ENTERGY OPERATIONS, INC.

WATERFORD STEAM ELECTRIC STATION

UNIT NO. 3

BASEMAT MONITORING PROGRAM
SPECIAL REPORT NO. 3

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ENTERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION
UNIT NO. 3

BASEMAT MONITORING PROGRAM
SPECIAL REPORT NO. 3

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ENTERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION
UNIT NO. 3

BASEMAT MONITORING PROGRAM
SPECIAL REPORT NO. 3

1.0 PURPOSE

The Nuclear Plant Island Structure (NPIS) Common Foundation Basemat Monitoring Program required by Waterford 3 Technical Specification Section 6.8.4.e has been established to provide continuing assurance of basemat integrity and to ensure that conditions within the basemat do not change significantly. The monitoring program is being implemented according to Entergy Operations, Inc. Surveillance Procedures PE-5-033 and CE-2-100 (References 1 & 2). This is the third special report prepared to summarize the pertinent observations, measurements and evaluations conducted since Waterford 3 has been in operation.

2.0 SCOPE

This report documents the results of the Nuclear Plant Isl... Structure (NPIS) Common Foundation Basemat Monitoring Program for the four areas specified in Technical Specification Section 6.8.4.e. The four areas are:

a. Basemat differential settlement

b. Groundwater chemistry

c. Seasonal variation in groundwater level

d Crack surveillance

  i) Crack Width Monitoring

  ii) Wall Crack Inspection

The Basemat Monitoring Special Report No. 2 (Reference 3), issued in September, 1988 covered the monitoring data collected through August, 1988. This report is an extension of the previous report and adds the surveillance data collected in November, 1988 through March, 1990.

3.0 CONCLUSION

The Basemat Monitoring Program has been active since Waterford 3 has been in operation. The results of the monitoring program are summarized below.

3.0 CONCLUSION (CONTINUED)

a. Basemat Differential Settlement - The calculated differential settlements for all the eight monitoring points are within the specified action limits of ±1.0 inch. The maximum differential during this reporting period was 0.468 inch, noted in February, 1989 for the east side. The July, 1984 baseline differentials for the eight (8) settlement monitoring points are shown in Table 1. The settlement differentials for these eight (8) points with respect to the July, 1984 baseline differentials are calculated and reported in Table 2. The settlement differentials for all the eight (8) monitoring points were of the same order of magnitude as previous values. Cyclic behavior with slight overall long term settlement has been observed.

b. Groundwater Chemistry - The maximum level of groundwater chloride content analyzed was 48 ppm, observed in June, 1987, for the east side, which was substantially below the defined limit of 250 ppm. The maximum groundwater chloride content level for the third special basemat monitoring report period was recorded at 43.20 ppm in November, 1989 for the east side.

c. Seasonal Variation in Groundwater Level - Groundwater level variation is small and is similar in the east and west wells. The overall variation is 2.20 feet for the east well and 2.03 feet for the west well.

d. i) Crack Width Monitoring - Fluctuation in crack width of the fifteen instrumented cracks over the surveillance period is below the prescribed action limit of 15 mils (0.015 inch). The maximum increase in crack width was 4.65 mils which was measured in March, 1988 for Crack No. 12 as reported in Special Report No. 2 (Reference 3). The crack width variation is cyclic in nature.

ii) Wall Crack Inspection - The last inspection and photographic survey of the lower portion of the shield building and selected exterior walls in the east and west cooling tower areas was conducted in May, 1989. The inspection results were evaluated against the action limit requirement that no cracks greater than 15 mils in width are visible in the walls selected for inspection. The cracks were verified to be below the action limit requirements. No significant changes were noted over the previous survey. Therefore, in accordance with the Waterford 3 Basemat Monitoring Program, Entergy Operations, Inc. has discontinued the photographic surveys of walls. (Reference 4).

3.0 CONCLUSION (CONTINUED)

The data collected between August, 1988 and March, 1990 has satisfactorily been below the action limits requirements and no unusual behavior of the basemat has been detected. The continued integrity of the basemat has, therefore, been verified by the surveillance program.

4.0 BACKGROUND AND PROGRAM OVERVIEW

A surveillance program for the Nuclear Power Plant Island Structure (NPIS) Common Foundation Basemat has been in place since 1985 and was instituted to provide continuing assurance of basemat integrity and to ensure that conditions within the basemat do not change significantly.

The Basemat Surveillance Program is divided into four major areas:

a. Basemat elevation, which is the primary method of identifying the gross response of the basemat to loading, soil consolidation and environmental changes, and flexural variations within the basemat.

b. Groundwater chemistry to detect any changes from the current absence of significant rebar corrosion potential within the basemat.

c. Groundwater level to detect any correlation of fluctuations in the groundwater level with measured basemat movements or measured changes in crack width.

d. Crack surveillance to provide an indication of changes in the state of strain at the top surface of the basemat.

The first Basemat Special Report was submitted for the data collected through December, 1986 as part of the surveillance program to the NRC via Reference 5 on January 5, 1987. The report documented and verified that the basemat was continuing to perform as designed. However, no definite trend of the data was observed.

The original surveillance program established in 1985 was modified to obtain more meaningful data as a result of the experience gained in the monitoring. The revised version of the surveillance program was presented to the NRC in Chapter IX of the Basemat Summary Report (Reference 6) and was approved by the NRC as documented in the Safety Evaluation Report issued on October 27, 1987 (Reference 7).

4.0 BACKGROUND AND PROGRAM OVERVIEW (CONTINUED)

The second Basemat Special Report documenting and evaluating the data collected through August, 1988 as part of the Surveillance Program was submitted to the NRC via Reference 3 in September, 1988. The analysis of the data collected demonstrated that for the four major areas of the Basemat Surveillance Program, there was no unusual behavior of the basemat. The monitoring data was satisfactorily below the action limits requirement and the basemat was considered continuing to perform as designed. A detailed program overview of the various elements of the Basemat Monitoring Program is described in detail in the second Basemat Special Report (Reference 3) dated September, 1988.

The crack surveillance program consists of taking precision measurements across representative cracks that were chosen based upon location, visual appearance, crack depth and accessibility. A total of fifteen (15) cracks have been instrumented using mechanical strain gauges (0.1 mil accuracy) as shown in Figure 3. The location of these instrumented cracks are shown on Figure 4. The quantitative data collection technique is discussed in detail in the Second Basemat Special Report (Reference 3).

4.1 Surveillance Frequency

a. Basemat Elevation Survey

A baseline date of July, 1984 was established for this monitoring and readings were initially taken quarterly in accordance with LP&L Procedure PE-5-033 (Reference 1). The program allows extending the interval after three (3) consecutive satisfactory surveillances.

The surveillance interval was increased to semi-annually after the May, 1985 survey as the preceding three consecutive surveys were satisfactory. At completion of the basemat confirmatory analysis and as a result of subsequent meetings between the NRC and LP&L, the surveillance frequency was revised in June, 1987 to require quarterly readings for one more year concurrent with instrumented basemat crack data. The revised surveillance procedure requires that after four (4) consecutive satisfactory surveillances in both areas, the interval may increase to an annual frequency and then to a refueling frequency after three (3) consecutive surveillances in both areas.

a. Basemat Elevation Survey (Continued)

Due to the problems encountered with the surveying techniques in the June, 1988 quarterly survey as discussed in Section 5.1.1 of the Basemat Special Report No. 2 (Reference 3), four additional quarterly surveys were conducted after the August, 1988 survey. These four surveys gave satisfactory results and hence a semi-annual survey frequency was implemented after the August, 1989 Basemat Elevation Survey.

b. Groundwater Chemistry

Sampling and analysis of groundwater for chloride content was initiated on August 19, 1984 and monitoring is being performed quarterly.

c. Seasonal Groundwater Levels

This element of the surveillance program was initiated in June, 1985 and groundwater level readings are being taken on a quarterly basis at the same time as the groundwater chemistry samples are taken.

d. Crack Surveillance

i) Crack Width Measurements

Four (4) cracks were initially instrumented with baseline readings taken in August, 1986. Gauges were installed on eleven (11) additional cracks with baseline readings taken at the end of May, 1987. Crack widths were monitored on a quarterly basis until August, 1989. The surveillance frequency then was increased to semi-annually as described in Section 4.1(a) above.

ii) Wall Crack Inspection

The inspection and photographic survey of selected walls were performed every eighteen (18) months with the first complete survey conducted in June, 1986. The last survey was done in May, 1989.

The photographic survey was discontinued after the completion of two 18 month surveys since no significant changes were noted in the selected wall cracks

ii) Wall Crack Inspection (Continued)

A letter was transmitted to the NRC on January 26, 1990 (Reference 4) to inform them of the discontinuation of the photographic survey.

5.0 RESULTS AND DISCUSSIONS

The surveillance data collected through March, 1990 for each element of the Basemat Monitoring Program is presented in the following subsections.

5.1 Survey Improvements

A number of improvements in the surveying procedure have been made since Basemat Special Report No. 2 submittal. Use of a more precise optical level fitted with a micrometer has been incorporated into the procedure and two new onsite benchmarks have been installed near the plant. (See Figure 2).

The existing offsite master benchmark used for all surveying done on the Waterford 3 site is located on a footing of the abandoned transmission tower located about one half mile east of the plant. The long distance between the benchmark and the plant site makes it difficult to close the survey loop in one day within the allowable tolerances due to heavy vehicular traffic on adjacent Highway 18 and other factors such as wind and temperature. In an effort to improve the surveying procedure further, two permanent benchmarks (SBM-A and SBM-B), with protective bumper guards were installed on the plant site located outside the protected area fence (see Figure 2).

Entergy Operations, Inc. believes that the vicinity of the new onsite permanent benchmarks will give more control over the survey and eliminate possible error introduced due to the distance traversed. The next survey will utilize the offsite benchmark located on the abandoned transmission tower to establish the fixed elevation for onsite benchmarks SBM-A and SBM-B. The new onsite benchmarks will then be utilized for the future Basemat Monitoring Surveys.

Surveyors use the offsite master benchmark located on the abandoned transmission tower footing every time a basemat elevation survey is conducted.

5.1 Survey Improvements (Continued)

Elevation for the onsite benchmark, SBM-1, inside the protected area fence is then determined and the loop is closed back to the master benchmark. The SBM-1 elevation is then used to determine the elevation for the monitoring points located on the NPIS basemat (see Figure 1). The first survey on February 20, 1990 established SBM-1, located on the east side of the Fuel Handling Building, at elevation 17.022 feet. The survey for all the other basemat monitoring points was completed using this elevation value for SBM-1. The SBM-1 elevation was appraised for its correctness. The Stationary Benchmark SBM-1 showed excessive elevation variation when compared to the elevation data collected in the past.

Later, the evaluation of the surveyed data became obvious that the SBM-1 elevation is a questionable one and cannot be used to determine the elevation for other monitoring points. The SBM-1 elevation was determined again on February 23, 1990 to authenticate the initial data evaluation. The second survey established the SBM-1 elevation at 17.048 feet. To elevate the confidence level in the resurveyed SBM-1 elevation and to validate the new SBM-1 elevation, it was surveyed a third time on March 12, 1990. The third survey returned 17.040 feet elevation for the SBM-1. An average of the second and third survey for SBM-1 elevation, 17.044 feet, was then used in determining the rest of the basemat monitoring points elevation.

5.2 Basemat Elevation Survey Results

Differential movements of the eight (8) points located at east and west edges of the NPIS foundation mat relative to the two points located adjacent to the shield building are being monitored and compared with the action limit of ±1 inch. These ten (10) points are now located on the surface of the basemat. The set of baseline differential for eight (8) monitoring points are recorded in Table 1. The differences between eight (8) sets of differential settlements and their corresponding baseline differentials for the entire period of December, 1985 through March, 1990 are listed in Table 2 and have been reviewed and evaluated for their acceptance.

The maximum difference of 0.54 inch was noted on December, 1985, for differential settlement between monitoring points "E5" and "F". The maximum differential during this reporting period was 0.468 inch which was noted in February, 1989 between monitoring points "E5" and "F." This is well within the action limit of ±1.0 inch.

5.2 Basemat Elevation Survey Results (Continued)

These eight (8) sets of settlement point differentials relative to the baseline are also pictorially represented in Figures 6 and 7 for better comprehension. These figures portray that differential settlements are cyclic in nature. Since the differential settlements are within the action limits without any unusual behavior, the element of the surveillance program related to the basemat differential settlements during this period is acceptable.

In addition, all the settlement monitoring points on the basemat surface have been monitored and evaluated as a group to review the overall flexural behavior of the foundation mat. The first elevation survey of most of these points was conducted in December, 1985.

Any meaningful comparison of the later surveys can, therefore, only be made relative to December, 1985. The results of subsequent surveys are represented as contour plots of Basemat Absolute Settlement relative to December, 1985.

The contour plots are shown in Figures 8 through 12 and represent accumulated settlements since December, 1985. A review of these plots reveals that the contour configuration for the various intervals is somewhat similar with fluctuations in the elevations, again representing a cyclic behavior.

The elevation variation for 37 monitoring points, located on the surface of the basemat, with respect to the July, 1984 or December, 1985 readings are shown in Figures 13 through 22.

The first available elevation reading is represented by the initial zero reading of the plot. A dotted line in the graph represents a lack of elevation reading for that period. Twenty-seven out of thirty-seven monitoring points are compared with the December, 1985 actual or derived readings and the rest of the ten points are compared with the July, 1984 readings. These figures clearly depict cyclic behavior with a slight overall gradual settlement of the basemat.

The basemat elevation surveillance is considered satisfactory and acceptable since no unusual behavior in the contour configuration and elevation survey of the monitoring points has been observed.

5.3 Groundwater Chemistry

The chloride content of the groundwater has been analyzed in accordance with LP&L Surveillance Procedure CE-2-100 (Reference 2). The groundwater chloride content values obtained from the start of the surveillance program through February, 1990 are listed in Table 3 and plotted on Figure 23. The chloride content varied from 20.9 ppm to 48.0 ppm for the east well and from a low of 5.0 ppm to a high of 28.50 ppm for the west well. These values are well below the action limit of maximum 250 ppm and are, therefore, acceptable.

5.4 Seasonal Groundwater Levels

The groundwater elevation in the two wells from the start of the program through February, 1990 are listed in Table 4 and plotted on Figure 24. The seasonal variation of groundwater levels is similar between both wells. The overall variation is 2.20 feet for the east well and 2.03 feet for the west well. The data is acceptable as there has been no significant variation.

5.5 Cracks Surveillance

5.5.1 Cracks Width Measurement

The change in crack widths without temperature corrections for the fifteen (15) instrumented cracks are listed in Table 5. Table 6 shows crack width variations after temperature correction is applied. The values given in the tables are cumulative variations in crack width with respect to the baseline reading which was established in August, 1986 for Crack Nos. 3, 5, 11 and 12 and May, 1987 for the remaining eleven (11) cracks.

The crack width change was calculated from the two sets of gauges installed across each crack and the algebraic average of the two (2) values was taken for each surveillance period.

The crack width variation with respect to its base reading for each crack from start to March, 1990 is also pictorially represented in Figures 25 through 28.

5.5.1 Cracks Width Measurement (Continued)

The results show that maximum increase in crack width was 4.65 mils which was measured in March, 1988 for Crack No. 12. This variation has since been reduced to 1.85 mils. The increase in width of the cracks was well below the action limit of 15 mils.

Cyclic behavior of the crack width variation can be easily seen from the plots confirming the cyclic behavior as observed from the elevation survey of the monitoring points.

Since the crack width variations were below the action limit, the crack surveillance element of the monitoring program for this period was satisfactory and acceptable.

5.5.2 Wall Crack Inspection

The last inspection and photographic survey of the lower portion of the selected fourteen (14) walls (Figure 5) was performed in May, 1989 in accordance with LP&L Surveillance Procedure PE-5-033 (Reference 1). The inspection results were evaluated against the action limit requirement that no cracks greater than 15 mils in width are visible in the walls selected for inspection. The cracks were verified to be below the action limit requirements. Therefore, the wall crack inspection element of the surveillance program is satisfactory and acceptable.

The photographic survey is used to assist in determining the integrity of the basemat. The first survey was performed in June, 1986 and a subsequent survey was done in December, 1987. In accordance with the Waterford 3 Basemat Monitoring Program, Entergy Operations, Inc. has discontinued the photographic surveys and notified the NRC via letter dated January 26, 1990 (Reference 4) about discontinuation of the photographic survey of the selected walls.

REFERENCES

1. LP&L Surveillance Procedure, "NPIS Common Foundation Basemat Integrity Check," PE-5-033, Revision 3.

2. LP&L Surveillance Procedure, "Chemistry Technical Specifications, Surveillance Performance Coordination," CE-2-100, Revision 5.

3. LP&L Report, "Waterford Steam Electric Station Unit No. 3, Basemat Monitoring Program Special Report No. 2," September, 1988.

4. Letter W3P90-0605, R. F. Burski to U. S. Nuclear Regulatory Commission, Docket No. 50-382, dated January 26, 1990.

5. LP&L Report, "Waterford Steam Electric Station Unit No. 3, Basemat Monitoring Program Special Report," December 30, 1986.

6. LP&L Report, "Waterford Steam Electric Station Unit No. 3, Basemat Summary Report," July, 1987.

7. NRC Safety Evaluation Report, "Basemat Confirmatory Analyses and Surveillance Program, Waterford Steam Electric Station Unit No. 3," Docket No. 50-382, October 27, 1987.

TABLE 1

ENTERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION
REPORT NO. 3

BASEMAT MONITORING PROGRAM
SPECIAL REPORT NO. 3

BASEMAT SETTLEMENT MONITORING
BASEMAT EDGE TO SHIELD BUILDING
BASELINE DIFFERENTIAL CALCULATION
(JULY, 1984)

Monitoring Points	Baseline Elevations (Ft)		Baseline Differential (Ft)
E5 - M9	(-35.284)-(-35.286)	=	+0.002
E5 - E13	(-35.284)-(-35.334)	=	+0.050
E5 - E14	(-35.284)-(-35.336)	=	+0.052
E5 - F	(-35.284)-(-35.438)	=	+0.154
M11A - M10	(-35.364)-(-35.440)	=	+0.076
M11A - M13	(-35.364)-(-35.288)	=	-0.076
M11A - A	(-35.364)-(-35.420)	=	+0.056
M11A - D	(-35.364)-(-35.606)	=	+0.242

NOTE: For location of Monitoring Points, see Figure 1.

TABLE 2

ENTERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION
UNIT NO. 3

BASEMAT MONITORING PROGRAM
SPECIAL REPORT NO. 3

SETTLEMENT POINTS DIFFERENTIAL RELATIVE TO JULY, 1984 BASELINE (b)
(inch)
(Action Limit = ± 1.0 Inch)

MONITORING Points (a)	DEC 85	JUL 86	DEC 86	JUN 87	SEP 87	DEC 87	MAR 88	AUG 88	NOV 88	FEB 89	MAY 89	AUG 89	MAR 90
E5-M9	0.156	0.180	0.192	0.168	0.168	0.348	0.324	0.132	0.336	0.336	0.276	0.264	0.360
E5-E13					0.120	0.276	0.324	0.114	0.252	0.192	0.288	0.300	0.288
E5-E14					0.096	0.300	0.324	0.091	0.192	0.156	0.264	0.288	0.240
E5-F	0.540	0.228	0.084	0.480	0.408	0.468	0.456	0.310	0.288	0.468	0.276	0.420	0.360
M11A-M10	0.228	0.168	0.288	0.084	0.216	0.312	0.348	0.215	0.408	0.300	0.264	0.252	0.324
M11A-M13	0.036	0.060	0.060	0.084	0.108	0.156	0.144	0.145	0.192	0.132	0.096	0.156	0.132
M11A-A	-0.024	-0.156	-0.024	0.036	0.420	0.036	0.420	0.102	0.096	-0.060	-0.024	0.036	-0.060
M11A-D	-0.060	-0.120	-0.024	0.000	0.396	0.060	0.384	0.024	0.108	-0.024	-0.036	0.000	-0.024

NOTES: (a) For location of monitoring points, see Figure 1.

(b) Differentials are calculated as "Baseline Differential" minus "Actual Differential."

TABLE 3

ENTERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION
UNIT NO. 3

BASEMAT MONITORING PROGRAM
SPECIAL REPORT NO. 3

NUCLEAR PLANT ISLAND STRUCTURE
GROUNDWATER CHLORIDE CONTENT (ppm)

(Action Limit = 250 ppm)

DATE	LOCATION: EAST WELL	LOCATION: WEST WELL
08/29/84	22.00	17.50
11/29/84	35.00	28.50
03/04/85	37.00	25.00
06/13/85	35.00	22.00
09/21/85	23.00	14.40
11/25/85	46.00	18.00
03/06/86	35.00	16.00
06/02/86	33.00	15.00
09/05/86	33.00	20.00
11/20/86	31.00	20.00
02/26/87	38.00	15.00
06/09/87	48.00	7.80
09/03/87	22.00	5.00
12/14/87	36.00	7.70
03/15/88	22.50	24.80
06/14/88	29.80	10.10
08/15/88	21.00	6.[illegible]
11/17/88	17.00	[illegible]
02/20/89	21.00	5.60
05/15/89	15.90	5.20
08/15/89	12.70	5.00
11/14/89	43.20	15.00
02/23/90	19.50	16.70

NOTE: For location of wells, see Figure 2.

TABLE 4

ENTERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION
UNIT NO. 3

BASEMAT MONITORING PROGRAM
SPECIAL REPORT NO. 3

NUCLEAR PLANT ISLAND STRUCTURE
GROUNDWATER ELEVATION (FT.)

(No Action Limit)

DATE	LOCATION	
	EAST WELL	WEST WELL
06/13/85	11.50	11.50
09/21/85	10.70	10.97
11/25/85	11.65	11.52
03/06/86	11.57	11.70
06/02/86	11.67	11.80
09/05/86	11.75	11.91
11/20/86	11.90	12.11
02/26/87	12.00	12.01
06/09/87	12.05	12.35
09/03/87	11.90	12.11
12/14/87	11.36	11.18
03/15/88	12.00	12.16
06/14/88	11.92	12.13
08/18/88	12.23	12.26
11/17/88	11.65	11.81
02/20/89	11.60	11.61
05/15/89	12.15	12.02
08/15/89	12.15	12.39
11/14/89	12.10	11.85
02/23/90	12.90	13.00

NOTE: For location of wells, see Figure 2.

TABLE 5

ENTERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION
UNIT NO. 3

BASEMAT MONITORING PROGRAM
SPECIAL REPORT NO. 3

CRACK WIDTH MONITORING
CHANGE IN CRACK WIDTH (MILS Inch) (b)

(Action Limit = 15 Mils)
Without Temperature Correction

CRACK NO. (a)	NOV. '86	FEB. '87	MAY '87	SEPT. '87	DEC. '87	MAR. '88	JUNE '88	AUG. '88	NOV. '88	FEB. '89	MAY '89	AUG. '89	MAR. '90
1				0.45	1.40	1.85	0.90	0.50	0.45	1.30	-0.65	-1.30	-1.50
2				0.15	1.00	1.70	0.40	0.25	0.90	1.05	-2.05	-1.90	-0.70
3	-0.40	-0.20	-0.20	-0.20	-0.10	1.35	0.05	0.00	0.25	1.20	-2.50	-2.80	-1.75
4				0.05	3.15	3.35	0.60	0.05	0.90	2.70	-1.25	-2.00	-0.20
5	-0.10	0.00	-0.50	-0.05	1.20	1.10	0.65	0.00	0.70	0.70	-1.60	-1.40	-1.70
6				-0.15	-0.50	0.15	-0.25	-0.45	-0.20	0.00	-2.85	-2.60	-2.30
7				0.40	0.90	0.80	0.15	0.05	0.10	0.15	-2.35	-2.30	-1.55
8				0.50	0.35	1.25	0.20	0.05	-0.20	0.20	-2.50	-2.55	-2.05
9				0.45	0.15	0.25	0.80	0.35	0.45	1.10	-2.30	-2.25	-1.75
10				0.65	0.75	2.00	0.65	0.30	0.85	1.20	-1.90	-1.85	-0.80
11	-0.10	1.50	-0.60	0.35	0.70	1.65	0.55	0.35	0.80	1.05	-1.95	-1.85	-0.95
12	1.30	3.50	0.70	0.10	1.30	3.95	2.30	1.25	1.15	5.35	0.50	-1.15	2.45
13				0.20	1.10	3.40	-0.05	0.45	0.85	1.90	-1.75	-1.95	-0.75
14				0.00	0.55	2.15	0.45	0.10	0.65	2.20	-1.70	-1.50	-1.40
15				0.80	0.95	1.65	0.40	0.90	1.05	1.45	-1.90	-1.75	-1.85

NOTES:

a. For crack designation and location, see Figure 4.

b. Baseline date for Crack Nos. 3, 5, 11 and 12 is August, 1986.
For remaining cracks, baseline date is June, 1987.

TABLE 6

ENTERGY OPERATIONS, INC.
WATERFORD STEAM ELECTRIC STATION
UNIT NO. 3

BASEMAT MONITORING PROGRAM
SPECIAL REPORT NO. 3

CRACK WIDTH MONITORING
CHANGE IN CRACK WIDTH (MILS Inch) (b)

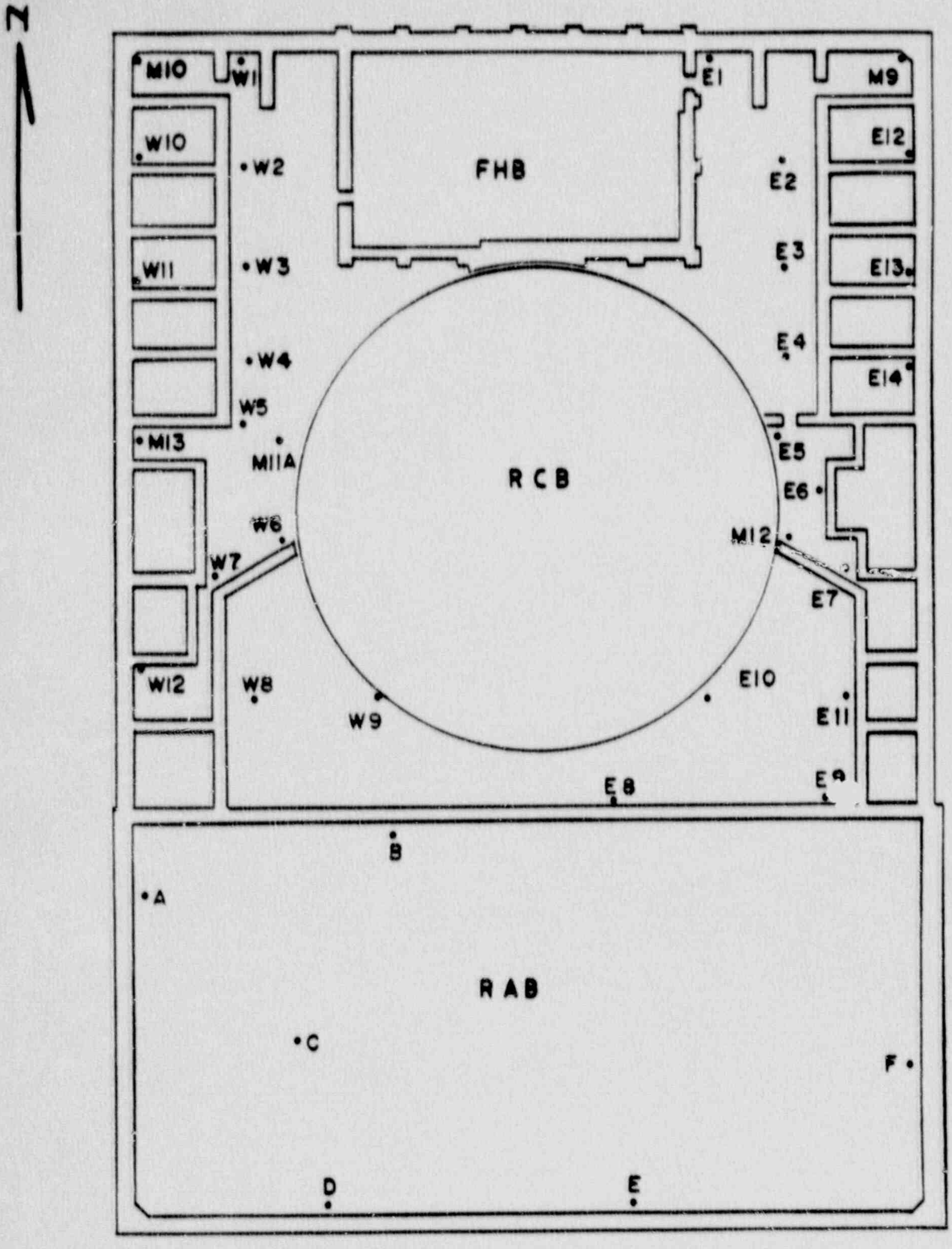
(Action Limit = 15 Mils)
With Temperature Correction

CRACK NO. (a)	NOV. '86	FEB. '87	MAY '87	SEPT. '87	DEC. '87	MAR. '88	JUNE '88	AUG. '88	NOV. '88	FEB. '89	MAY '89	AUG. '89	MAR. '90
1				-0.35	-0.20	0.45	0.20	0.10	-0.05	0.30	1.25	1.30	0.90
2				-0.65	1.30	1.10	-0.90	-0.55	-0.10	0.65	-0.25	-1.10	1.10
3	-0.50	0.20	-0.30	-0.20	-0.40	1.05	0.15	0.20	0.45	0.50	0.20	0.10	0.45
4				-0.55	2.35	3.15	-0.60	-0.65	0.30	2.00	0.25	1.30	1.80
5	0.00	0.40	-0.50	-0.35	1.10	0.00	0.35	0.00	0.80	0.20	0.50	3.00	-0.30
6				-0.35	-0.70	-0.55	-0.65	-0.65	-0.60	-0.40	-0.55	-0.10	0.20
7				-0.30	0.50	0.20	-0.75	-0.55	-0.40	-0.95	-0.25	-0.80	0.55
8				-0.20	-1.15	0.45	-0.90	-0.75	-1.60	-1.00	-1.00	-0.85	-0.45
9				0.25	-0.15	-0.25	0.00	0.15	0.55	0.80	0.20	-0.05	0.55
10				0.75	0.25	1.40	1.15	0.40	0.35	0.20	0.00	0.15	0.50
11	-0.50	0.10	-0.50	-0.35	0.50	0.05	1.95	-0.15	0.50	0.45	0.75	0.35	0.65
12	1.20	3.70	1.00	0.10	1.90	4.65	2.80	1.55	1.05	4.45	-0.50	1.25	1.85
13				0.20	1.00	2.40	-0.15	0.15	0.75	2.50	0.45	0.15	1.05
14				-0.80	0.55	1.95	0.05	-0.90	-0.65	0.80	-0.10	-0.40	0.40
15				0.70	1.05	1.75	0.50	1.20	1.75	1.35	1.30	1.55	1.45

NOTES:

a. For crack designation and location, see Figure 4.

b. Baseline date for Crack Nos. 3, 5, 11 and 12 is August, 1986.
For remaining cracks, baseline date is June, 1987.

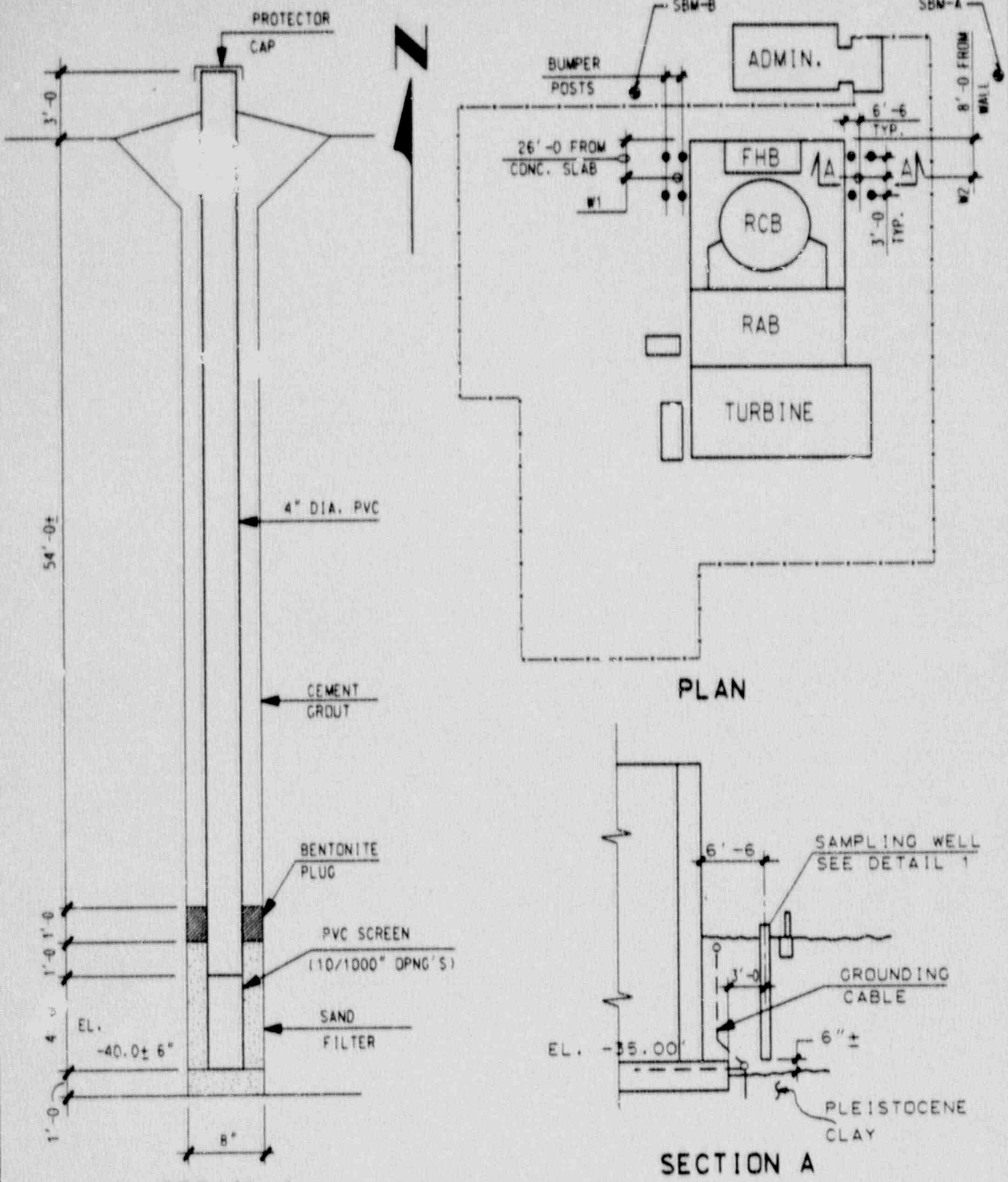


ENTERGY OPERATIONS

Waterford Steam Electric Station # 3

SETTLEMENT MONITORING POINTS

FIGURE 1



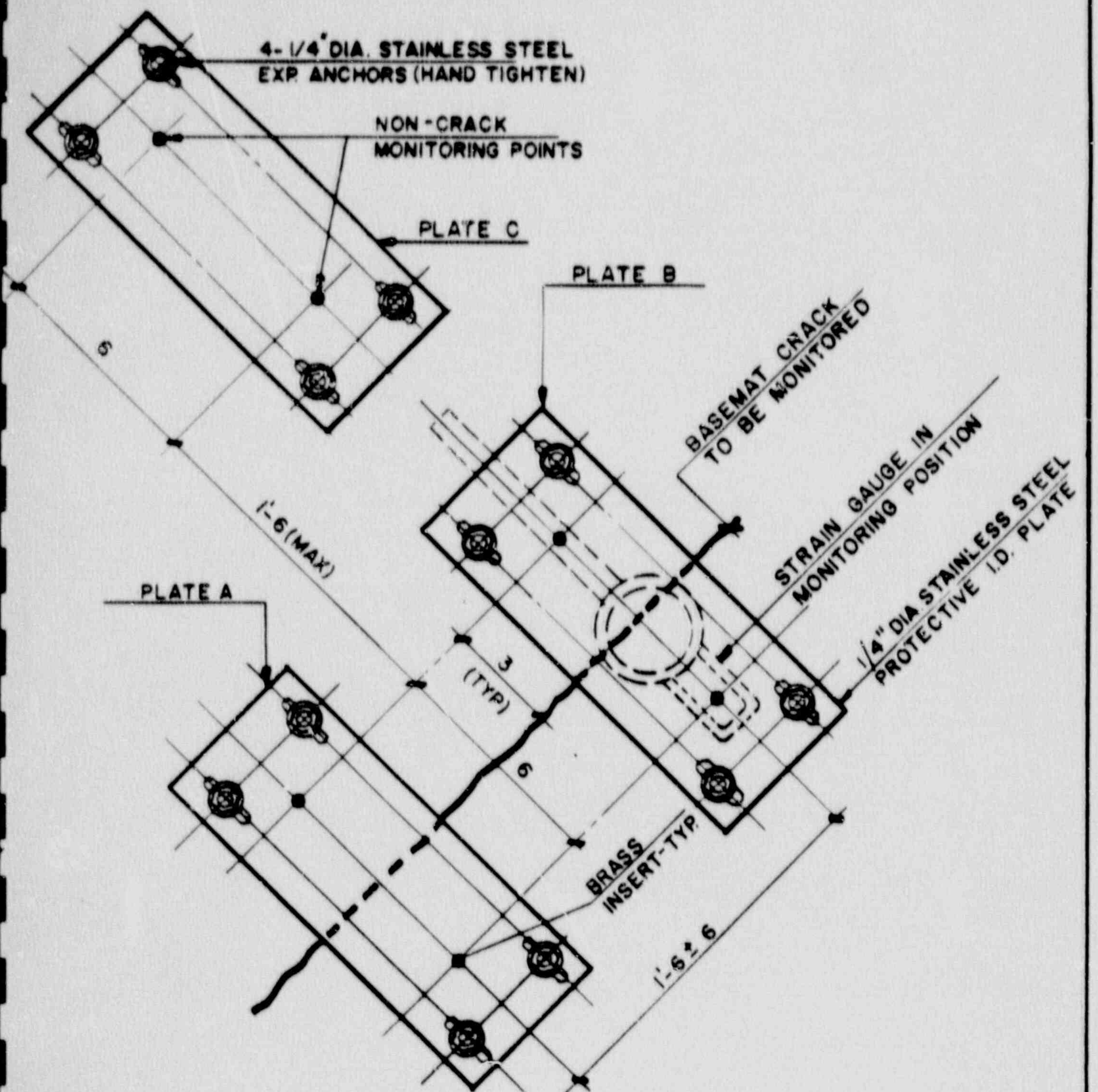
BENCH MARK	N-ft.	W-ft.	ELEVATION
SBM-A	4529.65	3451.87	15.195 ft.
SBM-B	4477.32	3997.30	16.653 ft.

ENTERGY OPERATIONS

Waterford Steam Electric Station Station #3

GROUNDWATER SAMPLING WELLS
& PERMANENT ONSITE BENCHMARKS

FIGURE 2

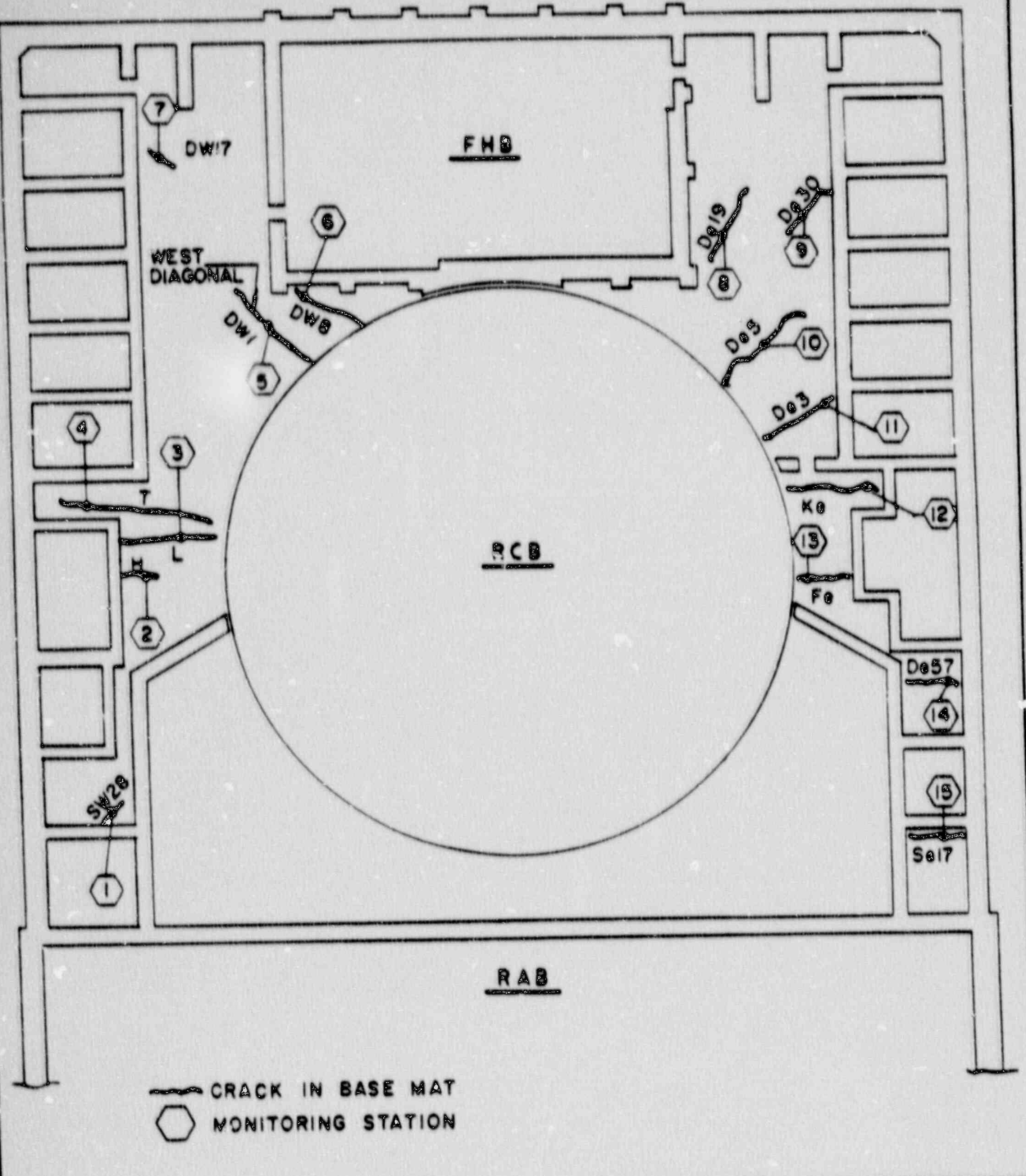


ENTERGY OPERATIONS

Waterford Steam Electric Station # 3

INSTRUMENTED ARRANGEMENT
AT CRACK WIDTH
MONITORING STATION

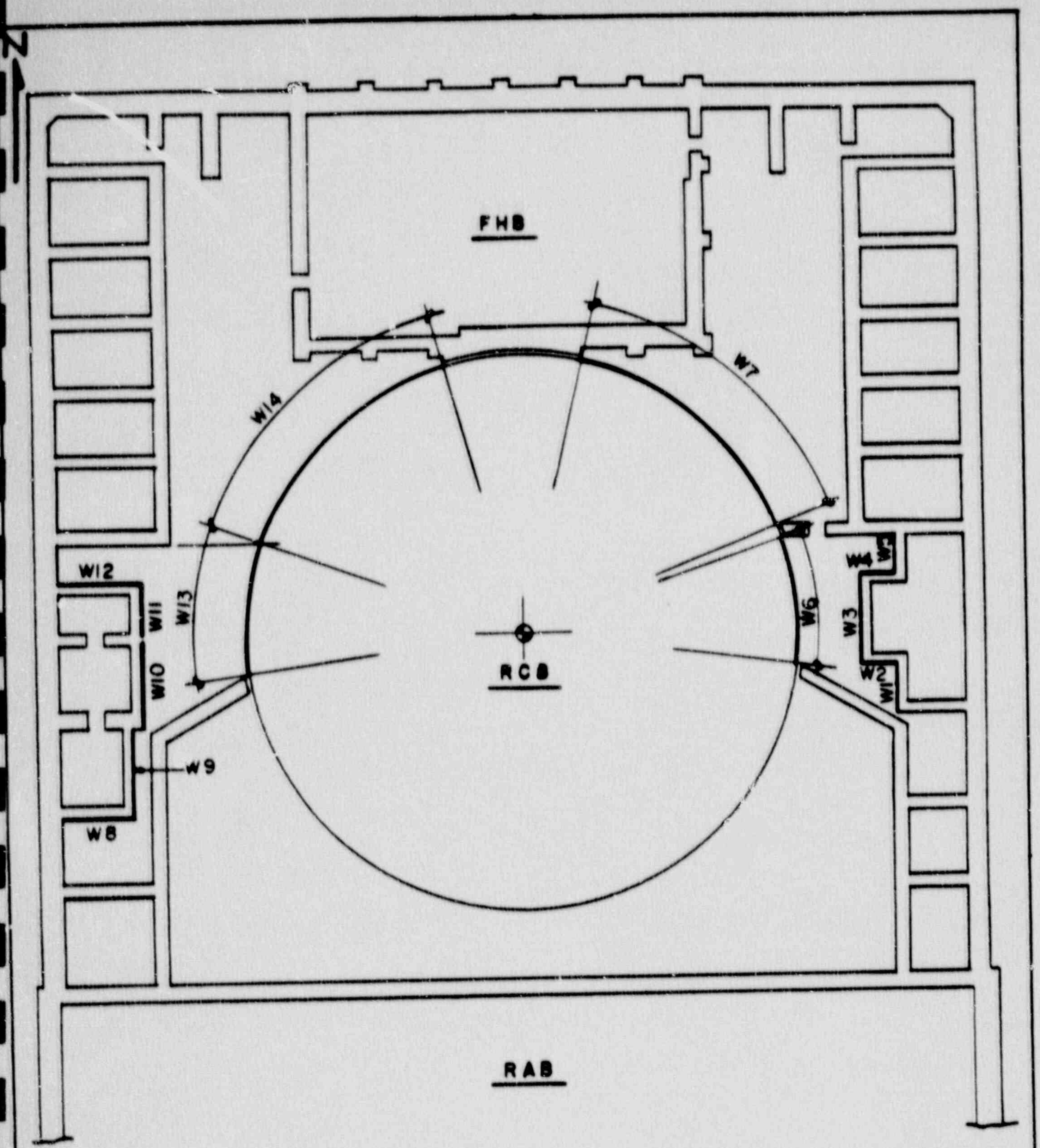
FIGURE 3



ENTERGY OPERATIONS
Waterford Steam Electric Station# 3

CRACK WIDTH MONITORING STATIONS

FIGURE 4

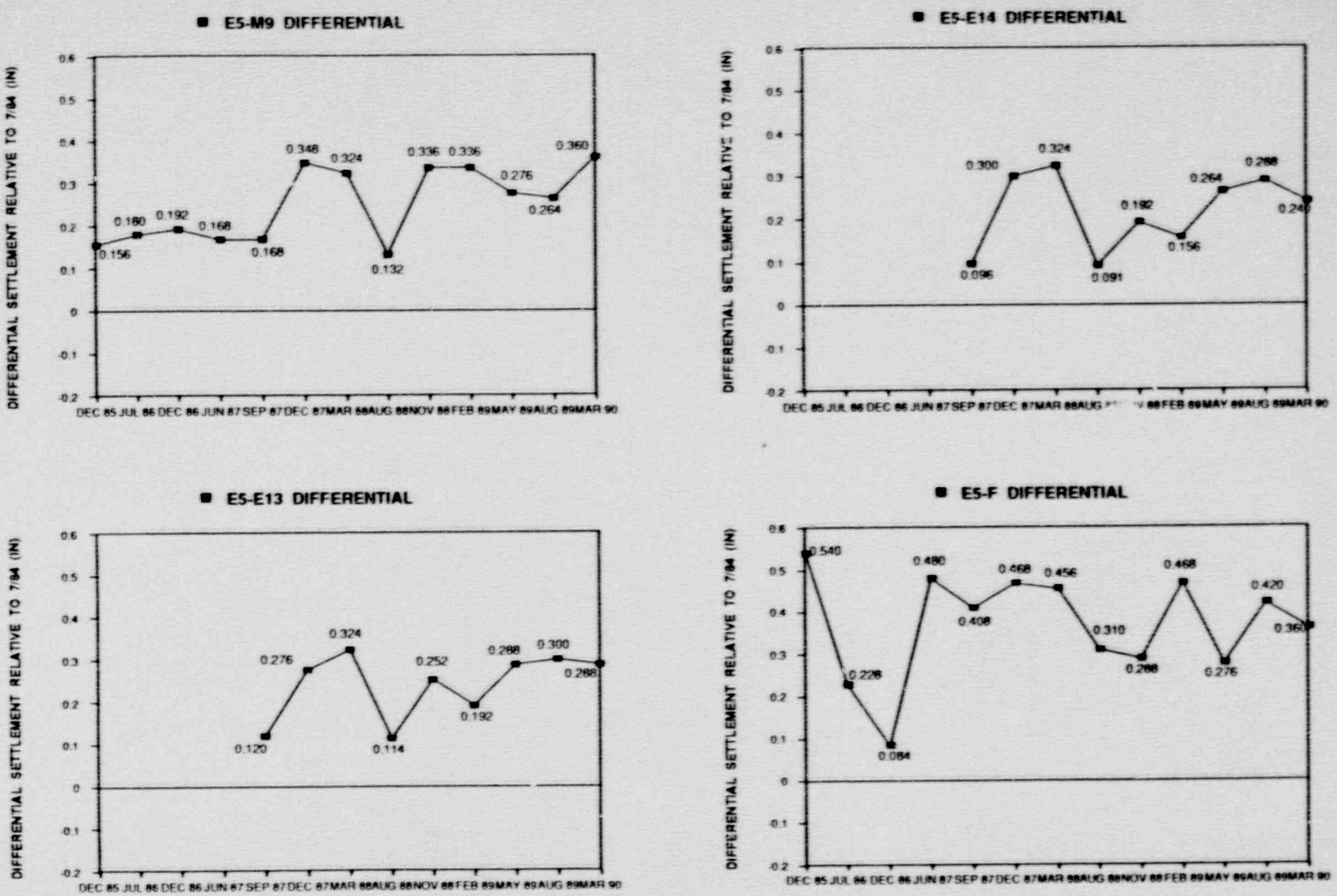


ENTERGY OPERATIONS

Waterford Steam Electric Station # 3

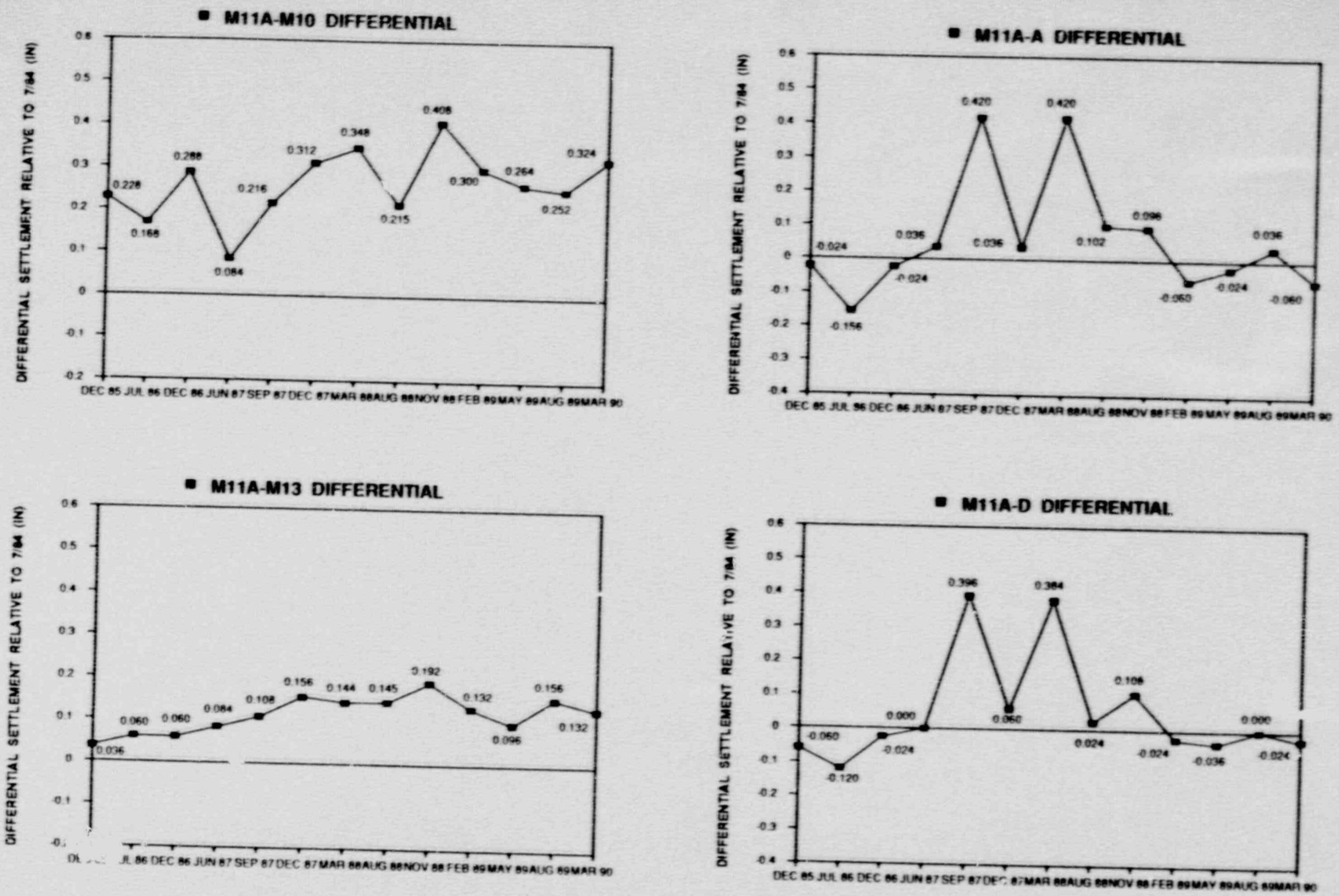
SELECTED WALLS FOR PHOTOGRAPHIC SURVEY

FIGURE 5



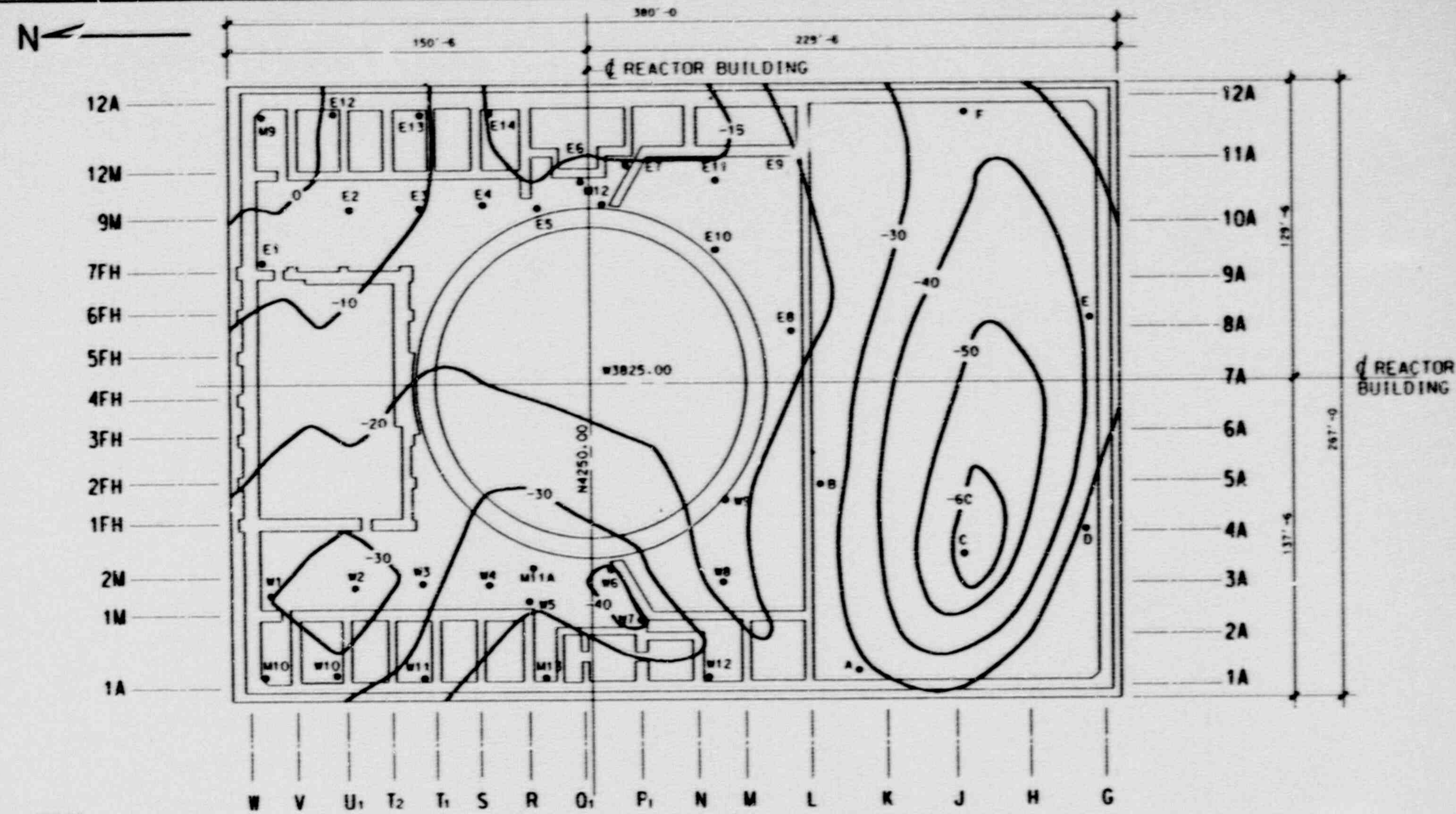
SETTLEMENT POINTS DIFFERENTIAL

FIGURE 6



SETTLEMENT POINTS DIFFERENTIAL

FIGURE 7

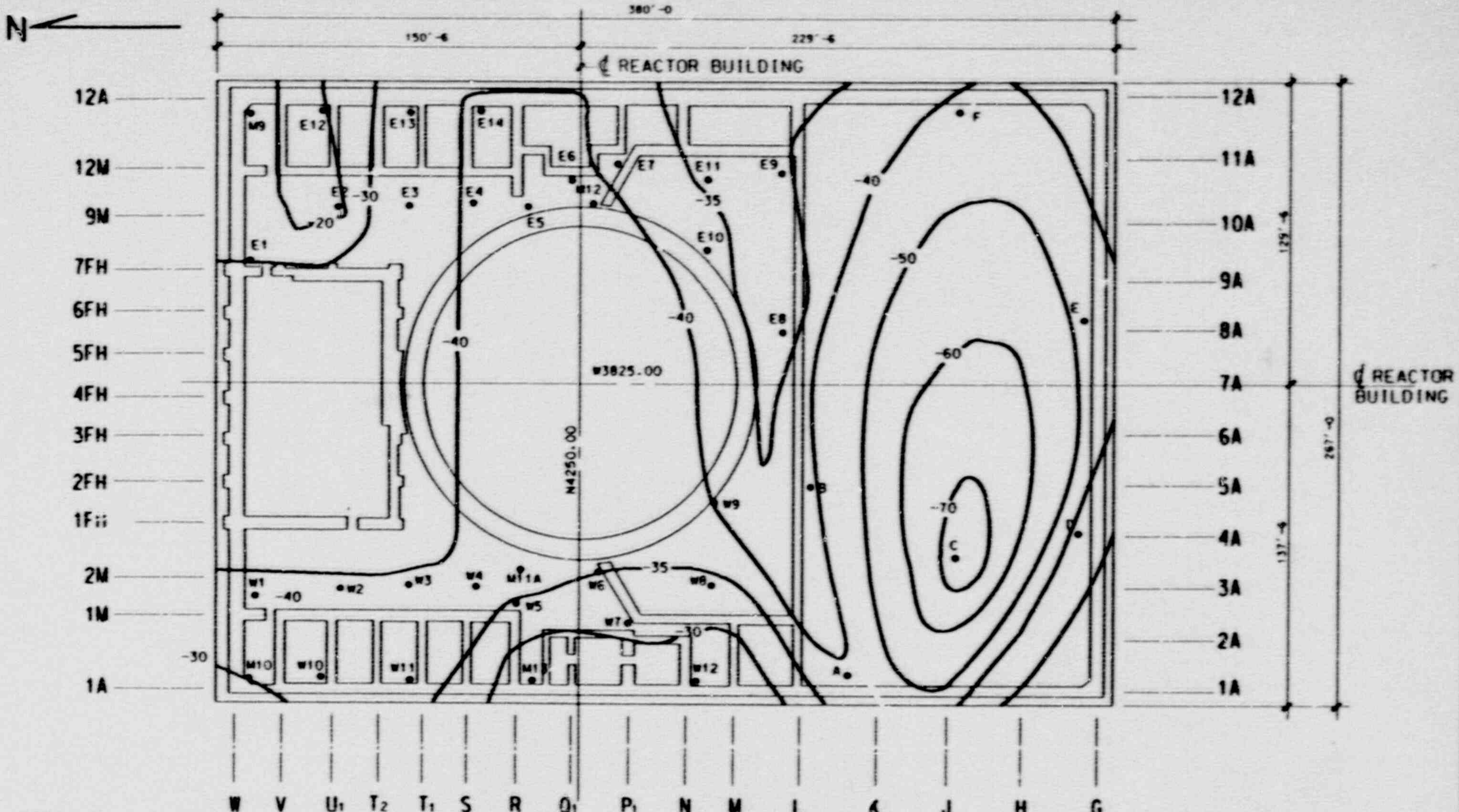


NOTES:
CONTOURS ARE IN 0.001 FT
(-)= DOWN
• = MONITORING POINT

BASEMAT ABSOLUTE SETTLEMENTS

PERIOD DEC. 1985 TO NOV. 1988
35 MONTHS

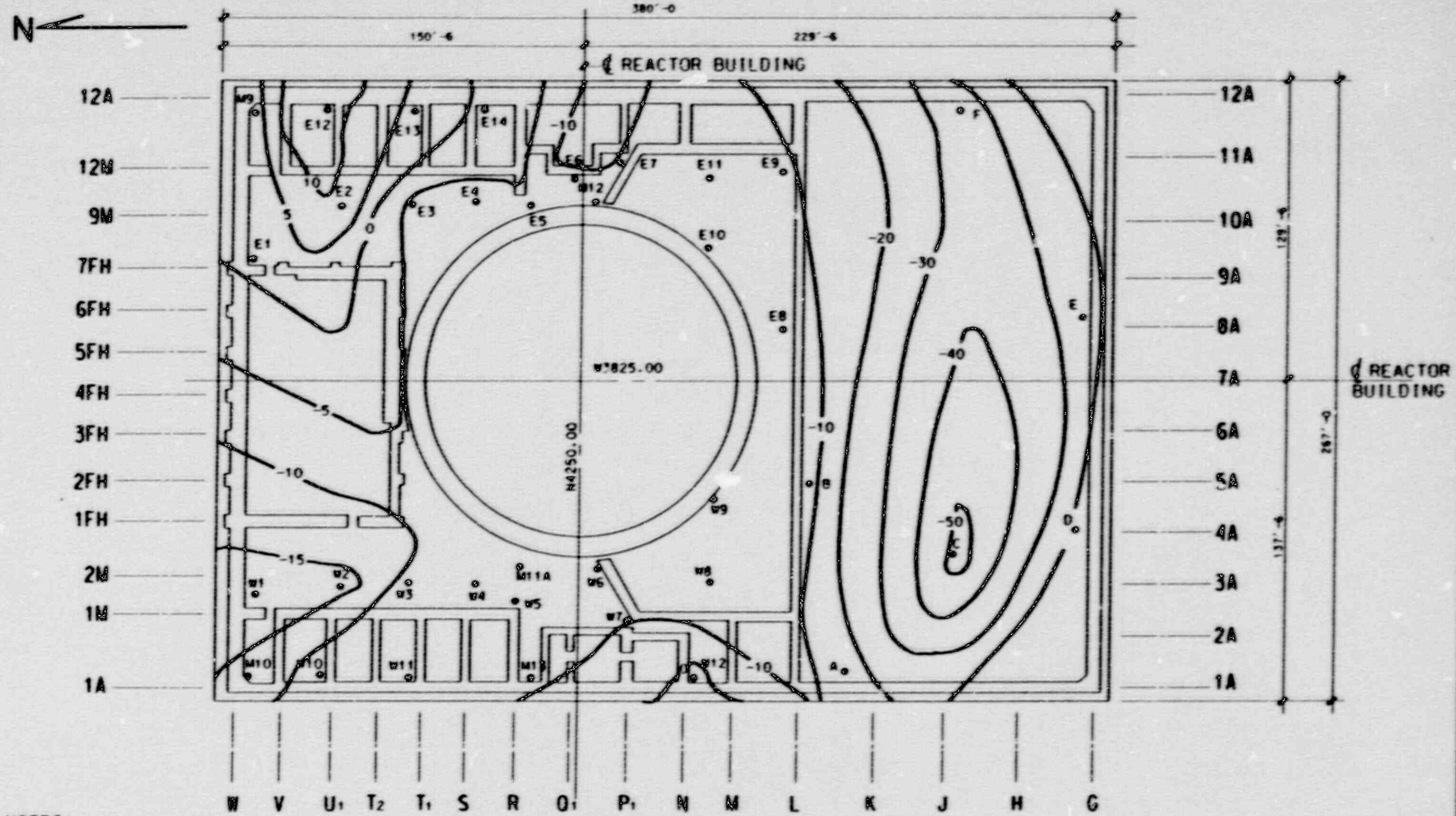
FIGURE 8



NOTES:
CONTOURS ARE IN 0.001 FT
(-)= DOWN
•= MONITORING POINT

BASEMAT ABSOLUTE SETTLEMENTS
PERIOD DEC. 1985 TO FEB. 1989
38 MONTHS

FIGURE 9

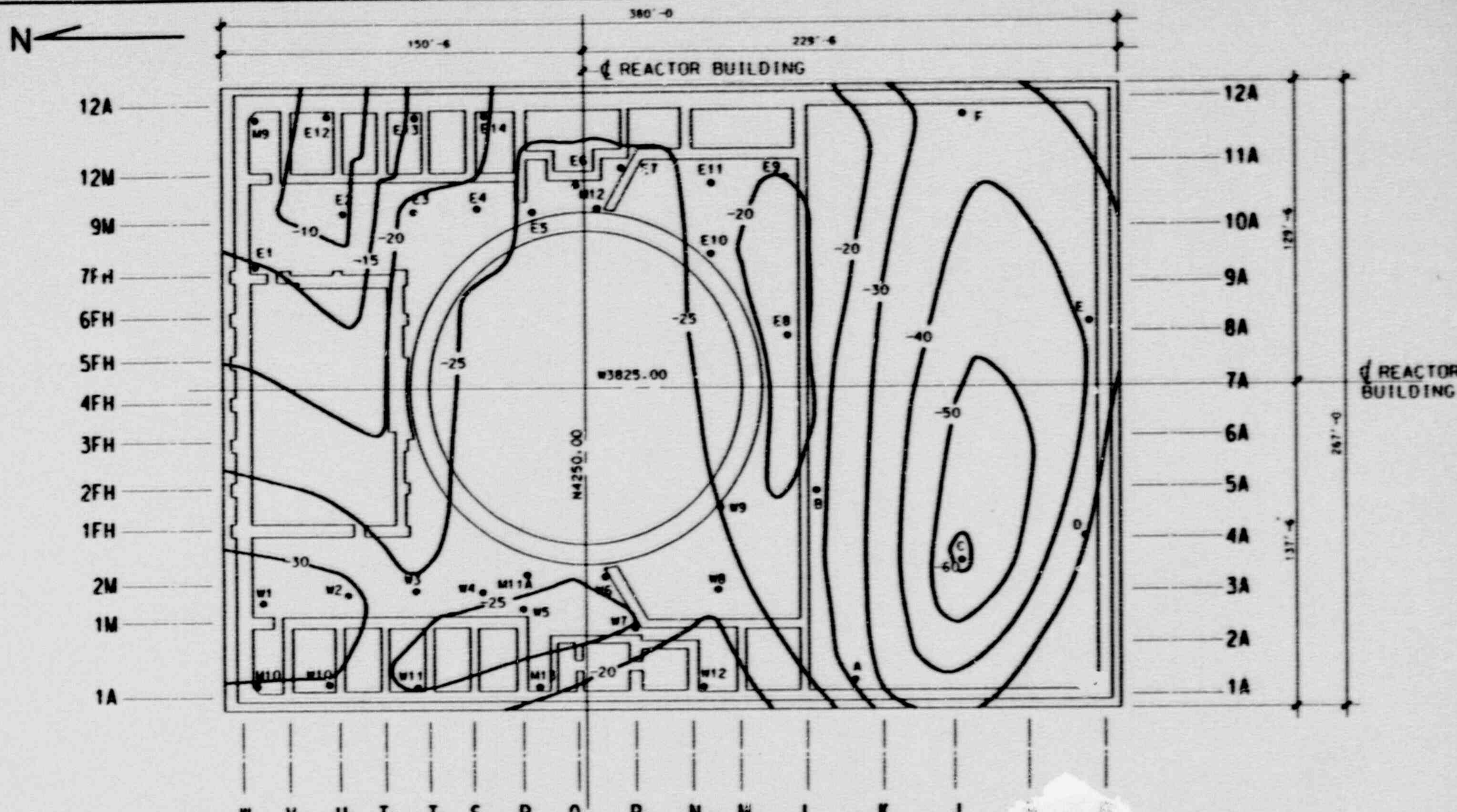


NOTES:
CONTOURS ARE IN 0.001 FT
(-)= DOWN
o= MONITORING POINT

BASEMAT ABSOLUTE SETTLEMENTS

PERIOD DEC. 1985 TO MAY 1989
41 MONTHS

FIGURE 10



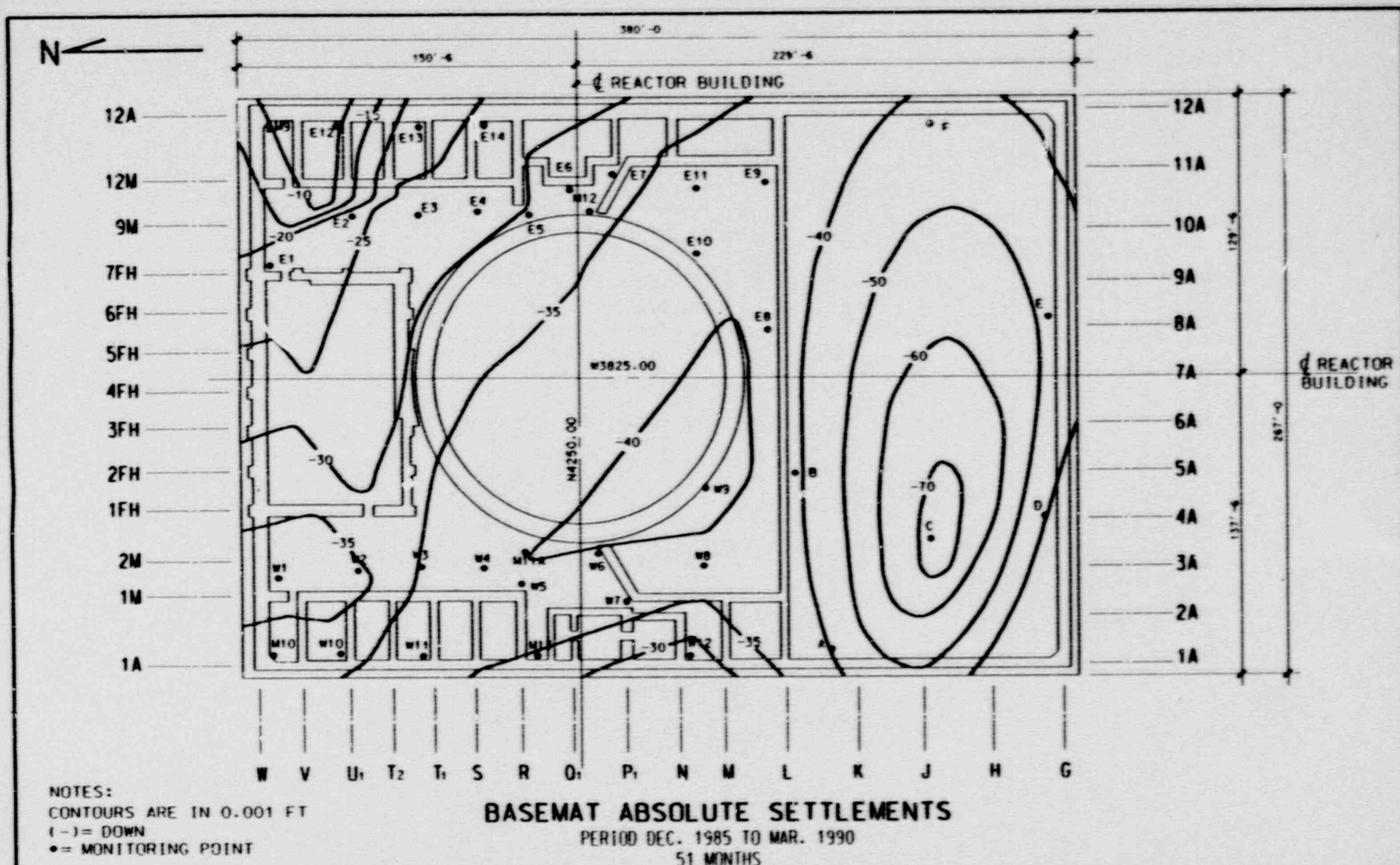
NOTES:
CONTOURS ARE IN 0.001 FT
(-)= DOWN
•= MONITORING POINT

BASEMAT ABSOLUTE SETTLEMENTS

PERIOD DEC. 1985 TO AUG. 1989

44 MONTHS

FIGURE 11

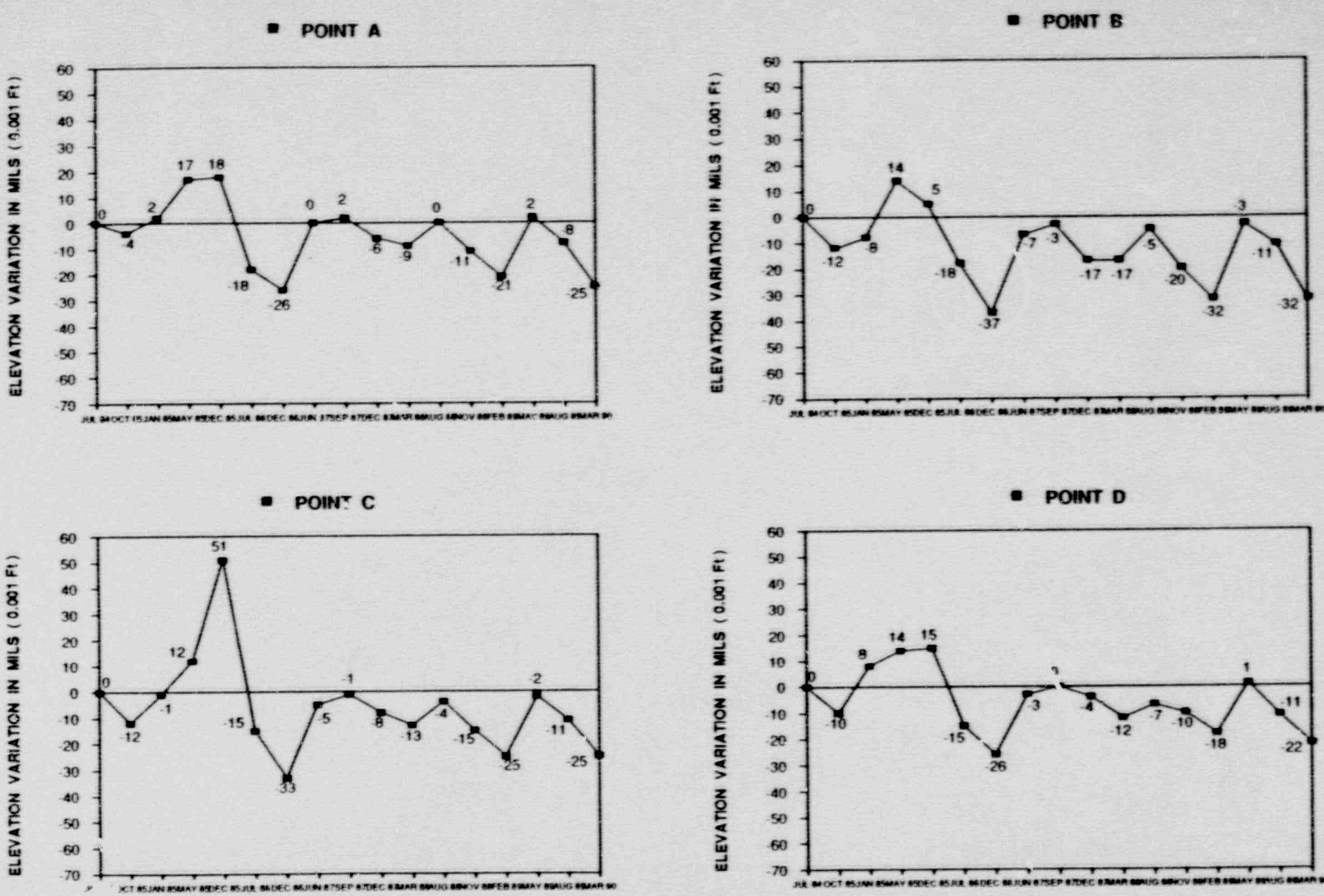


BASEMAT ABSOLUTE SETTLEMENTS

PERIOD DEC. 1985 TO MAR. 1990

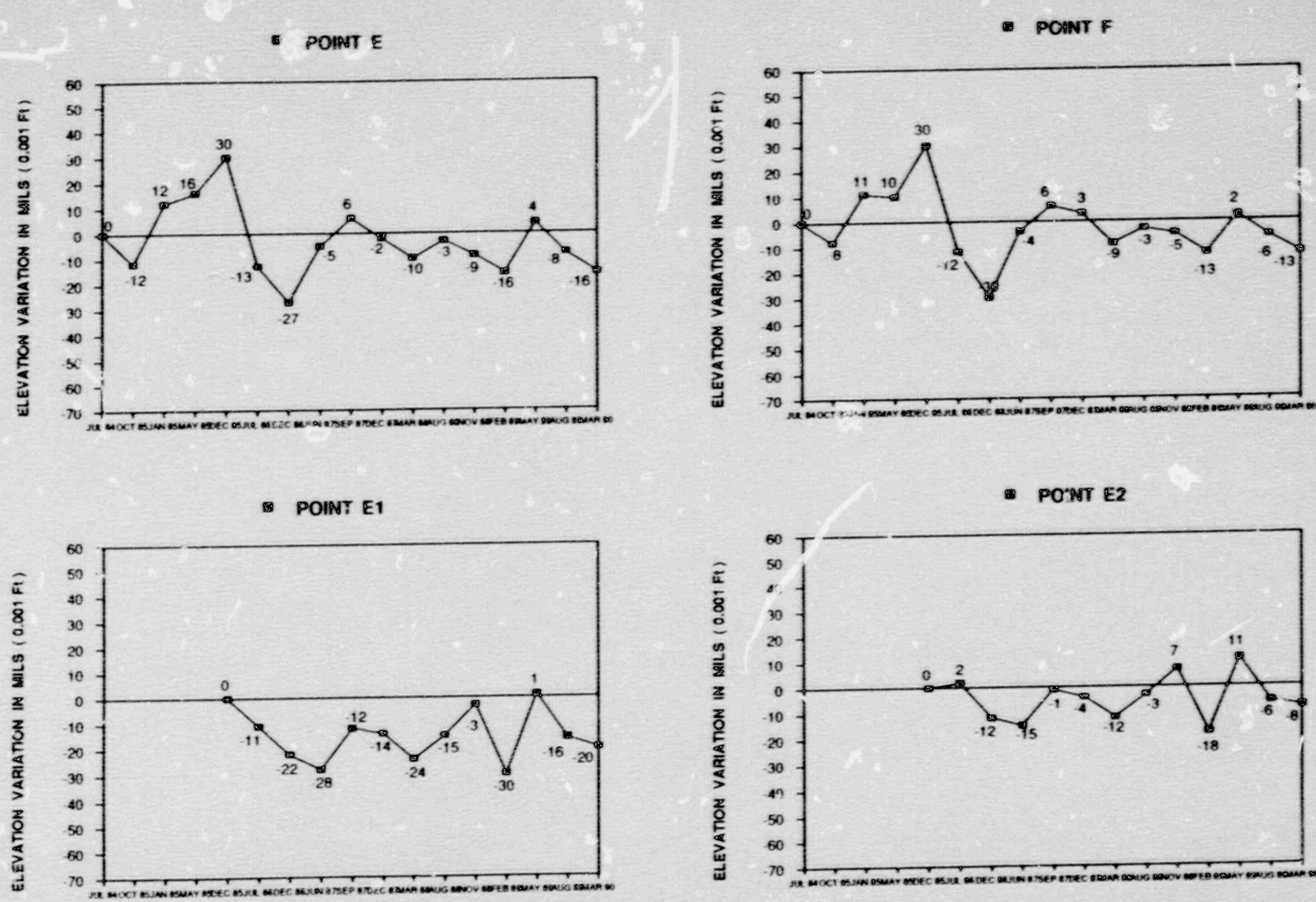
51 MONTHS

FIGURE 12



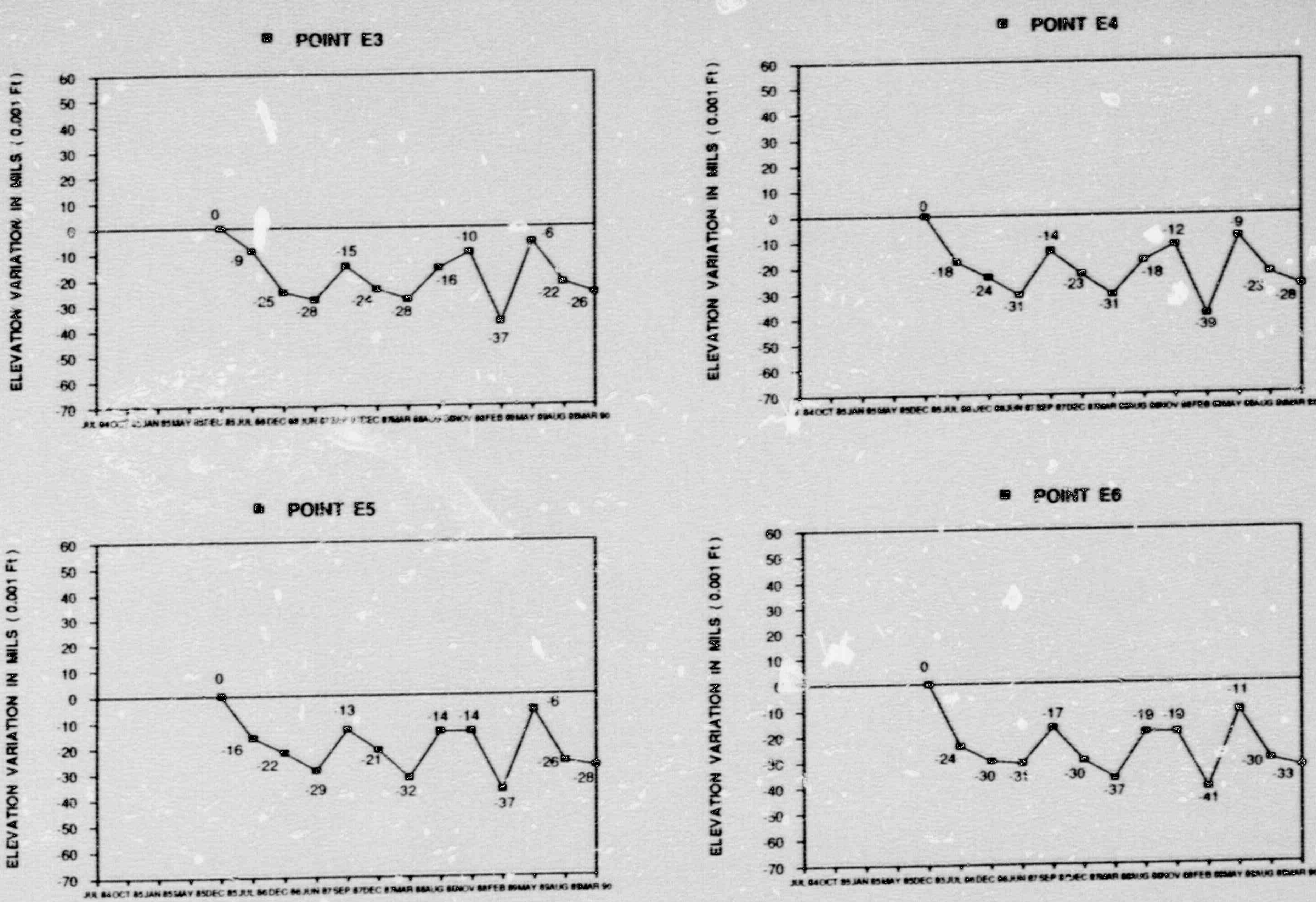
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 13



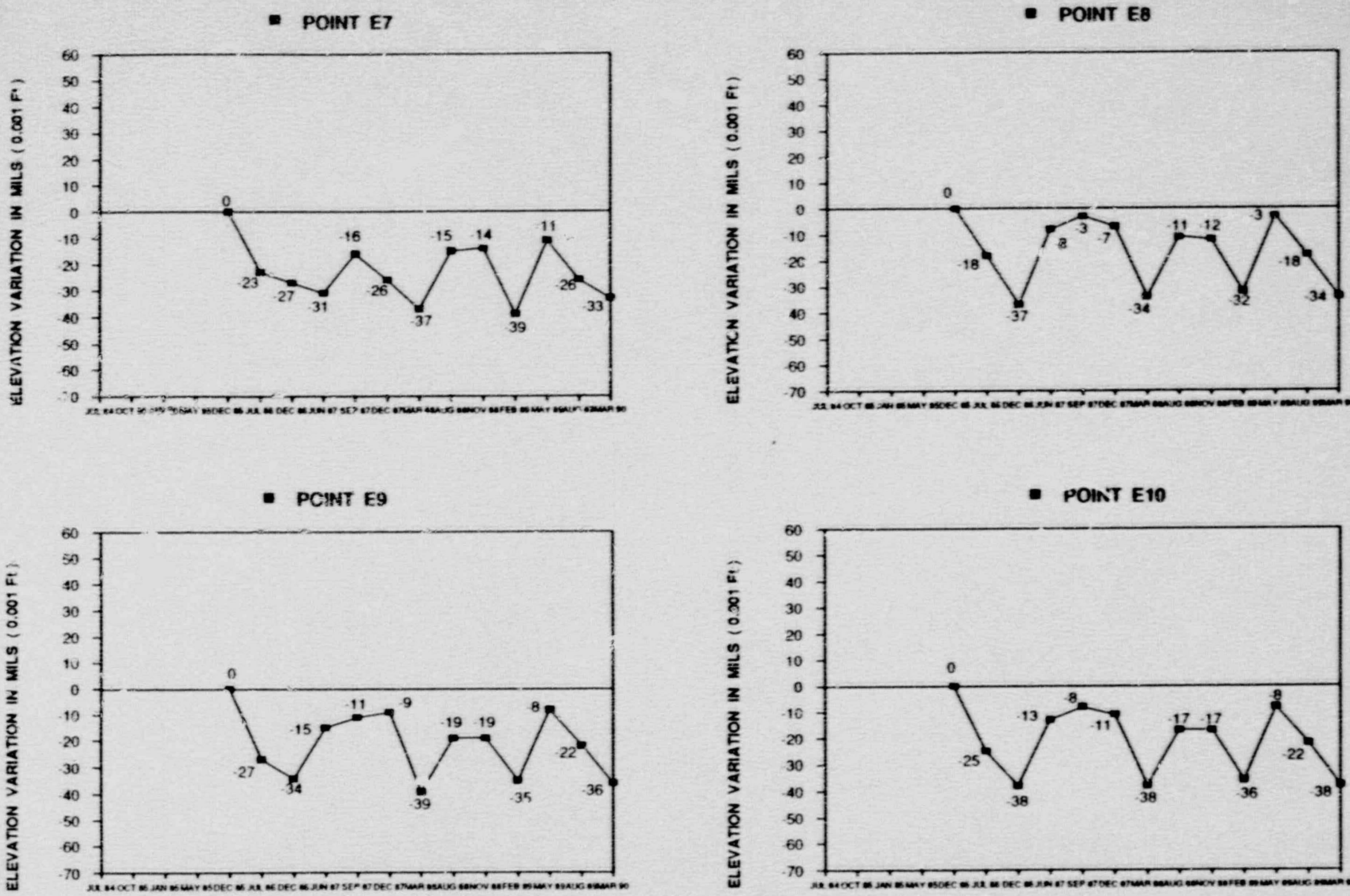
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 14



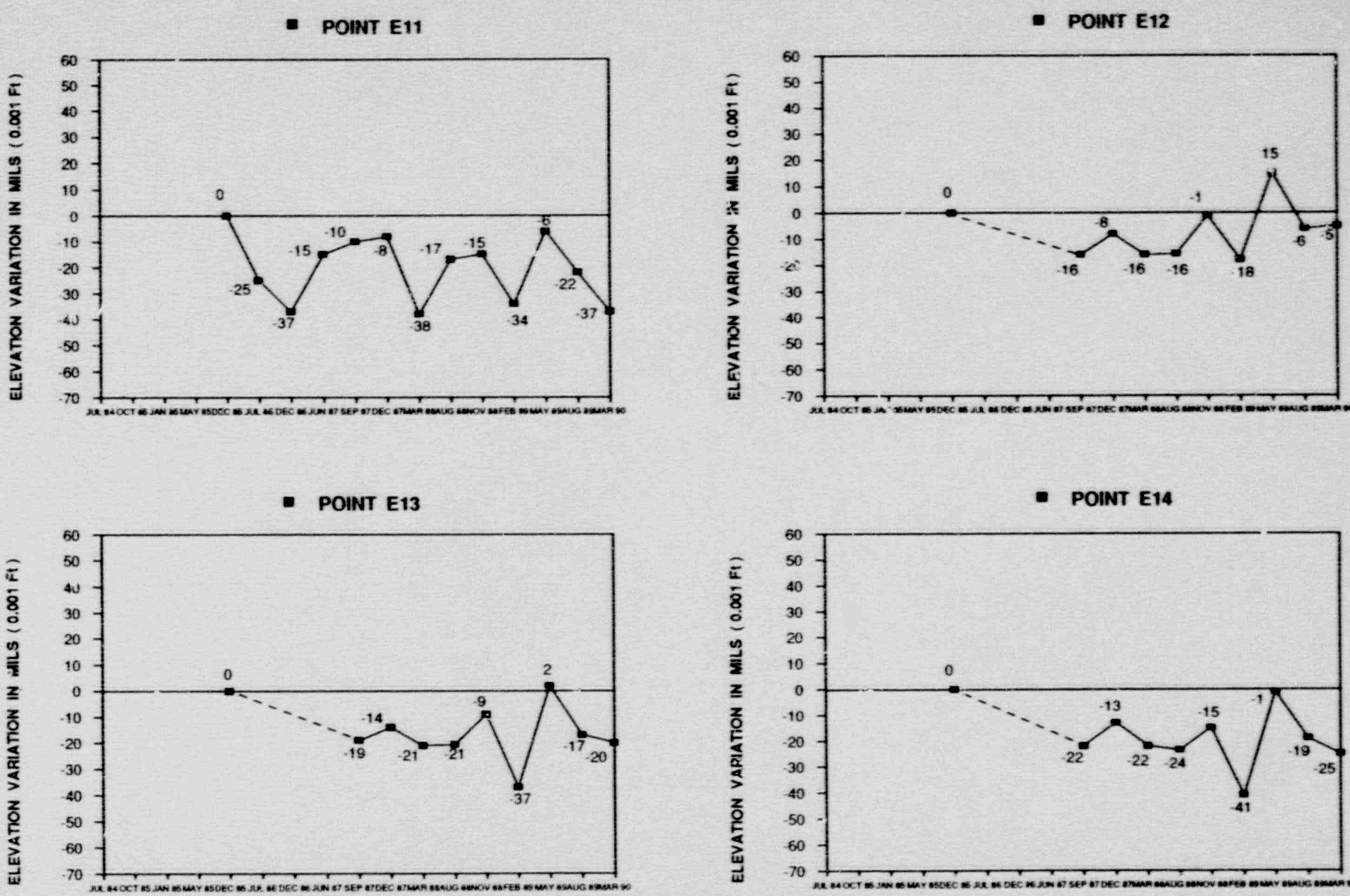
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 15



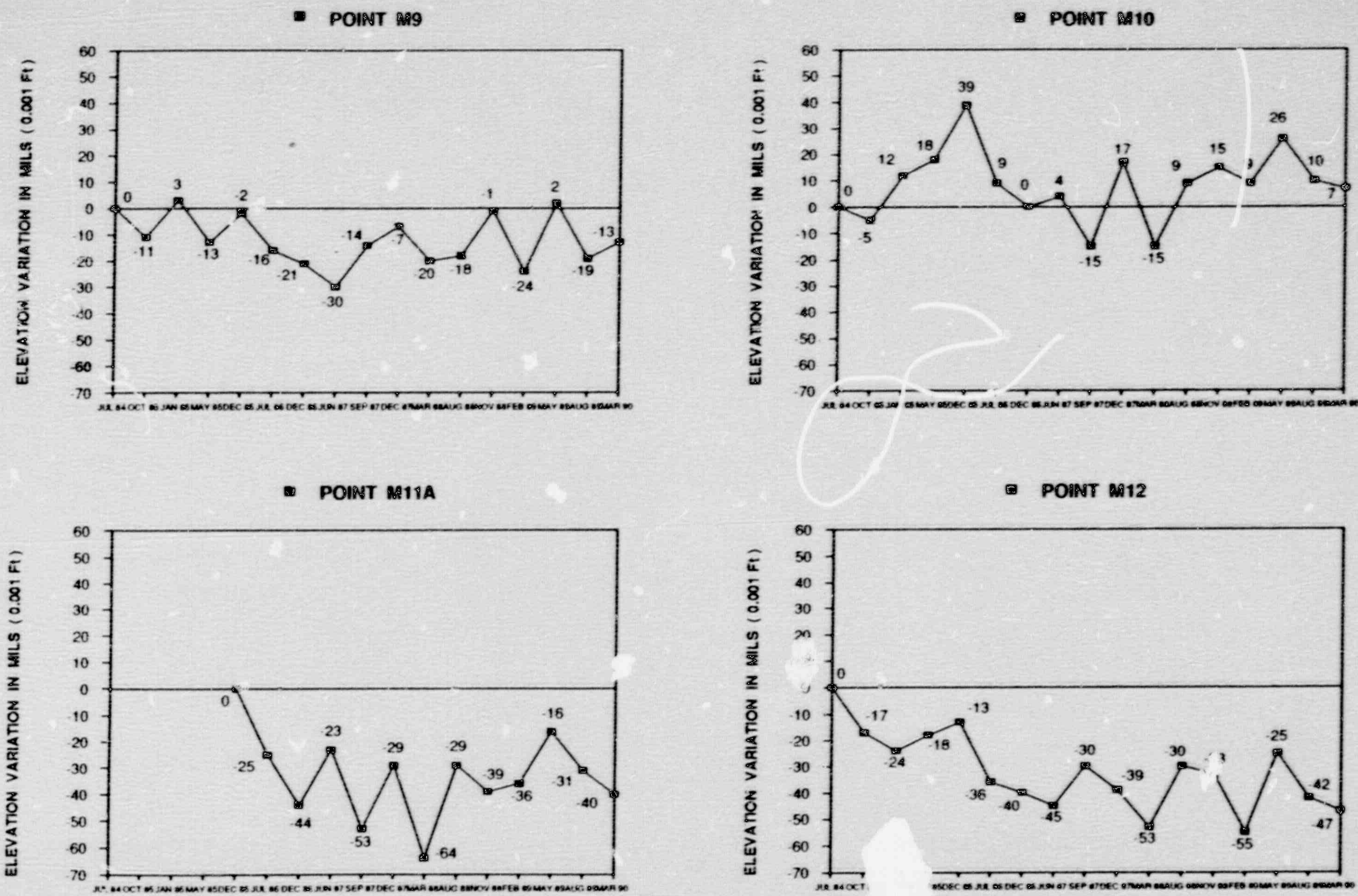
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 16



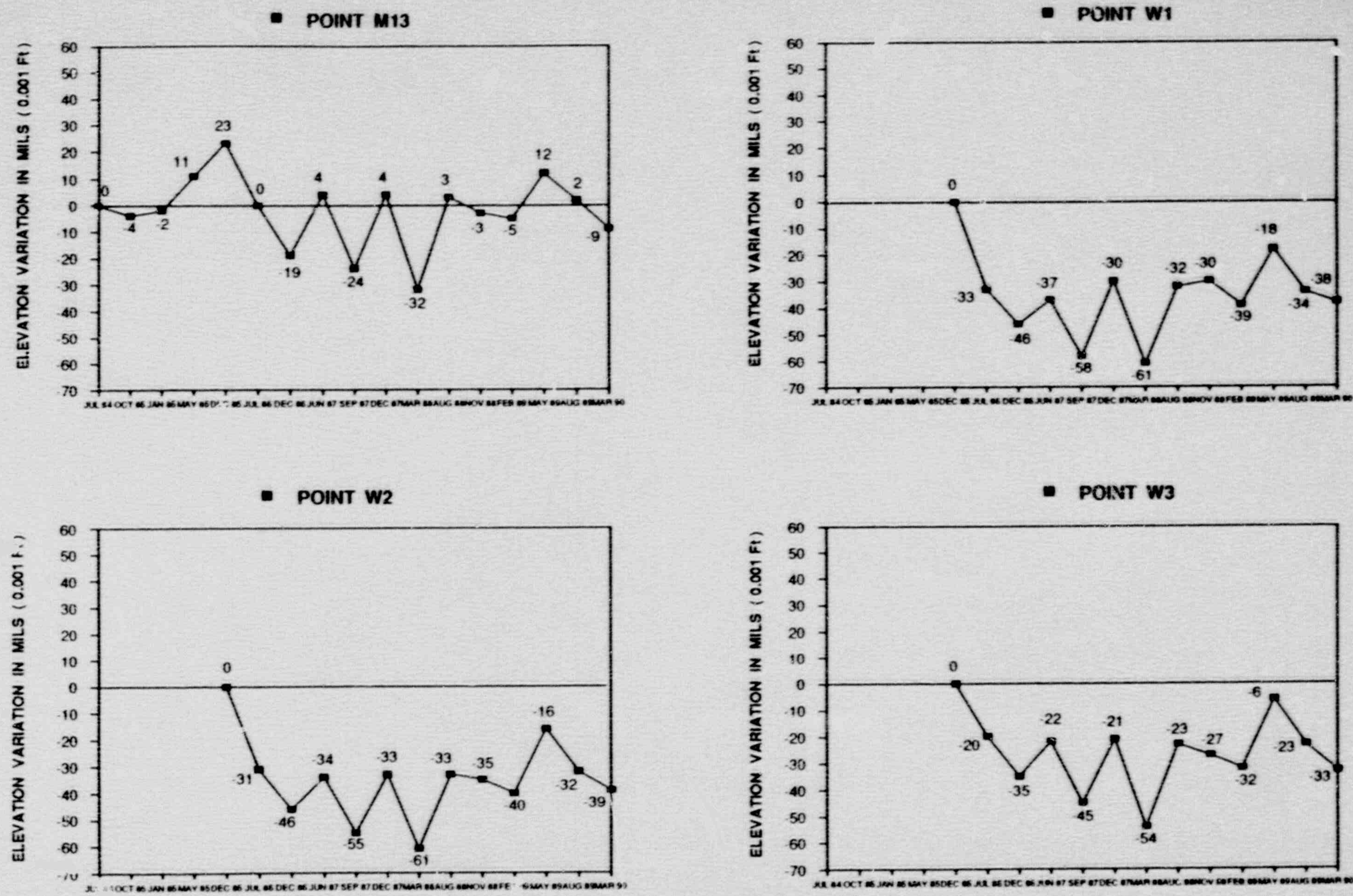
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 17



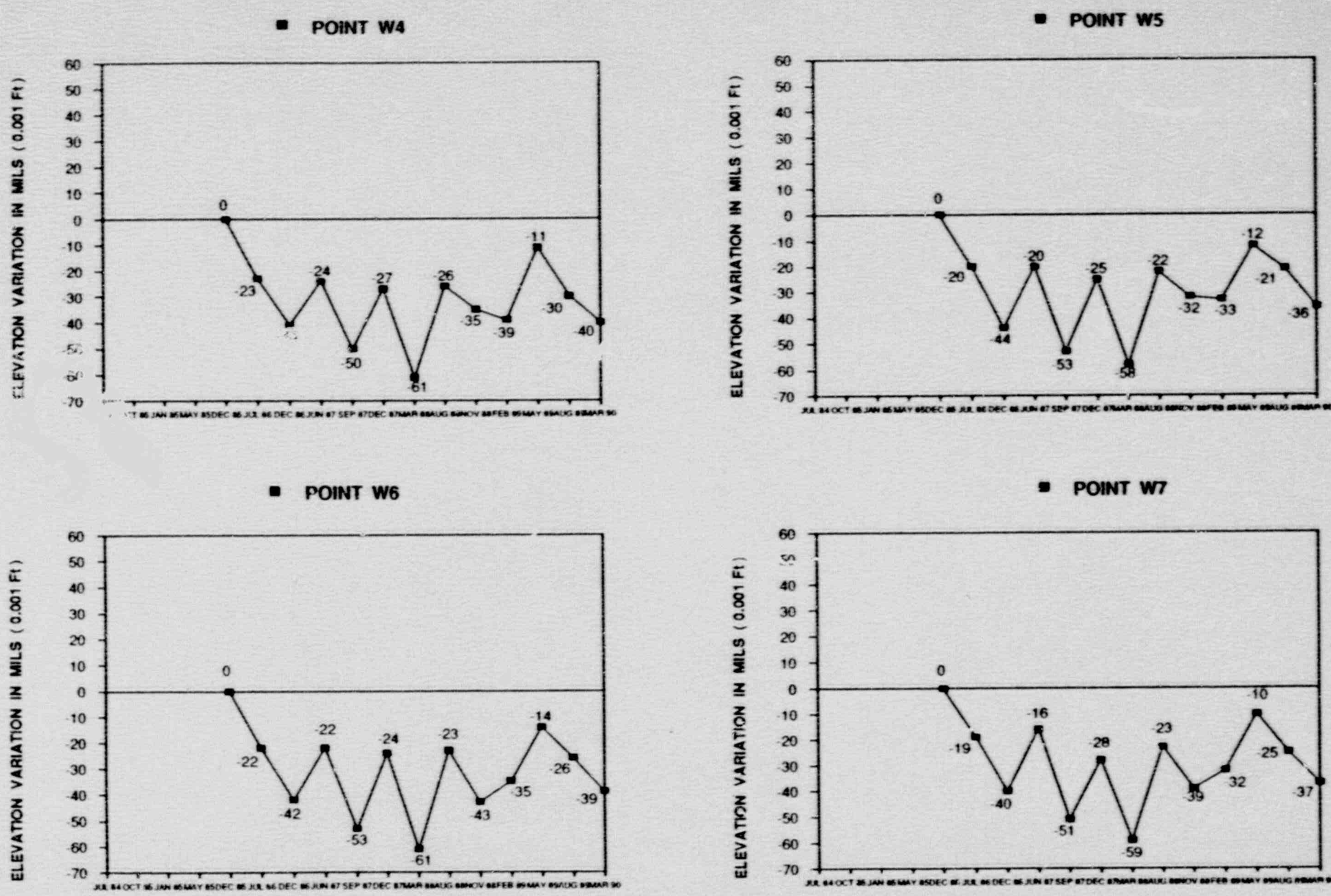
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 18



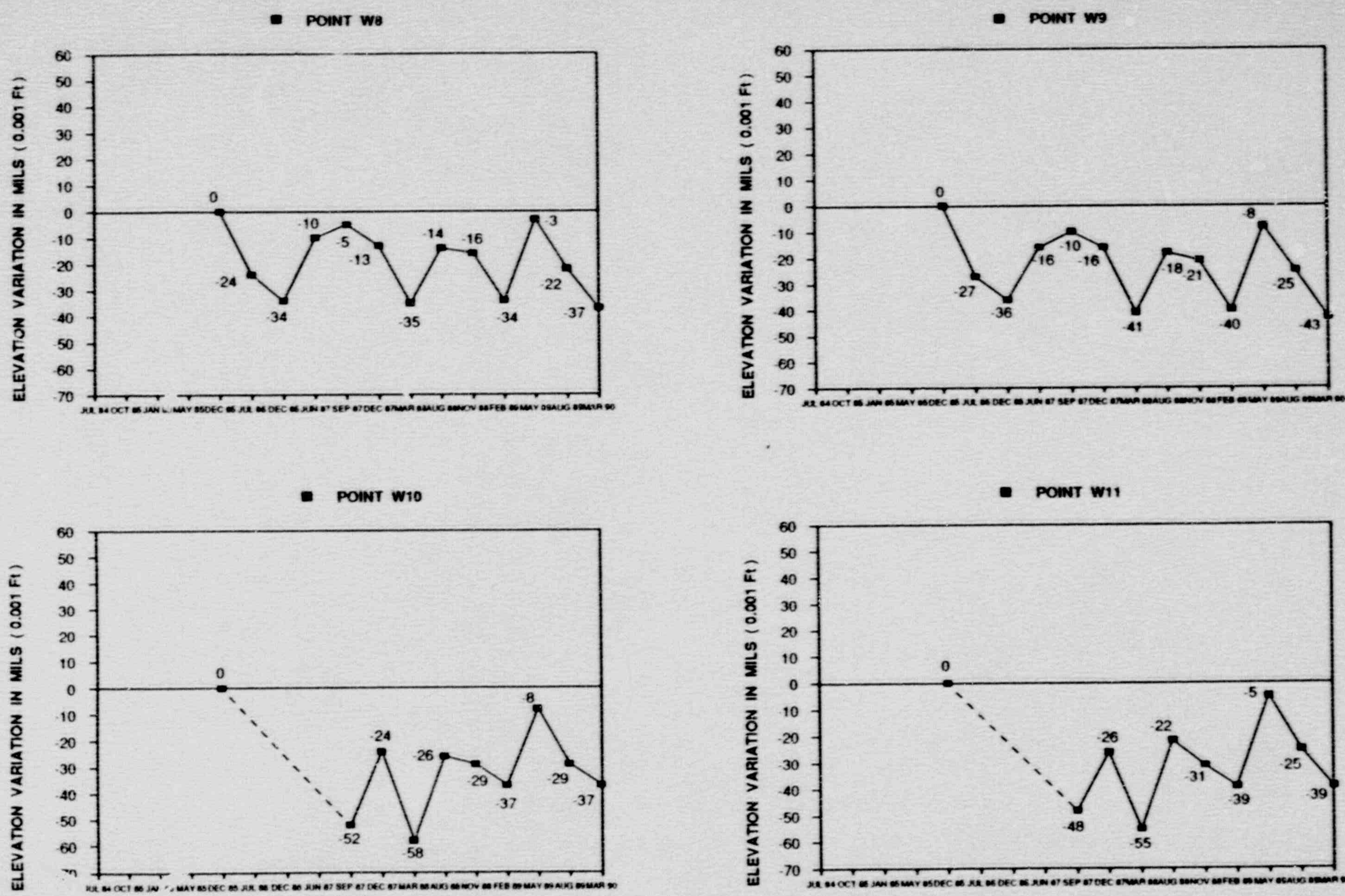
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 19



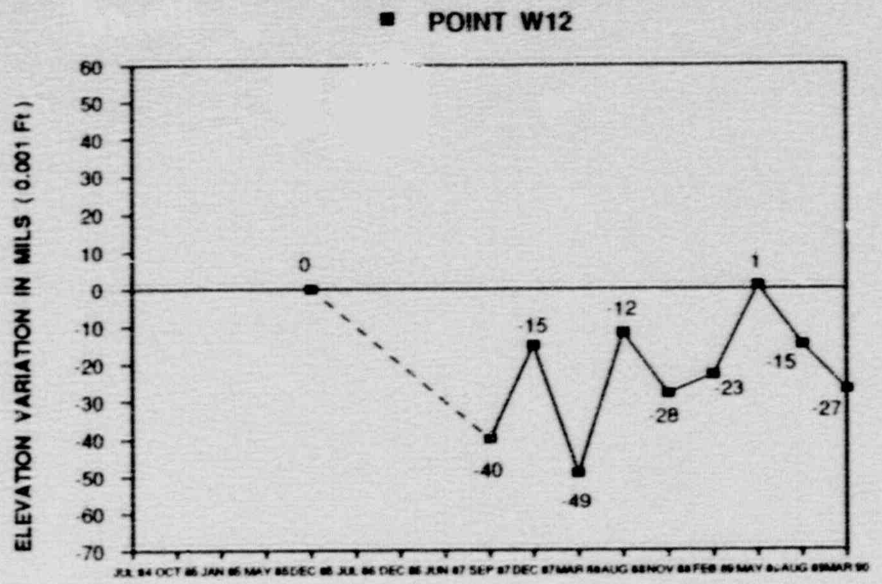
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 20



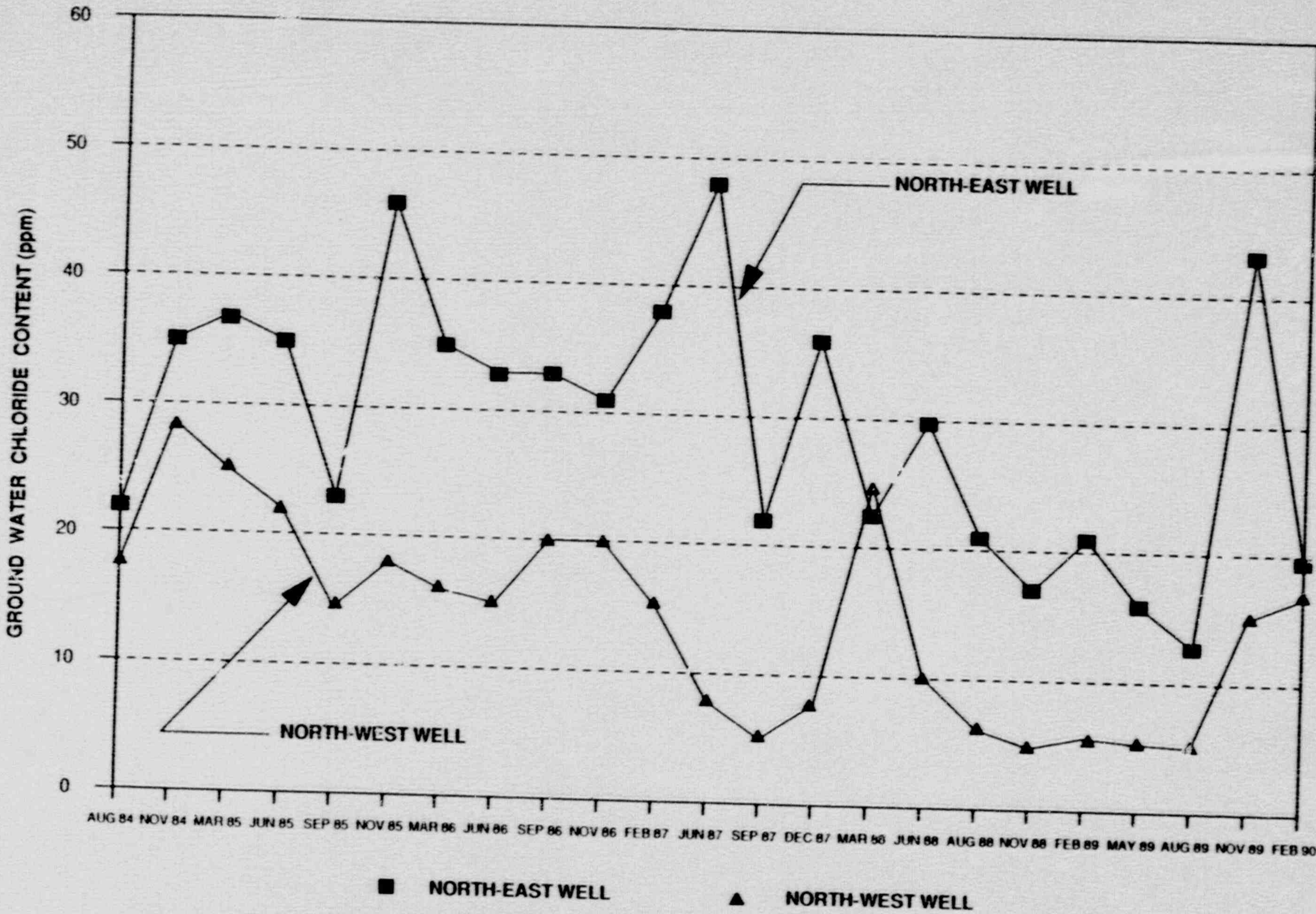
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 21



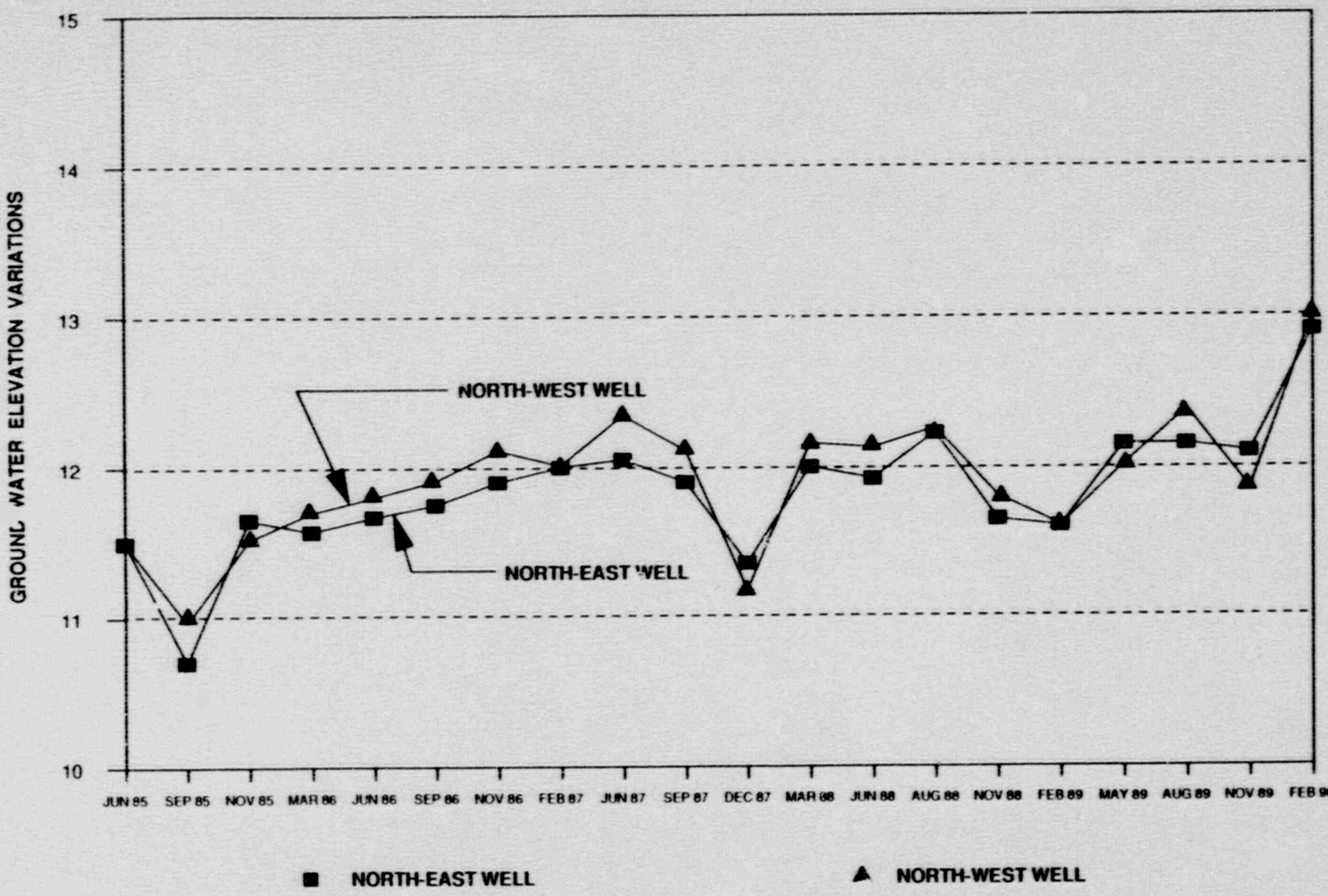
ELEVATION VARIATION OF MONITORING POINTS

FIGURE 22



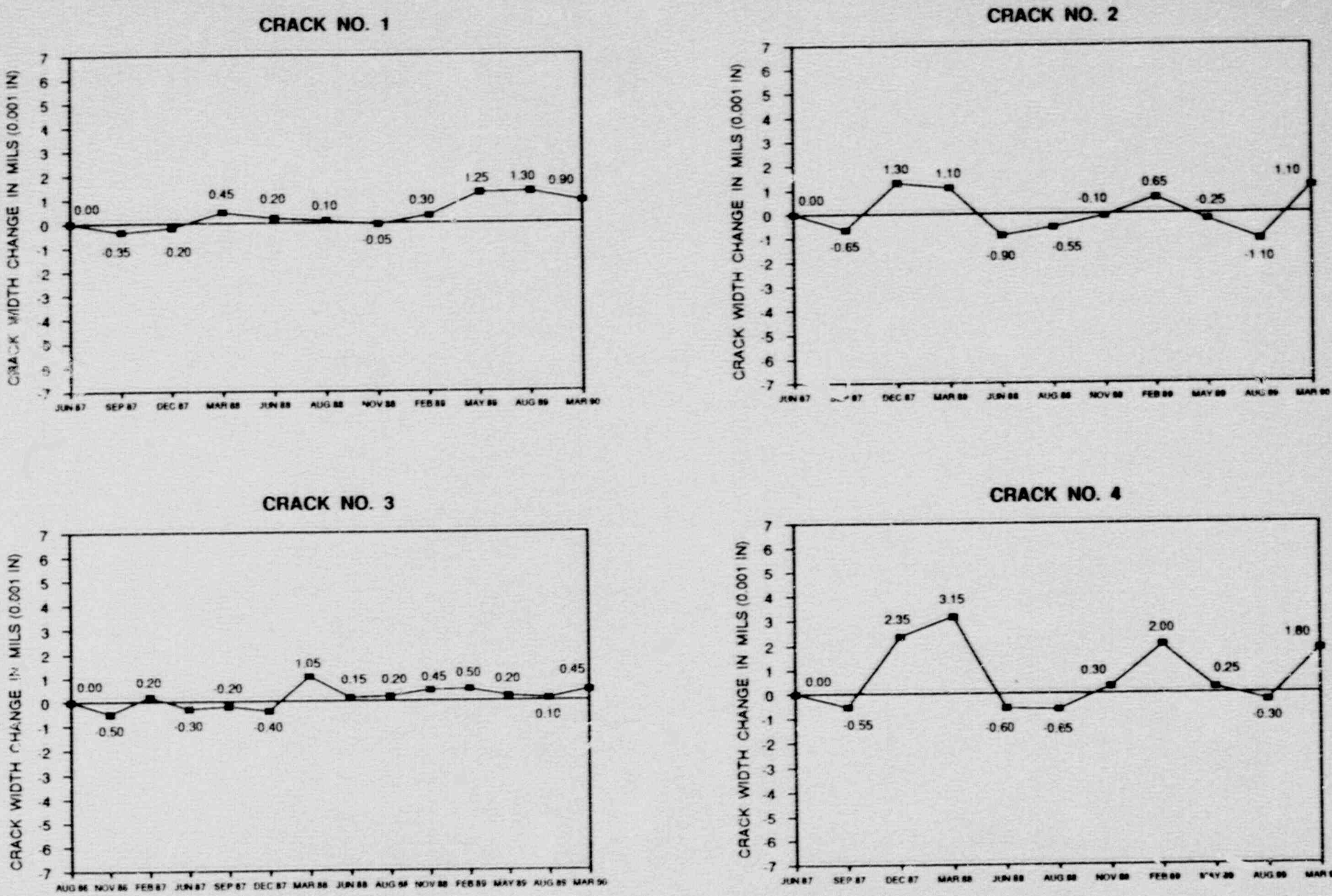
GROUNDWATER CHLORIDE CONTENT VARIATIONS

FIGURE 23



GROUNDWATER ELEVATION VARIATIONS

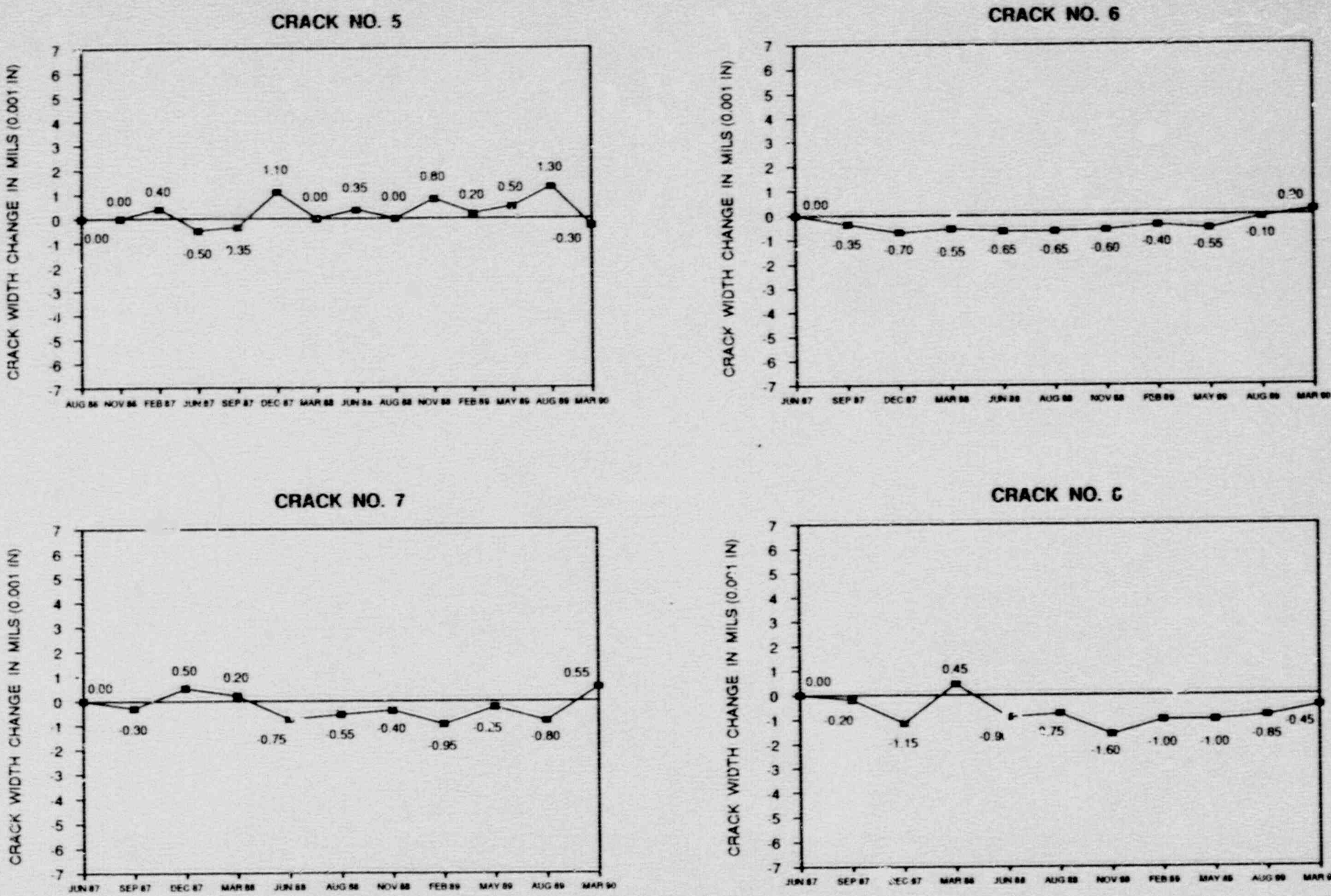
FIGURE 24



CRACK WIDTH VARIATIONS

(WITH TEMPERATURE CORRECTIONS)

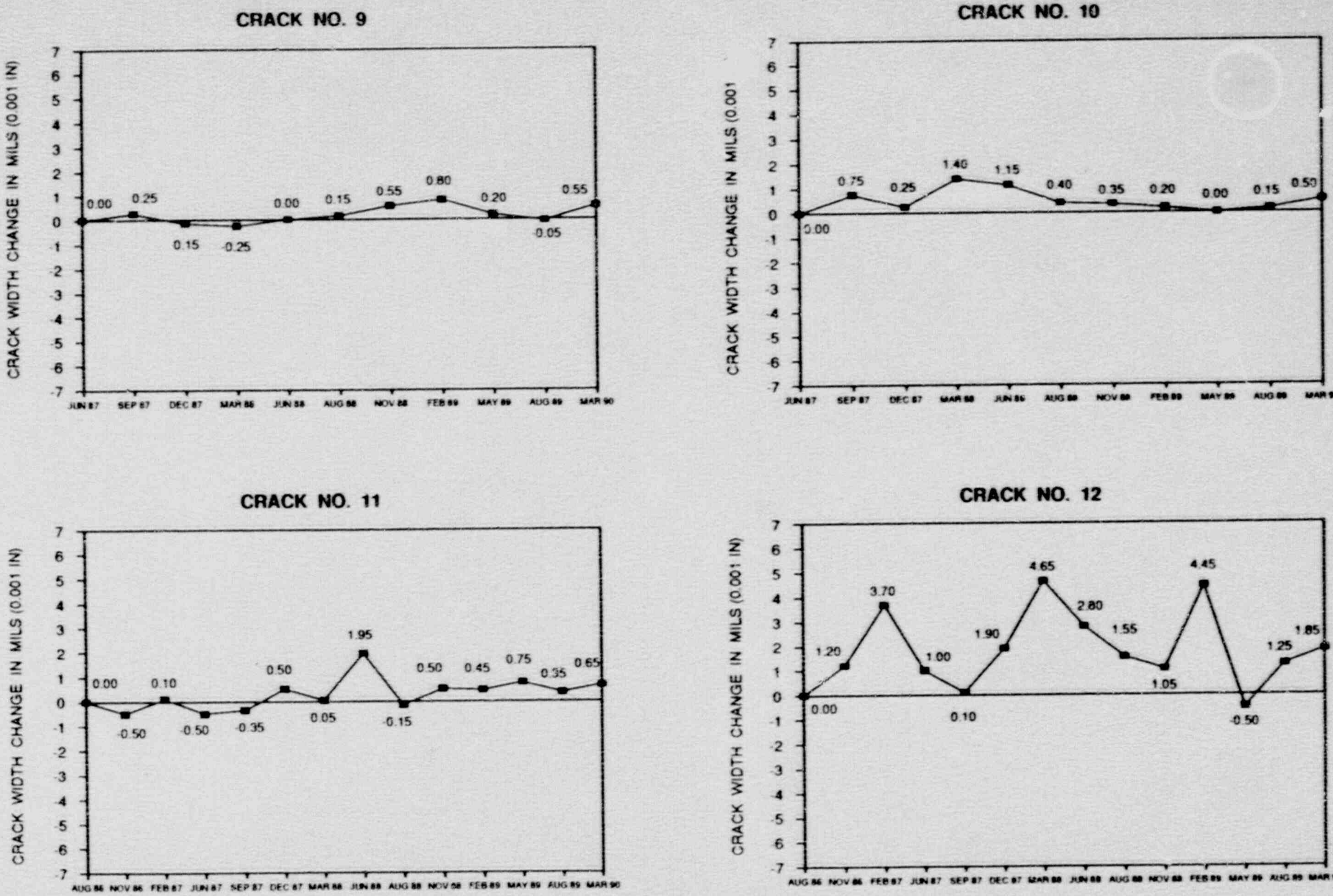
FIGURE 25



CRACK WIDTH VARIATIONS

(WITH TEMPERATURE CORRECTIONS)

FIGURE 26

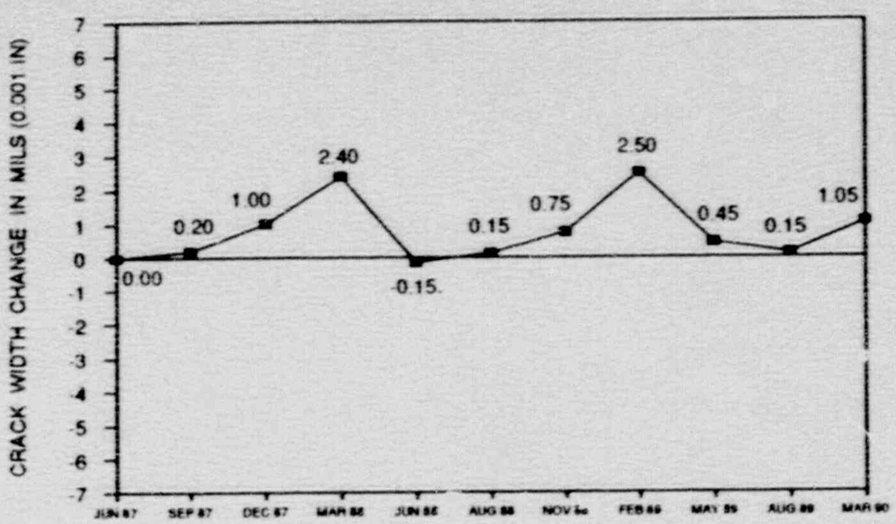


CRACK WIDTH VARIATIONS

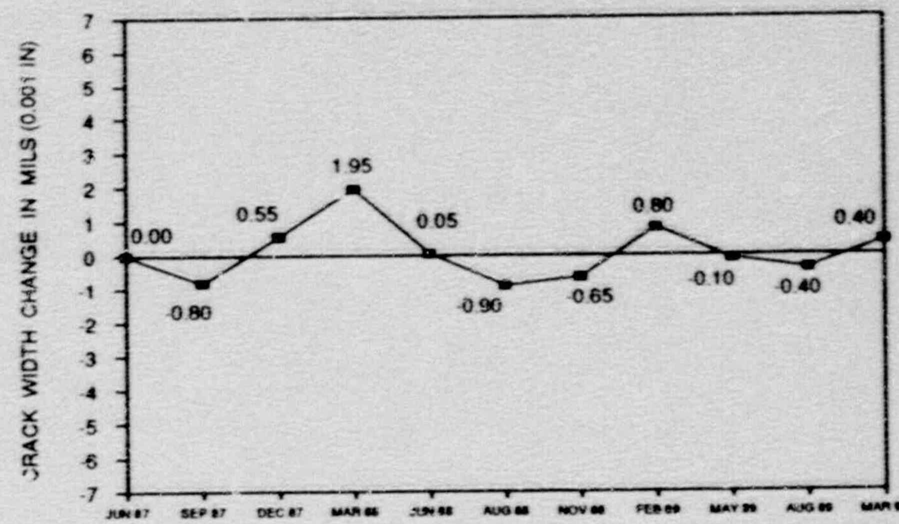
(WITH TEMPERATURE CORRECTIONS)

FIGURE 27

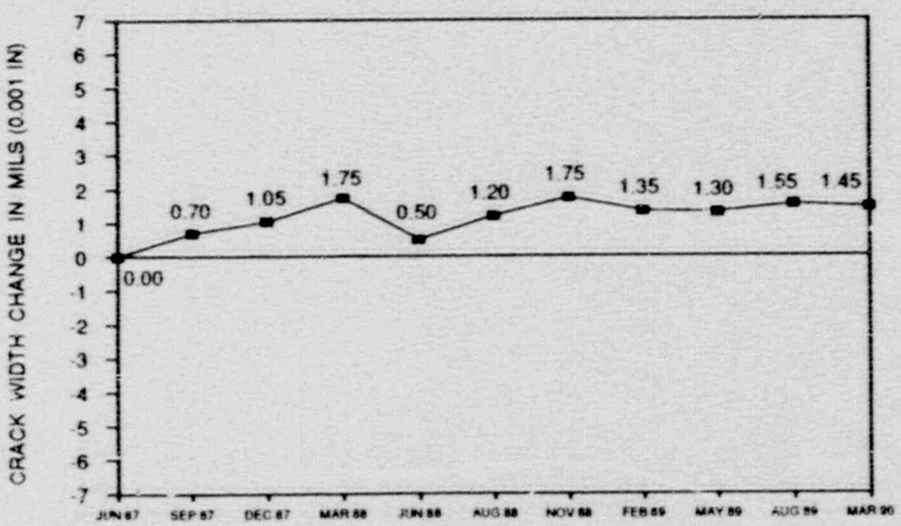
CRACK NO. 13



CRACK NO. 14



CRACK NO. 15



CRACK WIDTH VARIATIONS

(WITH TEMPERATURE CORRECTIONS)

FIGURE 28