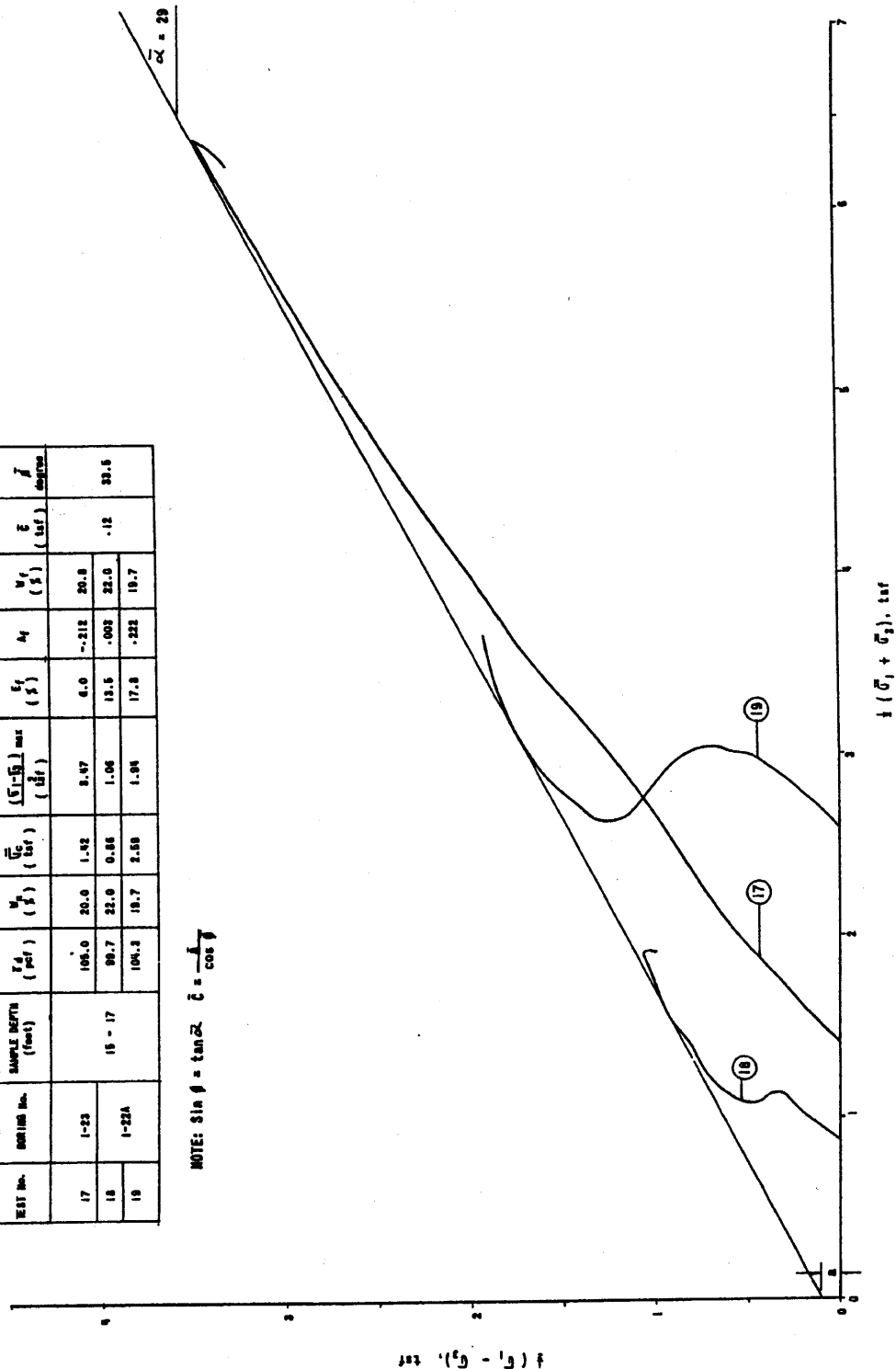
PERRY NUCLEAR POWER PLANT

Typical Plate Loading Test
Curve - Lower Till

Figure 2.5-126

TEST No.	SOIL No.	SAMPLE DEPTH (feet)	γ_d (pcf)	w_L (%)	$\frac{(\sigma_1 - \sigma_3)}{(\sigma_1)}$	$\frac{(\sigma_1 - \sigma_3)}{(\sigma_1)}$ max (pcf)	$\frac{(\sigma_1 - \sigma_3)}{(\sigma_1)}$	A_f	w_f (%)	$\bar{\epsilon}$ (pcf)	$\bar{\epsilon}$ (pcf)
17	1-23		106.0	20.0	1.42	9.47	6.0	-212	20.8		
18	1-22A	15 - 17	99.7	22.0	0.86	1.06	13.5	.003	22.0		
19			104.2	19.7	2.55	1.96	17.8	-222	19.7		

NOTE: $\sin \phi = \tan \alpha$ $\bar{\epsilon} = \frac{A_f}{\cos \phi}$



(Rev. 12 1/03)



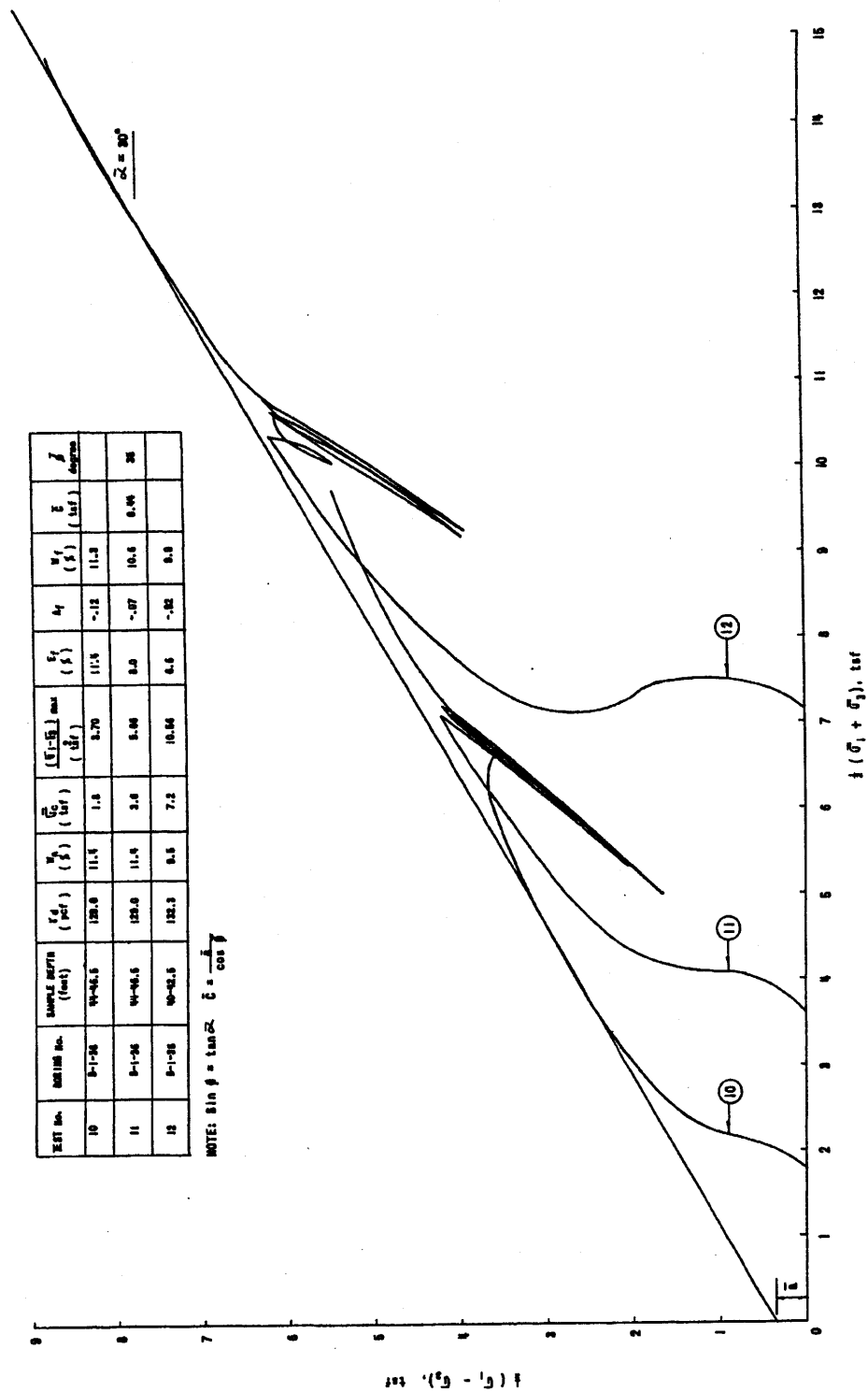
PERRY NUCLEAR POWER PLANT

Typical Effective Stress Paths -
Lacustrine Sediments

Figure 2.5-127



Figure 2.5-128



† $\frac{1}{2} (\sigma_1 - \sigma_3)$

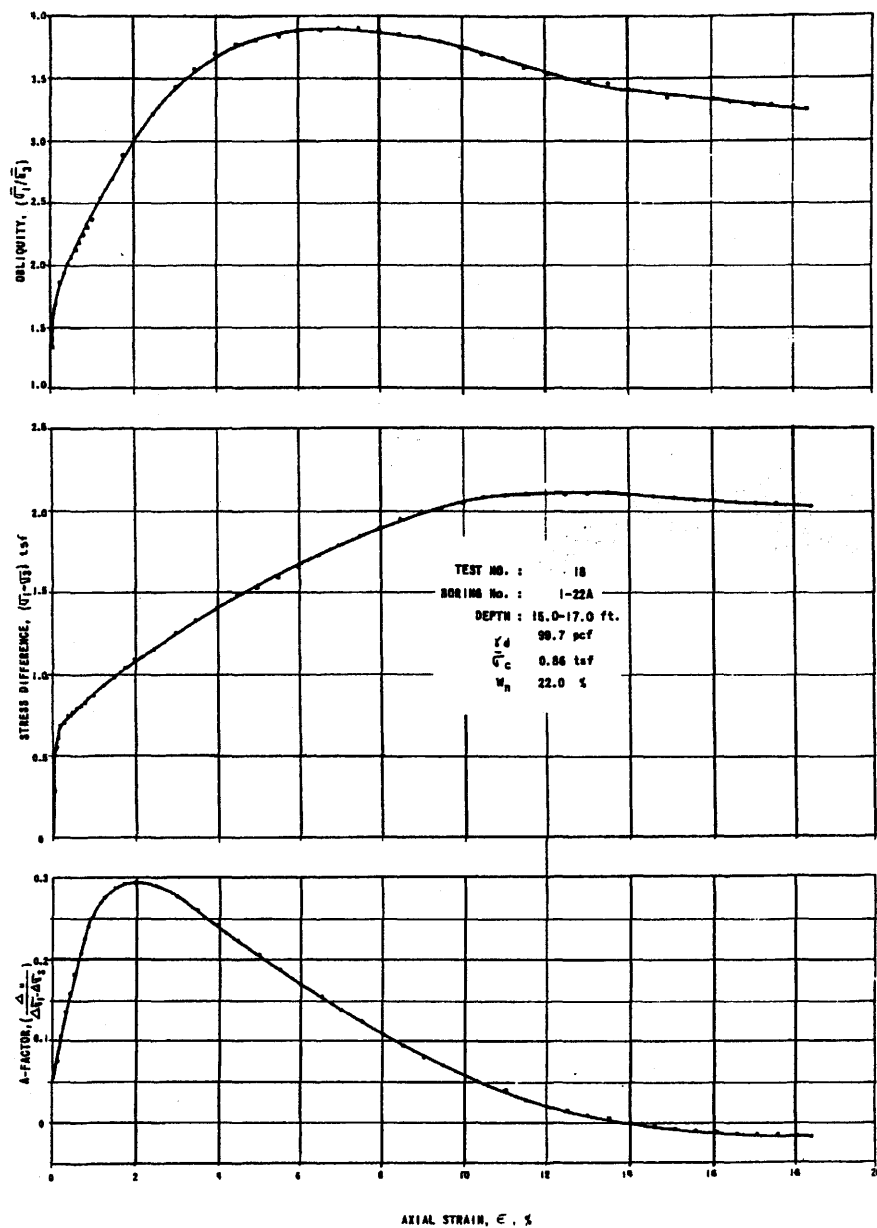
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Effective Stress Paths -
Lower Till

Figure 2.5-129



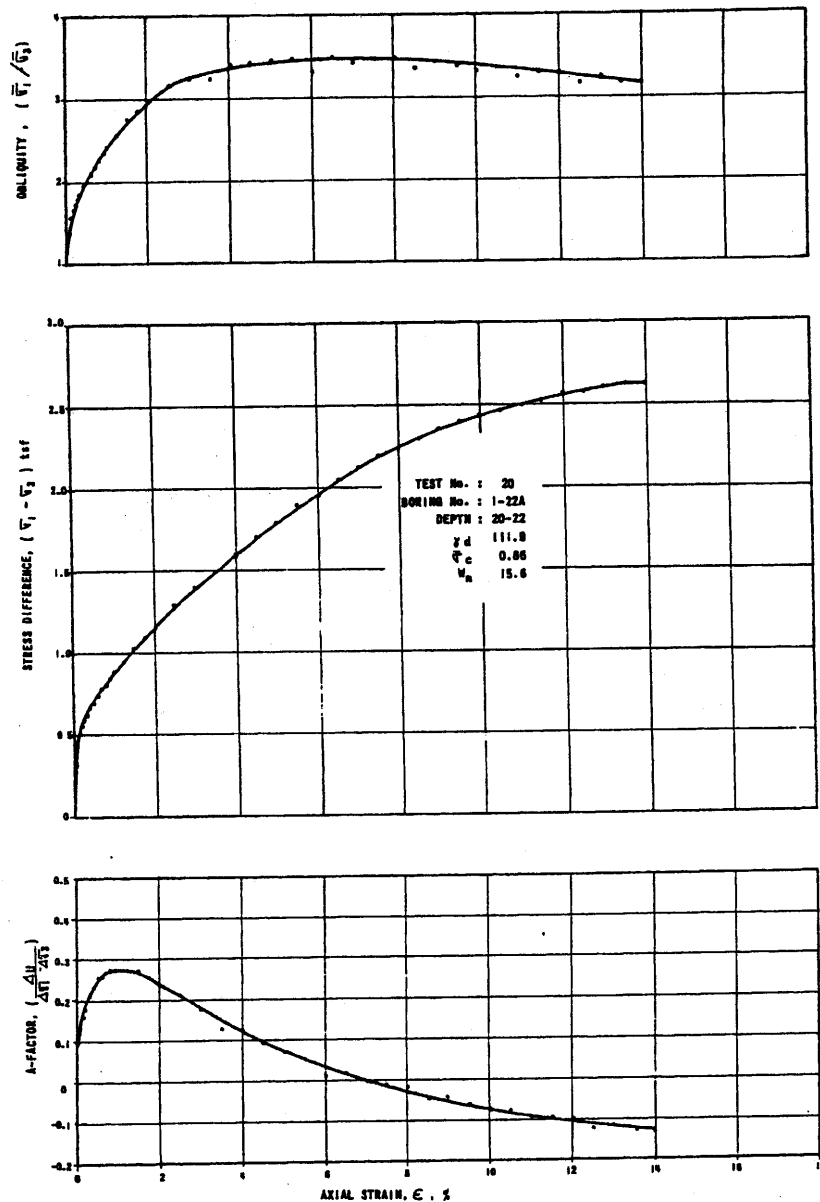
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Effective Stress -
 Strength Characteristics of
 Lacustrine Sediments

Figure 2.5-130



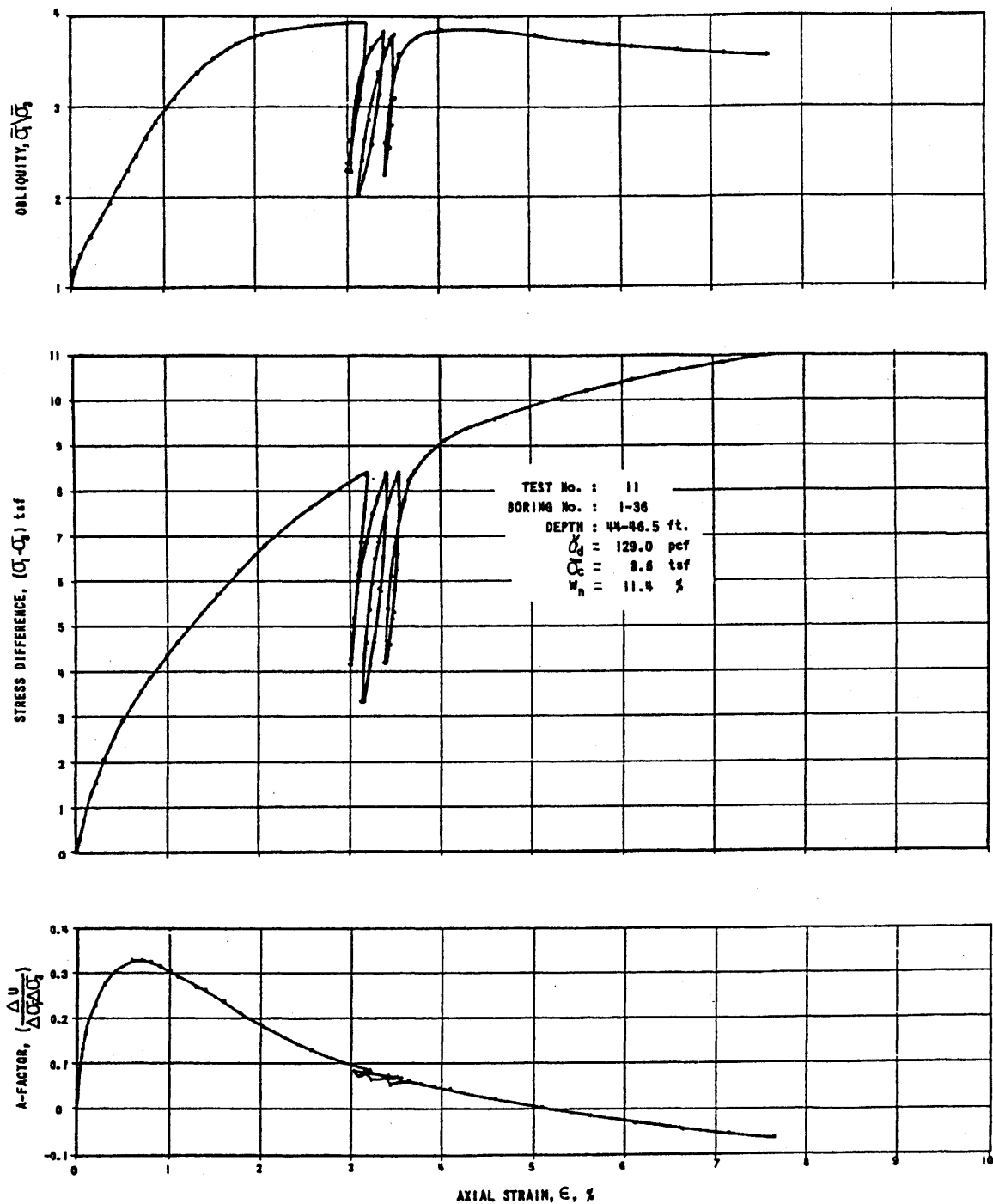
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Effective Stress -
Strength Characteristics of
Lower Till

Figure 2.5-131



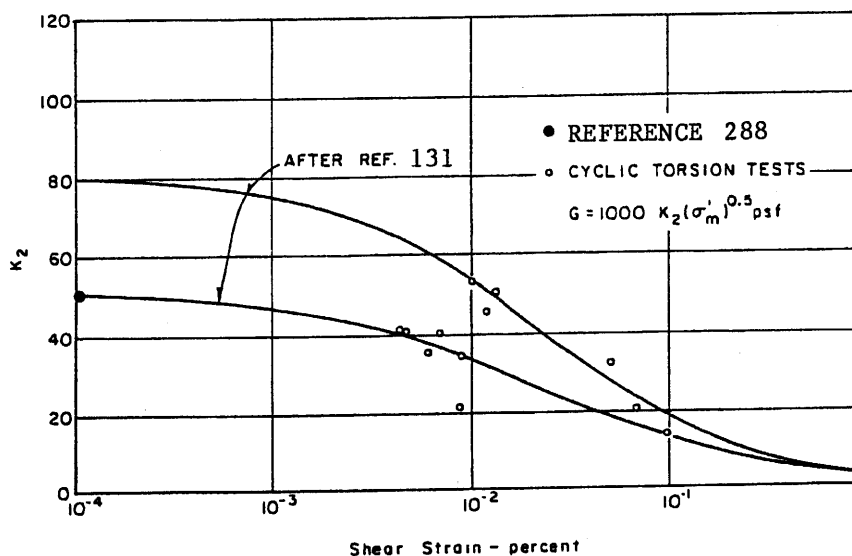
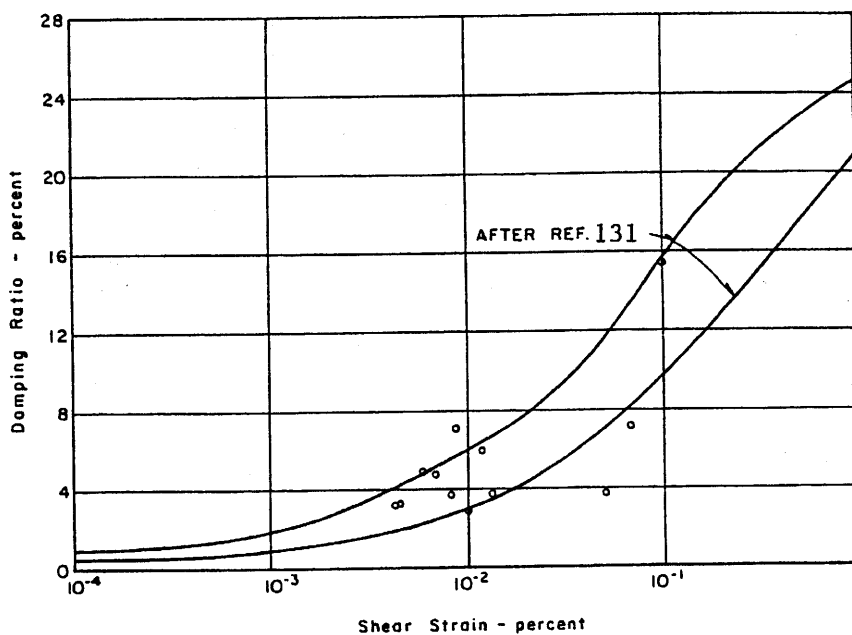
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Effective Stress -
 Strength Characteristics of
 Upper Till

Figure 2.5-132



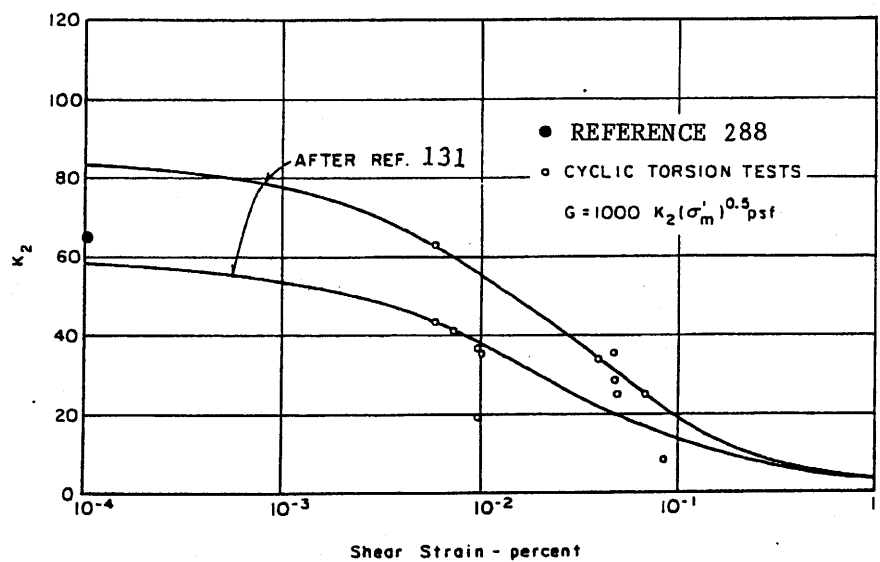
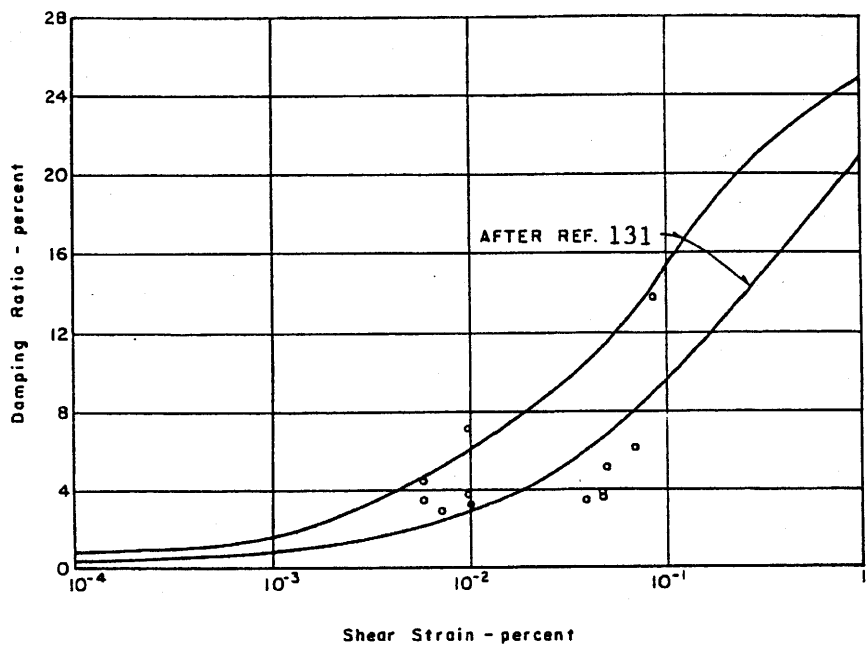
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Dynamic Properties of
Lacustrine Sediments

Figure 2.5-133



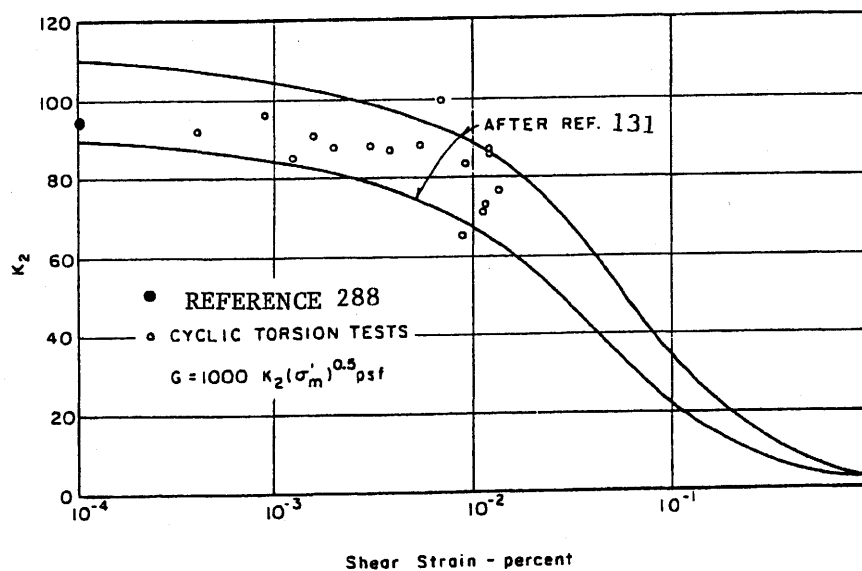
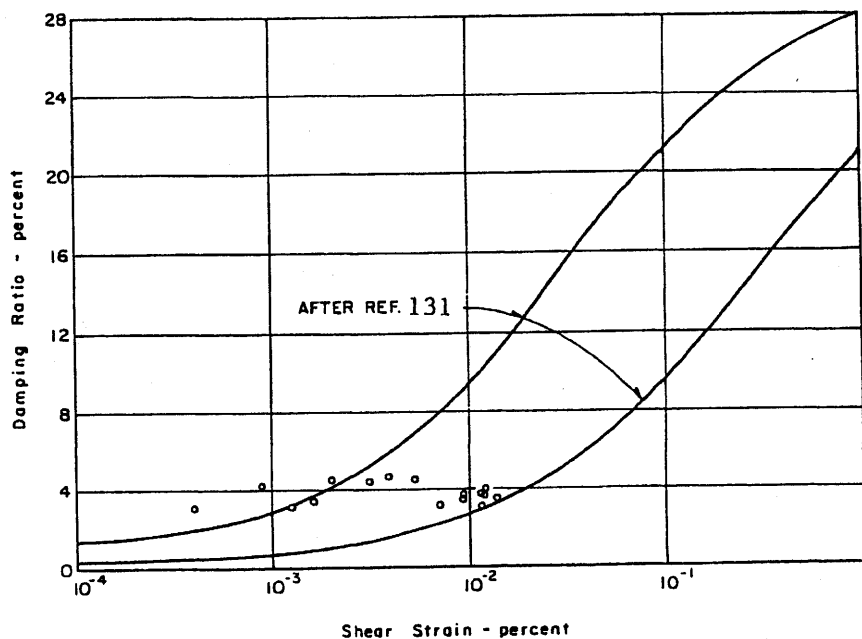
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Dynamic Properties of Upper Till

Figure 2.5-134



(Rev. 12 1/03)

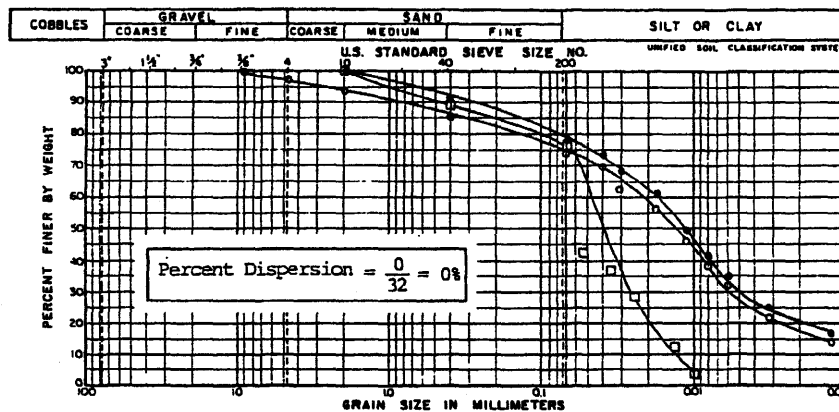


PERRY NUCLEAR POWER PLANT

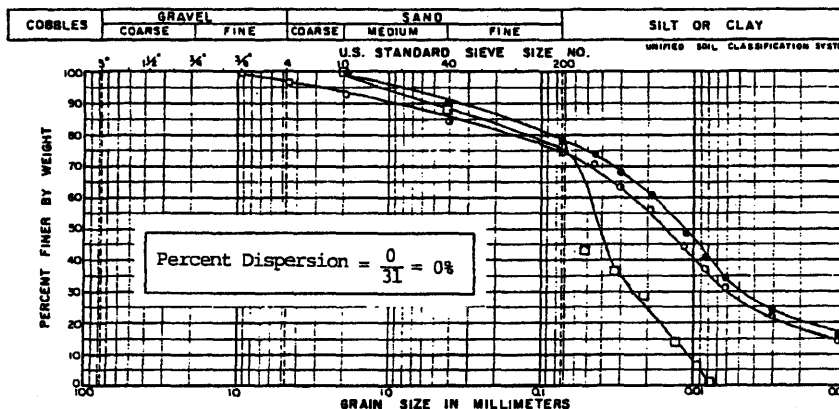
Dynamic Properties of Lower Till

Figure 2.5-135

MECHANICAL ANALYSIS



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
	S-1		○	Standard Grain Size Distribution - Entire Sample	10.0	21	14
	S-1		•	Standard Grain Size Distribution - Minus No. 10			
	S-1		□	Grain Size Distribution - Minus No. 10 without Deflocculation			



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
	S-2		○	Standard Grain Size Distribution - Entire Sample	9.9	20	15
	S-2		•	Standard Grain Size Distribution - Minus No. 10			
	S-2		□	Grain Size Distribution - Minus No. 10 without Deflocculation			

(Rev. 12 1/03)

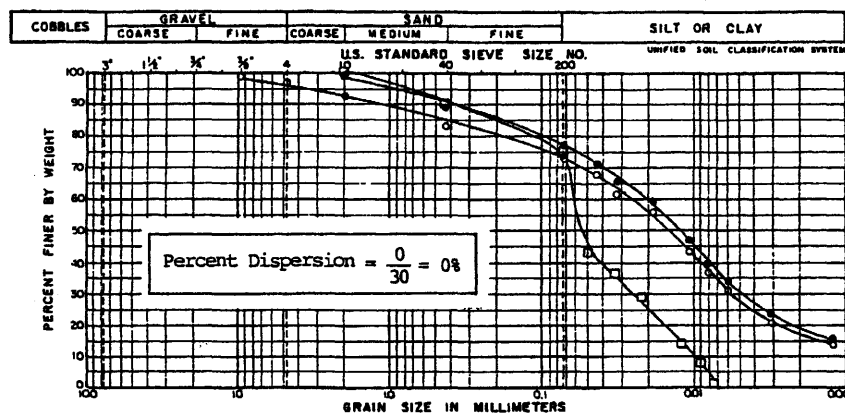


PERRY NUCLEAR POWER PLANT

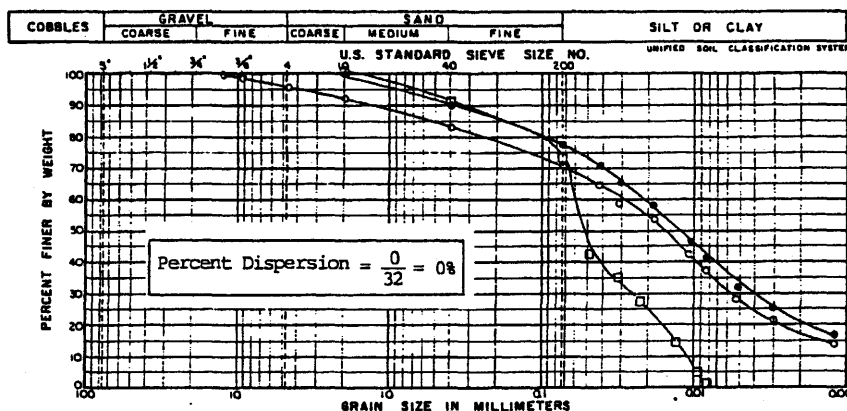
Soil Conservation Service
Tests on Lower Till

Figure 2.5-136 (Sheet 1 of 3)

MECHANICAL ANALYSIS



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
	S-3		○	Standard Grain Size Distribution - Entire Sample	10.2	21	15
	S-3		•	Standard Grain Size Distribution - Minus No. 10			
	S-3		□	Grain Size Distribution - Minus No. 10 without Deflocculation			



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
	S-4		○	Standard Grain Size Distribution - Entire Sample	10.1	20	16
	S-4		•	Standard Grain Size Distribution - Minus No. 10			
	S-4		□	Grain Size Distribution - Minus No. 10 without Deflocculation			

(Rev. 12 1/03)

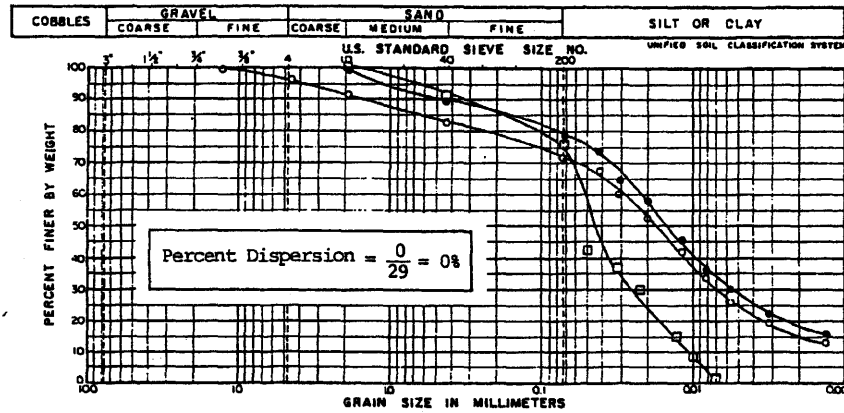


PERRY NUCLEAR POWER PLANT

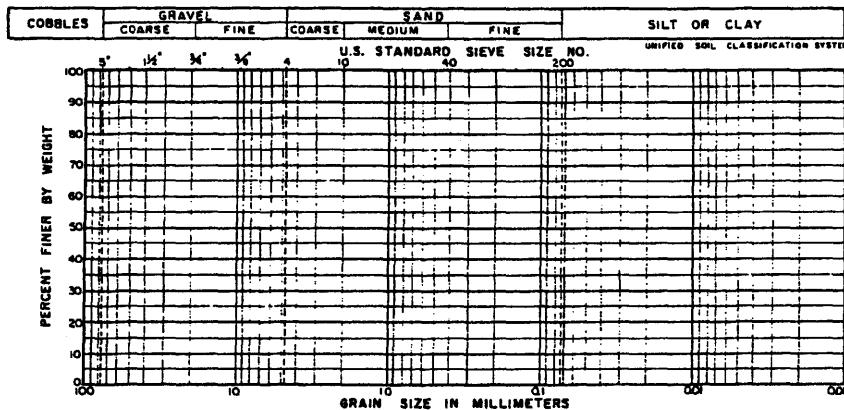
Soil Conservation Service
Tests on Lower Till

Figure 2.5-136 (Sheet 2 of 3)

MECHANICAL ANALYSIS



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL
	S-5		○	Standard Grain Size Distribution - Entire Sample	9.8	20	17
	S-5		●	Standard Grain Size Distribution - Minus No. 10			
	S-5		□	Grain Size Distribution - Minus No. 10 without Deflocculation			



BORING	SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PL

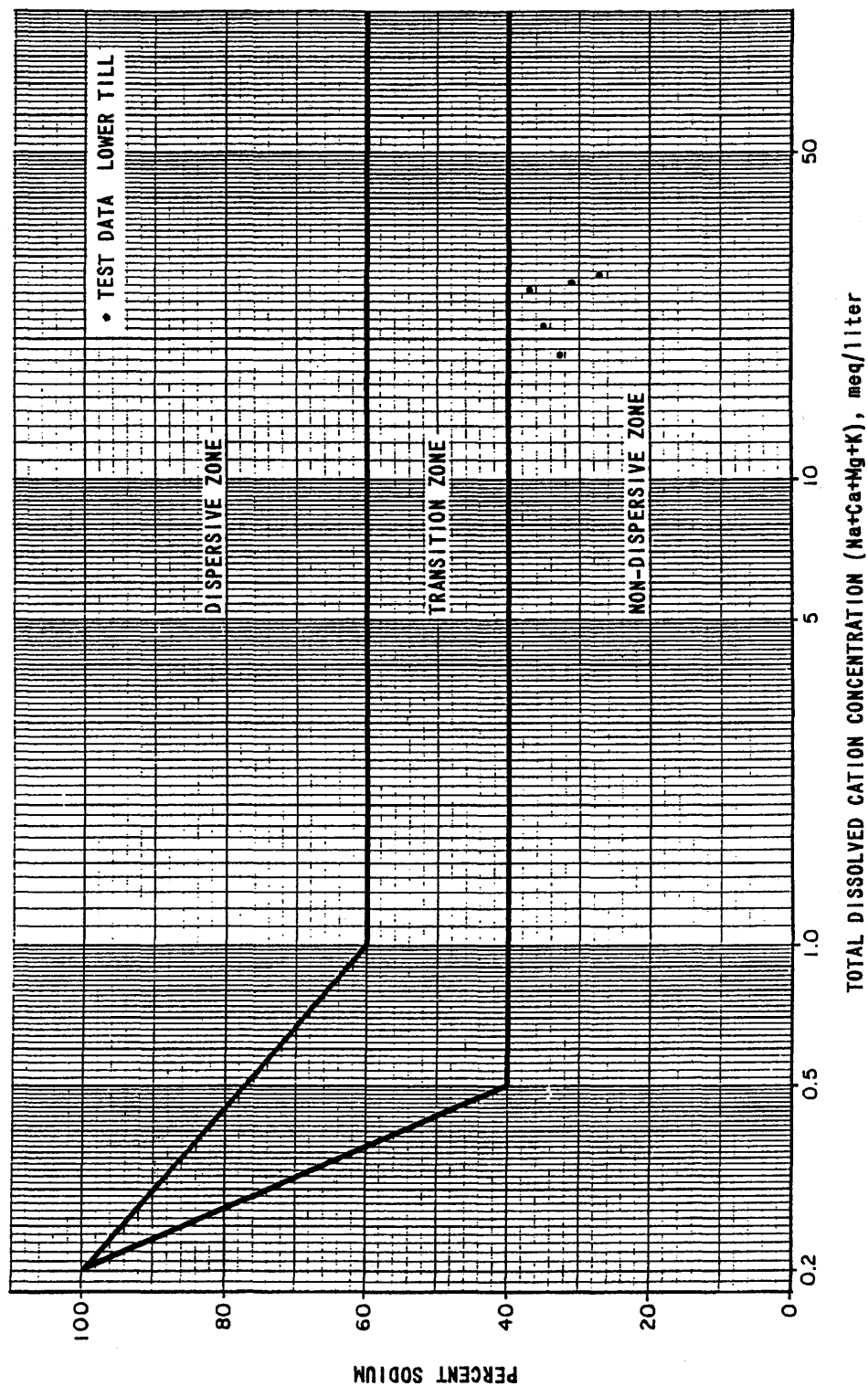
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Soil Conservation Service
Tests on Lower Till

Figure 2.5-136 (Sheet 3 of 3)



(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Dissolved Salts in
Saturation Extract

Figure 2.5-137

MECHANICAL ANALYSIS

Sample 81-13

SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PI
81-13	67.0	•	SH			
81-22	94.0	•	SH			

Sample 81-22

SAMPLE	DEPTH	SYMBOL	CLASSIFICATION	MC	LL	PI
81-22	146.1	•	SH			
81-23	59.0	•	SH			

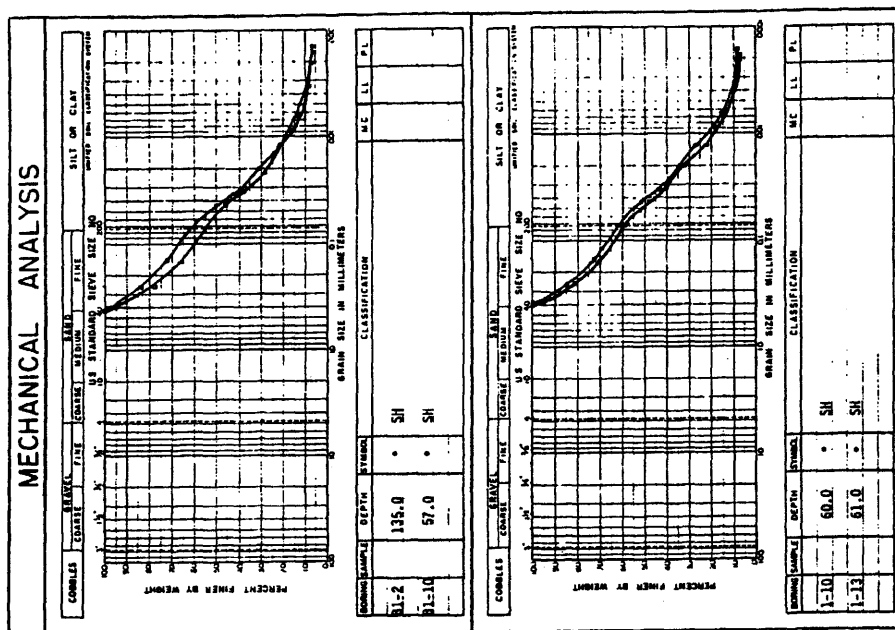
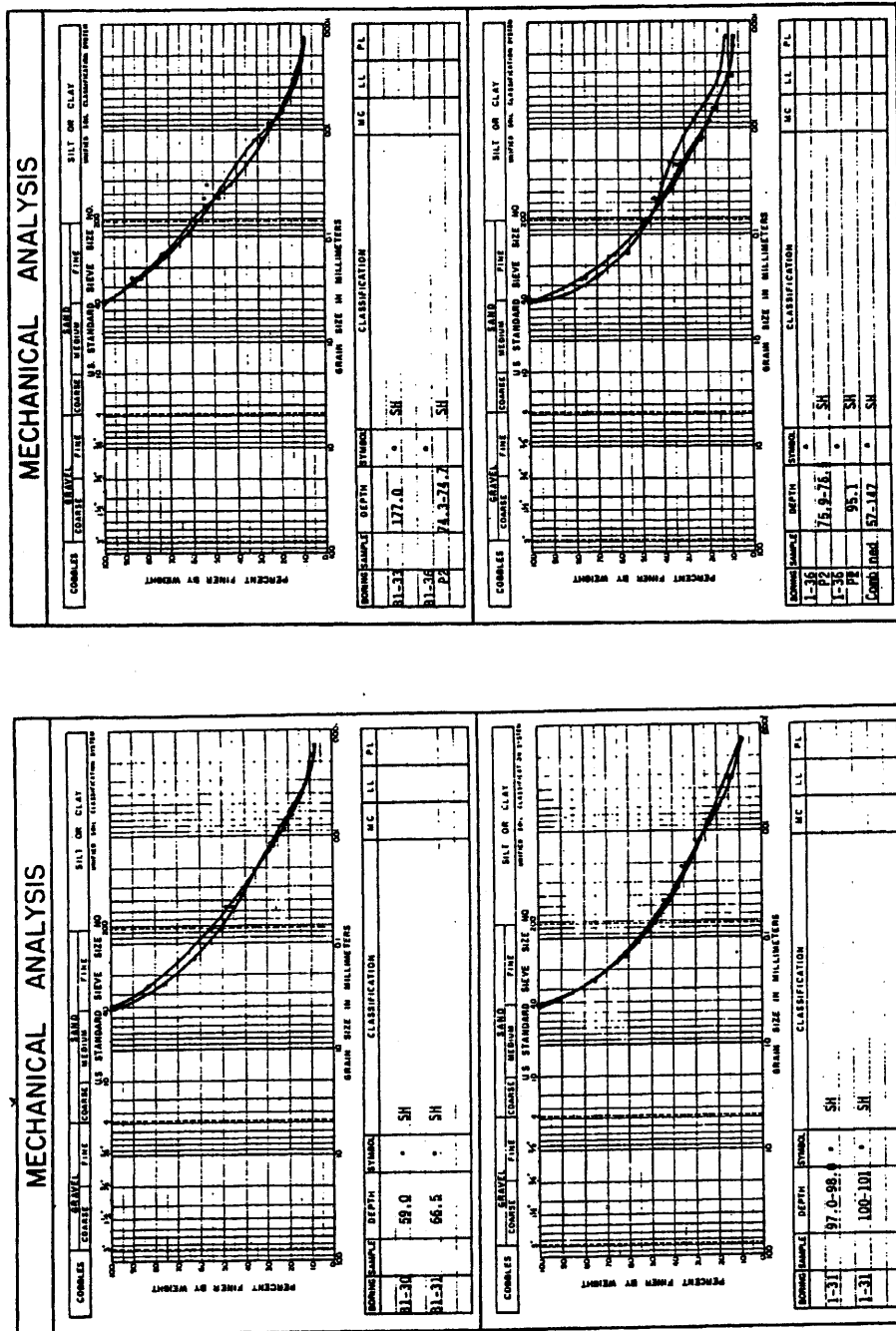


Figure 2.5-138 (Sheet 1 of 2)



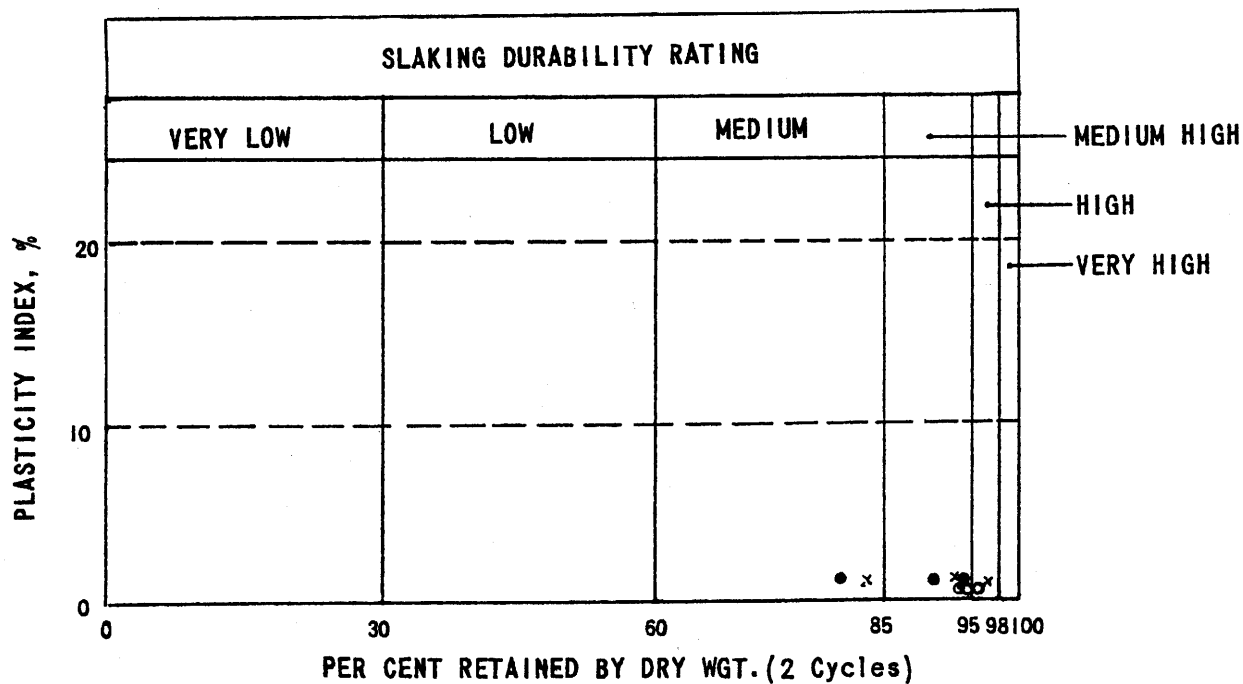
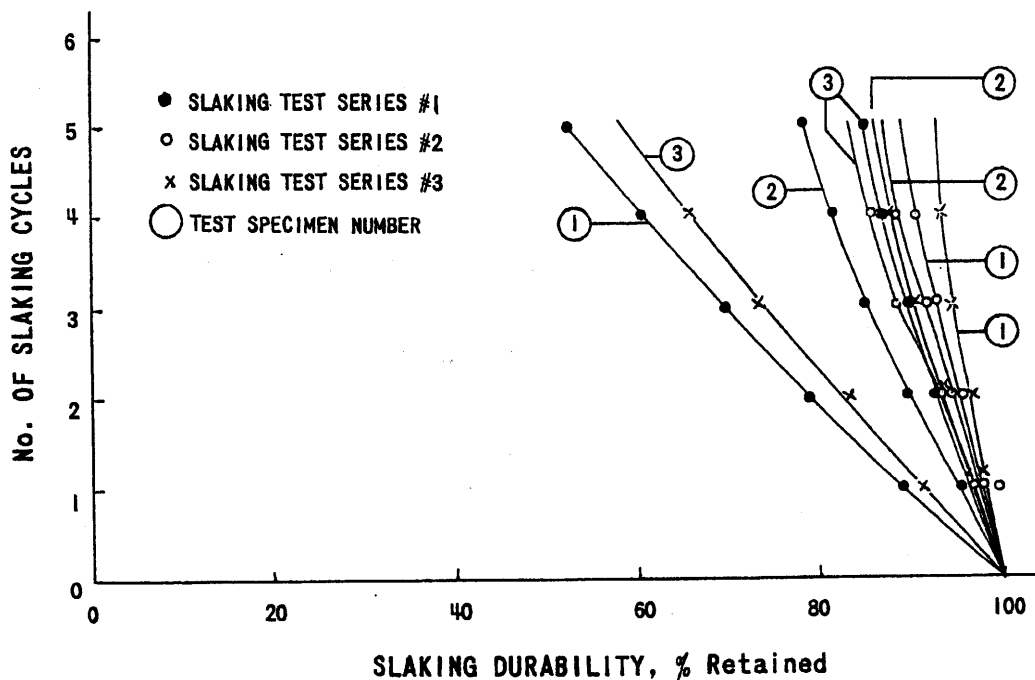
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Grain Size Distribution Curves -
Chagrin Shale

Figure 2.5-138 (Sheet 2 of 2)



(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

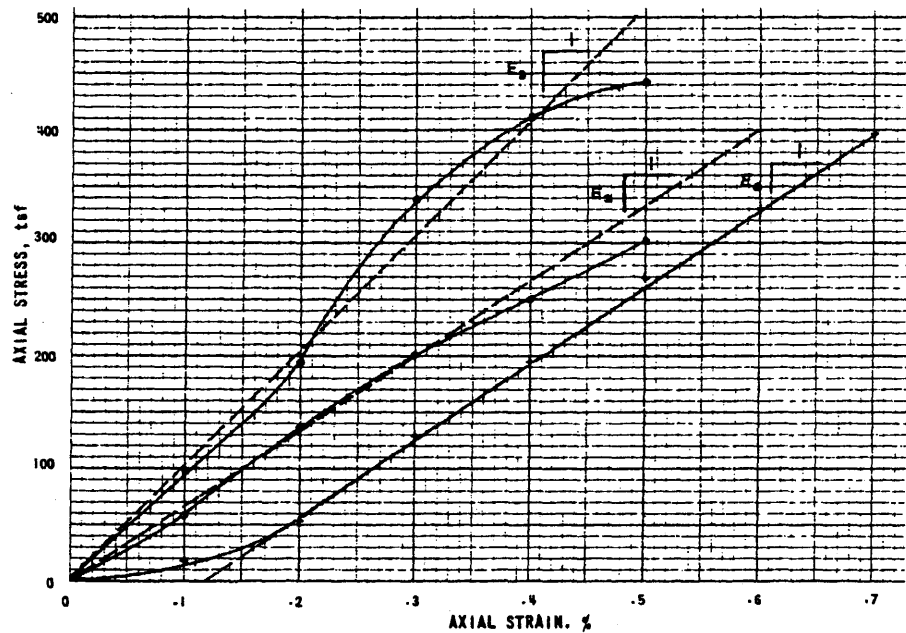
Wet-Dry Cycle Slaking Durability
Test on Chagrin Shale

Figure 2.5-139

TYPICAL STRESS - STRAIN CHARACTERISTICS OF SHALE IN UNIAXIAL COMPRESSION

SYMBOL	BORING No.	SAMPLE DEPTH (Ft)	γ_d (pcf)	w_n (%)	ULTIMATE STRESS (tsf)	ULTIMATE STRAIN (%)	E_s (tsf $\times 10^3$)
•	1 - 33	152	158.0	4.5	302	0.50	67
•	1 - 33	161	150.0	4.7	442	0.50	102
+	1 - 1	124	164.7	2.1	542	0.91	53

ALL SAMPLES EXHIBITED AN ABRUPT BRITTLE FAILURE



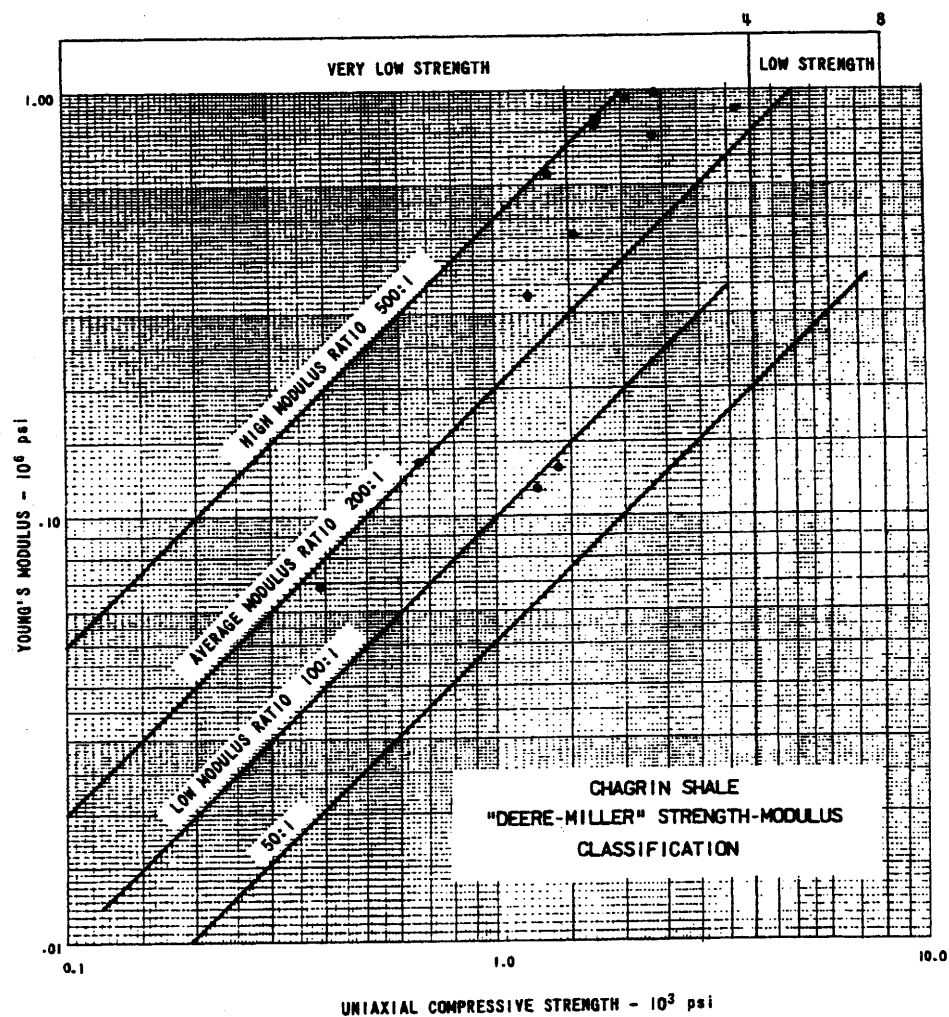
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Stress - Strain
Characteristics of Shale in
Uniaial Compression

Figure 2.5-140



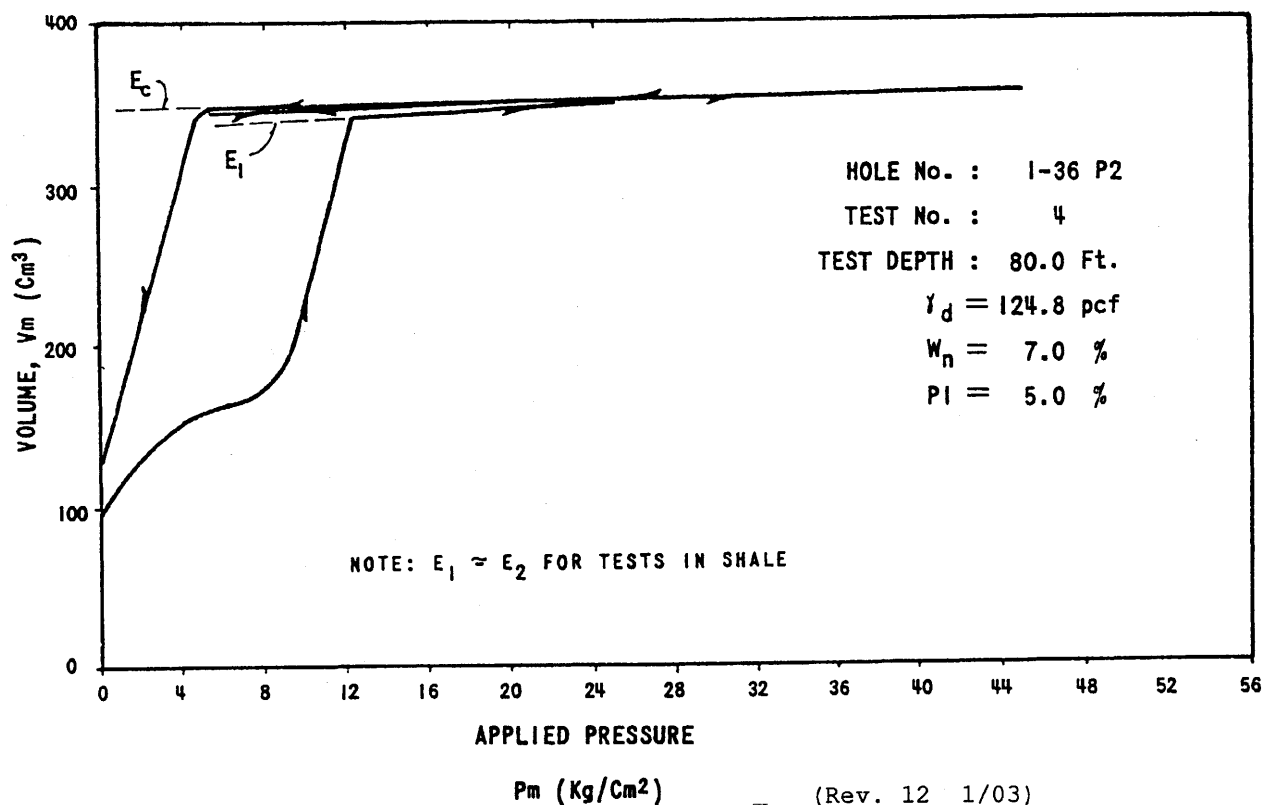
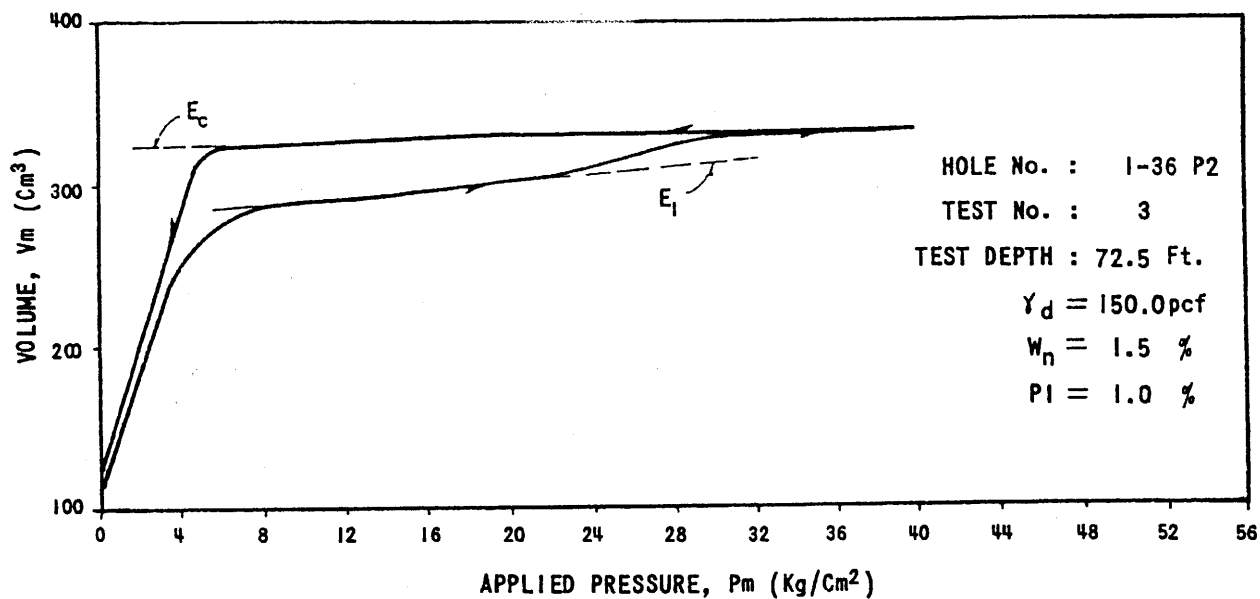
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Deere-Miller Strength -
Modulus Classification of
Chagrin Shale

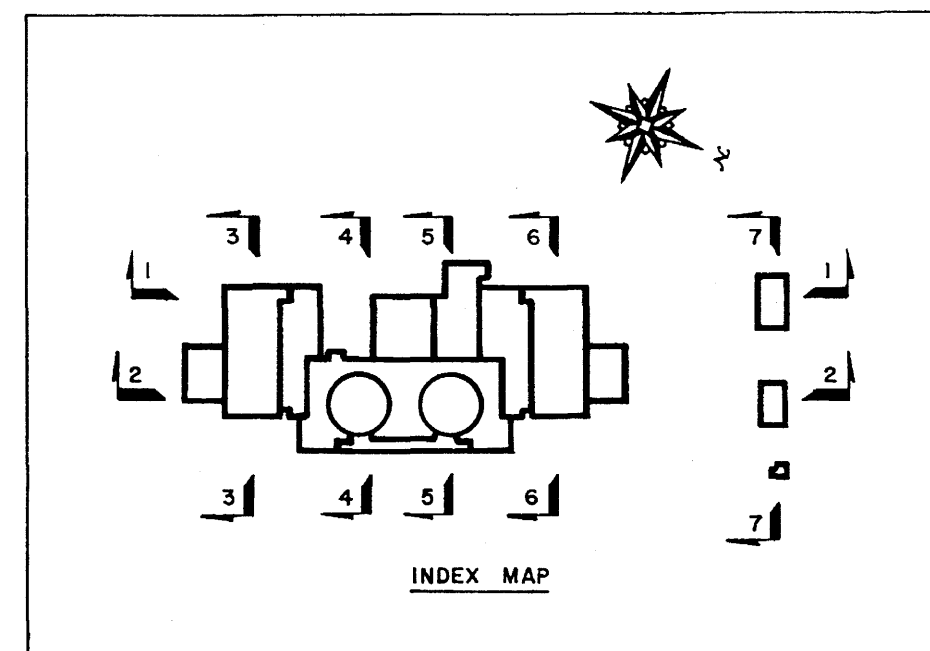
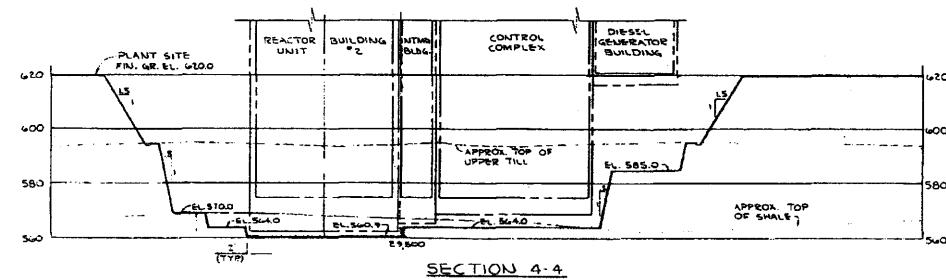
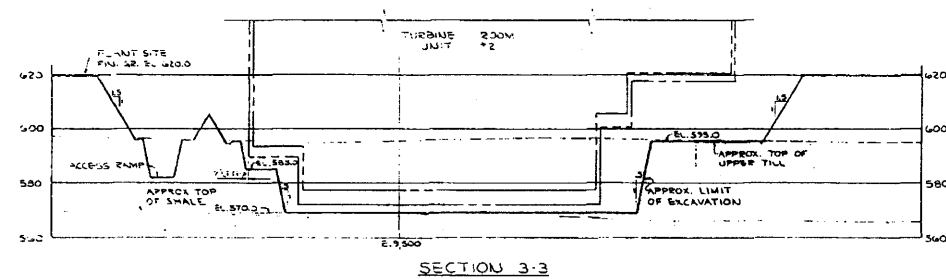
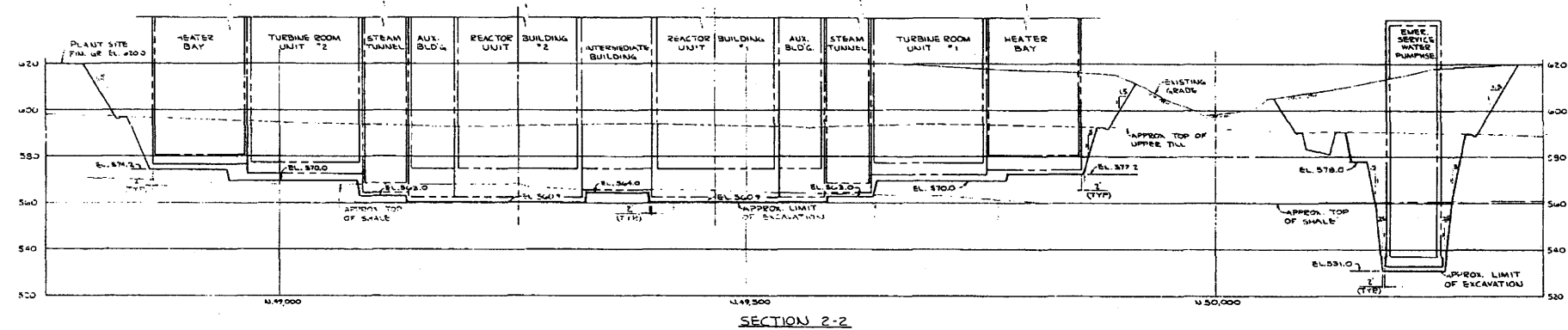
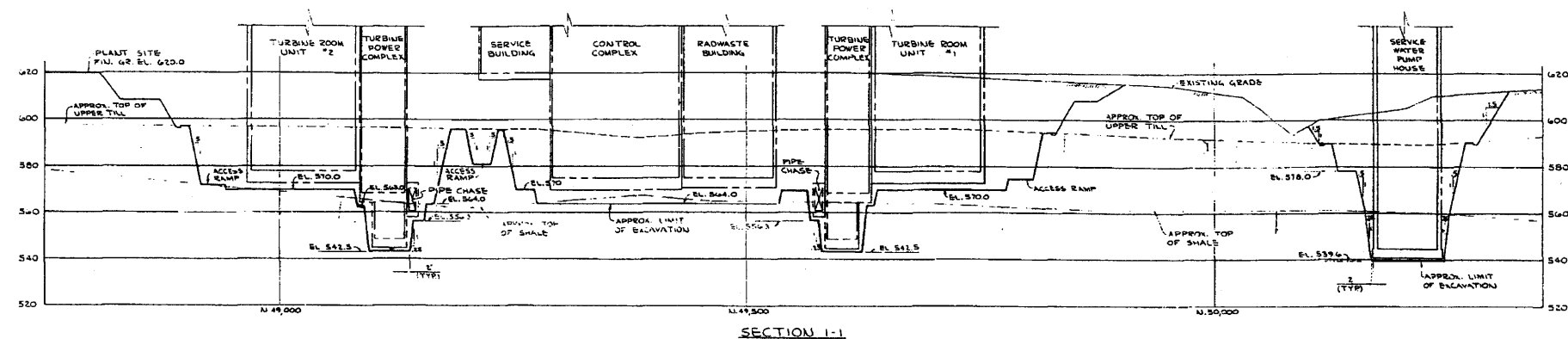
Figure 2.5-141



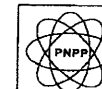
PERRY NUCLEAR POWER PLANT

Typical Pressuremeter Test
Results in Chagrin Shale

Figure 2.5-142



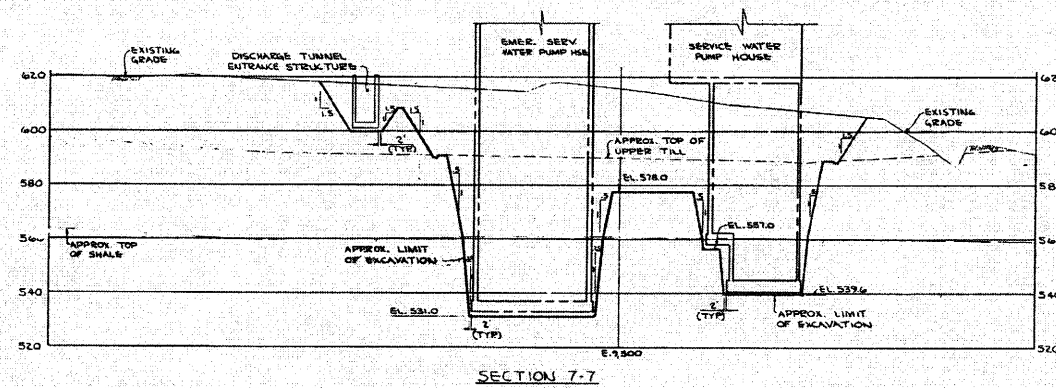
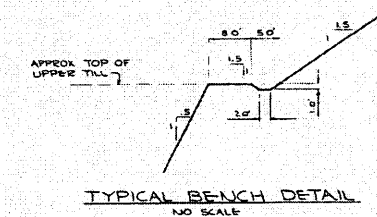
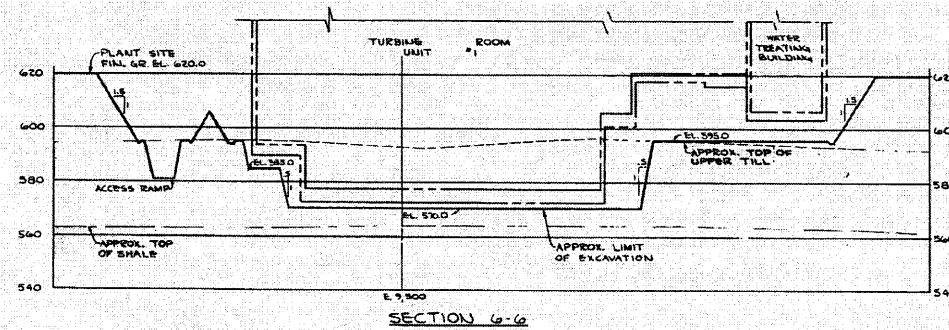
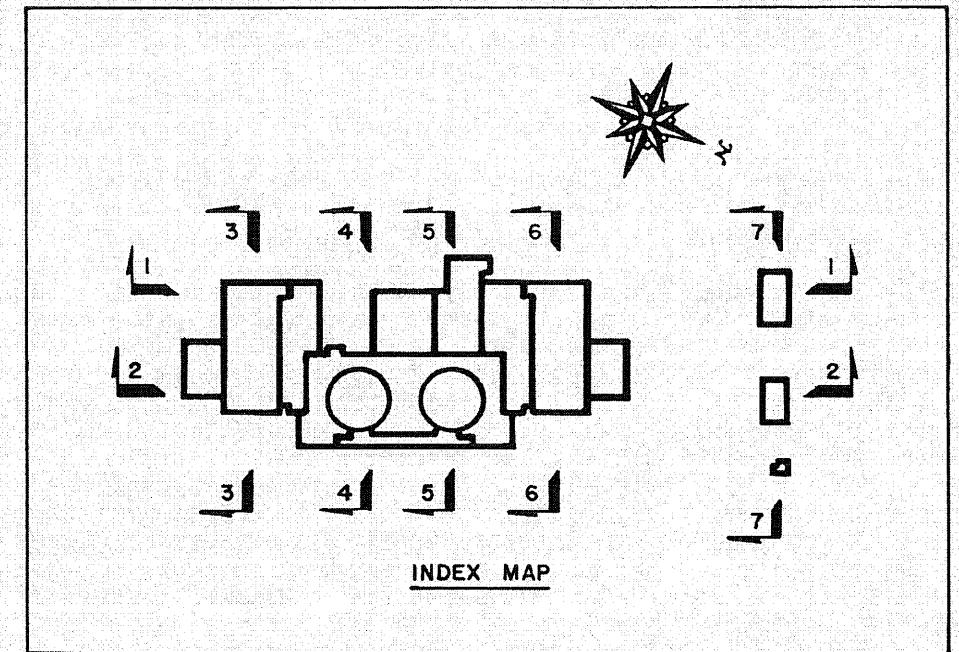
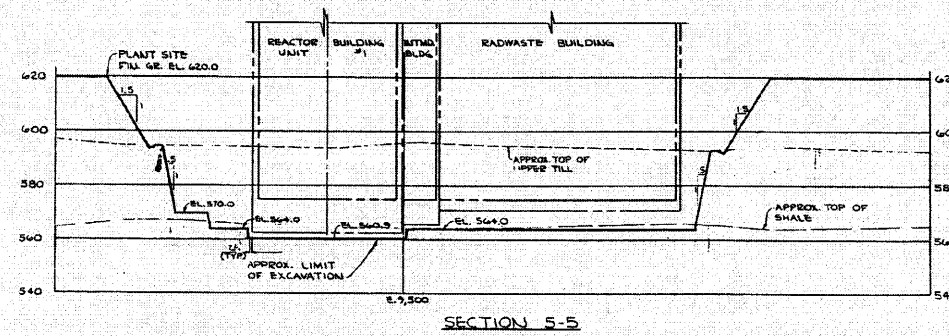
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Subsurface Stratigraphy and
Excavation Sections
(Preconstruction)

Figure 2.5-143 (Sheet 1 of 2)



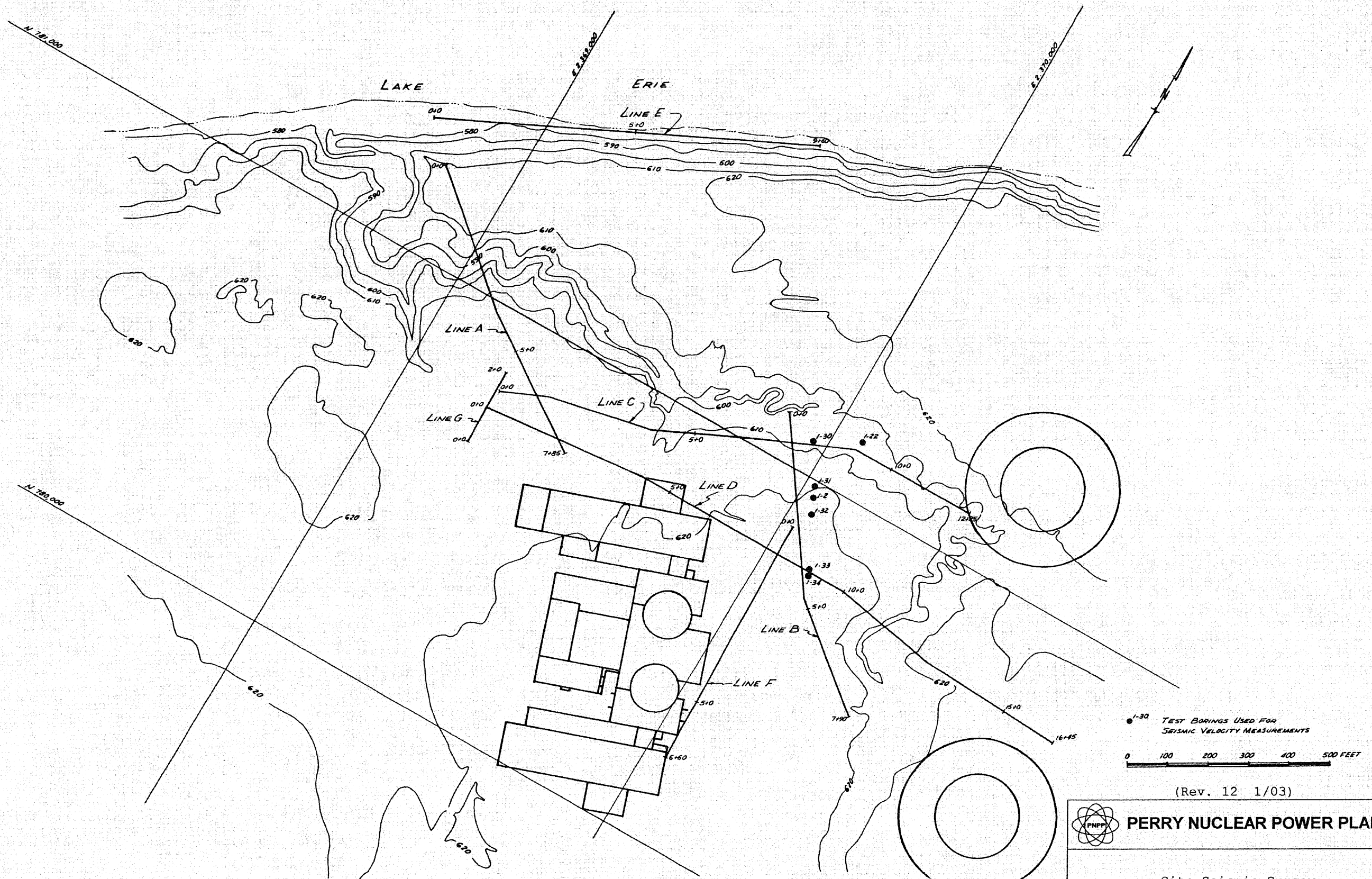
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Subsurface Stratigraphy and
Excavation Sections
(Preconstruction)

Figure 2.5-143 (Sheet 2 of 2)



(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Site Seismic Survey

Figure 2.5-144



(Rev. 12 1/03)

Anticlinal fold and overthrust fault in Bedford formation on Bates Creek, southeast of Painesville.

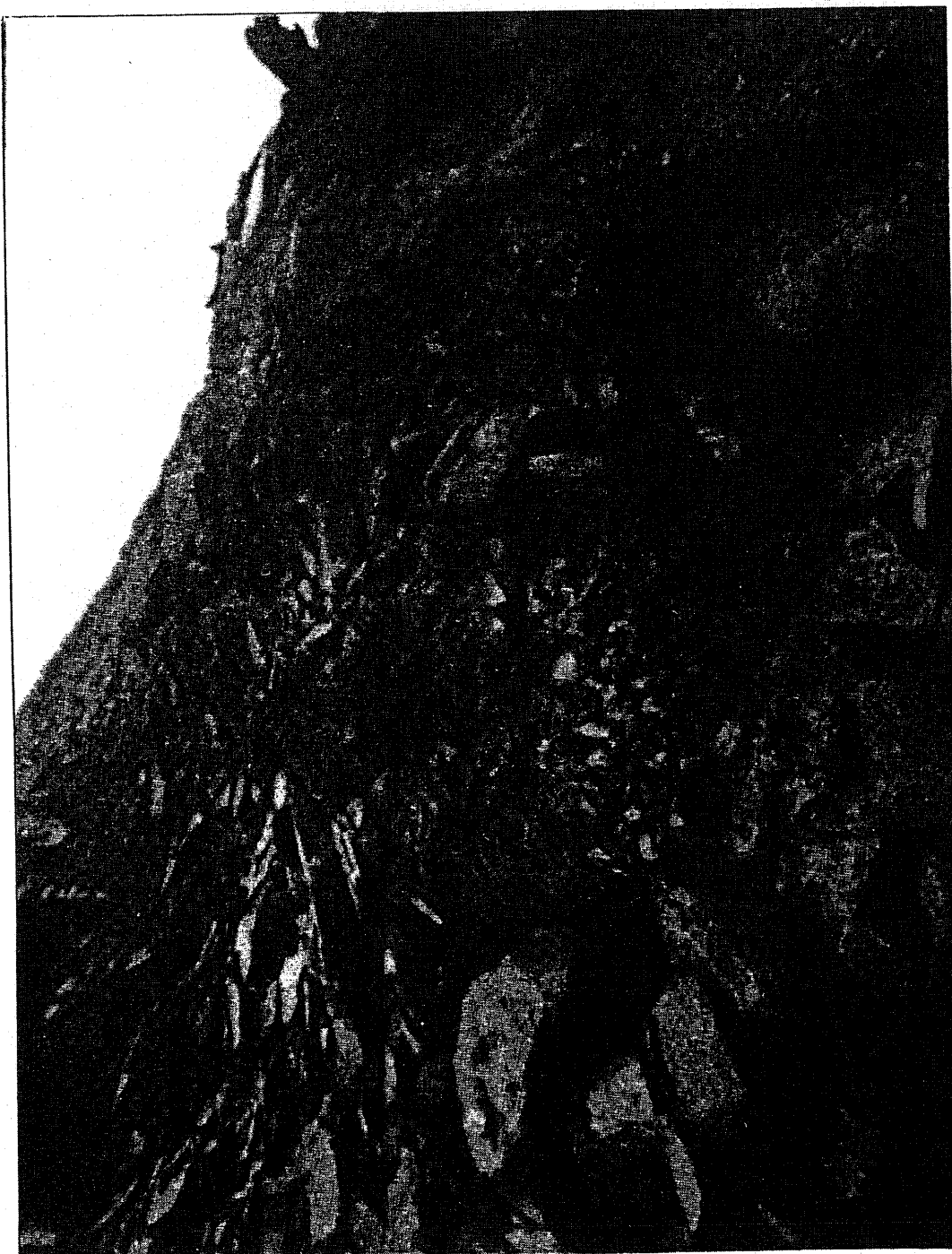
(Reference 289)



PERRY NUCLEAR POWER PLANT

Warners Creek Thrust
Fault from Prosser

Figure 2.5-145



Anticline produced by buckling of the shales at the base of the landslide at Cleveland, Ohio. (Reference 289)

(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Anticline Produced by Sliding
from Van Horn

Figure 2.5-146



UNSYMMETRICAL ANTICLINE

This shows 5 feet of disturbed shale overlain by 2 feet of glacial drift. (Reference 290)

(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Anticline in Shale from
Van Horn

Figure 2.5-147



UNSYMMETRICAL ANTICLINE WITH BOTTOM LAYERS HORIZONTAL

Eight feet of shale are covered by 2 feet of glacial drift. (Reference 290)

(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Anticline in Shale from
Van Horn

Figure 2.5-148



This view shows 3 feet of glacial sand and 5 feet of folded iron-stained shale having 3 well defined concretionary ironstone bands, 3 feet of blue shale with less folding, and 3 feet of horizontal shale. (Reference 290)

(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Anticline in Shale from
Van Horn

Figure 2.5-149



(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Aerial Photograph of Warners
(Bates) Creek Fault

Figure 2.5-150



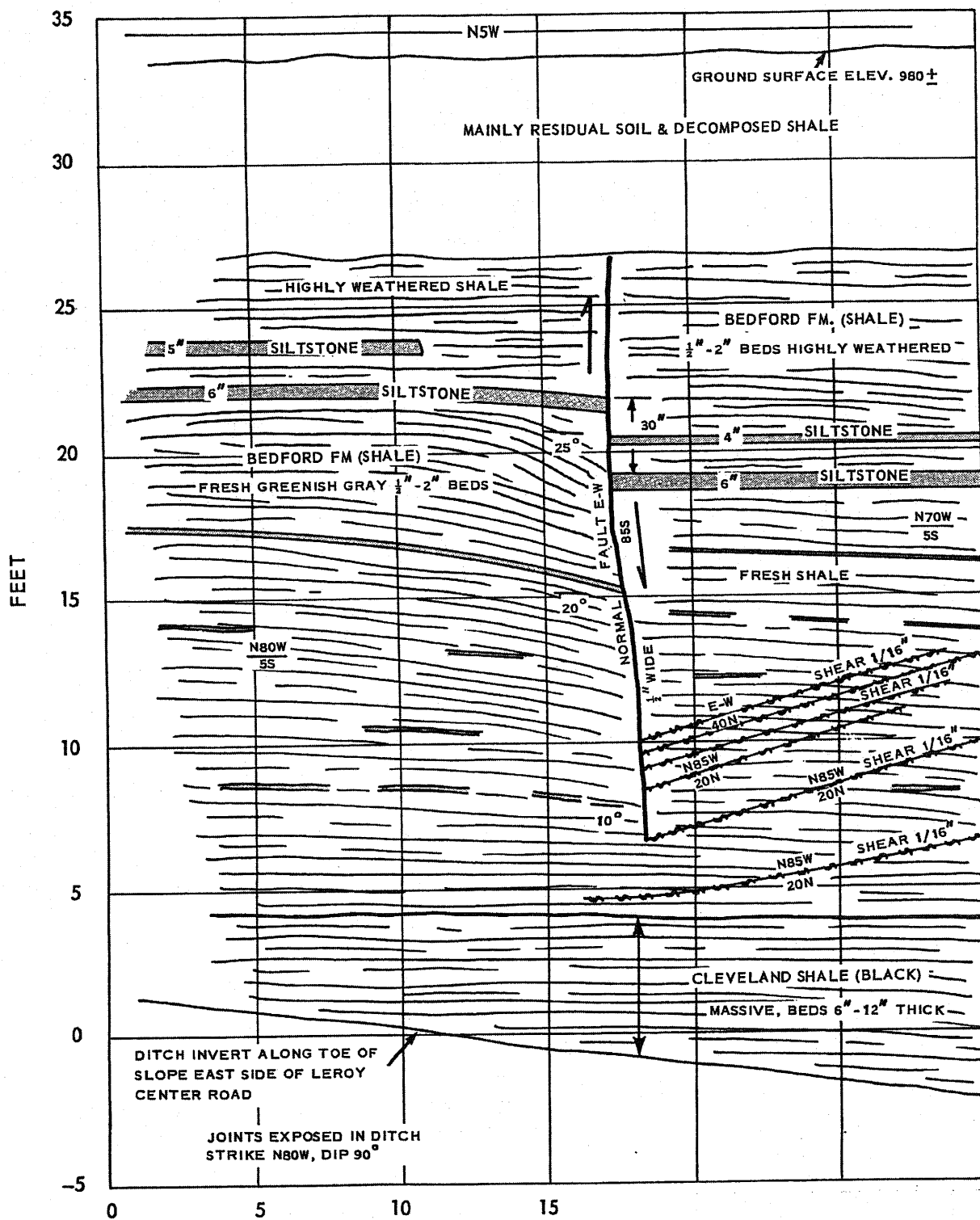
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Aerial Photograph of Hell
Hollow Faults

Figure 2.5-151



(APPROXIMATELY TO SCALE)

NOTE: FAULT #1 IS 7 MILES SE OF PERRY SITE

FEET

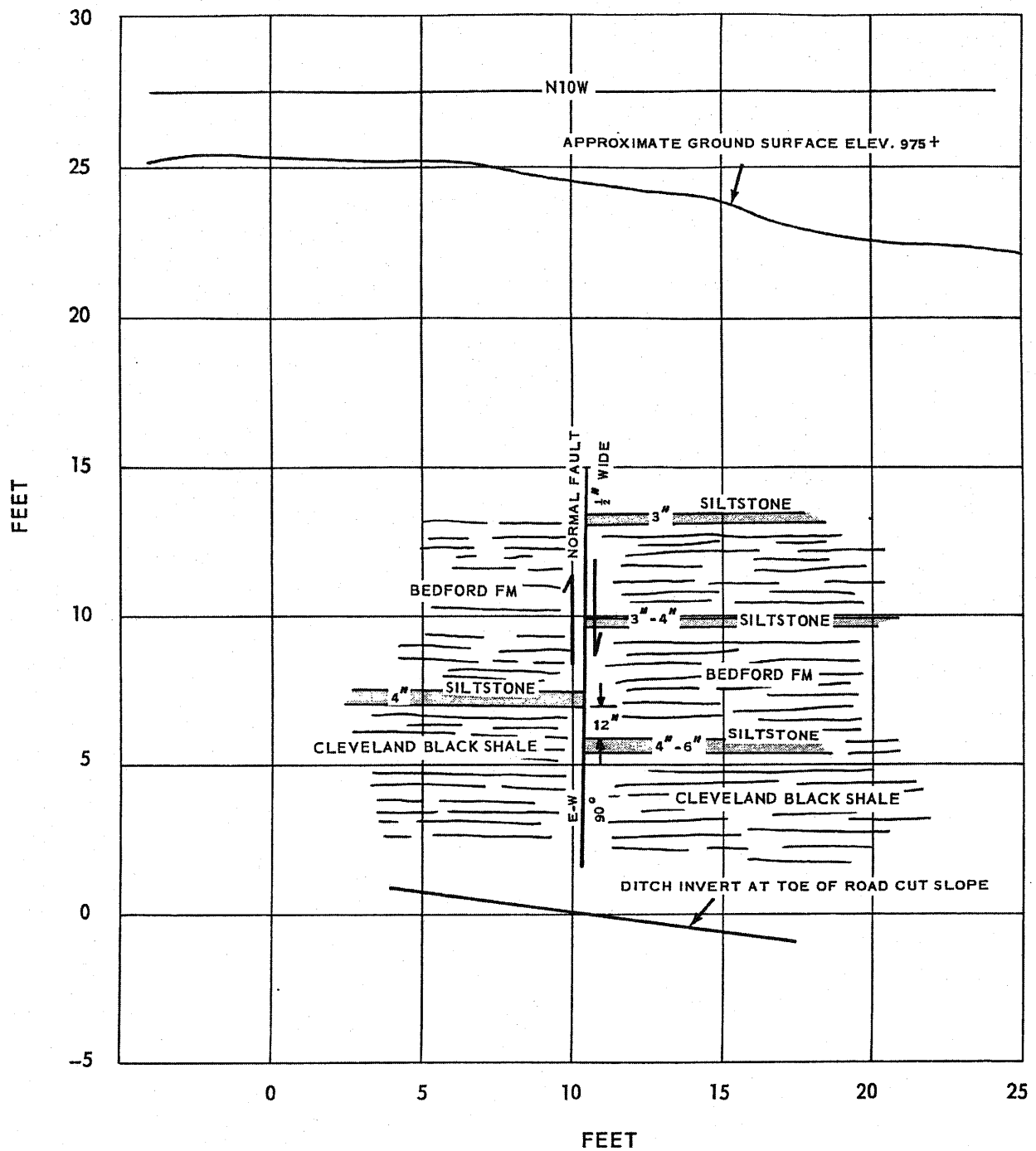
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Sketch of Excavated Rock Slope
Showing Hell Hollow Fault #1

Figure 2.5-153



(APPROXIMATELY TO SCALE)

NOTE: FAULT #2 IS 40 FT SOUTH OF FAULT #1

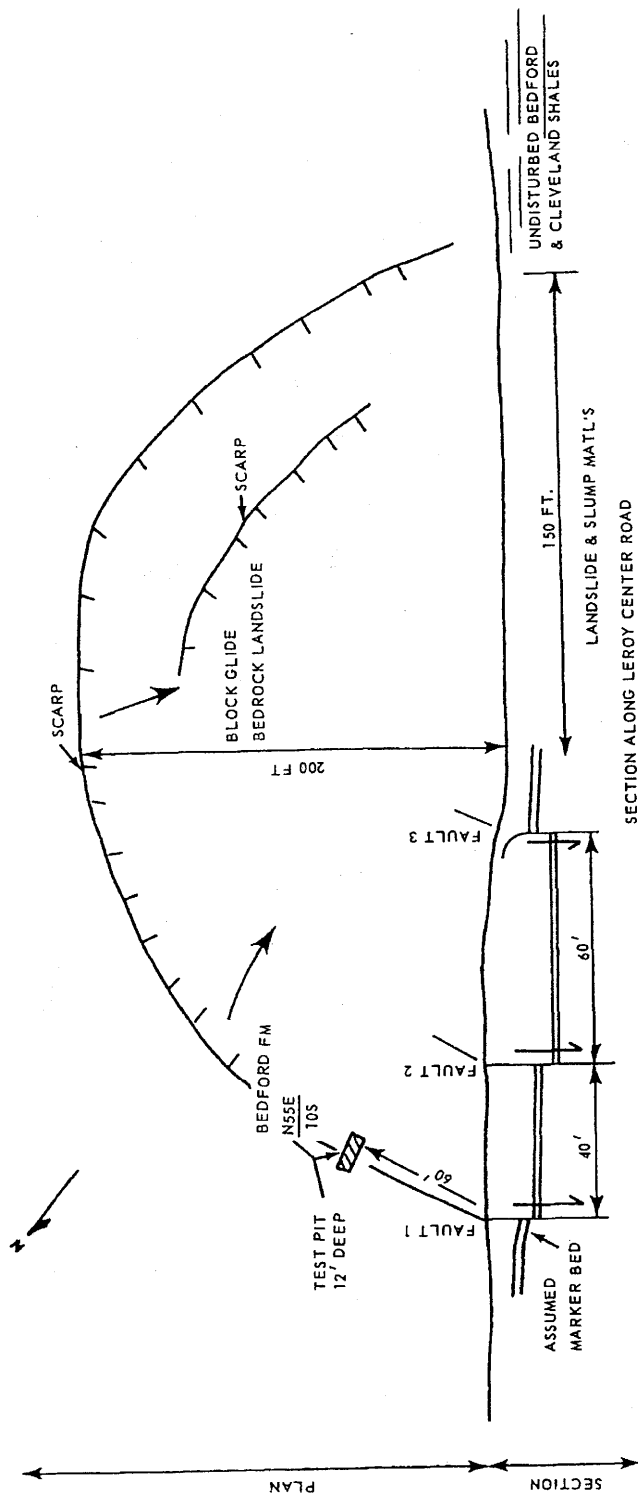
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Sketch of Excavated Rock Slope
Showing Hell Hollow Fault #2

Figure 2.5-154



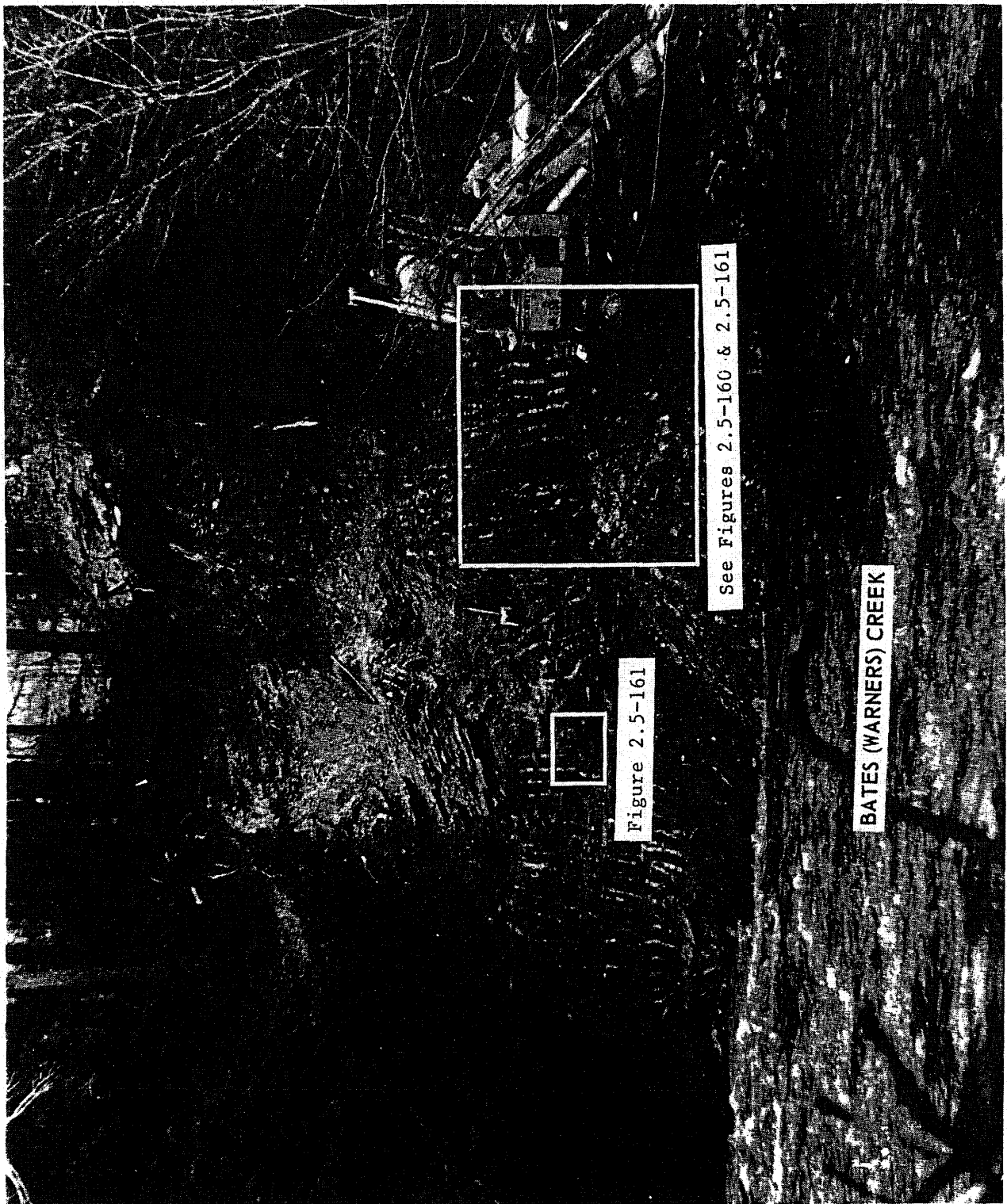
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Interpretative Sketch of
Hell Hollow Faults
Related to Slumping

Figure 2.5-156



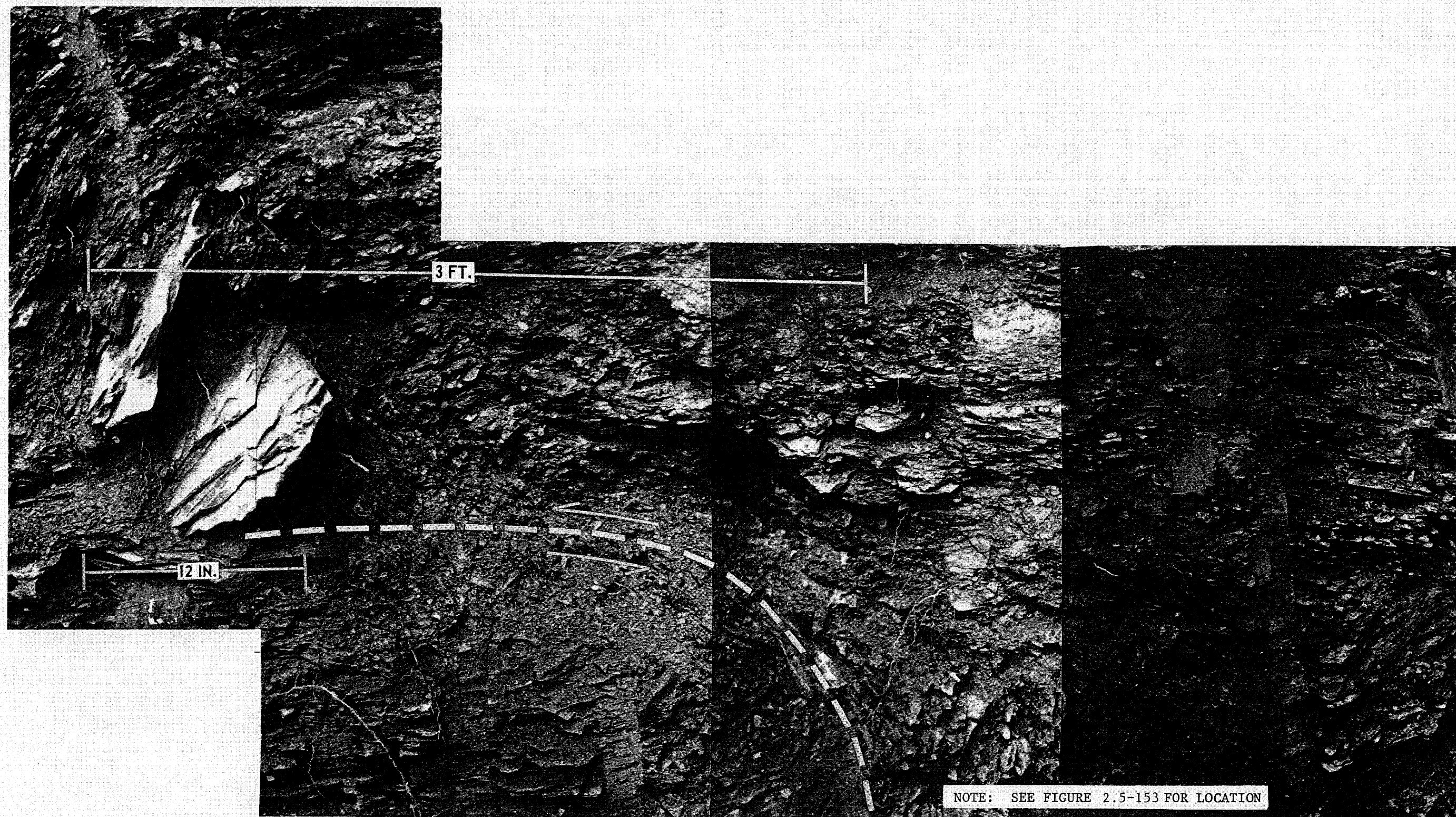
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photograph of Warners
(Bates) Creek Exposure

Figure 2.5-157



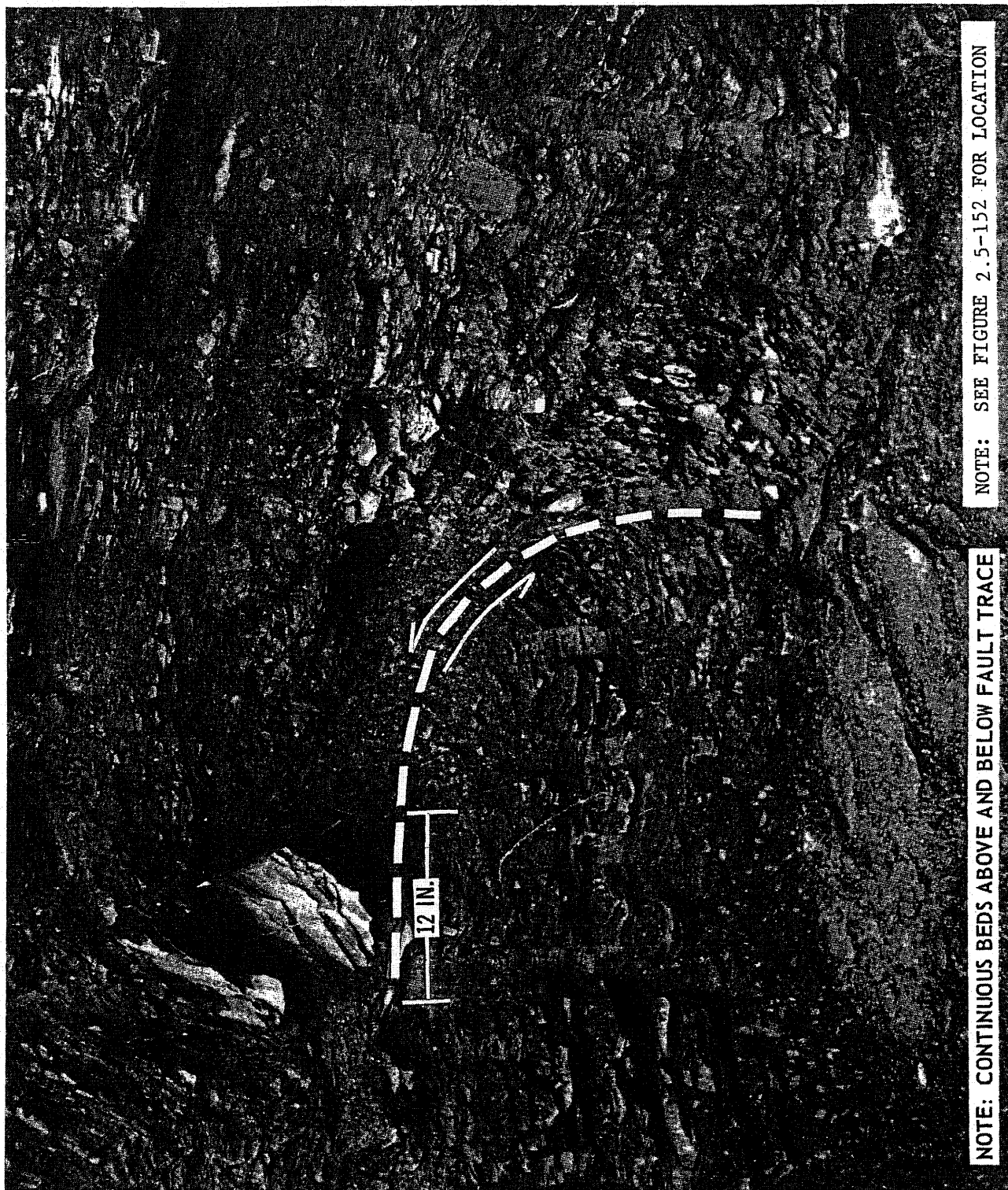
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photographic Enlargement of Fault
of Warners (Bates) Creek

Figure 2.5-158



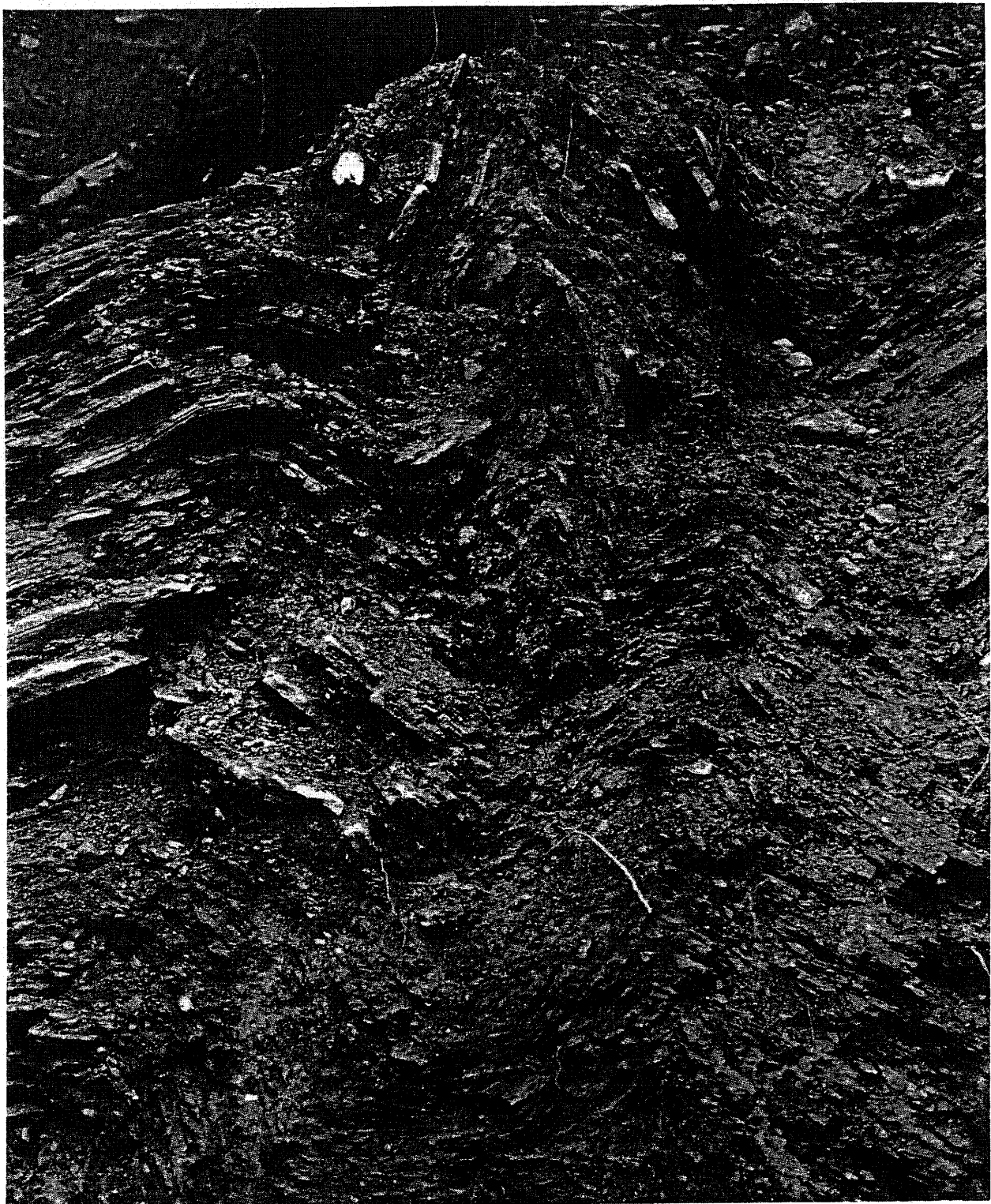
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photographic Enlargement of Fault
of Warners (Bates) Creek

Figure 2.5-159



(Rev. 12 1/03)

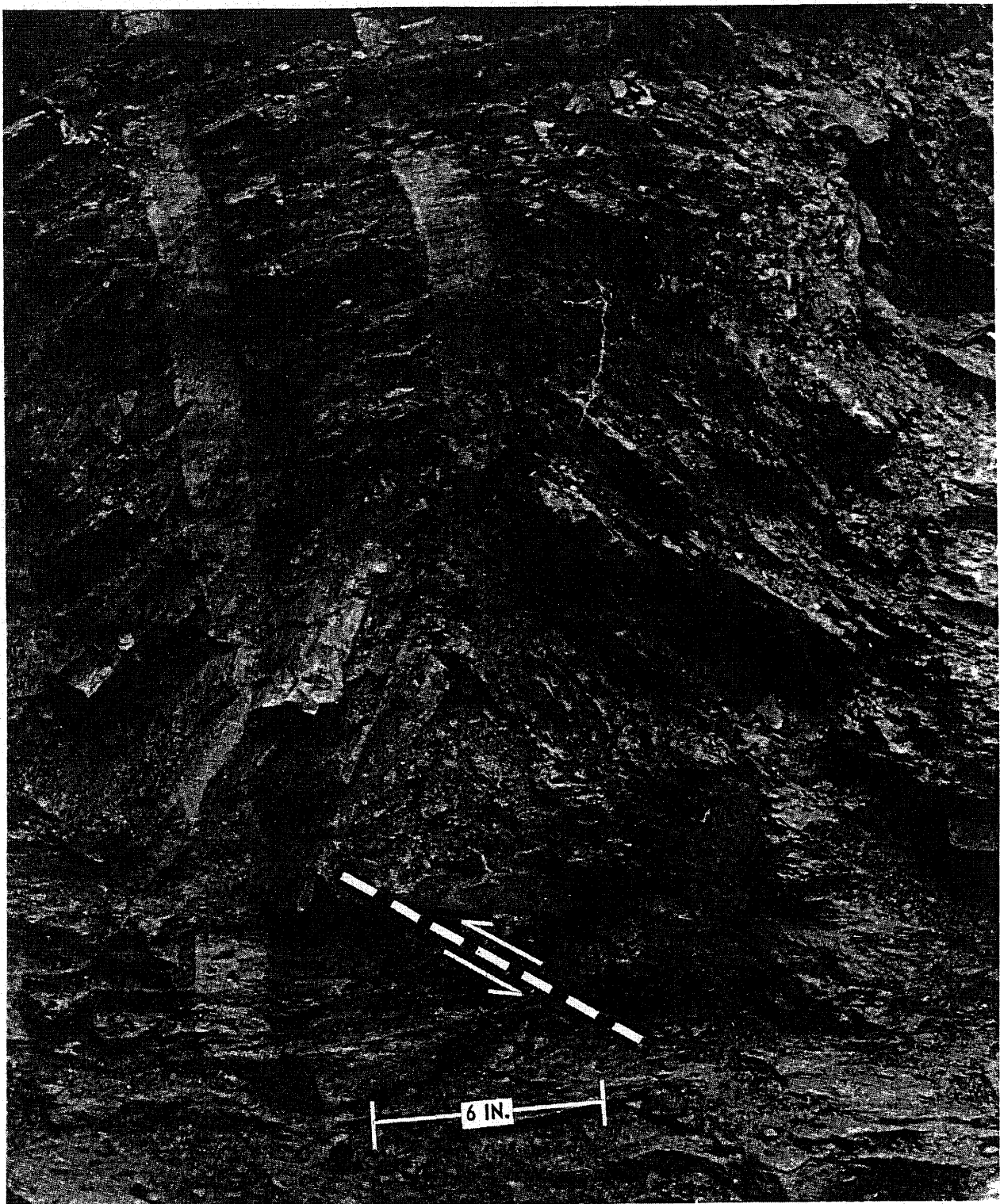
NOTE: See Figure 2.5-152 for Location.



PERRY NUCLEAR POWER PLANT

Photographic Enlargement of
Tightly Folded Strata at
Warners (Bates)

Figure 2.5-160



Note: See Figure 2.5-152 for Location.

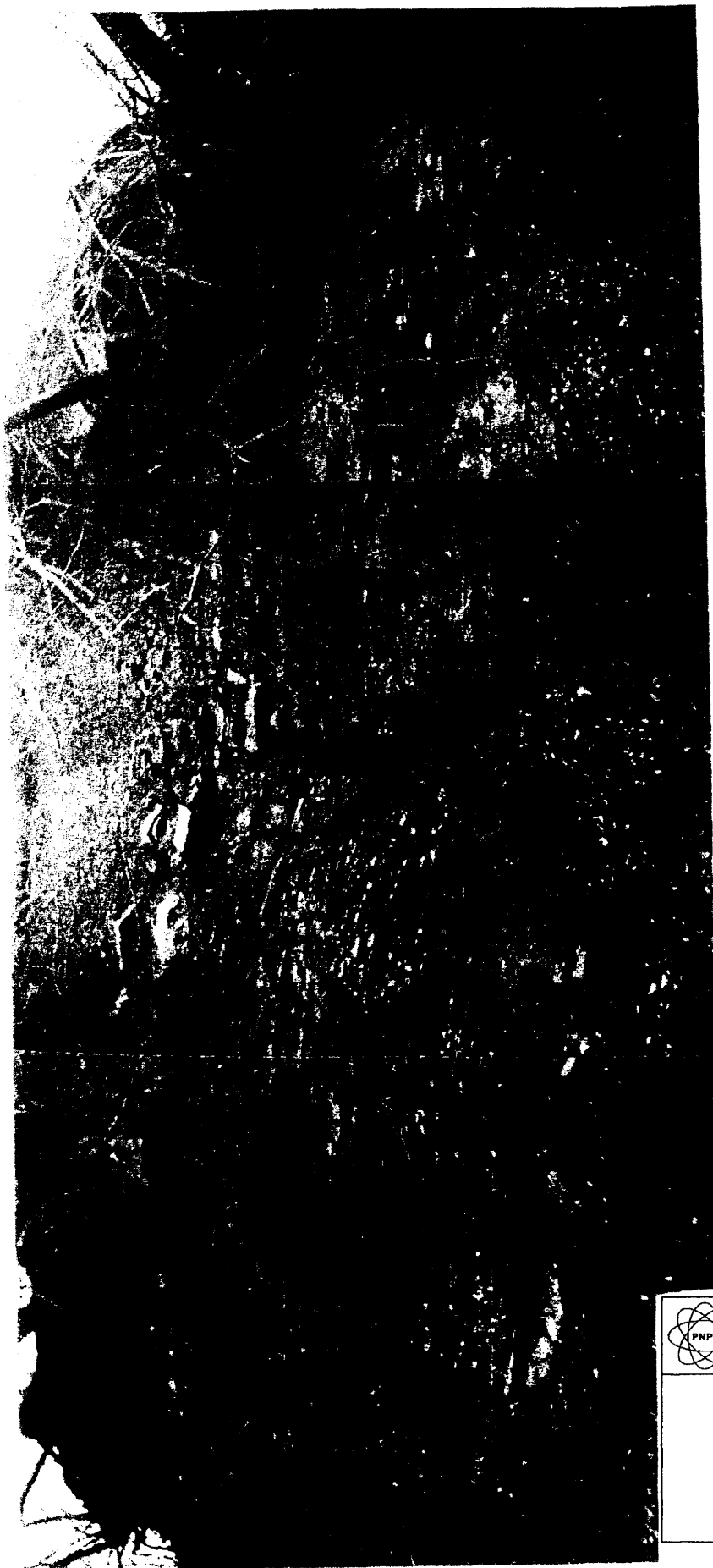
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photograph of Minor Thrust Fault,
20 ft North of Warners
(Bates) Creek Fault

Figure 2.5-161



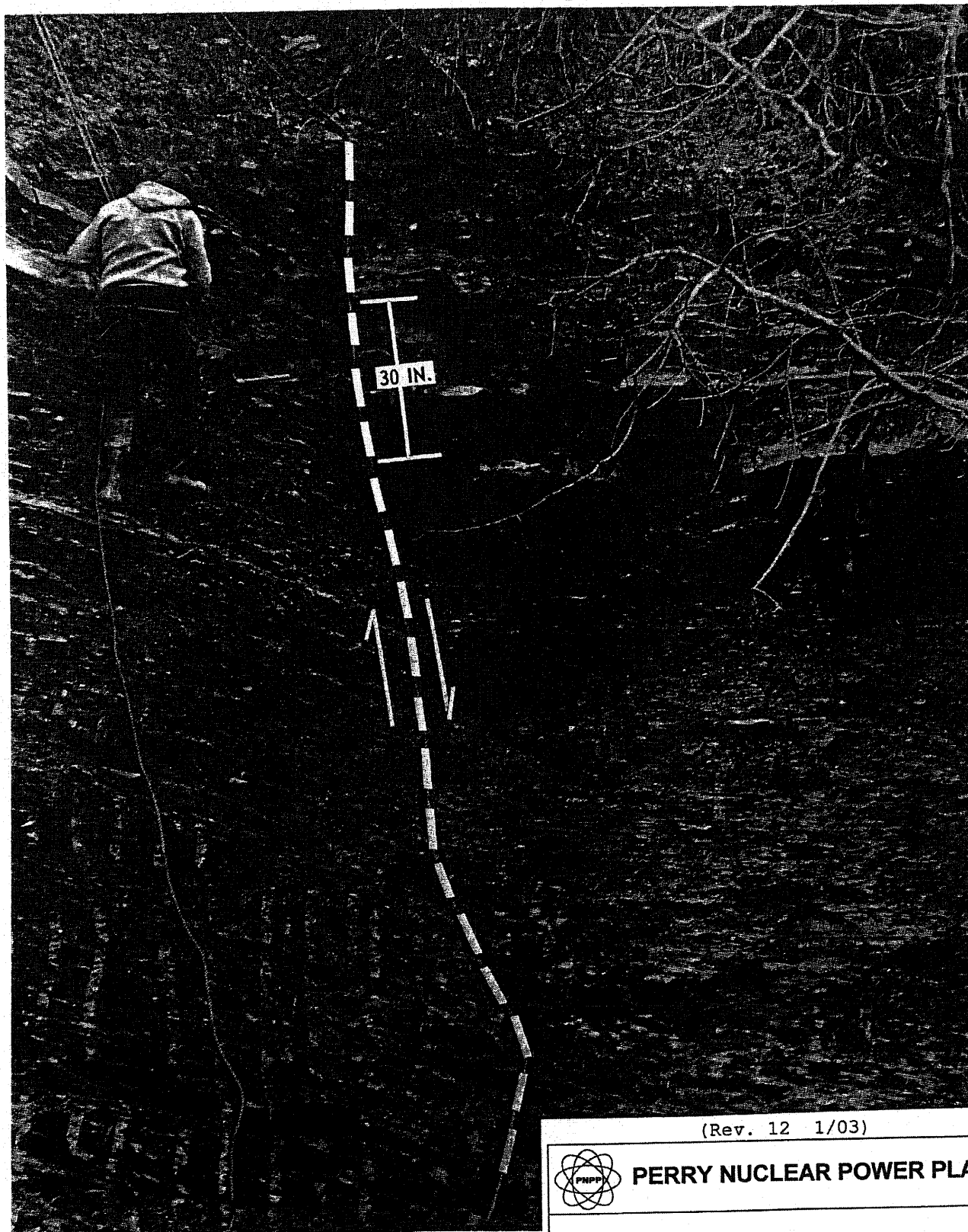
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photograph of Hell Hollow
Fault #1 Prior to Excavation

Figure 2.5-162



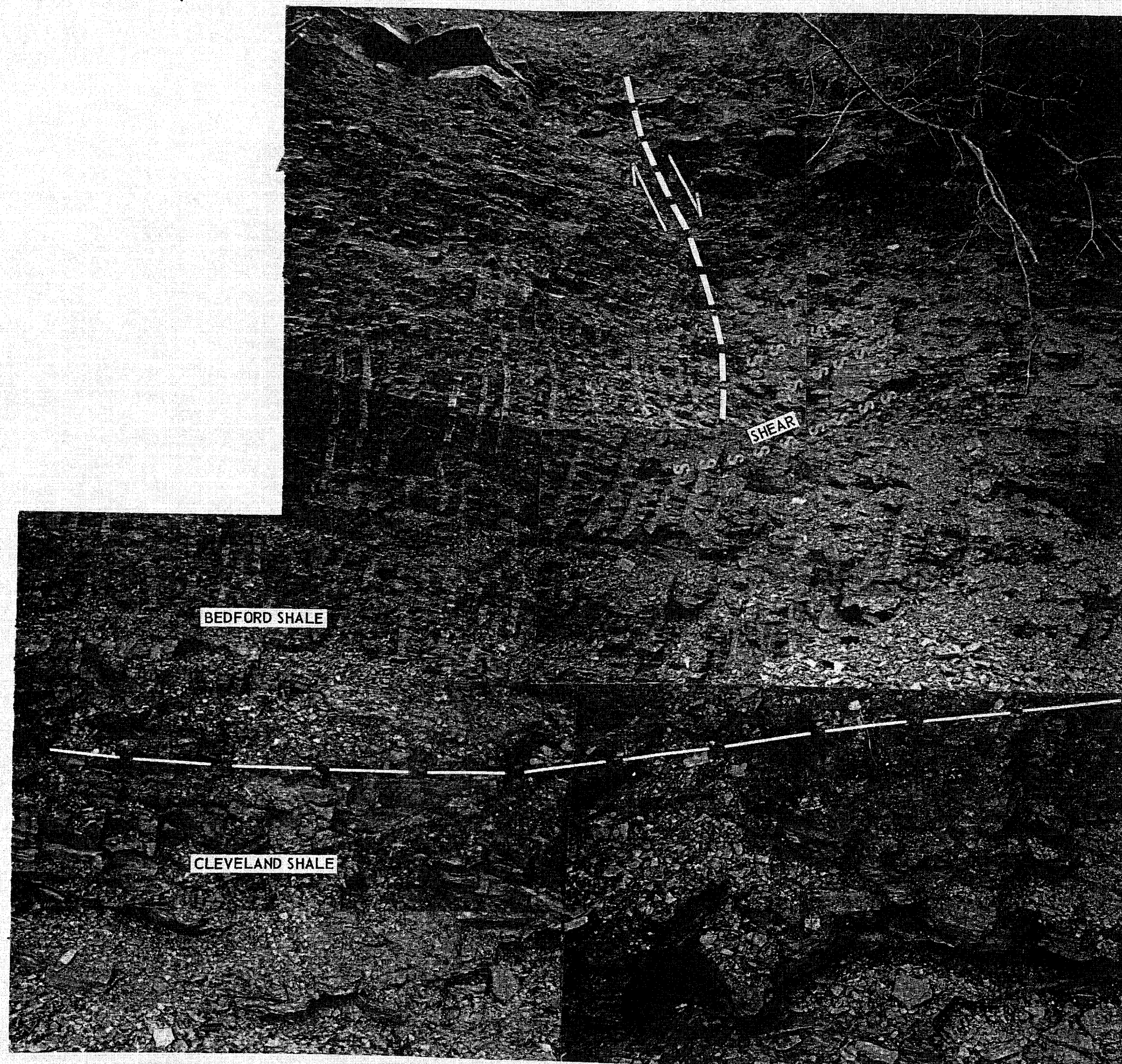
(Rev. 12 1/03)



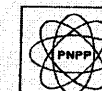
PERRY NUCLEAR POWER PLANT

Photograph of Hell Hollow
Fault #1 After Excavation

Figure 2.5-163



(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photographic Enlargement of
Hell Hollow Fault #1
After Excavation

Figure 2.5-164



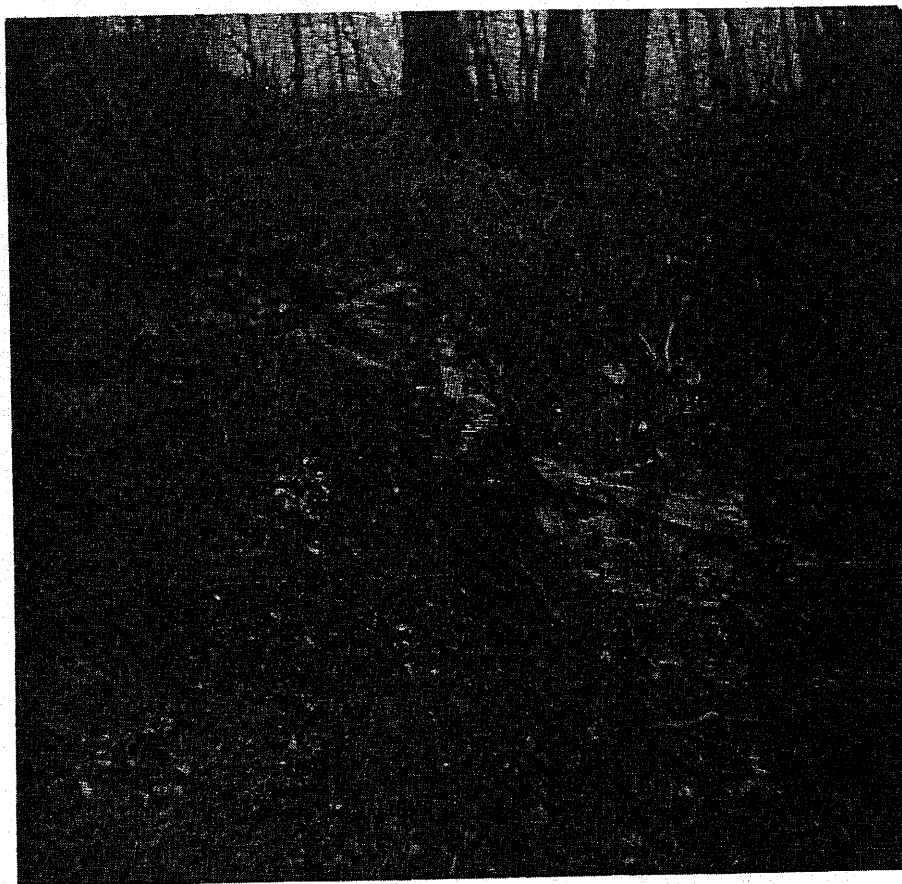
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photograph of Hell Hollow
Fault #2 After Excavation

Figure 2.5-165



(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photograph of Hell Hollow
Fault #3 Prior to Excavation

Figure 2.5-166



(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photograph of Hell Hollow
Fault #3 After Excavation

Figure 2.5-167



NOTE: SCARP IN FOREGROUND

(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photograph of Hell Hollow Slump
Area Facing South

Figure 2.5-168



NOTE: SCARP IN BACKGROUND

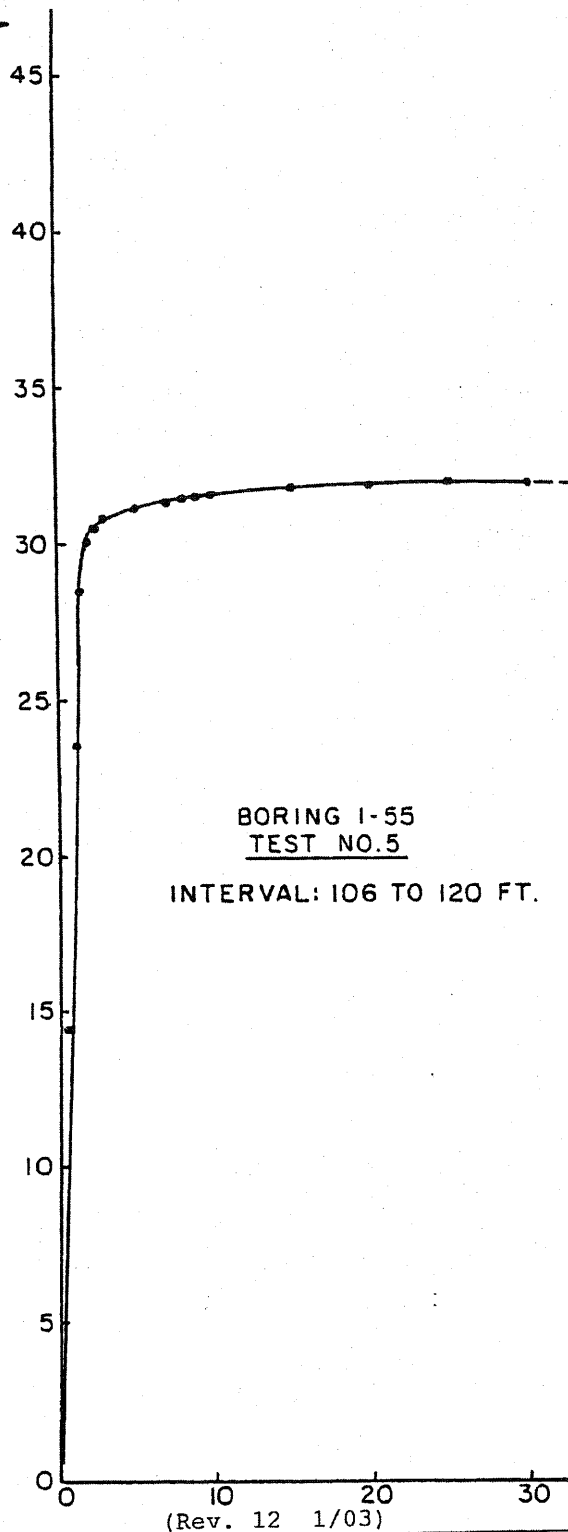
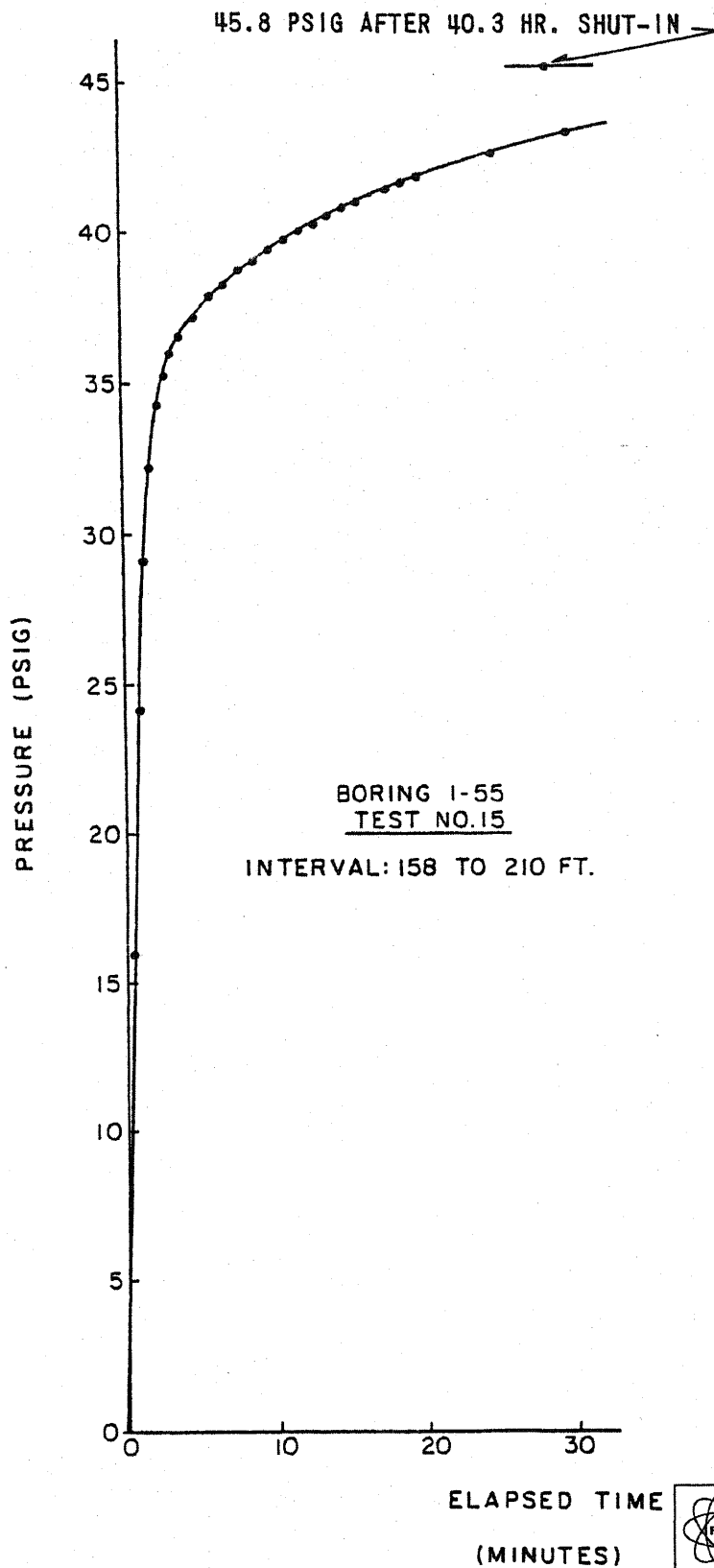
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Photograph of Hell Hollow Slump
Area Facing East

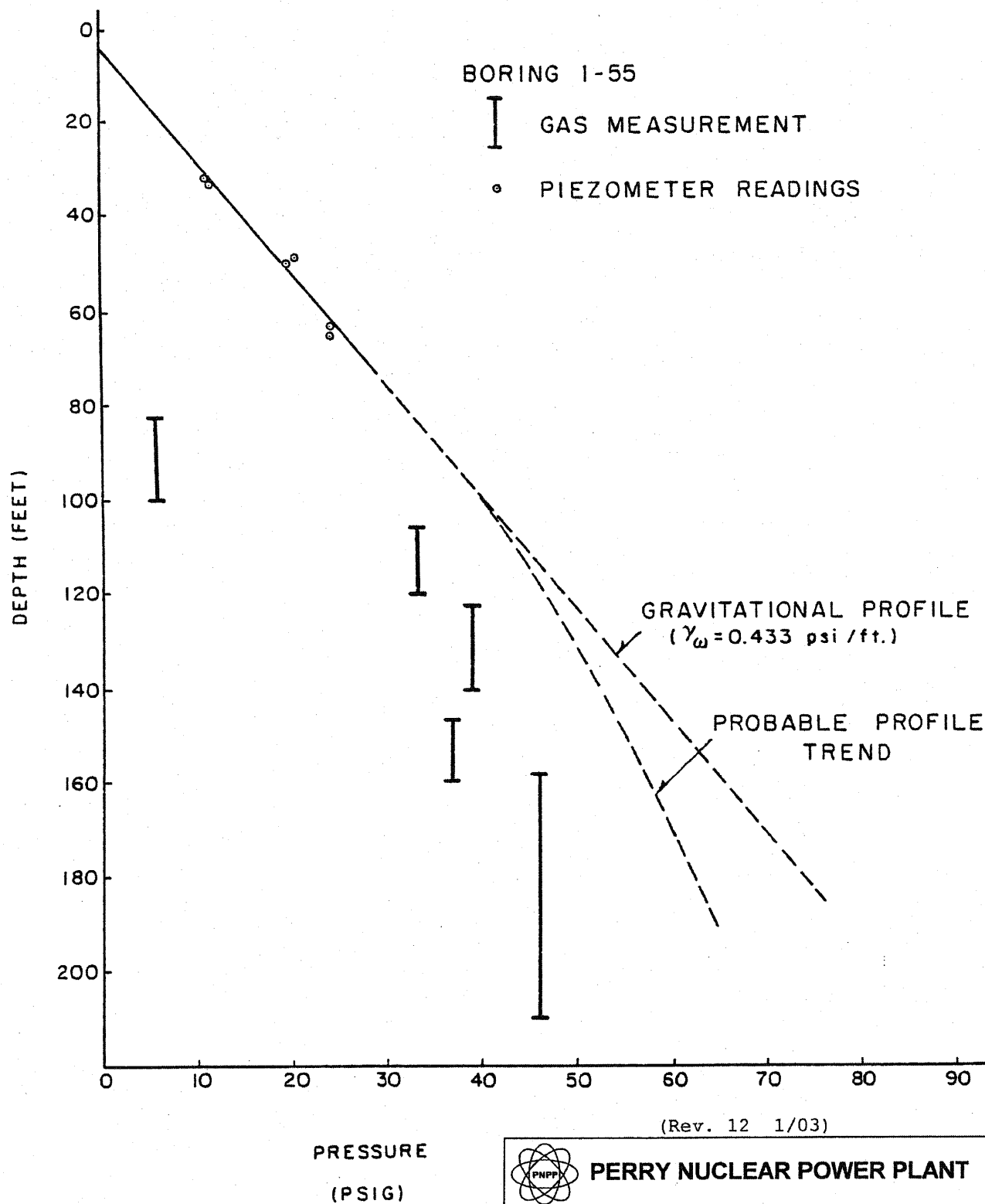
Figure 2.5-169



PERRY NUCLEAR POWER PLANT

Representative Records of
Pressure vs. Shut-in Time

Figure 2.5-170



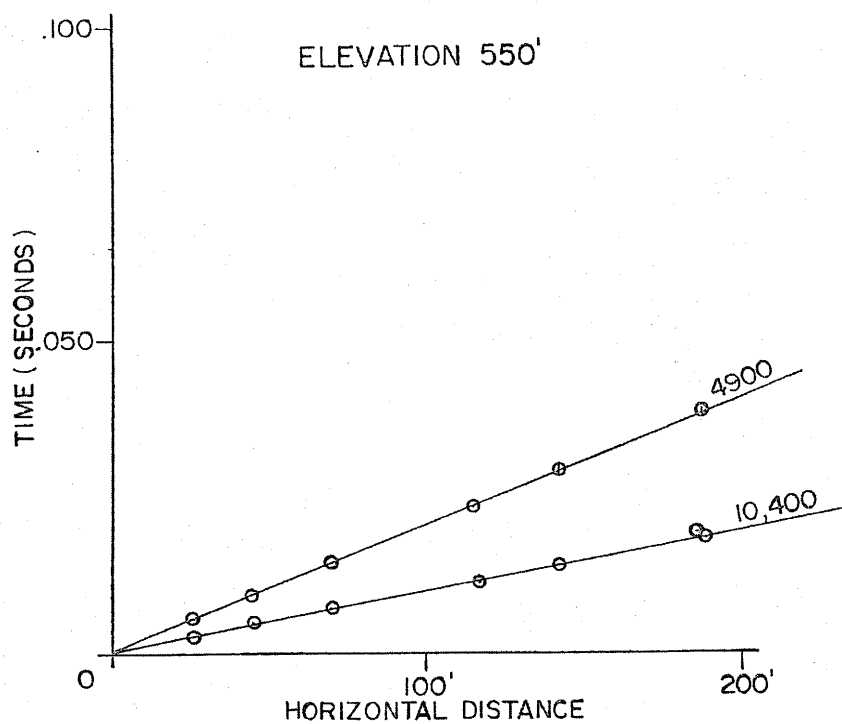
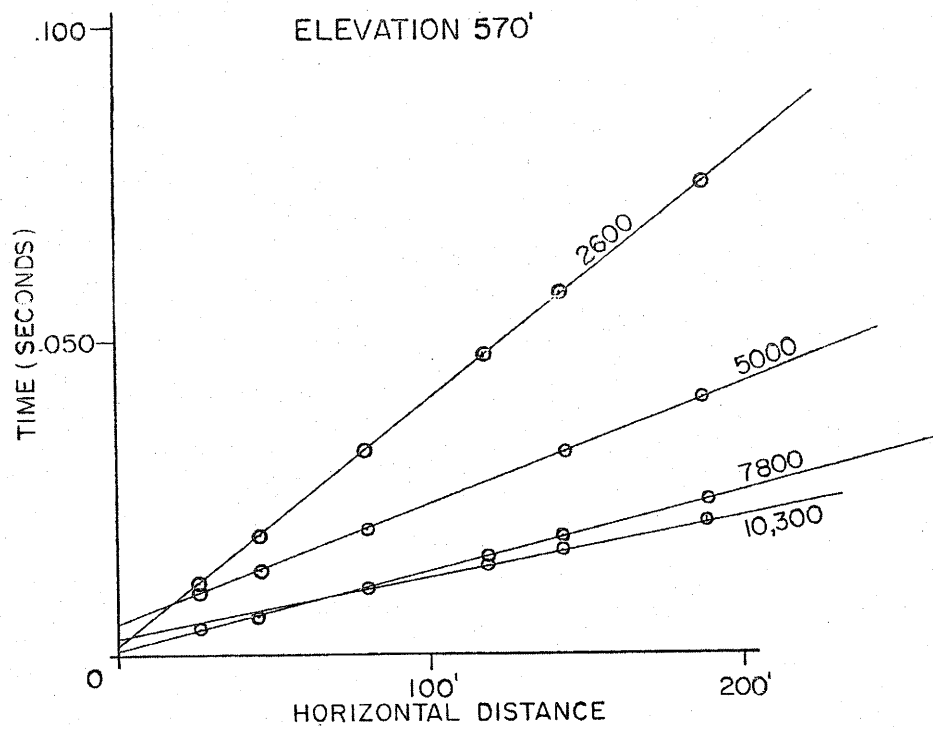
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Pressure vs. Depth

Figure 2.5-171



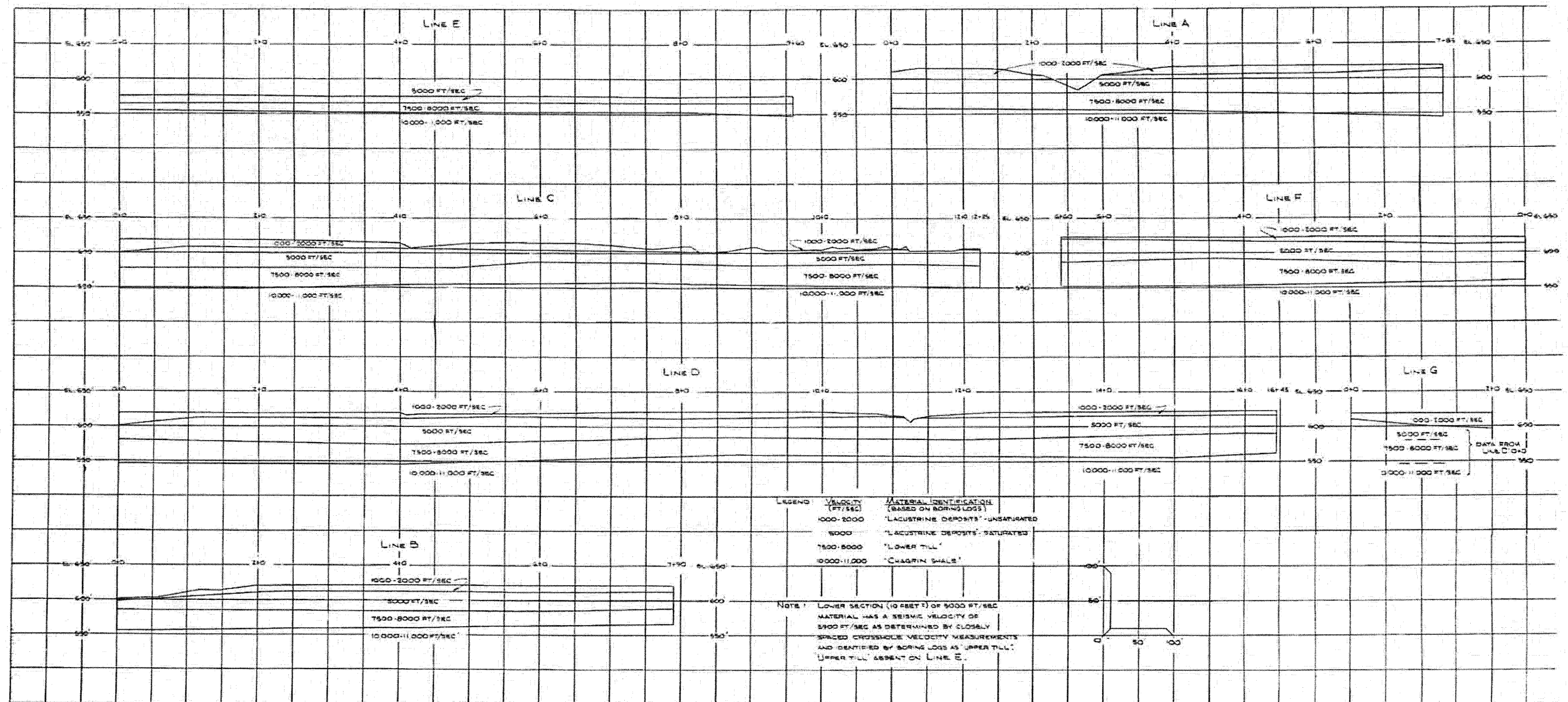
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Arrival Time vs. Distance

Figure 2.5-172



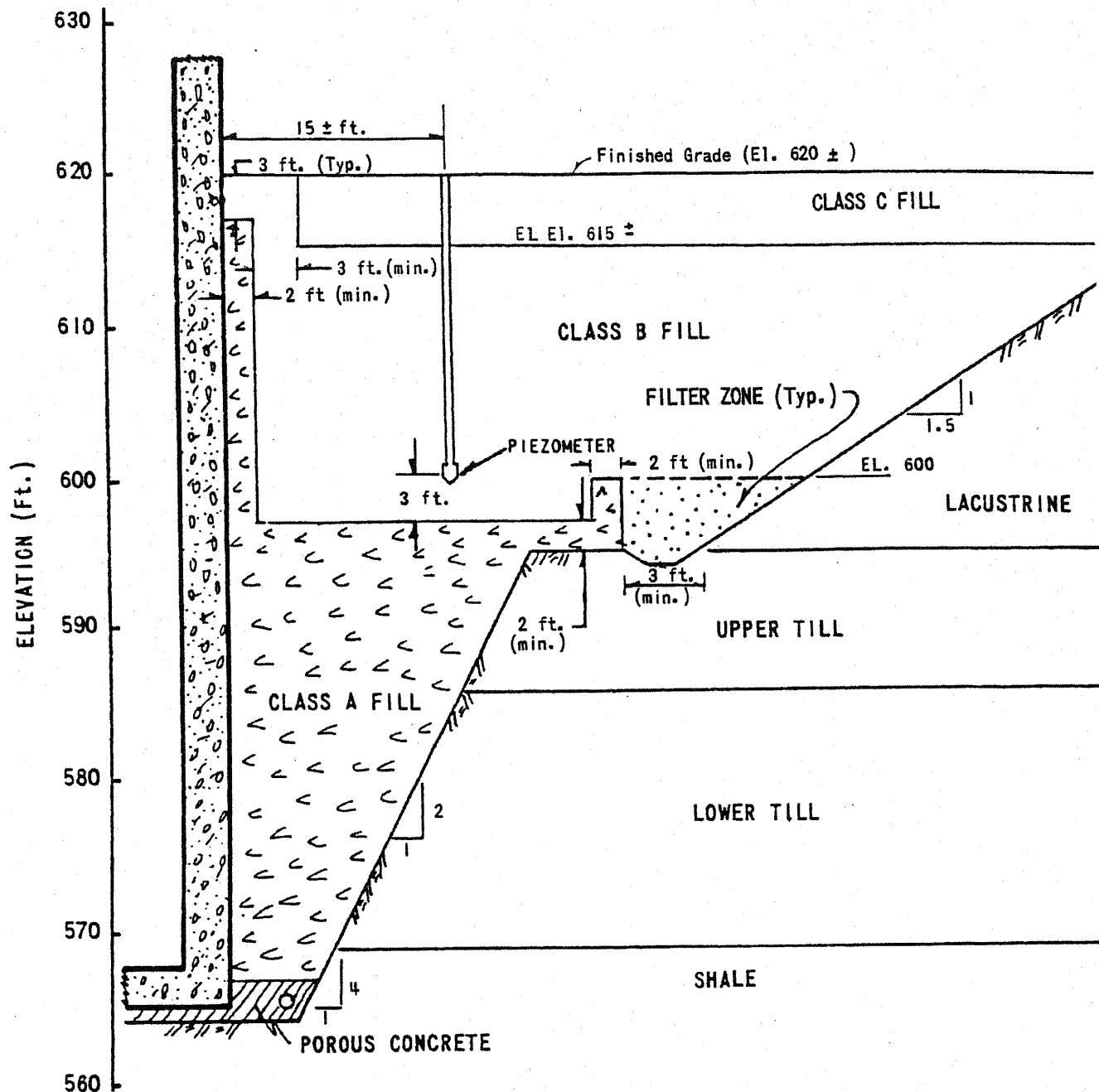
NOTE: See Figure 2.5-144 for Survey Line Traces.

(Rev. 12 1/03)

PERRY NUCLEAR POWER PLANT

Seismic Survey Profile

Figure 2.5-173



Note: As per section 2.5.4.5.5 the backfill materials shown in this figure may be replaced with Controlled Low Strength Material (CLSM).

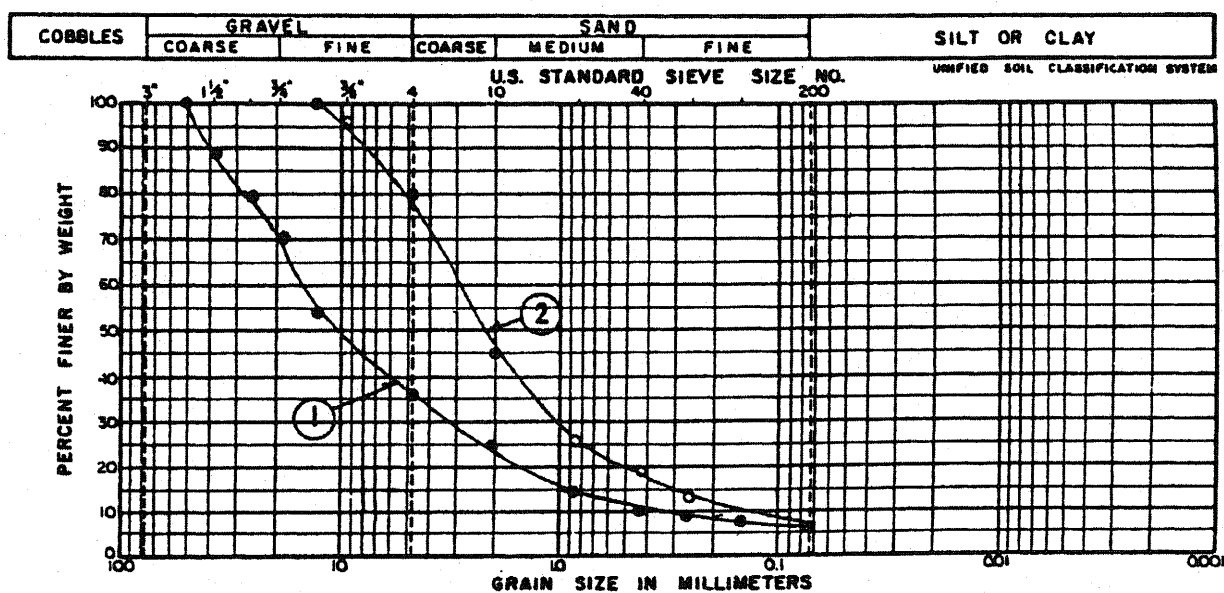
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Backfill Section

Figure 2.5-174



- ① - QUARRY - RUN, CRUSHED DOLOMITIC LIMESTONE
- ② - TEST SAMPLE

(Rev. 12 1/03)



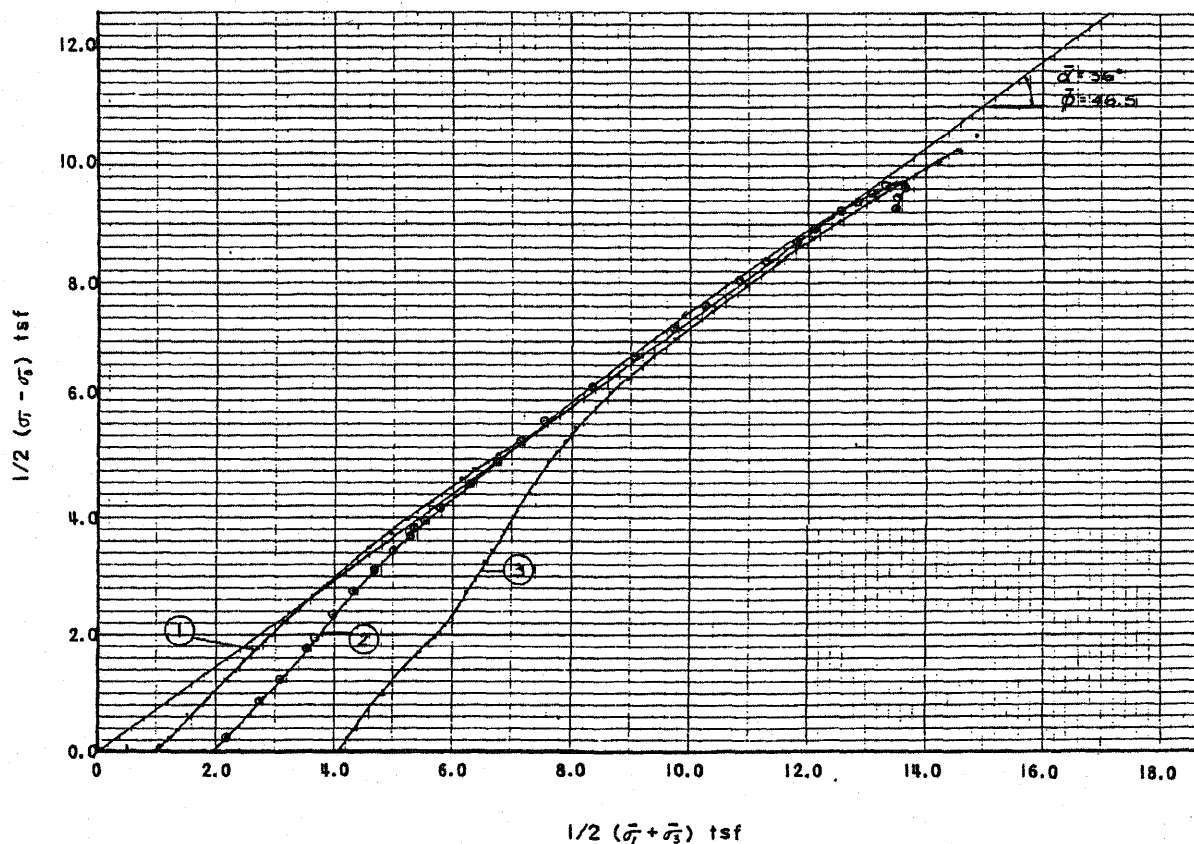
PERRY NUCLEAR POWER PLANT

Grain Size Distribution,
Class A Fill Design

Figure 2.5-175

Test No.	Unit Dry Wgt. (pcf)	Relative Density (%)	Effective Consol. Pressure (ksf) $\bar{\sigma}_c$	Max. Stress Difference (ksf) $(\sigma_1 - \sigma_3)_f$	Failure Strain ϵ_f (%)
①	120.7	85.0	2	31.3	12.9
②	120.6	85.0	4	37.4	9.0
③	120.9	86.0	6	42.0	8.3

NOTES: Maximum Density = 125 pcf
Minimum Density = 101 pcf



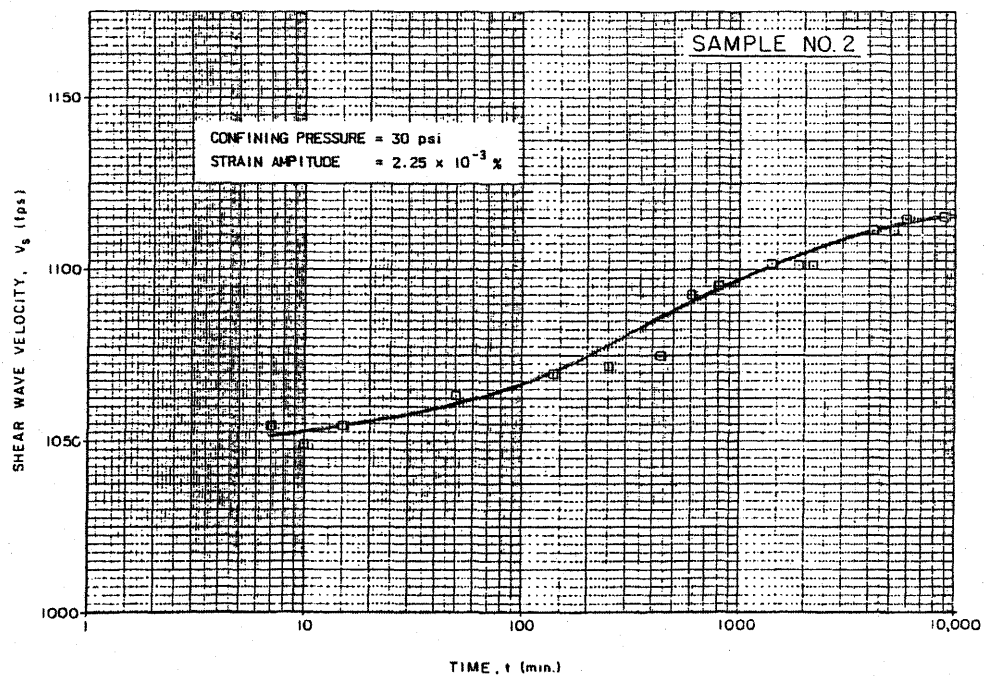
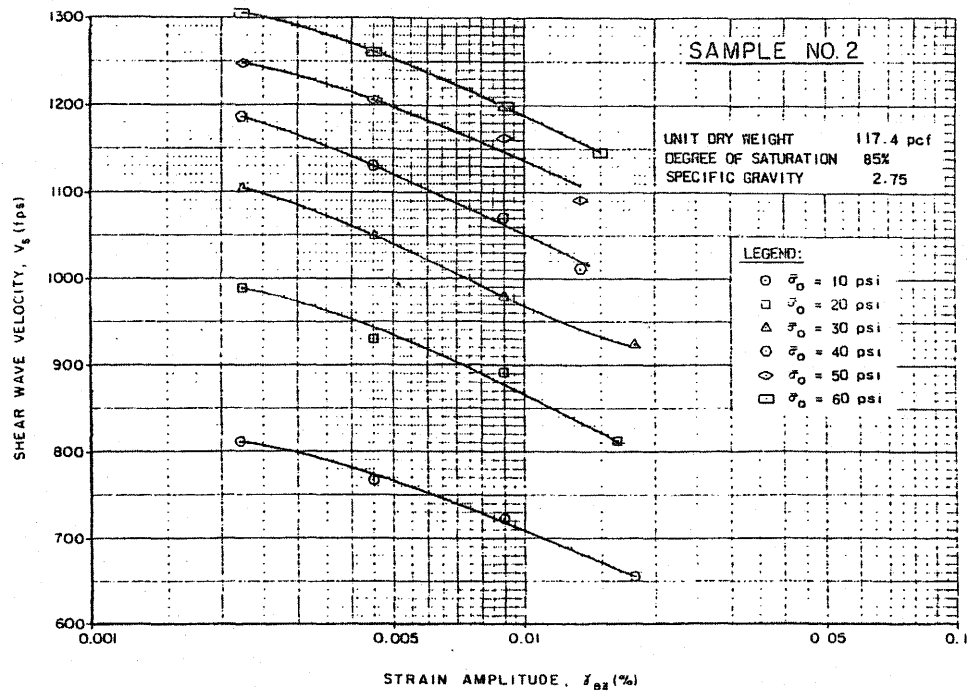
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Triaxial Compression
Test Results, Class A
Fill Design Investigation

Figure 2.5-176



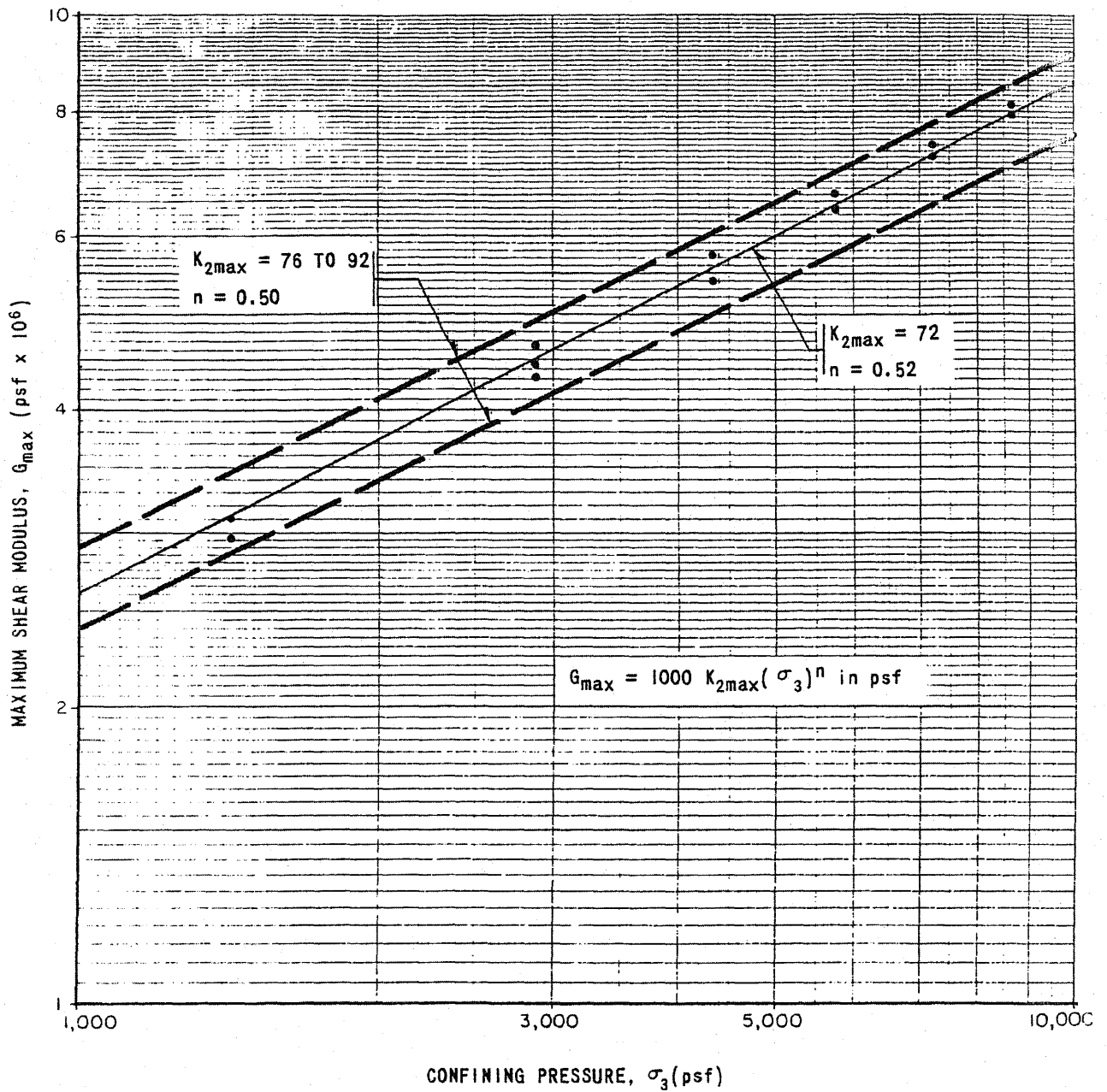
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Typical Results of High
Amplitude Cyclic Torsion Tests,
Class A Fill Design Investigations

Figure 2.5-177



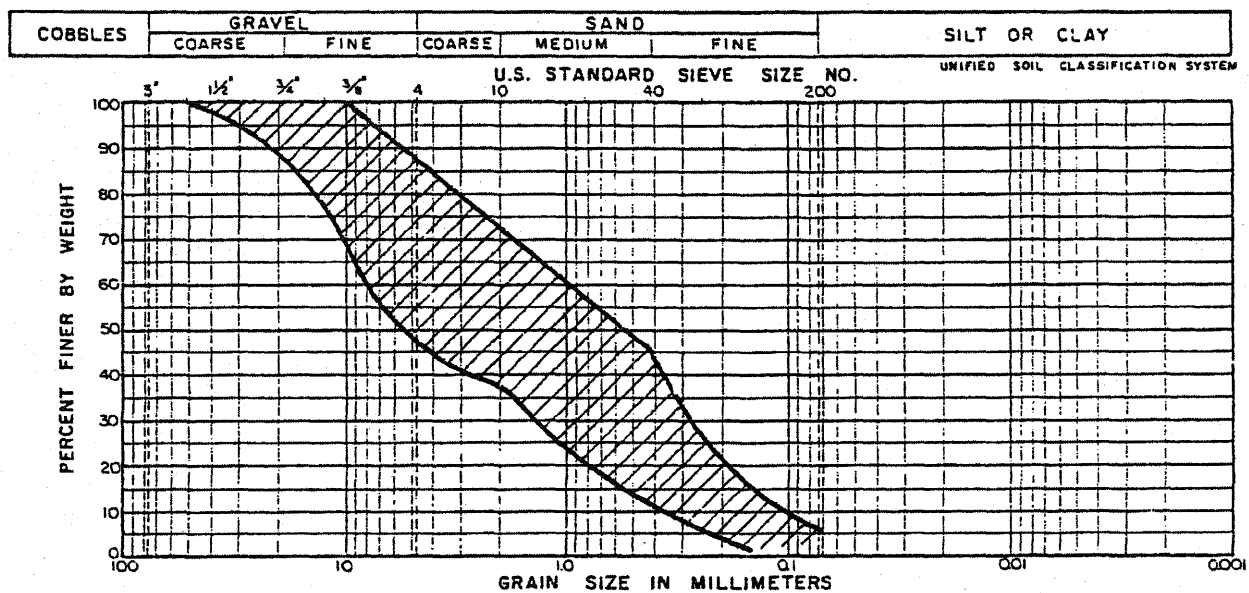
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Maximum Shear Modular vs.
Confining Pressure, Class A
Fill Design Investigation

Figure 2.5-178



NOTE: RANGE IS ESTIMATED BASED ON A RANDOM SAMPLING
OF APPROXIMATELY 675 TESTS

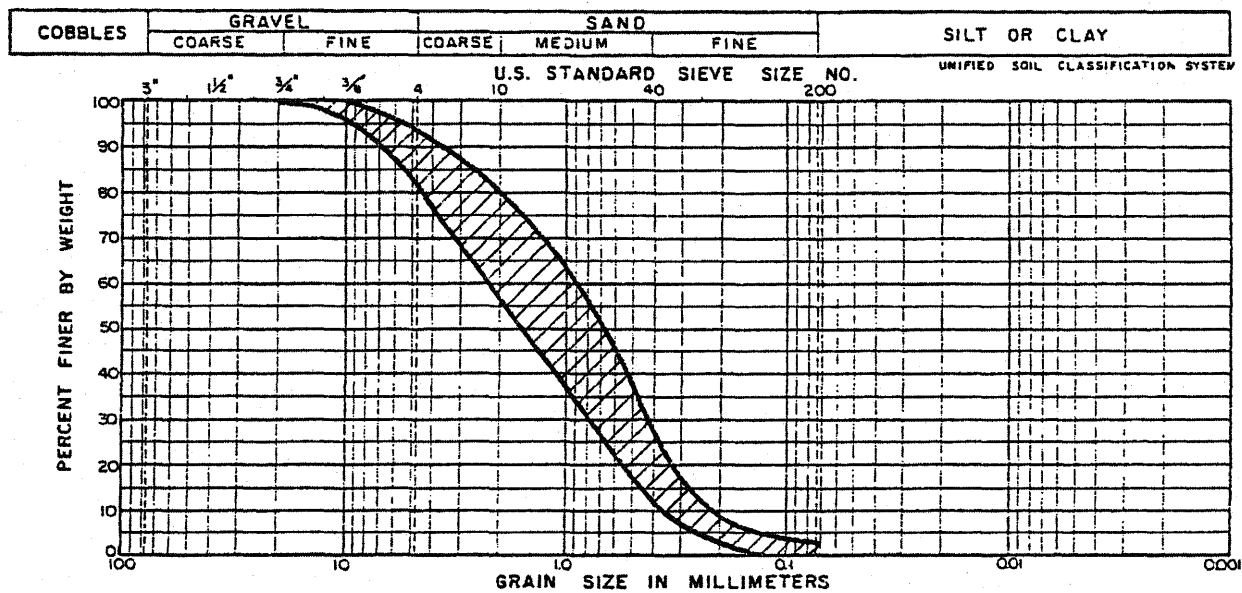
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Range of Grain Size Distribution
Test Results for Class A Fill
(Bestone Quarry)

Figure 2.5-179



NOTE: RANGE IS ESTIMATED BASED ON A RANDOM SAMPLING
OF APPROXIMATELY 5500 TESTS

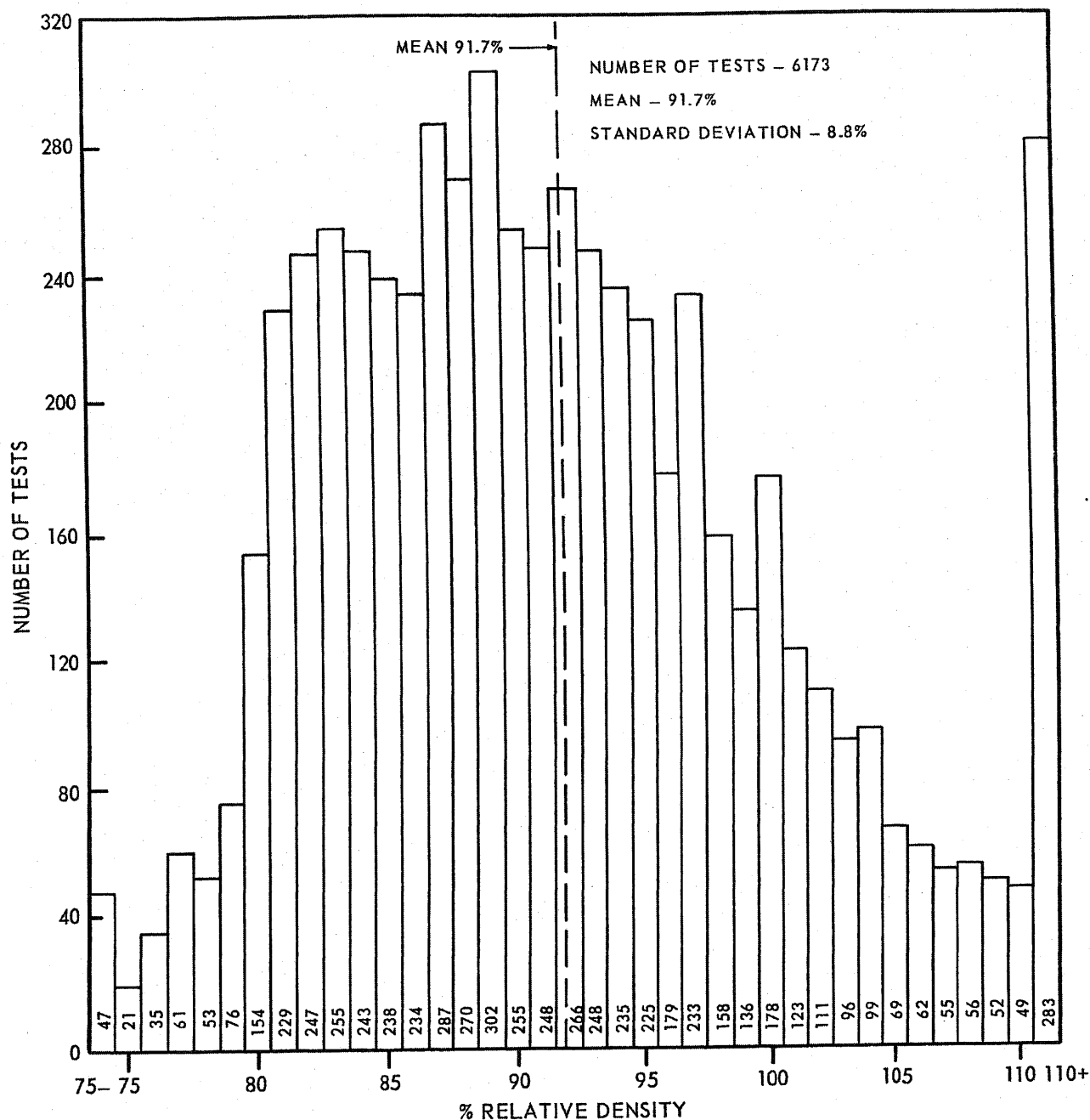
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Range of Grain Size Distribution
Test Results for Class A Fill
(Sidley Quarry)

Figure 2.5-180



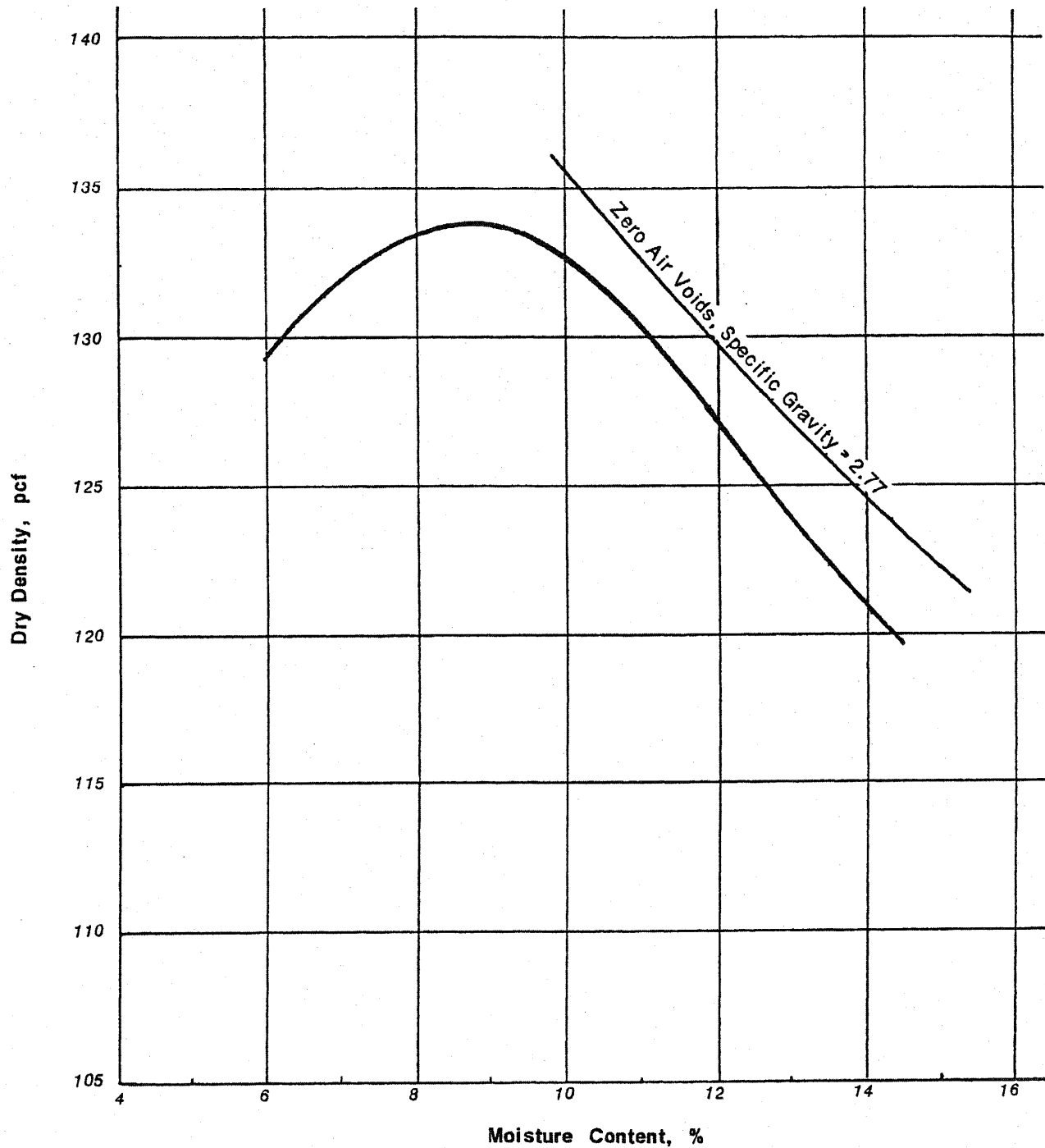
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Class A Fill - Field
Density Tests

Figure 2.5-181



(Rev. 12 1/03)

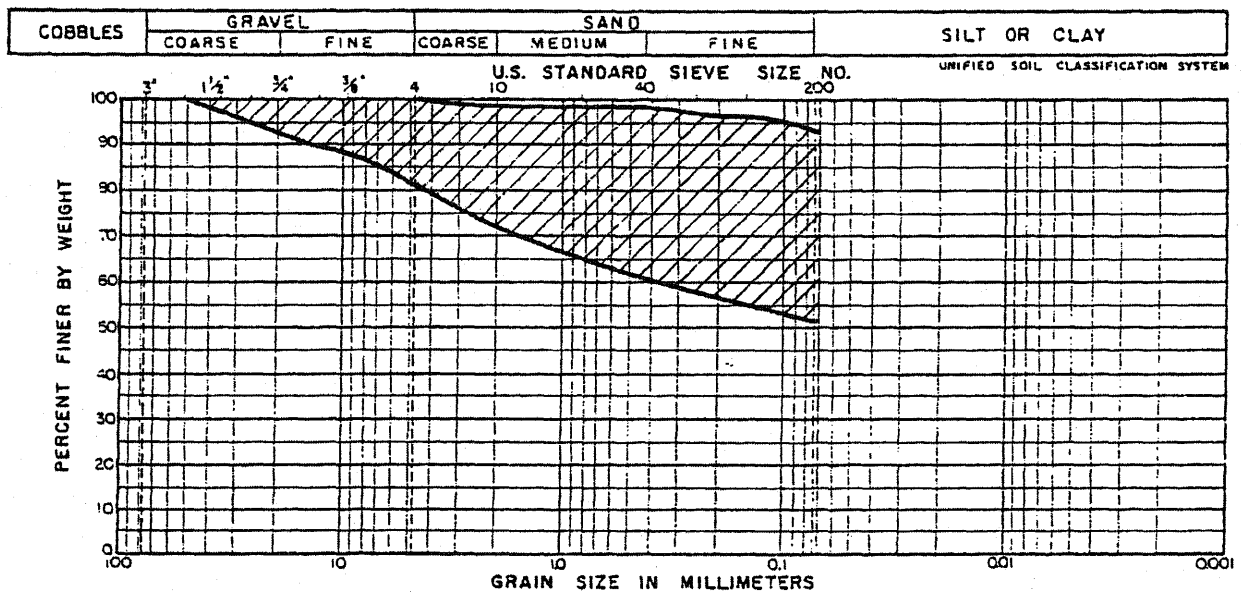
Maximum Dry Density: 133.7 pcf
Optimum Moisture: 8.9 %



PERRY NUCLEAR POWER PLANT

Typical Compaction Curve,
Class B Fill

Figure 2.5-182



NOTE: RANGE IS ESTIMATED BASED ON A RANDOM SAMPLING
OF APPROXIMATELY 200 TESTS

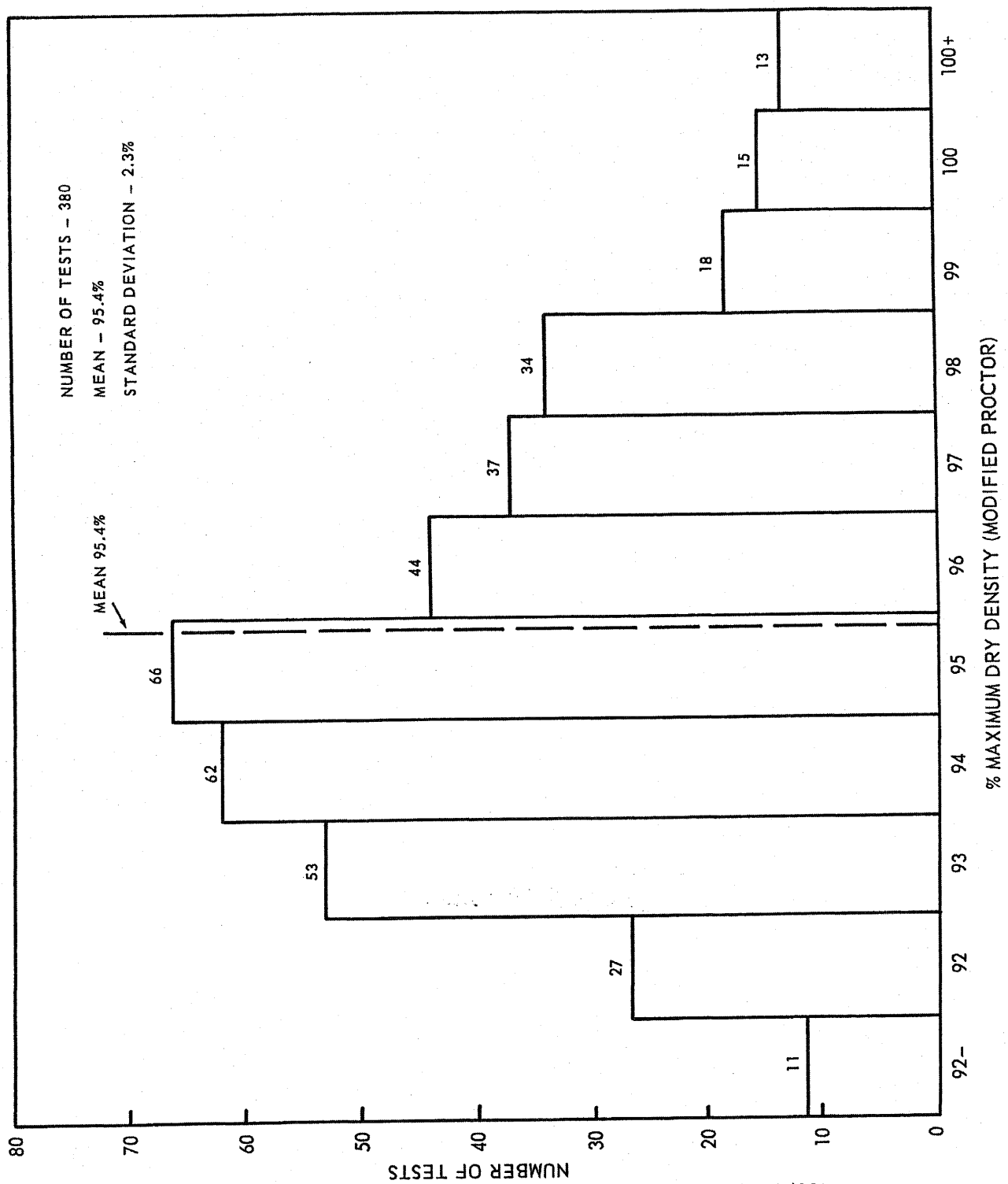
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Range of Grain Size Distribution
Test Results for Class B Fill

Figure 2.5-183



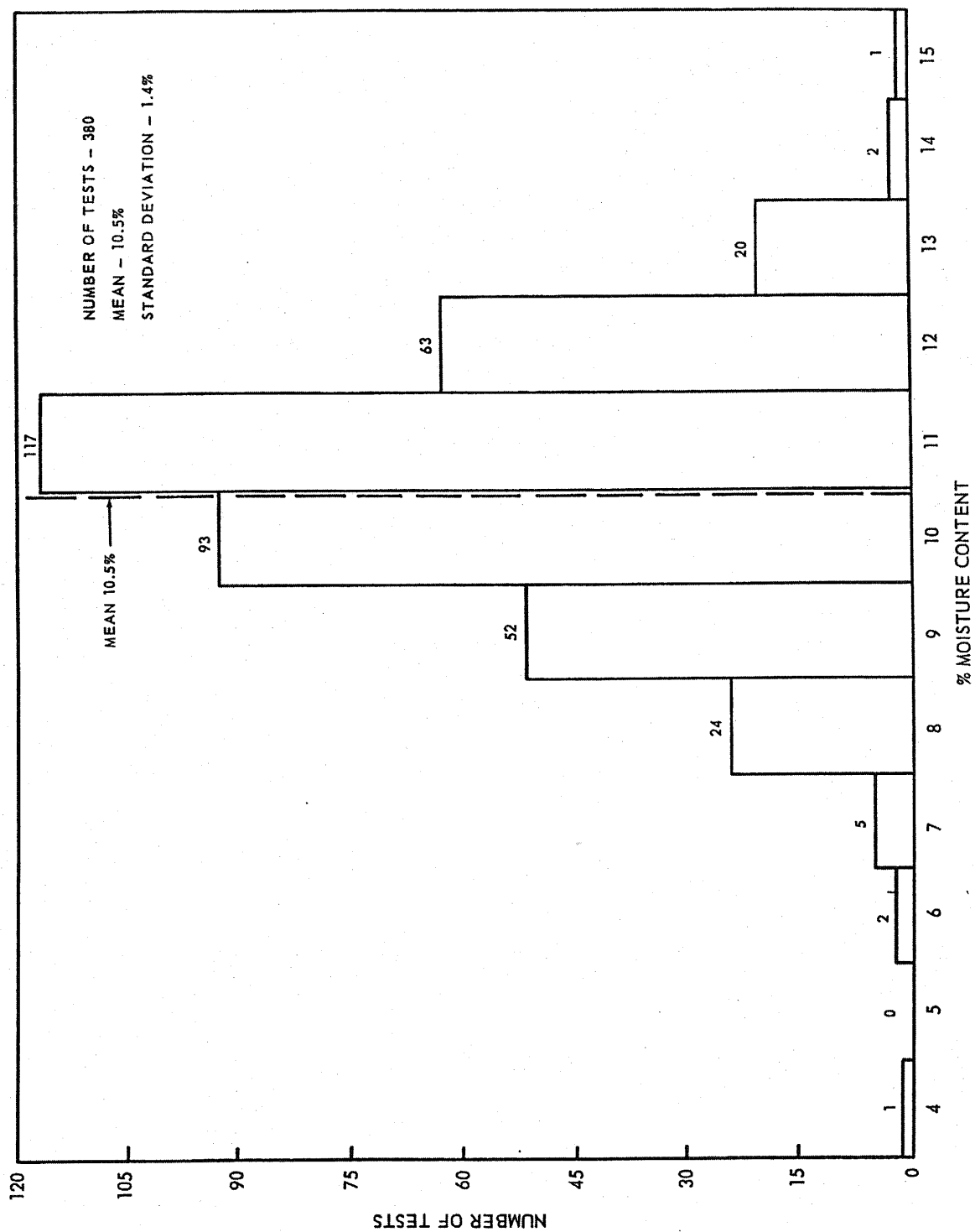
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Class B Fill - Field
Density Tests

Figure 2.5-184



(Rev. 12 1/03)

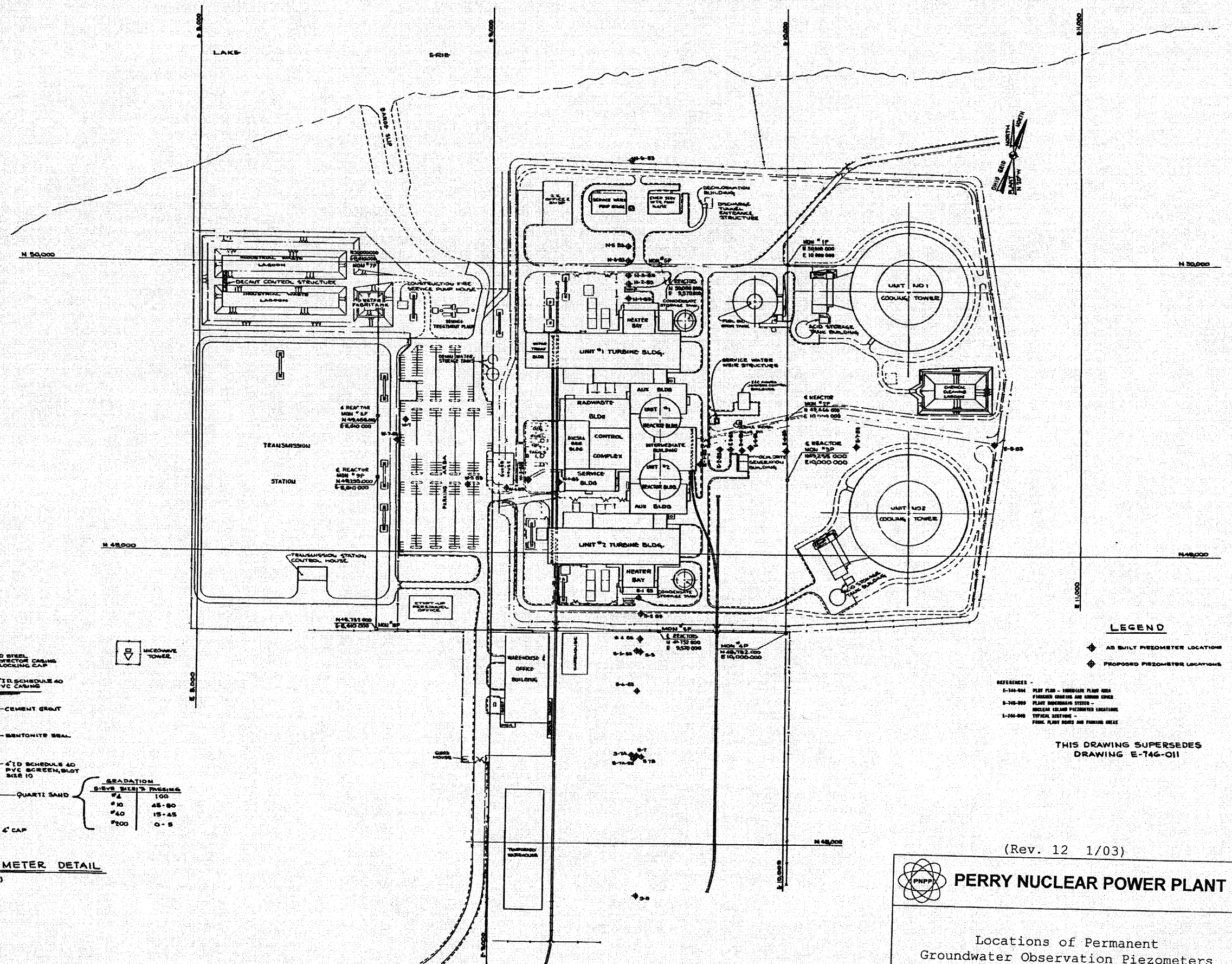
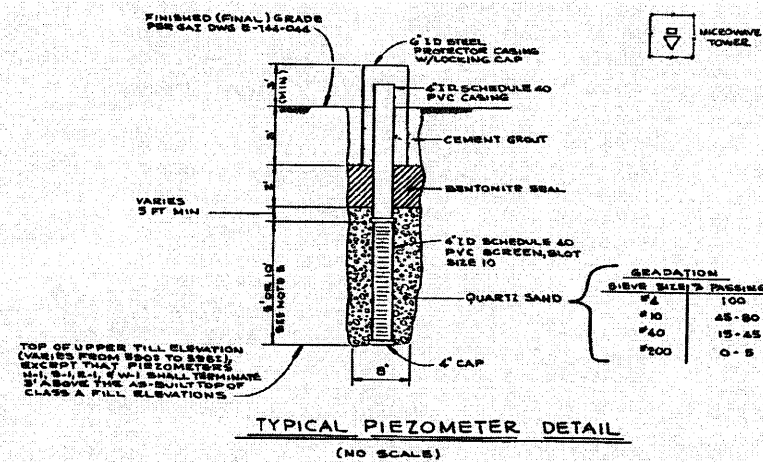


PERRY NUCLEAR POWER PLANT

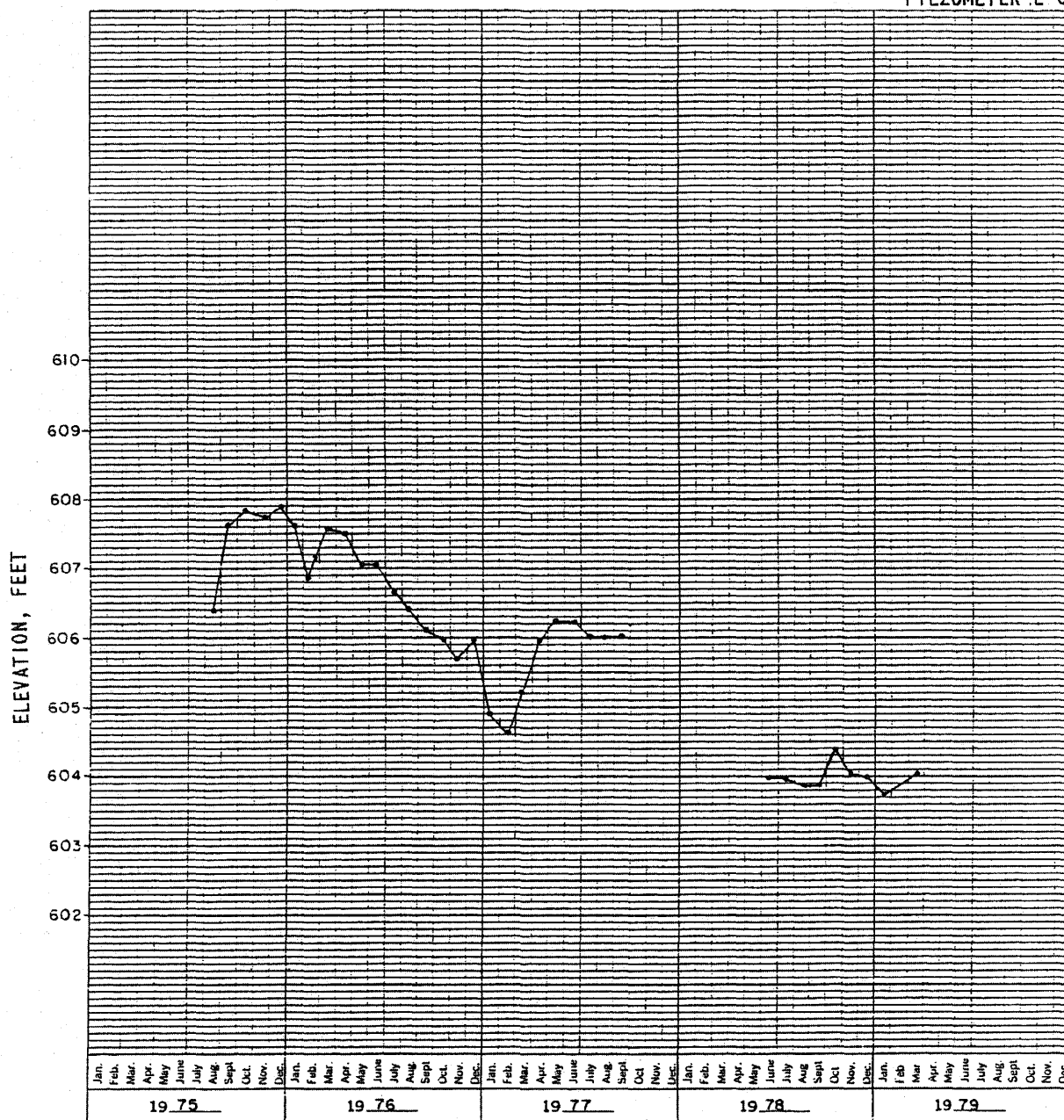
Class B Fill - Field
Moisture Tests

Figure 2.5-185

PIEZOMETER LOCATION SCHEDULE		
PIEZOMETER	N. COORD	E. COORD
N-1-B3	49,880.63	9,459.89
N-2-B3	49,889.81	9,460.04
N-3-B3	49,899.31	9,460.43
N-4-B3	50,009.13	9,460.39
N-5-B3	50,039.40	9,458.34
N-6-B3	50,051.61	9,471.80
S-1-B3	48,848.38	9,500.16
S-2-B3	48,790.46	9,505.26
S-4-B3	48,708.22	9,508.04
S-5	48,660.00	9,500.00
S-6-B3	48,662.99	9,498.40
S-6-B3	48,579.57	9,488.34
S-7	48,500.11	9,498.00
S-7A	48,502.71	9,494.00
S-7A-B3	48,501.62	9,488.31
S-7B	48,187.00	9,501.00
S-8	47,880.41	9,500.71
S-1-B3	48,508.33	9,708.83
S-2-B3	48,540.22	9,749.30
S-3-B3	48,559.81	9,803.52
S-4-B3	48,588.80	9,847.05
S-5-B3	48,569.48	9,877.01
S-6-B3	48,536.40	9,996.38
S-7-B3	48,510.71	10,238.94
S-8-B3	48,382.11	10,708.47
W-1-B3	49,744.80	9,376.15
W-2-B3	49,721.71	9,311.01
W-3-B3	49,722.21	9,047.24
W-4-B3	49,736.34	9,916.30
W-1	49,458.11	9,706.00
W-2	49,586.95	9,678.50



PIEZOMETER E-3



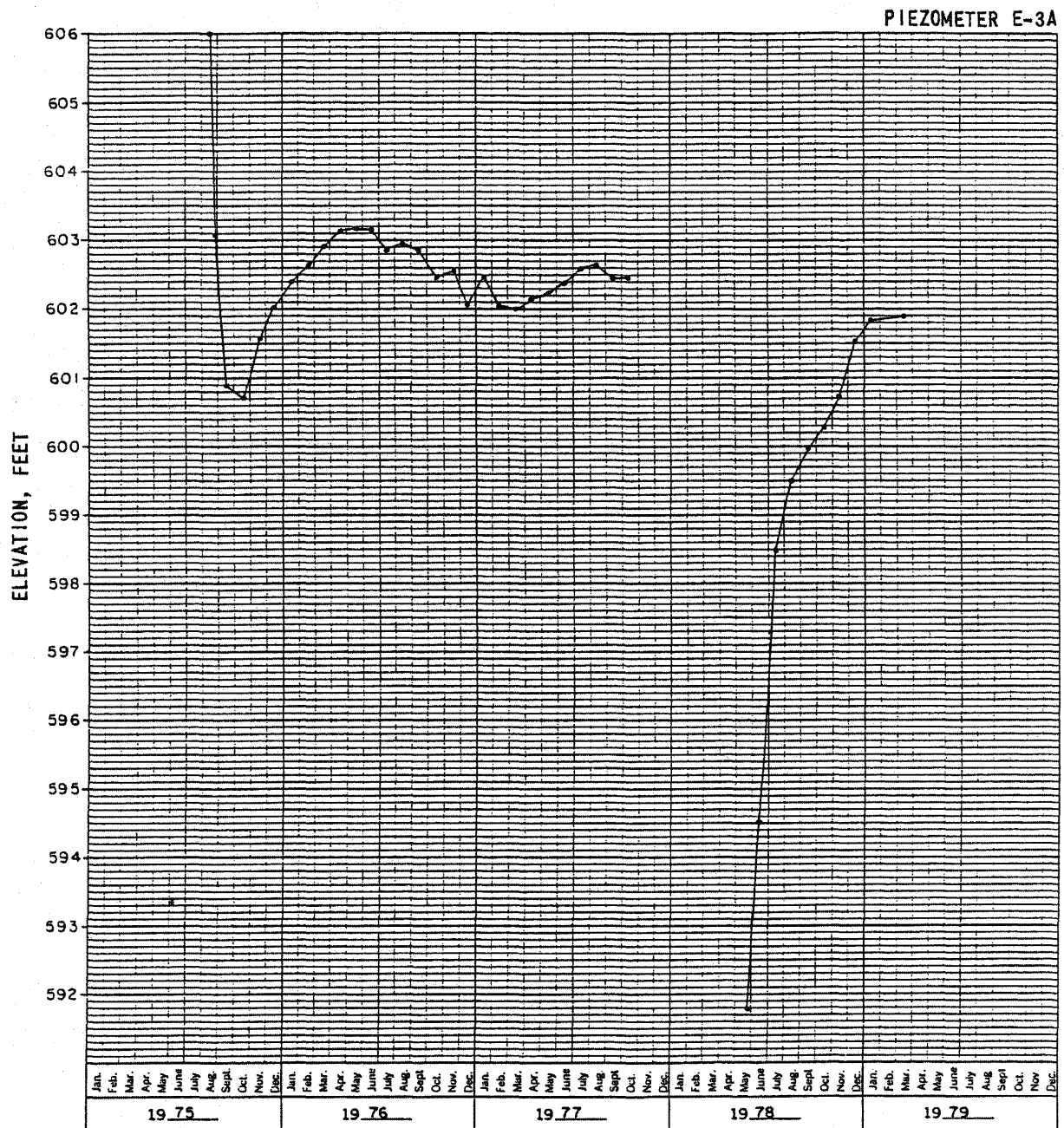
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 1 of 34)



(Rev. 12 1/03)

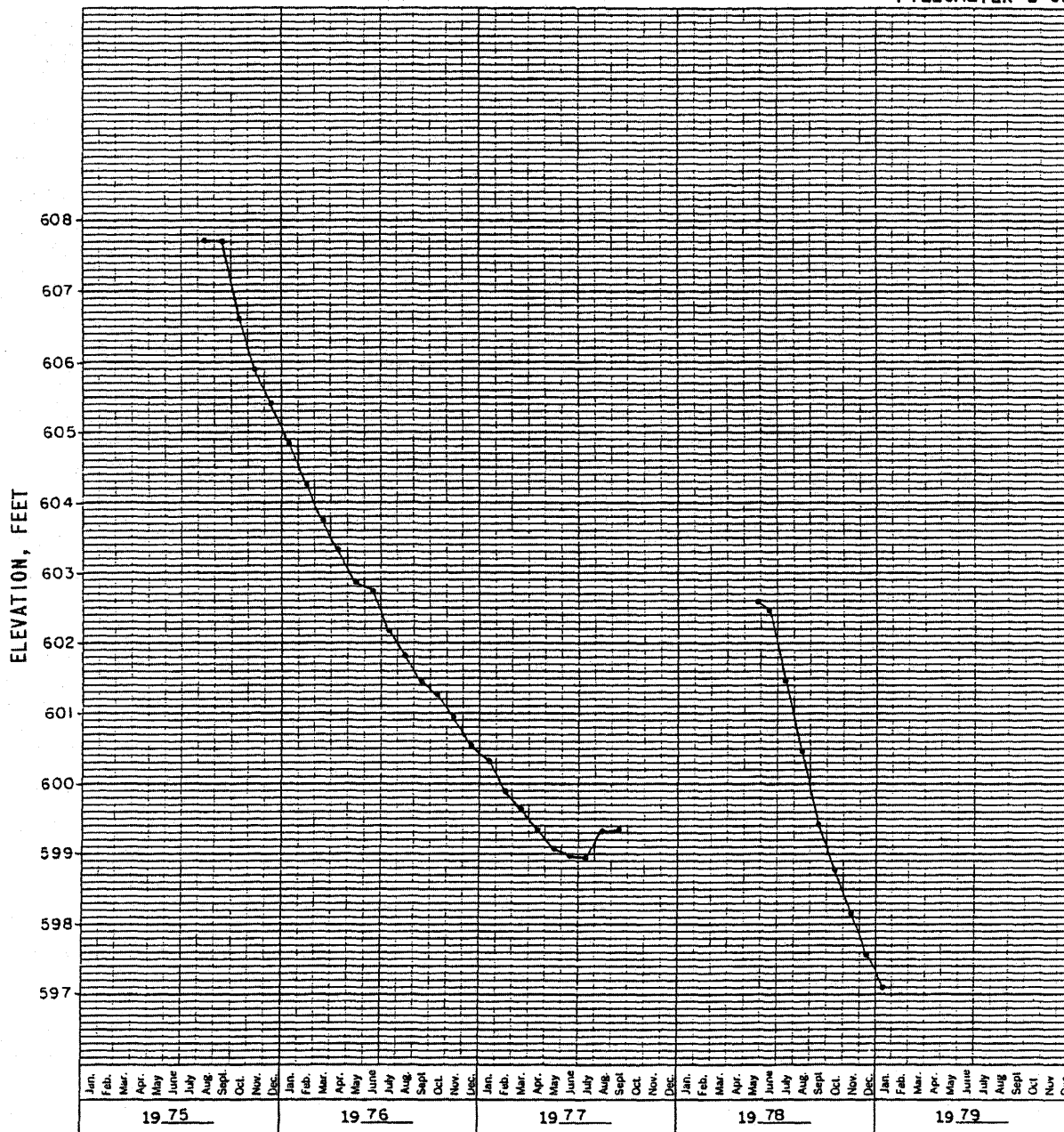


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 2 of 34)

PIEZOMETER E-3B



(Rev. 12 1/03)

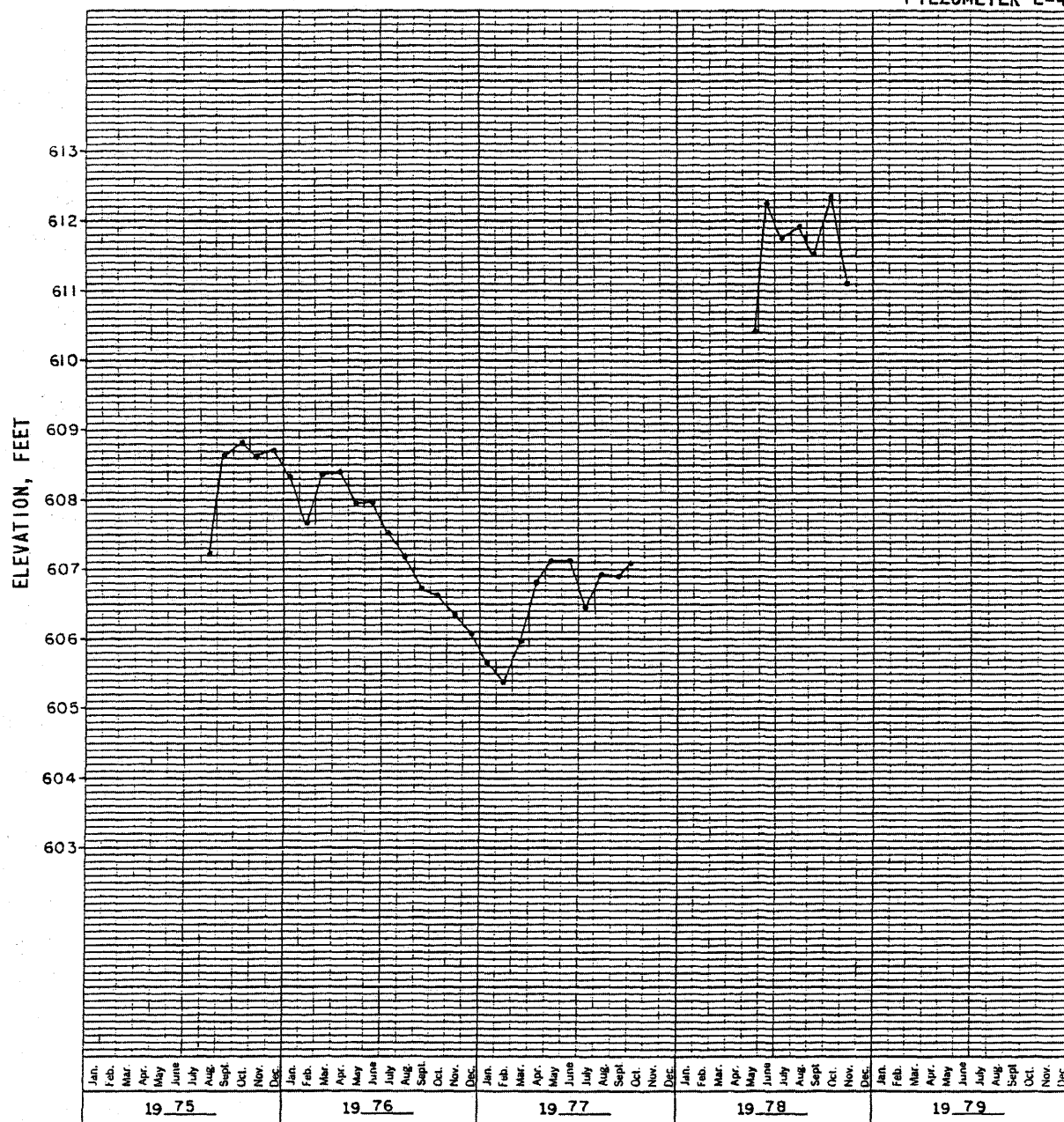


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 3 of 34)

PIEZOMETER E-4



(Rev. 12 1/03)

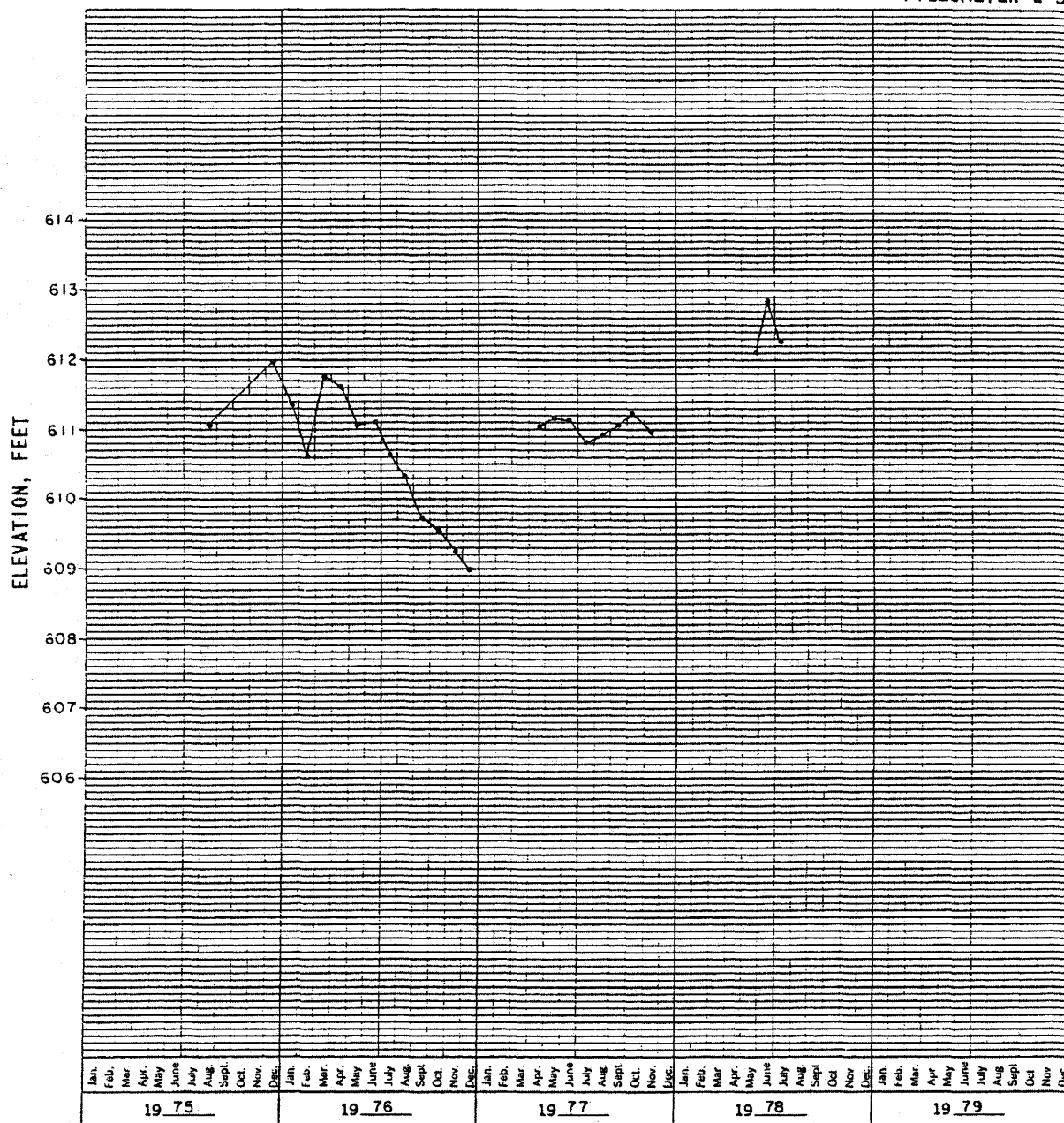


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 4 of 34)

PIEZOMETER E-5



(Rev. 12 1/03)

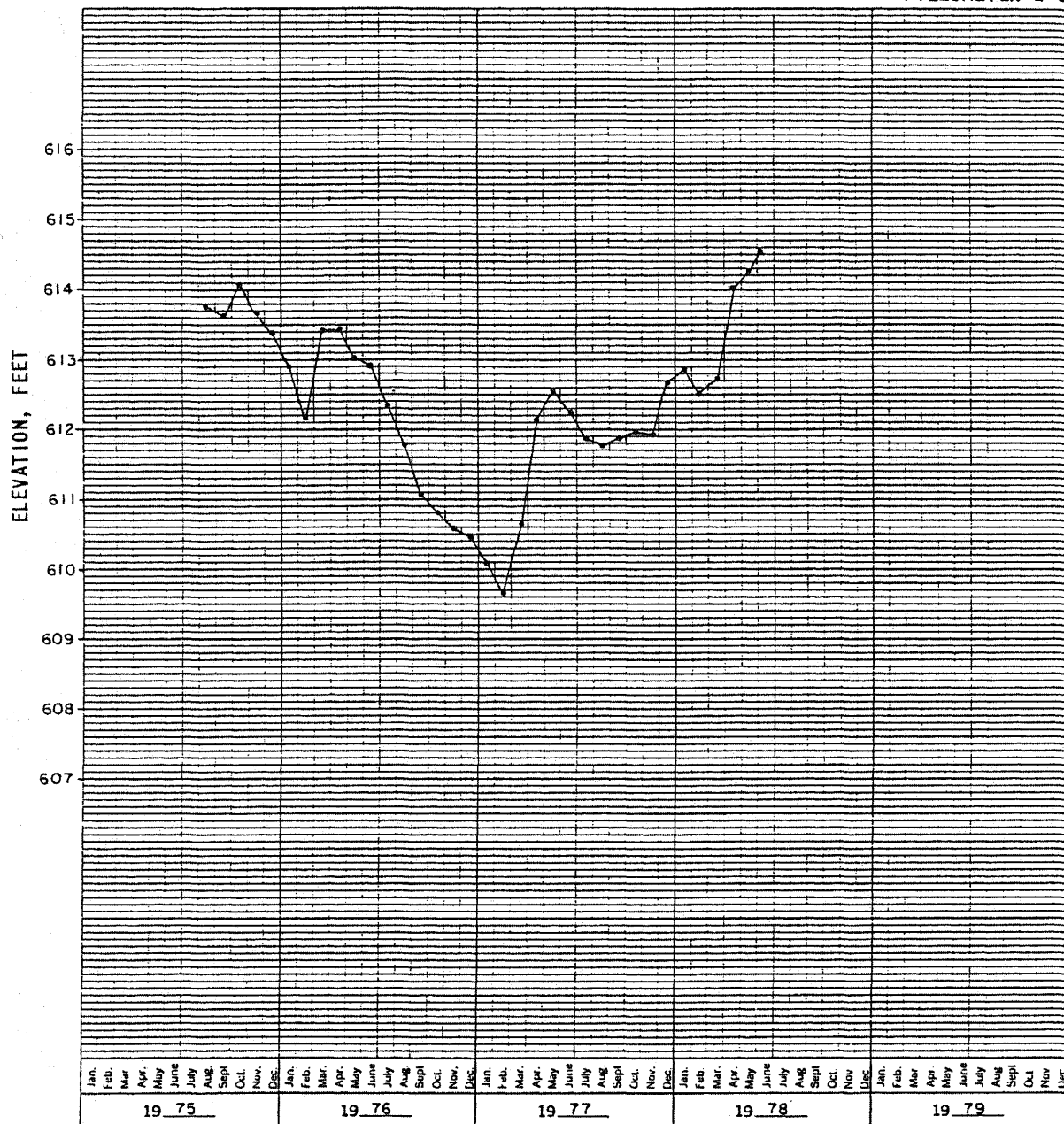


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 5 of 34)

PIEZOMETER E-6



(Rev. 12 1/03)

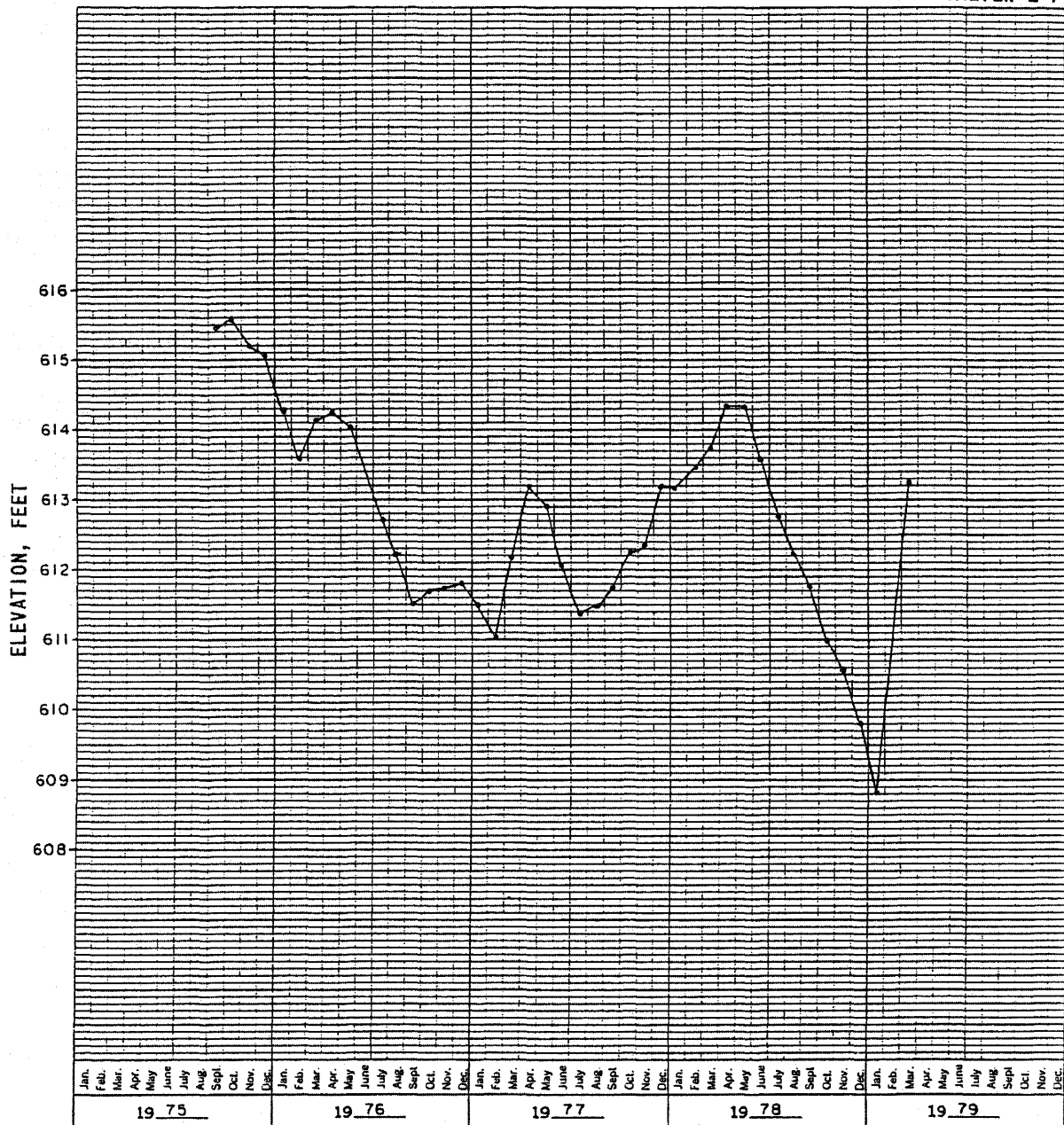


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 6 of 34)

PIEZOMETER E-7



(Rev. 12 1/03)

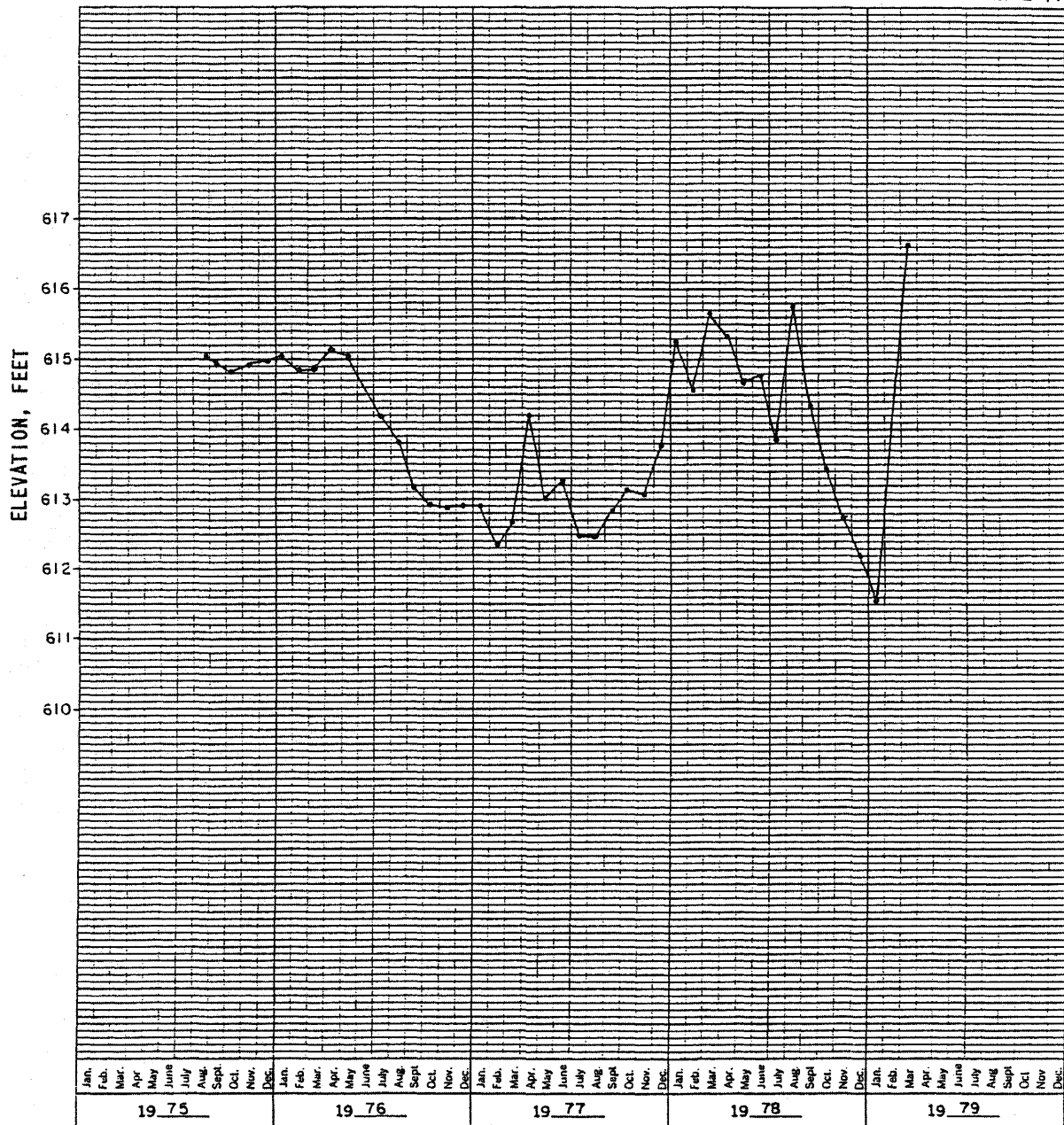


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 7 of 34)

PIEZOMETER E-7A



(Rev. 12 1/03)

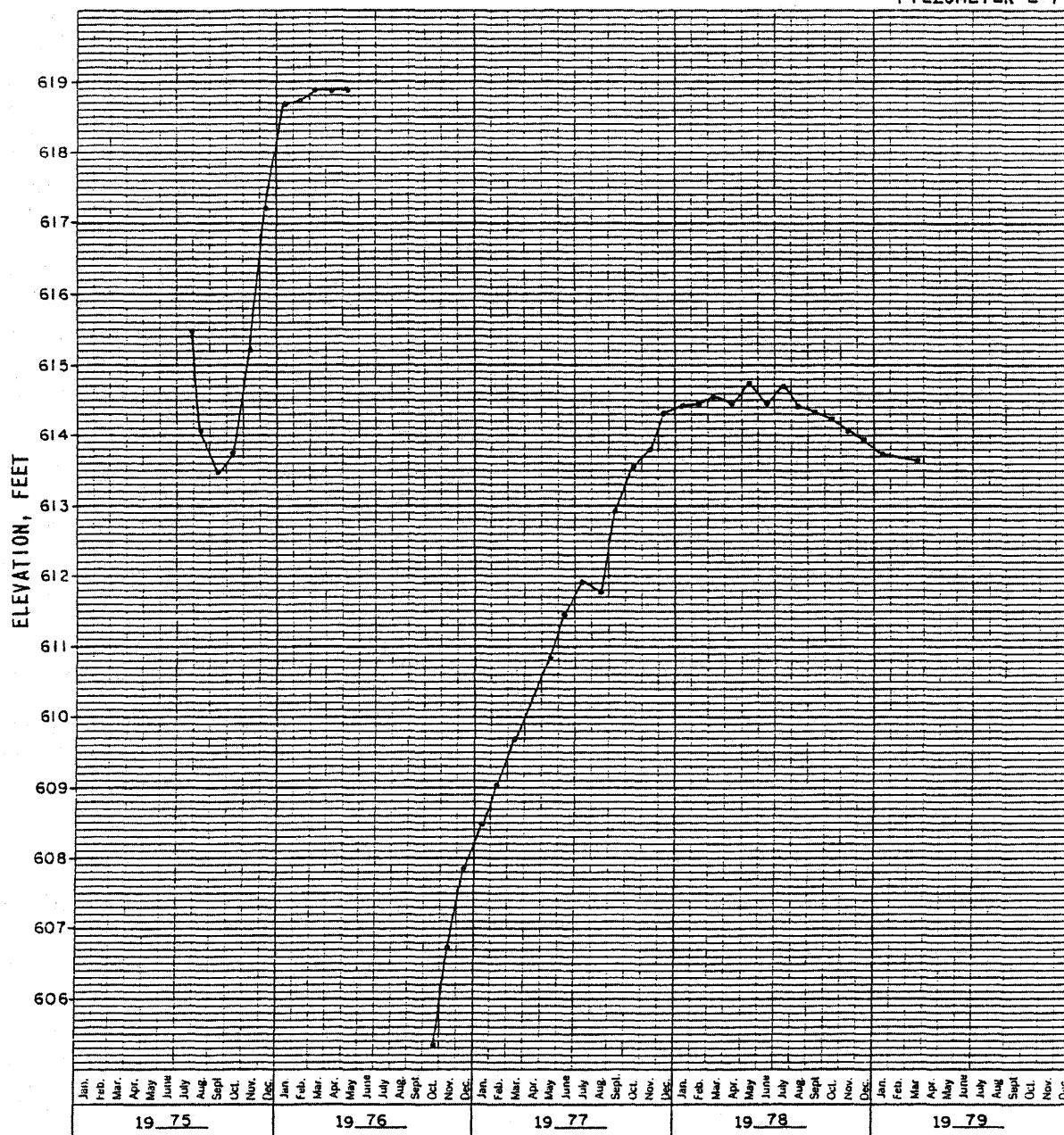


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 8 of 34)

PIEZOMETER E-7B



(Rev. 12 1/03)

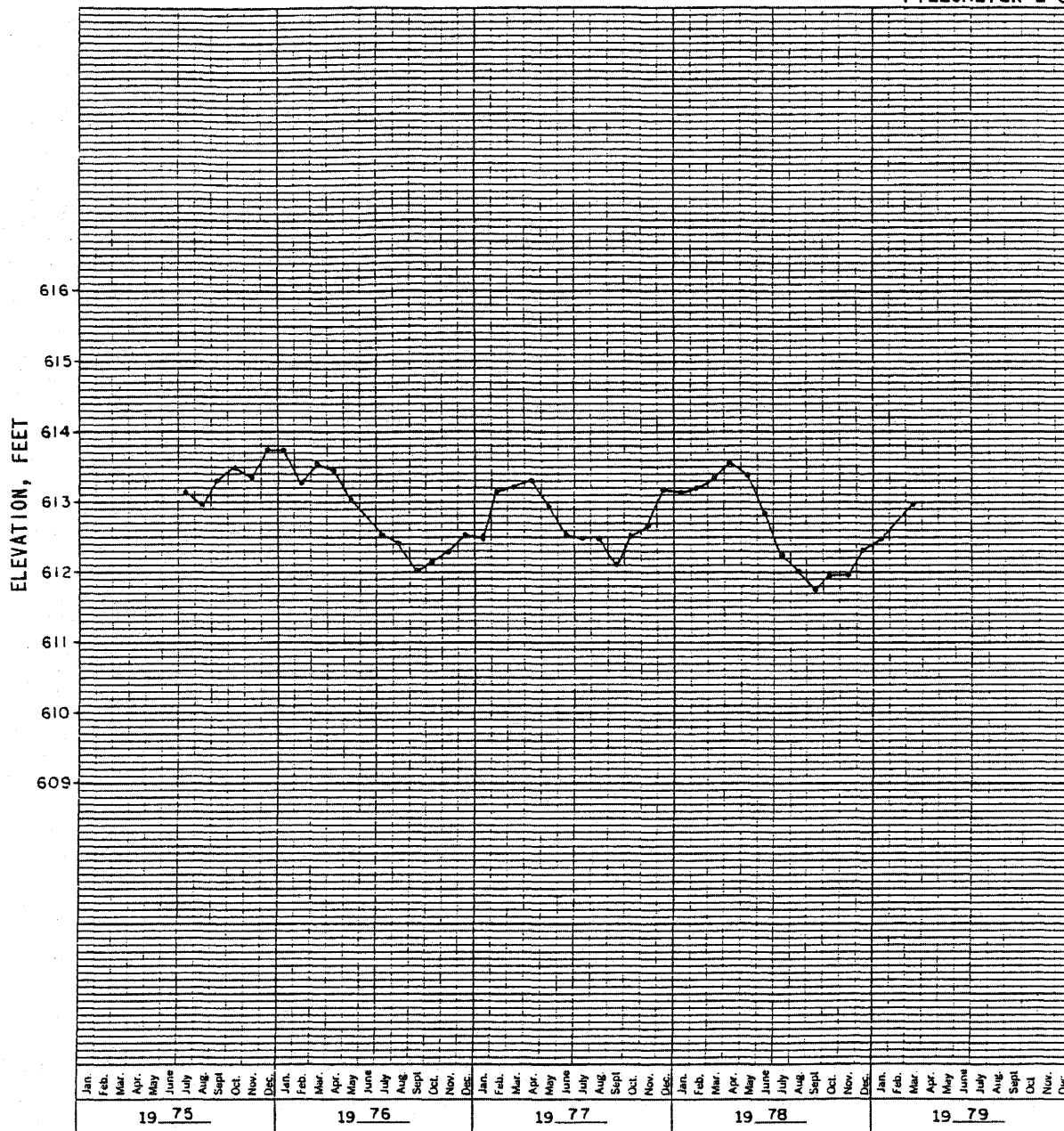


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 9 of 34)

PIEZOMETER E-8



(Rev. 12 1/03)

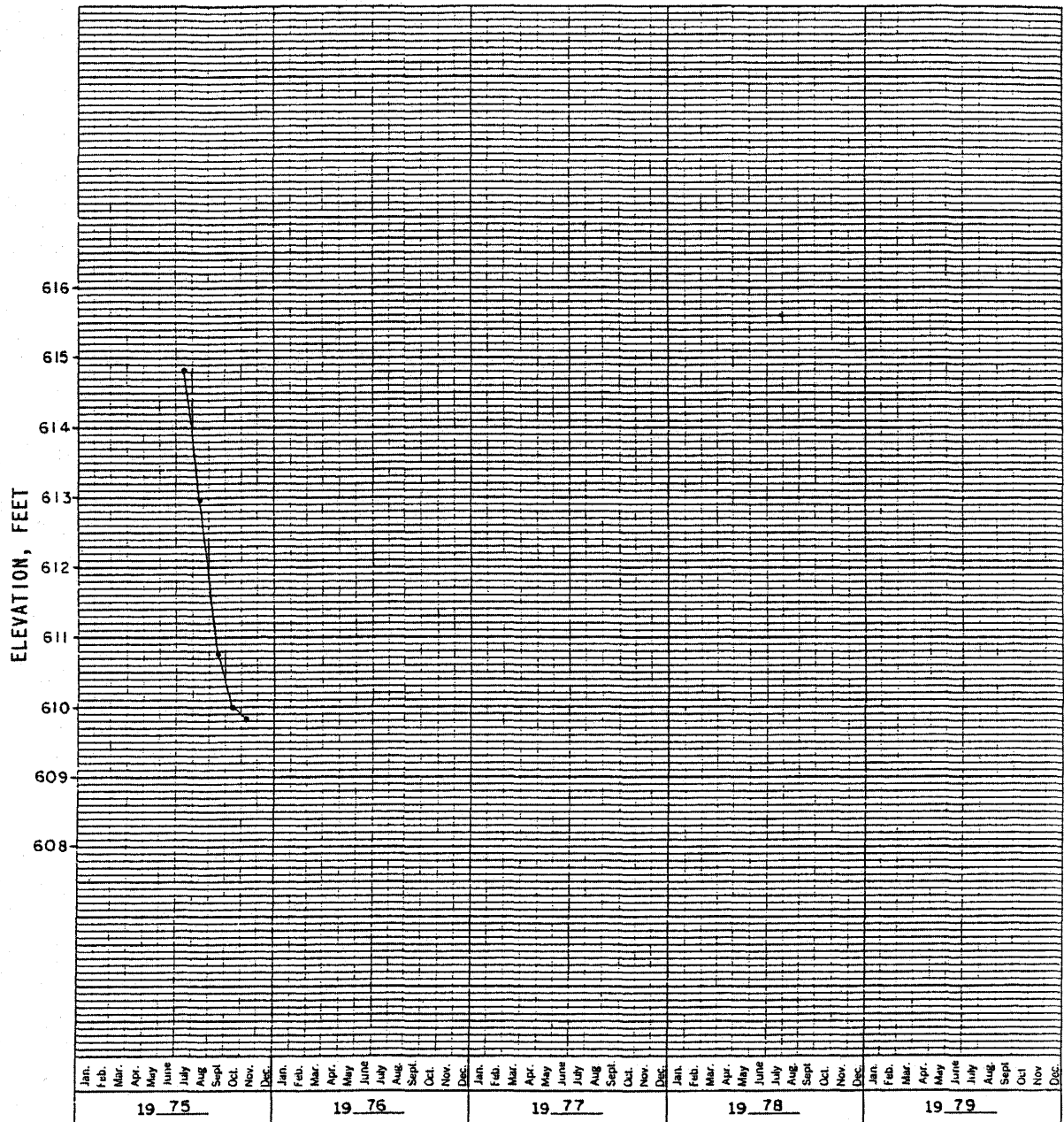


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 10 of 34)

PIEZOMETER W-4



(Rev. 12 1/03)

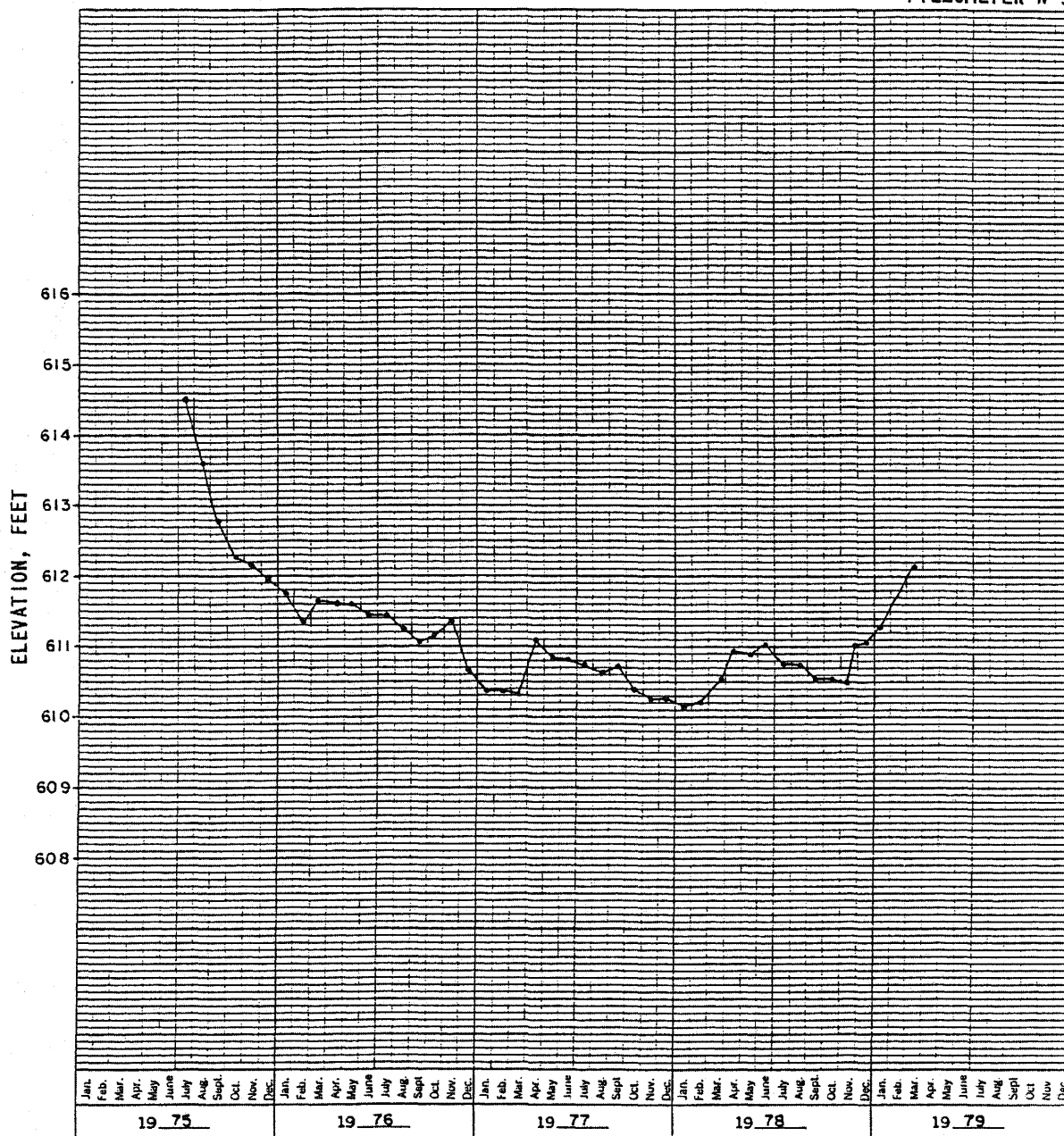


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 11 of 34)

PIEZOMETER W-5



(Rev. 12 1/03)

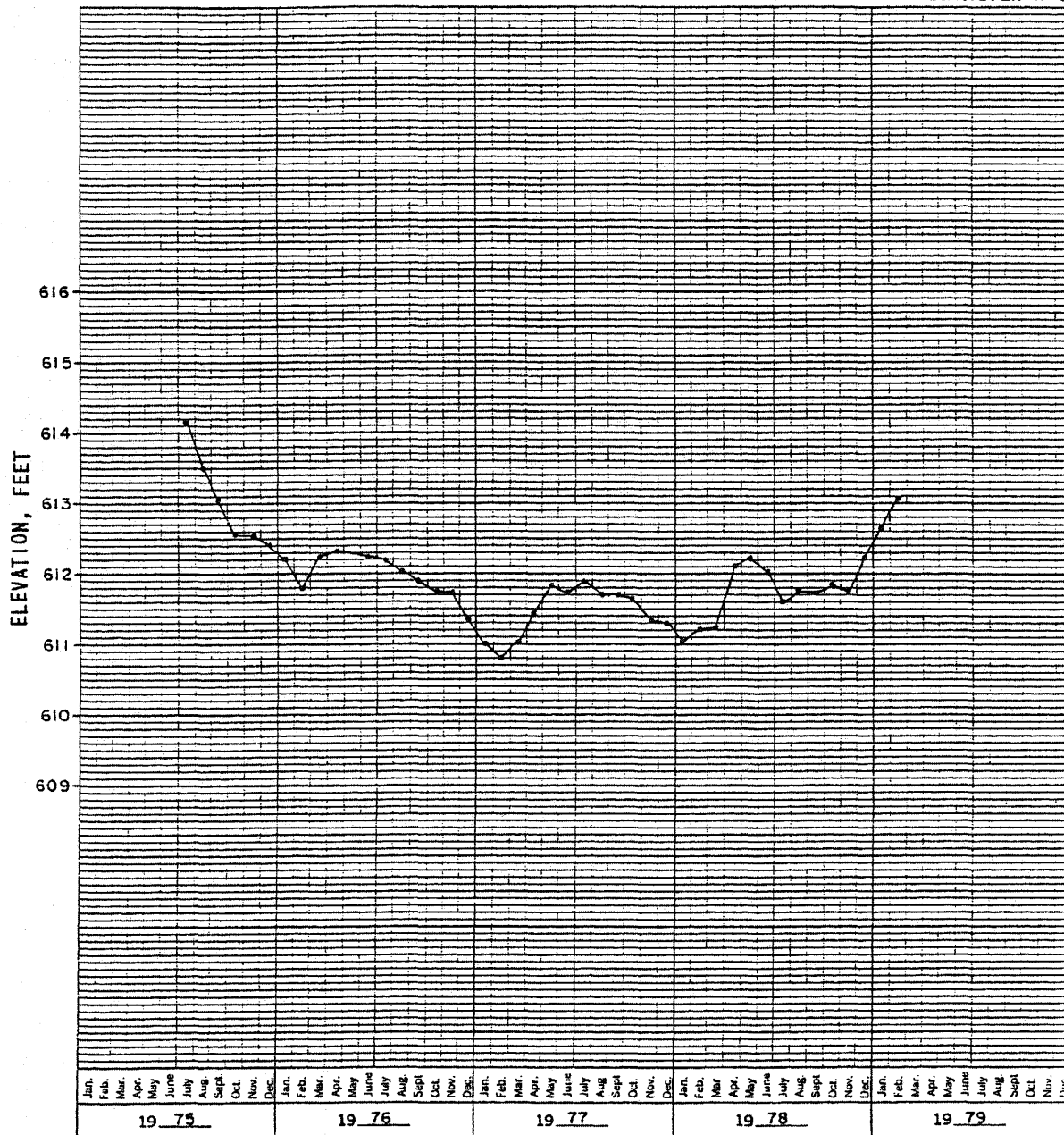


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 12 of 34)

PIEZOMETER W-6



(Rev. 12 1/03)

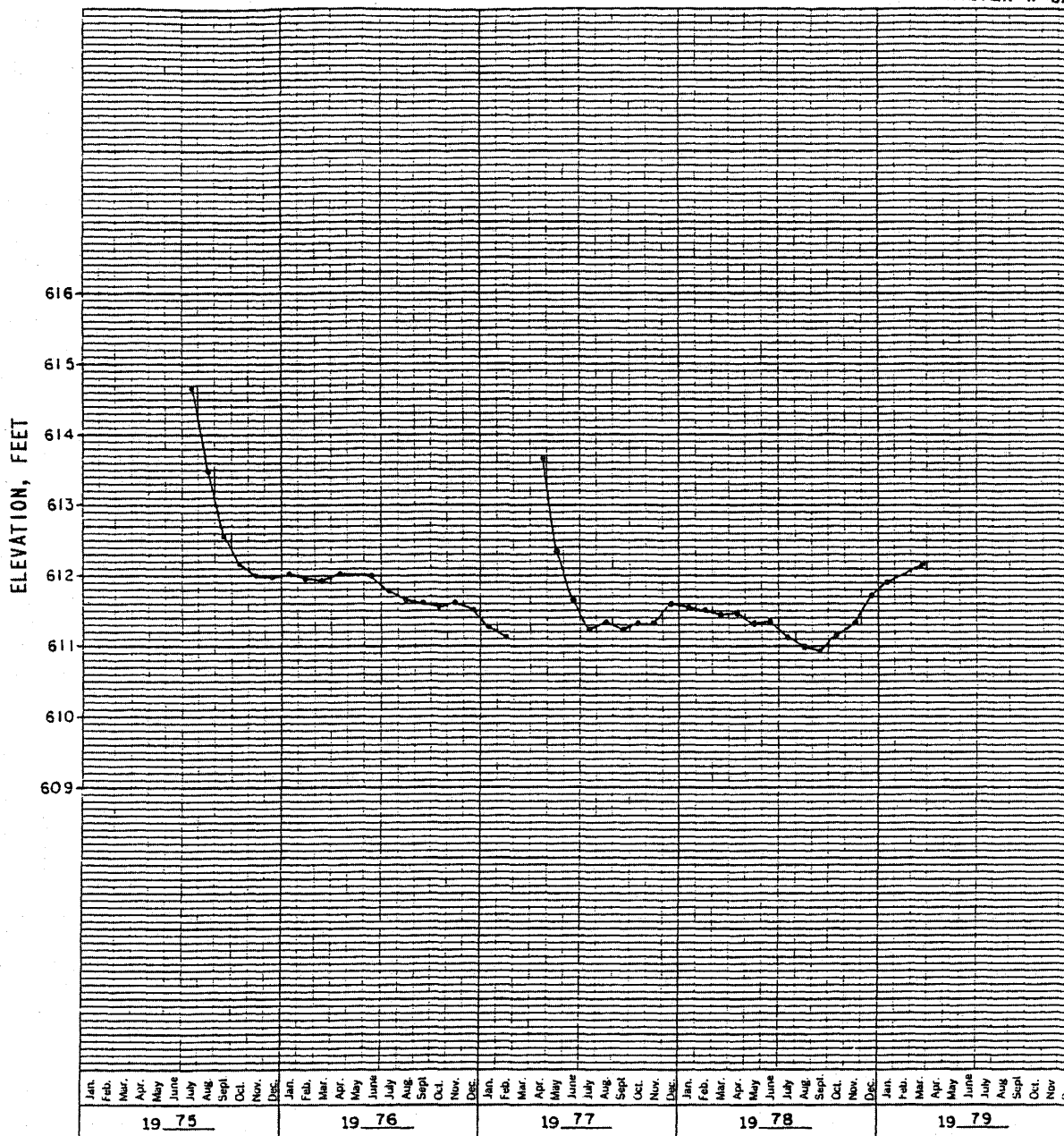


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 13 of 34)

PIEZOMETER W-6A



(Rev. 12 1/03)

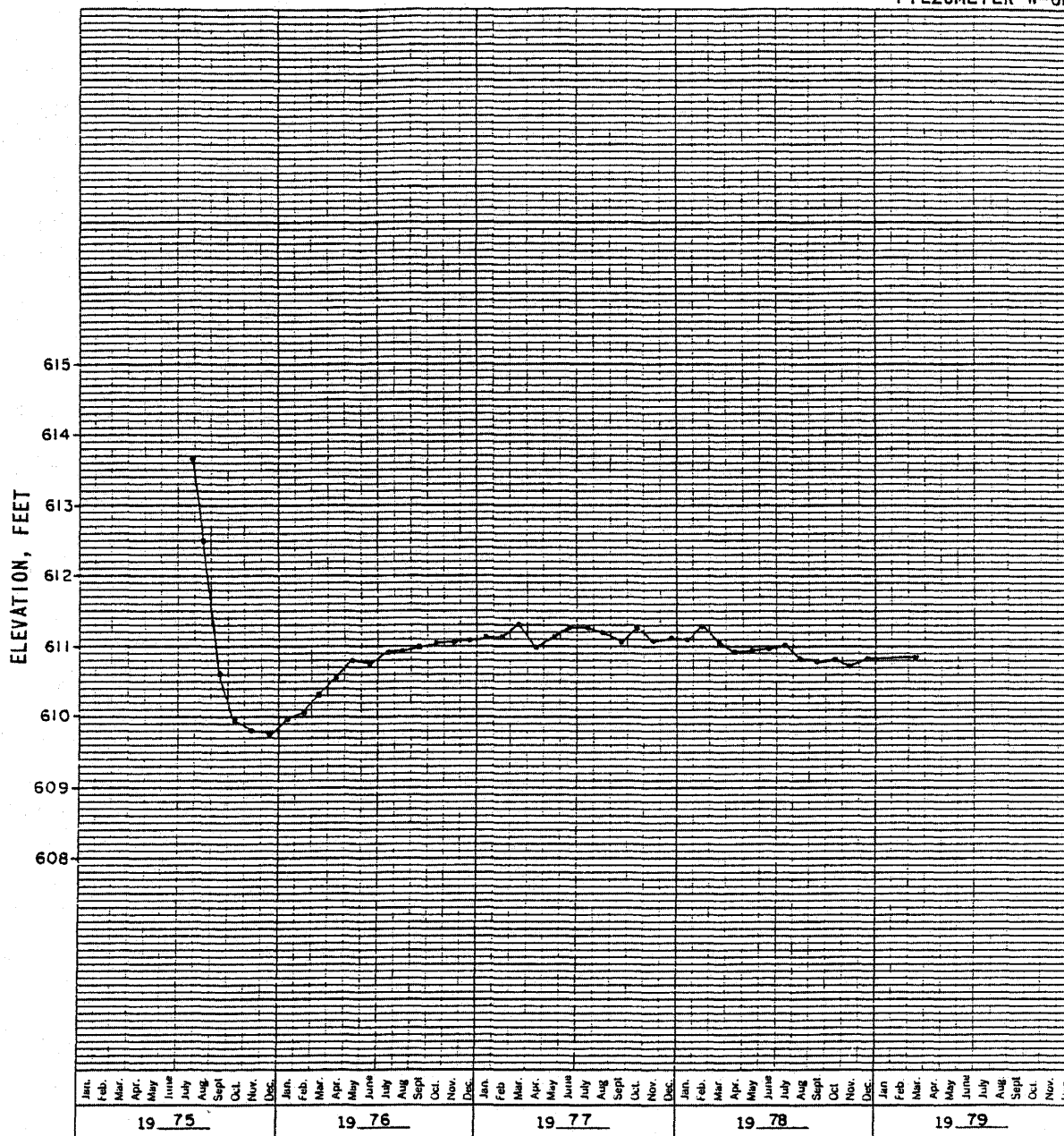


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 14 of 34)

PIEZOMETER W-6B



(Rev. 12 1/03)

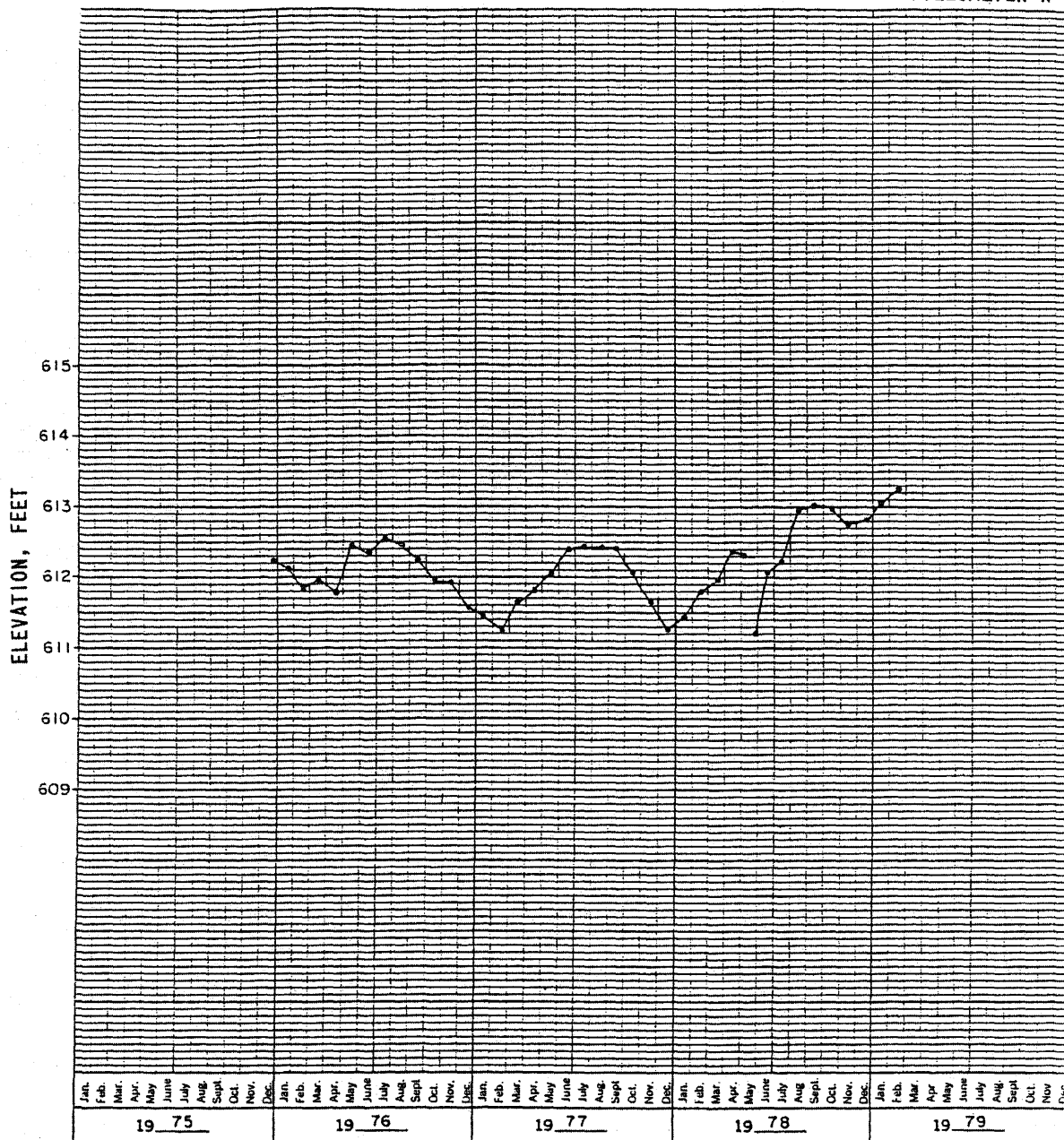


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 15 of 34)

PIEZOMETER W-7



(Rev. 12 1/03)

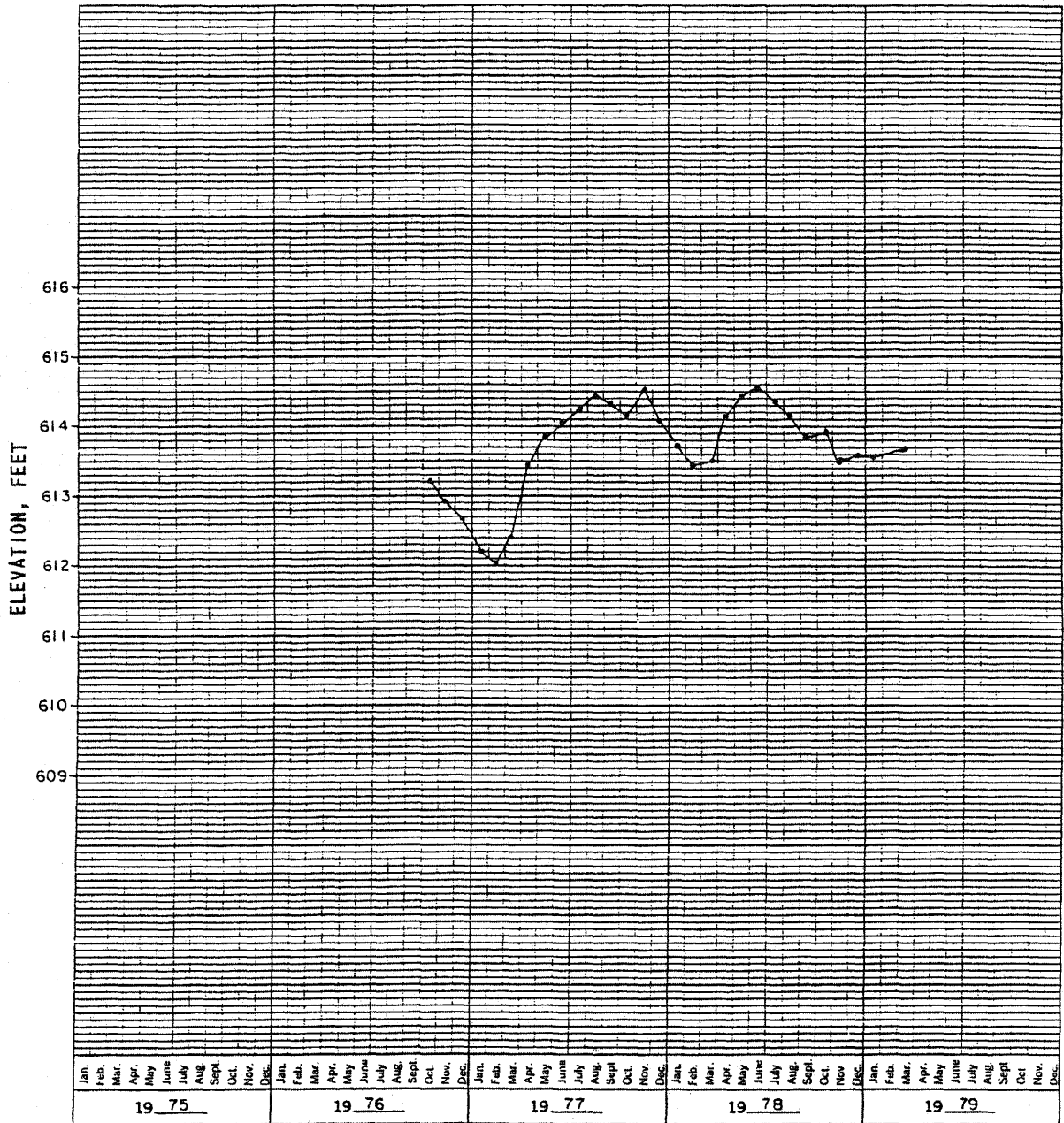


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 16 of 34)

PIEZOMETER W-8



(Rev. 12 1/03)

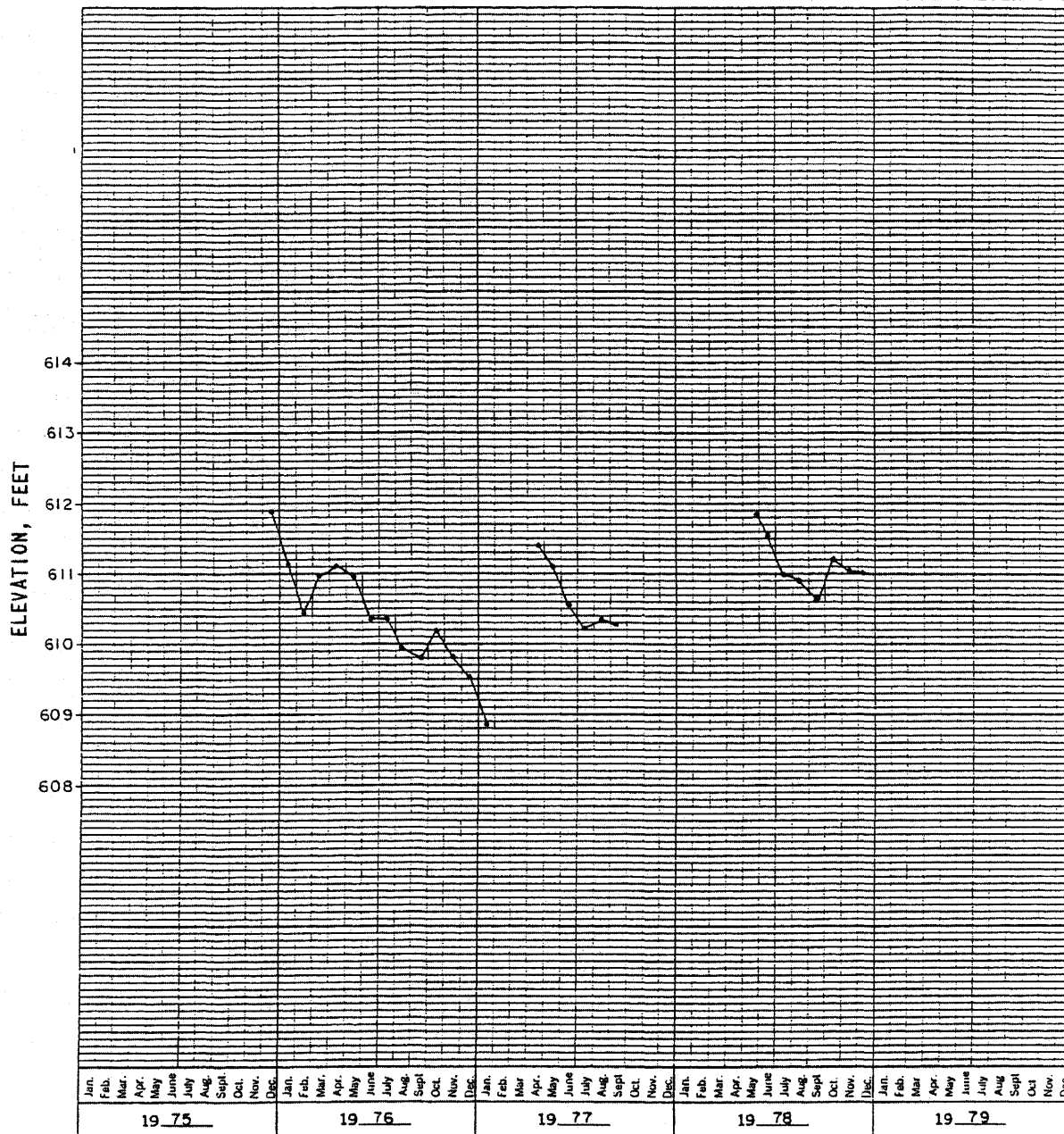


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 17 of 34)

PIEZOMETER S-3



(Rev. 12 1/03)

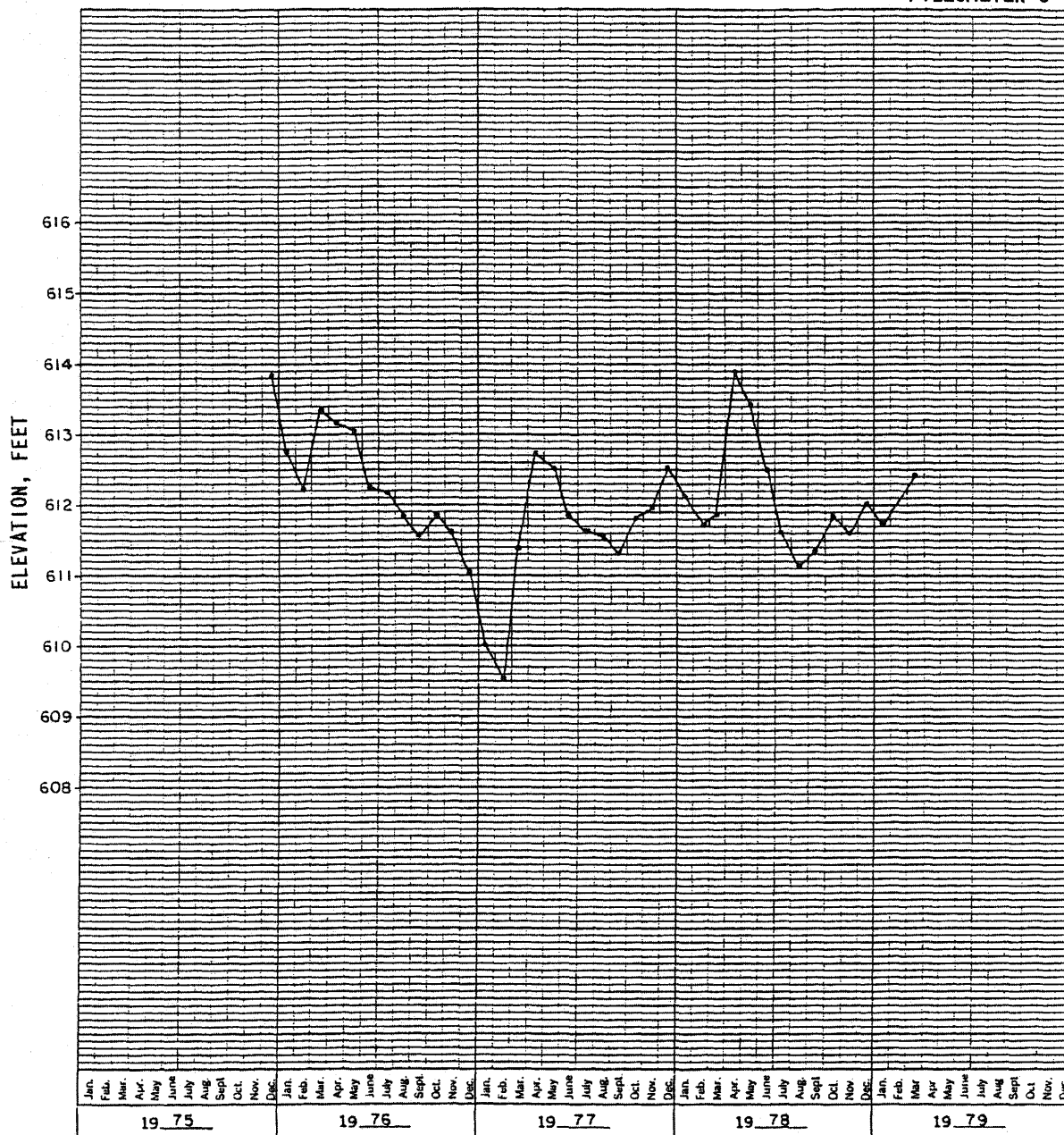


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 18 of 34)

PIEZOMETER S-4



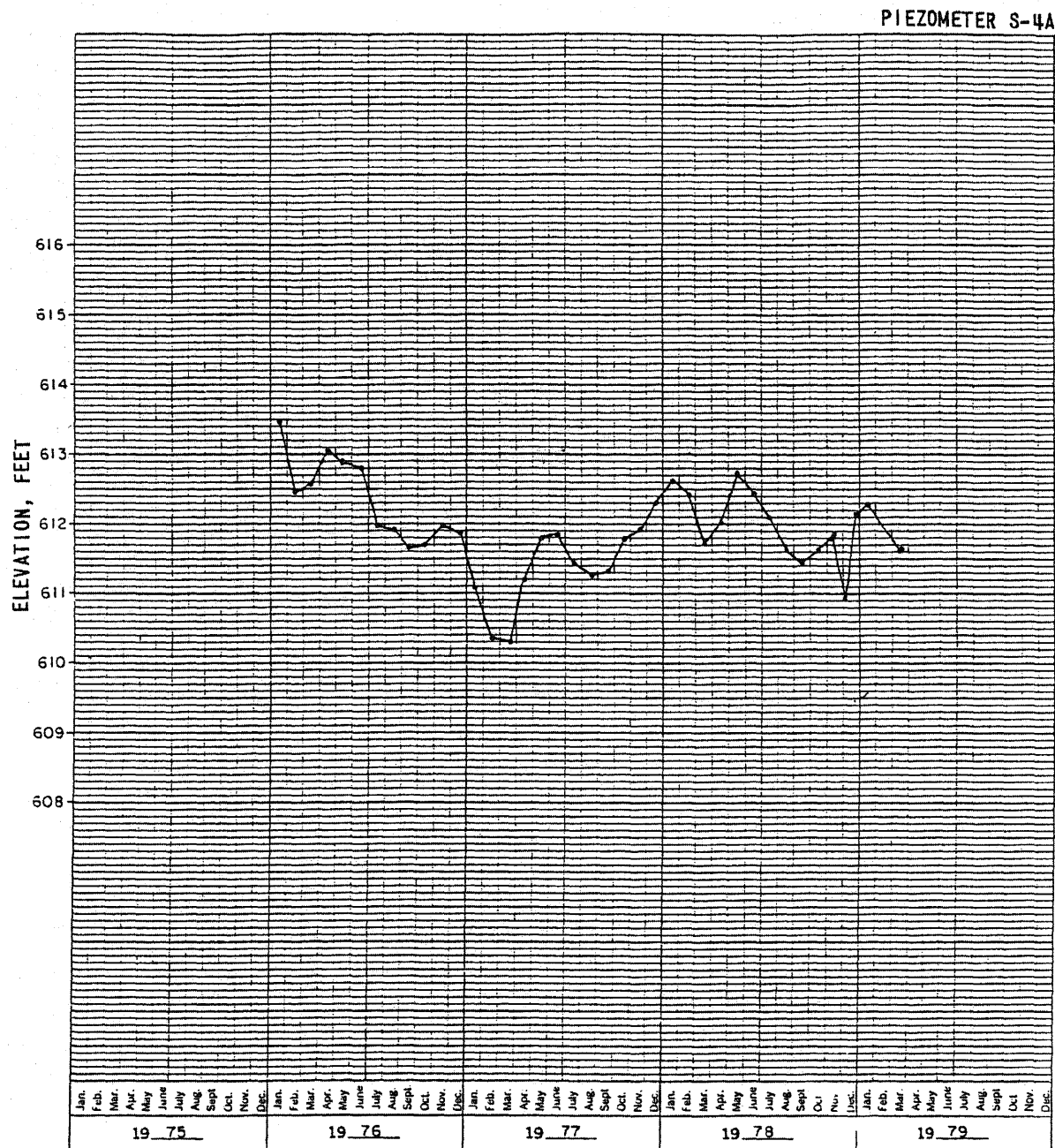
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 19 of 34)



(Rev. 12 1/03)

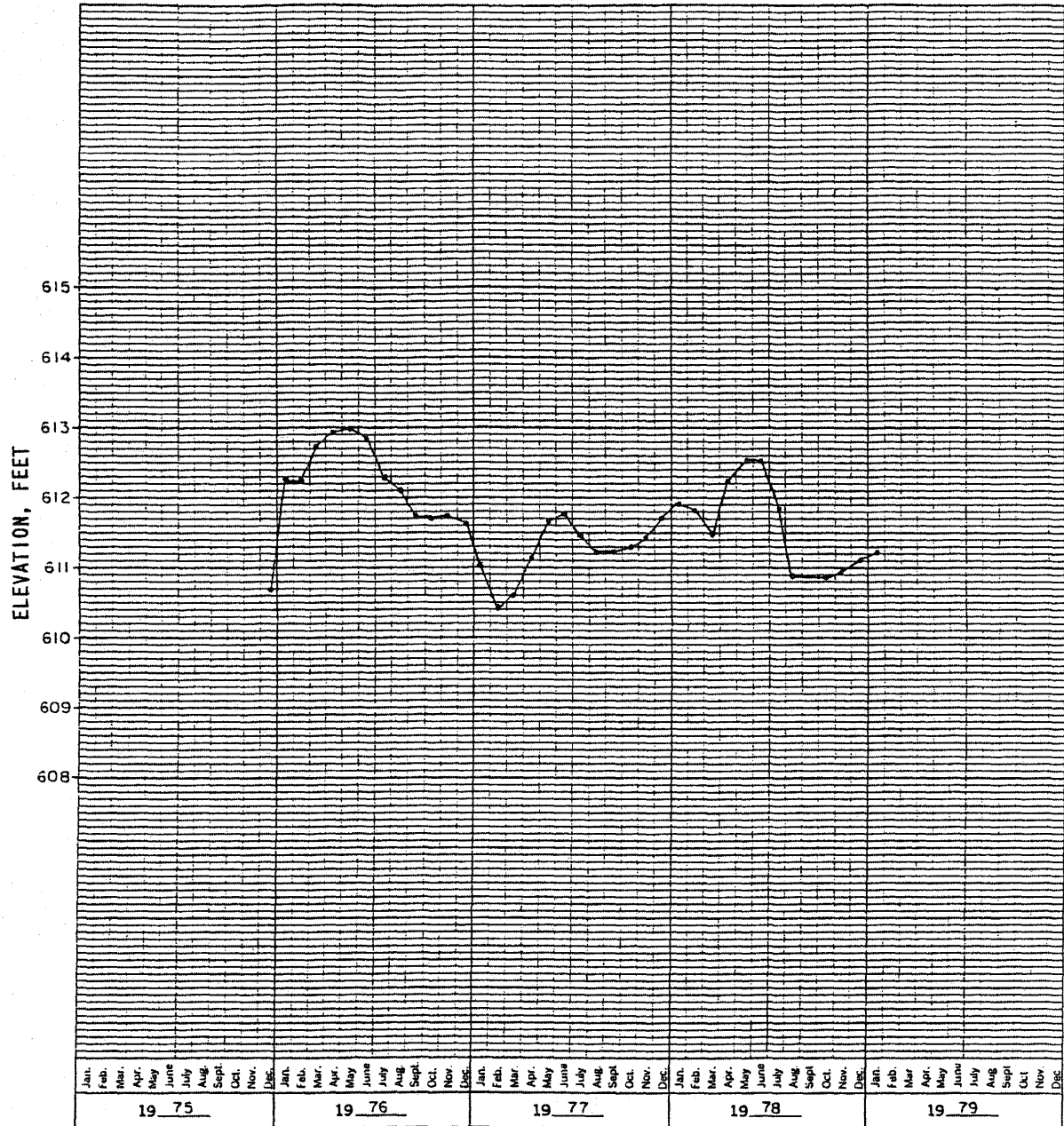


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 20 of 34)

PIEZOMETER S-48



(Rev. 12 1/03)

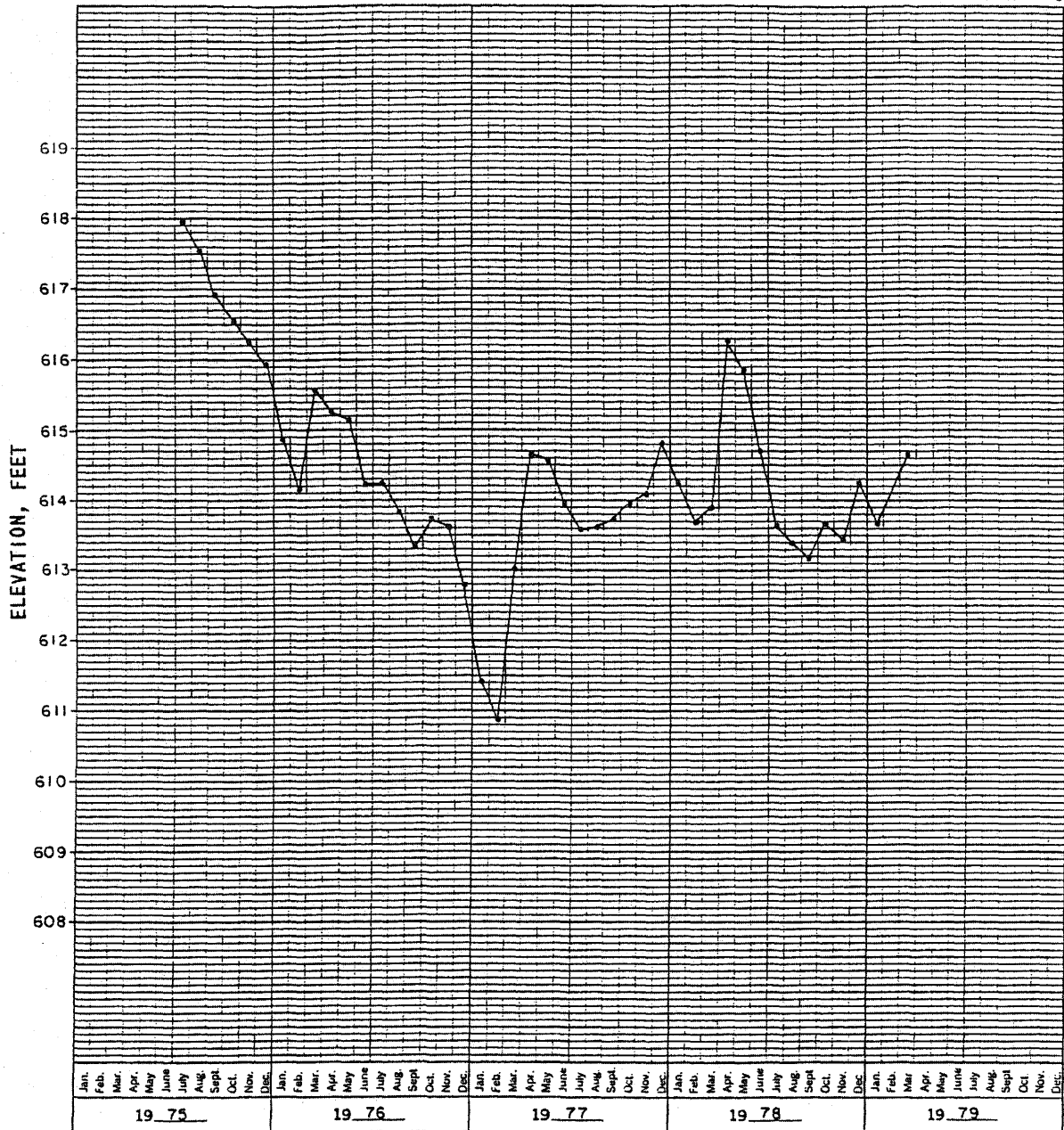


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 21 of 34)

PIEZOMETER S-5



(Rev. 12 1/03)

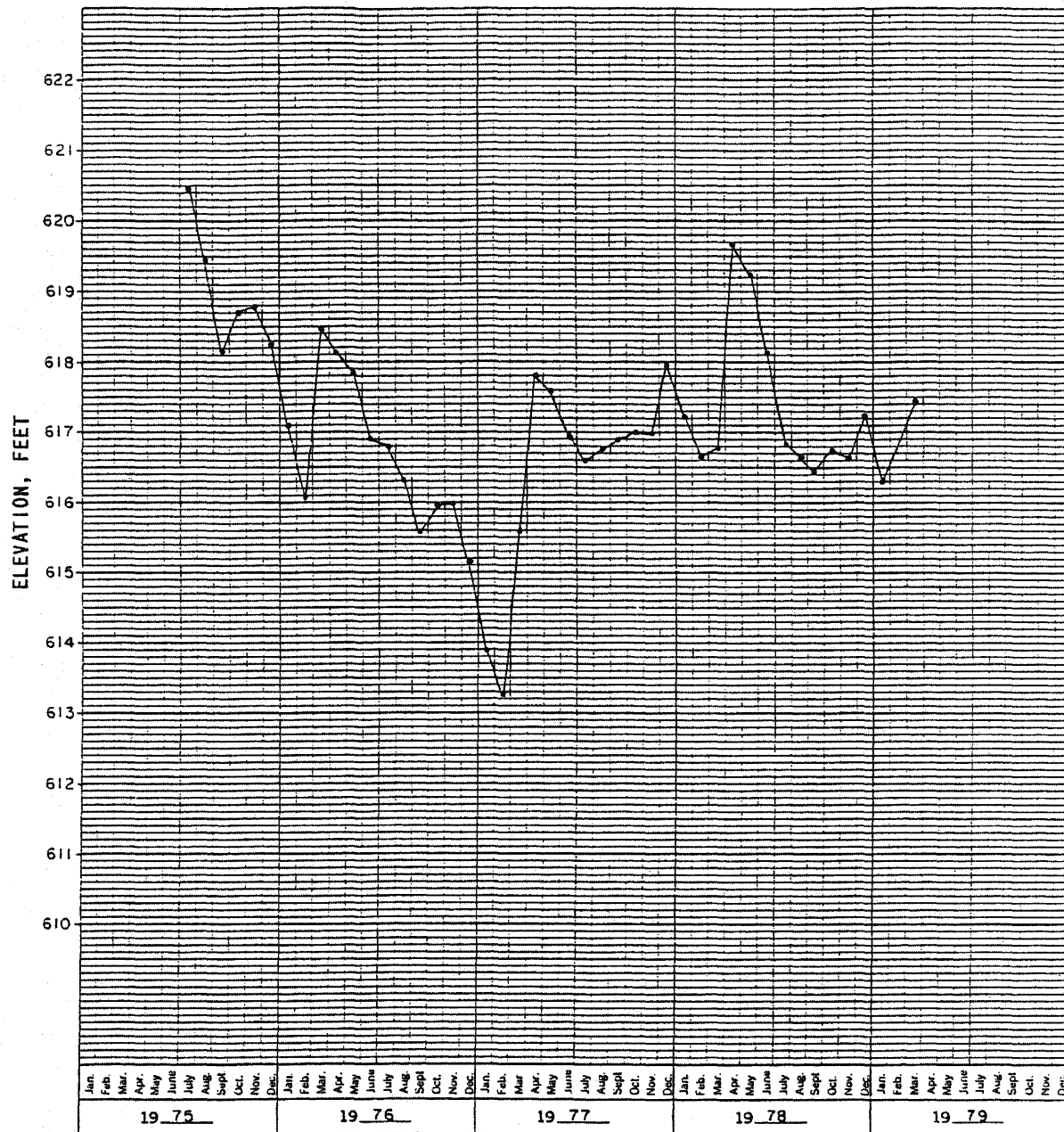


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 22 of 34)

PIEZOMETER S-6



(Rev. 12 1/03)

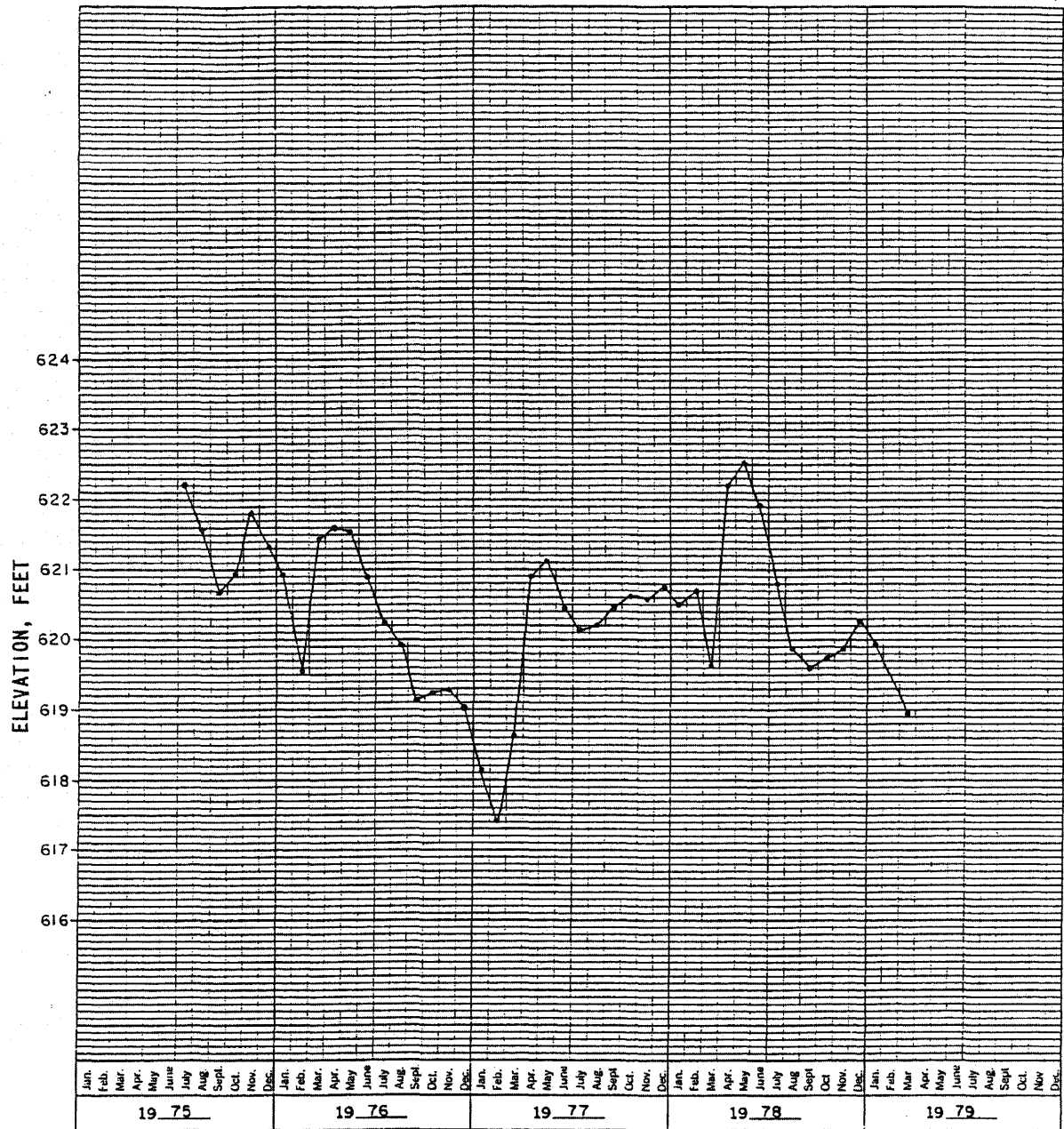


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 23 of 34)

PIEZOMETER S-7



(Rev. 12 1/03)

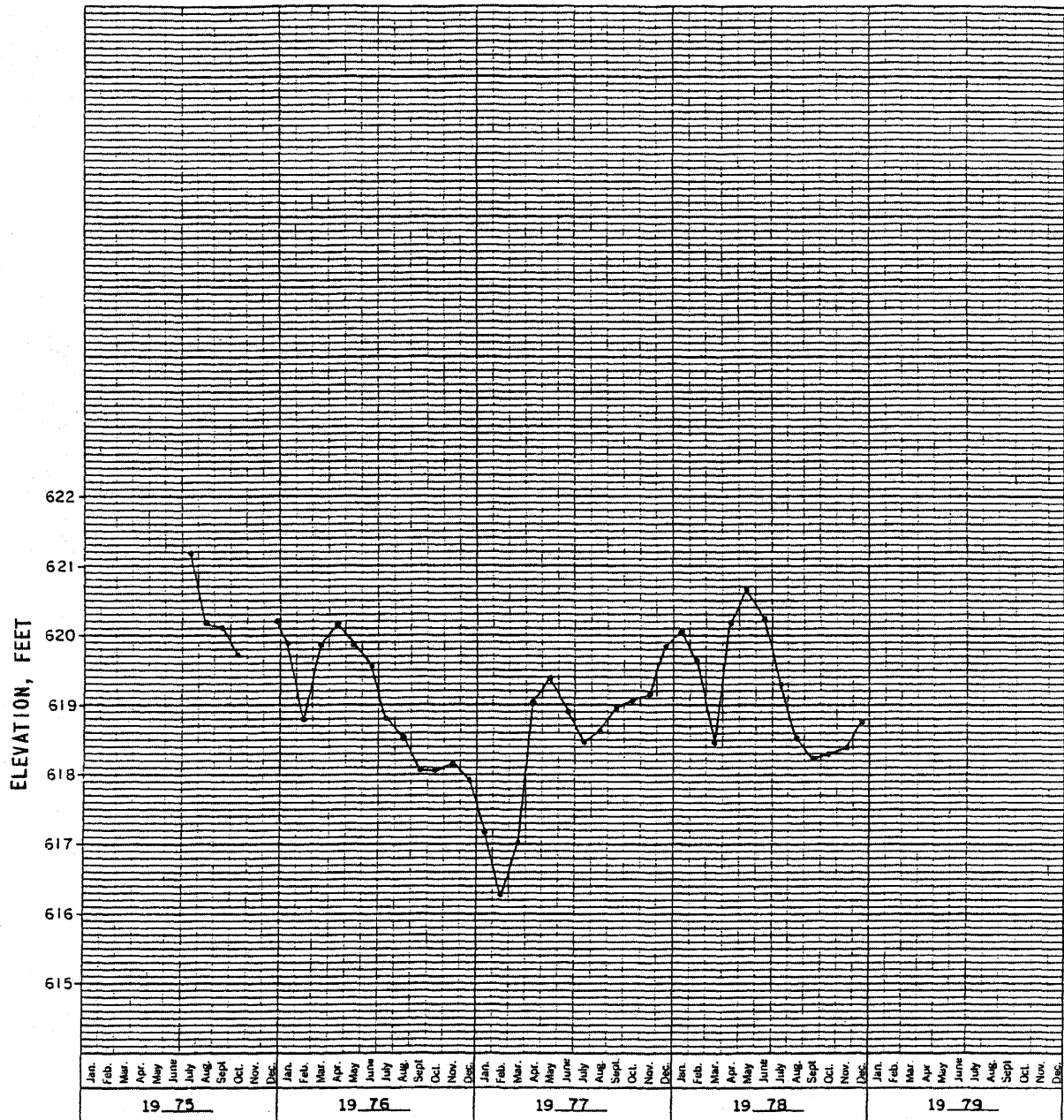


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 24 of 34)

PIEZOMETER S-7A



(Rev. 12 1/03)

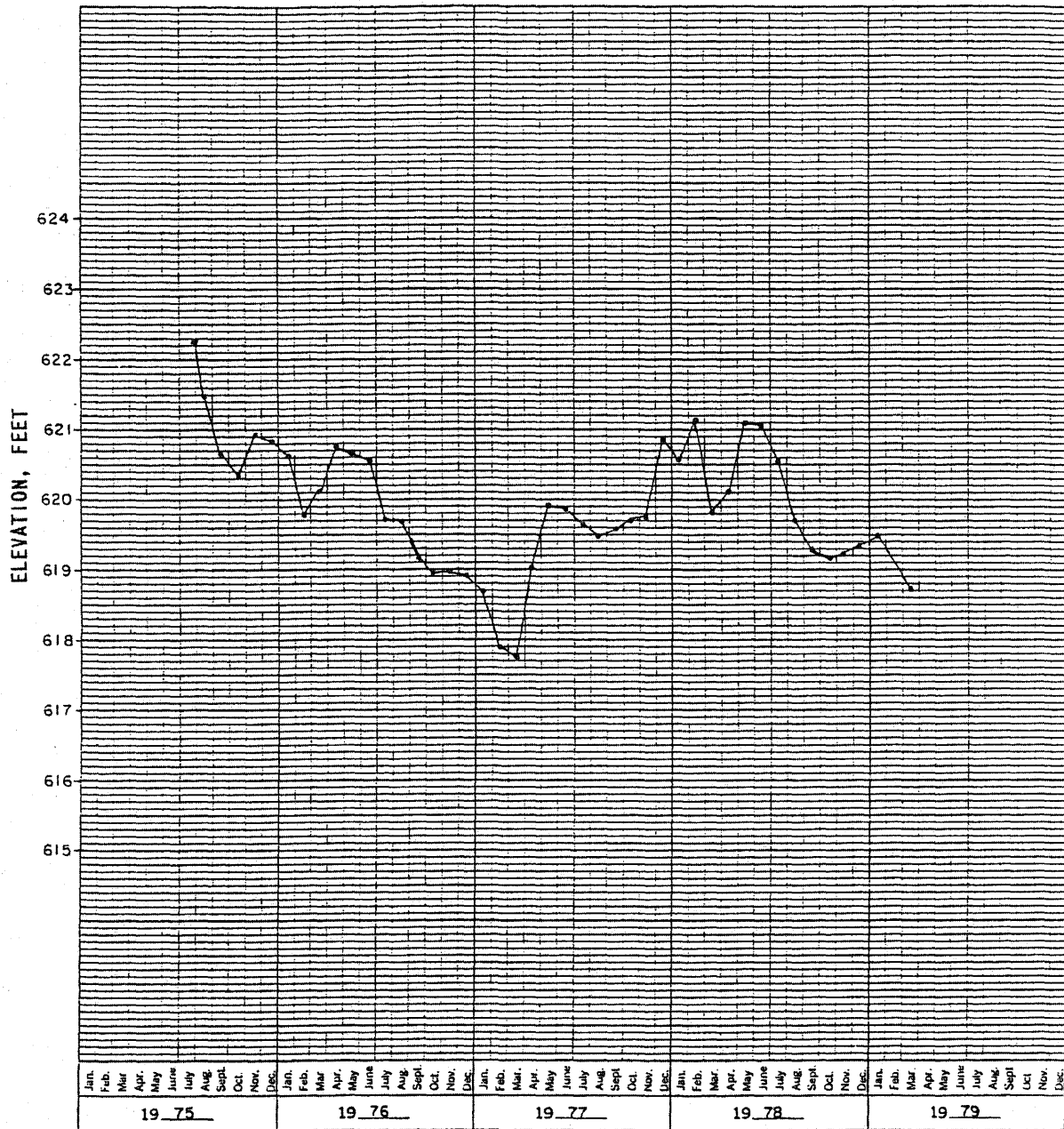


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 25 of 34)

PIEZOMETER S-7B



(Rev. 12 1/03)

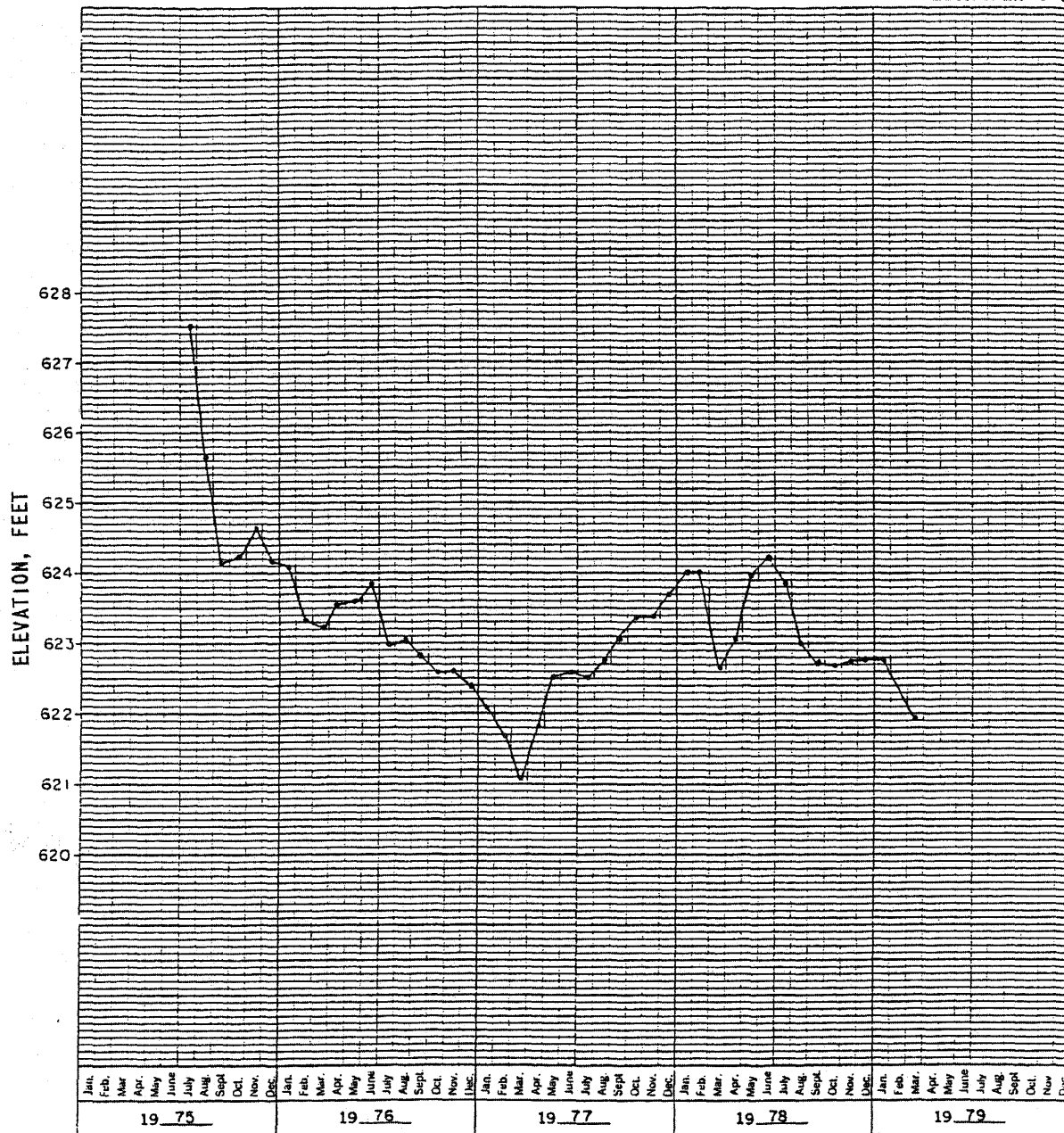


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 26 of 34)

PIEZOMETER S-8



(Rev. 12 1/03)

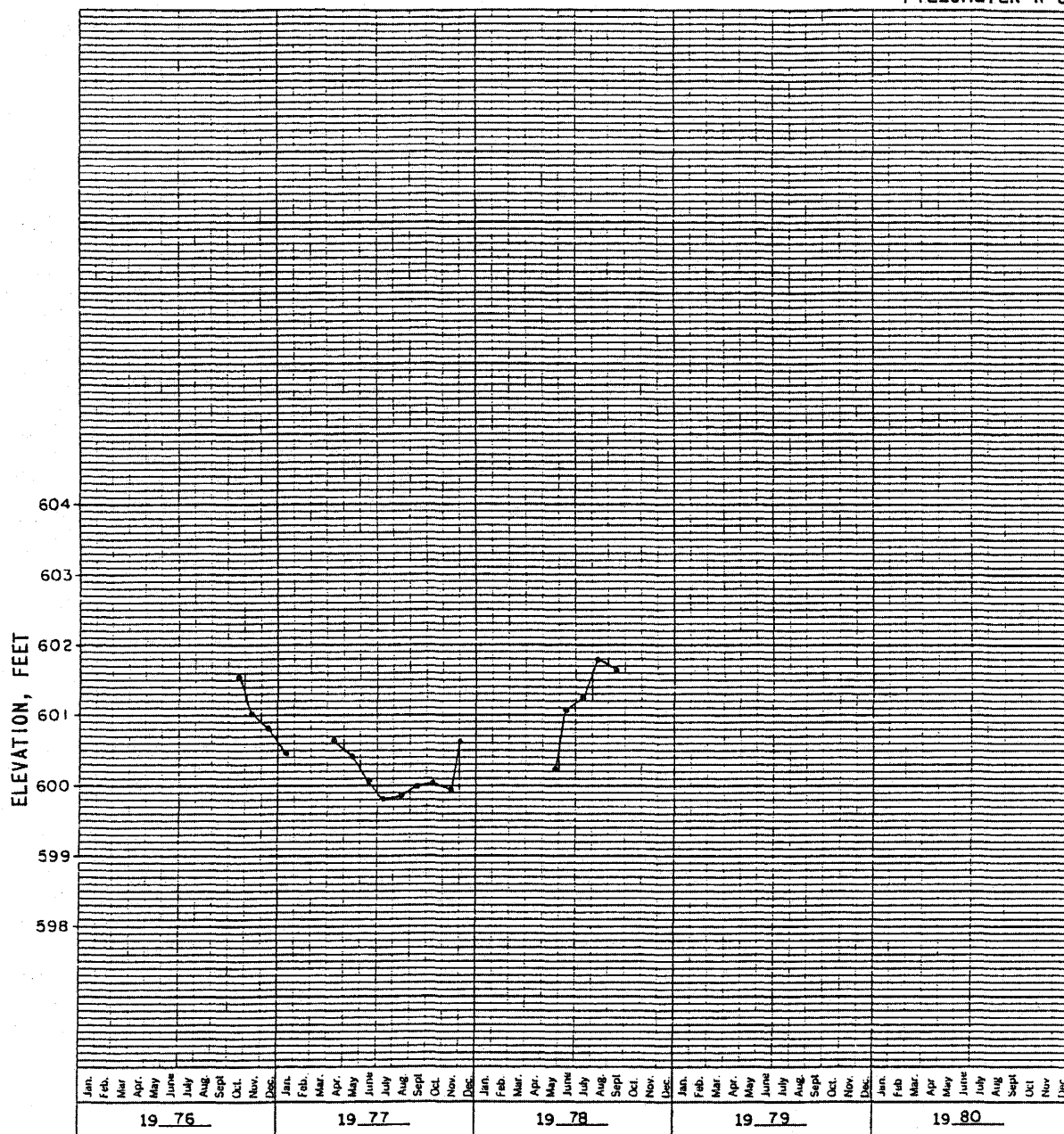


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 27 of 34)

PIEZOMETER N-3



(Rev. 12 1/03)

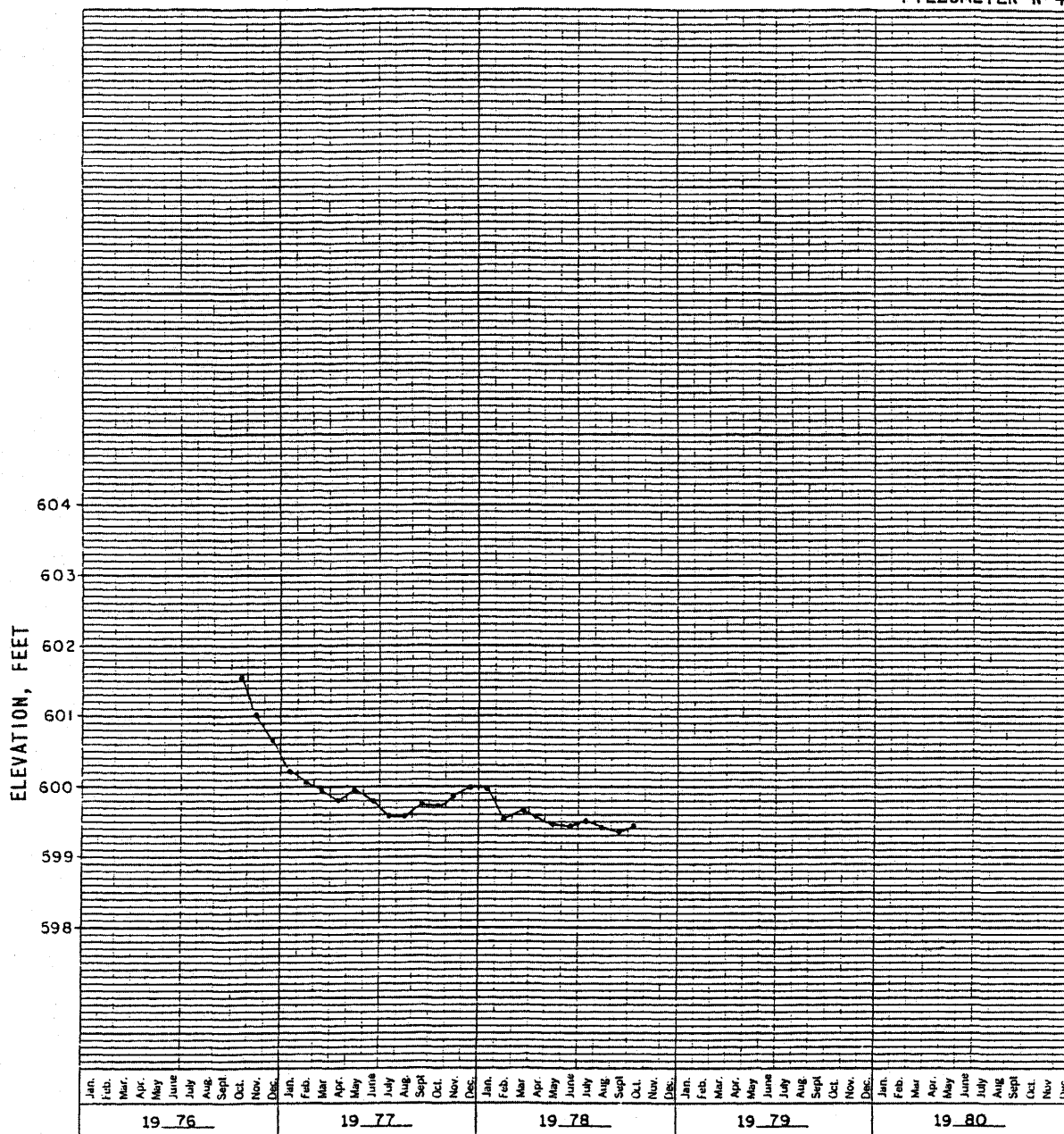


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 28 of 34)

PIEZOMETER N-4



(Rev. 12 1/03)

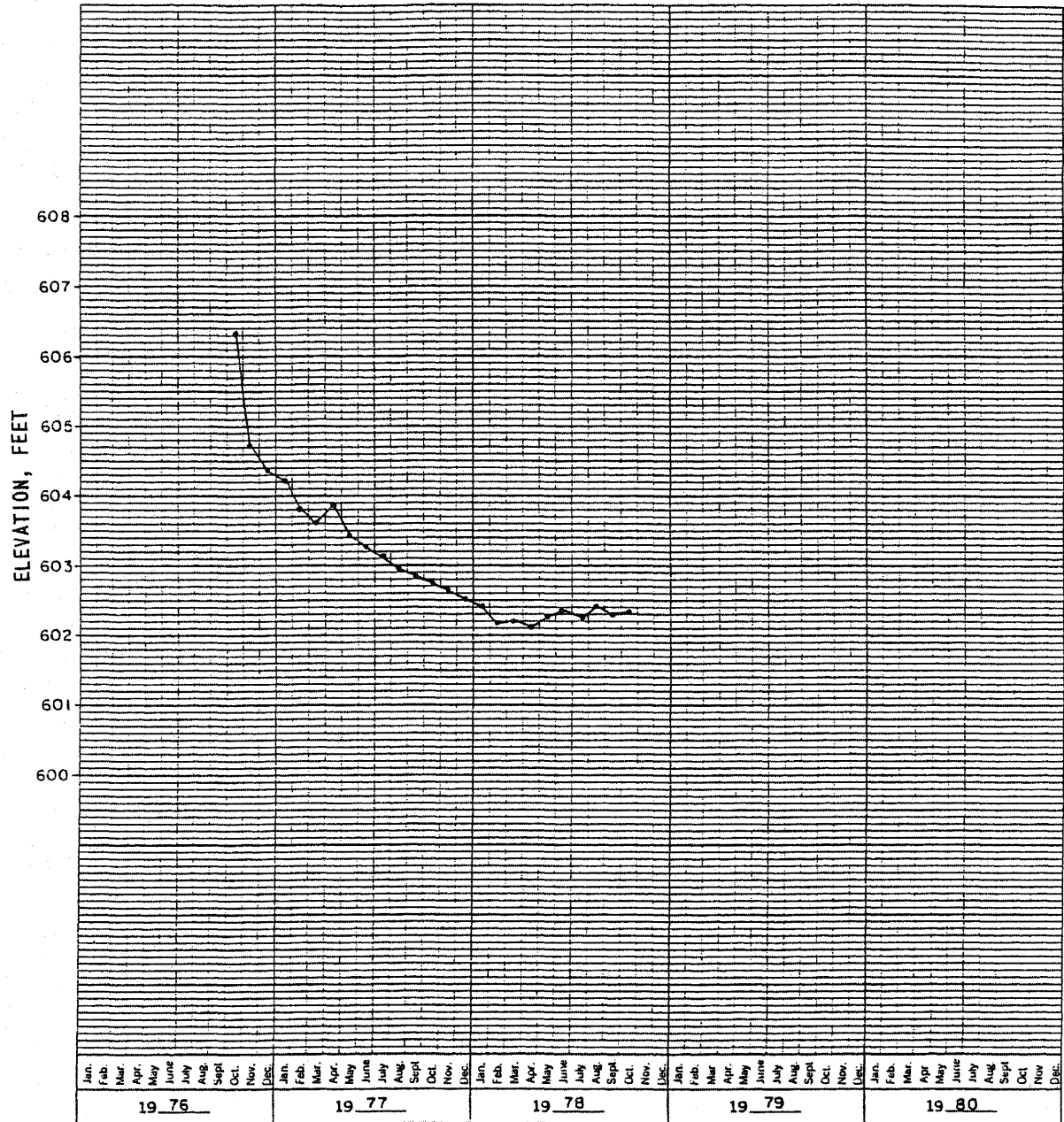


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 29 of 34)

PIEZOMETER N-4A



(Rev. 12 1/03)

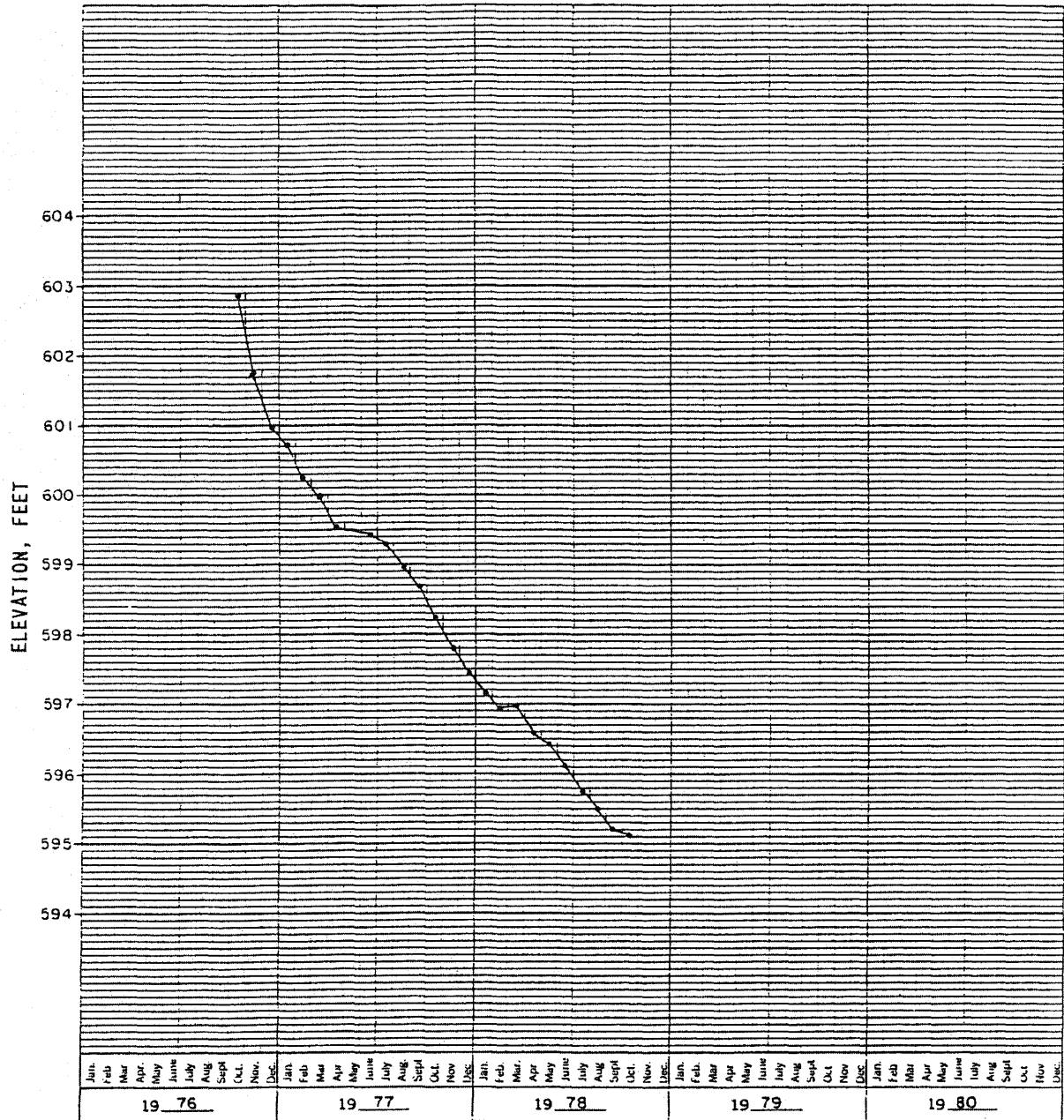


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 30 of 34)

PIEZOMETER N-48



(Rev. 12 1/03)

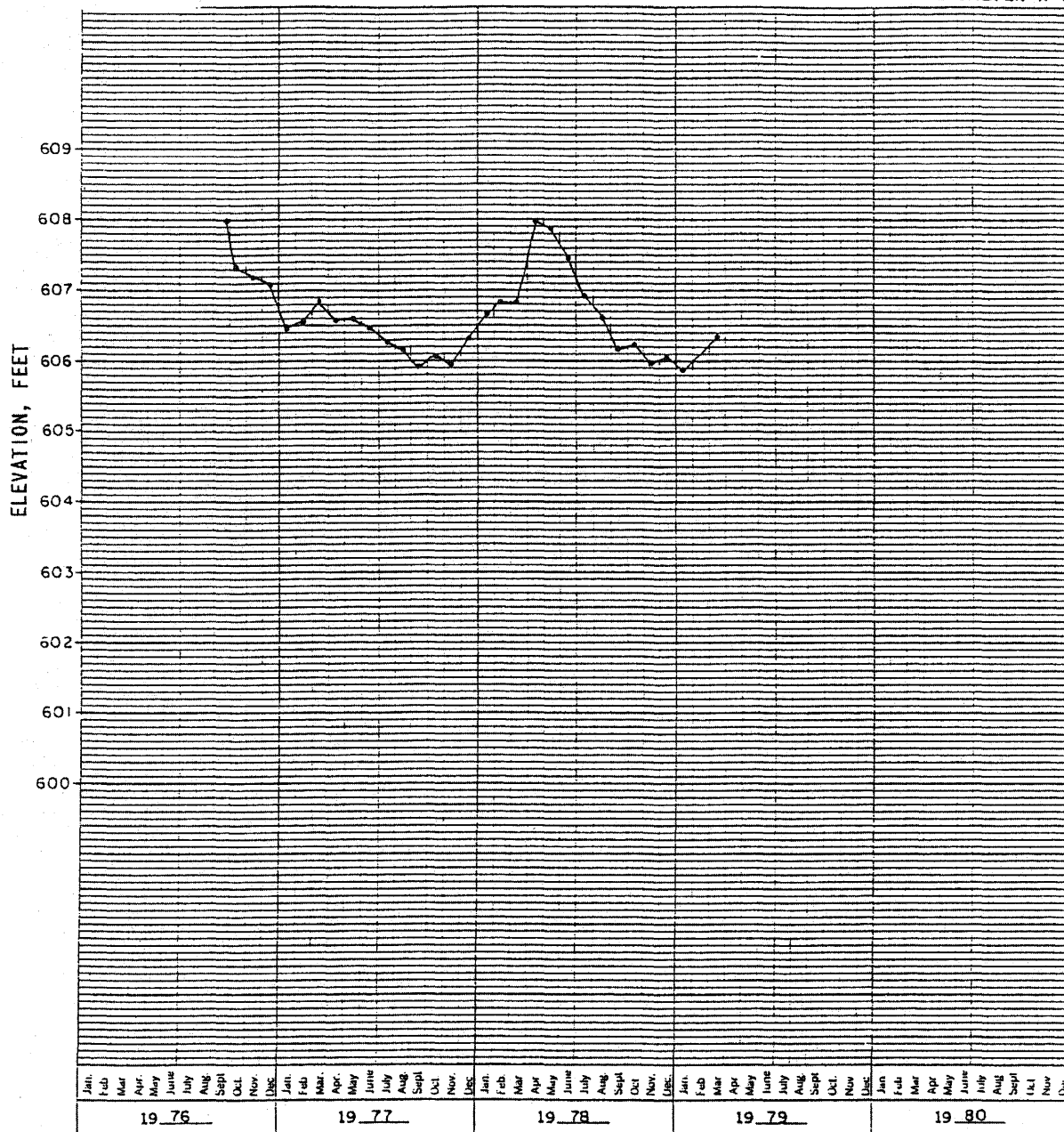


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 31 of 34)

PIEZOMETER N-8



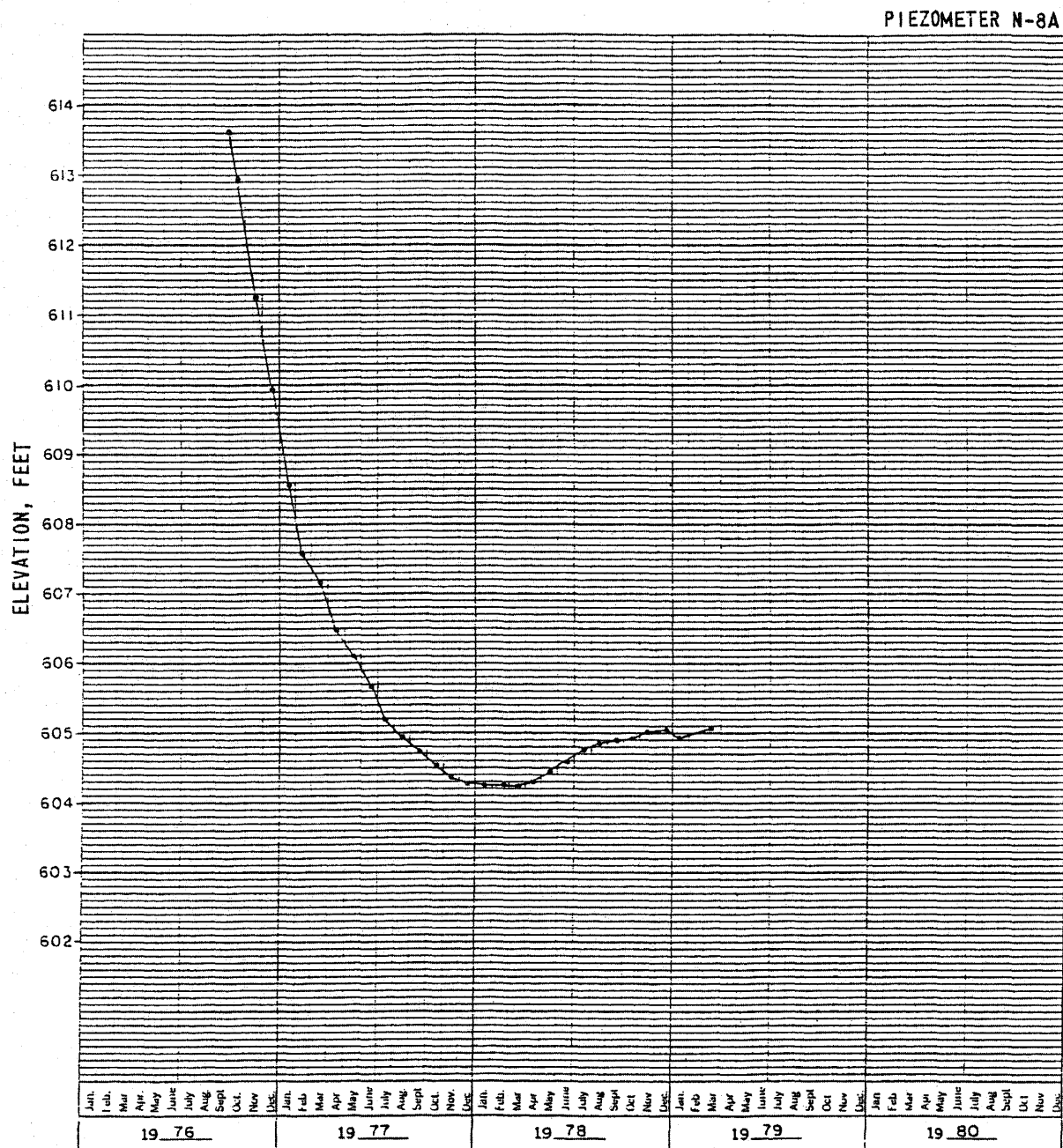
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 32 of 34)



(Rev. 12 1/03)

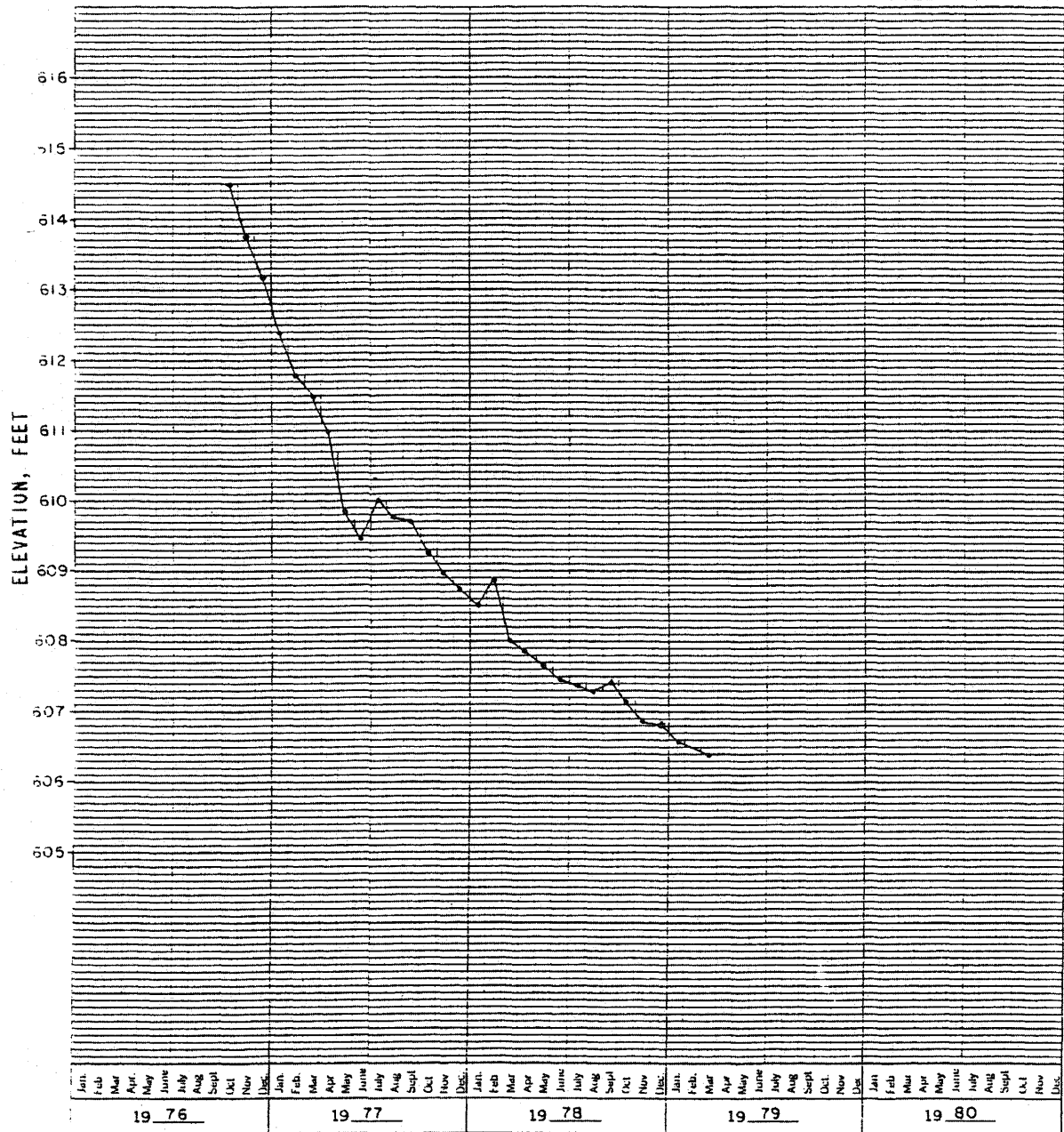


PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 33 of 34)

PIEZOMETER N-88



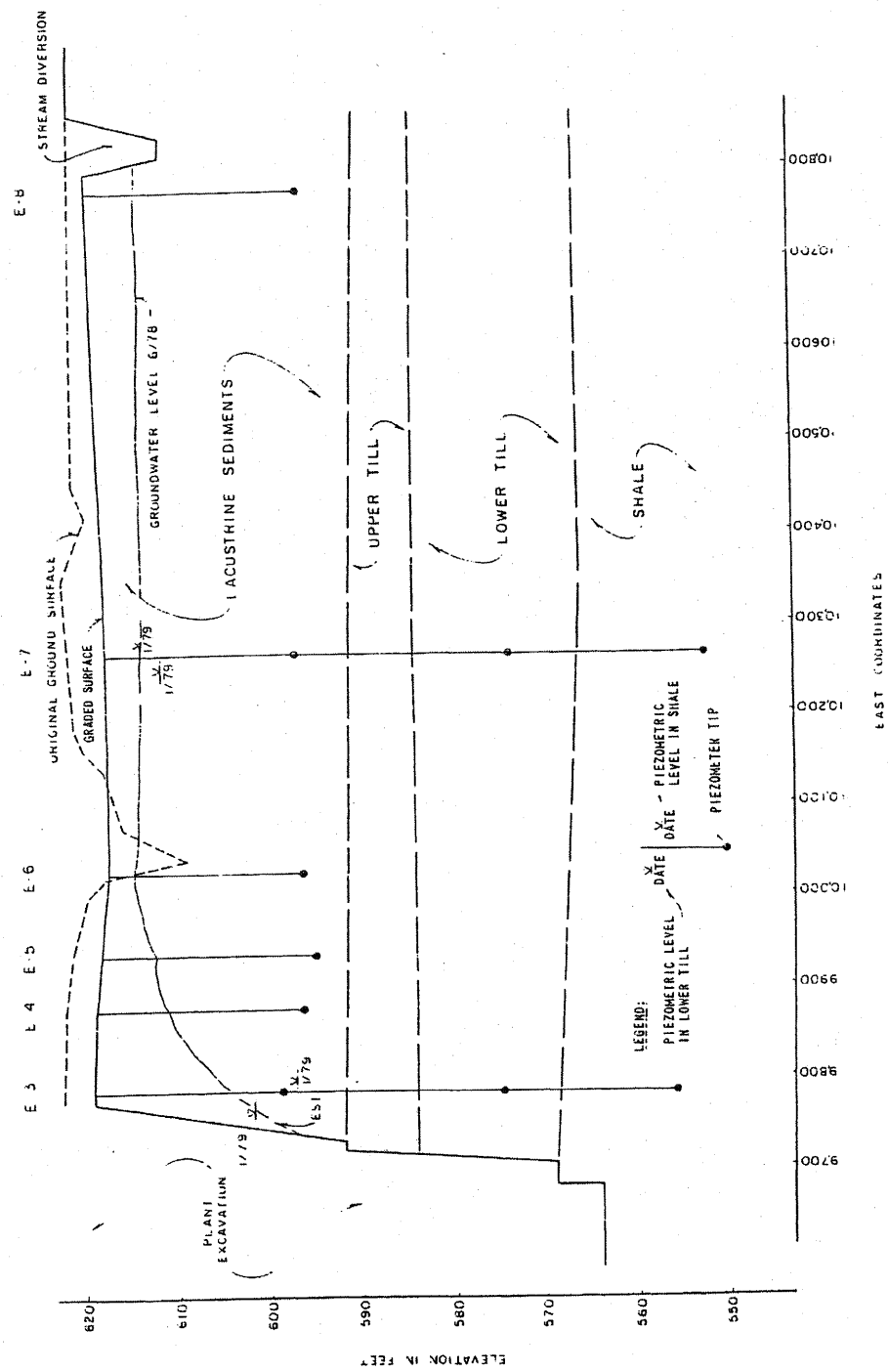
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Groundwater Observation
Piezometric Readings

Figure 2.5-187 (Sheet 34 of 34)



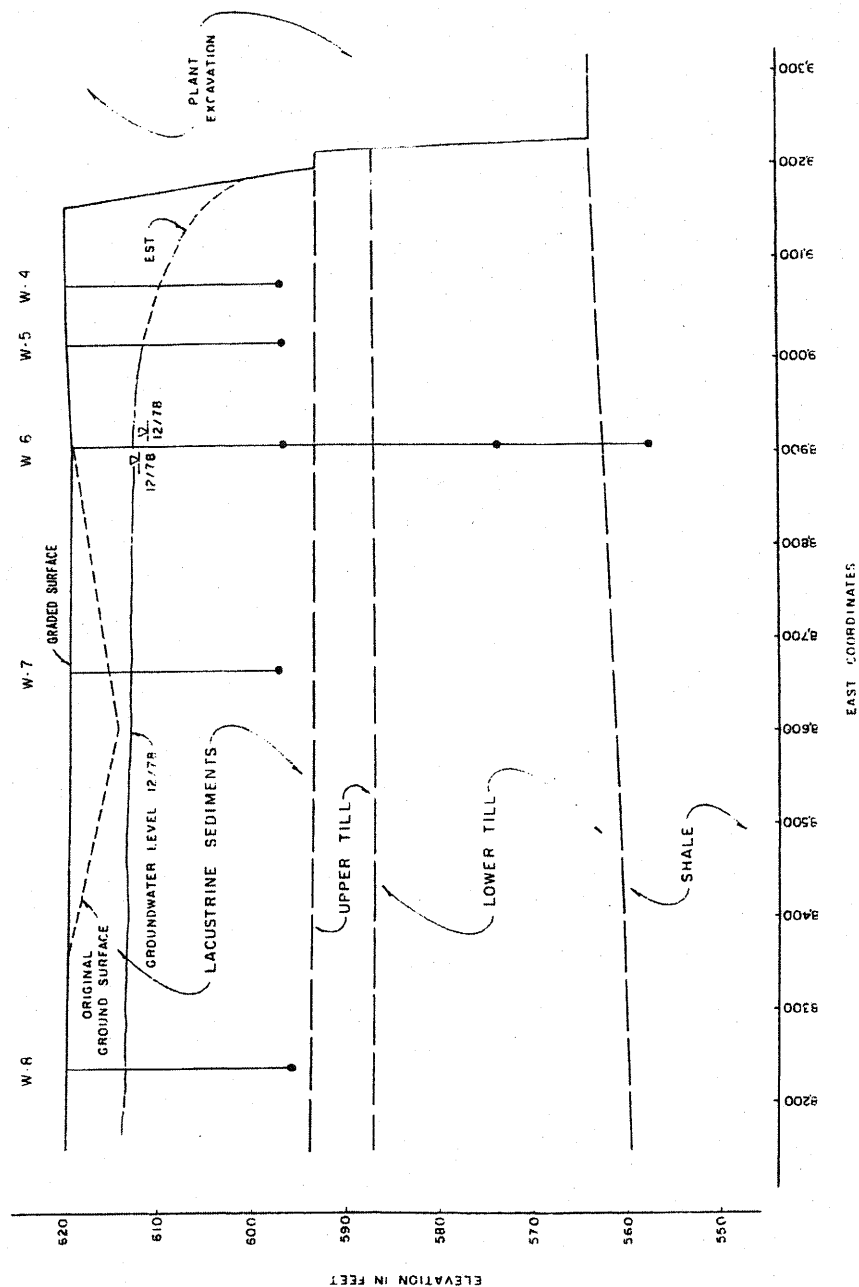
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Groundwater Profiles

Figure 2.5-188 (Sheet 1 of 4)



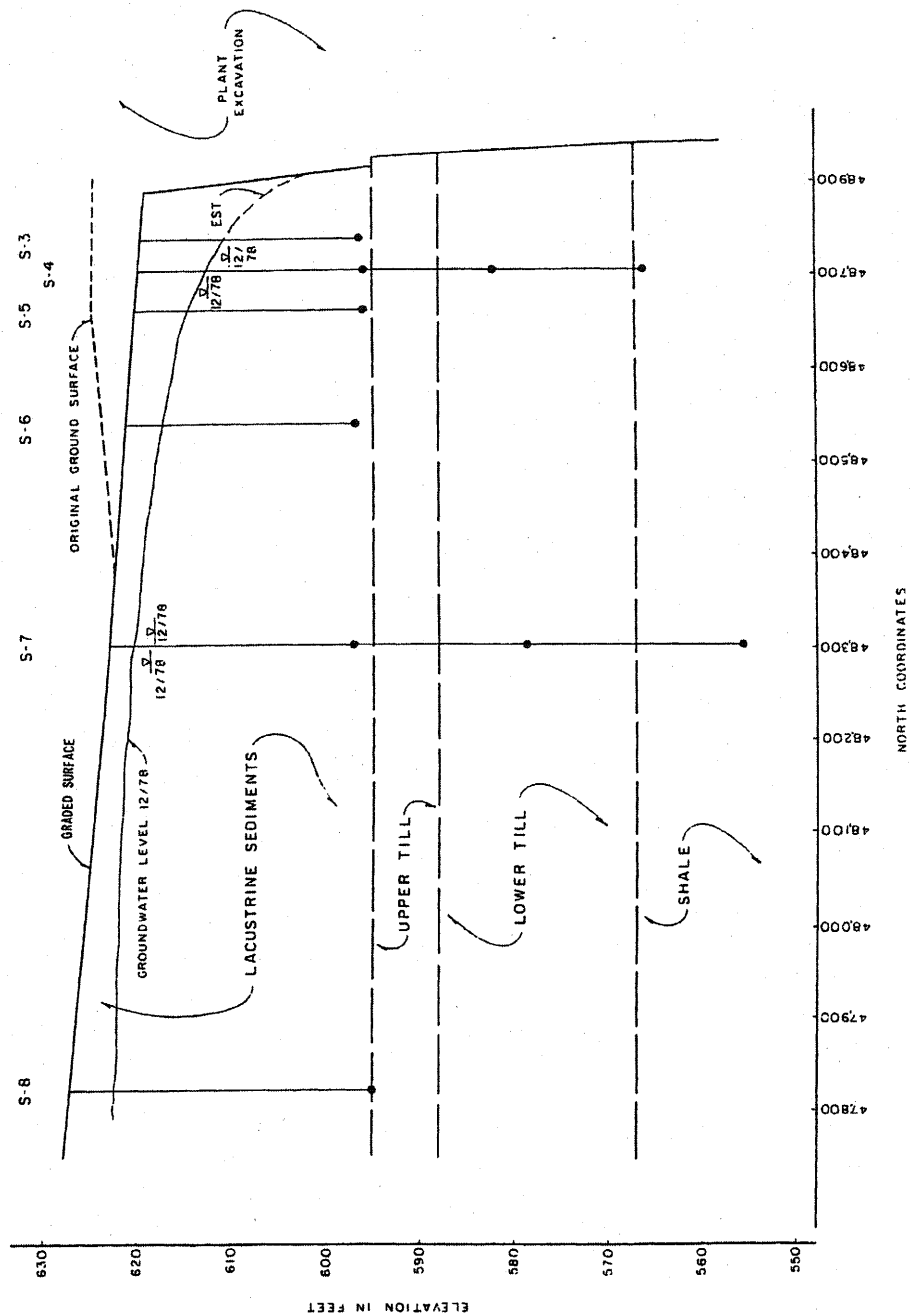
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Groundwater Profiles

Figure 2.5-188 (Sheet 2 of 4)



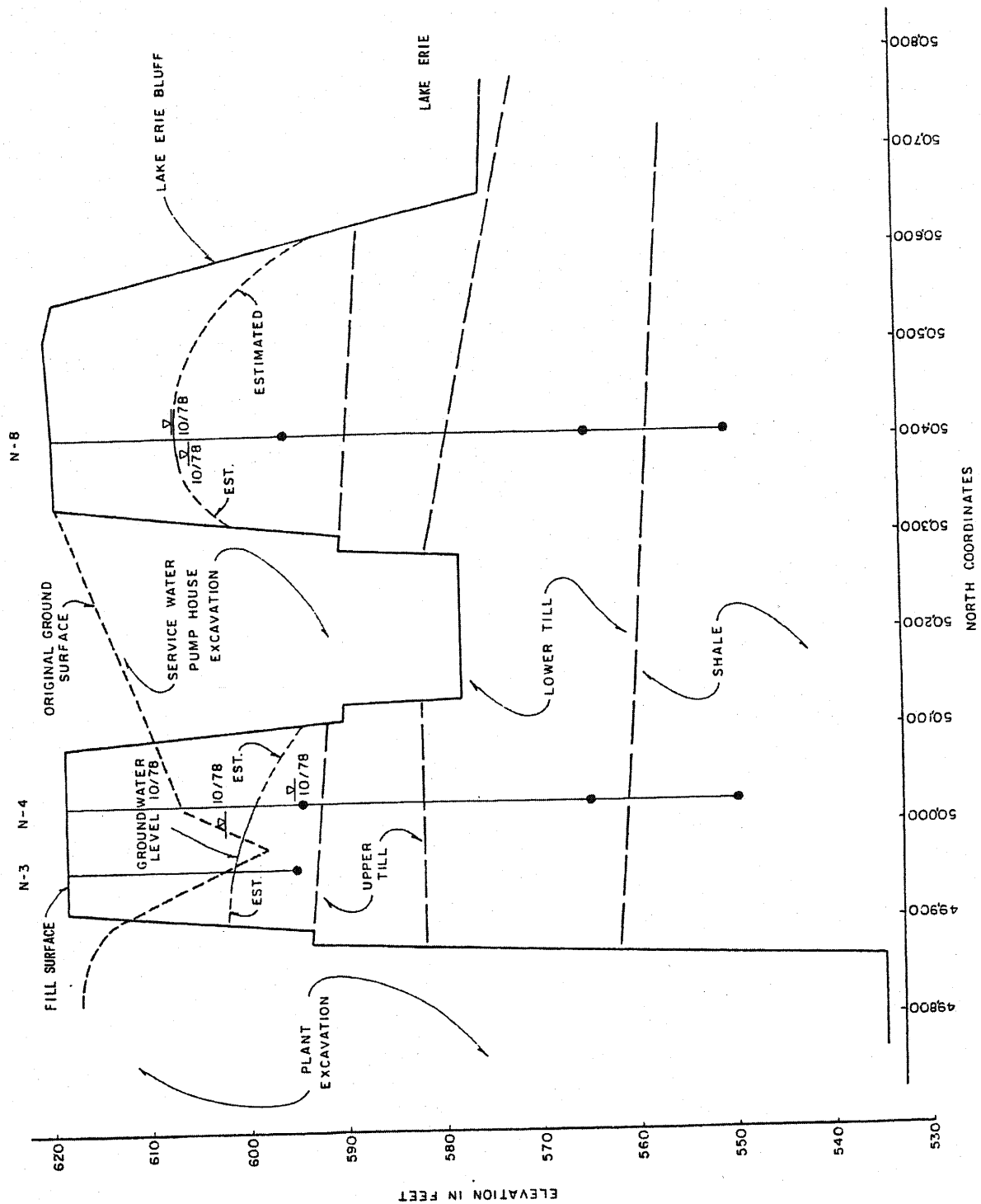
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Groundwater Profiles

Figure 2.5-188 (Sheet 3 of 4)



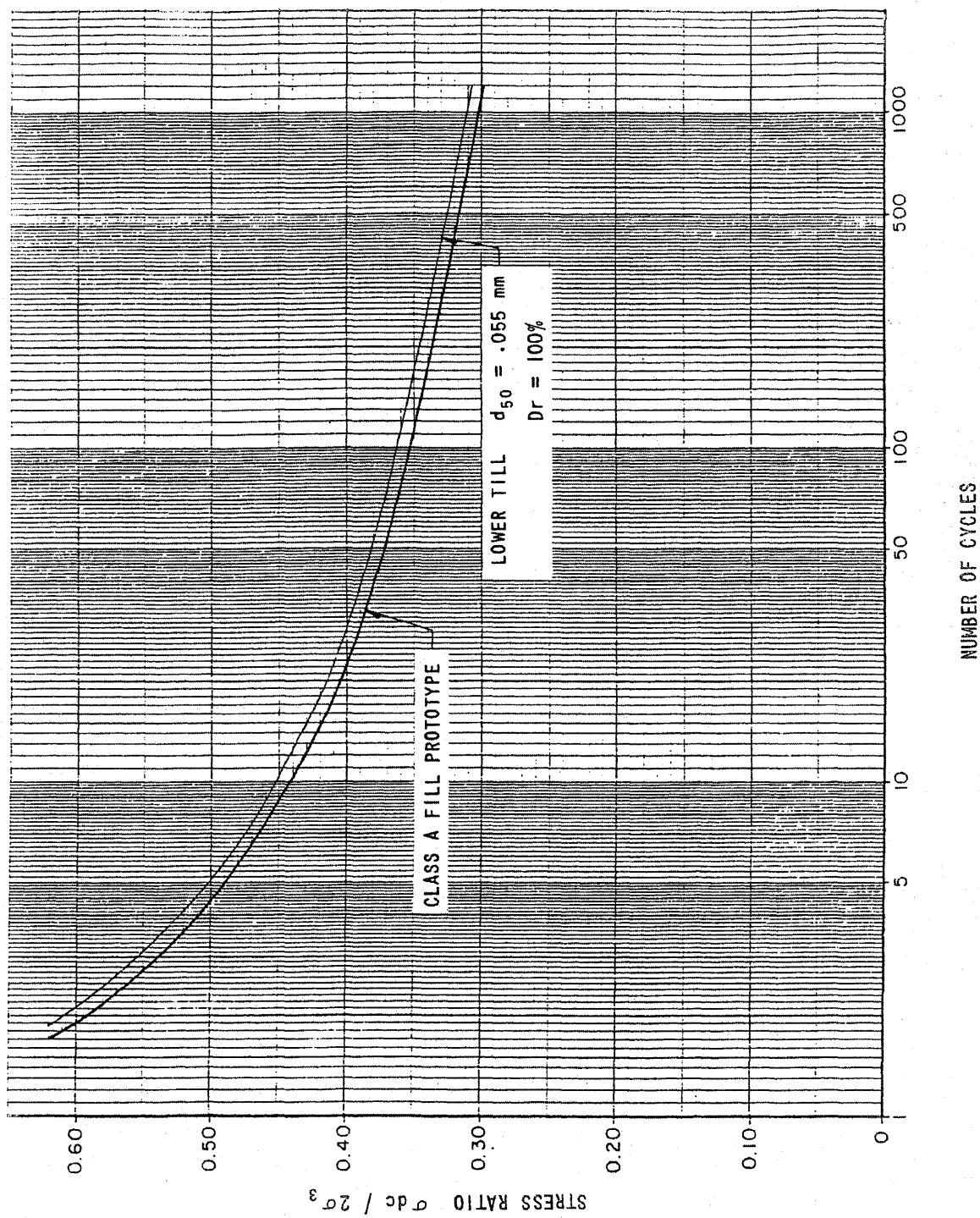
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Groundwater Profiles

Figure 2.5-188 (Sheet 4 of 4)



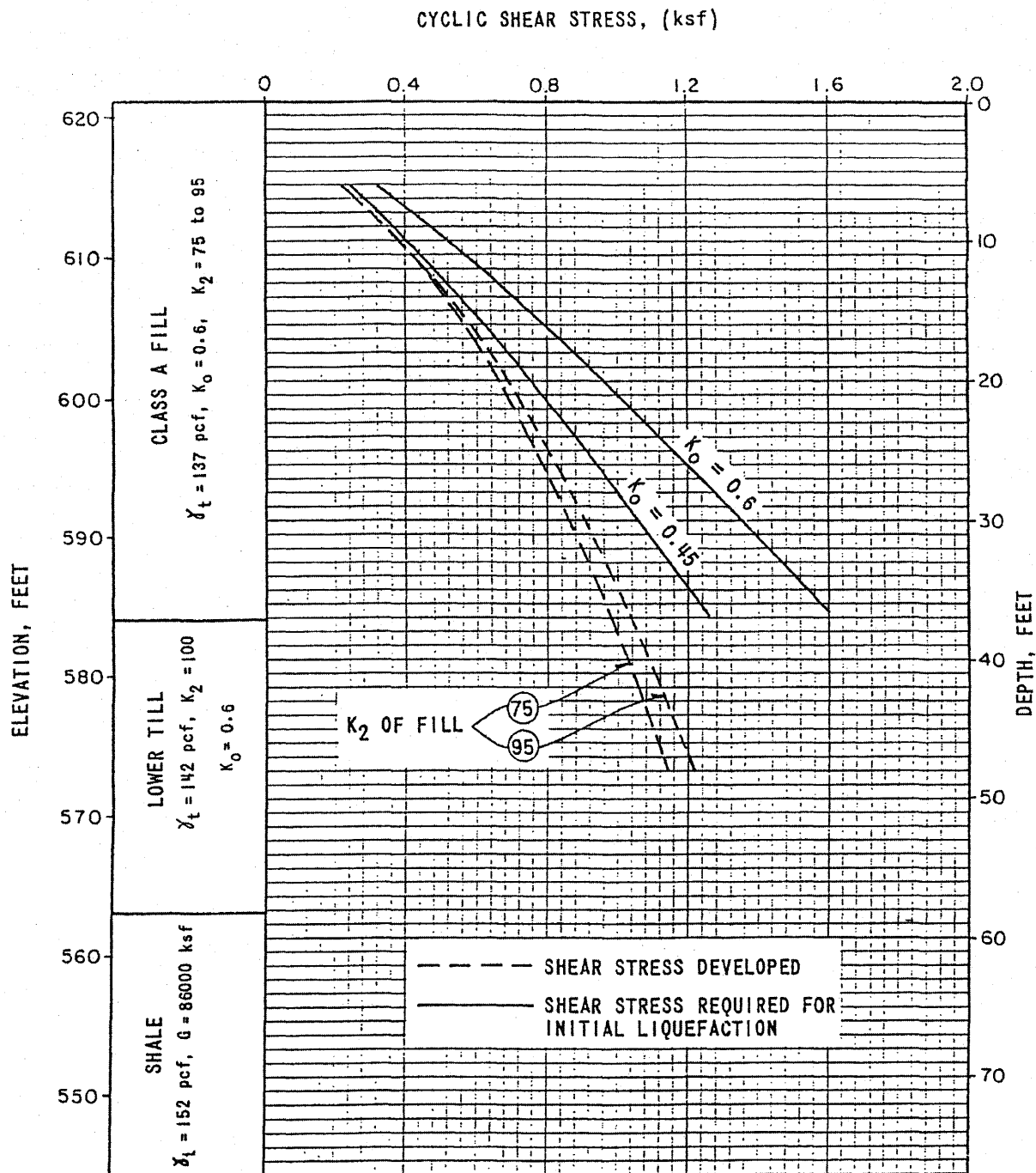
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Number of Cycles Required
for Initial Liquefaction

Figure 2.5-189



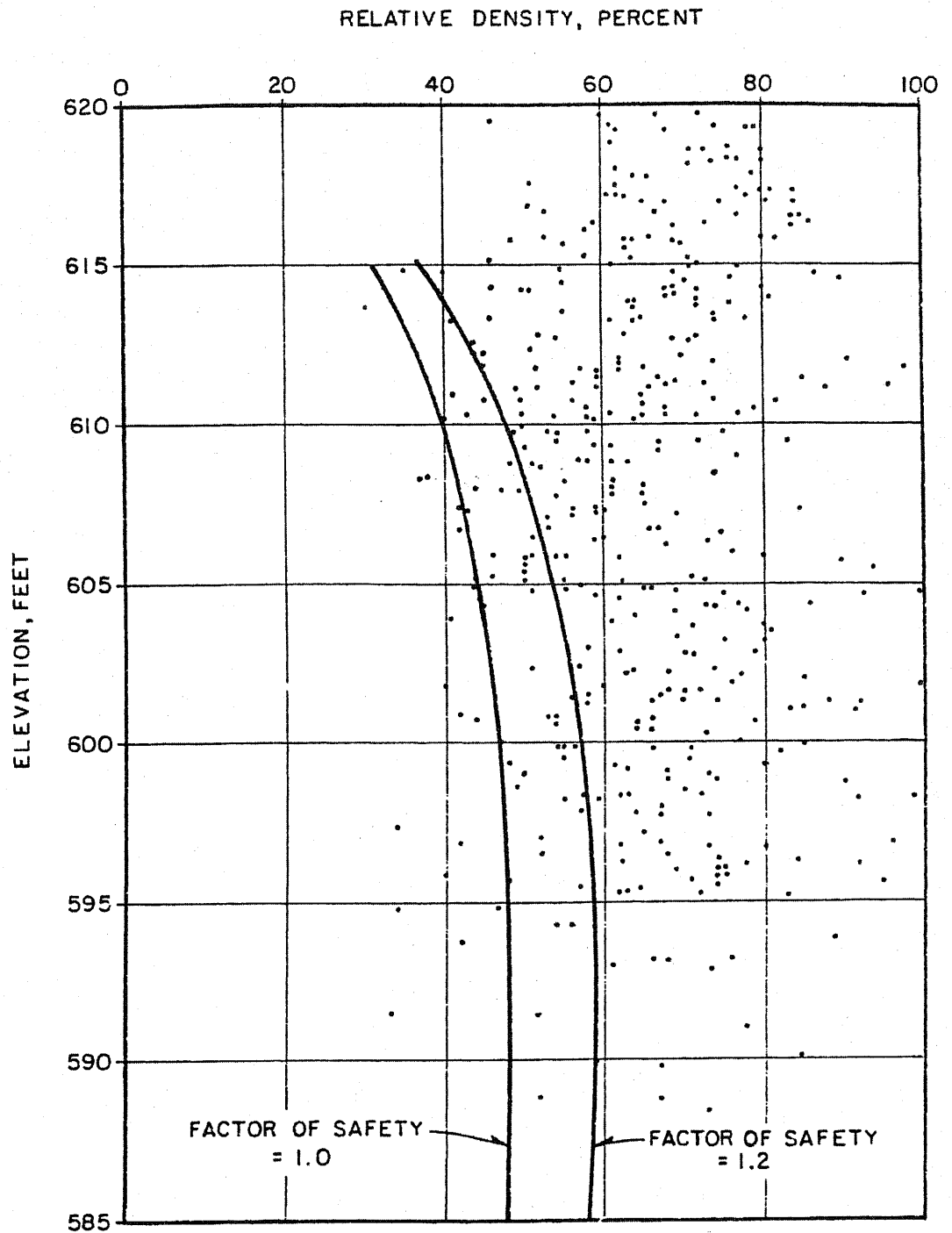
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Cycle Stress Developed and
 Required for Initial
 Liquefaction in 10 Stress Cycles

Figure 2.5-190



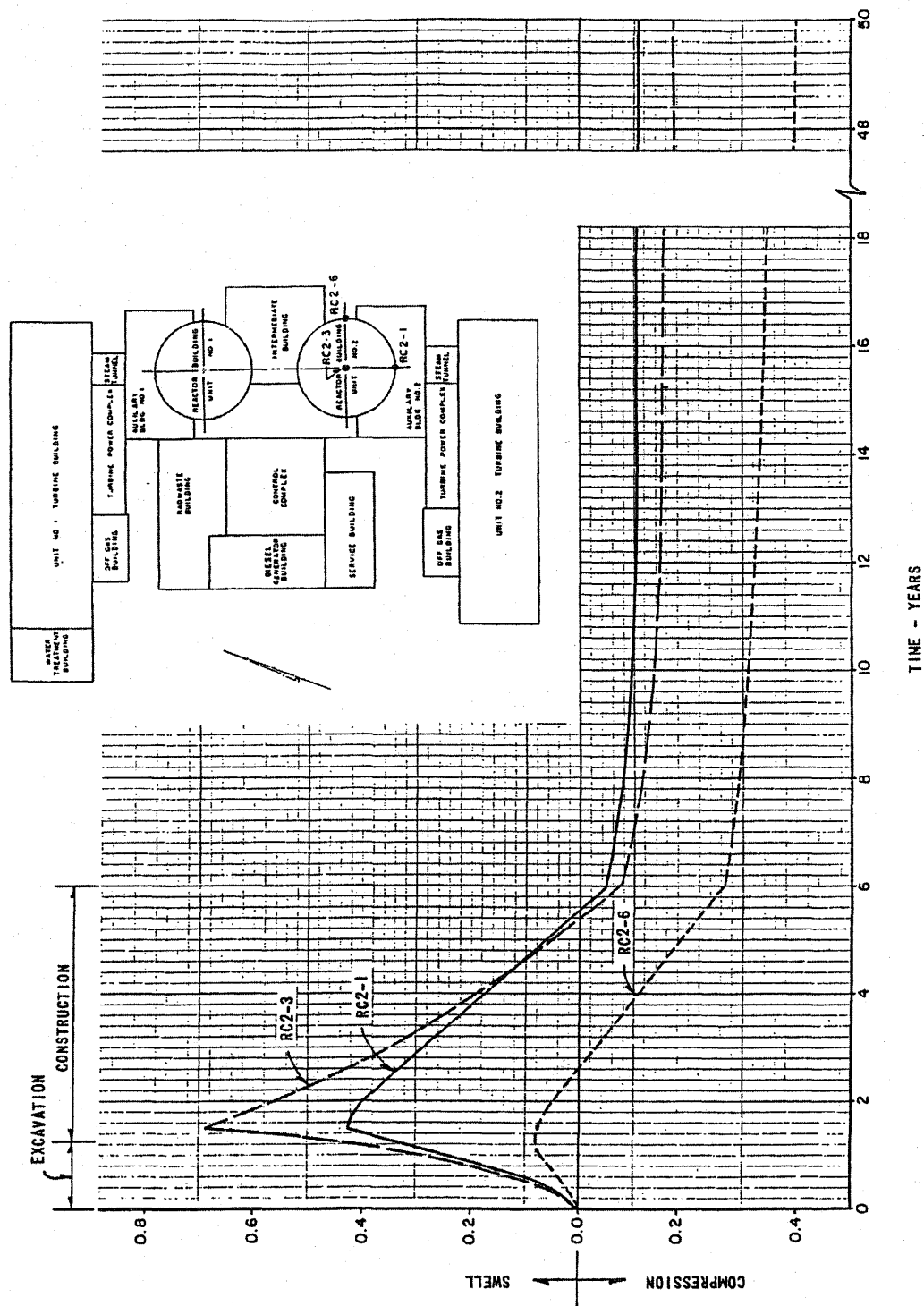
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Liquefaction Potential Analysis
of Lacustrine Sediments

Figure 2.5-191



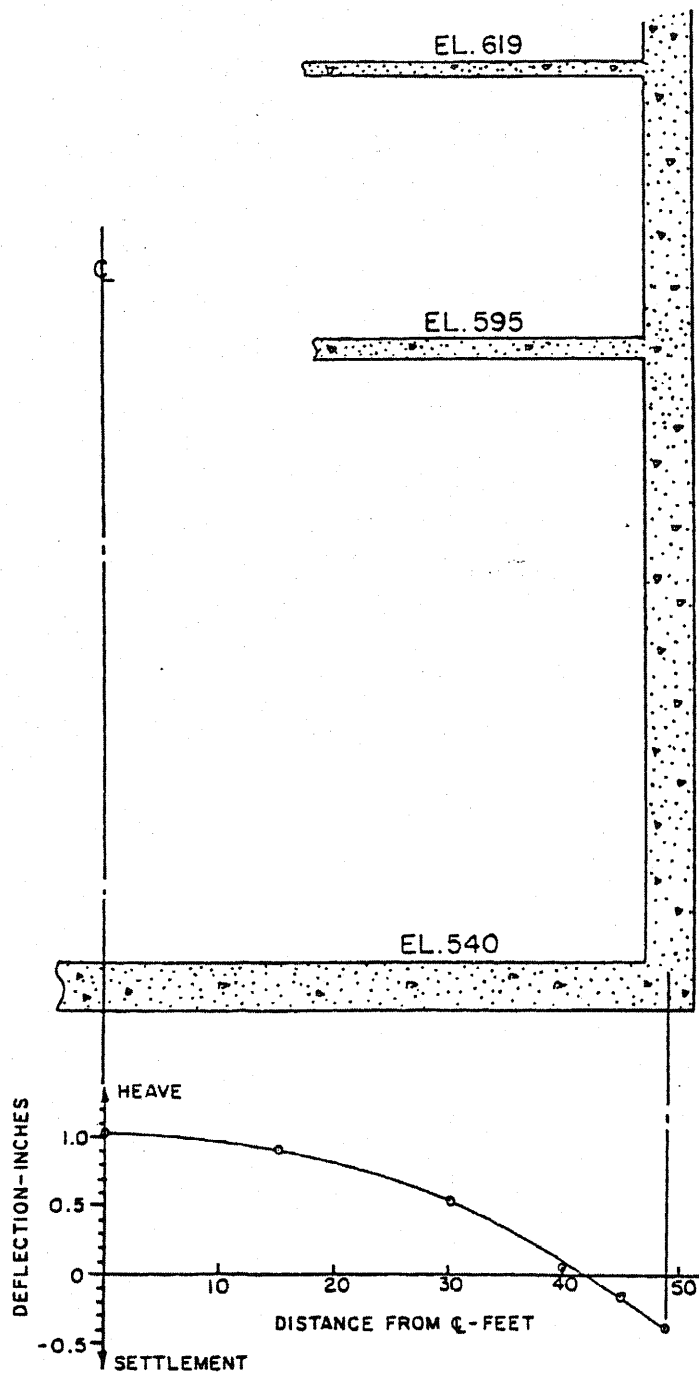
SUBGRADE DEFORMATION - INCHES
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Time-Deformation Analysis for
Reactor Building Complex

Figure 2.5-192



NOTES:

- (1) K_0 (SHALE) = 2.0
- (2) K_0 (FILL) = 1.0
- (3) ANALYSIS ASSUMES 33% OF TOTAL SHALE SWELL OCCURS BEFORE MAT PLACEMENT.
- (4) DEFLECTION SHOWN IS FOR END OF CONSTRUCTION CONDITION PRIOR TO SERVICE LOADING.

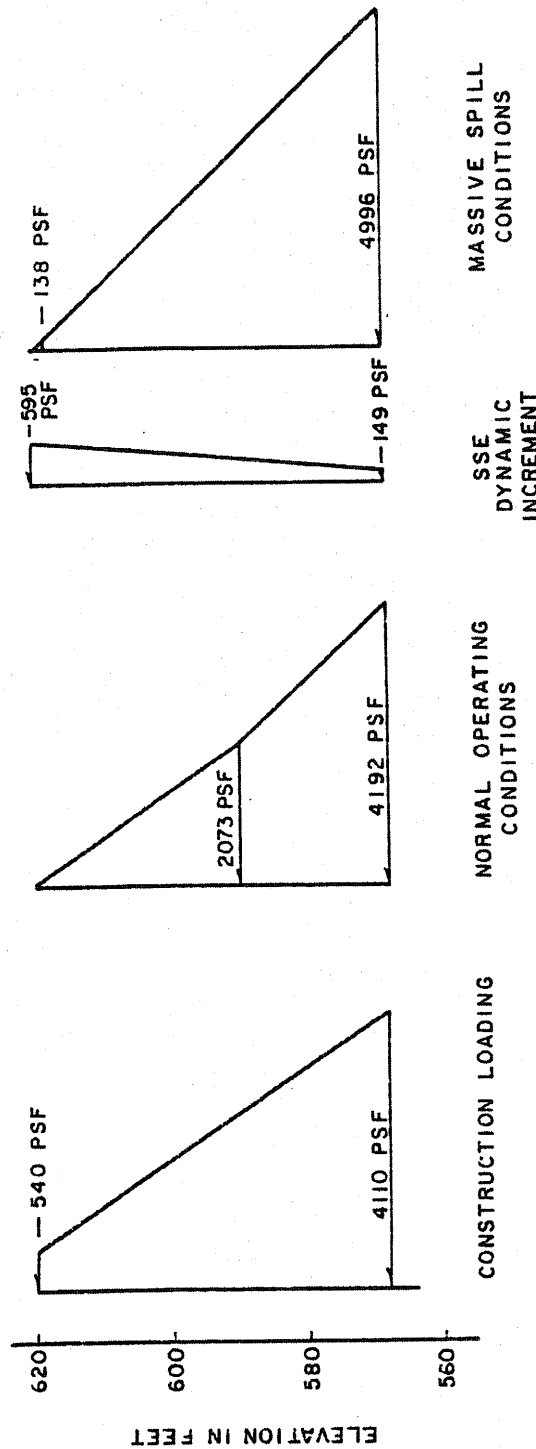
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Deformation Analysis for
Emergency Service Water Pumphouse

Figure 2.5-193



- NOTE: 1. DYNAMIC INCREMENT ADDED TO NORMAL OPERATING CONDITIONS FOR SSE EVENT
2. ADDITIONAL LOADINGS DUE TO SURCHARGE FROM CRANES, RAILROADS OR ADJACENT FOUNDATIONS ADDED AS REQUIRED
3. FOR LOADS APPLICABLE TO EMERGENCY SERVICE WATER PUMPHOUSE SEE FIGURE 2.5-195

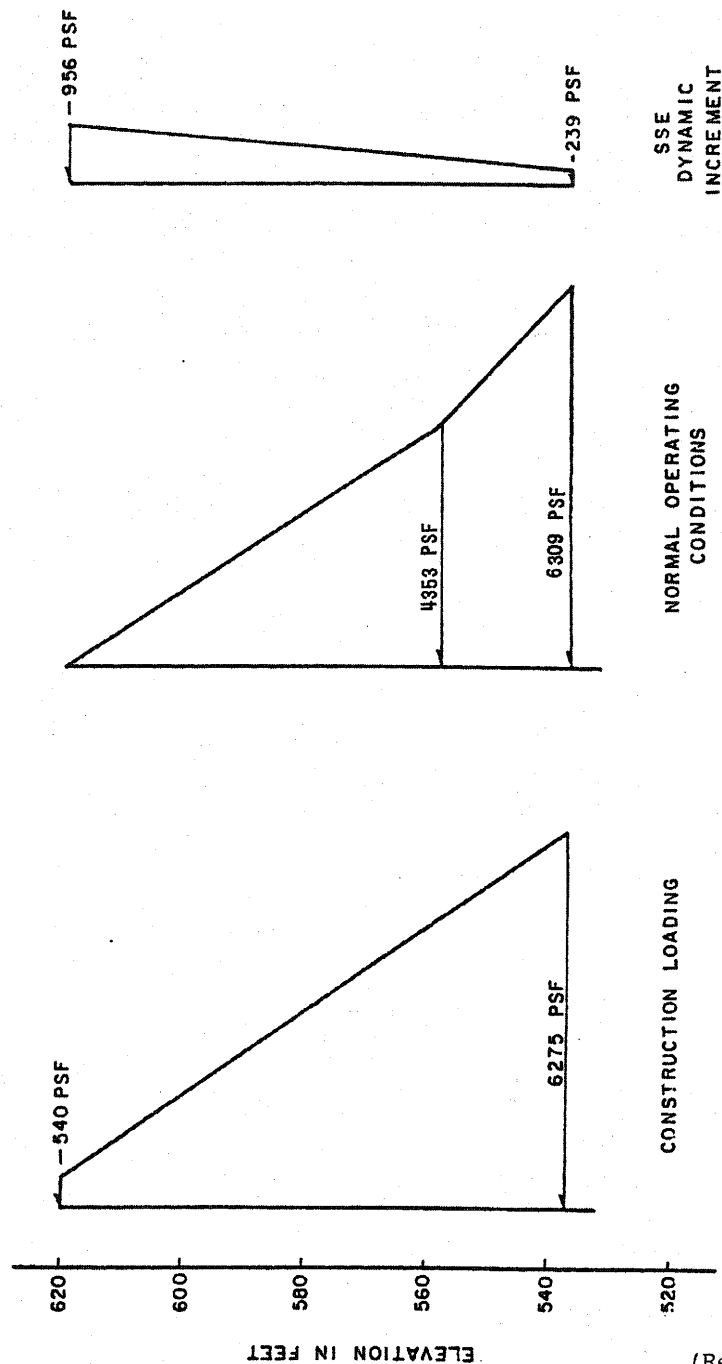
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Earth Pressure Diagrams for
Rigid Subsurface Walls

Figure 2.5-194



NOTE: DYNAMIC INCREMENTS ADDED TO NORMAL OPERATIONS CONDITIONS FOR SSE EVENT

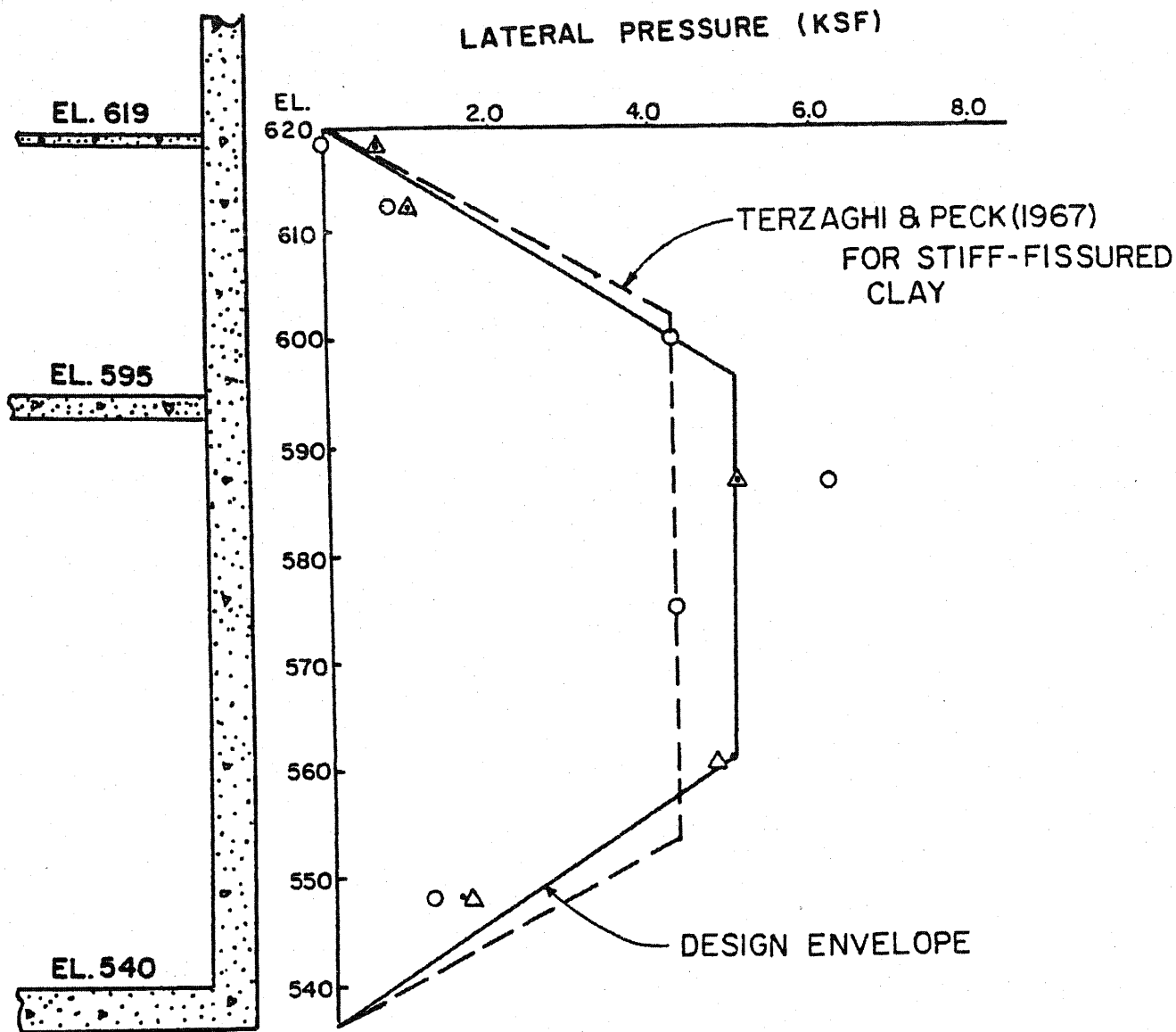
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Earth Pressure Diagrams
for Emergency Service Water
Pumphouse Subsurface Walls

Figure 2.5-195



LEGEND:

- CASE 1; $K_0(\text{SHALE}) = 2$, $K_0(\text{FILL}) = 1$ INCREMENTAL WALL CONSTRUCTION
- △ CASE 2; $K_0(\text{SHALE}) = 2$, $K_0(\text{FILL}) = 1$
- CASE 3; $K_0(\text{SHALE}) = 1$, $K_0(\text{FILL}) = 0.5$

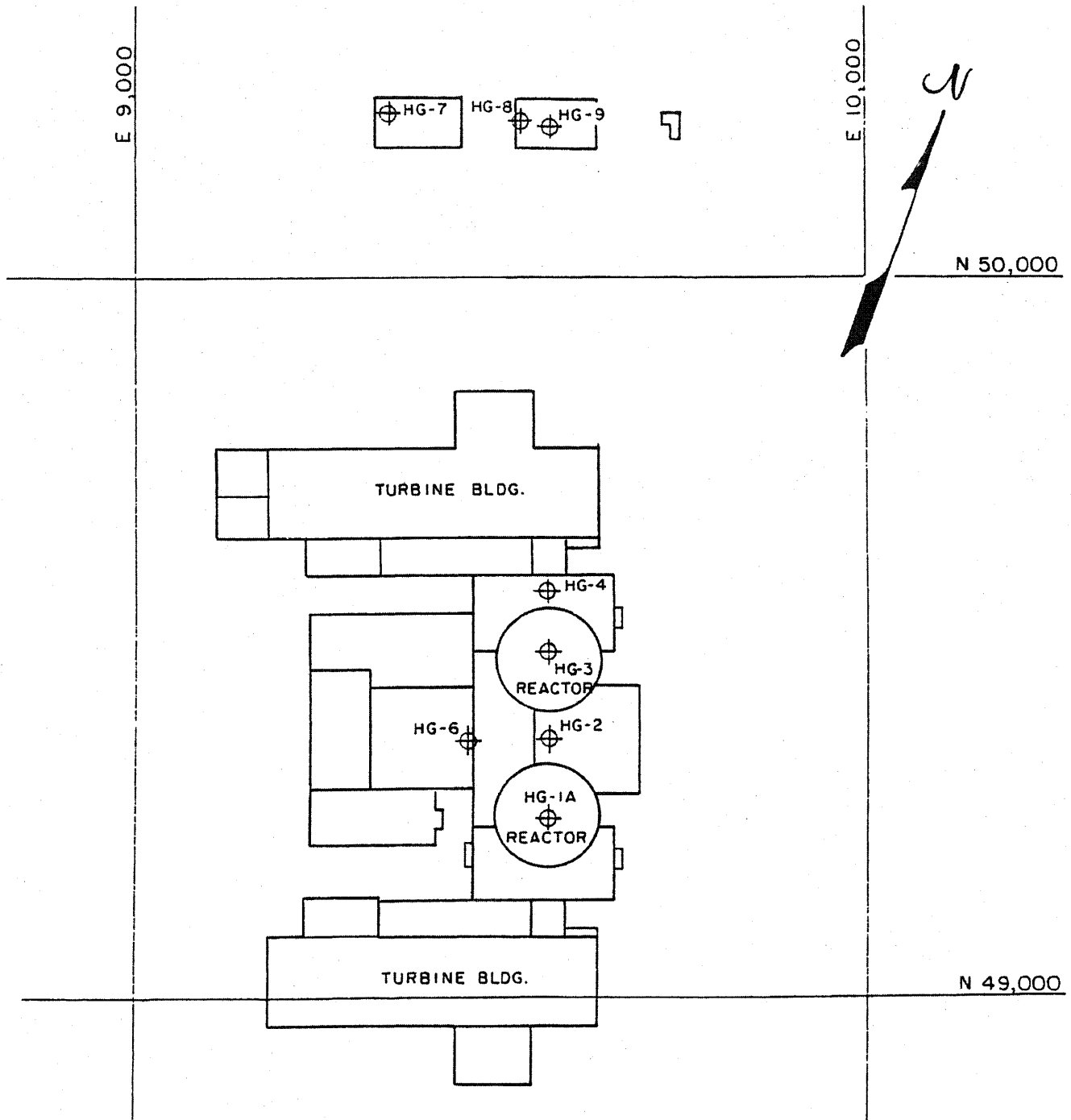
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Lateral Pressure - Emergency
Service Water Pumphouse

Figure 2.5-196



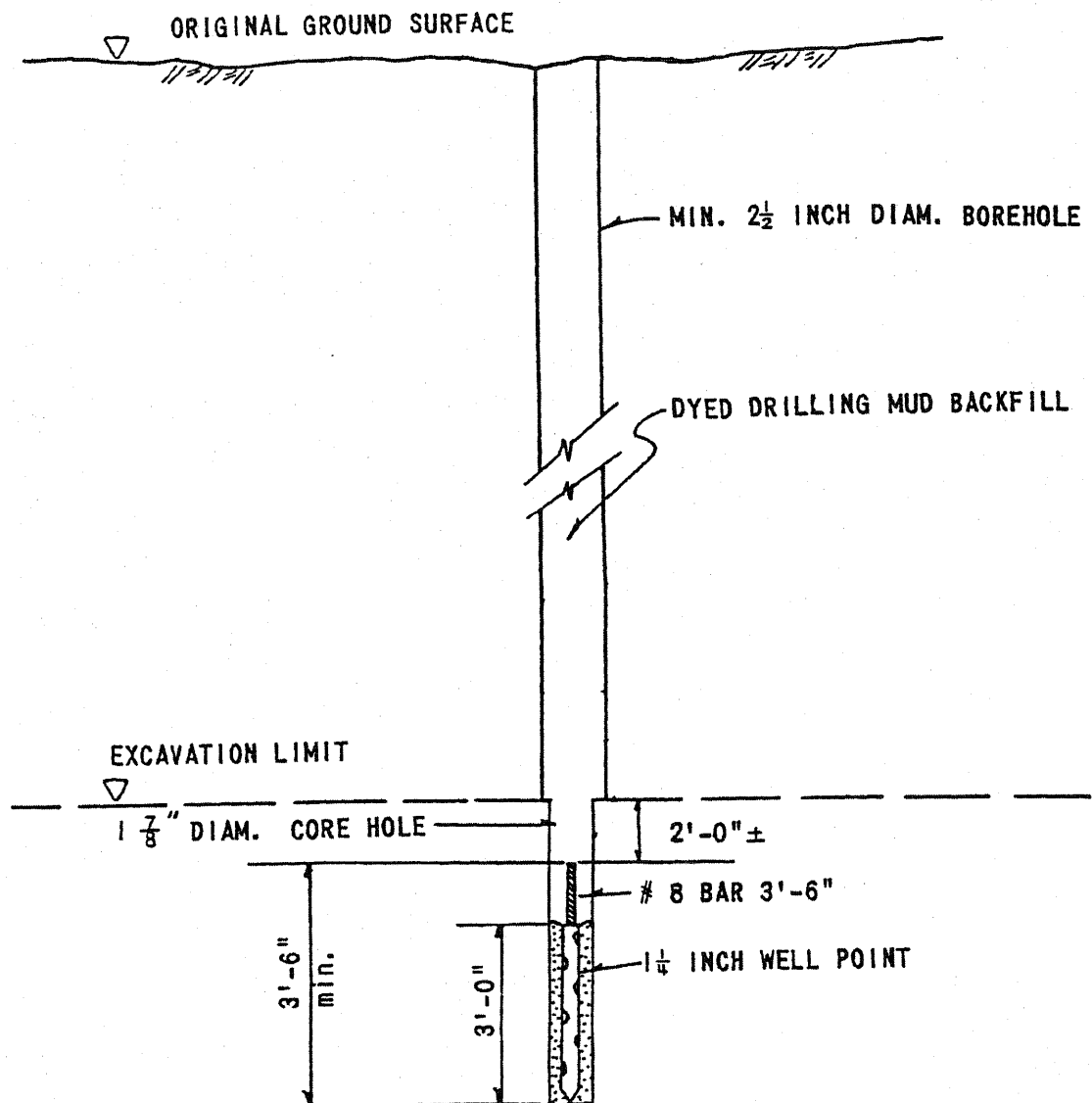
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Shale Heave Gauge
Location Plan

Figure 2.5-197



NOTE: # 8 BAR PLACED WITH AND DRIVEN INTO $1\frac{1}{4}$ INCH WELL POINT
ELEVATION OF TOP OF BAR ESTABLISHED FROM SURFACE

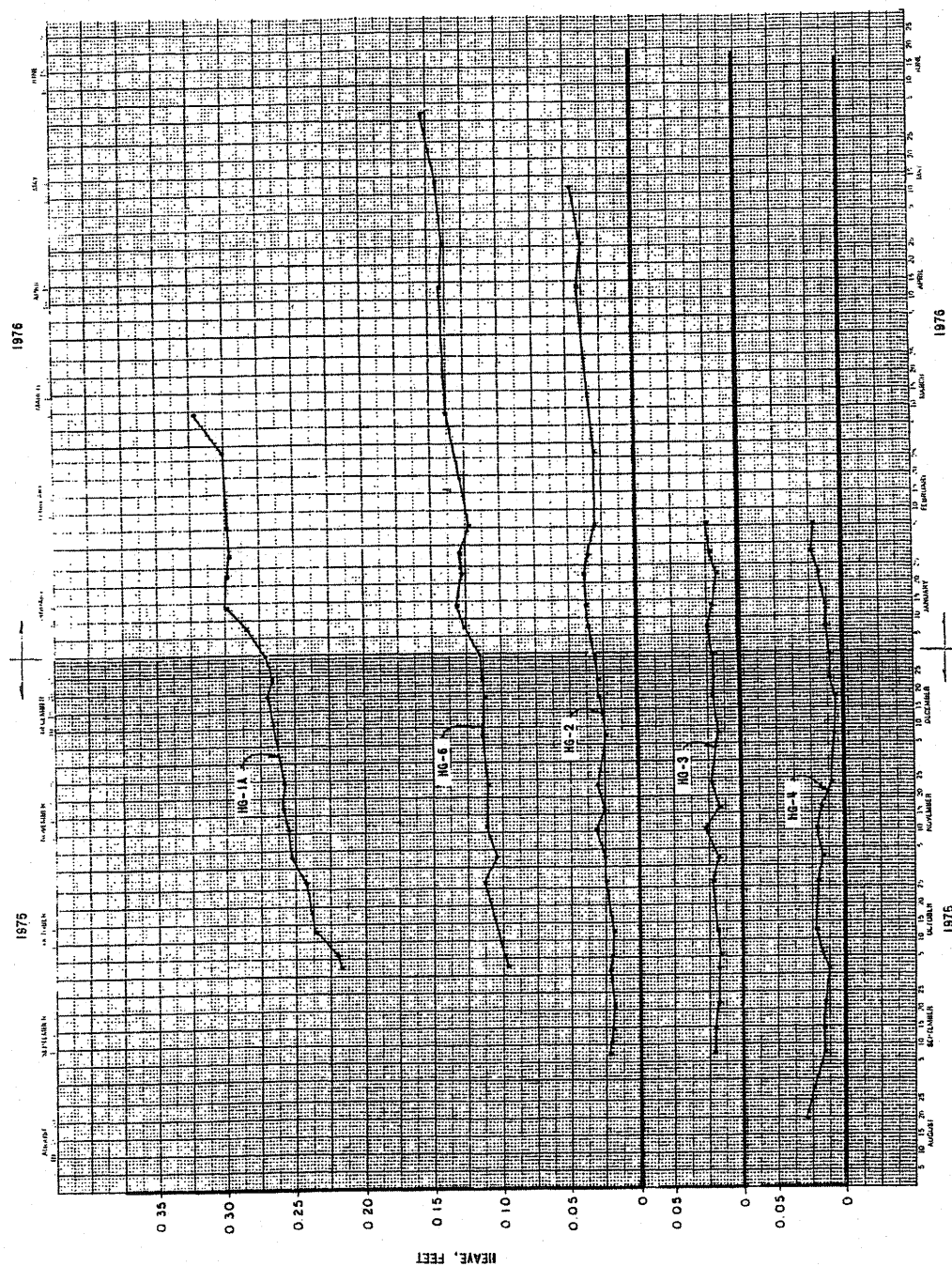
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Shale Heave Gauge Detail

Figure 2.5-198



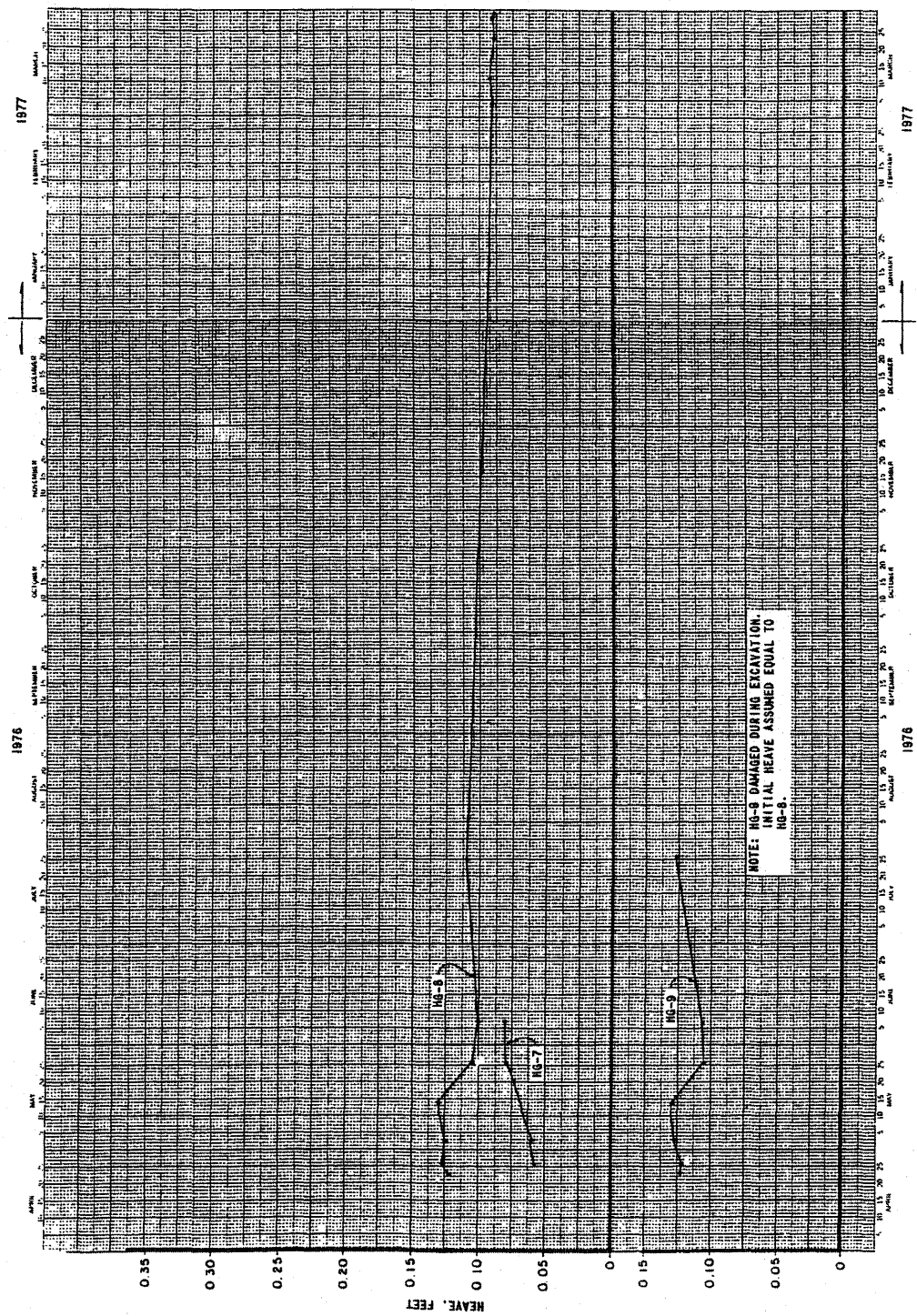
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Shale Heave Gauge Monitoring Data

Figure 2.5-199 (Sheet 1 of 2)



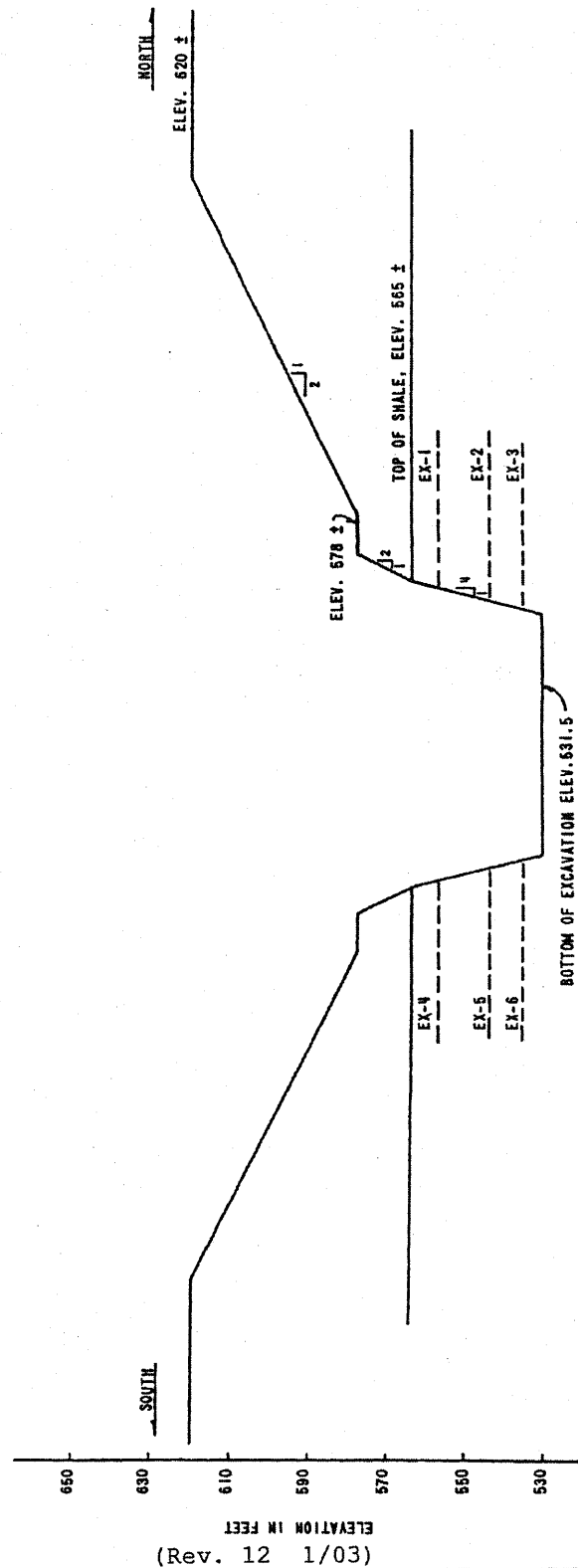
(Rev. 12 1/03)



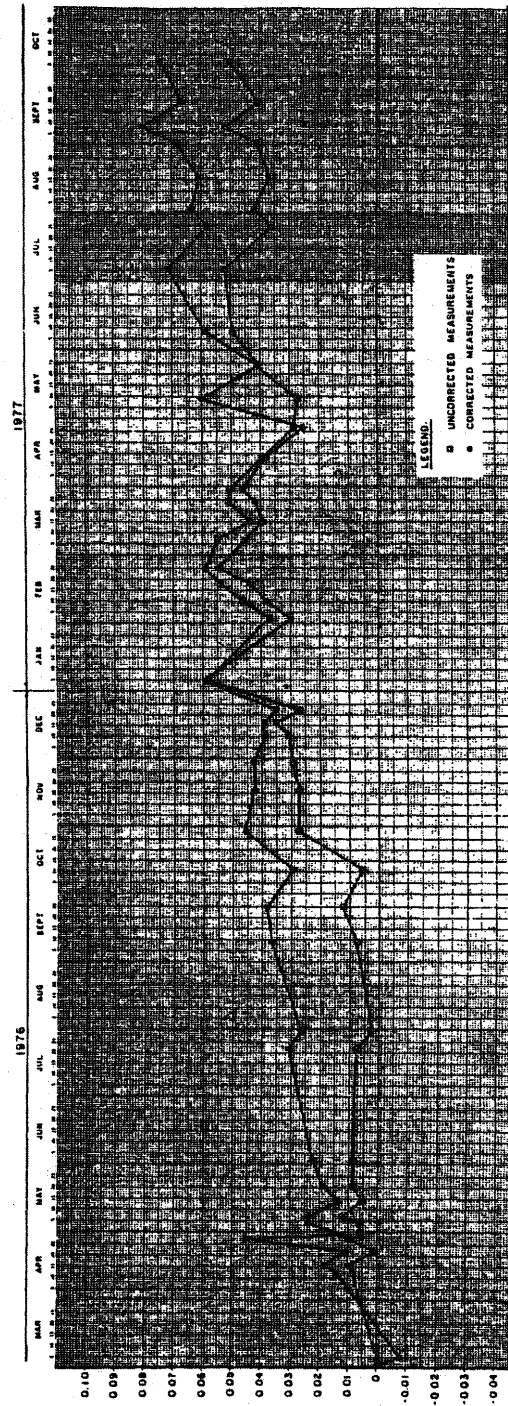
PERRY NUCLEAR POWER PLANT

Shale Heave Gauge Monitoring Data

Figure 2.5-199 (Sheet 2 of 2)



EXTENSOMETER EX-1



RELATIVE DEFORMATION (INCHES)
 (Rev. 12 1/03)

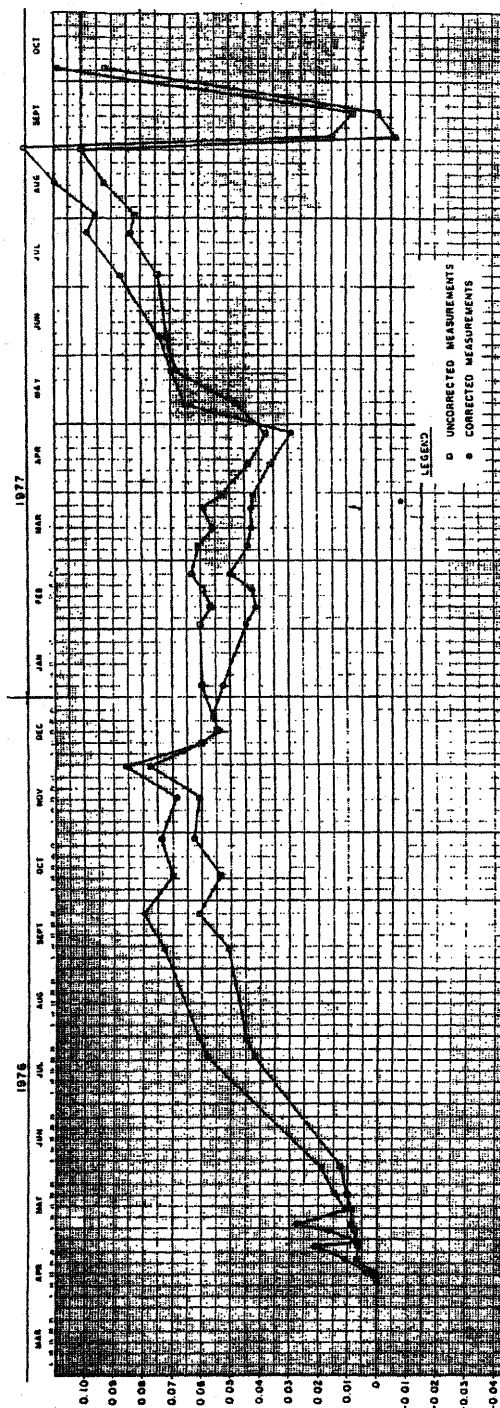


PERRY NUCLEAR POWER PLANT

Shale Extensometers Monitoring
 Data

Figure 2.5-202 (Sheet 1 of 6)

EXTENSOMETER EX-2



RELATIVE DEFORMATION (INCHES)
(Rev. 12 1/03)

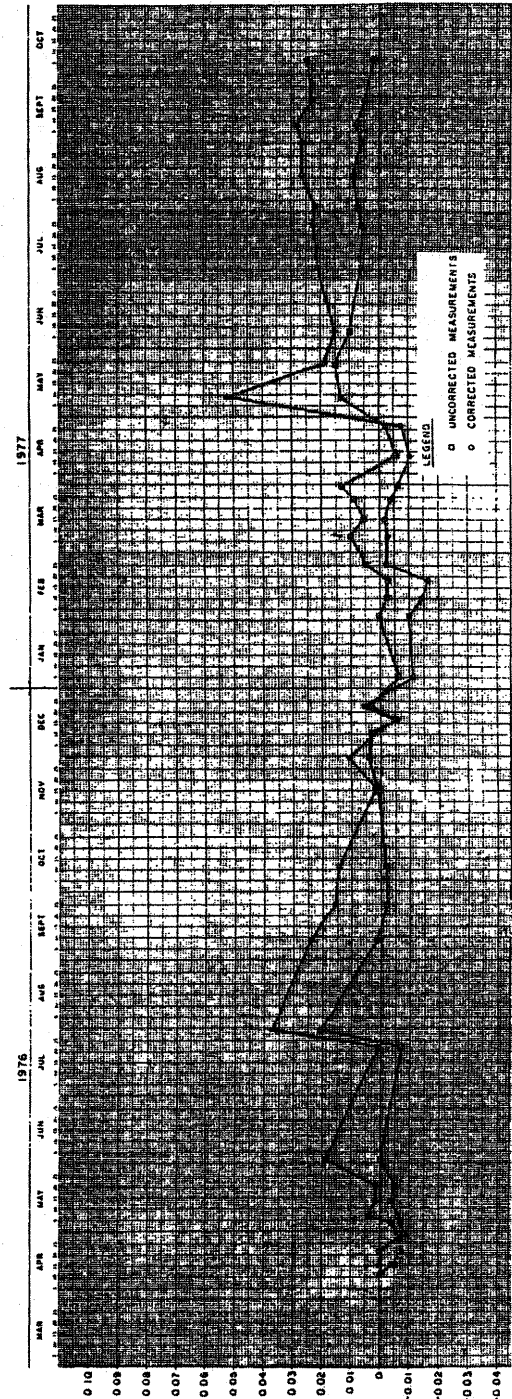


PERRY NUCLEAR POWER PLANT

Shale Extensometers Monitoring
Data

Figure 2.5-202 (Sheet 2 of 6)

EXTENSOMETER EX-3



RELATIVE DEFORMATION (INCHES)
 (Rev. 12 1/03)

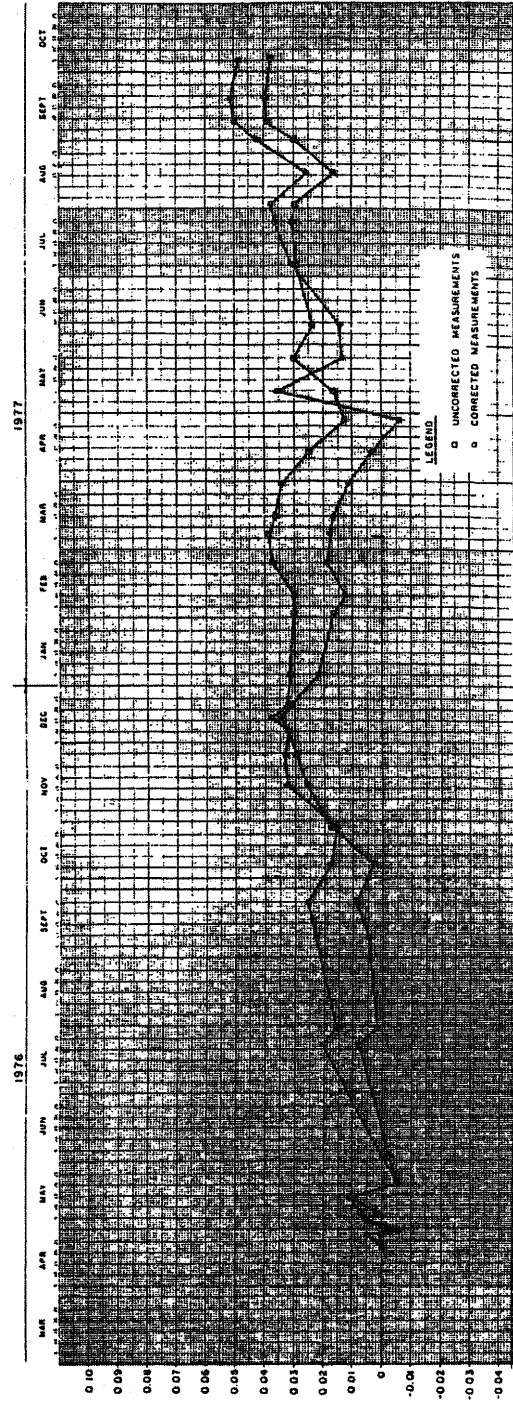


PERRY NUCLEAR POWER PLANT

Shale Extensometers Monitoring
 Data

Figure 2.5-202 (Sheet 3 of 6)

EXTENSOMETER EX-4



RELATIVE DEFORMATION (INCHES)
(Rev. 12 1/03)

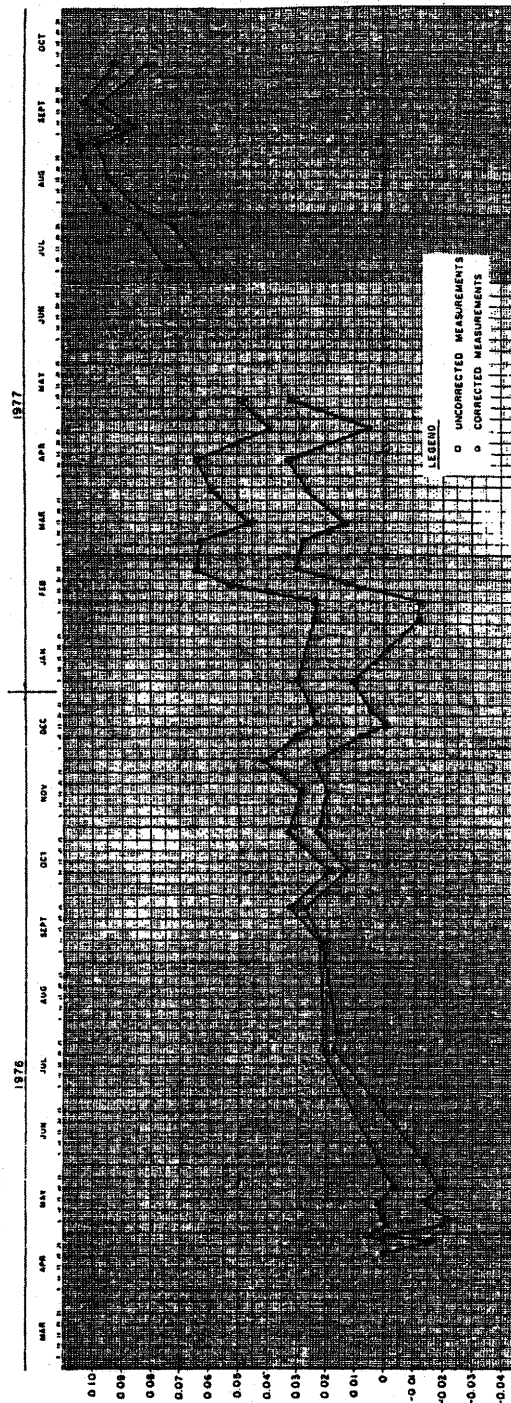


PERRY NUCLEAR POWER PLANT

Shale Extensometers Monitoring
Data

Figure 2.5-202 (Sheet 4 of 6)

EXTENSOMETER EX-5



RELATIVE DEFORMATION (INCHES)
(Rev. 12 1/03)

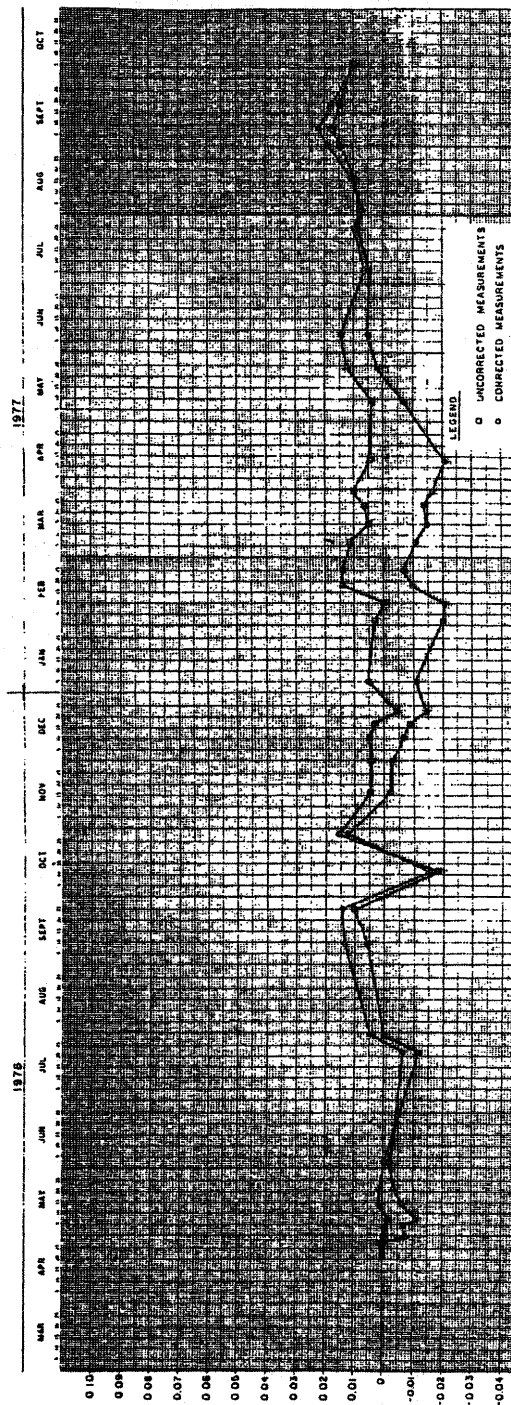


PERRY NUCLEAR POWER PLANT

Shale Extensometers Monitoring
Data

Figure 2.5-202 (Sheet 5 of 6)

EXTENSOMETER EX-6



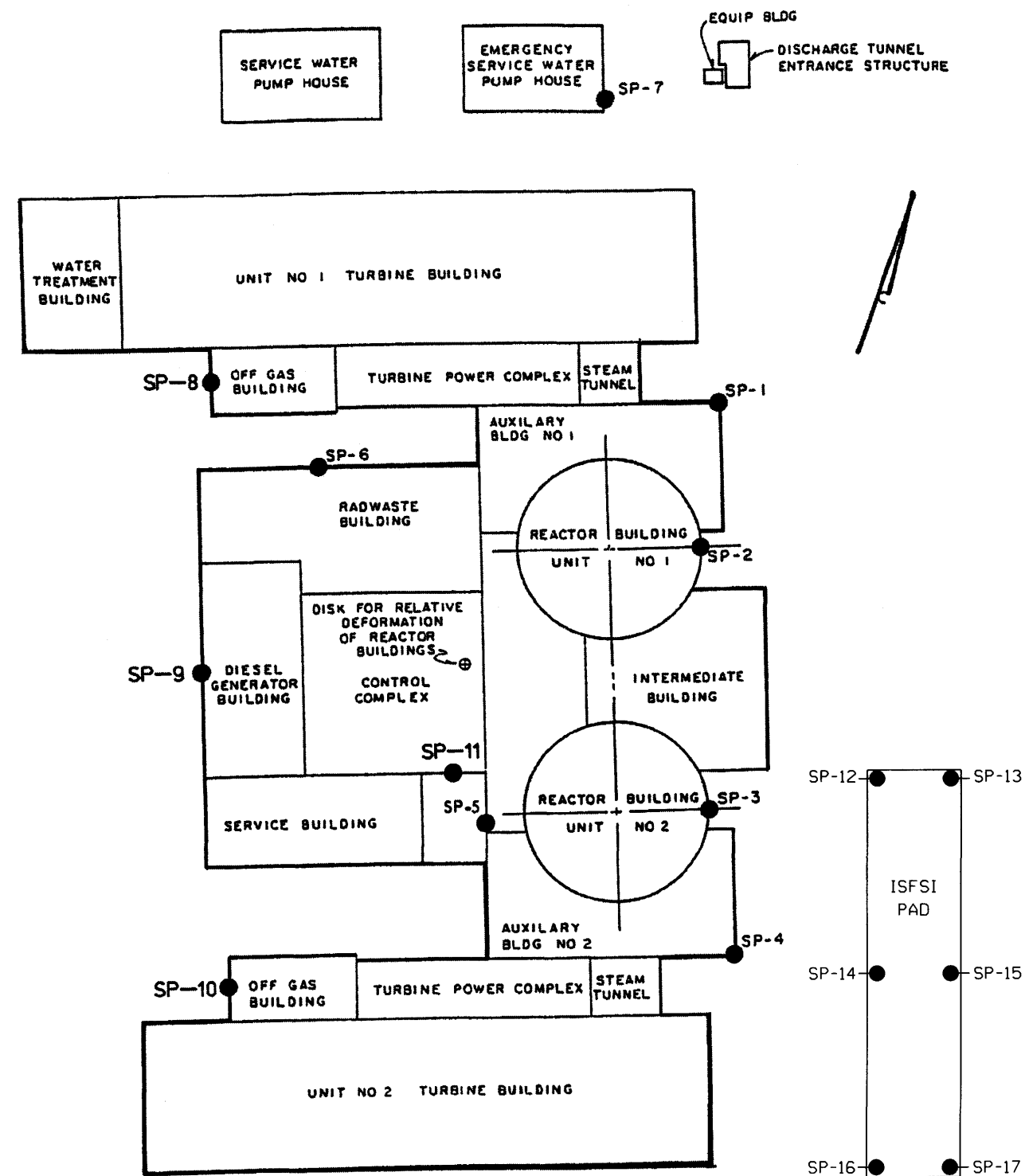
RELATIVE DEFORMATION (INCHES)
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Shale Extensometers Monitoring
Data

Figure 2.5-202 (Sheet 6 of 6)

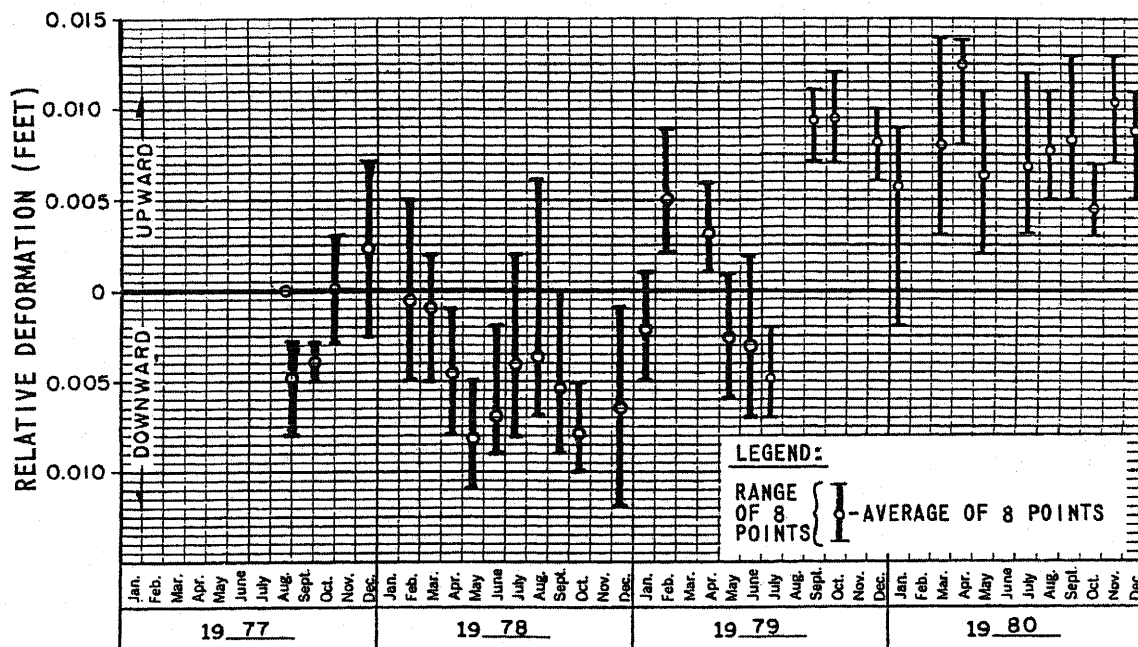
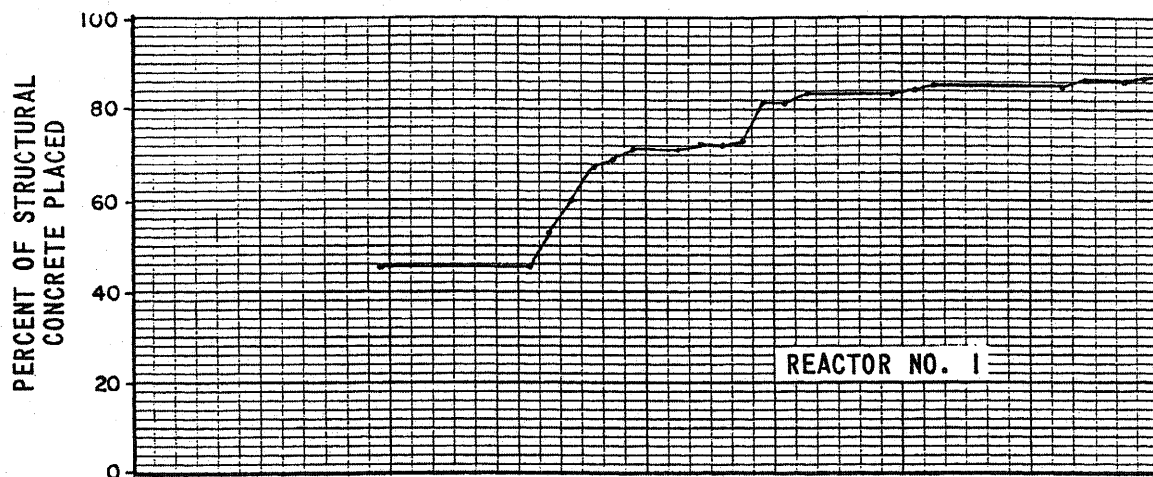


(REV. 19 10/2015)

PERRY NUCLEAR POWER PLANT
10 CENTER RD., PERRY, OHIO 44081

SETTLEMENT MONUMENT
LOCATION PLAN

FIGURE 2.5-203



NOTE: MEASURED DEFORMATION IS RELATIVE TO
MONUMENT WITHIN CONTROL COMPLEX

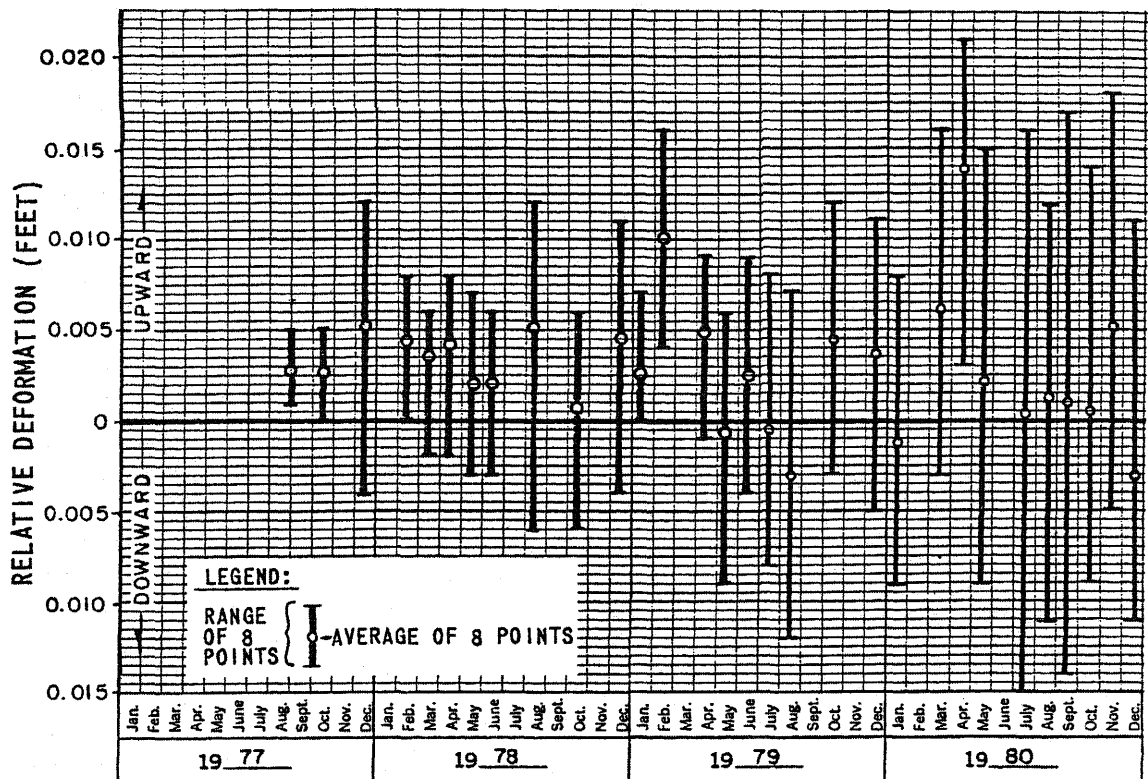
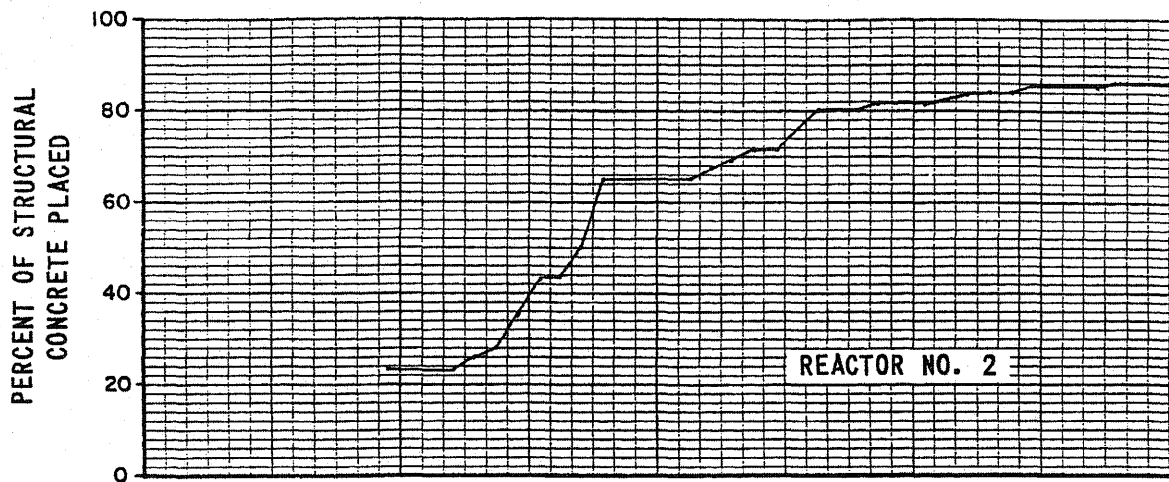
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Reactor Mat Deformation

Figure 2.5-204 (Sheet 1 of 2)



NOTE: MEASURED DEFORMATION IS RELATIVE TO MONUMENT WITHIN CONTROL COMPLEX

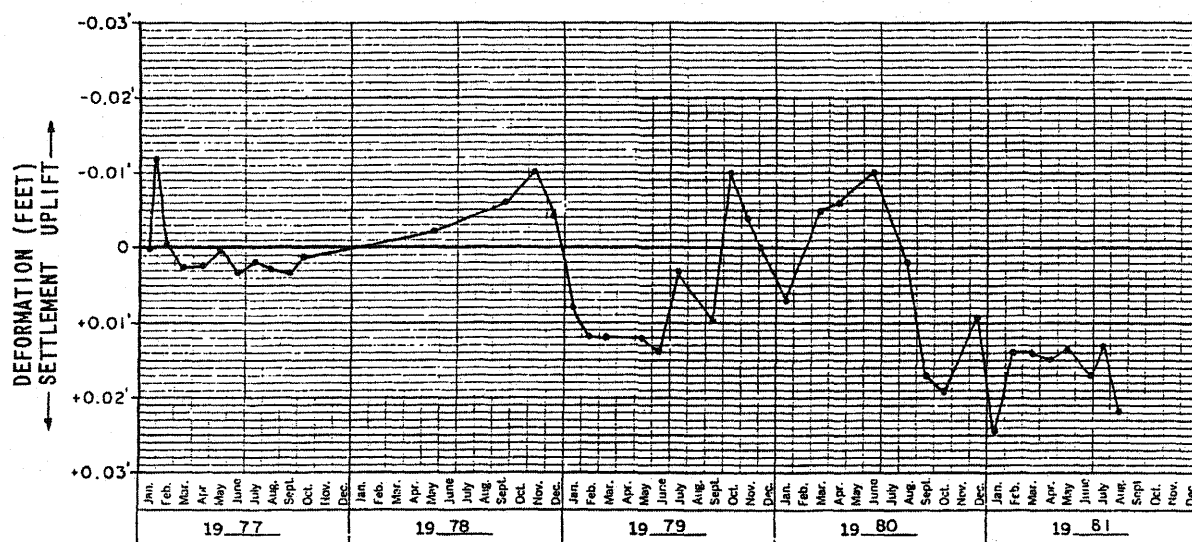
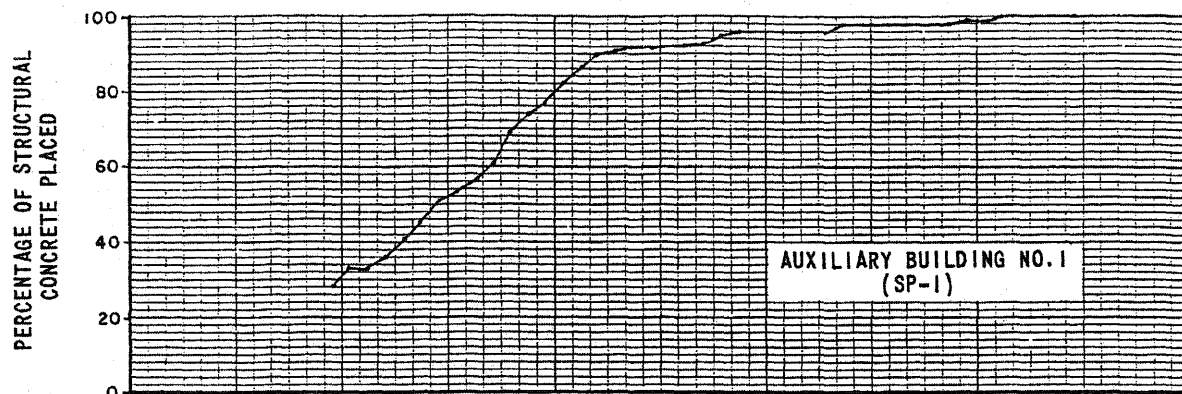
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Reactor Mat Deformation

Figure 2.5-204 (Sheet 2 of 2)



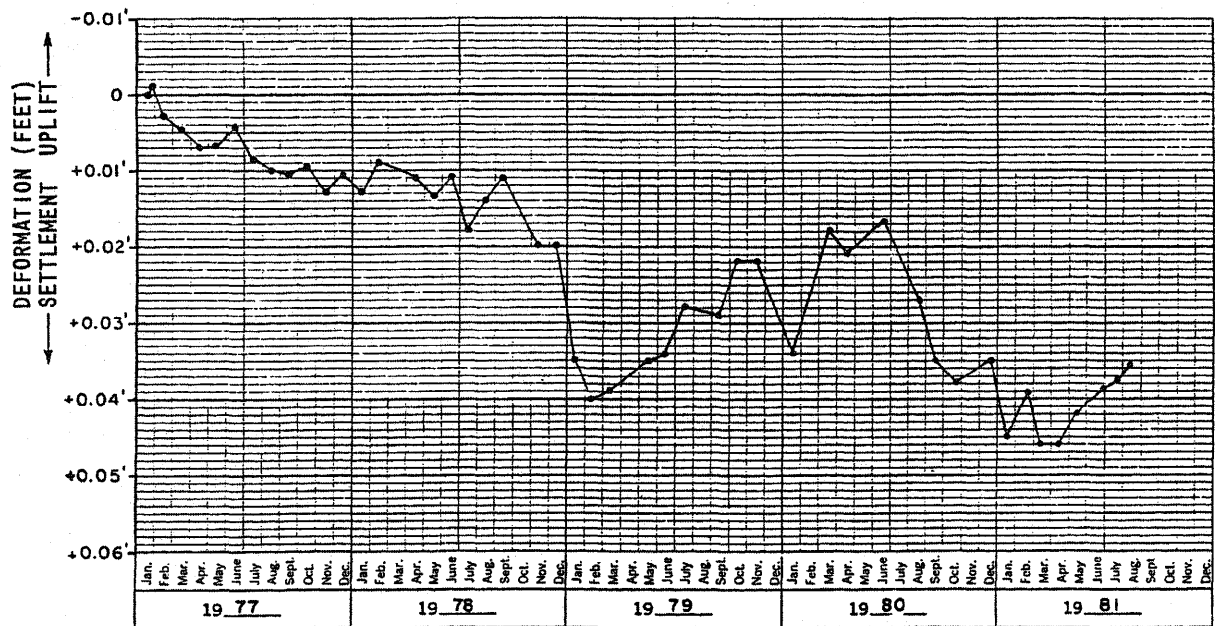
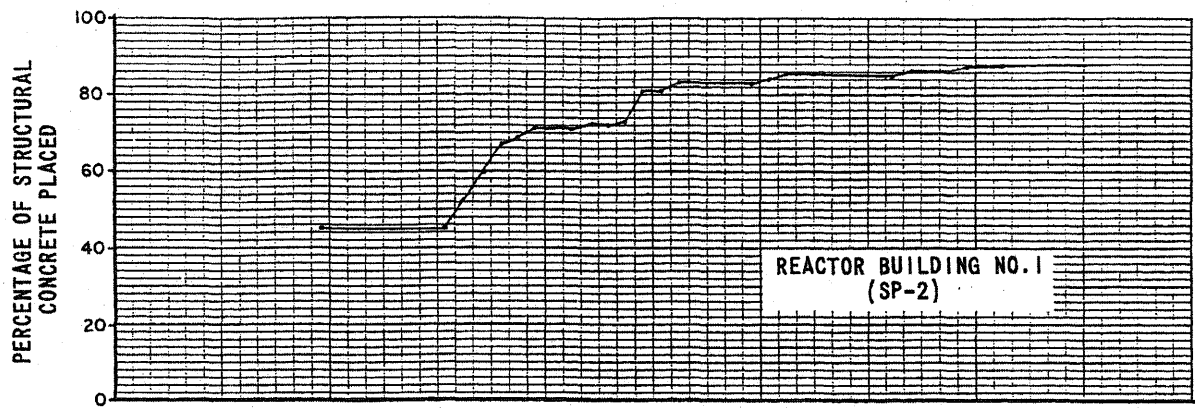
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Settlement Observation Data

Figure 2.5-205 (Sheet 1 of 6)



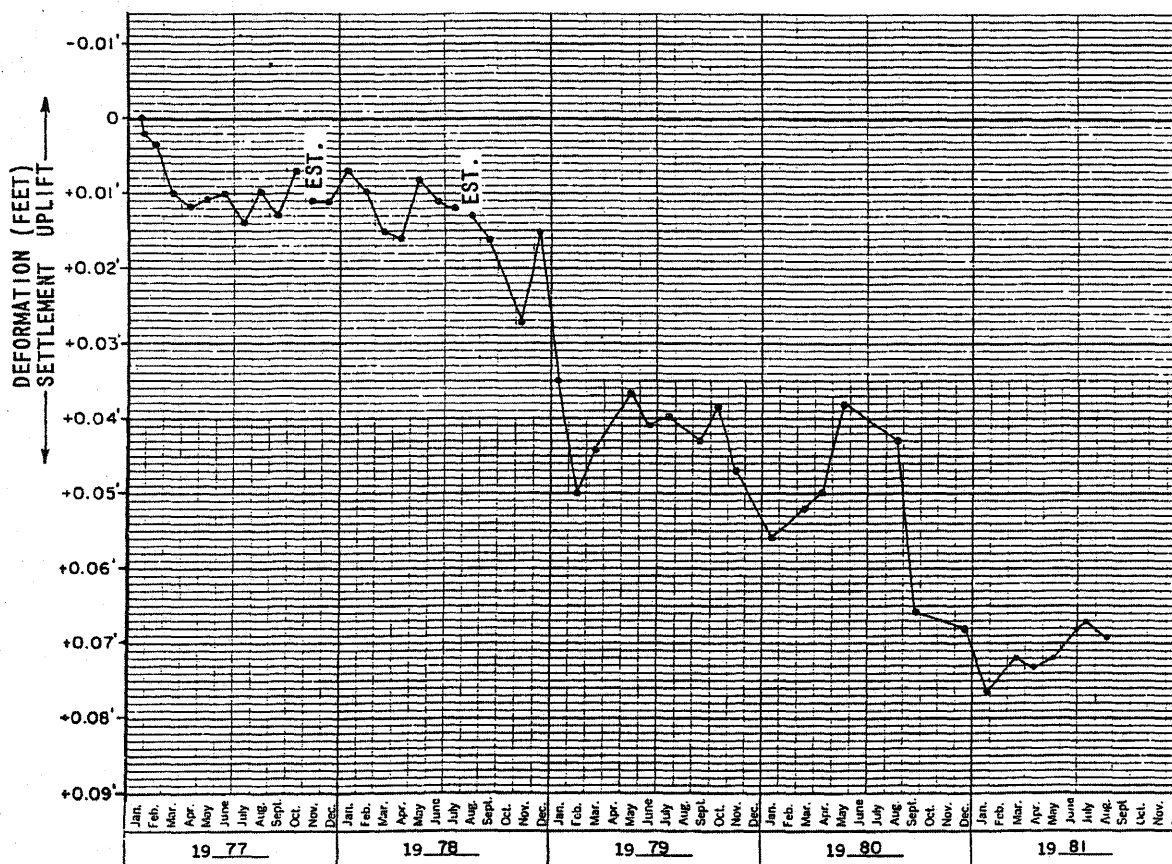
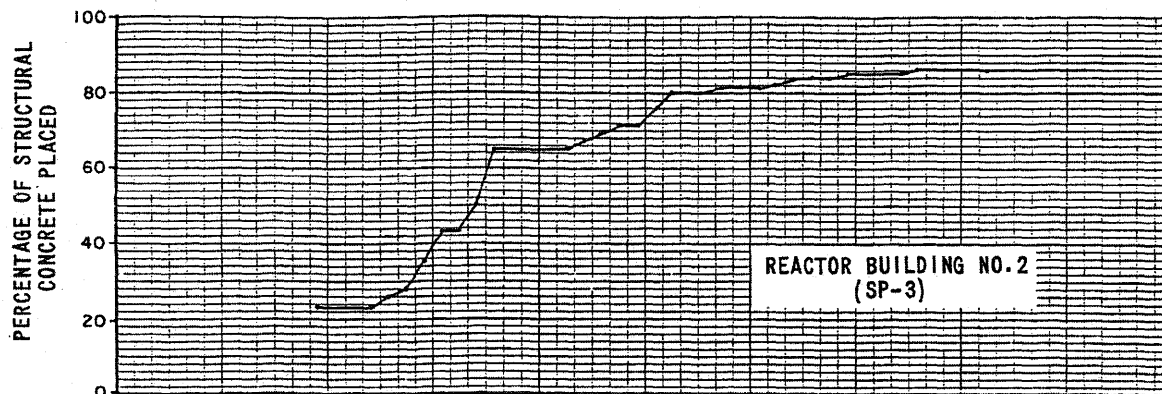
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Settlement Observation Data

Figure 2.5-205 (Sheet 2 of 6)



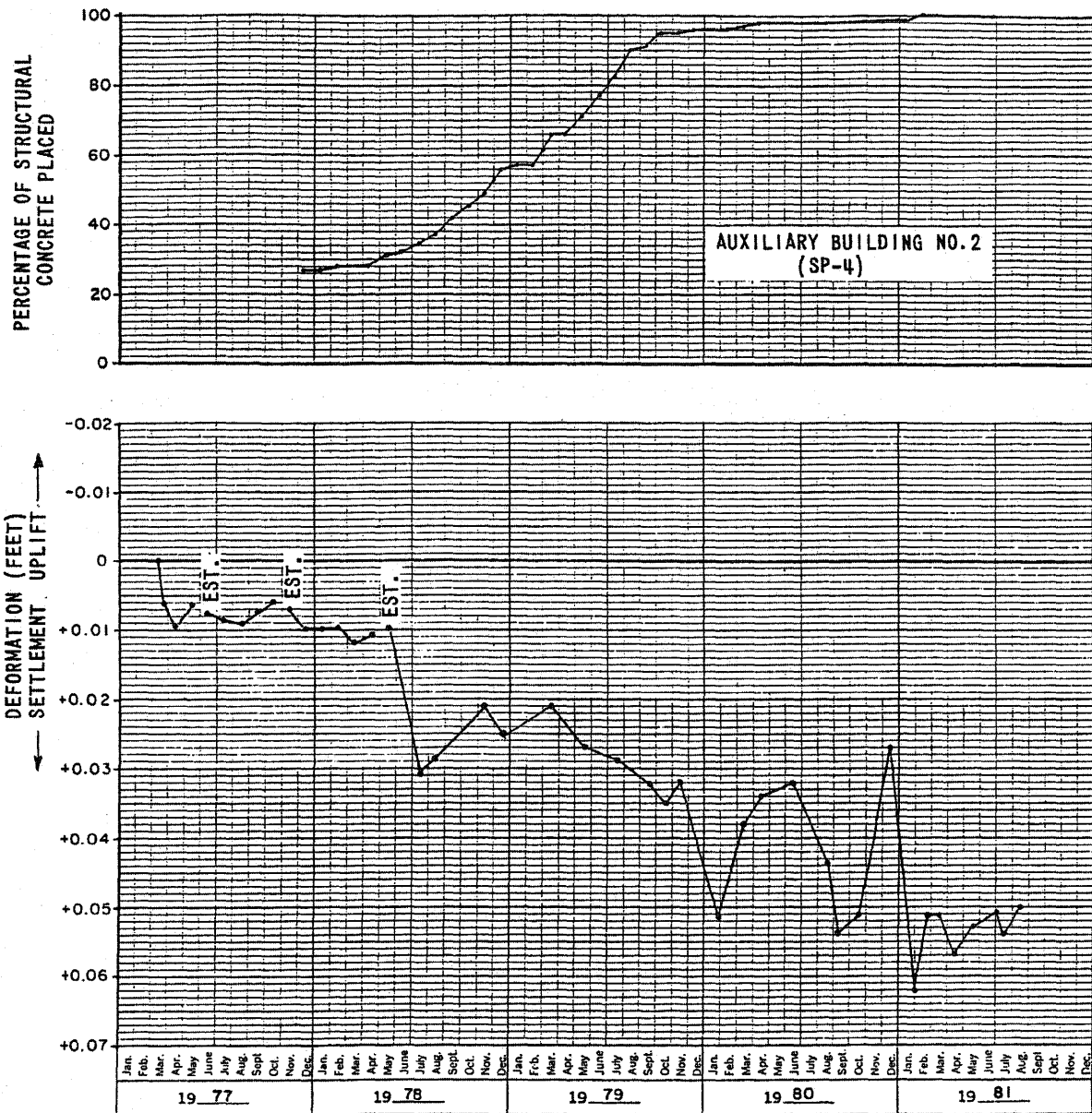
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Settlement Observation Data

Figure 2.5-205 (Sheet 3 of 6)



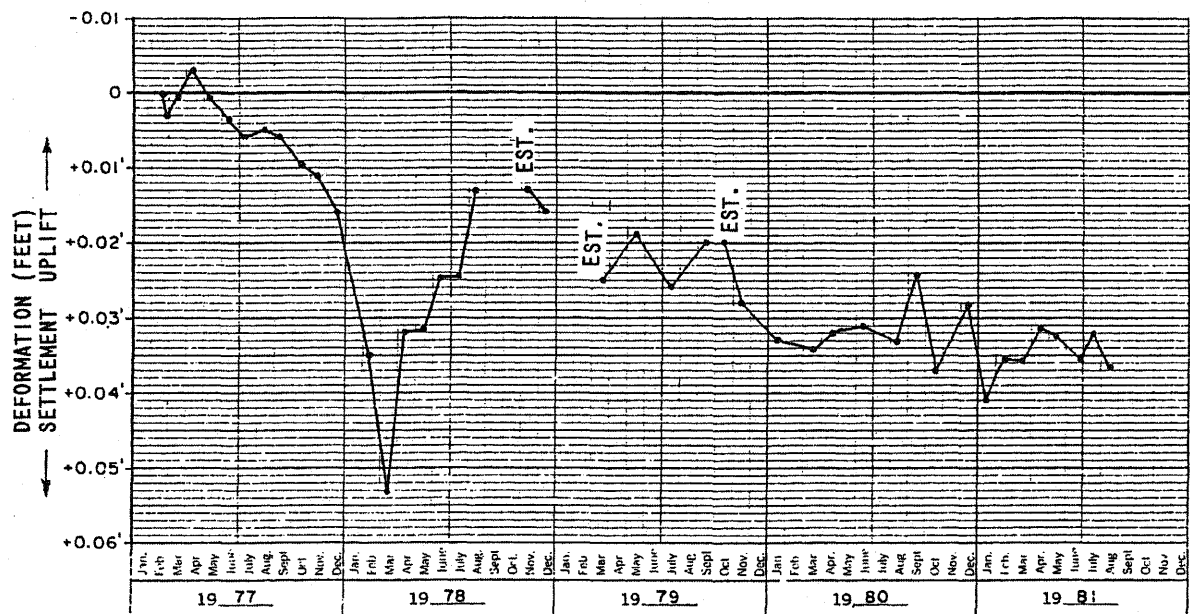
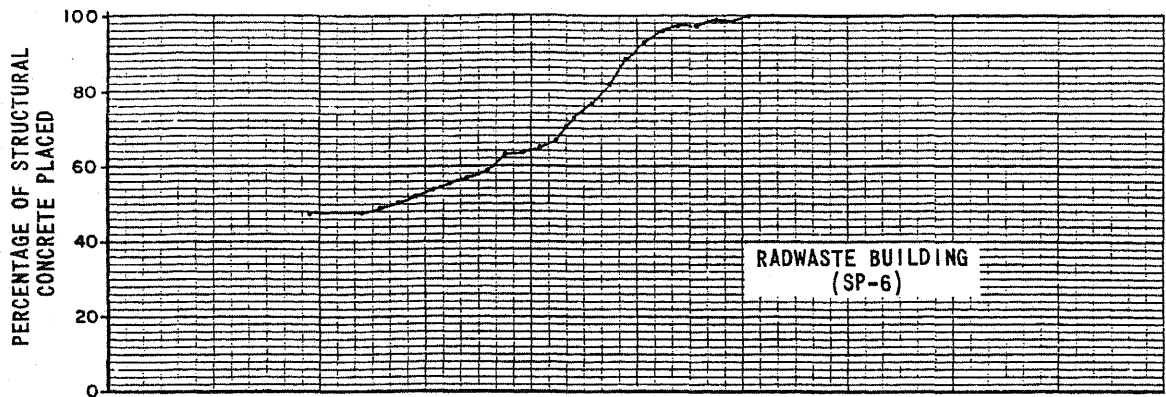
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Settlement Observation Data

Figure 2.5-205 (Sheet 4 of 6)



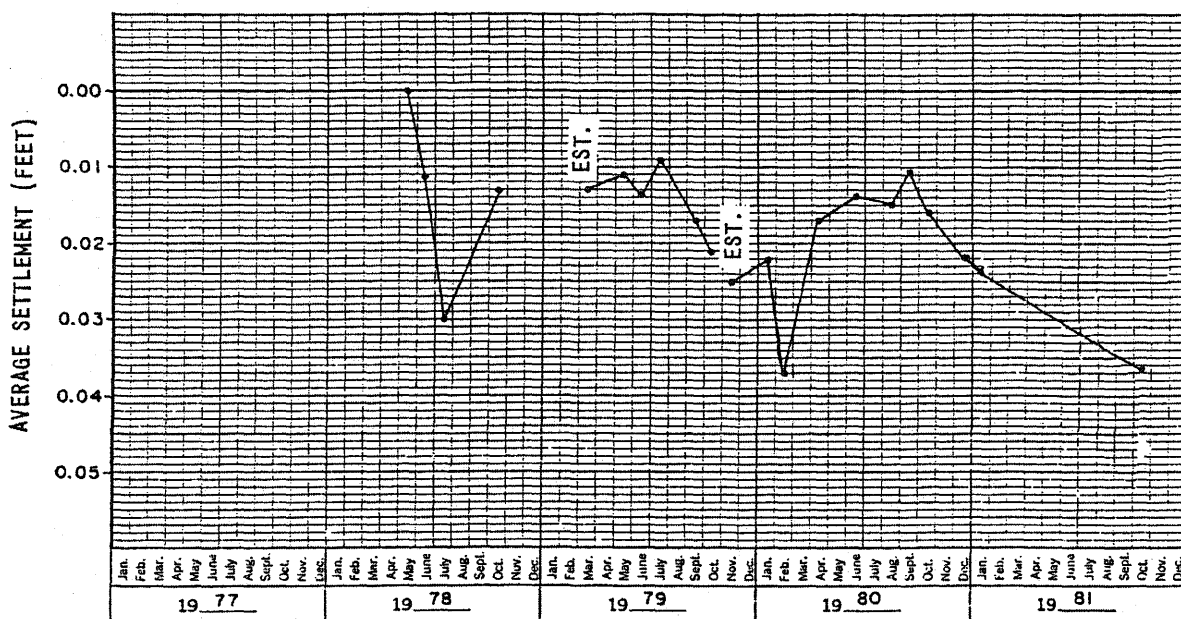
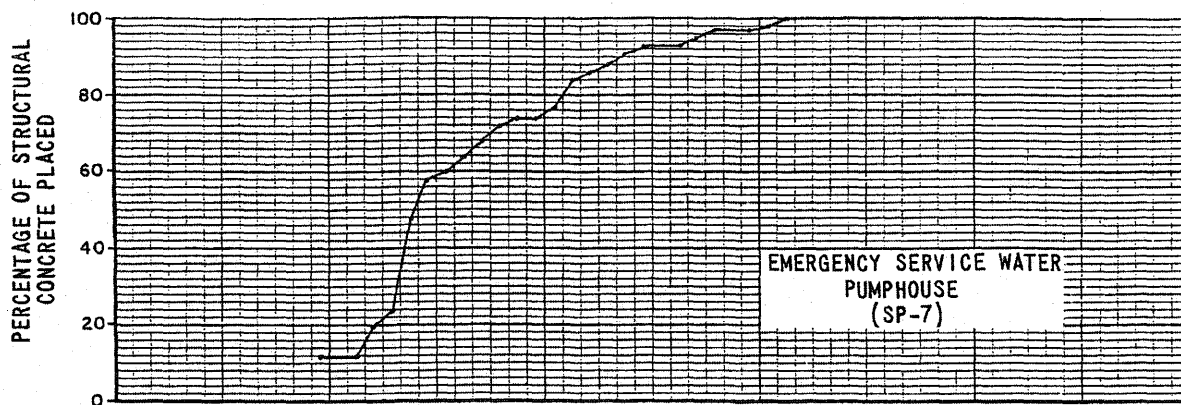
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Settlement Observation Data

Figure 2.5-205 (Sheet 5 of 6)



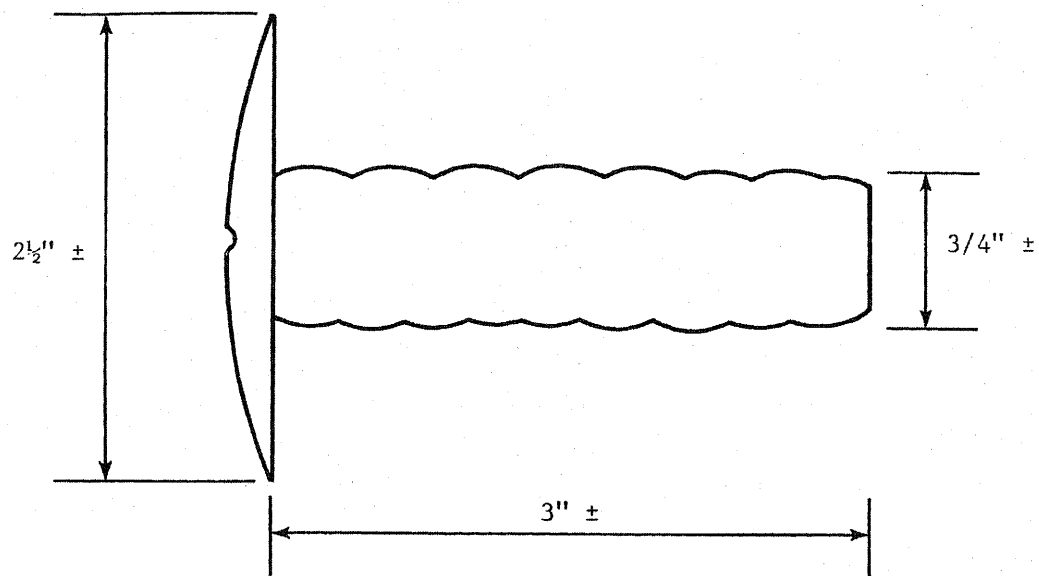
(Rev. 12 1/03)



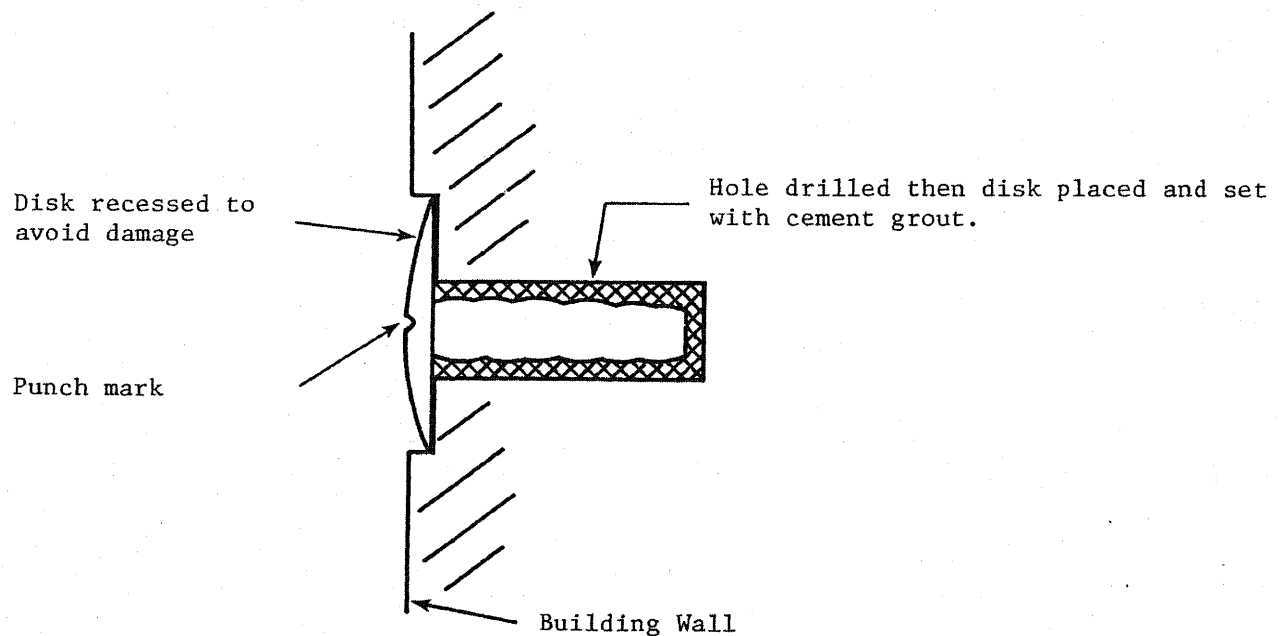
PERRY NUCLEAR POWER PLANT

Settlement Observation Data

Figure 2.5-205 (Sheet 6 of 6)



BRASS DISK DIMENSIONS



TYPICAL DISK INSTALLATION

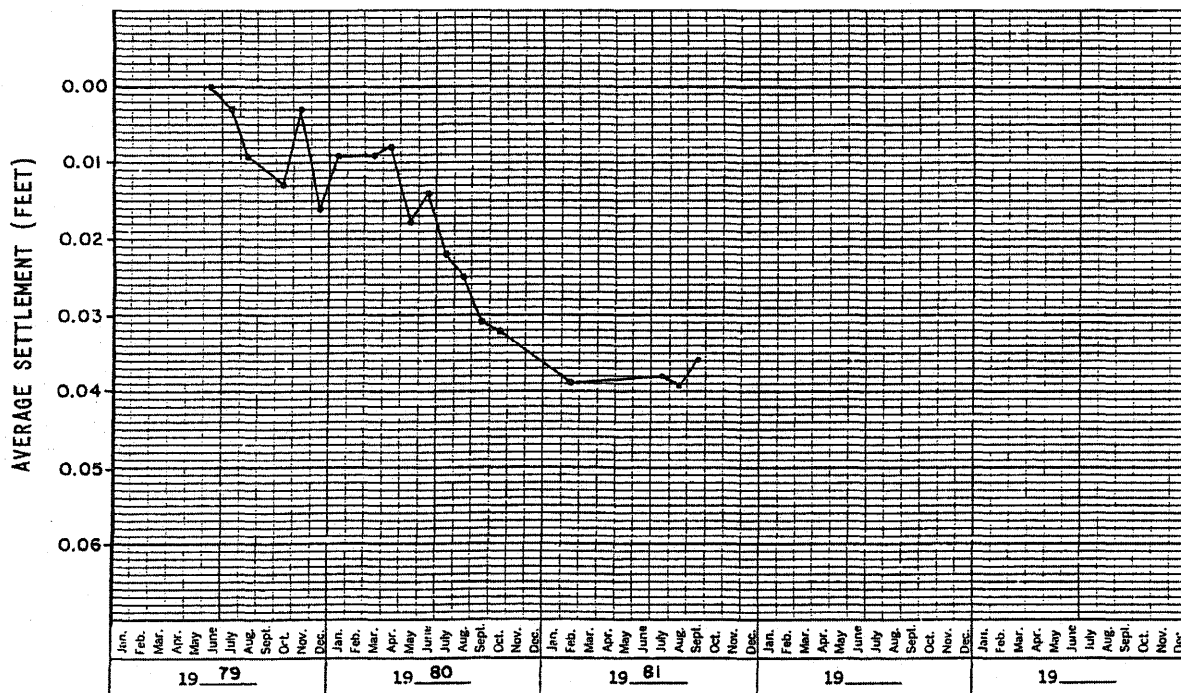
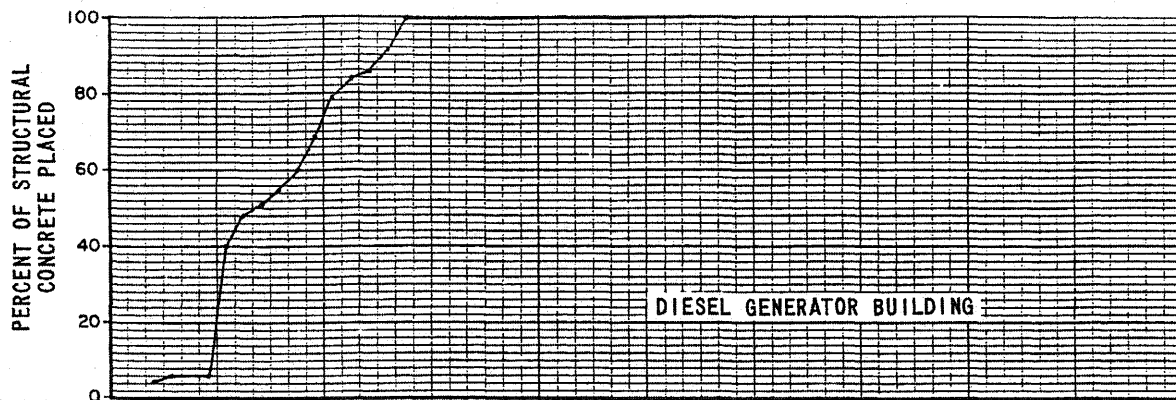
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Building Settlement
Monitoring Disks

Figure 2.5-206



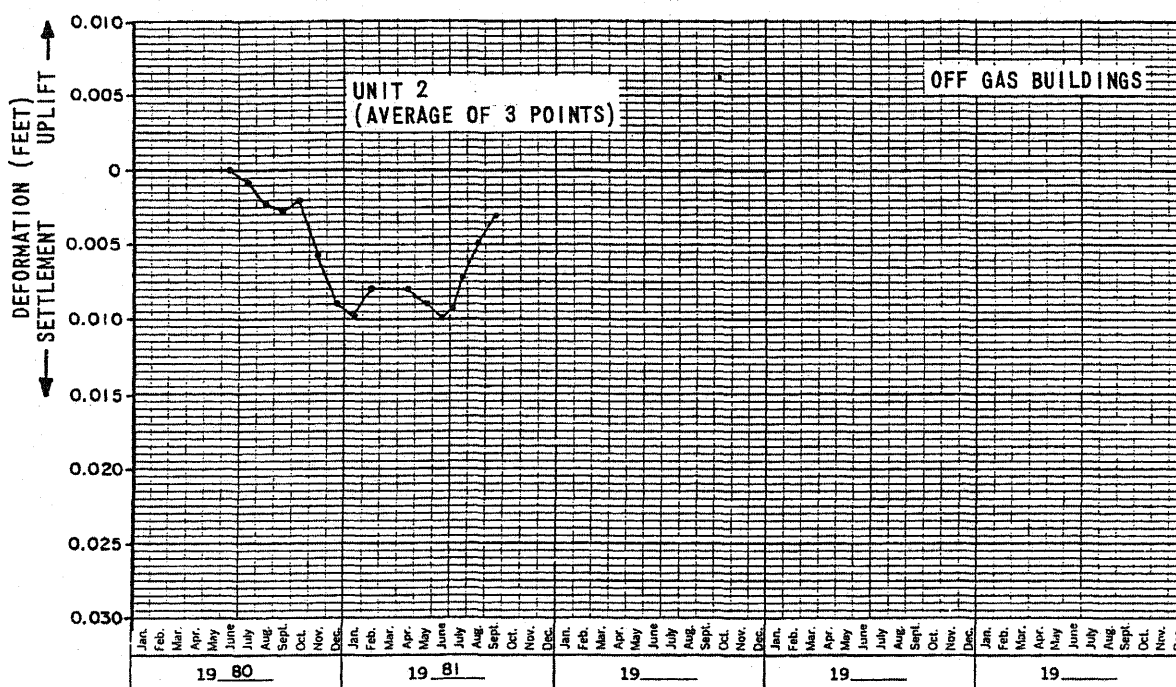
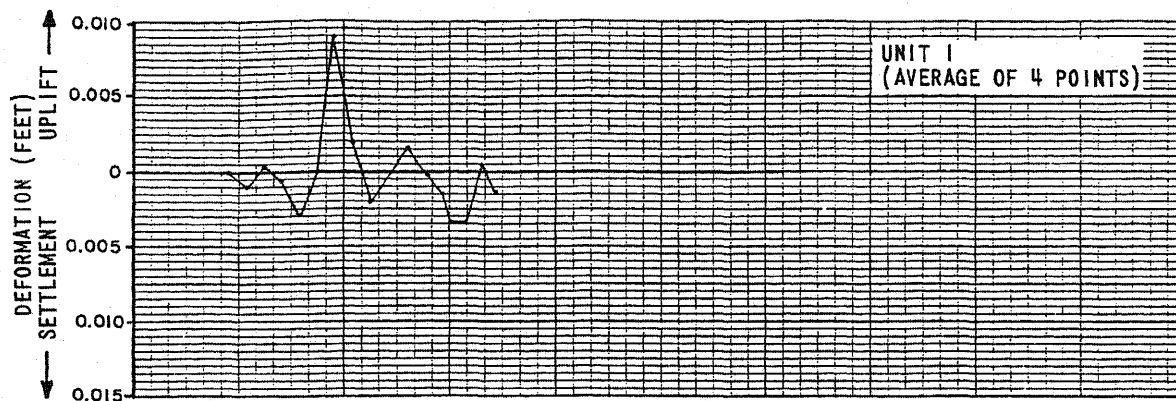
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT


Settlement Observation Data

Figure 2.5-207

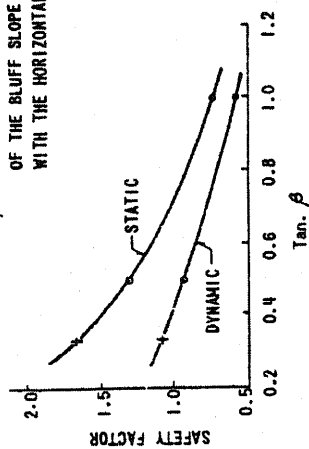


NOTE: STRUCTURAL CONCRETE PLACEMENT
COMPLETED PRIOR TO SETTLEMENT
MONITORING.

(Rev. 12 1/03)

	PERRY NUCLEAR POWER PLANT
	<p>Settlement Observation Data</p> <p>Figure 2.5-208</p>

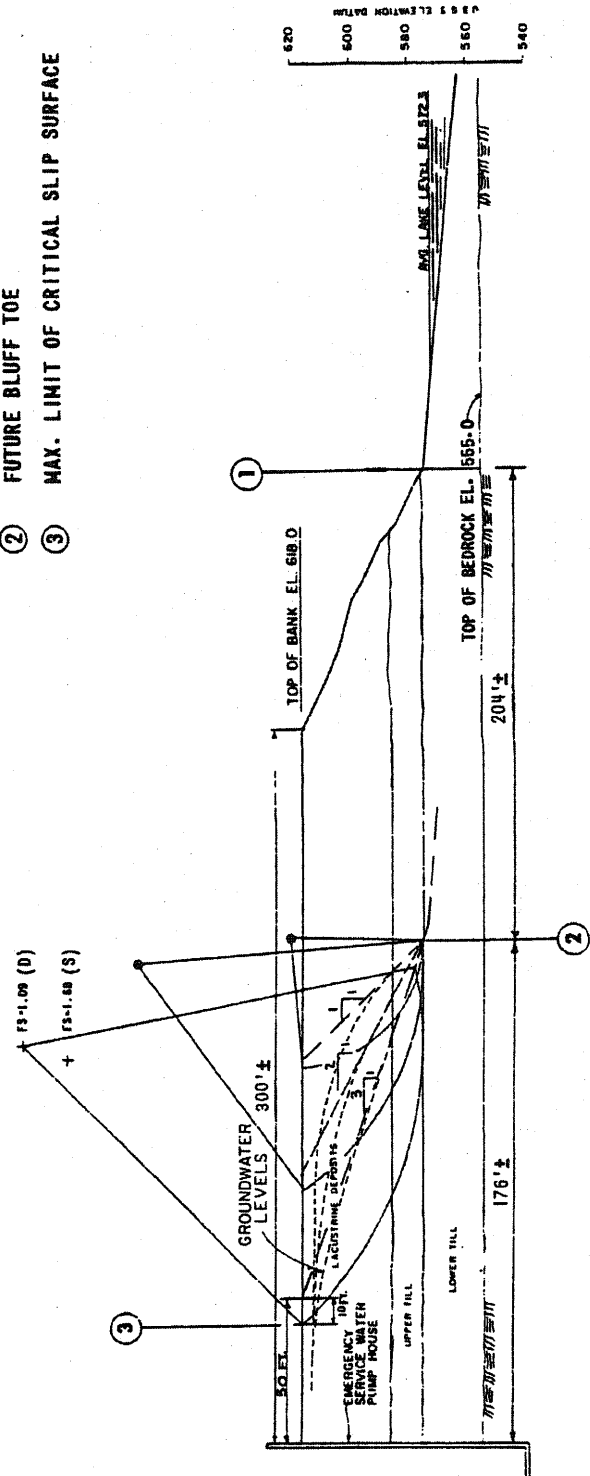
NOTE: β = ANGLE OF INCLINATION
OF THE BLUFF SLOPE
WITH THE HORIZONTAL



SYMBOL	AVERAGE SLOPE	FACTOR OF SAFETY		MAX. ②-③ DISTANCE (Ft.)
		STATIC	DYNAMIC*	
●	1:1	0.73	0.56	46
○	2:1	1.32	0.94	86
+	3:1	1.68	1.09	136

* $k_s = 0.15$

- ① EXISTING TOE OF BLUFF SLOPE
- ② FUTURE BLUFF TOE
- ③ MAX. LIMIT OF CRITICAL SLIP SURFACE



(Rev. 12 1/03)



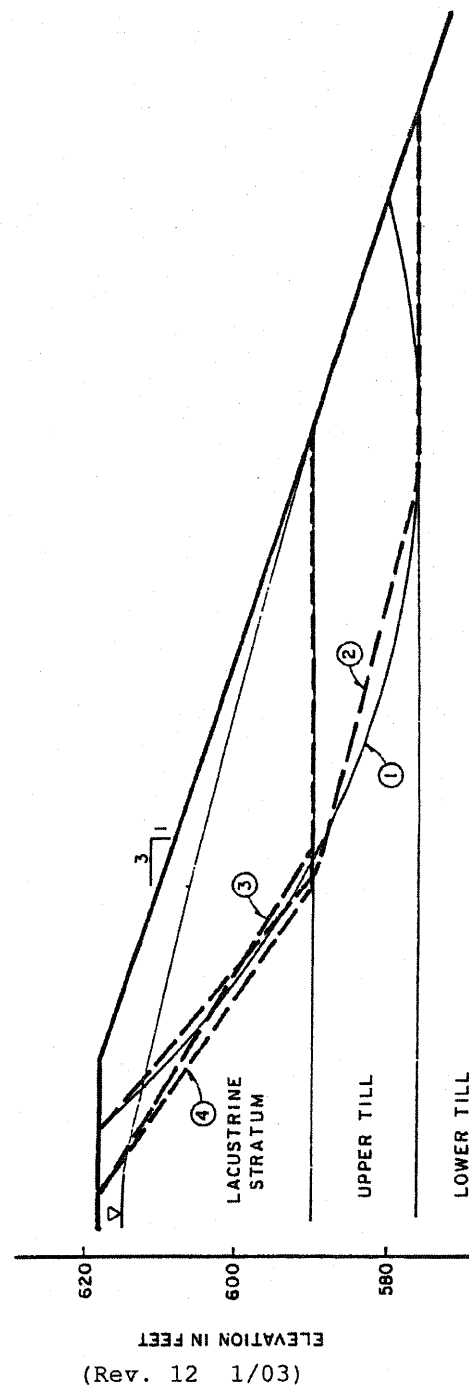
PERRY NUCLEAR POWER PLANT

Bluff Stability Analysis

Figure 2.5-209

FAILURE SURFACE NO.	METHOD	SEISMIC COEFFICIENT	FACTOR OF SAFETY
①	B	0.00	1.68
①	B	0.15q	1.09
②	M-P	0.00	1.69
②	M-P	0.15q	1.18
③	M-P	0.00	2.16
④	M-P	0.15q	1.45

NOTE: B = BISHOP METHOD
M-P = MORGENSTERN - PRICE METHOD



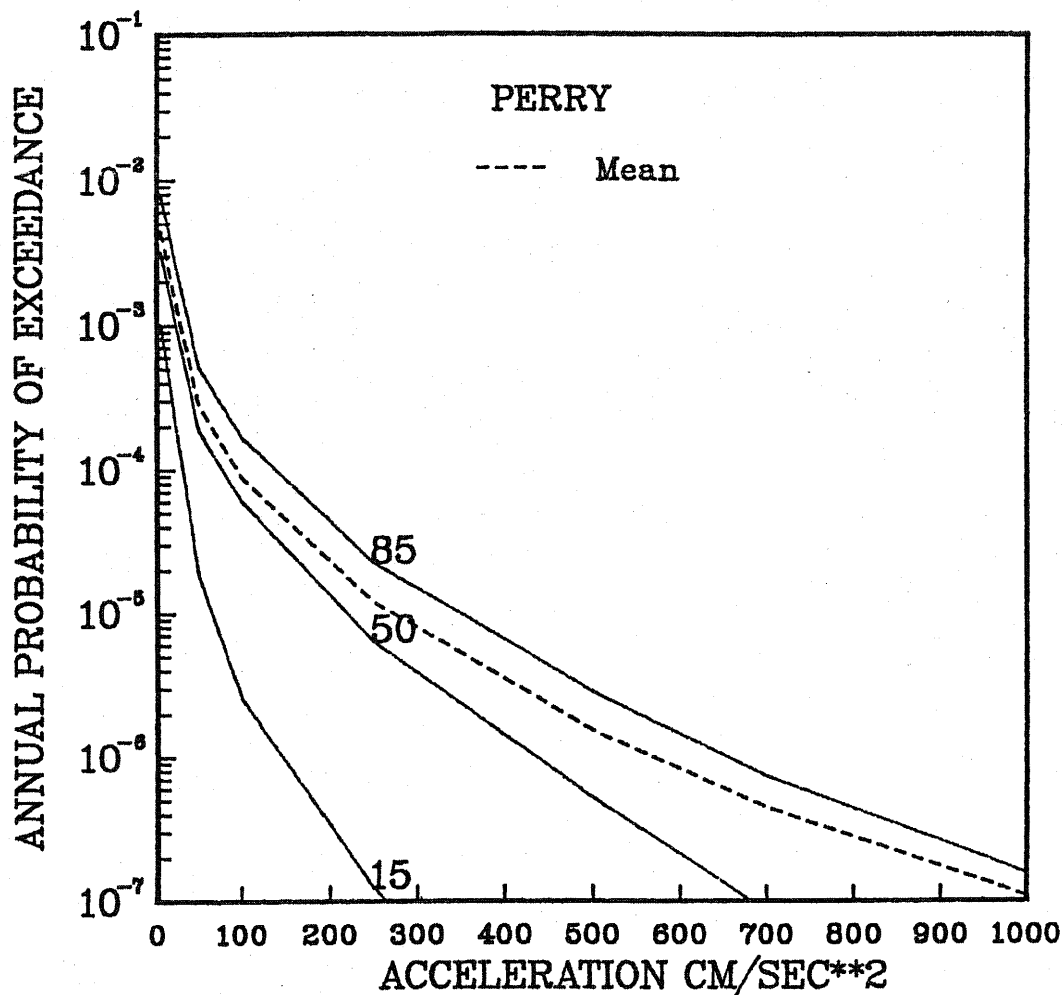
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Stability Analysis of
Lake Erie Bluff

Figure 2.5-210



15th, 50th, 85th fractiles and mean annual probability of exceedance of peak ground acceleration from EPRI Report RP 101-53 ⁽³⁰⁸⁾

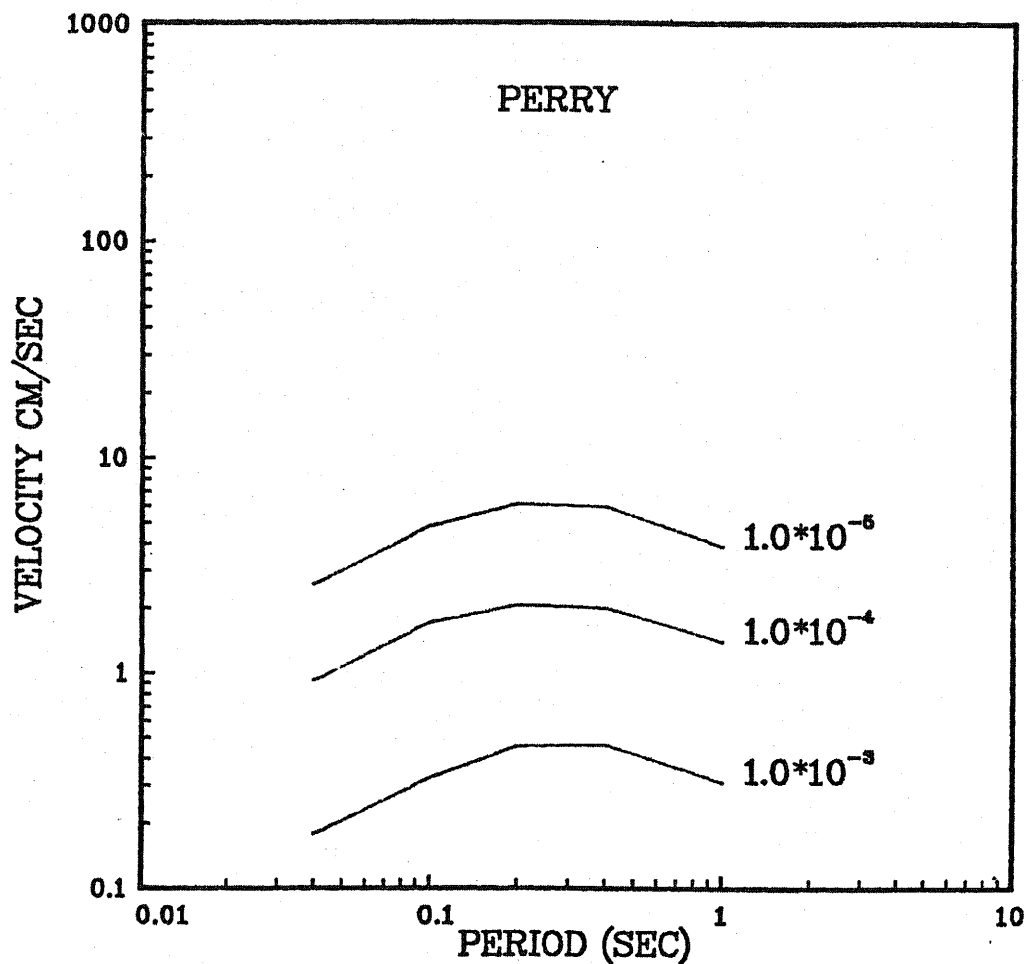
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

EPRI Seismic Hazard
Calculations Results
for PNPP

Figure 2.5-211



Median uniform hazard spectra at the
 $1.0\text{E-}3$, $1.0\text{E}4$ and $1.0\text{E}5$ annual probability
of exceedance from EPRI Report RP 101-53⁽³⁰⁸⁾

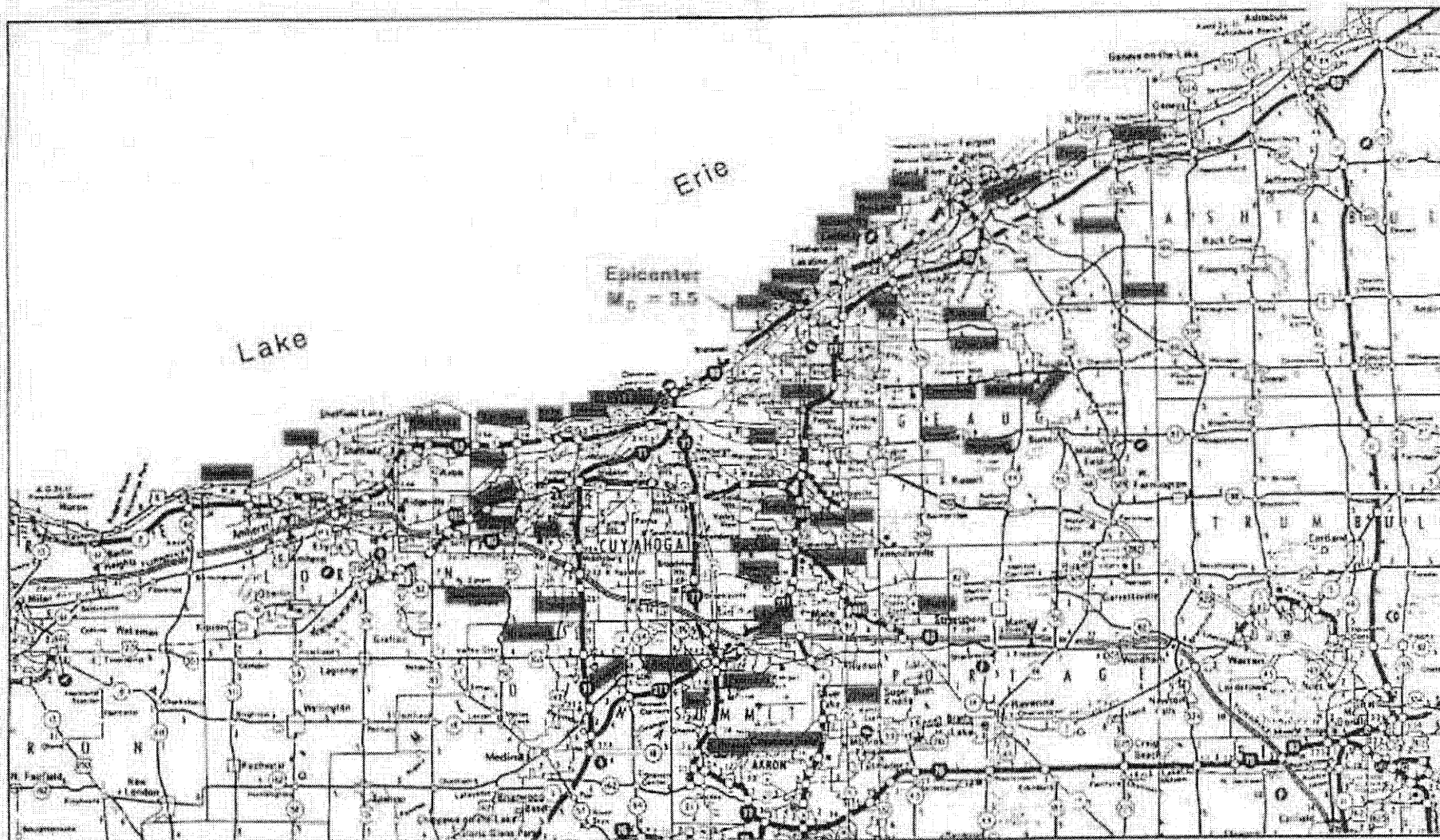
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

EPRI Seismic Hazard
Calculations Results
for PNPP

Figure 2.5-212



Base map: Official Transportation Map, Ohio Department of Transportation, 1987.



■ Felt report location
(per police/sheriff, newspapers or
phone calls to area residents)

Note: Epicentral symbol equivalent
to uncertainty.

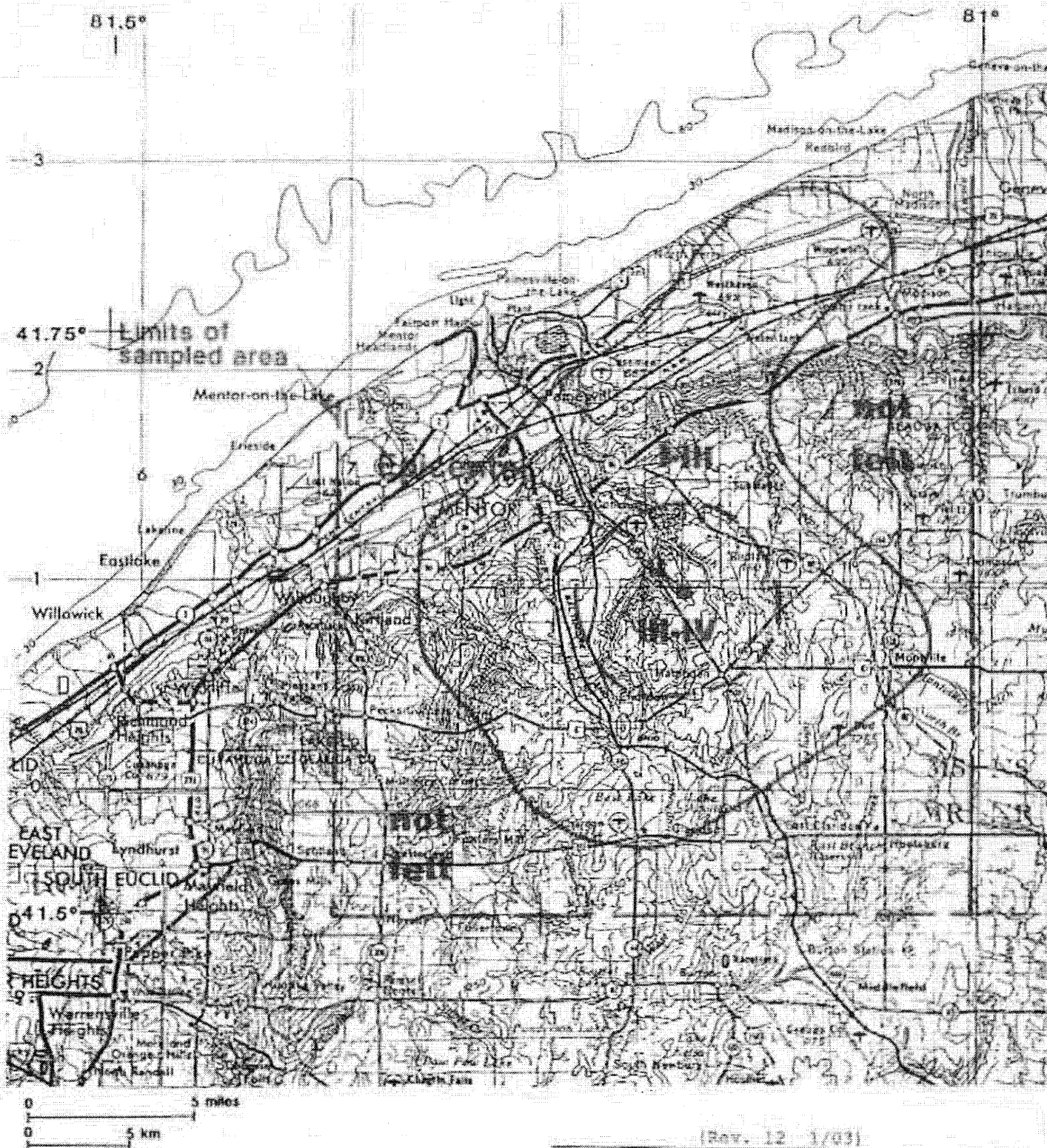
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Distribution of Felt Reports
1/26/1991 Earthquake

Figure 2.5-213



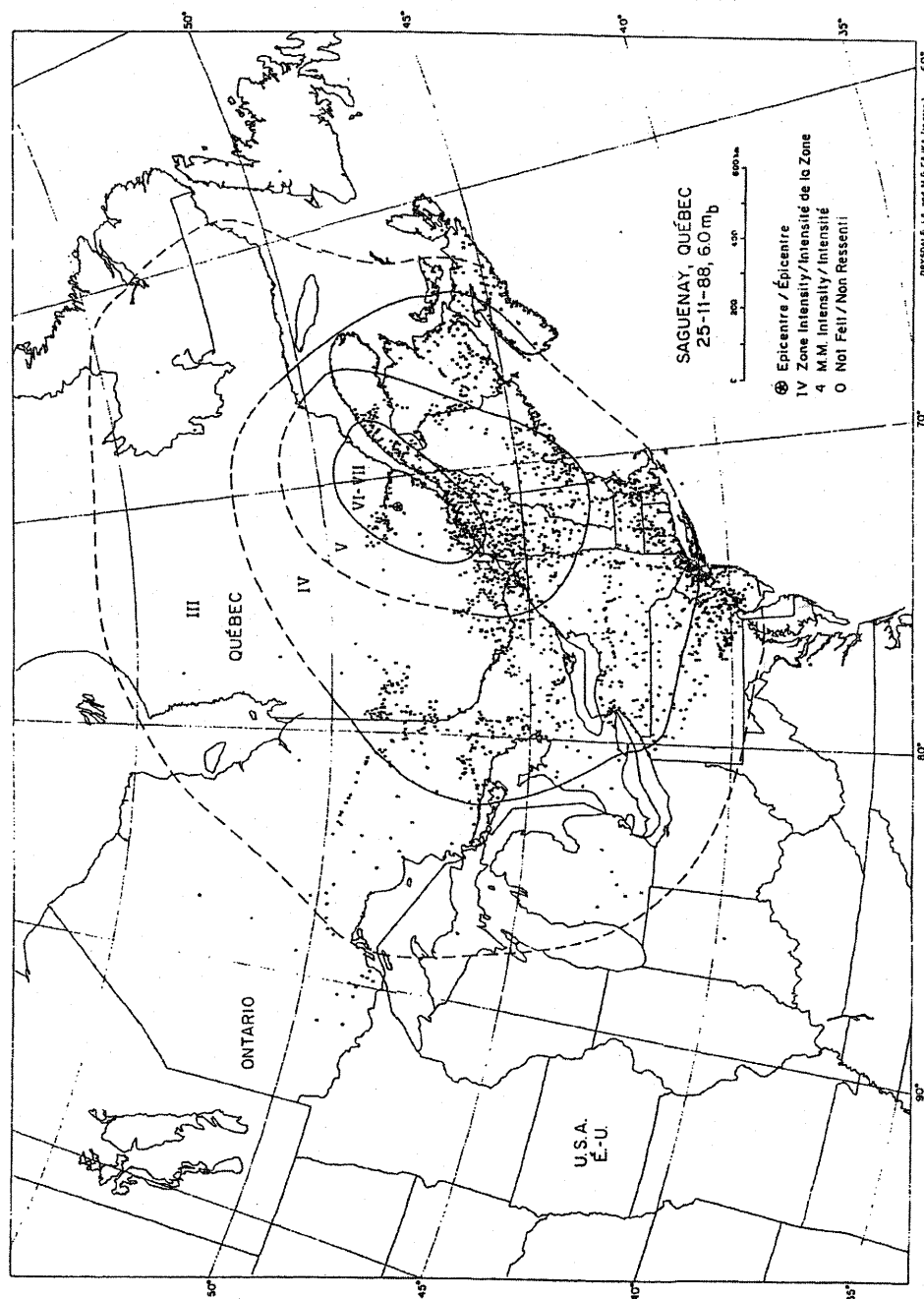
(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Total Felt Area of
Dec. 28, 1989 (23:29 UT)
Microearthquake $M_c=2.5$

Figure 2.5-214



(Rev. 12 1/03)



PERRY NUCLEAR POWER PLANT

Isoseismal Map
Saguenay Earthquake
November 25, 1988

Figure 2.5-215